Delaware Department of Transportation

PROJECT DEVELOPMENT MANUAL

July 2015

Project Development Manual

Chapter Five - ALTERNATIVES DEVELOPMENT cont.

Chapter Six - PROJECT DESIGN AND FINAL MINIMIZATION

Chapter Six - PROJECT DESIGN AND FINAL MINIMIZATION cont.

Delaware Department of Transportation
Nondiscrimination Policies – Your Rights Under Title VI, Title II and Section 504

Title VI of the Civil Rights Act of 1964 states that no person in the United States shall, on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance.

Title II of the Americans with Disabilities Act of 1990 provides that no qualified individual with a disability shall, by reason of such disability, be excluded from participation in, be denied the benefits of, or be subjected to discrimination by a department, agency, special purpose district, or other instrumentality of a State or local government. Section 504 of the Rehabilitation Act of 1973 states that no qualified handicapped person shall, solely by reason of his handicap, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity that receives or benefits from Federal financial assistance.

Inadequate efforts to reach and involve low income, minority, disabled or LEP (Limited English Proficiency) populations during the planning process can result in denying these groups the opportunity to participate in public decisions on transportation systems and projects directly affecting them.

The Delaware Department of Transportation (DelDOT) operates programs and activities without regard to race, color, national origin, sex, age, or disability and prohibits discriminatory acts (or inaction) whether intentional or unintentional directed toward any group or individual as previously noted.

Effective public involvement includes opportunities that encouraged participation in the planning process by transportation stakeholders. Statewide and metropolitan planners and decision makers are required to develop public participation plans that serve as a guide for the participation process to ensure ongoing public involvement in the development and review of transportation plans, programs and projects.

In response to its commitment to ensure proactive measures to prevent discrimination, DelDOT has implemented public involvement processes to ensure that transportation stakeholders, including community groups, businesses, environmental groups, LEP populations, and the general public, are given the opportunity to participate in the planning process. These processes include but are not limited to:

- Public involvement solicited early on during the planning process
- Public meetings held at convenient times and accessible locations
- Reasonable accommodations (as needed) for individuals with disabilities
- The use of visuals to describe plans
- Public information available in electronic and accessible formats
- Public comment periods held open after hearings and workshops to allow submission of written comments

DelDOT periodically evaluates public involvement policies and procedures to determine effectiveness and continued compliance with federal requirements.

An individual or group that believes they have been subjected to discrimination by DelDOT or by one of DelDOT subrecipients based on their race, color, national origin, sex, age, disability or gender identity may file a complaint. Click here to view DelDOT's complaint procedure or go to: http://regulations.delaware.gov/AdminCode/title2/2000/2500/2501.

Individuals may contact DelDOT at the address below if additional information or assistance is required.

Delaware Department of Transportation
Attn: Civil Rights Administrator
800 Bay Road
PO Box 778
Dover, DE 19903

Complaints may also be filed with:

Federal Highway Administration or U.S. Department of Justice. Contact information is included in the published complaint procedures.

Additional information related to Title VI, ADA and other Civil Rights issues is located at the address below:

http://deldot.gov/information/business/cr/index.shtml

Chapter One

INTRODUCTION

Transportation and quality of life in the communities of the State of Delaware are inextricably linked. This connection is largely influenced by the role that transportation facilities, such as highways, streets, bus stops, sidewalks and bikeways, play in everyone's daily life.

By bringing together transportation professionals, local residents, business owners, and interest groups, transportation planning can produce public facilities and programs which support community goals while providing safe efficient transportation for individuals and goods, enhance the economy, and protect the natural environment. The project team develops designs that meet DelDOT's operational and safety requirements while preserving the aesthetic, historic, and cultural re- sources of the affected area.

1.1 PURPOSE OF THE PROJECT DEVELOPMENT MANUAL

The purpose of this *Project Development Manual* (*PDM*) is to provide a guide for the development of projects. Project development is the second phase of a project's life. The first stage is long range/statewide planning; the third stage is construction and the fourth is maintenance and operations.

DelDOT's Design Resource Center (DRC), found on the intranet at http://deldot.gov/information/business/drc/index.shtml provides links to many of the resources needed for the development of projects, including forms, policies and design manuals. This PDM will help provide a guide in the use of the information found on the DRC.

The guiding principles of the Project Development Manual are:

- A Clear Project Development Process — to establish a clear and transparent project development and design process that can be administered consistently throughout the state.
- Complete Streets – Incorporate and consider the principals of "Complete Streets" into project planning and design.
- Context Sensitive Solutions — to incorporate, throughout project planning, design, and construction, the principles of Context Sensitive Solutions. To accomplish this goal, all stakeholders are involved in a collaborative, interdisciplinary approach to develop a transportation solution that fits its physical setting and preserves scenic, aesthetic, historic and environmental resources, while maintaining safety and mobility for all users.

1.1.1 A CLEAR PROJECT DEVELOPMENT PROCESS

A clear and consistent project development process is important for a number of reasons; the most significant are:

- Ensure compliance with state and federal regulations.
- To ensure all alternatives have been evaluated.
- The project development process is a project management and decision-making process for transportation projects. It encourages a seamless transition between project development phases while providing effective and efficient project management.
- Project development as described in this PDM is based on the Mid-Atlantic Transportation and Environmental Streamlining Process (MATE). A task

force was formed in order to cooperatively set goals and develop a systematic approach to address the streamlining provisions set forth in the Transportation

Equity Act for the 21st Century (TEA-21), as well as to improve communication and cooperation between transportation and environmental agencies. A streamlined process was developed that is specific enough to ensure its effective implementation in all states, yet allows the states to fit their individual project development processes into its framework. The most significant product of this effort is the integration of additional permitting and environmental review processes with the 1992 Integrated National Environmental Protection Act (NEPA/404). This process should be used as a tool for improving communication among environmental and transportation agencies, increasing the efficiency of the transportation project development process through concurrent environmental reviews, and as a mechanism to avoid or resolve interagency disputes.

It should be noted that the MATE process was developed to support project development for large complex projects with fairly significant natural and cultural resource issues. The majority of DelDOT project development efforts will be for smaller less complex projects; Bridge replacement, roadway reconstruction, safety improvements, etc. These types of projects will more than likely require some level of resource evaluation and agency coordination, but with less formal decision making milestones.

Because the majority of DelDOT project development efforts are small and less complex, the *PDM* will not focus on many of the key and structured steps of MATE; however, the MATE framework should be utilized for larger and more complex projects, like new highway alignments and large rail capacity improvements.

1.1.2 COMPLETE STREETS

Another guiding principle of the *PDM* is that the state's transportation system should safely accommodate all users of the public right-of-way, depending on the type of road and context of the surroundings, including:

- Motor Vehicles
- Automobiles and Motorcycles
- Trucks
- Transit vehicles
- Pedestrians, including people requiring mobility aids (canes, service animals, wheelchairs, walkers, scooters, etc.)
- Bicyclists
- Transit users

The *PDM* takes the approach that non-motorized transportation modes are fundamental considerations in the design process. As such, pedestrian and bicycle design requirements within a shared right-of-way are integrated throughout the project development process wherever possible.

1.1.3 CONTEXT SENSITIVE DESIGN SOLUTIONS

A third guiding principle of the *PDM* is that roadway projects should be planned and designed in a context-sensitive manner. Projects for improving the transportation network should be implemented so that the character of the project area, the values of the community, and the needs of all users are fully considered. An important concept in planning and design is that every project is unique; whether the project is a modest safety improvement, or a ten-mile upgrade of an arterial roadway, there are no generic solutions. Each project requires a project team to address the needed improvements while safely integrating the design into the surrounding natural and manmade environment. Several characteristics of context sensitive projects have been identified by FHWA, including:

- The project satisfies its purpose and needs as defined in the Long Range Transportation Plan (LRTP), the State Transportation Improvement Plan (STIP) and the Community Transportation Program (CTP).
- The project is a safe facility for users of all ages and abilities as well as for the surrounding community.
- The project meets or exceeds minimum design standards for accessibility for people with disabilities, giving attention to universal design principles.
- The project is in harmony with the community and preserves environmental, scenic, aesthetic, historic, natural or constructed resources of the area
- The project is designed and built with the least possible impacts to the community.
- The project adds lasting value to the community

An effective process helps achieve projects that respect the values of the community and the natural and built environment, while meeting transportation needs. Federal Highway Administration (FHWA), American Association of State Highway and Transportation Officials (AASHTO) and DelDOT publications available online clearly establish the importance of a sound project development process for achieving context-sensitive highway solutions.

1.2 TRANSPORTATION DECISION MAKING

The transportation decisions made today will affect the State for many years to come. While transportation improvements can generate increased mobility and allow economic growth, they also profoundly affect the nature of our communities and our environment. For these reasons, it is vital to have an objective and inclusive project development process in which all of the effects of transportation proposals can be understood and considered. Communication about, administration of, and understanding of the process through which potential projects are evaluated can improve the efficiency of the allocation of transportation resources concentrating on feasible solution.

Decisions should be made in a coordinated manner, with decision-makers considering the needs of all affected citizens and ensuring that services are delivered in the most efficient and orderly way. Decisions should also be transparent with public knowledge of the final decisions and the process used to reach all decisions. All decisions should be made in an inclusive manner, with the active participation of individuals, businesses, interest groups, and affected constituencies.

DelDOT has developed and implemented a project development process that includes regular communication among technical disciplines, which results in quality plans and minimizes cost overruns during project construction. This transportation decision-making approach provides a seamless process from planning through construction and encourages open communication for making informed decisions during all stages of project development. By involving all disciplines at the earliest stages of the process, issues affecting project type, scope, purpose and need, concept development, and cost are identified early. The process has been streamlined by:

- Encouraging communication among disciplines;
- Requiring documentation of the reasoning behind decisions;
- Eliminating duplicated effort among disciplines;
- Providing for early identification of potential problem issues; and
- Ensuring that work products are completed as early in the process as possible.

1.3 PROJECT TEAM

This Manual is intended to describe the various activities that are necessary to move a project from inception to implementation. Emphasis is placed on the day-to-day responsibility of those assigned to ensure that the project reaches implementation successfully. In this Manual, Team collectively refers to the entire design group working on a project. When projects are assigned solely to in-house staff; the Team consists of the project engineer/designer working under supervision of a program manager. Projects as- signed to consultants the Team consist of the consultant team selected for the project and the DelDOT project manager (PM), who is responsible for the direct supervision of the consultant. The DelDOT group engineer is responsible for overseeing the Team assigned to the project.

1.4 PROJECT DEVELOPMENT STAGES

The four phases of a project are planning, design, construction and maintenance. The participation in these phases is dependent upon a project's environmental Class determination. Chapter 3 defines the various classes and types of projects that fall under them. The following highlights most of the tasks encountered on a major capital improvement project designated as a NEPA Class I or III. Action requiring an Environmental Assessment (EA) or an Environmental Impact Statement (EIS), the Team coordinates the studies and reports being prepared by other support sections. The majority of DelDOT projects are designated as Categorical Exclusion Evaluations (CEE) and many of the planning activities are abbreviated with the Team's major responsibilities concentrated in the design and construction phases. For a description of the types of projects under each of these classes see Section 3.5.

1.4.1 PROJECT LEVEL PLANNING

- CTP Approval Received
- Project Initiation
- PM Assigned

- Determine the Need for and Execute and Agreement with a Consultant
- Identify Project Planning Team
- Scoping – Project Objective
- Purpose and Need Studies
- Alternative Development
- Concept Plan/Preferred Alternative
- Alternative Approval

1.4.1.1 Concept Designs

- **Scope -** Statement of the project objectives
- **Conceptual plans** – Plans that typically include location, preliminary scope of work for design, typical sections, right-of-way requirements
- **Proposed transportation modes** - A discussion of each transportation mode included in the scope and how they are integrated into the transportation solution as well as transit, park-and-ride, pedestrian and bicycle needs.
- **ITMS/DelTrac solution**- How ITMS technology is to be used to meet project objectives and what needs to be installed.
- **Supporting documentation** - All socio-economic, environmental, and historical documents and information; known commitments to legislators and communities; responses from public outreach efforts including workshops, hearings and working groups.
- **Identification of wetlands and cultural resources** by location and extent with mapping, potential impacts, and sufficient analysis of alternatives for avoiding or minimizing impacts to identify permit and compliance requirements.
- **Context Sensitive Design –** A discussion of significant project features that should influence final design details in order to ensure the project is developed to complement the community or surrounding area.
- **Air Quality Conformity Determination**
- **Drainage solutions** that address storm-water quality and quantity and wetlands mitigation
- **Construction Project Estimate Form** – A complete breakdown of project budget/cost estimates and engineering estimates
- **Initial Project Schedule**
- **Project Checklist**
  - Project name
  - Project limits
  - Contract Number
  - PM Name
  - Federal Aid Number (if applicable)
  - Current CTP project programming
  - Approval
- **Location map** showing general location and project limits
- **NEPA information**– including a list of required permits and summary of cultural resource consultation requirements
- **Public Involvement** – summary of process to date and expected future requirements

1.4.2 DESIGN

I. Identify project design team

   A. If not previously selected, determine the need for and engage a design consultant

II. Confirm NEPA class, cultural and natural resource survey requirements and permit status with Environmental Studies

   A. Refine project management goals
   B. Utility designation (test pits)
   C. Request Deeds or Title Search from Real Estate Engineering

III. Request Geodetic and Engineering Surveys

   A. Wetland designation

IV. Complete Survey Plans

   A. Establish existing R/W baseline and existing R/W
   B. PM reviews
   C. Coordinate TS&L Plan with Bridge Design
   D. Request review and comments as per Plan Distribution List

V. Develop Preliminary Plans

   A. Confirm/update traffic data
   B. Conduct Scoping Meeting
   C. Request soil borings/pavement cores
   D. Obtain pavement evaluation
   E. Conduct Public Workshops/Meetings
   F. Submit engineering report for design approval (if required)
   G. Request design exceptions (if necessary)
   H. Incorporate all new data and comments into preliminary plans
   I. Coordinate with Traffic Section the traffic signal plans, including roadway lighting, DelTrac, and ITMS
   J. Review with Stormwater Management
   K. Meet with Traffic Safety and

Construction to initiate temporary traffic control plan, construction phasing and overall TMP scope

VI. Finalize Preliminary Plans
   A. Include Conceptual Drainage Plans
   B. Review for conformance with QA/QC Plan
   C. Conduct internal review of preliminary plans
   D. Distribute plans
   E. Request comments on preliminary plans as per Plan Distribution List

VII. Develop Semifinal Plans
   A. Review for conformance with
   B. QA/QC Plan
   C. Internal review of semifinal plans with management
   D. Conduct public work- shops / meetings (if necessary)
   E. Review status of environmental process
   F. Review utility test pit data and proposed relocation plans
   G. Coordinate preparation of specifications package
   H. Submit semifinal plans for comment as per Plan Distribution List
   I. Incorporate comments/utility plans
   J. Prepare semifinal TMP
   K. Provide semifinal quantity calculations

VIII. Develop Semifinal Right-of-Way Plans

   A. Reviews for conformance with
   B. R/W Plan Checklist
   C. Conduct meeting (if necessary) with Project Team to discuss comments on preliminary plans
   D. Develop semifinal drainage report (Storm water Management sites and BMP's)
   E. Determine right-of-way needs for any utility relocation
   F. Develop semifinal right-of-way plans
   G. Send semifinal right-of-way plans to Team Support and Real Estate for comment
   H. Revise Semi-Final **Finalize Right-of-Way Plans**
   I. Review and incorporate semifinal plan comments and prepare final right-of-way plans
   J. Review for Conformance with R/W Checklist
   K. Forward Revised Semi-Final Right-of-Way Plans to Real Estate and Team Support

IX. Finalize Design Plans
   A. Review for conformance with QA/QC Plan
   B. Conduct review meetings with
   C. Project Team as necessary
   D. Develop final design plans
   E. Submit final plans for approval signatures and statements
   F. Submit final TMP for signature
   G. Submit final plans for timing and constructability review (coordinate a meeting if necessary)
   H. Complete quantity calculations and submit to Construction for re- view
   I. Assemble PS&E submission
   J. Review PS&E statements and final specifications for agreement with plans
   K. Finalize engineers' estimate o Review PS&E Package
   L. Submit PS&E Package

1.4.2.1 Project Advertisement, Bid and Award

- **Advertise the Project**
  - Conduct Pre-Bid Meeting (if, necessary)
  - Review Contractor Questions in
  - Response to Bids
  - Prepare/Review Addendums
  - Review Contractor Bids, Perform Bid Analysis and Recommendation to Award or Not to Award
- **Notification of Award and Contract**

1.4.3 CONSTRUCTION

- **Construction assumes Project Management role**
  - Preconstruction Meeting
  - Monthly construction progress meetings
  - Public Working Group Meeting as necessary
  - Change orders and revisions
  - Contingency increases
  - Project Closeout
  - Final inspection and project acceptance
  - As-Built Drawings and As-Acquired Real
  - Estate
  - Post Construction Review (if necessary)

1.4.4 MAINTENANCE

- Administering construction section sends request for project acceptance to the Maintenance & Operations (M&O) Director

- M&O Director officially sends project acceptance memo.

Chapter Two

The DelDOT Design Resource Center

2.1 Overview

DelDOT's Design Resource Center (DRC), found on the intranet at: http://deldot.gov/information/business/drc/index.shtml provides links to many of the resources needed for project development, including forms, policies and design manuals. The DRC categorizes information that can be found in one or more of the following categories: Bridge Design, CADD, Construction, Cost Estimating and Project Timing, Timing, Environment, Highway Design, Hydrology and Hydraulics, Model Plans, Pavement and Materials, Planning, Project Management, Right-of-Way, Stormwater Management & Erosion and Sediment Control, Traffic, and Utilities. Each of the categories of the DRC has one or more of the following subcategories:

- Guidelines –Includes policies, design guidance, and applicable regulations
- Manuals – Includes design manuals, or links to other applicable publications
- Forms – Includes standard forms (letters, spreadsheets, etc) that are commonly used during the Project Development Process
- Presentations
- Design Aids
- Training
- Related Links

The DRC is updated as needed. Updates are found on the home page under "News and Updates", in spreadsheet format. It is recommended that the DelDOT PM and/or Consultant periodically check this page to ensure that they are using the latest and best information. The News and Updates section also provides guidance on how to automatically receive notifications of updates to the DRC.

2.1.1 General Overview of the DRC Sections

2.2. Bridge Design

Guidelines include Design Guidance Memorandums (DGMs) on Structural Related items, guardrails, Bridge Design Checklists, and regression equations. Manuals include the Bridge Design Manual. Related Links include LRFD Design Examples and QConBridge.

2.3 CADD

Guidelines include Bentley Training Courses. Manuals include the CADD Standards Manual. Downloads include the cell libraries.

2.4 Construction

Guidelines include the E&S Field Guide, Guardrail Installation Procedures, and Change Order Reason Codes. Manuals include the Construction Manual, Standard Construction Details, and Standard Specifications.

2.5 Cost Estimating and Project Timing

Guidelines include estimating Road User Costs, Quantity Calculation Guidelines, Production Rates, Estimate Forms, and scheduling information. Manuals include the Standard Specifications

2.6 Environmental

Guidelines include DelDOT's Noise Policy and NEPA Planning Requirements. Presentations include guidance on how not to lose federal funding

2.7 Highway Design

Guidelines include DGMs on Pipe Materials, Triangular Channelizing Islands, and use of the Safety Edges. Manuals include *Enhancing Delaware Highways, Flexibility in Highway Design*, and DelDOT's *Road Design Manual*. Related Links include a link to the AASHTO Task Force 13

2.8 Hydrology and Hydraulics

Guidelines include DGMs on Personnel Safety Grates and a Sample Drainage Report. Manuals include *Design of Urban Drainage*, and HDS and HEC Manuals. Design Aids include technical information for Drainage Pipe Design, and Maps of New Castle County Watersheds. Related Links include links to the American Concrete Pipe Association, and FHWA Hydraulic Engineering Toolbox.

2.9 Model Plans

This section provides examples and Model Plans for Bridges, Cross Sections, Highway Plans (for both Urban and Rural examples), and R/W Plans

2.10 Pavement & Materials

Guidelines include Pavement Design Guidelines, and usage of Carbonate and Non-Carbonate Hot Mix Items. Manuals include the Materials and Research Manual. Forms include the Soil Boring Request Form. Presentations include New Pavement Technologies, and Precast Prestressed Concrete Pavements.

2.11 Planning

Forms include Checklists for Subdivision Record Plan Approval. Guidelines include Volume Warrants for TISs.

2.12 Project Management

This section provides the most guidance in the Project Development Process, and should be utilized by the PD Team in most stages of the process. Guidelines include standard plan notes including MOT; Engineering Instructions (EI) on set up of electronic files; Entering Estimate Data into Primavera; STIP and TIP Modification Procedures; Plan Submission Checklists; and Plan Revision Guidelines. Manuals include the Professional Services Manual. Forms include standard letters for Plan Distributions; Recommendation to Award; Data Collection Requests; Consultant Management forms; Finance Requests; and Design Standard Forms. Links include the DelDOT Archived Plan Lists and FHWA Program Policy and Guidance Center.

2.13 Right of Way

Guidelines include the R/W Data and Tabulation Sheet Program and Right of Way Plan Checklist. Related Links include links to County websites for parcel searches.

2.14 Stormwater Management & Erosion and Sediment Control

Guidelines include Approved E&S Product Lists and Sediment & Stormwater Management Project Design & Review Checklist. Manuals include The Erosion and Sediment Control and Stormwater Management (ES2M) Design Guide. Forms include BMP Identification Number Form. Related Links include links to DNREC and E&S Regulations.

2.15 Traffic

Guidelines include Lighting, Markings, Signing, and Signalization, along with Pedestrian Traffic Control detour examples. Manuals include the DE MUTCD, Traffic Calming Manual, and Work Zone Safety and Mobility Procedures.

2.16 Utilities

Guidelines include Utility Process Flow Chart and Relocation Memo & Checklist. Manuals include the Utilities Manual.

Chapter Three

PROJECT INITIATION

3.1 OVERVIEW

For Project Development, usually the most critical aspect is ensuring funding is available for all phases of a Project. This is also critical for Project Initiation.

3.2 TRANSPORTATION ORGANIZATIONS AND OTHER IMPORTANT ASPECTS

There are organizations that are involved in the development and approval of capital transportation improvement programs. They include Metropolitan Planning Organizations (MPOs). The MPOs develop 20 Year Regional Transportation Plans (RTP) and 3 Year Transportation Improvement Programs (TIPs), among other responsibilities. The MPOs in Delaware and the areas they cover are:

- WILMAPCO - New Castle County, Delaware, and Cecil County, Maryland. http://www.wilmapco.org/
- Dover/Kent County MPO - Kent County, Delaware, including the cities of Milford and Smyrna. http://doverkentmpo.delaware.gov/
- Salisbury/Wicomico Area MPO – a portion of Sussex County, Delaware, including Town of Delmar; and Wicomico County, the Cities of Fruitland and Salisbury, Maryland. http://www.swmpo.org/
- Sussex County: Currently does not meet the federal criteria requiring the organization of a MPO. DelDOT maintains a county based transportation plan in order to provide the same level of planning effort as afford by Kent and New Castle County's MPOs.
- DelDOT: DelDOT develops and maintains a 6 year statewide program of transportation projects that is designated as the Capital Transportation Program (CTP) DelDOT also develops a State Transportation Improvement Program (STIP) that contains the projects in the first four years of the CTP. The STIP incorporates the MPO's TIP. The documents are usually found on DelDOT's Website: http://deldot.gov/information/pubs_forms/
- Delaware General Assembly: The General Assembly provides the authority, on a yearly cycle, via the "Bond Bill" for funding projects. http://legis.delaware.gov/

A Project is funded only if it's found in these documents as required, consistent with State and Federal requirements. If estimates change which require additional funding for any phase, there are guidelines on how to modify the STIP and/or TIP, found on DelDOT's Design Resource Center (DRC): http://deldot.gov/information/business/drc/misc_files/modification_procedures_for_stip_and_tip.pdf.

Close coordination is recommended between the Project Development Project Manager and Finance Section to anticipate when STIP and/or TIP changes are needed.

3.3 PROJECT INITIATION

Project development begins when the project is assigned to one of DelDOT's project development regions. The following is an overview of the major items accomplished during the initiation phase.

For project development, the state is divided into a north (New Castle County) and south region (Kent and Sussex Counties). When a project is initiated, the Assistant Director reviews staff assignments and select the Team for the project.

The first priority of the Team is to obtain a project number that will be used to identify the project and to set up funding. The project number request process is automated and can be accessed through Primavera and FACTS systems on DelDOT's Intranet web site. Using data from the CTP/STIP, the PM will enter the project description, codes and approved estimate. Once all required information is entered into Primavera, a finance number is requested using the FACTS system. The previously entered data is automatically transferred into FACTS. Finance reviews all the data for accuracy, assigns a finance (project) number, and the federal number, if applicable.

An important step in this process is a determination of the funding source and, in particular, FHWA's role in project development. For federally funded projects, refer to the current DelDOT/FHWA Stewardship Agreement which defines the responsibilities of the two agencies.

Finance forwards the assigned project number notification via email through Primavera to the Team and Environmental Studies.

The funding process is similar for all projects. However, for larger, more complex projects that have a high probability of being determined to be Class I EIS's and Class III EA's the initial funding may be limited to project planning and alternative studies.

An environmental document of some type is required before any federal funds can be used on any phase of a project. DelDOT's annual Capital Transportation Program (CTP) lists project phases according to Federal Highway Administration's (FHWA) definitions: Preliminary Engineering (PE, includes both preliminary and final design), Right of Way (RW), and Construction (C), includes Traffic, Utility, and Construction Engineering (CE). Because both preliminary and final design phases are combined into one PE phase in DelDOT's CTP, there may be some uncertainty as to when preliminary design ends and final design begins. This can pose a risk to DelDOT's project development schedule and funding if final design activities inadvertently proceed before they are authorized by FHWA.

Each phase is funded and authorized separately by FHWA. Prior to issuing a Notice to Proceed (NTP) for the PE phase of a federally-funded project, the project phase must first have three components in place:

1. It must be listed in the STIP,
2. It must have a NEPA document prepared and approved (i.e., NEPA decision has been made in the form of an approved Programmatic Agreement CEE for the PE phase of the project) and
3. An authorization/agreement must have been executed (FMIS Approval)

Prior to issuing a Notice to Proceed (NTP) for the RW and/or C phase of a federally-funded project, the project phase must first have three components in place:

1. It must be listed in the STIP,
2. It must have a NEPA document prepared and approved (i.e., NEPA decision has been made in the form of an approved Programmatic Agreement CEE or a FHWA approved CEE, or a FHWA issued Finding of No Significant Impacts (FONSI) for Environmental Assessments (EA), or a FHWA Record of Decision (ROD) for Environmental Impact Statements (EIS), for the RW and/or C phase of the project, and
3. An authorization/agreement must have been executed (FMIS Approval)

If those three components are not in place at the time of NTP issuance, or work otherwise advances beyond the current federally-authorized phase, FHWA cannot provide funding for activity that occurred prior to their approval.

Final design cannot proceed until the NEPA process is completed. *To prepare the NEPA document, it is necessary to proceed with preliminary design to assess alternatives and select a preferred alternative. It may also be necessary to proceed to a higher level of design on specific portions of a project (work that would typically be completed under final design phase) to allow for better evaluation of potential impacts to Section 106 resources and Section (4f) resources or to develop additional information for permit decisions to reach a NEPA decision*

3.4 ENVIRONMENTAL DETERMINATION

Once Environmental Studies receives the notification that the project number has been assigned, the initial environmental evaluation is made to determine the appropriate class and level as defined by NEPA and other federal and state regulations. For project management, all subsequent project activities will be based on the results of this determination.

The environmental review is based on the guidelines set by NEPA creating a requirement that projects be assessed for their potential and existing impacts both physically and socially on the environment. The initial environmental assessment focuses on the probability that a project will be determined to be a CEE. This category identifies projects that are determined to have little to no impact. Basically these are projects with similar scopes of work that have been completed in the past with little to no impacts on the environment and therefore it can be concluded that similar type projects will have none.

If it is determined that there may be significant impacts then an EA is made to determine if an EIS is necessary. The majority of projects have no significant impact and a FONSI is issued. The Environmental Studies Manager concurs on the project level determination, agency and public involvement requirements and critical environmental findings. Section 4(f) requires a project be analyzed for its impact on eligible or potentially eligible historic structures, parklands, wildlife refuges or other publicly owned recreational use areas. If potential impacts are determined a possibility, further coordination, evaluation and documentation is required.

The following briefly describes the initial environmental class and level determination process.

3.4.1 MAJOR CAPITAL PROJECTS – CLASS I & III ENVIRONMENTAL IMPACT STATEMENT AND ENVIRONMENTAL ASSESSMENT

Project development and preparation of environmental documentation follows guidelines found in the Code of Federal Regulations at 23CFR771.119 through 127. Projects determined to require further evaluation within the guidelines set for an EIS may result in either an EA with a FONSI or an EIS with a ROD. For these projects, only survey, environmental studies and conceptual design is authorized using the team approach. These funds are used to determine the project's purpose and need identify viable alternatives, perform detailed studies of the alternatives and recommend a preferred alternative for approval.

EA's and EIS's are typically prepared with the assistance of DOTS open-end consultant services with review and oversight provided by the PM and the Environmental Studies Office.

3.4.2 MINOR CAPITAL PROJECTS - CLASS II (c) & (d) CATEGORICAL EXCLUSIONS

Activities typical of this type of classification are described in the Code of Federal Regulations at 23CFR771.117. The majority of DelDOT's program are CEE activities and environmental review and compliance documentation typically is done in house.

Appropriate documentation is required which demonstrates that significant environmental effects will not result.

Many CE projects, Class II(c) or (d), are authorized to proceed directly to the design phase and do not require a preferred alternative plan package. However, depending upon the scope of work, many project development activities will be evaluated in detail or superficially before actually beginning design.

The majority of CE's require little more NEPA documentation than a completed Project Initiation Form and CEE Checklist along with a simple, concise narrative report, a CEE.. These, actions do not individually or cumulatively have a significant social, economic, or environmental affect are excluded from the requirement to prepare an EA or EIS, and can be processed as a

CEE. This is not to say that these types of projects will not require some level of natural and cultural resource evaluation and or agency coordination, most will; just not to the extent of a larger more complex construction project.

Examples of projects which may qualify as CE's under NEPA guidelines with appropriate documentation are:

- Highway resurfacing, restoration, rehabilitation, reconstruction, adding shoulders, or adding auxiliary lanes (e.g., parking and turning lanes)
- Highway safety or traffic operation improvement projects including the installation of lighting
- Bridge rehabilitation, reconstruction or replacement
- The construction of grade separation to replace existing at-grade railroad crossings
- Transportation corridor fringe parking facilities
- New truck weigh stations or rest areas
- Approvals for changes in access control
- Construction of bus transfer facilities (an open area consisting of passenger shelters, boarding areas, kiosks and related street improvements) in a commercial area or other high activity center with adequate street capacity for projected bus traffic
- Acquisition of land for hardship or protective purposes; advance land acquisition loans under section 3(b) of the Urban Mass Transit Act.

There are various approaches to documenting required CEE determinations. For minor activities, programmatic approaches reduce paper generated while still assuring adequate program control. FHWA and DelDOT have entered into a Programmatic Agreement Regarding the Processing of Certain Categorical Exclusion Actions. This allows internal approval by the Manager of the Environmental Studies Office for certain activities, actions most frequently processed under this agreement include bridge maintenance, TA's, pave and rehab and small HEP projects, certain restrictions apply. A copy of the PA has been made available on the DelDOT public web site under Doing Business with DelDOT, Intergovernmental Agreements.

More complex projects require more information in a formal submission from DelDOT so FHWA can conclude the project will not cause a significant environmental impact.

The CEE Report, prepared by the Project Manager with the assistance of the Environmental Studies Office, provides an assessment of the social, economic, cultural and environmental impacts of each project, and a checklist of environmental compliance issues. It is very important that the designer coordinate with the Environmental Studies Office from project inception to ensure the proper baseline surveys (e.g., wetland delineations and archeological surveys) are completed early in the project development process. It is important to continue to coordinate with Environmental Studies Office in resource evaluation, impact assessment and the development of avoidance and mitigation efforts throughout the project development process. This is integral to successful plan development. Any questions concerning environmental requirements should be directed to Environmental Studies. The designer must advise Environmental Studies of any changes to the design on which the CEE Report was based. Monthly ESO/PD/BS meetings are held to support this effort. The ESO is available for individual meetings and field reviews as needed to guide the PD effort.

3.5 CONSULTANT USAGE

When it has been determined that a Team will include a consultant, the time required to hire a consultant can be shortened by selecting one of the firms that DelDOT has established open-end contracts with. If the appropriate expertise cannot be found from among those with open-end contracts, DelDOT may elect to procure additional design services through another agreement, which may take a number of months. Refer to DelDOT's *Professional Services Procurement Manual* for criteria to use when selecting a consultant. While a consultant is being considered, the Team can begin the process of gathering data for subsequent project development steps such as a needs analysis or mapping.

3.6 DEFINE STUDY AREA OF INTEREST

Some projects require additional studies beyond those initially identified through the long range planning or systems analysis that

identified the transportation problem. The study area is verified and refined based on input from DelDOT technical staff, stakeholders, and consultants. The study area is typically larger than the project limits. It must be big enough to include all areas that contribute to the transportation problem and encompass the range of alternative solutions appropriate to solving the problem.

3.7 STAKEHOLDER INVOLVMENT

Stakeholder involvement is essential for every step in the project development process. Stakeholders provide information and offer a unique perspective in identifying the problem and what changes or improvements are needed to have a successful project. Stakeholder involvement is also required by FHWA during the planning and environmental processes.

Stakeholders are individuals and groups who are or may be impacted by or have an interest in the project. In some cases, federal regulations define the stakeholders. Typically stakeholders could include:

- DelDOT (including DART)
- FHWA
- MPO
- Elected officials
- Local public agency, i.e. the county and/or municipality
- Civic and community associations
- Property owners/residents
- Environmental justice populations (i.e., low-income populations and minority populations)
- Local businesses
- Environmental resource agencies, both state and federal
- Special interest groups, such as emergency responders.

3.8 INITIATION RESULTS

Project initiation should result in the development of a project schedule that can be used by the Team to coordinate and track project schedules, reports and milestones, and manage the critical path activities that must be completed as planned to maintain the project schedule. This also includes determination of agency involvement, advisory groups and the PIP.

During the project initiation stage the Team will have time to research any studies currently available and perform a cursory analysis of major issues such as:

- Constructability / Feasibility
- Financing
- Utility and railroad involvement
- Traffic operations and ITMS needs
- Transportation management plans
- Environmental questions
- Identification of individuals and institutions likely to be affected by the project.

The Team is responsible for establishing a project file that will include all data, maps, photographs, meeting summaries and correspondence throughout the life of the project, as well as a project binder per the QA/QC plan.

During the project initiation phase the following has been completed:

- Completed the project number request and initial funding authorization through FACTS.
- Entered other required data in Primavera
- Determined federal funding and PODI (Finance).
- Project initiation notice is complete from
- Finance (FACTS)
- Evaluated the need for consultant services.
- Held preliminary office and field scoping review meetings with the project team.
- Set preliminary scheduling parameters (such as length of project, project goals, type of work, and initial milestones).
- Established the initial level of environmental documentation and class determination.
- Developed the public involvement strategy.

Chapter Four

SCOPING

4.1 PURPOSE

For many designated categorical exclusion and state funded projects, the scoping phase also establishes a project's purpose and need as well as the feasible alternatives.

4.2 PRINCIPLES

The scoping process is based on the principles of:

- Teamwork
- Developing a tentative public and stake- holder involvement program
- Comprehensive decision making
- Project team consensus
- Documentation

4.3 PROJECT SCOPING STEPS

The steps for scoping a project are:

- Developing the process
- Team organization
- Scoping Objectives - determining
- Needs, complexity and feasible alternatives
- Developing the public involvement process
- Documenting the scoping results
- Approval of proposed scope

4.4 DEVELOPING THE PROCESS

Defining the goals of the scoping process is a very important step for the PM. There are two overlapping aspects in the scoping process: developing the technical needs; and planning how to manage the project.

In order to define the process, the PM should be familiar with the numerous technical tasks that must be completed to achieve each designated project milestones. By knowing the general scope of the project and relating the expected work tasks to the milestones, the PM can define the level of scoping, and identify the probable project team members and how to involve them in the process. Keep in mind that for each milestone there are specific people who must review and comment on the product being developed, including the final scope of work. Time must be allocated in the project schedule to account for these steps.

During the project initiation process, the PM should evaluate the assigned project using all currently available information. There are very clear steps that the PM needs to undertake in order to manage the project and establish a solid project team, including:

1. Evaluate the project. Understand the project's funding source and the extent of its local and area wide impact
2. Clearly establish the project goals and requirements. Understand the ultimate result of the project and how these goals will be achieved.
3. Develop a tentative Project Schedule. This includes project completion dates (months) for each milestone.
4. Team Responsibilities. The basic goal of the Team is to develop a project scope that addresses transportation, community and environmental concerns in the project area.

4.5 PROJECT TEAM ORGANIZATION

As a part of the project initiation process, Environmental Studies previously reviewed the general scope as defined in the CTP. At this time a presentation at a monthly

Environmental Studies staff meeting of the current vision of the project scope and project development process may be appropriate before proceeding too far into the scoping process. The project introduction marks the first in a series of interactions between DelDOT and state and federal resource and regulatory agencies and others as determined by Environmental Studies. The PM and designated team members attend this presentation as necessary.

The initial project review with the agencies would include the project's planning history and a review of DelDOT's internal scoping process. The PM may be requested to provide maps of the study area to familiarize the agencies with the location in relation to communities, natural, socioeconomic and cultural resources, and other current or planned transportation improvements plans.

For the PM, the initial presentation identifies any issues of potential concern, outlines the scope of studies, and presents a general project schedule that includes agency review/involvement that the PM will integrate with project development milestones.

Environmental Studies will coordinate and maintain continuous interactions with affected agencies as a part of regular periodic sessions, meetings and field reviews as needed with:

- DNREC
- FHWA
- SHPO
- Advisory Council on Historic Preservation
- US Army Corps of Engineers
- EPA
- US Fish & Wildlife
- Others as needed at county, state and federal levels

Depending on the probable project scope, the PM recommends which DelDOT specialty areas should be considered to participate on the team. Available specialty areas include: Environmental Studies

- Utilities
- Right-of-Way Engineering
- Storm water Management
- Traffic
- Systems Design
- Safety Programs Manager
- TMC
- Work Zone Safety
- Real Estate
- Maintenance and Operations
- Pavement Management
- M&R
- Construction
- DTC
- Bicycle and Pedestrian Coordinators
- ADA Coordinator
- Hazardous Materials
- Bridge Design
- Bridge Management
- Quality
- Railroad Coordinator
- Public Relations

The goals of managing a project are to make sure the project is completed on time and within the established budget, that it meets a high degree of professional quality and with a minimum number of changes to the design during construction. Meeting all of these goals requires significant effort and a variety of monitoring and management techniques.

The sections that are usually members of the project team at all stages in project development are Environmental Studies, Utilities, Team Support, and Traffic.

4.5.1 ENVIRONMENTAL STUDIES

All transportation projects have a level of environmental impact. Numerous agencies, laws and regulations govern these impacts. In most cases, several agencies must approve plans and designs and/or issue permits before a project is advertised for construction. Each of these agencies ensures compliance with the laws and regulations that govern their individual areas of concern; a project can be affected by any of them. Chief among compliance issues are water, wetland and permitting coordination and cultural resource compliance.

Due to the comprehensive nature of these issues, regulations and agencies, DelDOT has an Environmental Studies section staffed with experts. In addition to providing subject matter expertise, this section maintains and manages DelDOT's relationships with each of the governing agencies to ensure smooth operations during

the permit and approval process. It is the PM's responsibility to ensure that Environmental Studies is continuously involved in the project – even if a consultant is handling this portion of the project. There is a requirement to provide the appropriate level and type of data related to the project design details and the environmental resources necessary for permit applications. The time required for obtaining approvals and permits can be extensive. Therefore, Environmental Studies must begin their work as early in the process as possible.

In addition to securing permits and approvals, Environmental Studies also provides feed- back from the regulatory agencies through project development that must be incorporated into the plans and specifications. Regulations require that all construction projects be designed in a way that mitigates adverse impacts on the environment.

One excellent source for information regarding environmental laws and regulations and their association to transportation project development is The Center for Environmental Excellence by AASHTO. These sites are constantly updating webinars, practitioners hand books, current transportation environmental issues, and solutions etc.

4.5.2 UTILITIES

Transportation projects frequently affect either underground or aerial utilities: cables, pipes, wiring, etc. DelDOT has franchise agreements with the various utility companies that allow them to occupy state right-of-way but require all necessary adjustments to be performed by the affected utility. Therefore, since these companies are organizations independent of DelDOT, they need time to assess, mitigate and fund any impacts of the proposed construction. Therefore, it is critical that continuous and consistent communication be maintained with them. In some cases, such as municipal water or sewer lines and privately owned utilities, it may become necessary to prepare and include these plans in the project for their adjustment or relocation. Knowing this early in the process will keep a project on schedule.

DelDOT's Utilities Section coordinates and communicates with the utility companies at least on a monthly basis. Lead times for utility work – plan review, test pits, relocation plans – can be very long. Involving the Utilities Section as early as possible in the process and maintaining communication throughout is important.

4.5.3 ROW Engineering

Depending upon the alternatives being considered during this phase, an initial evaluation of the right-of-way impact may be a valuable decision-making tool. Acquisition of right-of- way can be controversial, expensive and time consuming. Team Support can determine the existing right-of-way by researching old plans, deeds, wills and other information for the PM.

The PM should be aware that the real estate acquisition process (appraisal, review, negotiations, possible condemnation, etc.) can be lengthy depending on how many property owners are involved and how willing they are to negotiate with DelDOT. The initial scoping should consider the real estate impacts; time must be allocated to account for this process.

4.5.4 TEAM SUPPORT – STORMWATER MANAGEMENT

One of the significant project concerns that must be identified and provided for early in project development is storm water management. Providing areas for BMP's, storm water management ponds, retention and detention facilities can seriously affect right-of-way requirements and project cost. Early Team Support will minimize scheduling delays and serious disruption of private property later in project design.

4.5.5 TRAFFIC

Many projects involve safety, capacity and other traffic issues. Several subsections within Traffic are represented on the Project Team throughout the process. At the scoping level, discussion would focus on accident data and other relevant operational issues. The Traffic Studies group may have studies already avail- able. Traffic would also assist in evaluating impacts on the various traffic controls and monitoring systems operating within the study area.

Traffic issues that need to be discussed and responsibilities assigned at this stage would include:

- Design year
- Future year traffic projections
- Traffic counts, if needed
- Crash analysis
- LOS/capacity analysis
- Analysis and evaluation of the above factors for each proposed alternatives
- TMP analysis, documentation and monitoring

Chapter Five

ALTERNATIVES DEVELOPMENT

5.1 INTRODUCTION

For CEE projects, the Team will not normally need a detailed alternative development phase. However, during the course of the development of many projects, the Team will encounter discussion, comments or concerns on the topics described in this chapter. The Team should be familiar with them and be aware of the possible impact they may have on a project.

Before alternatives can be developed, the purpose and need for the project must be determined. A comprehensive Purpose and Need Statement is required for a project needing an EA or EIS. The need for a project must be clearly demonstrated for it to proceed and to receive federal or state funding. The level of participation of the Team depends upon alternatives being considered and the significance of their impacts. Preparing the Purpose and Need Statement is primarily the responsibility of the Environmental Studies Section. The Purpose and Need Statement will later be used in any required environmental documents and the development of design alternatives.

CE projects do not require a detailed Purpose and Need Statement. However, for the benefit of the project development team, there should be a brief statement documenting the transportation problem to be solved by the proposed project. It may contain broad goals and objectives, and a description of the transportation conditions (congestion, safety, etc.) underlying the problem. This statement is entered into Primavera and the project file and is the basis for setting the criteria for

After determining the Purpose and Need, the alternatives development phase involves developing the engineering design concepts that meet the identified purpose and need of the project using the team approach. The level of plan development available for studies will vary from project to project. Available material may range from aerials with some field verification to detailed concept plans or survey plans.

The final result of this phase is the choice of an alternative for the project and the appropriate NEPA documentation. For most CE projects, this phase is minimal. The level of impacts identified determines specific NEPA documentation required for the project. Projects with little or no significant impact to re- sources can be processed with a CE, while those with significant impact require an EIS. An EA should be carried out for projects with an undetermined level of impact(s). See Section 6.16 for further information about the NEPA documents.

Depending on the project size and scope and its initial environmental class determination, alternatives development may include some or all of the following; right-of-way, surveys and mapping, environmental issues, safety, highway design, pavements, hydraulics, geotechnical, structural design, maintenance, construction, ITS, work zone safety, traffic management, traffic operations and analysis to support the identification of a preferred alternative. For project alternatives that impact or involve structures, it is important to have early and ongoing coordination with the Bridge Design Section. Traffic capacity and safety issues are coordinated with Traffic.

Many of the coordination efforts run parallel to the development of alternatives. The in- formation collected and the collaboration initiated during the study phase should continue.

Once the proposed purpose, need and

objective have been established, all reasonable alternatives that can accomplish the objectives should be identified. These should be practical engineering solutions for addressing the identified need within the overall limits, funding, and intent of the planning and programming goals.

Several reasonable build alternatives may need to be investigated and considered. Alternatives should be developed using design criteria and guidelines provided in the following:

- AASHTO *Green Book* (*A Policy on Geo- metric Design of Highways and Streets)*
- AASHTO *Roadside Design Guide*
- AASHTO *LRFD Bridge Design Specifications* DelDOT *RDM*
- DelDOT *BDM*
- DelDOT *DGM's*
- *DelDOT Traffic Design Manual*
- Delaware *MUTCD*
- DelDOT *Work Zone Safety and Mobility Guidelines*
- DelDOT *Traffic Calming Manual*
- Guidance on Pedestrian and Bicycle Facilities
- Guidance on Sea Level Rise in the State of Delaware

While the categories of alternatives indicate the proposed action, more specific terms must be used to describe an alternative beyond general physical characteristics to evaluate its operational, safety and structural performance. If one or more build alternatives are developed, the documentation should include the following information:

Type of improvement (e.g., traffic operations, reconstruction, realignment);

- General design criteria (e.g., roadway width, design speed, surface type);
- Design elements (design exceptions, typical roadway cross sections, preliminary alignment and grade, grading/clearing limits, clear zone, auxiliary lanes/tapers, intersection types, right-of-way widths);
- Multi-modal accommodation and operational characteristics for all users (e.g., accessibility, shared use, pedestrian or bicycle facilities, transit, traffic control, ITS);
- Physical impacts (e.g., limits of impact, boundaries of resources, compatibility with adjacent environment, land uses and activities)
- Technical features (e.g., safety appurtenances, bridges, walls, large culverts);
- Constructability and work zone impacts
- Constraints (e.g., environmental and cultural resources); and
- Cost estimate.

The intent of the development of conceptual design alternatives is not to develop the final project design, but to provide the direction and scale of the improvement, and confirm that the alternative is viable physically and financially.

Feasible alternatives should be developed to comparable levels for evaluation. A practical, cost-effective design of each proposed alternative should be developed for relative comparison. The alternatives evaluation should accomplish the following:

- Identify, evaluate and compare benefits and impacts of each alternative;
- Establish design flexibility;
- Define commitments to protect and pre- serve the environment for each alternative; and
- Provide potential impacts to properties.

The alternatives design phase should define the project by alignment (and grade if applicable), existing and proposed right-of-way limits, and roadway geometry in general terms based on projected traffic volumes, terrain and other special features.

Initially, alternatives might cover a range or scale of improvements, but they should be condensed to three or four succinct alternatives for which further engineering analyses can be applied. Otherwise, the details, data and descriptions are cumbersome to handle.

5.2 TYPES OF ALTERNATIVES

Some basic categories of alternatives to be considered for most road projects are:

- No Build
- TSM
- 3R
- Reconstruction
- New Construction

5.2.1 NO BUILD

The no-build alternative would only continue the routine maintenance of the facility. It does not include any upgrades that would change the road's operation or extend its service life. This alternative serves as a baseline comparison of the other available options.

5.2.2 TRANSPORTATION SYSTEM MANAGEMENT

TSM alternatives should always be considered when upgrading a road. TSM is an integrated program to optimize the performance of existing infrastructure through the implementation of systems, services, and projects designed to preserve capacity, and improve safety and reliability. TSM consists of travel controls, operational improvements, and/or limited construction to maximize the operation and efficiency of the existing facility without major reconstruction or new construction. Working with the Traffic Section, these types of alternatives include improvements to the transportation system such as:

- Traffic detection and surveillance
- Arterial management
- Freeway management
- Work zone management
- Emergency management
- Traffic incident management
- Roadway weather management
- Traveler information services
- Commercial vehicle operations
- Traffic control
- Freight management
- Coordination of highway, rail, transit, bi- cycle, and pedestrian operations

In considering an alternative, a combination of TSM initiatives (such as minor signing, striping, signal, and ITS upgrades) should be studied. Although it may not completely satisfy all the identified needs, it may be able to partially address a variety of important needs at a low cost and can be implemented within a year.

5.2.3 3R PROJECTS

3R projects make improvements to a high- way along the same general alignment. The 3R's are resurfacing, restoration and rehabilitation. These types of projects address a variety of issues primarily by upgrading the road- way structure and drainage.

5.2.4 RECONSTRUCTION

Reconstruction may involve modifying the existing highway's horizontal and/or vertical alignment, including alignment shifts, in order to improve safety and traffic operations. Re-construction work normally involves substantial construction to rebuild the existing high- way to or close to full geometric and safety standards to provide long-term, multi-modal transportation performance. The complete spectrum of design deficiencies and functional obsolescence of the roadway and structures, as well as future transportation needs, should be addressed. Typical work includes widening, realignment, access improvement, and replacing bridges. While reconstruction approximately follows an existing road corridor, it may deviate significantly in width and alignment from the present road to achieve full geometric standards.

5.2.5 NEW CONSTRUCTION

This alternative is to build a road and/or bridge on completely new alignment or substantially upgrade a highway facility along an existing alignment providing new access to or through an area. Examples are a bypass constructed to carry through traffic around a town or a new access route linking an existing highway with a new recreational facility. Typically, the highway is built on new alignment in a virgin corridor. It normally is constructed to full geometric standards to fulfill both the current and long-term transportation needs of the area.

5.3 DEVELOP PRELIMINARY ENGINEERING CONCEPTS

At the onset of the conceptual design of alternatives, clearly define the project, the design standards to be followed, the LOS and the requirements for each functional classification. Develop the design features for each viable alternative under consideration to a similar level of detail. Refer to Chapter 3 of DelDOT's *RDM* for design objectives.

5.4 ENVIRONMENTAL ANALYSIS

Technical studies are completed to assist in developing the location and design of project alternatives, and to provide a comparison of environmental impacts among the no-build and build alternatives under consideration.

The timing for the study phases may differ depending on the project development process being utilized for the individual project. Field or baseline studies may be completed first as part of the environmental screening process. The comprehensive impact analysis would come later, with full consideration given to the identified environmental factors.

Technical studies are prepared by technical specialists within DelDOT or by consultants. Environmental Studies or other appropriate sections will generally oversee and review consultant studies or perform these studies in-house. Once the studies are completed, the study findings will be summarized for the NEPA document. The technical studies to be conducted are:

- Cultural Resources (architectural/historical and archaeological);
- Natural Resources (threatened and endangered species, wetlands, water quality, terrestrial and aquatic resources);
- Noise;
- Air Quality (based on the regional model);
- Hazardous Materials;
- Conceptual Stage Relocation Plan; and
- Soils and Geology.

5.4.1 IMPACT, AVOIDANCE AND MITIGATION

In all project phases, Environmental Studies staff coordinates impact avoidance and minimization with the project designer. Projects requiring complex mitigation or minimization activities require close coordination with construction staff during planning, design and construction. The three basic types of environmental commitments are:

- Avoidance – The project design could include alignment shifts, grade changes or alternate locations of facilities in order to avoid sensitive resources, including wetlands and historic properties.
- Minimization – This involves creating and implementing measures to reduce the potential impact to a resource. Minimization measures can include: alignment shifts or design measures to reduce the footprint of impact; time of year construction restrictions to avoid endangered species habitat during breeding season; or landscaping to serve as a visual screen.
- Mitigation – This includes compensation and enhancement.
- Compensation - replacing land or facilities to offset damages and displacements, e.g., adding to public park and recreation areas to replace lost facilities or constructing wetland mitigation sites.
- Enhancement - adding desirable features to the project so it will blend more harmoniously with the surrounding environment, e.g., habitat enhancement, developing shared use paths adjacent to roadways. or creating wildlife passages.

5.4.2 Environmental Commitments

Once all of the NEPA approvals and permits have been obtained, environmental/mitigation and resource agency commitments are memorialized in several ways. A typical DelDOT plan set, for projects requiring permits, includes environmental compliance (EC) plan sheets. The EC sheets were developed particularly to highlight water/wetland/natural heritage compliance issues but are used for 106 commitments when appropriate. An environmental statement is required and is made part of the contract documents for all DelDOT projects. The statement is used to call out environmental compliance commitments, restrictions and substantive permit and/or MOA special conditions. For larger more complex projects the permit documents can be made part of the contract documents. In addition, when all permit approvals are in for a given project a permit arrival notification (PAN) is sent to the project manager and construction management personnel attaching copies of permits as well as calling out any notable special conditions. Complying with plan and design special conditions for permits and 106 compliance then typically becomes the responsibility of construction managers. Many of the mitigation commitments or requirements are accomplished with construction of the project. Other types of follow-up compliance, mitigation monitoring, preparation and distribution of final 106 reports, etc, stay with the ESO.

In terms of tracking longer term mitigation commitments, Section 106 MOA and conditional no adverse effect commitments are tracked through the use of electronic files, documented in an annual report and discussed specifically at an annual meeting with DESHPO and FHWA to go over what has been accomplished and what remains to be done. As necessary, these commitments are on the agenda of regularly scheduled monthly meetings with SHPO and FHWA. Likewise longer term wetland monitoring requirements are tracked through the use of spreadsheets. Electronic files and spreadsheets are kept and updated by ESO staff.

In addition, in order to monitor and confirm that permit commitments are being met, the ESO makes regular field visits to review active construction projects. This initially involves attendance at the Erosion & Sediment Control Preconstruction meeting. At this meeting all permit conditions and other environmental requirements are reviewed with the Contractor and the DelDOT Construction Inspection personnel. Subsequent field meetings and inspections are scheduled as needed to address specific concerns and issues that arise during construction. This field presence is beneficial in assuring that the commitments made during design are being carried though construction.

Ninety to ninety-five percent of DelDOT projects are relatively small with minor impacts and minimal environmental requirements. For larger more complex projects, EIS type, the construction management team will have a designated Environmental Monitor on staff to catalogue and track all the environmental mitigation commitments and process plan changes back through the resource agencies as appropriate for permit modification/approval.

5.4.4 HAZARDOUS MATERIALS

A records check can be conducted during environmental screening to identify major known areas of HAZMAT concerns that may influence or control the development of corridors, alignments or design options by requiring avoidance, minimization, or remediation. This involves identifying whether any EPA Superfund sites are in the project area http://www.epa.gov/superfund/sites/npl/de.htm. Other records are generally checked in conjunction with hazardous materials studies conducted by consultants for DelDOT during or after the NEPA phase.

While NEPA does not specifically mandate the completion of hazardous materials investigations, other laws do. In general, hazardous materials investigations are conducted in response to two laws:

- CERCLA assigns the liability for cleanup costs of contaminated sites to the responsible parties. SARA modified

CERCLA to provide defenses to the liability provisions for contaminated sites.

- RCRA deals with the manufacturing, storage, transportation, use, treatment, and disposal of wastes including hazardous materials.

5.4.5 NOISE

NEPA provides broad authority and responsibility for evaluating and mitigating adverse environmental effects, including highway traffic noise. DelDOT has a federally approved set of criteria based on FHWA regulations in 23 CFR 772. A copy of the State of Delaware Highway Transportation Noise Policy can be found on the DelDOT web site as Policy Implement No. D-03. The policy defines the types of projects that require a noise analysis. EIS and in almost all cases EA type projects would require a noise analysis and consideration for mitigation/noise abatement. Many large CE projects could also require a Noise analysis and mitigation consideration based on regulation and policy.

5.4.6 AIR QUALITY

An analysis of a project's potential impacts to the air quality in the project area is required under the CAA, the most comprehensive legislation related to air quality. It established six criteria pollutants and required the EPA to set NAAQS for these pollutants. The six criteria pollutants are ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, and lead. CAAA requires a qualitative discussion of the air quality impacts of a transportation project and any transportation control measure, which may be used to mitigate the air quality impacts attributable to the project.

The EPA Final Conformity Rule, revised on July 1, 1999, requires state Departments of Transportation and MPO's to develop LRTP's and TIP's that conform to the emissions budget and the implemented schedule of TCM's established in the SIP for air quality.

The purpose of air quality conformity is to reduce the severity and number of violations of the NAAQS; to achieve the NAAQS as expeditiously as possible for areas designated as Non-Attainment areas; to ensure compliance with an air quality maintenance plan; and to support the intent of the 1990 CAAA to integrate transportation, land use and air quality planning. The CAAA establishes three designations for areas based on ambient air quality conditions observed for NAAQS pollutants:

- Non-attainment areas currently exceed NAAQS for transportation-related criteria pollutants;
- Maintenance areas at one time were designated as nonattainment areas, but have since met NAAQS for transportation related criteria pollutants; and
- Attainment areas, which are all other areas.

The EPA has designated all three of Delaware's counties as being non-attainment or moderate for one or more pollutants. DNREC is responsible for preparing and updating the SIP.

Transportation conformity is a way to en- sure that federal funding and approval are given only to transportation projects that are consistent with federal air quality goals. According to the CAA, transportation plans, pro- grams and projects cannot:

- Create new NAAQS violations;
- Increase the frequency or severity of existing NAAQS violations; or
- Delay attainment of the NAAQS.

Federal funding for transportation projects and programs can be withheld if a region is found to be in violation of conformity standards.

The responsibility for conformity falls upon the USDOT; MPO's have assumed responsibility for conformity. These agencies ensure that the transportation plan and program with- in the metropolitan planning area boundaries conform to the SIP. The policy board of each MPO formally makes a conformity determination on its transportation plan and transportation improvement program prior to submitting them to the USDOT for approval. Verification of project conformity for currently approved TIP's for both MPO and non-MPO projects, including listings of qualifying projects in each MPO area are on file with DelDOT's Planning Division. The status of a project is addressed in the MPO-approved TIP's as exempt or analyzed, meaning that the project was included in the conformity analysis for the current TIP.

5.4.6.1 Air Quality Analysis

The air quality analysis required during the NEPA process will vary considerably in con- tent and level of detail from one project to an- other based on the project scope, size, geo- graphic location, background conditions and anticipated impacts. DelDOT's Air Quality Program Manager will coordinate the requirements and scheduling for air quality analysis.

5.4.6.2 Documentation

The draft environmental document should summarize the findings of the air quality analysis or discuss that an analysis was not needed for the project and explain why. The final NEPA document should include copies of letters or e-mails indicating that all necessary agencies have been consulted and are in concurrence with the air quality analysis.

5.4.6.3 Mitigation Measures

If a project analysis indicates that the direct and long-term impact of the project would worsen air quality, FHWA will not approve the project as planned; thus no mitigation measures would be appropriate.

All projects require the implementation of mitigation measures to address short-term air quality impacts, i.e., construction impacts. BMP's can be used to mitigate these impacts.

5.5 SOCIAL AND COMMUNITY RESOURCES

5.5.1 SOCIAL/COMMUNITY IMPACTS

Assessing community impacts is needed for practical reasons, but is also required and supported by federal regulations, policies and Executive Orders, such as:

- Title VI of the Civil Rights Act of 1964, and related statutes
- 23 USC 109(h), Standards (1970)
- 23 CFR 771, Environmental Impact and
- Related Procedures
- Executive Order 12898 on Environmental
- Justice.
- NEPA
- SAFETEA-LU

The social and community impact analysis is needed for an EA or when there are a great number of possible relocations for the project. Some of these issues may also need to be considered depending on the land use in the project area.

No template exists for evaluating social and community impacts. Evaluations will differ based on the scope and type of project and on differing community values. Guidance is in the Technical Advisory and several other publications, such as *Community Impact Assessment: A Quick Reference for Transportation* (Publication No. FHWA-PD-96-036, available online). The community impact analysis ensures that consequences to the social fabric are considered with other environmental impacts.

To prepare the social and community impact analysis, complete the following study area tasks to create a community profile:

1. Obtain Census data from the US Census Bureau (www.census.gov). GIS can be of valuable assistance in spatially plot- ting the demographic data. Areas to be examined include trends in population growth and demographics, ethnicity and race, age distribution, income levels, educational attainment, and employment status.
2. Obtain population projections. One source is the Delaware Population Consortium.
3. Conduct a field review of the project area using the previously prepared inventory map. Look for community facilities (e.g., hospitals, emergency services, fire departments, schools, police, recreation areas, libraries), land use concentrations (e.g., residences, neighborhoods, strip development, central business districts, neighborhood commercial areas, possible minority or low-income concentrations, historic districts), types of businesses, planned and approved future development, parklands and other recreation areas.
4. Contact/interview local governments and local Chambers of Commerce. Deter- mine if any community issues exist.
5. Obtain employment and unemployment data from the Delaware Department of Labor.
6. How will the project affect safety for motorists, non-motorized vehicles, and pedestrians? For school children/buses?

7. Will travel patterns be changed, e.g., a change in access to community services or shopping areas?
8. Will residents be displaced? Will community services be displaced?
9. Will it affect emergency response?
10. Will recreational facilities be impacted?

Public involvement is integral to the community impact assessment and the development of measures to avoid, minimize or mitigate impacts. When adverse community impacts are identified, the Team should work to identify design options that would address the impacts, starting with avoidance, and then moving to minimization and mitigation techniques. If none exist, enhancement opportunities considered a reason- able expenditure of FHWA funds could be included in a project, upon approval from FHWA.

5.5.2 ENVIRONMENTAL JUSTICE

During environmental screening, it is advisable to conduct research to preliminarily determine whether EJ issues may exist in a proposed project area. Use GIS to map census data, and coordinate with local government officials. The EPA has an on-line assessment tool EJ View that can be used to identify relevant concerns (http://www.epa.gov/enviro/ej/).

5.5.2.1 Environmental Justice and Non - Discrimination

Title VI of the Civil Rights Act and Executive Order 12898 on Environmental Justice re- late to the programs and projects of federal agencies and their impacts on minority and low-income populations.

Title VI, 42 U.S.C. 2000d et seq., was enacted as part of the landmark Civil Rights Act of 1964. It prohibits discrimination on the basis of race, color, and national origin in programs and activities receiving federal financial assistance.

Executive Order 12898 and FHWA compliance procedures (FHWA Order 6640.23, December 2, 1998) require identifying and ad- dressing disproportionately high and adverse human health and environmental effects, including the interrelated social and economic effects of their programs, policies and activities on minority and low-income populations. Definitions are in the FHWA Order.

The CEQ publication *Environmental Jus- tice—Guidance under the National Environ- mental Policy Act* provides a good overview of the regulations and assessment process. It is available on EPA's website http://epa.gov).

An Environmental Justice issue may arise at any time during NEPA and even in early project planning prior to the commencement of NEPA. DelDOT must consider these issues, as appropriate, at every step of the project development process. Environmental Justice cover a broad range of impacts that fall under the NEPA umbrella, including impacts on the natural or physical environment and interrelated social, cultural and economic impacts. Be highly sensitive to the history or circumstances of a particular community or population, the particular type of impact, and the nature of the proposed action.

The data collected above for social/community impacts are combined with public outreach and a field review to deter- mine if the project has the potential to impact low or minority populations, and if these impacts are disproportionate. The data utilized include race, color, national origin, age and level of income of overall population, as well as the existence of any minority or low-income populations or communities. GIS can spatially plot the U.S. Census demographic data collected for this analysis.

In the NEPA document, present the baseline data. The discussion of this information should be accompanied by tables of data that provide an overview and a means for referencing the data later in the document. Describe community involvement and any issues identified by the community related to Environmental Justice. Develop and present a clear statement in the NEPA document of whether the project alternative(s) will involve an environmental justice issue, i.e., if it will have a disproportionately high or adverse effect on minority and low-income populations. In this assessment, it is important to recognize that impacts on such populations may be different from impacts on the general population due to a community's distinct cultural practices.

When a disproportionately high and adverse effect on a low-income population or minority population has been identified, an analysis should be done to show how the effects are distributed within the affected community. Displaying

available data spatially with GIS can provide an effective visualization of the distribution of impacts among the various demographic populations.

Lastly, when EJ issues are identified, DelDOT should encourage members of these communities to develop and comment on possible alternatives as early as possible in the process.

5.6 RELOCATIONS

The federal Uniform Relocation Assistance and Real Property Acquisition Policies Act, as amended, (43 CFR 24) requires that relocation assistance be made available to all displaced persons without discrimination, in order that they not suffer disproportionate burden as a result of projects designed for public benefit.

The project designer requests a relocation study by Real Estate. The purpose of this conceptual stage relocation plan is to ascertain the number and type of relocations, to determine whether comparable replacement housing is available and to determine project impacts. The number and type of relocations is one factor used in developing, refining and selecting project alternatives.

5.7 SECTIONS 4(F) AND 6(F)

Two federal regulations apply to projects that impact certain recreational resources: Section 6(f) of the Land and Water Conservation Fund Act of 1965 and Section 4(f) of the Department of Transportation Act of 1966, as amended. The latter also applies to other types of resources. These are commonly referred to as Section 6(f) and Section 4(f), respectively.

Section 4(f) applies to all historic sites eligible for the NRHP and to publicly owned parks, recreation areas, and wildlife and water- fowl refuges. It also applies only if the project impact is considered a "use".

Impacts will necessitate coordination with FHWA. Impacts can range from taking right- of-way to visual impacts.

5.8 FARMLAND IMPACTS

The farmland impact assessment is coordinated with the Delaware Department of Agriculture for an EIS involving a new alignment; a LESA will also have to be completed. Guidance is available on FHWA's Environmental Guidebook at the website http://environment.fhwa.dot.gov/guidebook/chapters/v1ch5.asp.

The purpose of Delaware's FPPA of 1981 is to "minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to non-agricultural usages, and to ensure that Federal programs are administered in a manner that, to the extent practicable, will be compatible with State, local government, and private programs and policies to protect farmland." If farmland, as defined in the Act, is converted to non-agricultural use by a project and if there are adverse effects, FHWA and DelDOT must examine alternatives to minimize the impacts. Pursuant to the FPPA, "farmland means prime or unique farmlands."

5.9 TRAFFIC AND SAFETY IMPACTS

Crash reports for the project area for at least the most recent three year period are re- quested from Traffic and used to identify safety and/or community impacts for discussion in the NEPA document. In addition, available studies from the HEP should also be used in the design of alternatives.

The traffic data received include existing (baseline) traffic and projected traffic for each alternative. This information and traffic counts are used for a LOS analysis, for conducting air and noise analyses and pavement type and bridge design. The traffic impact analysis is used to show how the proposed project is alleviating traffic congestion, particularly if this is one of the purposes of the project. A LOS analysis must be done for existing and proposed conditions.

Using crash reports, the locations by mile- post and crash type are identified. These are mapped to identify the actual crash locations. The crash analysis could show:

- Patterns in accident occurrence that may indicate specific highway features which should undergo safety investigation
- Particular types of accidents which should be targeted for countermeasures

The crash rate analysis is prepared to identify any high crash locations by route segment. This is

the first step toward identifying any problem locations and countermeasures that should be considered in the design. The various alternatives should be coordinated through Traffic. See the volumes of NCHRP Report 500 and the Highway Safety Manual for more information on countermeasures. If new traffic signals are proposed- at a minimum the peak hour signal warrant needs to be evaluated.

5.10 CONSTRUCTION IMPACTS

Prepare the analysis of a project's potential adverse construction impacts. The discussion for the NEPA document should address construction-related concerns such as, but not limited to, the following:

- Access to the site,
- Initial assessment of work zone traffic impacts
- Employment benefits;
- Waste disposal;
- Utility relocation;
- Discovery of archaeological sites;
- Erosion control;
- Air quality; and
- Noise.

In some of these areas, impacts will be very similar from project to project; review of the construction impact section of previously approved NEPA documents will provide guidance on how to address each of these issues. Some projects will require more analysis to be completed in areas of concern. The construction-related commitments to avoid and minimize impacts should be outlined in the NEPA document. Several commitments are standard to DelDOT.

5.11 PEDESTRIAN AND BICYCLE CONSIDERATIONS

There are growing efforts throughout the United States to improve conditions for bicycling and walking, including Federal transportation funding legislation, and the state's Livable Delaware Agenda. Refer to DelDOT's Policy Implement Number O-6, Complete Streets Policy.

FHWA considers non-motorized modes of transportation to be an integral part of their mission and a critical element of the local, regional and national transportation system. To varying extents, pedestrians and bicycles will be present on many transportation facilities; it was the intent of Federal legislation that all new and improved transportation facilities be planned, designed and constructed with this in mind.

Due consideration of bicycle and pedestrian needs should include, at a minimum, a presumption that bicyclists and pedestrians will be accommodated in the design of new and improved transportation facilities. In the planning, design, and operation of transportation facilities, bicyclists and pedestrians should be included as a matter of routine; the decision to not accommodate them should be the exception rather than the rule. There must be exceptional circumstances for denying bicycle and pedestrian access. However, all limited or denial-of-access facilities prohibit walking and bicycling.

DelDOT's policy is to routinely integrate bicycling and walking options into the transportation system as a means to improve mobility and safety of non-motorized traffic.

If non-motorized transportation is already a feature of a facility, the continuation and enhancement of that function should be considered in project development. In addition, changes in traffic or traffic patterns may detract from a pedestrian-friendly environment. Include this consideration in the NEPA document.

5.12 VALUE ENGINEERING

During the alternative development phase there may be a need to evaluate one or more of the alternatives based on VE considerations. VE is defined as the systematic application of recognized techniques by a multi-disciplined group to identify the function of a product or service, establish a worth for that function, generate alternatives through the use of creative thinking, and provide the needed functions to accomplish the original purpose of the project, reliably, and at the lowest life-cycle cost without sacrificing safety, necessary quality, environmentally attributes of the project of the surface transportation Refer to DelDOT's Policy Implement D-05 for more information.

5.13 REFINE ALTERNATIVES

Impact studies and public involvement activities may identify major issues that are to be addressed before an alternative is presented in the draft NEPA document. Analysis of these issues might result in modifying an alternative, such as shifting an alignment in order to avoid impacts. Such issues

could include: Section 4(f) use;

- A historic or archaeological site;
- Extensive wetland impacts;
- Environmental justice - disproportionately high and adverse impacts on a minority population;
- Does not solve safety or traffic needs, and
- Access for new industrial or residential development.

These issues should be displayed on an updated "environmental constraints" map. The Team should meet to discuss how these issues impact the project alignment, the technical studies that may have already begun or will soon begin, and the project schedule. Addressing issues at this early stage through minor alignment shifts or other means may save time and avoid problems at later project stages. Any shifts in project alignment, whether minor or major, may require additional technical field studies and analyses or study updates to be completed in the added project impact area.

5.14 RECOMMENDED ALTERNATIVE

After the preliminary engineering and technical analysis is complete, one alternative will typically be identified as the preferred or recommended solution. For the recommended alternative, document all the reasons and logic to recommend this improvement over the other alternatives considered. This should show succinctly and clearly how the improvements of this alternative meet the transportation- related goals and objectives of the project's purpose and need. This information will be used in the environmental process and incorporated within the decision document. Visual depictions and visualizations of project alternatives should be used to convey the full extent of the project.

5.14.1 DESCRIPTION OF ALTERNATIVES

Provide a detailed description of each alternative considered, whether or not it is carried forward for final consideration. The alignments and their impacts should be fully described, including specifics on why the improvement option was considered. This information should also be supplemented with a map depicting the location of the alternative and a typical section showing widths for vehicle lanes, bicycle lanes, pedestrian facilities, landscape buffers, etc. When comparing numerous alternatives, it can also be effective to display them together.

A fatal flaw analysis should be performed on each alternative to determine if it has flaws which prevent meeting the established purpose and need; if so, then determine that the alternative cannot be modified to meet the transportation, environmental, socioeconomic, and feasibility goals of the project, and finally that the flaws make the alternative insurmountable to proceed further in the development process.

If during development of a concept, an option does not appear to best meet the goals and objectives of the project, document the reasons why the alternative was not carried forward so that others in the future considering this area or option will have the benefit of this evaluation.

5.14.2 ALTERNATIVE RECOMMENDATIONS

The benefits and consequences of each alternative considered should be documented. The engineering and technical analysis is closely coordinated with the analysis of environmental and social impacts. A suggested method of evaluation is to compare each alter- native relative to its fulfillment of the project's purpose and need. For comparison, each alternative may be evaluated for its benefits and consequences, such as:

- Mobility Improvements
- Operational Efficiency (Volume to Capacity Ratio or LOS changes)
- Safety Improvements
- Environmental or engineering design is- sues
- Extent or number of impacts
- Economic development impacts
- Land use impacts
- Residential or business right-of-way acquisitions
- Accommodation of pedestrian and bicycle use, including ADA compliance
- Life-cycle cost
- Utility relocation
- Maintenance requirements
- Design exceptions

Alternatives may be presented in an evaluation matrix chart show the evaluation and comparison of the alternatives. The evaluation matrix visually presents the alternatives in a manner that facilitates comparison and helps ensure that the benefits and consequences of each alternative are

consistently considered for screening the best option. Weighting may be assigned to each benefit or consequence to indicate its relative importance in the evaluation. The benefits and consequences for each alternative may then be scored and tabulated so they can be directly compared to each other. The criteria and weighting used to assess fulfillment of the objectives in assigning scores to the different benefits and consequences should be developed with collaboration, understanding and agreement of the agency stakeholders, and fully explained to stakeholders at the completion of the evaluation.

The alternatives analysis of engineering and technical feasibility is performed concurrently, in combination and close coordination with the analysis of environmental impacts, economic viability, and public involvement.

5.15 PROPOSED PROJECT ALTERNATIVE ELEMENTS TO BE IDENTIFIED

This section describes the preliminary de- sign parameters of the proposed improvements that form the project definition in terms of highway engineering practice. DelDOT's *RDM* is used to establish the criteria to be followed for developing the project. A clear and succinct summary of the known and unknown design parameters should be outlined as part of the preliminary design. This information will be used as the controlling design information as the project moves from a study to final design.

This preliminary design information is also needed to quantify environmental impacts and assess compliance with numerous environmental laws and responsibilities. Specific design and engineering information is needed to support the environmental process and ultimately a NEPA decision document. A primary objective of this section is to identify the discipline-specific information needed to support that decision-making process.

5.15.1 GEOMETRIC DESIGN

Incorporate consideration of the geometric design controls proposed for the recommended improvement. If any adjustments were necessary during the alternatives investigation, they should be clearly defined.

5.15.1.1 Design Speed

An initial step in alternate studies is to establish the design speed, in consultation with Traffic, to be used for each type of facility (e.g., mainline, intersecting collectors, front- age/access roads, turnouts). If there are changes in the design speed due to changes in topography or facility capacity, describe where the changes occur and why they were necessary.

5.15.1.2 Horizontal and Vertical Controls

For the horizontal alignment, establish the minimum radius to be used for each design speed and roadway section, and the requirements for stopping and passing sight distance.

Determine the normal crown and maximum super elevation of the roadway and curves. Define the methodology for distribution of super elevation on the curve and on the tangent, and the maximum and minimum rates for various conditions. Determine if spirals should be used in the horizontal alignment.

5.15.1.3 Typical Section

Fully develop the cross section elements of the final design. For each roadway section, develop the number of lanes, lane widths, shoulder type and widths, type and location of auxiliary lanes and widths, median provisions fore slope widths and slope, the conceptual design of ditches, curb and gutter requirements, etc. If lane widening is required for turning movements, also develop the lanes, shoulders and slopes.

Determine the provisions for pedestrians, including ADA-compliant sidewalks, cross-walks, curb ramps and other facilities, and bicycle accommodation features.

Determine the widths of clear zones, and location and type of roadside barriers and terminal sections.

5.15.1.4 Slope Selection

Develop cut and fill slope selection criteria. The general slope requirements of the road- way section are shown in the typical section. If there are special slopes required due to variations in the materials, provide these criteria. Develop the preliminary design of cut and fill slopes.

5.15.2 INTERSECTIONS

Determine the location, density, standards and criteria for access points and intersections within the project. Determine and describe the design

vehicle, and the minimum radius of intersection corners. Also determine the turn lanes, acceleration and deceleration lanes that are proposed. Determine the horizontal and vertical alignment of approaches, type of control, number and types of lanes, lane widths, median opening configuration, shoulders, islands, traffic phasing/control, storage lengths, and auxiliary lane transitions and terminals. Also determine the intersection pavement cross slope, curve radii and tapers, sight distances, pedestrian facilities (including side- walks and crosswalks), and bicycle facilities.

For controlled access facilities, determine the general configuration of interchanges, speeds, alignments and widths of ramps, and auxiliary lane locations.

If there are known constraints that preclude obtaining the desired intersection sight distance, provide guidance on how to mitigate this safety concern.

For project alternatives that propose to include any new traffic signals and in order to obtain FHWA approval, Traffic must pursue a process for establishing the warrants and justifying a new signal using before and after studies.

5.15.3 RAILROAD-HIGHWAY CROSSINGS

Define the scope of improvements to the crossing by conducting a field meeting at the site with railroad staff, DelDOT's traffic safety and railroad coordinators and other interested parties, before starting the survey or design. If possible, obtain a recent railroad map of the site indicating railroad right-of-way for the meeting. This field meeting should clarify railroad company policies on the following topics:

- The closest encroachment to the centerline of tracks permitted,
- Sight distance triangles,
- Traffic maintenance (detours),
- Drainage or other proposed features, and
- Railroad work schedules.

Coordination is needed early with the rail- road company for temporary traffic control that may affect the railroad. Safety is a major concern whenever trains are involved. Identify all matters necessary to resolve financial responsibility, scheduling, and authorization to proceed with the work. Traffic control and protection (e.g. type, number and location or railroad signals) to be installed should also be determined.

All utilities, both aerial and buried, in possible conflict with the proposed installation must be determined, including facilities interfering with proposed railroad signals or gate installations requiring adjustments. Consider any future railroad or highway widening projects when determining signal locations. Current federal regulations may specify that railroad safety upgrades be included in the studies.

Photographs should be taken during field visits since they are a very helpful reference during subsequent design activities.

5.15.4 GEOTECHNICAL

Determine the scope of follow-up investigations still needed for the design process.

5.15.5 HYDROLOGY AND HYDRAULICS

Develop the conceptual hydrology and hydraulic design for the drainage watersheds where the project is located, including typical roadway ditches, and determine the location, type and size of major drainage crossings and culverts that have an impact on the preliminary roadway design or which control the alignment and grade.

Determine the extent of any apparent existing drainage problems and develop the preliminary design of needed improvements based on field observations, previous safety reports or discussions with Maintenance and Operations staff. Determine if there are any special measures required for erosion control or improvements to existing inlets/outlets. Also, determine any roadway profile issues that may need to be addressed during the final design (e.g., insufficient clearance over proposed culverts or adjustments in the roadway design or drainage facilities to prevent roadway flooding or overtopping). Remember that BMP's that will need to be installed for water quality requirements.

5.15.6 STRUCTURES

Determine the location, type, size, cross section, railing and transitions, and other results of the evaluation for proposed structures. Coordinate with the Bridge Design section.

5.15.7 PAVEMENT TYPE

For conceptual design, contact M&R for the pavement design. The request should include:

future ADT, functional classification, and percent trucks. The latest available traffic data should also be included.

5.15.8 RIGHT-OF-WAY

Identify the existing right-of-way corridor and roughly approximate the proposed area of right-of-way takings and easements. Describe the properties affected and the nature of impacts. Estimate the approximate right-of-way cost and any special right-of-way problems. If all or part of the route crosses public lands, identify the agency controlling the land.

5.15.9 ACCESS MANAGEMENT

Access management should be considered and discussed when evaluating alternatives, in particular the one recommended. Effectively managing access to a facility is an economical means to increase mobility, capacity, safety, and reduce travel times. Access is managed through limiting the ingress and egress points as well as the spacing and layout of entrances.

Access management is based on the designated functional classification. The higher the classification (freeway), the less access is permitted. The factors entering into a discussion on access are:

- Proposed LOS and capacity
- Type and width of median
- Spacing of median openings, intersections and interchanges
- Traffic control devices and signal spacing
- Turning and auxiliary lanes
- Street connections
- Crash data
- It may be beneficial to establish a working group of property owners within the study area to discuss upgrading or combining existing access points to meet the current subdivision standards.

5.15.10 UTILITIES

At this stage, the Team is the primary source for identifying utilities in the areas of study and for providing an overview of possible effects on the utilities.

5.15.11 TRAFFIC MANAGEMENT PLAN AND TEMPORARY TRAFFIC CONTROL

During alternative analysis, study the possible impacts on traffic within, adjacent to and outside the project limits. This is usually not a detailed study, but a cursory review by the Team using several elements that can be compared as to their probable impact and cost. These elements may include:

- Type of construction,
- Scope and complexity (number of operations affecting traffic and pedestrian flow),
- Working days and probable seasons of year for construction,
- Effect on tourist traffic and special events,
- Current congestion in and near the construction site,
- Anticipated capacity reduction (lane and other closures),
- General ability to travel within and near the site area,
- User and worker safety through and within the area,
- Residential and business impacts in the immediate construction site,
- Site detours and alternate routes,
- Reasonable alternate routes nearby,
- Available construction staging areas and site access.

Many of these can affect project schedules, work operations, restrictions on certain construction activities, costs and public acceptance of the inconveniences. The information developed during this phase will be the basis for the TMP.

5.15.12 CONSTRUCTION

Incorporate construction considerations in- to the preliminary design, including the sequencing of the work and its constructability.

5.15.13 SEA LEVEL RISE

Climate change and associated sea level rise and flooding has become an issue that needs to be addressed for transportation facilities in coastal states, like Delaware. These issues, as related, but limited to, future roadway and bridge elevations, roadway and roadside materials, and overall system planning for future transportation facilities, should be addressed as part of planning and design activities.

5.15.14 DESIGN EXCEPTIONS

Evaluate and discuss possible features of the preliminary design that do not conform to current

approved standards for preparing a de- sign exception approval request. See the *RDM*.

5.15.15 COST ESTIMATES

Develop a cost estimate for the project using data furnished by DelDOT's supporting sections. This may be used to determine the project's viability, when the project can be funded, or if it should be broken into multiple construction packages due to funding limitations. If changing the scope or dividing the project into segments is considered, all members should be involved in the decision.

Chapter Six

PROJECT DESIGN AND FINAL MINIMIZATION

6.1 DESIGN PROCESS OVERVIEW

Project design consists of ensuring that an extensive list of criteria and issues, including environmental compliance, has been evaluated at the level determined in the earlier stages of project development. The PM coordinates the development of final design plans, continuing to minimize impacts where possible in cooperation with the appropriate stakeholders. Mitigation commitments are incorporated into the final plans.

These tasks and their sequence can be found on DelDOT's Design Resource Center (DRC) web site in the *Road De- sign Manual*, *Bridge Design Manual*, Quality Control/Quality Assurance Plan, Plans Distribution List, Plan Development Process, Plan Submission Checklist, Plan Comment Form, Utilities Coordination Guidelines, Right-of- Way Plan/Design Checklist for R/W Verification, Sediment & Storm Water Management Project Design & Review Checklist, Primavera and Trns*port. Most of these can be found on DelDOT's web site at http://deldot.gov/information/business/drc/index.shtml

Typically a project's design process is grouped into several major phases under the following milestones:

1. Design Start-Up
2. Finalize Concept Plan
3. Survey Plans
4. TS&L Approval (projects with structures)
5. Preliminary Construction Plans
6. Semifinal Right-of-Way Plans
7. Semifinal Construction Plans
8. Final Right-of-Way Plans
9. Final Construction Plans
10. PS&E Submission
11. Advertisement and Award
12. Construction

6.1.1 PROJECT SCHEDULE

All Team deliverables must be tracked and managed by the PM to ensure that the project stays on track. The PM is responsible for managing the project to ensure that the entire Team meets each deliverable date, not just those responsible for the design.

6.1.2 PROJECT REVIEW

Keep in mind that for each milestone there are specific DelDOT sections that review and comment on the work product (usually a phase of the construction and right-of-way plans, or other critical documents). The Quality Control/Quality Assurance Plan outlines the various elements necessary for reaching each milestone. Time must be allocated in the project schedule for these steps, including review time. Larger-more complex projects have a full range of reviews while many projects may be selected to go through abbreviated reviews. Each reviewing section conducts an independent review for their area of responsibility and sends their written comments to the PM. Each comment needs to be addressed in writing using the review comment form and the appropriate changes made before the next plan submission.

FHWA participates in the design, review and approval process for projects having federal oversight based on the provisions of the current DelDOT/FHWA Stewardship Agreement. FHWA and Finance review project scopes and preliminary estimates to determine eligible federal aid and oversight projects.

Prior to Department wide general re- views, projects are reviewed by the section. This review may take place at any stage but is normally conducted prior to the preliminary and semifinal plan submissions. The goal is to minimize design changes, and have consistent plan content and quality.

6.1.3 PLAN DISTRIBUTION

DelDOT uses both electronic file and paper distribution of plans. Refer to DelDOT's latest Plans Distribution List and Quality Assurance/Quality Control Plan including addressing previous comments.

6.1.4 DESIGN PLANS

A typical project design results in a comprehensive set of plans to direct the contractor and assist the DelDOT inspection team to assure compliance during the construction phase. Keep the plans as concise as possible, while providing the necessary data for construction. The total plan package combines the design detail sheets necessary for constructing the roadway and any structures as well as a series of other plans that detail specialized portions of the supporting construction elements such as storm water management and environmental compliance.

The main purposes of the plans are:

- To clearly present the details and guidance necessary for construction of the project
- For prospective bidders to prepare a bid as accurately as possible
- For state construction inspector-contractor teams to oversee and perform construction efficiently and accurately
- To provide an accurate record of the construction for future reference.

Accurate and clear plans are essential for accurate bids, efficient construction, and good permanent records. Unclear and/or incorrect plans can result in increased costs and work for the following reasons:

- Incomplete or inaccurate plans require additional handling and processing.
- Cost the state more time and money to advertise and bid the contract.
- Lead to a rescheduled bid date if there are revisions or major questions within a week of the original date.
- Data that is unclear or interpreted in more than one way could result in higher bid prices by contractors.
- Unclear data also could result in claims for more compensation and/or working days by the contractor.

6.1.5 FIELD REVIEWS

Field reviews of projects at various phases are necessary and important. The PM is responsible for scheduling field reviews with the appropriate sections. At an early stage (either prior to or at least at the preliminary stage), Construction, M&O, Utility Coordinators, DTC, the Bicycle and Pedestrian Coordinators, ADA Coordinator, Traffic, Storm- water Management should be involved in the project's design. This discussion should include constructability, utility conflicts, pedestrian crossings, lighting, bus shelter locations, accessible pathways, storm- water pond locations, etc.

6.2 DESIGN START-UP

Once a project has been approved in the CTP, initiated and classified as a CE much of the detailed studies described in Chapters 2 through 6 will be abbreviated and the responsibility of the Team to complete. At this point, the project has been at least partially initiated. However, it is likely that there is still additional effort required in the completing the project initiation, scoping, establishing the purpose and need, studying the possible alternatives to meet the project's purpose and need, and developing a concept plan. Design should not begin until these tasks have been completed at a level commensurate with the project's complexity. Since many projects are not large and complex, these steps are shortened, simplified or combined.

6.3 SURVEY PLANS

After a project's purpose and scope have been defined, a work program developed, and, in most cases, an approved concept plan is available, the survey plans phase of design can begin.

The survey plans consist of a base set of plans of available information gathered from two main sources:

1. Survey – For projects designed in-house, a request for a field survey would be made to DelDOT's Survey Section; if they are unable to complete the survey due to a heavy workload, the PM will be notified and will have to arrange for survey to be done by a consultant via one

of DelDOT's open-end agreements. The designer should highlight on tax maps and/or old contract plans known corner monuments for the Survey Section before field survey to aid significantly in locating any additional monuments in the field and generating complete and accurate existing right-of-way lines. The designer is supplied with a CAD file that includes the survey point information and features, a file for the existing surface, a copy of the field book notes, and a data file of the survey points. The designer will have to pat- tern certain elements, add labeling to features and create the R/W baseline. Projects being designed by consultants will normally be surveyed by them or under their supervision.

2. Right-of-way - Right-of-way research includes obtaining copies of past DelDOT construction plans, tax maps, deeds, plats and recorded easements to be used by the designer to determine the existing right- of-way. When deeds or title searches are requested from Right-of-way Engineering, the request should include the parcel numbers and a copy of the tax map showing the anticipated project limits. Right-of-way Engineering will supply the designer with deeds or title searches found for the properties indicated. All research must be reconciled by the Team and Right-of-way Engineering to reach a conscientious decision as to its validity. For consultant-designed projects, the consultant is responsible for acquiring all necessary information for determining the existing right-of-way. A copy of this information is forwarded to Right-of-way Engineering. The goal is to ensure the verified existing right-of-way as shown on the plans cannot be disputed. It is important to anticipate issues early and effectively address them.

At a minimum survey plans should include:

- Items included on the Plan Submission
- Checklist as found on the DRC

6.3.1 PLAN SUBMITTAL AND COORDINATION

Ensuring that there is a detailed review of the survey plans that leads to a comprehensive coordination process for the following phases of plan development is critical to a project's schedule and success. Using the Plans Distribution List, this review should include submissions to:

1. The Utility Section for their distribution to utility companies for plotting existing facilities. In many cases, existing facilities will be designated (underground location/test pits) to determine exact locations early in the design process.
2. When in question, the determination of whether a project will be designated will be made by the Utilities Section and Project Development, with input from Construction.
3. Right-of-way Engineering –For more detailed information on right-of-way plan preparation refer to the Team Support Right-of Way Plan/Design Checklist for R/W Verification.
4. DTC for existing or proposed transit services and facilities
5. Environmental Studies for verification or identification of wetland, historic or other sites potentially requiring permits. In most cases, sites should have been identified during the development of alternatives.
6. Bicycle and Pedestrian Coordinators for identification of existing and proposed facilities not already identified.
7. Materials and Research for:
   a. Existing pavement condition and proposed pavement design, if not done at concept plan stage (including pavement cores and soil borings)
   b. Structural Borings and other Soil Borings
   c. Infiltration Test based on the results of soil borings for the evaluation of potential storm water management sites
   d. Unstable subgrade stabilization recommendations
   e. Identify unsuitable excavation areas
   f. Identify possible rock excavation areas
8. The Hazmat Coordinator for site

delineation and remediation
9. Traffic for confirmation of traffic infrastructure, signal phasing/timing, lane assignments, ITS and TMP initiation.

In addition, copies of the survey plans are distributed to the following for comments:

1. Maintenance District
2. Subdivision
3. Regional Construction Section
4. Railroad Coordinator

As the design is advanced, it is important to maintain previous commitments. It is also important to minimize environmental impacts throughout the design process.

Existing roadway maintenance, drainage problems and concerns of residents should have already been identified. However, if the project site has not been reviewed with regional maintenance personnel, make sure items of concern are discussed at this stage. This request should include a brief description of the project scope, limits and a deadline for comments.

6.3.2 TYPE SIZE AND LOCATION PLANS

Projects on the NHS with any structure estimated to cost one million dollars or greater require a formal submission and approval of TS&L Plans by FHWA. See the *BDM* for requirements. For other projects, the TS&L approval process is a part of the preliminary plan review procedure.

6.4 PRE-PRELIMINARY DESIGN MEETING

For large or complex projects, an internal team meeting may be valuable to discuss important elements to be included in preparing the preliminary construction plans. This meeting would be scheduled after forwarding the survey plans to the project team. This meeting may include:

- Discuss project scope/requirements
- Determine if a meeting with utility companies prior to preliminary plan distribution is necessary
- Discuss multi-modal transportation requirements including future and existing facilities including bicycle and pedestrian coordination
- Establish design criteria
- Define the need for any design exceptions
- Discuss lane assignments and signal phasing
- Establish lighting requirements
- Discuss Traffic Management Plan
- Discuss railroad crossing upgrades and coordination
- Establish HAZMAT investigation requirements
- Discuss permit requirements and environmental impacts
- Discuss impacts of any active subdivision plans
- Establish public participation plan
- Discuss role for Public Relations
- Constructability
- Define any current maintenance or drainage/flooding problems
- Discuss stormwater management strategies.
- Establish other areas requiring investigation/discussion

This meeting should include a site visit by the project team to field verify the feasibility of project intent and scope.

Information from this meeting will be used to further determine any outstanding issues such as R/W, environmental, and storm water management in order to address them early in the process. Documentation with meeting minutes is important.

The latest version of the selected alternative is presented. These plans normally include information from scoping meetings, traffic systems coordination issues, public hearings stormwater management, environmental and permit issues, utilities and other project team areas of interest compiled to this point in project development. These plans are discussed to reinforce the merits of the selected alternative and confirm the design approach is feasible.

6.5 PRELIMINARY CONSTRUCTION PLANS

The project can move into the preliminary plan phase. Review the recommended alternative again to determine that all of the necessary information is available to ensure that any special public, environmental or other

issues are considered in the design, cost estimates and project schedule. Updated data may need to be obtained, such as requesting accident reports if it has been three or more years since that data had been obtained and analyzed; this data may alert the designer to previously undocumented safety hazards.

Incorporate new comments and additional data into the preliminary construction plans. These plans are more detailed than the survey plans.

While keeping in mind potential utility conflicts, and right-of-way easements and takings, the basic design process for preliminary plans is the following:

Design Standards - Confirm the design standards including the thirteen controlling criteria (design speed; through lane and auxiliary lane widths; shoulder widths; stopping sight distance; horizontal alignment; vertical alignment; minimum and maximum grades; cross slopes; super elevation rate; lateral offset; vertical clearance; bridge width; and structural capacity), clear zone width, median width, front and back slope, barrier off- set, and any design exceptions. (Refer to Chapter 3 of the *RDM*.)

Horizontal and Vertical Alignment - A roadway's alignment may have vertical and horizontal curves used to minimize impacts and be compatible with existing community and environmental constraints. Alignment de- sign is critical in the effort to balance the needs and safety of the road user while minimizing any adverse effects on the project area and maintaining the project's design standards. The designer must use engineering judgment applied to a variety of factors to develop effective and efficient geometry. (Refer to Chapter 5 of the *RDM*.) An initial critical step in the design process is setting the horizontal and vertical elements for a project considering:

- project limits
- project scope
- topography
- private property
- pedestrian functions
- accessibility for people with disabilities
- significant cultural (historical/archaeological) areas and features
- wetlands
- natural drainage courses
- endangered species habitat
- intersecting roads and driveways
- underground and overhead utilities
- rail facilities

Cross Section Elements – Elements of the roadway and roadside cross section are chosen to provide a safe, multi-modal transportation

infrastructure which is context sensitive. (Refer to Chapter 4 of the *RDM*.) Refer to the Plan Submission Checklist and Model Plans on the DRC for some common cross sectional features of a project. Pavement cross sections should be included. The designer should coordinate with the Materials and Research section for pavement design prior to submission of preliminary construction plans.

Intersections – An intersection encompasses all alterations (e.g., turning lanes) to the otherwise typical sections of the intersecting streets. (Refer to Chapter 7 of the *RDM*). Intersection designs are coordinated with Traffic for lane assignments, signalization justification, traffic signal phasing and traffic control. Signalized Intersections are a key feature of street design in four respects:

1. Focus of activity - The adjoining land is often a concentration of travel destinations.
2. Conflicting movements - Pedestrian crossings, and motor vehicle and bicycle turning and crossing movements
3. Traffic control - Movement of users is as- signed by traffic control devices - signs, pavement markings, and traffic signals.
4. Capacity - Traffic control and the intersection configuration limits the capacity of the intersecting roadways - the number of users that can be accommodated within a given time period.

Proposed Drainage and Storm water Facilities – At this stage of plan development, the horizontal layout of proposed drainage is designed. (Refer to Chapter 6 of the *RDM*.) One of the most important considerations in roadway design is ensuring proper drainage of surface runoff from the roadway. Additionally, the design of roadways often affects drainage patterns in the surrounding area. Adequate subsurface drainage is also needed to maintain the integrity of the roadway structure. Improper drainage poses significant safety hazards for all users of a roadway and can have a negative impact on the facility's life span. Drainage design needs to respect the integrity of natural watercourses, environmental resources, flood- plains, and other features of the surrounding area. Another important component is the preservation of water quality and the minimization of erosion. The evaluation of site hydrology and storm water management should be included early in the project development process to:

- Avoid and minimize impacts to wetlands
- Minimize impervious surfaces
- Reproduce pre-development hydrologic conditions
- Fit improvements to the terrain
- Consider using vegetated swales and medians
- Improve existing drainage systems

Prior to Preliminary Plan distribution the Team should meet with the storm water section for the first concurrence meeting.

Traffic Plans – For in-house projects, Traffic is requested to prepare preliminary plans for any proposed signalization, highway lighting, and ITS. Traffic typically performs the initial TMP studies. Several months prior to preliminary plan submission, the designer should provide the traffic section with the appropriate design files for the incorporation of the signal design plans.

The preliminary plan stage is a major milestone in project development. These plans incorporate all previous plan and field review comments and most, if not all, design decisions and elements have been defined and approved and their costs established. Any significant changes from this point forward in the design process could be detrimental to project implementation. Therefore, a thorough review of the preliminary plans is important. Prior to the formal submission of preliminary plans, there should be an internal review of the plans from the designer's section to address inconsistencies in plan content and presentation.

6.5.1 PRELIMINARY PLAN REVIEW

The purpose of the preliminary plan submission is to allow various support sections within DelDOT to review the proposed project. The Plan Submission Checklist defines the required contents for the preliminary construction plans and typically includes:

See *Plan Submission Checklist and Distribution List* on DRC

Using the Plans Distribution List as a guide, the following plan submittals and coordination occur at this stage:

- To Utilities Section for distribution to utility companies for overhead facility relocation design (to determine real estate needs), and underground facility conflict review. Based upon the extent of under- ground utility conflicts and coordination with the Utilities Section; request the appropriate number of utility test pits and designation where necessary through Utilities Section. Also, provide locations and approximate depths of large cuts and fills.
- To Right-of-way Engineering for review and comment on proposed R/W needs.
- To Storm water Engineer for review and comment.
- To Bridge Design for review when bridges, sign structures, or other structures such as retaining walls are involved.
- To Bridge Management when bridges or sign structures are involved in the project.

- To Environmental Studies for continued coordination with affected resource agencies and consistency with environmental documentation.
- To Hazmat Coordinator.
- To Planning for general review and comment.
- To Traffic for review and comment pertaining to signal design, highway lighting, proposed signing and striping, TMP, MOT and ITS.
- To Construction for overall review and comment.

- To the Specifications Engineer for Special Provisions for the Semifinal plan submission.
- To Roadside Development for evaluation of tree impact, mitigation and replacement as per the requirements of the "tree bill". (This could greatly affect R/W needs.)

- Projects should be submitted to the appropriate Maintenance and Operations district for their review. To identify maintenance-sensitive issues such as those with intensive landscaping or guardrail placement.

- Other submittals are to be made to the following for general review and comment: Materials and Research, Quality Section, Bicycle and Pedestrian Coordinators, FHWA (as required), DTC, Chief Engineer and others. (See the current Plan Distribution List).

It should be pointed out that highway lighting is expensive, requiring an annual charge for maintenance and operation. Therefore, it is not a common project element and has its own justification requirements and standards. Criteria are set in DelDOT's *Lighting Design Guidelines*.

6.5.2 PUBLIC INVOLVEMENT

An important part of DelDOT's ability to fulfill its goals is to involve the public in each project and give them the opportunity to have meaningful input in a project's planning, design and construction. Appendix C and Policy Implement O-03 describes DelDOT's public involvement guidelines. While these involvement/outreach efforts can make all the difference in the ultimate success or failure of a project, they impose schedule, technical and budget risks; the more people involved in the process, the more complex it can become.

Depending on the project scope, at least one Design Public Workshop will typically be held after the review of the preliminary plan submittal and comments are received. The workshop format can take a variety of forms ranging from those scheduled in an auditorium setting to Internet virtual presentations with email response forms.

The public involvement strategy is established at the project initiation phase and should be should be maintained for project continuity. The level of public involvement is established by the environmental assessment performed during the early stages of project development. Major changes to scope resulting from workshops will require immediate coordination with all sections involved.

6.5.3 ENVIRONMENTAL REVIEW

For projects with environmental concerns it is recommended to meet with the Environmental Studies section with the preliminary plans to discuss the following:

- Progress towards application for permits
- Progress on data requirements and data checklist
- The schedule and content for presentation at an upcoming meetings, including the need for a field review meeting with agencies
- Additional opportunities to avoid and minimize impacts to environmental resources.
- Further refinement of mitigation concepts, such as wetland mitigation site plans and historic mitigation designs.

6.5.4 UTILITY COORDINATION

Continued coordination with the Utility Section and affected utility companies is required. There can be considerable costs and scheduling problems when aerial and underground utilities are affected by the design. The Utility Coordinator will request the designer to attend regularly scheduled coordination meetings with affected utility companies.

An important early decision the designer

needs to coordinate is defining the need and providing areas for relocation of facilities, in particular aerial facilities. This is required so that the proper area of real estate can be acquired to facilitate the relocation. The relocation of these facilities can be coordinated with other aerial items such as signal poles, light poles, and sign structures.

An evaluation of drainage locations both laterally and vertically, using the plans, profile and existing utility location information will give an early indication of utility conflicts. If the design cannot be changed to avoid the probable conflicts or they need to be field verified, a utility test pit plan is developed with the Utility Section to obtain the necessary field data. This information will determine conflict points and the need for adjustments in the design. It is imperative that the utility test pit information be analyzed to determine which underground utility conflicts cannot be avoided. This analysis is to be accomplished as part of generating detailed cross sections for the semi-final construction submission. Once it is determined that it is not possible to avoid the utility conflict, the affected utility company needs to be informed as soon as possible so underground relocation design can commence. If underground relocation will impact real estate needs, it should be identified at this time. It should also be noted that any conflicts that arise after preliminary plan submittal as the result of a design change should be brought to the attention of the affected utility company as soon as it is identified. Consult the *Utilities Manual* for the coordination procedure.

6.5.5 PROJECT TEAM MEETING

Depending upon the preliminary plan review comments it may be necessary to hold an internal project meeting to discuss major issues or concerns raised. The purpose of this meeting is to resolve any issues and changes to the preliminary construction plans prior to developing the semifinal right-of-way plans and construction plans. At a minimum, discuss the following issues:

- Evaluate the preliminary construction plans against the original project scope to ensure multi-modal integration.
- Review design exceptions, if any.
- Verify proposed R/W needs in conjunction with Utility Section.
- Determine the need for utility coordination meeting/utility relocation.
- Develop a plan for utility test pits to determine utility conflicts.
- Review status of storm water management boring data.
- Confirm ITMS/DelTrac requirements.
- Develop detour plans, determine if road closure will be necessary and continue developing details of the construction phasing/MOT.
- Determine the need to make early contacts with critical property owners.
- Determine any ADA requirements.
- Determine design modification to mitigate real estate and environmental impacts as well as context-sensitive design and maintainability issues.
- Determine if changes/comments will impact scope, budget and proposed schedule of project.

At this point, the various types of bridge alternatives and other structural elements of the project should be available for review and approval.

If the changes discussed during the meeting will significantly affect the scope of the project (including project limits), or will change the project budget by 20% or more, the Contingency Management Team must review and approve the changes. All budgetary and significant scope changes must be forwarded to Finance. If a consultant is used for design, all changes to the project scope must be issued in writing with a confirmation that they are with-in the original project budget. Otherwise, a supplemental agreement may be needed.

6.6 SEMIFINAL PLANS

Once the preliminary plans are completed and reviewed, the next two major milestones are to prepare semifinal right-of-way plans and semifinal construction plans. These two milestones are achieved concurrently.

Many projects involve coordination of construction and maintenance of traffic phasing that may include the design of detour routes. After receipt of all comments on the

preliminary plans, hold a meeting with Construction and Traffic, including the Safety Section, to finalize the traffic-related project elements and TMP to minimize this task.

Incorporate review comments and additional data into the semifinal plans. These plans are nearly complete, along with specifications, a drainage report, and quantity calculations and update cost estimate. The design is refined with more detailed information, such as coordinates and other geometric data, information about items to be constructed, drainage inverts, construction details, phasing, and maintenance of traffic.

6.6.1 CONSTRUCTABILITY

An important consideration in designing a project is selecting work items that can be performed using commonly available materials and equipment. Projects should also use methods and details that are normally encountered by qualified bidders. To ensure this occurs some projects may have a constructability review by the final plan stage and preferably at the semifinal stage. The following items need to be considered during project design prior to advertisement. Not only will they adversely affect the bids but may limit the number of interested bidders. Considerations include:

- Can the project actually be built according to the plans?
- How will the various items be constructed, particularly those requiring special details or unique materials or construction techniques?
- Is the sequence of construction practical?
- How will materials and equipment be transported to the project site?
- Is a staging area readily available?
- How will the utility relocations affect the schedule?
- How will traffic be maintained at each stage of construction?
- How will the contractor access the site?

This is a very good time to discuss whether there will be significant impact and delays to users. If there are anticipated detrimental impacts, then there should be discussion of modifying the design to require different construction techniques, applying road user costs/ liquidated damages to certain operations, or including special requirements in the bid documents. Depending upon the solution(s) selected, it may be necessary to coordinate this effort with both the Specifications Engineer and Contract Administration.

A constructability review should include at least the Quality, Traffic and Construction.

6.6.2 SEMIFINAL RIGHT-OF-WAY PLANS

Preparation of semifinal right-of-way plans follows the guidelines in the Right-of-Way Plan Checklist for R/W Verification. Completion of the semifinal right-of-way plans is an important milestone as the beginning of the real estate acquisition process. This process can be quite lengthy and impact a project's schedule. The Real Estate Section will make an initial assessment of their ability to initiate and complete the acquisition process. The Team needs this assessment for scheduling subsequent design phases.

At a minimum semifinal right-of-way plans should include: Items included on the Plan Submission Checklist as found on the DRC

6.6.3 PLAN REVIEW

The semifinal right-of-way plans are submitted to:

1. Right-of-way Engineering for review and comment and preparation of a draft town agreement, if the project is located within incorporated town limits. The semifinal right-of-way plans are to be accompanied by construction plans.
2. To Real Estate for review and comment.

Once the semifinal right-of-way plans are forwarded to Right-of-way Engineering and Real Estate, a meeting may be needed to discuss:

- The complexity, schedule constraints or other issues with Team Support
- The ability to initiate the total acquisition process with Real Estate
- Ensure the right-of-way plans include lighting, signal installation, requirements for all aerial utility needs, and transit features
- Need for a town agreement

6.6.4 SEMIFINAL CONSTRUCTION PLANS

This phase in the design process is also critical. At this stage other items required to move into the PS&E and construction phases are in progress as parallel activities and nearing completion as the plans are finalized, including preparation of environmental documentation, specifications and special provisions, traffic signalization plans, structural designs, and utility adjustment and relocation plans. At this stage all agreements between DelDOT and other parties should be executed. This will allow for preparation of final right-of-way, construction and the other portions of the PE&E to be completed in accordance with the various agreed to parameters. The Team is responsible for coordinating these parallel activities with the overall project schedule.

At a minimum semifinal plans should include: Items included on the Plan Submission Checklist as found on the DRC.

6.6.5 INTERNAL REVIEW

Prior to distribution of Semifinal Plans, there may be a need to review them with the responsible Project Development staff and to ensure that the plans comply with DelDOT guidelines, the project scope and include all necessary design features. Also discuss and reconfirm any design exceptions.

A more detailed review with Construction, Traffic and Maintenance and Operations is appropriate to fully evaluate the project impacts. This is also an opportunity to determine whether or not specific requirements and/or restrictions are to be placed in the construction contract documents, i.e. time of day, seasonal, special events, community commitments, incentives disincentives, etc. This information is used in calculating the calendar days for construction.

Also prior to distribution of the plans, the initial CTP estimate should be compared to the current project cost. The CTP cost estimate form is used to ensure a complete estimate. This estimate should include updated real estate, environmental, and utility costs, as well as a detailed construction estimate commensurate with the level of detail in a set of semifinal construction plans. At this stage the estimate should be entered into Trns*port. A decision may be necessary to consider reducing the contingency amounts or altering the design without affecting the scope.

The cost estimate should be treated as a checkpoint to ensure the total project cost has not increased by more than the percentage set by Finance. The importance of this estimate cannot be over emphasized. Should the estimate exceed the budget by the currently set controls, there may have to be a complete reassessment of the project scope. This evaluation would involve the Contingency Management Team, the MPO and FHWA. Such an evaluation could also trigger updating all NEPA documents.

6.6.6 PLAN REVIEW

Following the internal review and any changes made, the semifinal construction plans along with a copy of the preliminary plan review comments are submitted for review and comment to:

- Storm water Engineer with Semifinal Plans and Drainage.
- Construction with marked-up Semifinal special provisions.
- Traffic, also for approval of the TMP and initiating preparation of the Traffic Statement which is prepared by a consultant but must be reviewed by Traffic.
- Environmental Studies, also for continued resource agency coordination, permit re- quests and to begin preparation of the Environmental Statement.
- Specifications Engineer.
- Roadside Development Section to ensure proper selection of tree types for compliance with the replacement policy.
- Utilities Section for distribution to utility companies for final utility relocation design. Utility companies will prepare a semifinal utility statement that the Team will incorporate into a bar chart showing the road construction sequencing in coordination with the utility relocation sequencing. A coordination meeting will then be scheduled with the affected

utility companies to review the semifinal statements and sequencing bar chart. Utility companies will modify the semifinal statements based upon the coordination meeting; final utility statements are to be submitted to DelDOT within 30 days after the meeting. The Team will modify the bar chart based upon the coordination meeting for inclusion in the final utility statement. (See Utility Coordination Guidelines.)

- Coordinate with Office of Performance Management for determination of the preliminary construction scheduling, taking into account the time detailed in the final utility statements. The construction sequencing bar charts will be updated and ultimately included in the final advertisement package.
- Others include: Materials and Research, Chief Safety Inspector, Bicycle and Pedestrian Coordinators, ADA Coordinator, FHWA (as required), Architectural Accessibility Board (for approval), DTC, Chief Engineer and others. (See the current plan distribution list.)

A semifinal plan review is scheduled based on the plan review process guidelines and the approved distribution list. When the semifinal plans are distributed, a request for comments specifically from all project team members may also be appropriate. It is important that the continuity of the team remain intact throughout the design process. There should be a timeframe provided for comments which is adequate for complete review; a late submission of plans shall not reduce the review time of various sections. The Team is responsible to follow up with all reviewers to ensure that the appropriate comments and information on the plans are received as scheduled. The Plan Review Comment Form is a good guide.

6.6.7 PERMIT COORDINATION

The final steps necessary to obtain all permits begin with issuance of Semifinal Plans. The Team works with the Environmental Studies Section to ensure that all necessary information has been provided and they are fully appraised of the project scope and design status. Since the process of applying for permits can take 6 to 12 months, it is imperative that the Environmental Studies Section be included in all project team meetings. Permits must be in place prior to advertising the project since environmental concerns and mitigation can significantly affect project costs and scheduling.

6.6.8 SPECIFICATIONS COORDINATION

The semifinal plan review process includes a semifinal specifications package compiled by the Specification Engineer. If the project requires unique materials and/or construction techniques, the Team may need to assist in preparing the specifications. It is critical that the review verify the correlation between the specifications and the design details as presented on the plans.

6.7 FINAL PLAN PHASE

The final plan phase includes coordinating the preparation of the final right-of-way plans and final construction plans.

Meeting the scheduled PS&E date depends upon this phase because the appraisal and acquisition process may be lengthy. Although it is necessary to advance the final right-of-way plans at a faster rate than the final constructions plans, the finalized right-of-way plans should be submit- ted for approval only if there is little possibility that construction plan changes will affect the right-of-way needs. This includes finalized utility relocations, storm water management and environmental needs, NEPA approval, and finalized traffic and signal plans. All projects within incorporated town/city limits require a town agreement prepared by Team Support. Normally the town agreement is sent to the municipality after final right-of-way plan approval.

6.7.1 FINAL RIGHT-OF-WAY PLANS

After determining that the right-of-way plans are complete, revised semi-final right-of-way plans are submitted to Team Support to ensure that all semifinal construction and right-of-way plan comments have been addressed. The plans are then approved by the Team Support Engineer becoming final right-of-way plans and forwarded to Real Estate. Approval of these plans is required for Real

Estate to begin the process of obtaining right-of-way, easements and/or property acquisition.

At a minimum final right-of-way plans should include: Items included on the Plan Submission Checklist as found on the DRC. It may be necessary to meet with Real Estate after they receive the final right-of-way plans for the following:

- Review plan details
- Develop a list of project issues that may needed to be discussed with affected property owners
- Develop a list of critical property owners for early contact
- Develop a schedule of status meetings with the Real Estate team
- Schedule a project review meeting with the negotiators to ensure they understand the history, design details and property owner issues
- Inform Real Estate of any advanced utility relocation anticipated
- Set up a feedback process with Real Estate to ensure that negotiated special items from Real Estate transactions are incorporated into the plans

6.7.2 FINAL CONSTRUCTION PLANS

The final construction plans are prepared after analyzing all comments received during both the semifinal construction and right-of-way plan submissions. The content of the final plans follow the Plan Submission Checklist, the Plan Sheet Sequence Guidelines and other DelDOT guidelines.

Although not considered a part of the final plan package, final cross sections are prepared and available. These sheets are very important for constructing the project. They show in a sectional view at various intervals and at designated special features such as drainage the existing surface, proposed surface, pavement box, limit of construction, existing and proposed right-of-way, clear zone, proposed drainage, and existing and proposed utilities. They shall be provided to inspection personnel prior to construction.

6.7.2.1 Plans and Project Team Meeting

Depending upon the comments and recommendations discussed or proposed at the semifinal plan review, it may be necessary to schedule a team meeting (including management) before completing the final plans.

6.7.2.2 Final Plan Submission

The final plans are distributed to:

- Storm water Engineer with final Drainage
- Construction with final quantity calculations
- Real Estate for continued acquisition and preparation of R/W certification
- Utilities Section for verification of final
- Utility Statement
- Traffic for TMP signature and finalization

The final plan submittal letter includes a summary of major changes to the plans since the semifinal plan submission. A brief description of significant comments and response taken from the semifinal plan review will make this review go much faster. Final design plans are circulated per the distribution list, with the semifinal plan comments and responses.

During the final plan distribution, the PM has several important management tasks that will ensure an orderly transition into the PS&E phase. These tasks will involve contacting several of the key sections to review their status on completing their portion of the PS&E package. The PM should not assume that the final plan distribution submittal letter automatically triggers the completion of the various statements needed prior to PS&E. This includes reviewing the status of environmental mitigation and permits, traffic signalization plans, town agreement, special provisions, real estate, utility adjustments and any construction constraints. It is also prudent to ensure the project is still within budget and consistent with the original scope. Other important items are confirming the project schedule and timeframes for critical items. These management tasks will allow the PM to estimate the critical dates for the advertisement process including:

- PS&E submittal
- Advertisement date

- Addendum dates (if needed)
- Bid date
- Pre-bid meeting date (if needed)
- Pre-construction meeting date

Traffic Statement

- Environmental Studies for final Environ- mental Statement
- Quality Section for consistency and plan presentation
- Timing and Scheduling Section with final quantity computations for final time assessment
- Award recommendation letter and analysis dates
- Estimated date for Notice to Proceed

By making a thorough, detailed review of the plans, specifications and estimate prior to PS&E submission, revisions and addenda can be minimized. After the PS&E submission any changes create multi-layers of additional work, delays in the advertising schedule and may cause confusion.

6.7.2.3 Timing and Scheduling Meeting

The Timing and Scheduling Section should receive at least a draft copy of all statements for the analysis of the final plans to estimate the number of working days to complete the project.

Although some projects may not require a formal meeting to discuss timing and scheduling, there should be evaluation and discussion of the project's timeline, coordinating it with other projects in the region. The PM selects the sections needed to discuss seasonal/wildlife constraints, utilities, schools, peak hour or nighttime requirements, permits and other work items that would affect timing and bids. This meeting should be conducted as close to the completion of the final plans as possible.

6.8 PS&E SUBMISSION

The three main components of the PS&E submission are:

1. **Plans** are the documents prepared to convey physical information so that designers, reviewers, and the public can understand both the existing conditions and the project. Plans, along with the specifications, must describe the location and design features and the construction requirements in sufficient detail to allow for accurate bids and to provide for the construction of the project without significant change orders and claims. They define the right-of-way available or to be acquired.
2. **Specifications** define the materials and methods to be used by the contractor when constructing a project. The specifications generally consist of three elements:
3. **Standard Specifications are** standards adopted by DelDOT for work methods and materials used for construction. The Standard Specifications are a part of the Bid Proposal for general use on all projects. They provide the Department's criteria for: bidding; awarding the contract; the contractor's duties; controlling the material quality; the contractor and the Department's legal requirements; executing the contract; and measuring and paying for contract items.
4. **Supplemental Specifications** are additions, deletions and/or revisions to the Standard Specifications that have been adopted by DelDOT since the last revision of the Standard Specifications. They will be incorporated in- to the Standard Specifications at the next revision.
5. **Special Provisions** are additions or revisions to the Standard Specifications and the Supplemental Specifications setting forth conditions and requirements for a special situation on a particular project. Special Provisions are included in the contract documents for that project and are not in- tended for general use.
6. **Cost Estimates** are prepared for project budgeting and to evaluate responses to project advertisements.

The approved final plans (signed and sealed) and the Engineer's Estimate are sent to the PS&E Coordinator for inclusion in the final bid package. As a part of this submission, the Team requests the responsible sections to complete their statements and transmit them to

the PS&E Coordinator. At this time there should be approved and signed signal and detour plans available. The PS&E submission also includes the timing and scheduling statement, environmental statement, utility statement, and right-of-way statement. The PS&E Coordinator ensures that all city/town agreements, railroad agreements, utility agreements, and permits are completed. In order to ensure preparation of a complete package that fully identifies all the items a contractor must comply with and include in the unit costs, there is a great deal of coordination and interaction among the various sections. The PS&E submittal automatically triggers Finance to set up the various funding categories.

Prior to the electronic PS&E submittal, it is the responsibility of the Team to review the contents and status of items in the PS&E package, including all statements and the special provisions. A review by the design resource engineer and PS&E coordinator should be completed to ensure that the statements and the special provisions in no way conflict with information provided in the final plans.

The final PS&E transmission is an extremely important milestone in project design. Any changes that occur between this submission and throughout the advertisement process will require that the plans are resubmitted and discussed with the sections affected by the change. In all cases, Construction must receive updated plans.

As a part of PS&E there may be a need to issue one or more of the statements with a stipulation. Most frequently this will be the right-of-way statement for negotiations still in their final stage or the environmental restrictions. If any stipulated statements were required to advertise the project, it is the Team's responsibility, in conjunction with the appropriate section, to make sure any outstanding issues are resolved. If revised statements are required; they must be added to the bid package prior to the receipt of bids.

6.9 ADVERTISEMENT

Contract Administration is responsible for preparing the Bid Package, advertisement, coordinating contractor questions; distribute responses and acceptance of contractor bids for constructing the project. State and Federal laws and regulations must be followed in the bidding process. Contract Administration assures that these are not violated.

Depending on the complexity of the project, a pre-advertisement or pre-bid meeting may be required for prospective bidders to discuss with the project team complex tasks included in the contract plans. The determination of whether a pre-bid meeting will be held is made jointly with Project Development Management and Contract Administration.

After the project has been advertised, it is important for the Team to be available to Contract Administration to answer any questions prospective bidders may have regarding the plans. Questions from potential bidders must be answered promptly; a delay may delay the bid opening, and potentially the availability of funding.

6.9.1 ADDENDUMS

Based on questions from contractors, it may be necessary to issue one or more addendums to the construction plans or specifications. Issuing addenda should not be used as a means of finishing incomplete plans submitted by the PS&E submission deadline.

All addendums must be coordinated with DelDOT's Specifications Engineer and Contract Administration. Contract Administration ensures that contractors receive copies of addenda prior to submitting their bids. It is required that prospective bidders have addenda at least 48 hours before the bids are due; Contract Administration will need additional time to physically send the addendum to the contractor, whether by fax, e-mail or postal service. The contract procurement process is a regimented procedure that is strictly adhered to. It is important that all prospective bidders have the same access and knowledge about answers to all questions that have been raised.

6.10 CONTRACT AWARD

Review of the bids is conducted jointly by Contract Administration, the Team and FHWA (Projects of Interest only). The purpose of the review to determine if the bid is reasonable when compared to the Engineer's Estimate and

expected costs. Depending upon the number of bidders and differences in unit prices bid, a bid analysis could be lengthy and detailed. The bid tabulations should also be provided to the appropriate construction personnel for their review and concurrence.

Preparing a bid is an expensive and time-consuming activity for contractors. Review of the bid tabulation is important and necessary to minimize possible contractor objections. By law, from the time bids are opened there is only a 30-day time frame to make the award. It is important to conduct the bid tab analysis quickly so the requisite signatures that accompany the award letter can be obtained within the allotted time. If the bids are determined to be unacceptable, immediate consultation with Contract Administration is required to determine the appropriate action to take. This can range from meeting with the low bidder to resolve any questions to canceling the bid. Rejecting a bid normally requires that the project scope be reevaluated and involve major or minor changes in plans or limits.

6.10.1 BID ANALYSIS

The purpose of a analyzing a bid is to determine that the low bidder's unit prices are reasonably in conformance with the engineer's estimate. One of the key concerns in all bid analyses is to check for any unbalancing to ensure that neither the low bidder, DelDOT or project completion could be adversely affected. Bids can be unbalanced either mathematically or materially. One of the difficulties in analyzing bids is determining if the various unit prices reflect a proportional amount of its associated material costs and all of the various costs to the contractor to complete the work.

There are several reasons why bids could be unbalanced i.e. the unit price is higher or lower than that which is reasonably expected for performing the work. One reason is to have more money available early in the project. A possible example is a contractor with financing difficulties and needs to obtain funding during the initial phase. This could mean the contractor ultimately may be unable to fulfill the contract terms or perform the work. To minimize this occurrence DelDOT provides a specification and a bid item entitled Initial Expense.

Another reason is maximize profits. This is done by overpricing items that are anticipated to be required in greater quantity than estimated or underpricing items that are anticipated to be overestimated and will not be used. A third reason could be that the specifications, material requirements, installation methods or method of payment have made it difficult for bidders to develop a reasonable unit price. These issues are usually identified and corrected for future projects.

Rarely the designer may find a unit price or total bid submitted by one or more of the bidders that is obviously much larger or smaller than the engineer's estimate or completely unreasonable for the work anticipated. This is referred to as a "token bid". Normally this type of bid will be rejected, but if there are several of these on a project it could indicate serious underlying problems with the bid proposal package.

6.10.1.1 Mathematically Unbalanced Bids

This is a bid for a lump sum or unit price item that does not reflect the actual costs plus a reasonable profit, overhead costs, and other indirect costs that may be involved in performing the work. The bid is based on nominal prices for some work and inflated prices for other work. Although not normally a factor in preparing a bid, for the reasons previously discussed, an unbalanced bid item may be encountered in the analysis. Still, the primary principle for publicly advertising and accepting bids is based on the expectation that each item will carry its proportional cost of the total bid. After the analysis, the bid may be accepted if the conclusion is that it will result in the contactor being paid a fair price for the intended work and that DelDOT and FHWA are receiving an acceptable final product.

6.10.1.2 Materially Unbalanced Bids

This type of bid is based on the decision that there is reasonable doubt that by awarding the contract to the low bidder with a mathematically unbalanced bid that DelDOT/FHWA will receive the lowest ultimate cost.

6.10.1.3 BID ANALYSIS METHODS

There are several ways to analyze and compared bids. Several are relatively straight-forward and quick. However, the last two discussed are more exhaustive, detailed and time consuming. The analysis is both statistical and subjective. The primary concern is: are the costs reasonable for the work to be performed?

6.10.1.4 Comparison Of Engineer's Estimate and Low Bid

The designer or design consultant is a key participant in the award process by making a critical analysis of each bid. The first comparison is determining the percent difference between the low bid and the engineer's estimate. For projects with a difference of 10% or more, there must be a formal written bid analysis prepared to accompany the recommendation to award. Even for projects close to the engineer's estimate, further analysis is required to assure there are no major items with unbalanced unit prices.

6.10.1.5 Statistical Comparison

Normally, during the initial bid overview, only the items that represent the greatest costs are analyzed. They usually are approximately 20% of the total items but 80% of the total cost. These items and their unit prices are compared with bids received on similar projects, with similar items and quantities versus the engineer's estimate. For each major item, the percent difference between the low bidder and the engineer's estimate is determined.

Major items with a difference between the low bidder and the engineer's estimate greater than 20% are identified. For these items, a comparison between the low bidder and the representative bid is made. Using these comparisons, the major items are reviewed for any unbalancing. The plans and quantity calculations are reviewed to determine why this may have occurred.

A part of the bid analysis is statistical in nature. The difference in absolute dollars between the low bidder and the second lowest bidder is determined. A significant difference could indicate many factors such as contractor workload and availability. However, it could indicate basic problems with the contract documents, such as unrealistic scheduling, complexities in the design/construction, and material availability problems, not considered in the design that could result in subsequent cost increases and time delays.

For projects with at least four bidders, the representative bid is determined for the major items by throwing out the high and low bid and averaging the remaining bids. The percent difference between the low bidder and the representative bid is determined to make a judgment if it is logical.

6.10.1.6 Historical Unit Price Comparison

Upon receipt of the bid tabulations, the PM performs an item-by-item analysis to ensure that awarding the project to the low bidder is in the best interest of DelDOT, and that the bid is not unbalanced. This analysis should include a comparison of the low bidder's unit prices with the other bidders for the project and historical bid data to ensure the low bidder's unit prices are within the historic range, considering the contract location and projects with similar quantities. This analysis is quick and simple. If any irregularities in the low bid prices are evident then further analysis is made. This would include a check of the calculated quantity, material availability, scheduling requirements, any special construction procedures and bid documents.

6.10.1.7 Constructability and Contract Requirements Review

This analysis involves a much more detailed review of the total bid package. It also entails a constructability overview of the project looking at cost differences between bids and the engineer's estimate of items that may have the potential for overrunning during construction. This method should be supported by involvement of the designated construction inspection team.

The actual date for acceptance of bids may differ considerably from that anticipated during the final design phase and PS&E submission. This can significantly affect construction operations, sequencing, scheduling and costs. This is particularly relevant to maintenance of traffic items that depend upon a contractor's work schedule. Such changes need to be

considered during the bid analysis as they may impact the bids, the ultimate cost of the project, the second lower bidder and possible errors in quantity calculations.

This method also uses the major items since they are usually the fewest individual items but involve the largest quantity and the largest portion of project cost. These items are compared with other bids and the engineer's estimate. For each major item, the percent difference between the low bidder and the engineer's estimate is used.

Again, the major items, where the difference between the low bidder and the engineer's estimate is greater than 20%, are identified. For these items, a comparison between the low bidder and the representative bid is used. Using these comparisons, the major items are reviewed for any unbalancing. The total bid documents and all supporting data including plans, general notes, special construction details, unusual materials or construction techniques, methods of measurement and payment are reviewed. In addition the quantity calculations are reviewed to find out why this may have occurred.

6.10.1.8 Contractor's Available Assets And Financial Support

Depending upon the size, type of work, the need to meet specific completion dates or other special requirements in the bid proposal, the range of bids or differences in unit prices, it may be prudent for Contract Administration to review in greater detail the low bidder's financial status, current workload, other scheduling commitments, and in some cases material and equipment availability. Although rare and within the strict guidelines of the bid laws, it may be determined that the low bidder is not financially capable of completing the contract and it should be awarded to another, higher bidder.

6.10.2 CONTRACT AWARD LETTER

When it is determined that the bids are acceptable, the PM will prepare a Recommendation to Award letter to be sent by Assistant Director to Finance, copying Contract Administration. It may be necessary to coordinator this letter with the Construction and the Chief Engineer. The award letter summarizes the results of the bid analysis including identifying the major items that exceeded the 20% range, identifying any questionable items, and summarizing discussions with any bidders and others that may have occurred.