



### III. PLAN PREPARATION

This Chapter of the DelDOT Traffic Design Manual discusses the general steps required for preparing plans for any traffic design project. It includes a discussion of the required contract documents, and outlines the process for developing preliminary, semi-final, and final design plans. Additional details regarding specific design elements are presented in Chapter IV (Traffic Signals) and Chapter V (ITS Devices).

#### A. Required Contract Documents

Traffic Design projects may be prepared in one of five formats:

1. Capital Project
2. Traffic-Only Signal Project (individual)
3. Traffic-Only System Improvement Project
4. ITS-Only Project (individual)
5. Developer / Subdivision Project

Capital Projects include the insertion of traffic devices into highway design and/or bridge projects prepared by DelDOT or consultants for formal advertisement. These types of projects, which require formal advertisement and construction of the entire project, must be coordinated closely with DelDOT's Project Manager and the Design Team.

Traffic-Only Signal Projects typically utilize the services of Statewide On-Call Contractors who have already been selected on a competitive bid basis and are readily available to begin work on new projects. Alternately, some small work tasks with low cost for installation or minor maintenance of material (small phasing change or head replacement) may instead be completed by Traffic Signal Maintenance Group or other DelDOT in-house forces.

Traffic-Only System Improvement Projects may require minor roadway geometric improvements together with the installation of new devices or modifications to existing traffic control equipment. Traffic-Only System Improvement Projects may be developed for a specific corridor or as part of a statewide implementation plan.

ITS-Only Projects typically utilize the services of Statewide On-Call Contractors or Integration Vendors who have already been selected on a competitive bid basis and are readily available to begin work on new projects. Alternatively, some small work tasks with low cost for installation or minor maintenance of material (device swaps, equipment upgrades) may instead be completed by Traffic Signal Maintenance Group or other DelDOT in-house forces.

Developer / Subdivision Projects historically represent traffic control signal designs that are prepared by DelDOT's Traffic Systems Design Group, as part of the permit approval plan set.



The signal documents are prepared and reviewed by DeIDOT's Traffic Systems Design Group and the Sub-Division Section prior to approval by the Chief Traffic Engineer. Although DeIDOT Traffic is responsible for preparing the signal plans, the Developer is responsible for obtaining the necessary right-of-way easements to construct the signal. The Developer is also responsible for providing DeIDOT with digital files for preparation of design plans, and should continue to coordinate with DeIDOT Traffic, updating any design files, as needed. Additionally, the Developer is responsible for designing all geometric elements of the signal design plans, including islands and curb ramps, as well as other associated traffic control devices (signs and pavement markings).

**Table III-1** below identifies the PS&E requirements for each of the contract types from the previous page:

<b>Table III-1 Requirements for Plans, Specifications and Engineer's Estimate</b>					
<b>Contract Documents Required</b>	<b>Capital Projects</b>	<b>Traffic-Only Signal Projects</b>	<b>Traffic-Only System Improvement Projects</b>	<b>ITS-Only Projects</b>	<b>Developer / Subdivision Projects</b>
Title Sheet	Yes <sup>(6)</sup>	No	Yes	No <sup>(5)</sup>	Yes
Signal Plan / ITS Device Plan <sup>(1)</sup>	Yes	Yes	Yes	Yes	Yes
Signing, Striping, and Conduit (SSC) Plan <sup>(1) (2)</sup>	Yes	No <sup>(4)</sup>	No <sup>(4)</sup>	No	Yes
Specifications	Yes	No <sup>(3)</sup>	No <sup>(3)</sup>	No <sup>(3)</sup>	Yes
Traffic Statement / Cost Estimate	Yes	Yes	Yes	Yes	Yes

**NOTES:**

<sup>(1)</sup> Signing and marking are typically shown on the signal plan, but may be detailed separately.

<sup>(2)</sup> All Traffic Control devices should be integrated in to the State's ITMS Program. Communication plans may be required.

<sup>(3)</sup> Specifications will need to be written for non-standard items.

<sup>(4)</sup> While not required, a separate SSC plan may be needed for clarity.

<sup>(5)</sup> May be needed based on magnitude of project.

<sup>(6)</sup> An overall title sheet is required for the Capital Project. Typically, a separate title sheet for the traffic elements is not required.



## 1. Title Sheet

A title sheet may be required for some traffic control projects that are part of a proposed system-wide upgrade or as part of a DelDOT Traffic project that is formally advertised. The title sheet shall identify the project location and limits of work on a location map. The title sheet shall also provide an index of the sheets contained in the plan set, and include signature blocks for, at minimum, the Chief Traffic Engineer, Systems Design Manager and Recommending Designer/Reviewer. When title sheets are used, a signature block may not be needed on each individual sheet (unless requested by the Traffic Systems Design Manager). Furthermore, the DelDOT or Federal-aid contract numbers (as applicable) and project location and project name shall be shown on the top center of the title sheet. The DelDOT Traffic Section has developed a standard title sheet format that is consistent with the general DelDOT title sheet. The standard traffic title sheet is included in this Manual in **Appendix D**.

## 2. Plan Sheet

The major objective of the design plan sheet is to graphically describe how the device is to be constructed and operated. This includes showing the existing and proposed geometrics, the location of all hardware and other pertinent information.

When preparing a traffic control device plan, the north arrow should be located in the upper right corner of the plan and should generally point up toward the top of the plan sheet. For signal plans, the major route should typically be oriented from left to right. However, for Capital and Developer Projects, the orientation should follow the roadway plan set conventions to maintain consistency within the plan set. Under the north arrow should be a note stating that the assumed direction of the major street is either east-west or north-south. The note - not the north arrow - will be used for numbering of the signal heads. Standard signal borders shall be used for signal plans. For other traffic control devices, a modified signal or standard state construction border may be used, depending on signature requirements. The Designer should check with the Systems Design Manager on border requirements. A typical signal design border includes a legend, signal phasing, signal head diagram, general signal notes, project title, location, permit number, contract number, county location, scale, addendum/revision block and signature block.

Generally, plan sheet layouts should be laid-out as follows: Project-specific notes should be shown in the top left corner of the plan. The conduit run schedule should be placed in the lower left corner. Notes pertaining to the conduit run schedule should be placed below the schedule. Any special MOT notes should be shown on the specific MOT plans or included in



the construction hand-off package. MOT notes should not be shown on the traffic device plan sheet. Unless space limitations require an exception, all existing and proposed signs should be shown in the lower right portion of the plan. If needed, project-specific details should be shown where space allows or on a separate sheet. Fonts, symbols and title block and border should be used in accordance with DeIDOT's CADD standards.

For new traffic control devices, the title block, whether placed on the title sheet or on the plan sheet, should include the Permit Number (if applicable) and contract number. For minor traffic control modifications, if required by the System Design Manager, the title block and the revision block should match the latest as-built plan and any previous revision. The revision block should include a brief description of the proposed revision and shall be initialed by the Designer. Larger-scale modifications, such as a phase change or pole relocation, will require the development of a new plan sheet, as directed by the Systems Design Manager.

Sample title sheets (**Appendix D**) and plan sheets (**Appendix E**), including ITS device sheets (**Appendix T** through **Appendix Y**), are provided in this Manual in the appendices.

### 3. Specifications

Standard Specifications, Special Provisions and Standard Construction Details for traffic projects have generally been established and standardized by DeIDOT. Unless a unique or non-standard item is required, there should be no need to provide any additional specifications (i.e. special provisions). However, on a case-by-case basis, there may be a need to include an additional drawing or details for site-specific geometric and/or construction requirements. It should be noted, however, that non-standard specification usage should generally be avoided, to the extent possible.

On a case-by-case basis, there may be a need to include drawing details for site specific Temporary Traffic Control plans and/or Transportation Management Plans.

### 4. Traffic Statement (Cost Estimate)

The development of a Traffic Statement, or cost estimate, is required for all traffic design projects. Technically, a formal "Traffic Statement" is only required for Capital Projects. However, all projects require a cost estimate, and typically the same Traffic Statement form is used to prepare the cost estimate for all project types.

Traffic construction items, supplied and installed for all traffic control related items, are broken down into three different categories and vary by project type:



- Project Contractor Items (Capital and Developer/Subdivision projects only)
- Traffic Contractor Items (all)
- Traffic Supply Items (all)

### **Project Contractor Items (Capital and Developer/Subdivision Projects only)**

Due to construction schedules and coordination issues, DelDOT has determined that some items will become the General Contractor responsibility for Capital Projects and Developer Projects. Typically, these items cover the supply and installation of underground facilities (conduit, junction wells, pole bases, cabinet bases, and loop detectors) and the removal of underground facilities by the project's main contractor. For Developer Projects, when off-site improvements are required, project versus Traffic Section contractor responsibilities should be defined during the design phase of the project.

### **Traffic Contractor Items (All)**

These items cover supply and installation of items by the Traffic Section's Statewide Signal Contractor, as well as the installation of items furnished by DelDOT Traffic Signal Construction that are installed by Statewide Signal Contractor or by DelDOT's Traffic Signal Construction and/or Maintenance Groups. These items typically include the installation of all above-ground traffic control equipment and wiring. If the project is associated with a Developer/Subdivision Project, the underground equipment is typically the responsibility of the developer.

### **Traffic Supply Items (All)**

These items account for all items supplied by the Traffic Section to the Statewide Signal Contractor for installation. These also cover the cost of integration of all equipment into DelDOT's Integrated Transportation Management System (ITMS).

The Traffic Statement shall show the unit and total cost of each item separately, as well as a combined total project cost. The Traffic Statement shall use item numbers and unit costs provided by Traffic for all Traffic Contractor and Supply items. For Project Contractor Items on Capital and Developer Projects, the unit cost should be estimated by the Capital/Developer Project Designer, and not by the Traffic Section.



## B. Preparation of Design Plans

One of the most fundamental tasks in the traffic design process is the preparation of design plans. Traffic design plans provide the blueprint for all traffic elements installed in the field, and the information provided on the plans must be clear, thorough, and accurate. The preparation of design plans consists of the following activities:

- Collecting preliminary data. This involves researching the existing plan records and gathering items related to the study location, including as-built plans, right-of-way plats, highway design plans, utility design plans, and timesheets for existing signals.
- Developing base plans and performing a field survey verification, including verification of existing geometrics, signal timings, above and underground utilities and other roadway features.
- Preparing preliminary, semifinal, and final design plans and related documents, as necessary, for approval.
- Obtaining signatures and approvals of the final design plans to allow the design to move to the construction phase, activation, and ultimately the operational hand-off of the traffic device.

This chapter of the DeIDOT Traffic Design Manual includes a discussion of each of the activities required during the design plan preparation process.

### 1. Collect Preliminary Data

The first step involved in the preparation of design plans is to collect preliminary data that is available for the study location. The Traffic Designer should begin by collecting all pertinent data that would help in the development of the base plan. This includes researching DeIDOT records for as-built traffic plans, highway design plans, right-of-way plats, and utility plans. Gathering these items will help provide the Designer a history of the location and assist in the development of base plans. Some of this information may have already been gathered if the project is part of a Capital Project or Developer/Subdivision Project. It is the responsibility of the Traffic Designer to obtain and review these documents prior to any plan development.

For projects initiated by the Traffic Studies or Safety Sections or as part of a Traffic Impact Study agreement with a Developer, additional information related to the study location may also be available. The Designer should coordinate with the applicable Section, as appropriate, to obtain additional background information on the study intersection, such as traffic count data, existing signal timings (timesheet), and recommendations on the proposed lane arrangements and proposed signal operations. This information is often available in the Traffic Signal Study. Chapter IV-A of this Manual provides additional information regarding the data contained in a Traffic Signal Study.



## 2. Prepare Base Plans

After the Designer has collected all preliminary data, the next step in the process is the development of base plans. A base plan should contain all existing roadway geometrics, as well as the locations of any traffic control devices, signs, markings, lighting, and utilities. An itemized list of the typical base plan features is shown in **Table III-2**.

<b>Table III-2 Typical Traffic Base Plan Features</b>	
<b>Roadway Geometrics</b>	
<ul style="list-style-type: none"> <li>• Alignment of intersecting streets</li> <li>• Right-of way lines (existing and proposed)</li> <li>• Widths and number of lanes</li> <li>• Physical features (curb and gutter, sidewalks, medians, shoulders, drainage structures, guardrail)</li> <li>• Street lighting</li> <li>• Corner radii</li> <li>• Utility locations including overhead height and underground</li> <li>• Roadway entrances within 150 feet of the intersection</li> <li>• Any existing sight-distance obstructions</li> <li>• Any railroads or emergency entrances in the vicinity</li> <li>• Building lines, fences, trees, shrubs</li> </ul>	
<b>Traffic Control Features</b>	
<ul style="list-style-type: none"> <li>• Lane usage and scaled dimensions</li> <li>• Parking restrictions</li> <li>• Location and message of existing signs</li> <li>• Locations and operation of existing traffic signal devices</li> <li>• Existing speed limits</li> <li>• Existing pavement markings</li> <li>• One-way streets</li> <li>• Bus stops and loading zones</li> <li>• Turn restrictions</li> </ul>	

On a case-by-case basis, a topographical survey may be needed to define geometric improvements such as intersection channelization. When required, a planimetric plan with spot elevations shall be provided as the basis of the base plan.

The Designer shall follow DeIDOT’s CADD Standards when preparing the base plan sheet. All standard items required in the development of the base plan, including the title block,



cell library, seed files, fonts, line styles and borders, may be obtained from the Delaware Department of Transportation website ([www.deldot.gov](http://www.deldot.gov)). All base plans shall be prepared utilizing the current version of MicroStation.

### 3. Perform Field Survey

Before proceeding too far along in the design process, it is important for the Designer to verify that the items contained on the base plan match existing field conditions. This is typically accomplished by performing a field survey. A field survey generally includes either a tape-and-wheel survey at an intersection or field verification of surveyed data. The limits of the survey are usually determined by the device type. For projects involving new or modified signals, the limits on each approach should be chosen to include the length of all existing and proposed turn lanes, all potential advance signing locations, and all possible locations for the placement of detectors. During this survey, the following information should be collected or verified:

- Number of lanes and lane widths for each approach
- Intersection skew
- Medians and type
- Roadway curvature
- Pavement markings
- Signing
- Signal Timing and Phasing
- Lighting
- Sidewalks and handicap ramps
- Guardrail
- Driveways and entrances
- Utilities, including proposed electrical feed
- Parking
- Buildings
- Trees and vegetation
- MISS UTILITY (Underground)

Preliminary device locations and potential power source should also be identified during the field survey. Overhead utility lines should be measured and documented with photographs. By measuring utility lines at the proposed device location in the field, the Designer can ensure that the locations do not conflict with overhead utility lines and other physical features. Documentation of these measurements can also help resolve future utility disputes, should the height or location of utility lines change prior to device installation. The Designer should tabulate the locations and clearances of all overhead utilities on the



plans where a potential conflict could occur. For locations with existing traffic control signals, the Designer should check that the signal timing and phasing described on the timesheet matches both the plan sheet and the actual operations in the field. This requires that the cabinet be opened during the field survey, which must be performed or supervised by DelDOT Traffic staff.

## 4. Preliminary Design Plans

### a. Development

Once the initial field survey is completed, the next step for the Designer is to prepare preliminary design plans. The preliminary design plans should identify the following design elements:

- Proposed device location
- Cabinet location
- Conduit and junction well (general layout)
- Power feed
- Signing and marking
- Integration considerations
- Communication pathway
- Utility clearances

For signal projects, the following additional design elements should also be included in the preliminary design plans:

- Configuration and pole type
- Signal head placement and display
- Pedestrian facilities

It should be noted that this list is not meant to be exhaustive. Depending on the specific needs of the project, additional design elements may be required to be included in the preliminary design plans, and should be identified at this stage of the process. Any design constraints or special project requirements should also be denoted in the preliminary design plans to help in the plan review process. For additional detail regarding preliminary design plan elements, refer to Chapter IV-C of this Manual.



## **b. Review**

Once the proposed layout for the design elements listed in the previous section has been established, the preliminary design plan review can take place. The preliminary design plan review is the first in a series of reviews built into the traffic design process to allow the members of the Project Process Group to provide input on the design and ensure quality control.

As part of the preliminary design plan review, the Designer will meet with the Project Process Group to review the design and to receive comments on the preliminary design plans. If the proposed design is part of a Capital Project or Developer/Subdivision Project, the Designer should coordinate with the designated Traffic Systems Design representative to attend or verify a meeting with the Project Process Group. During the preliminary project process review additional recommendation and/or approval of preliminary design elements will be given at which time the design will move forward to the appropriate stage. Projects that are relatively small in scale with minimal impacts may forgo the preliminary plan submission upon approval by DelDOT's Traffic Systems Design Manager.

## **5. Semi-Final Design Plans**

For Capital Projects and Developer/Subdivision Projects, the traffic design should follow the plan submission schedule outlined by the Project Manager. In many cases, this requires a semi-final plan submission. Traffic Section Projects generally skip the semi-final phase and proceed to preparation of final plans following preliminary plan review.

### **a. Development**

If semi-final design plans are required, the Designer should address all comments received from the Project Process Group as part of the overall preliminary plan review before submitting semi-final design plans. Additionally, the semi-final plans should also be based on discussion with Traffic Safety and should include items such as pedestrian MOT and time restrictions. If conflicting comments are received, the Designer should work with the representatives who provided comments to determine an appropriate path forward to resolve the discrepancy.

The semi-final design plans should also include additional design elements that are typically not required until the final design stage. The more elements that the Designer can include in the semi-final design will result in a more-accurate initial traffic statement (engineer's estimate).



## **b. Initial Traffic Statement (Cost Estimate)**

Once the Designer has addressed all comments and identified the additional design elements to be included in the semi-final design plans, the next step in the process is to prepare the initial traffic statement (see Chapter III-A). The traffic statement identifies the funding method to be used for the project and includes the engineer's estimate of anticipated project costs. Quantity takeoff should be performed following current DelDOT specifications (also see Chapter III-A). The Designer should verify that the correct unit costs are being applied and that the assumed contingency meets current DelDOT practices. The Designer should also coordinate with the Systems Design representative to determine which items will be considered the contractor's responsibility and which will be the responsibility of DelDOT's Construction Group (typically, the contractor is responsible for all underground work). This will affect the portion of the total cost for which DelDOT will be responsible.

## **c. Review**

After the semi-final plans have been distributed, the Designer shall again coordinate with the DelDOT Systems Design representative and meet again with the Project Process Group. Following this meeting, additional recommendations may be provided or approval of semi-final design will be given and the design will move to final phase of design.

## **d. 90% Plan Submission**

For some projects, the submission schedule developed by the Project Manager will require a "90%" submittal of plans for review, or there may be comments received during the semi-final plan review that necessitate a "90%" submittal. However, in most cases, the DelDOT Traffic Section prefers that the 90% plan submission should be avoided, if possible, because it can disrupt the project schedule. In most cases, issues can be addressed during other submittals.

## **6. Final (PS&E) Design Plans**

For Traffic Section Projects, the preparation of final design plans typically follows the preliminary design review. For Capital Projects and Developer/Subdivision Projects, the preparation of final design plans typically follows the semi-final design review. The steps required for preparing final design plans, often referred to as plans, specifications, and estimates (PS&E), are presented in this chapter.



### **a. Development**

During the final design plan stage, the Designer should address all comments received from the Project Process Group throughout the design process and finalize all remaining design elements. As with the preliminary plan review, if conflicting comments are received, the Designer should work with the representatives who provided comments to determine an appropriate path forward to resolve the discrepancy.

Once all comments have been addressed, the following remaining design elements should be identified for inclusion on the final design plans:

- NEMA phasing (for signal projects)
- Detectors (for signal projects)
- Finalize any required schedules (conduit run, mast arm, span, signing, etc.)
- Construction notes

Additional design elements that have been identified throughout the design process should also be included in the final design plans. Any design constraints or special project requirements should also be denoted in the final design plans to help in the construction process. For additional detail regarding final design plan elements, refer to Chapter IV-D of this Manual.

### **b. Final Traffic Statement (Cost Estimate)**

Once the Designer has sufficiently addressed all comments and identified the additional final design elements to be included in the final design plans, the next step in the process is to prepare the final traffic statement. As discussed in Chapter III-B.5.b, the traffic statement identifies the funding method to be used for the project and includes the engineer's estimate of anticipated project costs. The final traffic statement should reflect all revisions made during the development of the Final Design plans, and include costs for every design element shown in the Final Design plans. An example of a Final Traffic Statement is provided in **Appendix F**.

### **c. Obtain Signatures**

Following completion of the final design plans and final cost estimate, it is necessary for the Designer to obtain a series of signatures to get final approval of the plans. The following steps are required:

1. If the design plans are prepared by a Consultant (for a Developer/Subdivision Project, for example), the consultant should sign the plans as "recommended" and turn them in to DelDOT's Traffic Section for review. Following the review, the DelDOT Traffic Designer should also sign the plans as "recommended."



2. If the design plans are prepared in-house by DelDOT staff (for Traffic Section Projects and Capital Projects, for example), the Traffic Designer should sign the plans as “recommended.”
3. Once the plans are signed as “recommended,” they should be sent to DelDOT’s Systems Design Manager for review. If acceptable, the Systems Design Manager approves and signs the plans.
4. For traffic control signal projects, plans signed by the Systems Design Manager shall be sent to the TMC manager to authorize the development of a Signal Timesheet.
5. In the final step in the process, the plans and approved Timesheet are sent to DelDOT’s Chief Traffic Engineer for the final approval signature. In some cases, primarily for Capital Projects, the traffic design plans are signed by DelDOT’s Chief Traffic Engineer while the Timesheets are being finalized. The signed version of the plan should be included in the PS&E record set.

#### **d. Construction Hand-off**

Once the Designer obtains the final signed version of the plan sheet(s), they are responsible for completing the design project check list and preparing the construction handoff package. A formal construction hand-off package is required for all Traffic Section Projects. For other project types, the construction hand-off typically occurs at PS&E. The hand-off package, provided in **Appendix C**, should contain the following items:

- Copy of signed plan(s)
- Traffic Statement
- Traffic Systems Design Handoff Form
- Funding Source
- Timesheet Status
- Any additional construction requirements (signing, marking, and/or lighting)
- Any special construction requirements
- Any special MOT requirements
- Any public relation notification requirements

Once all required documents and coordination has been completed, the Designer shall submit all related documents to DelDOT’s Signal Construction Manager (or in some cases, Maintenance Manager), as well as any other sections within DelDOT that are required to perform work associated with the project.



Once the construction hand off document is received, DelDOT's Construction Manager will place the project on the construction schedule. If the project is part of a Capital Project or Developer/Subdivision Project, the Traffic Construction Manager will place it on the schedule and coordinate with the appropriate construction inspection staff on the proposed construction schedule. If required, the procurement of any lead time items shall begin. Once construction begins, if any design changes are required, the Traffic Construction Manager will coordinate with the Designer and/or Construction Inspector to verify that a sound construction alternative is chosen. During the construction process, if minor construction changes occur, DelDOT's Traffic Construction Manager will provide DelDOT's Traffic Design Section with an as-built plan showing all plan adjustments or changes. Except on Capital Projects, the Traffic Design Section will be responsible for changing the record plans to reflect all construction changes.

Prior to completion of device construction, the Construction Manager should notify DelDOT's Public Relations office informing them of a pending new device activation and/or traffic operation change. Prior to completion of work in which a signal operational change and/or new traffic pattern is to occur, a message board should be installed on all approaches prior to implementation. For new signal activation, a message board should be installed on all approaches seven (7) days prior to implementation and a minimum 72-hour flash operation shall occur prior to full signal activation. For new signal projects and projects involving major phase changes to a signal, representatives from the following DelDOT Sections should be present at the field meeting to activate the device: Design, Construction, Maintenance, and the TMC. A representative from DelDOT's Traffic Studies Section should also visit the site within 24 hours of activation to verify that all traffic control devices are in-place and functioning properly.