I. INTRODUCTION

The guidelines contained in this Traffic Design Manual have been written to define the standards and processes that should be followed in the preparation of design plans for all new or modified traffic system devices owned and/or maintained by the Delaware Department of Transportation (DelDOT). The manual also applies to all projects in which DelDOT is serving in an oversight role.

This introductory chapter outlines the purpose of the Manual and discusses the different types of traffic system devices. This chapter also compares the three primary project types that involve traffic system design and includes some important maintenance of traffic considerations. Finally, this chapter defines the roles and responsibilities of various groups involved in the traffic system design process, both within DelDOT and throughout the state of Delaware.

A. Purpose

This Manual sets forth the latest design concepts and standard practices for engineers and technicians when preparing plans and specifications for traffic system design projects. This manual represents DelDOT's practices, techniques, and procedures that will be applied in developing plans, special provisions, standards, and specifications for any new or modified traffic system devices that will be installed or maintained by DelDOT. The manual also applies to all projects in which DelDOT is serving in an oversight role, regardless of ultimate ownership of the devices.

DelDOT's Traffic Section is responsible for the design, maintenance, and operation of all traffic devices (including signs, pavement markings, ITS devices, and traffic signals) that are on the state system outside of municipalities, and in compliance with town agreements, many traffic devices on state-maintained highways within municipalities. One of the primary objectives in developing this manual is to maintain uniformity and standardization in the use, design, and operation of powered traffic system devices throughout Delaware, regardless of who develops the plans (i.e., in-house designers, consultants, etc.).

It should be noted that this manual does *not* address the design of signs, pavement markings, or lighting, except when associated with powered traffic system devices. For information on the design of signs and pavement markings, refer to the Delaware Manual on Uniform Traffic Control Devices (DE MUTCD). For information on lighting design, refer to the Delaware Department of Transportation's Traffic Lighting Policy. Note that all specific DE MUTCD citations in this Manual refer to the 2011 edition.

B. Traffic System Design Devices

The DelDOT Traffic Section is responsible for designing, reviewing, and/or approving a variety of traffic system devices that are used to monitor and control traffic throughout the State of Delaware. Safety, access, and mobility are all considered during the design process. The most common type of traffic system device is traffic signals. Traffic signals may include standard intersection traffic control signals, hazard identification beacons (HIB), intersection control beacons (ICB), all-way stop controls, emergency vehicle signals, signals at moveable bridges, school signals, pedestrian signals, and temporary signals. The various traffic signal types are described in more detail in Chapter IV of this manual.

While traffic signals are the most common traffic device installed and maintained by DelDOT, the design of all other traffic systems devices follows a similar design process, which is outlined in this Manual. The design process for the following traffic devices is also governed by this manual: communications infrastructure, including underground conduit and some wireless networks; real-time traffic monitoring projects, including system loops and remote traffic microwave sensors (RTMS); closed-circuit television (CCTV) cameras; dynamic message sign (DMS) boards; roadway weather information stations (RWIS); and WTMC repeaters and auxiliary towers. These traffic devices are discussed further in Chapter V of this manual.

C. Project Types

There are four (4) primary project types in Delaware that result in the need for traffic system design elements. Each project type will require a slightly different design process. However, regardless of the project type, all traffic system equipment must be justified by the appropriate level of study and the resulting equipment must be designed to uniform standards.

The four project types are described below:

1. **Capital Projects** – This project type includes all traffic design elements associated with DelDOT capital projects. Capital projects are typically led by the Project Development, Bridge, or Transportation Solutions Sections of DelDOT. Examples of these projects include new roads, corridor improvement projects, sidewalk/multi-use path projects, or other capital improvement projects. The need for traffic control signals and/or other traffic system design elements is often based on projected traffic volumes developed during the DelDOT project development process. The DelDOT Traffic Section serves in a support role on these projects. Capital project traffic system elements may be designed by engineering consultants as part of an overall capital project assigned to a consultant. For consultant projects, the consultant's engineer of record is responsible for the development of the design, cost estimates, etc., and Traffic Systems Design Section

staff serve as reviewers and coordinators. For capital projects designed in-house by DelDOT staff, a DelDOT Traffic Systems Design staff member typically prepares the design plans for the traffic system elements. For in-house projects, the assigned Traffic System Design staff member is an important part of the project design team, and it is critical for the project designer to closely coordinate all relevant aspects of the project with the Traffic Section.

2. **Pavement & Rehabilitation Projects** – Typically these projects include traffic signal design work required to meet Americans with Disabilities Act (ADA) requirements on Pavement & Rehabilitation projects. Due to the limited staff and compressed time frames of these projects, the process followed is significantly different than for other capital projects. Although the Traffic Section is in a support role on these projects, they are the lead on determining the need for and designing pedestrian signal upgrades.

3. **Traffic Section Projects** – These projects are typically associated with traffic signals or other traffic system elements requested by legislative representatives, private citizens, Community Transportation Fund, fire companies, and/or recommendations by Traffic Section staff. These improvements can be a new design, an operational improvement identified as a result of a traffic engineering study, or a safety or equipment improvement identified by DelDOT.

4. **Developer / Subdivision Projects** – These projects are typically associated with private developments including new subdivisions and new or modified commercial properties. The traffic system devices are often requested by the developer or required as part of the Traffic Impact Study or Traffic Operational Analysis approval process to facilitate movement to and from a new roadway or entrance.

D. Maintenance of Traffic Considerations

An important consideration on all DelDOT projects, including traffic system design projects, is the Maintenance of Traffic (MOT) requirements. In response to FHWA's Rule on Work Zone Safety and Mobility (23 CFR 630 Subpart J), DelDOT has developed a work zone safety and mobility policy that stresses DelDOT's commitment to always maintain optimum worker safety while having traffic travel smoothly and safely through work areas. The policy, outlined in DelDOT's 2007 document titled Work Zone Safety and Mobility Procedures and Guidelines, requires DelDOT to perform an evaluation of the broader safety and mobility impacts of work zones throughout project development and also requires that a Transportation Management Plan (TMP) be prepared for "significant" projects.

For Capital Projects and Pavement & Rehabilitation Projects, the traffic systems design is typically only a portion of the overall design effort. These types of projects require either a Type A or Type B Transportation Management Plan (TMP) depending on the level of anticipated traffic impacts-of-which the DelDOT Safety Section will determine. Therefore, the MOT plan is typically, but not always, developed for the final device design. Additionally, the traffic systems designer must coordinate with the project designer and the DelDOT Safety Section to ensure that the work zone impacts associated with the construction of the traffic system devices are properly included in the MOT plans. This is particularly true when construction will be completed in phases, occur at night or when pedestrian, bicycle, or vehicular routes are to be detoured. In all cases, the MOT needs should be addressed on the handoff form as well as in the cost estimate.

For Traffic Section Projects, it is the responsibility of the traffic systems designer to develop MOT plans and ensure compliance with the Work Zone Safety and Mobility (WZSM) Procedures and Guidelines. These types of projects are often considered non-significant in terms of the WZSM Guidelines and therefore, typically require only a Type A TMP, which consists only of the MOT plans. The traffic systems designer must also coordinate with the DelDOT Safety Section to ensure that the work zone impacts associated with the construction of the traffic system devices are properly included in the MOT plans and the TMP. This is particularly true when construction will be completed in phases, occur at night or when pedestrian, bicycle, or vehicular routes are to be detoured. Refer to the WZSM Guidelines for additional details. The MOT requirements for each Traffic Section Project need to be estimated and explicitly documented, including required MOT set-ups, pedestrian and bicycle MOT considerations, detours, and allowable times for lane closures.

E. Roles and Responsibilities

Before discussing the detailed process that should be followed for a DelDOT traffic system design project, it is important to identify all the key stakeholders and personnel, as well as the responsibilities they have in the context of a traffic system design project. The following DelDOT Sections, companies, and organizations can each typically have a role in the planning, design, construction, and operations of traffic system devices owned and maintained by DelDOT.

The **DelDOT Traffic (Engineering and Operation) Sections** are the authority for the approval of all traffic system design projects in the State of Delaware in which the traffic devices will be owned and/or maintained by DelDOT. The Chief of Traffic Engineering must provide “Concurrence of Installation” and sign all traffic signal plans, timesheets, and needed resolutions. The DelDOT Traffic Section consists of two subsections with several groups underneath each: Traffic Engineering, including Traffic Studies, Traffic Systems Design, Traffic

Design Resource/HSIP, Traffic Construction, Traffic Maintenance; Traffic Operations, including Traffic Safety, and the Transportation Management Center.

The **DelDOT Traffic Studies Group (commonly called "Studies")** performs and reviews traffic impact studies and traffic safety and operations studies. They have the responsibility of preparing traffic signal studies and signal justification/warrant analysis and subsequently initiating the signal design process for either new signal projects or modifications to the operations of existing signals.

The **DelDOT Traffic Systems Design Group (commonly called "Design" or "Traffic Design")** is responsible for the design, review, and recommendation for approval of all traffic system design projects to the Chief of Traffic Engineering, including the compilation of the design, specifications, and estimates; review and approval of "as-built" plans for traffic system devices; coordination and review of consultants' designs; coordination with DelDOT Project Development Section and Planning Division; and coordination within the Traffic Section.

The **DelDOT Traffic Design Resource/HSIP Group** is responsible for delivering the Department's Highway Safety Improvement Program (HSIP), including the state's Strategic Highway Safety Plan and other programs and projects to enhance safety on Delaware's roadways. The group is also charged with maintaining the Department's crash data analysis program and fulfilling Departmental requests for crash data. The Department's Railroad Coordination Program is also housed under this group.

The **DelDOT Traffic Field Operations, Signal Construction Group (commonly called "Construction" or "Traffic Construction")** is responsible for the installation, construction coordination, inspection, and acceptance of all constructed statewide traffic system devices. Once a traffic project is awarded or handed off, Construction acts as a liaison for the Traffic Section, coordinating construction activity with the Contractor, the Districts, and utility companies through all phases of construction. They also monitor and coordinate all traffic system device construction activity statewide.

The **DelDOT Traffic Field Operations, Signal Maintenance Group (commonly called "Maintenance" or "Traffic Maintenance")** is responsible for the maintenance and upkeep of all existing DelDOT traffic system devices statewide. They also assist Construction and the TMC by performing minor signal upgrades, including upgrades to wiring, signal head replacement, knock-down repairs, and some relatively minor upgrade projects (such as signal head modifications or installation of Accessible Pedestrian Signal (APS) equipment). They also aid in the construction and implementation of special traffic system devices.

The **DelDOT Traffic Safety Group (commonly called "Safety")**, for the purposes of this manual, is responsible for the review and approval of maintenance of traffic (MOT) plans, work zone safety, monitoring of MOT during construction, approval of temporary traffic control sign resolutions, TMP type designation/approval work hour checklist approval, and reviewing/approving detour plans.

The **DelDOT Transportation Management Center (commonly called "TMC"),** is responsible for the operation of all traffic system devices that are owned and maintained by DelDOT. Signal timings, incident management, corridor-level roadway monitoring, and developing signal corridor timing plans are among the many duties of this group. Some TMC staff focus on signal timings, systems monitoring, conveying information to the public, and running the day-to-day operations of the transportation system. Other TMC staff coordinate closely with the OIT communication group on maintaining and expanding the communications systems for traffic systems devices.

The DelDOT **Project Process Group** is comprised of representatives from the Design, Maintenance and Construction Groups, and the TMC, with occasional input from the Studies Group, Safety Group, HSIP, capital project designers and/or private developers. This group's primary role is to review the design plans at the semi-final stage and provide feedback to the traffic design engineer.

DelDOT's Traffic Support Services Group is responsible for coordinating the financial obligations of the DelDOT Traffic Section with DelDOT's Finance Section.

Consultant: DelDOT or a private developer may request the services of an engineering consultant to prepare traffic system design plans. When a consultant renders services, it becomes the responsibility of the consultant to coordinate all data collection and design activities with the Design Group, Project Development, local governments, and utility companies, through the Plans, Specifications and Estimates (PS&E) submission.

Power Company: The power company has the responsibility of providing electrical service to most new or modified traffic system devices. If the source of power is not obvious, or if conflicts are anticipated between existing aerial lines and proposed traffic equipment, coordination with the power company may be needed early in the design process. All traffic control signals should use hardwire power sources. Most ITS devices will also use hardwire power sources. If hardwire power is not readily available, some ITS devices may use solar power. However, the use of solar power requires prior approval from DelDOT's Traffic Systems Design Group.

MISS UTILITY: MISS UTILITY is a private agency and is responsible for coordinating the location of underground utilities on state and local roads. Generally, the Maintenance & Construction Group and/ or the Design Group will contact MISS UTILITY to verify the locations of underground utilities during the design process and prior to construction of the project. DelDOT will also contact MISS UTILITY after a project is completed, identifying the location of all new or modified underground equipment.

Local Governments: Local governments include cities or towns that may have an operational/safety interest, financial interest or obligation, or other responsibilities for a traffic system design project. Coordination with local governments is required since local guidelines and ordinances may apply to traffic system design projects, especially signal projects, even if both intersecting roads are maintained by DelDOT. Local guidelines and ordinances may dictate streetscape elements and the overall appearance of traffic system equipment. Additionally, town agreements may specify which public entity is responsible for which traffic control devices. For traffic systems that will be owned by local governments, design and specification elements of this Manual may be modified to meet local standards/ preferences, provided overall operational and safety parameters are met. For Traffic System Design Section-led projects within municipal limits, the following guidelines should be followed: 1) Notify the town of any/all projects. Depending on the scope, this could range from simple notification to a design review, to a consideration of different alternatives. This should be completed during design. 2) If the project impacts non-DelDOT equipment, a new town agreement is needed. 3) For any new installations within municipalities, a town agreement is needed whether the signal will be DelDOT or municipal-owned.

F. Traffic Design Manual Updates

The information contained in this manual is current at the time of publishing. It is expected that the guidance contained in this document may be updated periodically. Interim guidance may be published by DelDOT and will be made available on DelDOT's website within the Design Resource Center (DRC). Proposed changes to this manual should be suggested using the Traffic Systems Design Directive form found in **Appendix A** and must be approved by DelDOT's Chief of Traffic Engineering.