
635 TRAFFIC SIGNAL DESIGN AND DRAFTING GUIDE

This guide describes typical practices for new or modified traffic control signal installations statewide. This guide is a supplement to ADOT's Traffic Signal and Lighting Standard Drawings, Standard Specifications, Special Provisions, MUTCD, and other current design guidelines.

Deviations will be allowed based on informed engineering decisions.

1. Cell Libraries
 - a. Contact the Traffic Standards Engineer or Traffic CADD Coordinator for information on how to obtain or access the current ADOT Traffic cell libraries.

2. Scale
 - a. The scale for Traffic Signal plans should be 1" = 20'.
 - b. The scale for Lighting plans should be 1" = 100'.

3. Notes & Symbols
 - a. There should only be one set of General Notes or special symbols applicable to the entire project, which should be depicted on one sheet of the Electrical plans. **Abbreviations and symbols shown on the Traffic Signal and Lighting Standard Drawings or Standard Specifications shall not be redefined on a project.**

4. Existing Signals and Lighting
 - a. Where existing signals are to be modified or revamped, it is desirable that the construction plans include a separate plan of the existing "As-Built" system as well as a plan showing modifications. When the existing and proposed systems cannot be placed on the same sheet, a separate sheet should be used. **All utilities shall be shown on the signal plans. Crosswalks, lane designations, and left turn bays shall be shown on the plans, but not dimensioned.**

5. Research
 - a. Research files at Engineering Records or Traffic Engineering to obtain information on all projects at the intersection, including information on right of way and utilities. Use the traffic signal warrant study as a reference.
 - b. Traffic Operations Electrical has a file containing record drawings of signalized intersections. If plans information is needed, make a copy and immediately return the original to the file.
 - c. Reference (and copy) or draft geometrics. Draft geometrics to a minimum of 500' along each leg of the intersection.

6. On-Site Field Inspection

The designer collects all field data required to develop a base drawing of existing conditions which can be used for the design process. The On-Site Field Inspection Checklist (see TGP 636) includes data to be considered. The information gathered need not be limited to items found on the list, as conditions may warrant additional data.

7. Pole Layout

- a. **Place underground conduit and pullboxes. All pullboxes for conduits for street crossings shall be Number 7, with the exception that the pullbox on the corner where the control cabinet will be shall be a Number 7 with an extension.** Pull boxes for conduit runs to advance loop detectors or advance flashers should be Number 5.
- b. Place signal poles (and luminaire poles if needed). Poles should be placed to most efficiently satisfy signal visibility guidelines in Part 4 of the MUTCD. As a general rule, four signal poles will be installed at an intersection, unless there are circumstances (i.e. fewer or greater than four approach legs, overhead power lines, underground utility conflicts) that require a different number of poles. If poles cannot be placed in proximity to sidewalk ramps, then Type PB pedestrian pushbutton poles should be used to place pedestrian push buttons adjacent to the ramps. Six or eight pole intersections should be used when conditions require signal mast arms longer than 55 feet. In these cases, the mast arm pole should be moved to the end of the radius and a Type PB pole placed adjacent to the sidewalk ramp. Where the speed limit is posted at 55 mph or greater, poles should be placed outside the clear zone if practicable. Signal poles at intersections should typically be of a type incorporating a luminaire assembly, unless there is a conflict with overhead utilities. A minimum clearance distance of 10 feet or as required by the utility company, whichever is greater, should be maintained between the nearest point on the pole and any overhead electrical line. Poles placed in areas where there is curb, gutter, and sidewalk should be installed behind the sidewalk.

8. Electrical Power Source

Identify the electrical power source location, and distance to the meter pedestal. The designer is responsible for establishing the electrical service per the power company's requirements for trenching, conduit size, placement and conductors.

A service request letter shall be sent to the electrical utility showing estimated loads, the responsible party for paying the monthly power bill, and any other pertinent information. A copy of this letter shall be sent to the State Traffic Operations Engineer.

The application and construction fees shall be paid by the contractor directly to the power company after review by the Engineer. The Contractor shall then submit the paid invoices to the Engineer for reimbursement through an established bid item (typically 9240015) and according to the project special provisions.

9. Meter Pedestal Cabinet

The meter pedestal cabinet shall be Type I conforming to Standard Drawing T.S. 3-5.

Each traffic signal system should be provided with an 1100 V.A. uninterrupted power supply (UPS) unless specifically excepted by the State Traffic Operations Engineer. **The UPS shall be designed to provide power to the traffic signal system (but not roadway lighting) in case of a loss of main power.**

10. Traffic Signal Controller Cabinet

The traffic signal controller cabinet should be NEMA TS2, Type I. The cabinet size should be type IV or type V conforming to Standard Drawing T.S.3-9. The designer should specify an elevator base if a Type IV is selected. If the cabinet is in an unpaved area, a concrete pad conforming to Standard Drawing T.S. 2-4 should be installed in front of each cabinet. The Designer should check with the respective Regional Signal Supervisor regarding specific requirements, such as number of doors and cabinet size.

Factors to be considered in selecting a controller cabinet location:

- a. Location of electric service point.
- b. Location of telephone service (interconnect).
- c. Vulnerability to knock down by errant vehicle (clear zone).
- d. Visibility to signal faces.
- e. Vulnerability to flooding.
- f. Intersection sight distance.

11. Signal Faces

- a. **All signal faces shall be 12”.**
- b. **All signal faces shall have black louvered backplates.**
- c. Consider longer tunnel visors for skewed intersections.
- d. **On mast arms, signal faces shall be placed in accordance with the standards and guidelines listed in Part 4 of the MUTCD.**
- e. Consider side mounts for approaches facing east or west to address visibility in low sun angle conditions.
- f. Consider additional signal faces for approaches with high volumes of truck traffic.
- g. Consider additional signal faces to address advance sight distance for approaches on a curvilinear alignment.
- h. Verify with the Regional Signal Supervisor whether Type Q or Type G signal face assemblies are to be used for the signal installation.
- i. Pedestrian signal faces should be placed where to minimize visibility interference from vehicles stopped at the intersection. **All new pedestrian signal faces shall be of the countdown type.**
- j. Pedestrian signal indications should be aligned with marked crosswalks.
- k. **All signal faces shall be LED modules.**
- l. **Programmable vehicular signal indications, if used, shall require the approval of the State Traffic Engineer.**

12. Conduits & Labels

- a. **All street crossing conduits shall have at a minimum two runs of 3” PVC.**
- b. **All pullbox to pole conduits shall use 3” PVC.** (Exception: Where using a Type A pole or pushbutton pole, 2” PVC should be used.)
- c. **All loop detector stub-outs and advance loop detector and advance flasher runs shall use 2” PVC.**
- d. Poles are labeled with letters, starting at the controller cabinet with “A” in a hexagon (cell) and then proceed in a clockwise direction with pole lettering.
- e. Conduits are labeled with numbers in a circle (cell) beginning with “1” as the service run, runs 2 and 3 are the two conduits between the controller cabinet and the number 7 pullbox with an extension and then, in a clockwise direction from the controller cabinet, number street crossings, then pole runs, then loop detector stub-outs or runs.

13. Detection

Each traffic signal system shall be equipped with appropriate detection systems. Consult with the Regional Traffic Engineer to verify the type of detection to be used at the intersection

- a. If loop detectors are used, use 6'x50' quadruple loop detectors for left turn loops on mainline and for minor street loops.
- b. If loop detectors are used, and the speed limit on an approach is 40 mph or above, use 6'x6' advance loop detectors for the mainline thru movement in each lane.

14. Pole & Conductor Schedules

- a. The pole schedule summarizes information on type of mounting assemblies, signal faces, pedestrian faces, push buttons, poles, and mast arms on the project. The pole schedule also tells the contractor where the poles are located and where the mounting assemblies are to be placed on the pole. Incorporated into the pole schedule is the type of cabinet and controller to be used, along with the type of luminaire.
- b. The Traffic Electrical Design CADD menu item "trafo" may be used to build a pole schedule..
- c. The conductor schedule summarizes information on wire type, color coding, lengths, and phases assigned to each wire. All traffic signals should be initially wired for full 8-phase operation with "future" phases labeled appropriately.

15. General Notes

- a. Contact the Traffic Standards Engineer or Traffic CADD Coordinator to obtain the current set of ADOT traffic signal general notes. These notes should be modified by the designer to reflect project and site-specific conditions.

16. Specifications and Special Provisions

- a. Traffic Design Section maintains a set of Special Provisions which may be used to address a number of special items or conditions such as:
 - interconnect communications cable
 - temporary signals
 - countdown pedestrian signal indications.
 - UPS
 - accessible or tactile pedestrian push buttons
 - accessible pedestrian signals
 - pre-formed loop detectors
 - pull boxes
 - department-furnished material
 - sign lighting
 - Emergency Vehicle Preemption (EVP)
- b. Contracts and Specifications also maintains a set of Stored Specifications for use on signal projects. Please consult the most recent list of Stored Specifications to determine which of these specifications should be used with a project.