CHAPTER 4 – PLANS

PLANS
In this chapter, the items found in typical standalone traffic control signal and lighting plans will be presented. Typical plan sheet layouts and wiring diagrams are also presented.

4.1 Traffic Control Signal Plan

Traffic control signal plans are prepared on 11” x 17” plan sheets. The scale is indicated on the individual layout sheets. Each sheet of the plan will be properly identified with the State or State Aid Project Number and sheets after the title sheet will also be labeled as Sheet XX of XX. For traffic control signals the legend will be located on the title sheet and a sheet border with signature block, which, as shown in Figure 4-1, has important information such as the State Project Number, Trunk Highway Number, System Identification Number, Meter Address, T.E. Request Number, and Certified Signature will be on each of the plan sheets following the title sheet.

Traffic control signal plan sets typically include:

- Title sheet
- Detail sheets
- Intersection layout sheets
- Field Wiring Diagram
- Utility layout sheets
- Field wiring diagram sheets
- Utility layout sheets

Figure 4-1: Example of Sheet Border with Signature Block
4.1.1 TITLE SHEET
The title sheet is required for all plans. The title sheet contains the index for the sheets contained within the plan. It also includes content such as the following:

- Plan description
- Project location
- Governing specifications
- Plan preparation certification
- Signature block
- Plan revisions block
- Standard plates
- Statement of estimated quantities

Additional detail on title sheet content is presented below.

Plan Description
As presented in Figure 4-3, the plan description and location defines the type of work being performed and the location of the work.

Signal and lighting work can be part of a larger roadwork plan or they can be standalone projects.

Project Location
As shown in Figure 4-4, the index map is used to identify the exact location of the project(s). The generalized location (county and office) is shown on the title sheet in Figure 4-5.
Governing Specifications
As shown in Figure 4-6, the governing specifications for the project are defined.

Plan Preparation Certification
The plan preparation certification note shown in Figure 4-7 identifies:

- The individual who developed the plan set (and/or direct supervisor)
- The individual's state license information.
**Signature Block**
The signature block, as shown in Figure 4-8, is contained on the title sheet and varies depending on the type of project. Not all signature fields may be required on every project.

**Plan Revisions Block**
The plan revisions block is also included so that future plan revisions can be documented.

For revisions to the plan made after project advertisement, an "R" shall be used after the sheet number.

**Standard Plates**
A list of applicable standards plates for the project, as shown in Figure 4-10, is included in the plan set. The bold/darkened standard plates are applicable to that specific project.
Statement of Estimated Quantities

The statement of estimated quantities as shown in Figure 4-11, may be included on a separate sheet or shown on the title sheet (if there is room). Traffic control signal interconnection, emergency vehicle preemption system and other items such as conduit and handholes for future traffic control signal systems may be itemized separately from the traffic control signal system being installed due to cost participation.

<table>
<thead>
<tr>
<th>STATEMENT OF ESTIMATED QUANTITIES</th>
<th>COST BREAKDOWN</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITEM NO.</td>
<td>DESCRIPTION</td>
</tr>
<tr>
<td>2252.601</td>
<td>VEHICULAR SIGNAL</td>
</tr>
<tr>
<td>2254.601</td>
<td>REMOVE Curb AND COVER</td>
</tr>
<tr>
<td>2254.602</td>
<td>REMOVE CONCRETE WALK</td>
</tr>
<tr>
<td>2254.603</td>
<td>REMOVE BRICK MASON</td>
</tr>
<tr>
<td>2254.604</td>
<td>REMOVE DIRT SURFACES</td>
</tr>
<tr>
<td>2254.605</td>
<td>REMOVE AND REPLACE BITUMINOUS PAVEMENT</td>
</tr>
<tr>
<td>2254.606</td>
<td>REMOVE AND REPLACE PAVEMENT</td>
</tr>
<tr>
<td>2255.601</td>
<td>CEMENT BULK</td>
</tr>
<tr>
<td>2255.602</td>
<td>CONCRETE CURB AND COVER</td>
</tr>
<tr>
<td>2255.603</td>
<td>CONCRETE CURB DESIGN Y</td>
</tr>
<tr>
<td>2255.604</td>
<td>TRENCHED HOLES</td>
</tr>
<tr>
<td>2257.601</td>
<td>TRAFFIC CONTROL</td>
</tr>
<tr>
<td>2257.602</td>
<td>SIGNAL CONTROL SIGNAL SYSTEM</td>
</tr>
<tr>
<td>2257.603</td>
<td>EMERGENCY VEHICLE PREEMPTION SYSTEM</td>
</tr>
<tr>
<td>2257.604</td>
<td>TRAFFIC CONTROL INTERCONNECTION</td>
</tr>
<tr>
<td>2257.605</td>
<td>REVISE SIGNAL SYSTEM</td>
</tr>
</tbody>
</table>

Figure 4-11: Example of Statement of Estimated Quantities

The appropriate specification item numbers, item descriptions, and units using the state's computerized pay item list shall be included.

4.1.2 DETAIL SHEETS

The detail sheets show the details that are applicable to the project. Details may include the following:

- Service equipment detail
- Equipment pad layout
- Loop detector details
- Advance warning flasher details
- Pavement markings detail
- Type "D" and/or Type "C" sign details
- Wood pole and span wire mounting
- Any other details specific to the traffic control signal system
**Equipment Pad Layout**

The signal service cabinet (Type SSB) with battery backup capabilities pad detail is shown in the plan set. The equipment pad layout sheet in the plan shows the details for the equipment pad. Figure 4-12 shows a SSB signal service cabinet.

![Figure 4-12: Examples of SSB Signal Service Cabinets](image1)

Figure 4-13 provides an example of a SSB concrete pad for the traffic control signal cabinet and the SSB signal service cabinet.

![Figure 4-13: Example of an SSB Concrete Pad](image2)
Advance Warning Flasher Details
The detail sheet for the advance warning flasher (AWF) is also shown in the plan set.

Figure 4-14: Example of AWF Detail Sheet

Figure 4-15: Typical AWF Setup
4.1.3 SIGNAL INTERSECTION LAYOUT SHEET

Figure 4-16 shows a typical traffic control signal intersection layout.

Figure 4-16: Signal Intersection Layout Sheet
The signal intersection layout sheet includes the following (at a minimum):

- Intersection geometrics
- All graphics depicting traffic control signal system components
- Controller phasing diagram
- Traffic control signal system operation notes
- Signal head table
- Loop detectors table
- Signal pole notes
- Equipment pad notes
- Source of power notes
- Construction notes
- Traffic control signal system ID, meter address and TE number
- A scale
- A north arrow
- Speed limits
- Street names
- DO NOT show utilities on the layout sheet; include additional sheet(s) for utilities.

Figure 4-17: Intersection Notes
**Equipment Pad Note**

An equipment pad note is shown in Figure 4-18 as a circled "A."

A solid (filled) symbol identifies new equipment and an open symbol identifies in-place equipment.

**Signal Pole Notes**

The signal pole notes are shown in a hexagon as indicated in Figure 4-19. The signal pole bases are labeled clockwise around the intersection with Number 1 being adjacent to or near the controller cabinet. A solid filled symbol identifies new equipment and an open symbol identifies in-place equipment.
Figure 4-21 shows the signal pole notes identifying the mast arm at a right angle to the center line of the road. Signal heads and luminaires mounted to the pole reference the mast arm for proper mounting orientation. For signal head and luminaire orientation the mast arm is considered 0 degrees.

In Figure 4-22, the mast arm pole is shown on the plans and in the field.
Emergency vehicle preemption (EVP) is shown in Figure 4-23 with the arrow and two lines. Luminaires are labeled with a star shaped symbol.

The vehicle signal head is identified with the triangle. The heads are labeled from right to left as the intersection is approached. Signal heads are numbered inside of a circle with the controller phase first, followed by the head number (for example 2-1, 2-2, etc.).
Signal Head Table
The signal indications table identifies the head configuration for the signals shown on the plan sheet. The head identification number refers to the signal head shown on the plan sheet.

R = Red indication
Y = Yellow indication
G = Green indication
FYA = Flashing Yellow Arrow
LED = Light Emitting Diode

Figure 4-25: Example of Signal Indications Table
The pedestrian signal head is illustrated with an arrow. The head is numbered as the intersection is approached with number 1 being the first on the right and numbers 2, 3, and 4 as the intersection is entered. These numbers are preceded by a P and the controller phase number (for example P4-3, P4-4, etc.). The pedestrian push button is labeled with a PB and the controller phase number.

Figure 4-26: Example of Pedestrian Signal Head Detail
Loop Detectors
Loop detectors are shown in Figure 4-28 with a square or rectangle. The detectors are normally labeled as the intersection is approached, from right to left with number 1 usually a detector back from the stop line and number 2 to the left. These numbers are preceded by a D and the controller phase number (for example D1-1, D1-2, etc.).
The loop detector table identifies the size, function and location of the detector shown on the plan sheet. The detector number refers to the detector shown on the intersection plan sheet. The location shows the distance from the stop line to the detector.

### Figure 4-29: Example Loop Detector Table

#### 4.1.4 FIELD WIRING DIAGRAM SHEET

All electrical components are shown on the wiring diagram in Figure 4-31.
Figure 4-31: Pole Number One Wiring Diagram to Layout Sheet
The field wiring diagram is used to describe how the actual field wiring shall be routed through the conduit and terminated.

Figure 4-32: Example of a Controller Cabinet Wiring Detail

The field wiring diagram includes a conductor color coding chart as shown below.

Figure 4-33: Example Signal Control Cable Conductor Color Code Chart
The pole base wiring connector detail sheet includes a wire specification chart.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Specification Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/C 2</td>
<td>Power Conductors</td>
<td>3815.2B.1</td>
</tr>
<tr>
<td>1/C 6</td>
<td>Power Conductors</td>
<td>3815.2B.1</td>
</tr>
<tr>
<td>1/C 6 INS.GR.</td>
<td>Grounding Conductors</td>
<td>3815.2B.5</td>
</tr>
<tr>
<td>2/C 14</td>
<td>Loop Detector Lead-In Cable</td>
<td>3815.2C.4</td>
</tr>
<tr>
<td>3/C 14</td>
<td>Signal Control Cable</td>
<td>3815.2C.3</td>
</tr>
<tr>
<td>4/C 14</td>
<td>Signal Control Cable</td>
<td>3815.2C.3</td>
</tr>
<tr>
<td>6/C 14</td>
<td>Signal Control Cable</td>
<td>3815.2C.3</td>
</tr>
<tr>
<td>12/C 14</td>
<td>Signal Control Cable</td>
<td>3815.2C.3</td>
</tr>
<tr>
<td>6PR 19</td>
<td>Telephone Cables Outdoor</td>
<td>3815.2C.6b</td>
</tr>
<tr>
<td>3/C 20</td>
<td>EVP Detector Cable</td>
<td>3815.2C.5</td>
</tr>
</tbody>
</table>

*Figure 4-34: Wire Specification Reference Chart*

Some of the graphics used on the field wiring diagrams are shown here. Also, see the standard symbols from the MnDOT Technical Manual.

*Figure 4-35: Example Field Wiring Symbols*
4.1.5 UTILITIES SHEET

Figure 4-36 provides an example of a utilities layout sheet.

Figure 4-36: Example of Utilities Layout Plan Sheet
4.2 Typical Lighting Plan

Similar to traffic control signal plans, lighting plans are also prepared on 11" x 17" plan sheets. The scale is indicated on the individual layout sheets. Each sheet of the plan will also be properly identified with the State or State Aid Project Number and labeled as Sheet XX of XX. All sheets after the title sheet will include a sheet border with signature block, which has important information such as the State Project Number, Trunk Highway Number, Feed Point Number, Meter Address, and Certified Signature.

![Figure 4-37: Example of Sheet Border with Signature Block](image)

Lighting plan sets include:

- Title sheet
- Quantities sheet
- Lighting Detail sheets
- Removal Sheets
- Lighting plan sheets (including wiring diagram)
- Utilities
Figure 4-38: Typical Lighting Plan Title Sheet
4.2.1 TITLE SHEET
Similar to traffic control signal plan detail as presented above in 4.1, the title sheet of the lighting plan includes a map that indicates the location of the lighting project, an index for the lighting plan, approval signatures, and the governing specifications for the lighting project.

The title sheet is required for all plans. The title sheet contains the index for the sheets contained within the plan. It also includes content such as the following:

- Plan description
- Project location
- Governing specifications
- Plan preparation certification
- Signature block
- Plan revisions block
- Standard plates
- Statement of estimated quantities

4.2.2 QUANTITIES SHEET
For itemized projects, the lighting quantities sheet includes a statement of estimated quantities for each pay item as seen in Figure 4-39. A standard plates chart for the specific project is provided on all lighting plans.

For lump sum projects, the lighting quantities sheet includes only the lump sum pay item of estimated quantities and a standard plates chart for the specific project.

![Figure 4-39: Example of Itemized Lighting Quantities Plan Sheet](image-url)
4.2.3 **LIGHTING DETAIL SHEET**

This lighting detail sheet presents lighting units, light foundation, and the placement of lighting units in relation to the roadway (Figure 4-42). Detail sheets may include:

- Placement detail
- Underpass detail
- Lighting unit detail
- Foundation detail
- Median lighting detail

The detail sheets also have a legend. Note that a filled symbol on the legend indicates new equipment and a hollow symbol indicates in place, as presented on Figure 4-41.
Figure 4-42: Example Lighting Detail Sheet
Examples of Lighting Detail Sheets
The lighting detail below shows an example of how underpass luminaires are to be installed on bridges, including the location of conduits and junction boxes.

Figure 4-43: Example Lighting Detail Sheet Showing Underpass Luminaires
This lighting detail sheet presents the lighting unit and its required light foundation to be used on the specific lighting project.

Figure 4-44: Example Lighting Detail Sheet Showing Light Unit and Required Light Foundation
This lighting detail sheet details the base plate detail for bridge poles and median barrier poles with required specifications.

Figure 4-45: Example Lighting Detail Sheet Showing Base Plate Detail for Bridge Poles and Median Barrier Poles
4.2.5 LIGHTING PLAN SHEETS
The lighting plan sheets typically include:

- Legend
- Wiring diagram
- Lighting unit and foundations table
- Location of lighting units
- Source of power
- Service equipment note
- Equipment pad note
- Construction notes
- Scale
- North arrow
- Street names

If there is not room for the wiring diagram or lighting unit and foundation table they will go together on their own sheet.

A description of lighting plan sheet contents follows.

Figure 4-46: Example Lighting Plan Sheet
**Source of Power**
The SOP note gives information about the SOP provided by the local power utility, the lighting service cabinet, and equipment pad.

**Lighting Units and Foundations Table**
The lighting units and foundations table shows the foundation locations and lighting unit types on the plan.
Wiring Diagram
This part of the plan shows the wiring diagram (ladder diagram) for the lighting system. Note that every other luminaire is connected to the opposite leg to balance the electrical load.

Figure 4-49: Example Ladder Wiring Diagram
This lighting plan sheet details a bridge lighting layout, a wiring diagram, and feed point chart.

Figure 4-50: Example of Bridge Lighting Plan Sheet
4.2.2 UTILITIES SHEET

This is a plan sheet view of the public utilities within the project limits.

Figure 4-51: Example of Utilities Layout Sheet

4.3 Chapter 4 Resources

- Sample traffic control signal plan
- Sample lighting plan
- Signal Design Manual
- Lighting Design Manual