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DESIGN BULLETIN

Tips for Applying the Traffic Signal One-Line Diagrams
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Tips for Applying the Traffic Signal One-Line Diagrams

Several electrical utility companies and CDOT Regions are now requiring that traffic signal projects include electrical one-line diagrams. This requirement has caused delays in permitting and construction when an electrical engineer was not included in the design team. Previously, a contractor installed the electrical components without a one-line diagram as most contractors are aware of the electrical installation requirements for a traffic signal. Unfortunately, many electrical contractors are master electricians and do not have electrical engineers on staff to stamp one-line diagrams. This has resulted in the design team being required to include electrical engineers on traffic signal improvement projects.

Since most traffic signals have similar electrical power needs, CDOT has developed typical electrical one-line diagrams. The S-613-4 construction standards are intended to be applied at each intersection by the Engineer, for the specific power available at the site.

To utilize these electrical one-line diagrams, the Engineer is expected to identify which sheet in the standard is applicable for the project. The Engineer is also expected to identify the apparent power available at the intersection. And the length of the conductor between the power source and meter. The Engineer should follow the process listed below to identify these power requirements.

1. Work with the project utility coordinator to identify if the electric utility company utilizes hot or cold sequence meters (e.g., Xcel Energy requires cold sequence meters while Holy Cross Energy uses hot sequence meters).
    a. Cold sequence meter one-line diagrams are shown on S-613-4 sheets 1 to 3.
    b. Hot sequence meter one-line diagrams are shown on S-613-4 sheet 4 to 6.
2. Work with the project utility coordinator to identify the apparent power of the available power source (i.e., KVA of the transformer).
3. Identify the loads associated with the traffic signal. Note, most traffic signals will have a traffic cabinet, luminaires (i.e., streetlights), and cameras associated with them as shown on S-613-4 sheets 3 or 6. **At the completion of this step the Engineer will have identified which sheet in this standard is applicable for the specific project.**
4. Measure the distance of the conductors (i.e., electrical wiring) between the power source and meter. Note, the length of the conductor rising from underground and length of conductor running up a utility pole is included in this distance.
5. The Engineer will add a plan note next to each meter power pedestal on the traffic plan sheets identifying:
    a. What sheet in the S-613-4 standards are applicable for the intersection,
    b. The length of conductor,
    c. And which service lateral feeder size will be installed.

This identification could be identified if the Engineer inserted the identified fault current table into the applicable traffic plan sheet and highlighting the appropriate “New-MPP_” row.

For example, a new traffic signal improvement project in Grand Junction is within Xcel Energy’s territory.

1) Xcel Energy allows cold sequence metering so S-613-4 sheets 1 to 3 are applicable for the project.
2) The power will come from a 25kVA pole mounted transformer.
3) The traffic signal will include a traffic cabinet and luminaires. No additional cameras are anticipated; S-613-4 sheet 2 should be referenced.
4) The length of conduit to be installed between the transformer and meter power pedestal is 25-feet. The Engineer should also include a 4-foot rise where the conduit enters and exits the ground, and approximately 30-foot rise on the utility pole. The total conductor distance would be 63-feet.
5) On sheet 2 of the S-613-4 standard the Engineer should identify that row 1 of the “Individual Cold Sequence MPP Fault Current Table for Traffic Signal with Luminaires” will be utilized for the project.
    a. This row meets the cold sequence requirements, the transformer KVA, and the conductor distance is within the minimum and maximum range listed.

    While the following two rows for a 25kVA transformer could be selected, the conductor size on these rows is larger than needed. The larger conductors allow the meter power pedestal to be located further from the power source, when necessary. The larger conductor sizes are intended to be used if the previous maximum conductor distance has been exceeded or may be exceeded.

    Please note, conductor sizes and the power source size increase as you read down the table. A #1 copper conductor is smaller than a 1/0 copper conductor. Also, *(3#1 XHHW CU) 2” PVC* indicates that three (3) #1 AWG XHHW copper conductors will be installed in a 2-inch schedule 80 PVC conduit.

If an electrical engineer is part of the design, then the Electrical Engineer should be responsible for identifying which one-line diagram and fault current table should be utilized, or they should provide a project specific one-line diagram.

In a small number of instances, traffic signals may include loads or have electrical infrastructure that does not align with the parameters listed in S-613-4. In these unique applications an Electrical Engineer must provide a project specific one-line diagram.

If you have any questions, please contact Esayas Butta, Traffic Standards and Specification Engineer at esayas.butta@state.co.us.