**Northeast Region**

**Traffic Signals and Street Lighting Installation Checklist**

|  |  |
| --- | --- |
| **Date:** | Click to enter date. |
| **Project ID:** |  | **Project Location:** |  |
| **County:** |  | **Inspector:**  |  |
| **Signalized Intersection(s):**  |  |

**IMPORTANT General Pre-construction:**

[ ]  If you have any questions on construction methods for traffic signals and street lighting, call the **Electrical Field Unit at (920) 492-5654.**

[ ]  **Prior to any signal being flashed or turned-on the following must be completed:**

* 1. All signal equipment including loop detectors must be installed and fully operational
	2. All permanent signing including signal ahead signs, folding stops, etc. must be installed
	3. All permanent pavement marking must be installed.

[ ]  **The placement of loop detectors, signal bases and pedestrian push buttons is critical to the efficient operation of a signal.** In the case of all State Owned Signals, if for any reason, they cannot be placed where shown on the plans call the **Signal Operations Engineer at (920) 360-4749** to discuss moving them. In addition, the Signal Operations Engineer and Electrical Staff are willing to take the time to verify loop and signal equipment placement. Check the notes on the electrical detail sheets in the plans. Please call them to make arrangements.

[ ]  In addition, in the case of **all State Owned Signals**, if any of the loop detectors are to be placed different from the location shown on the plan, the Project Engineer shall notify the **Signal Operations Engineer at (920) 360-4749** and provide the revised signal plan. Prior approval is required before detectors are relocated. This information is needed to accurately develop the new timing for the signal.

[ ]  Furthermore, in the case of **all State Owned Signals**, it is extremely important that upon completion of the signal that the Project Engineer provides the Signal Operations Unit with **revised “as-built” of the signal plan sheets.** This information needs to be kept current for Digger’s Hotline.

[ ]  The **Project Engineer** (not the contractor) shall provide the **Signal Operations Engineer (920) 360-4749** with **three (3) working days**’ notice prior to the time of the requested inspection for both temporary signals and permanent signals and for the turn-on of signals. There shall be no inspections or turn-ons on weekends or holidays.

[ ]  Are all materials delivered to the job site, in accordance with the specifications and Electrical Qualified Products List (QPL)?

[ ]  If there is a question about a procedure or technique, was it clarified before acceptance for use?

[ ]  Are there any time-of-day restrictions for traffic signal turn offs, turn ons, traffic control, lane closures, etc.?

**UNDERGROUND**

## **Concrete Bases:**

[ ]  Are all concrete bases of a proper depth, width and height according to the standard detail drawing?

[ ]  Are all concrete bases level?

[ ]  Are all concrete bases **trowelled smooth** and there are no visible holes in the sides or top? (NO BROOM FINISH)

[ ]  Are all concrete bases void of cracks or damage?

[ ]  Are all conduits installed in each base as called for on the Standard Detail Drawing (S.D.D.) or plan details? (Correct number and size)

[ ]  Are concrete base anchor rods of proper length and diameter?

[ ]  Are concrete base anchor rods level and aligned to allow proper aim of mast arm following pole installation?

[ ]  Are concrete base anchor rods at the proper height above the base?

[ ]  Are conduits and end bells installed according to the S.D.D.’s?

## **Cabinet Base:**

[ ]  Is there caulk around the bottom of the control cabinet?

[ ]  Is the concrete cabinet base of a proper depth, width and height, and have plumb/vertical sides for mounting the meter pedestal according to the standard detail, or plan detail drawing?

[ ]  Is the concrete cabinet base level?

[ ]  Is the concrete cabinet base void of cracks or damage?

[ ]  Are all conduits installed in the base as called for on the Standard Detail Drawing (S.D.D.) or plan details? (Correct number and size)

**Conduit - General:** is used to provide a secure electrical raceway.

[ ]  Is underground conduit PVC of a schedule 40 or heavier, or rigid metallic conduit?

[ ]  Are the proper tools being used to bend conduit? For PVC: Hot Box, Heating Blanket – NO TORCHES.

[ ]  Is a pull wire/locate wire installed in all empty conduit? Is the pull wire/locate wire doubled back 2’ at each end of the conduit run?

[ ]  Before the trench is backfilled, was the conduit and its couplings inspected for damage or improper installation?

[ ]  If conduit is attached to a structure, is it secure? Are expansion joints installed as plans show?

[ ]  Is a conduit run the same size pipe from one pull box or junction box to another?

[ ]  Is the “location” arrow cut into the pavement or top of curb at the exact spot of the conduit crossing?

**PVC Conduit:** “Schedule 40” PVC is used to place a raceway under or in pavement. Schedule 80 PVC is required for any conduit above grade and is used in locations where damage to a raceway could easily take place (such as by lawnmowers).

[ ]  Is PVC rated “Schedule 40” or “Schedule 80” electrical conduit, and have the U.L. Label imprinted on the conduit?

[ ]  Are PVC conduit and end bells installed in accordance with contract requirements?

[ ]  Are PVC conduit and end bells installed before any wire installation in the conduit?

[ ]  Are PVC conduits installed properly and protected where heavy equipment could damage them?

[ ]  Was PVC conduit checked after pavement or protective cover was installed to be sure the conduit wasn’t damaged?

[ ]  Are bushings, plugs or caps installed on all conduits (in pull boxes, traffic signal bases, street lighting bases, etc.)?

[ ]  Are couplings properly installed?

[ ]  Are radius curves bent with proper diameters?

[ ]  All 3” conduit runs from pullbox to pullbox should be free of bends, unless pre-approved by Electrical Staff.

[ ]  Are the proper tools being used to bend conduit? For PVC: Hot Box, Heating Blanket – NO TORCHES.

[ ]  Are expansion fittings used at expansion joints and installed properly?

[ ]  Are PVC joints and fittings primed and properly glued?

**Rigid Metallic Conduit:**

[ ]  Are bushings installed on all rigid metallic conduit?

[ ]  Are bushings installed before wire is installed in rigid metallic conduit?

[ ]  Does rigid metallic conduit have the U. L. Label imprinted on the conduit?

[ ]  Are conduit ends square cut, threaded properly, reamed, and cold galvanized properly?

[ ]  Are bends made far enough from couplings so that threaded ends won’t fracture?

## **Conduit Depths and Placements:**

[ ]  Does the conduit extend 24” beyond the edge of the pavement?

[ ]  Is trench burial of conduit at proper depth?

[ ]  Minimum depth of 24” below the traveled way?

[ ]  Minimum depth of 18” when not below the traveled way?

[ ]  Maximum of 36” below finished grade?

**Pull Boxes:** when used with underground conduit, are short lengths of corrugated metal pipe with cast iron rings and covers or non-conductive with non-conductive rings and covers. When junction boxes are installed on structures, they are generally galvanized metal boxes with accessible covers.

[ ]  When installing a pull box on a gravel shoulder area,; is it 2” to 4” (max. 6”) below the surface?

[ ]  Do pull boxes located in top-soiled areas match the grade, not below or above the grade?

[ ]  Is there proper drainage of the pull boxes?

[ ]  Does the pull box require that a drain be installed?

[ ]  Do the pull boxes have the required amount of stone in the bottoms?

**Pull Boxes (cont.):**

[ ]  Are the holes cut into pull boxes made with a circular hole saw or hydraulic conduit punch and ¼” larger than the conduit size (o.d), not allowing dirt to wash into the box?

[ ]  There should be no extra or unused holes in the pull boxes.

[ ]  Are the pull boxes that are installed on structures, placed in an accessible location?

[ ]  Do conduits extend into the pull boxes 3” maximum, as required?

[ ]  Are the metallic pull boxes bonded to a nearby signal/lighting base?

**Loop Detectors - General:**

[ ]  Loop wires cannot be handled too carefully. Damaged insulation can show a resistance to ground and should be rejected. If resistance does not read > 500 mega-ohms, loop is not acceptable.

[ ]  Electrical Contractor shall provide the field inspection staff a measurement of the loop inductance, ground resistance, and loop wire resistance at the pull box end of loop wire.

**Loop Detectors:**

[ ]  Has the proper type of loop been installed as specified in the S.D.D.’s or plan details?

[ ]  Is the loop wire the type that is specified?

[ ]  Has the new loop wire including the insulation jacket, been damaged in any way? If so, it shall be rejected. Do not use the damaged wire!

[ ]  Have pull boxes in the roadway been installed properly?

[ ]  Are adjacent loop sides or corners appropriately spaced according to the plan?

[ ]  Is there the proper number of turns of wire placed in the conduit? (Number of turns are called for on the plans).

[ ]  Does the “T” conduit access fitting have a cast iron cover installed?

[ ]  Are joints in PVC conduit properly glued?

[ ]  If any loops in conduit are buried in the base course, is the conduit protected from traffic to prevent crushing and subsequent damage before paving?

[ ]  Is there slack in the loop wires to allow for expansion/contraction?

[ ]  Are PVC conduits anchored to prevent possible “floating” when placed on top of a surface that is to be paved?

[ ]  After installation of the PVC but before paving, are the pipes being protected from damage by machinery?

[ ]  Are bolt threads covered with an anti-seize compound before fastening the junction box cover down tight?

[ ]  Allow 2 feet of detector lead-in and twisted pair to extend two (2) feet above pull box.

[ ]  Before the splice is made, and after the loop sealant has been placed, was the loop tested for ground resistance?

[ ]  Does loop ground resistance > 500 mega-ohms after installation? If not, remove and replace.

[ ]  Are wires spliced with crimped butt connector and soldered at the splice?

[ ]  Are splice kits of an approved epoxy type?

[ ]  Are spliced wires insulated from each other in the splice kits?

[ ]  Are the ends of the splice kit taped or blocked so that sealant doesn’t run out?

[ ]  Is the sealant in the splice kit poured into the low side to force out all air during the kit filling operation?

[ ]  Are loop lead wires identified in relation to loops they are tied to?

[ ]  Don’t forget the “as built” loop layout.

[ ]  Refer to the Loop Special Detail Sheets or Loop Standard Detail Drawings (S.D.D.) for instruction in the installation of loops.

**Cable and Wire - General:**

[ ]  All types of wire must be handled with care to protect insulation. Is this being done, or is the wire being handled improperly? (Twisted, dragged across pavement or gravel, kinked or strained when pulling).

[ ]  All end bells shall be installed before pulling wire or cable.

[ ]  Is the specified underground multi-conductor cable used?

[ ]  Is a length of multi-conductor cable and/or wire left in the signal bases for splicing purposes?

[ ]  Is the signal head neutral conductor at least 12” longer than the others?

[ ]  Are the wires that are spliced in the signal base of a proper color to the signal head as specified on the plans?

**Branch Circuits (Field Wiring):**

[ ]  Is the wiring on light poles done in the breakaway base, if provided, and not the hand hole?

[ ]  Do wire nuts meet the specifications?

[ ]  After installation, is the top of the wire nut pointing up so the wire nut does not fill with water?

[ ]  Are the furnished circuit breakers rated according to specifications?

**ABOVEGROUND**

**Poles and Standards:**

[ ]  Are the shims used for leveling under all four corners of the cast base? (If so, restart leveling. At most, three corners need to be used). If four corners of shimming would be needed, a base in that condition should not have been accepted as properly poured.

[ ]  Are the mounting nuts tight and leveling shims firmly in place after mounting poles?

[ ]  If a breakaway base is used under the mast arm pole, is it mounted level before the pole is set?

[ ]  Is the pole, which holds the mast arm, of a proper length and type?

[ ]  Is the mast arm of a proper length?

[ ]  Is the pole holding the mast arm, plumb?

[ ]  Is the signal standard plumb on the concrete base?

[ ]  Are the standards screwed into the base tight enough so they will not loosen? (Check prior to any sign installations).

[ ]  Are the pole and signal standard caps (top only) installed with rubber washer to keep water and snow out?

[ ]  Are any poles\standards installed too close to high voltage wires? 10’ is the starting point. Required clearance increases as line voltage increases. Check with Traffic Unit.

**Signal Heads:** an assembly of one or more signal faces.

[ ]  Are all signal heads aimed properly?

[ ]  Is the overhead mast arm aimed for the most effective line of sight for motorists?

[ ]  Are heads mounted in a plumb or level manner as required?

[ ]  Are signal and walk light heads mounted with proper clearance above ground level?

[ ]  Are overhead signals mounted at the proper height?

[ ]  Are pedestrian push buttons mounted in the proper location?

[ ]  Are the proper stainless steel washers installed on the arms and brackets?

[ ]  Do all signal heads have a backplate installed according to the miscellaneous quantities and specifications?

[ ]  Is the signal head lens configuration arranged in accordance with plan details and the Manual of Traffic Control Devices? (See “figure 4-1” of the MUTCD & the Wisconsin Supplement to the MUTCD). If you are not sure, ask your District Traffic Engineer.

[ ]  Are the signal head lenses oriented properly? There is an orientation mark on the lens.

**Cable and Wire:**

[ ]  At points where wires exit from standards to enter a side mounted head, is a grommet or bushing provided to protect the wires?

[ ]  Is a bushing or grommet installed in poles where the hole for wire leads into the mast arm?

[ ]  Are wires free to move from the standard or pole, into the side mounting bracket or mast arm after installation, or are they pinched?

# **General – Post-construction:**

[ ]  Are all pipe and bolt threads coated with a heavy coating of an approved anti-seize agent as specified on the Approved Electrical Materials List?

[ ]  If unsuitable fill material is encountered, has it been removed and replaced with acceptable material?

[ ]  Has proper compaction of fill material been accomplished?

[ ]  Has a revised “as-built” of the signal plan sheets been given to Signal Operations Unit?

[ ]  Is painted equipment free from scratches or damage?

[ ]  Are all appropriate signs in place? (Folding stop signs, signal ahead signs, yield signs, etc.)

[ ]  Are all pedestrian push buttons in place with signs which are incidental to the push button?

[ ]  Has all clean up and all site restoration been completed?

[ ]  Has e-mat been cut away from pull box covers?

**LIGHTING**

**General - Pre-construction:** System Lighting means lighting fed from its own cabinet, whether on the freeway or at another location, such as an arterial, roundabout or a park-ride. The light poles connected to a traffic signal cabinet are considered part of the traffic signal system.

[ ]  Follow the checklist for the installation of traffic signal bases, wiring, etc. for the lighting installation. (The exceptions are listed below).

**Voltage Systems:**  The distribution voltage is shown on the plans

[ ]  Are the proper poles being installed?

[ ]  Is the proper method of wiring being used per the S.D.D. and the plan details?

[ ]  Is the proper fuse size and type being installed?

[ ]  Are the fuse holders properly installed?

**Lighting Cabinet Bases:**

[ ]  Are there the appropriate number of conduits installed, as shown in the plan?

**Light Pole Bases:** Lighting plans and quantities may show different bolt patterns and/or different bolt projections on the same project, depending on the location.

[ ]  Is the aim of the luminaire proper? Is the arm square to the bolt pattern?

**Luminaires:**

[ ]  Are the luminaire wattages/LED categories correct?

[ ]  Are the luminaires leveled properly?

[ ]  Are the luminaire arms aimed properly?

**Branch Circuits (Field Wiring):** New systems use the “Isolated Neutral System” which means that the metal parts are bonded to the Equipment Grounding Conductor (the green wire) and never to the Grounded Circuit Conductor (the white wire, commonly called the “neutral”).

[ ]  Are the appropriate wires being used to ground the lighting circuit?

[ ]  Are all wires insulated? (Never allow a bare wire to be pulled through a conduit with the circuit wires. It can only be stripped bare inside the cabinet or pull box).

[ ]  Are all legs of a splice coded properly (with colored tape) or colored insulation jacket?

[ ]  Are wires bundled and tagged?

**Pull Boxes and Junction Boxes:**

[ ]  Are all metallic pull boxes, metallic rings and covers, and metallic junction boxes bonded?

[ ]  Is the junction box gasket in place before bolting the cover to the box?

**General - Post-construction:**

[ ]  Has the lighting passed its Burn-in Test? (See Standard Specification 651.3)

[ ]  Have all light pole and cabinet identification plaques been installed per plan requirements?