*INCLUDE SECTION 636 AS NEEDED BASED ON CLAUSE INSTRUCTIONS*

$$636.00A

**Section 636. — TRAFFIC SIGNAL, TRAFFIC COUNTER, LIGHTING, AND ELECTRICAL SYSTEMS**

Revised 25 May 2022

*INCLUDE CLAUSE $$636.04A WHEN INSTALLING PULL BOXES FOR TRAFFIC COUNTERS. (IF USED, ALSO INCLUDE CLAUSES $$636.05B, $$636.08B, AND $$721.01A)*

$$636.04A

636.04. Add the following:

Fabricate pull boxes with fiberglass reinforced polymer concrete or precast concrete.

*INCLUDE CLAUSE $636.05A FOR REPLACEMENT/REPAIR OF TRAFFIC COUNTERS*

$$636.05A

636.05. Delete the first sentence of the third paragraph and substitute the following:

Remove and replace all existing conduit at the replacement sites. Ground conduits, junction boxes, and metal poles by using grounding brushes on the conduit ends.

*INCLUDE CLAUSE $636.05B IF CLAUSE $$636.04A IS USED*

$$636.05B

636.05. Delete the fourth paragraph and substitute the following:

Size pull boxes according to the National Electric Code (NEC) to accommodate the necessary wires and conduit for proper splicing of loop wires.

*INCLUDE CLAUSE $$636.05C WHEN REQUIRING BORING UNDER THE ROADWAY*

$$636.05C

636.05. Add the following:

When boring under the roadway to install conduits and lead-in cables, conform to the requirements of the *(insert State and State Specification Reference),* found at *(insert link to the* ***website*** *containing the State Specification Reference* ***not a direct link to the spec reference****)* subject to the approval of the CO.

*INCLUDE CLAUSE $$636.07A IF THE GOVERNMENT WILL PROVIDE THE TRAFFIC COUNTERS TO THE CONTRACTOR – VERIFY WITH PARTNER AGENCY*

$$636.07A

636.07. Add the following after the first paragraph:

The Government will furnish the traffic counter at no cost to the Contractor. Coordinate with the CO to request delivery of a traffic counter for each traffic count station shown in the plans. Begin coordination between 21 and 28 days before traffic count station work is to begin.

*INCLUDE CLAUSE $$636.07B IF THE GOVERNMENT WILL PROVIDE THE MODEMS FOR THE TRAFFIC COUNTERS TO THE CONTRACTOR – VERIFY WITH PARTNER AGENCY*

$$636.07B

The Government will furnish the modem at no cost to the Contractor. Coordinate with the CO to request delivery of a modem for each traffic count station shown in the plans. Begin coordination between 21 and 28 days before traffic count station work is to begin.

*INCLUDE CLAUSE $$636.07C WHEN A FAN AND THERMOSTAT ARE REQUIRED FOR THE NEW CABINET – VERIFY WITH PARTNER AGENCY IF A FAN IS NEEDED (IF USED, ALSO INCLUDE CLAUSE $$721.01F)*

$$636.07C

636.07. Add the following after the second paragraph:

Mount a fan inside the cabinet and position to direct the majority of airflow over the traffic counter and modem. Mount a fan thermostat at the top of the cabinet and minimize its interference with other cabinet components.

*INCLUDE CLAUSE $$636.07D FOR CABINET GROUNDING*

$$636.07D

For pole-mounted cabinets, install ⅝-inch diameter, 8-foot long, copper-clad steel ground rod or 14-inch squared, ground plate before pouring the concrete foundation. Connect the ground rod or plate to the cabinet ground busbar and cover with 6 inches of approved backfill. Drill hole in pole and back of cabinet to provide wire access. Run ground conductor out of cabinet and seal holes as approved by the CO.

*INCLUDE CLAUSE $$636.07E WHEN A SOLAR PANEL IS REQUIRED FOR THE TRAFFIC COUNTER – VERIFY WITH PARTNER AGENCY IF A SOLAR PANEL IS NEEDED*

$$636.07E

Furnish a 20-watt minimum solar panel capable of producing at least 36 watt-hours per day and a 12-volt, C100 36-ampere-hour, minimum gel type battery capable of powering the cabinet electrical components for a minimum of 25 days.

For new traffic counter installations that will utilize a fan in the cabinet, or located under tree coverage or in the low sun zones (northeast and pacific northwest), verify that the panel size will produce enough power for all cabinet components and increase the size of the solar panel as directed by the CO. Ensure the solar panel size does not exceed 750 square inches.

Frame the solar panel with bronze anodized extruded aluminum. Mount a weatherproof connection on the back of the solar panel to connect the output cable to the solar panel cable. Ensure all cell modules have been approved by Factory Mutual Research (FM Approvals LLC) for application in NEC Class 1, Division 2, Group D hazardous location.

*INCLUDE CLAUSE $$636.08A FOR PROJECTS WITH TRAFFIC COUNTERS, WHETHER ONLY TRAFFIC LOOPS ARE BEING REPLACED/REPAIRED, OR A FULL TRAFFIC COUNTER SYSTEM IS BEING INSTALLED (IF USED, ALSO INCLUDE CLAUSE $$636.08B AND APPLICABLE SECTION 721 CLAUSES)*

$$636.08A

636.08. Delete the second and third paragraphs, and substitute the following:

Wet cut clean, smooth, well-defined, ⅜-inch wide saw cuts at a depth to allow 2 to 2½ inches of cover without damaging the adjacent pavement. Drill 1½-inch diameter loop corners matching the saw cut depth. For the lead-in channel, saw clean, smooth, well-defined, ⅝-inch wide cuts providing a minimum cover of 2 inches. Ensure saw cuts are straight with less than ½-inch error in a 10-foot line. Saw cut the lead-in to the pull box as close as possible to the edge of pavement. Thoroughly clean the saw cut of foreign material with compressed air or water blasting. Dry the joint with compressed air.

Install the loop wire in one continuous length at the bottom of the cut using a 3/16- to ¼-inch thick rounded, smooth wood paddle. Install without kinks, curls, or other damage to the wire or its insulation. Replace damaged wires. Hold the loop wire in place with 1-inch lengths of ½-inch backer road spaced at 2-foot intervals.

For the number of loop wire turns, conform to Table 636-1.

|  |
| --- |
| **Table 636-1** |
| **Required Number of Loop Wire Turns** |
| **Lead-in Length, feet** | **Number of Turns** |
| ≤ 200 | 3 |
| >200 to 500 | 4 |
| >500 | 5 |

*INCLUDE CLAUSE $$636.08B WHEN CLAUSES $$636.04A AND $$636.08A ARE USED*

$$636.08B

636.08. Delete the fifth and sixth paragraphs, and substitute the following:

Twist the loop lead-in wires 6 turns per foot from the loop to the pull box. Do not twist different loop pairs together. Color code the wires of each loop using colored vinyl electrical tape for identification of separate loops inside each pull box as shown in Table 636-2. Coil 18 inches of lead-in slack in the pull box for each loop.

|  |  |
| --- | --- |
| **Table 636-2** |  |
| **Loop Labeling Convention** |  |
| **Loop** | **Number of Identifiers** | **Color** |
| 1 | 1 | Red |
| 2 | 1 | White |
| 3 | 1 | Green |
| 4 | 1 | Blue |
| 5 | 2 | Red |
| 6 | 2 | White |
| 7 | 2 | Green |
| 8 | 2 | Blue |

*INCLUDE CLAUSE $$636.08C FOR WIRING REQUIREMENTS WITHIN THE NEW CABINET; TYPICALLY, WHEN A FULL TRAFFIC COUNTER SYSTEM IS INSTALLED*

$$636.08C

Select wire insulation color within the RS-232 cables directing the traffic counter to read a specific loop, based on the color assignments shown in Table 636-3. This arrangement will allow up to eight loops to be connected to the traffic counter. At the terminal block, one RS-232 cable can connect up to four loops to the traffic counter. Provide two RS-232 cables if more than four lanes are counted. Connect cable 1 to loops 1 to 4 and cable 2 to loops 5 to 8.

|  |
| --- |
| **Table 636-3****Loop Assignments for RS-232 Cables** |
| **RS-232 Cable** | **Loop** | **Color** |
| 1 | 1 | Red |
| 1 | 2 | White |
| 1 | 3 | Green |
| 1 | 4 | Blue |
| 1 | Ground | Light green |
| 2 | 5 | Red |
| 2 | 6 | White |
| 2 | 7 | Green |
| 2 | 8 | Blue |
| 2 | Ground | Light green |

*INCLUDE CLAUSE $$636.08D FOR TRAFFIC LOOPS TESTING FOR CONTINUITY AND RESISTANCE (SEE INSTRUCTIONS FOR CLAUSE $$636.09B). IF CLAUSE $$636.08D IS USED, ALSO INCLUDE:*

* *CLAUSE $$636.09A FOR PROJECTS WITH WIRE LOOPS REPLACEMENTS/REPAIRS ONLY; OR*
* *CLAUSES $$636.09A AND $$ 636.09B FOR PROJECTS WITH FULL TRAFFIC COUNTER SYSTEM INSTALLATION*

$$636.08D

Before applying sealant, test the loop and lead-in for continuity and resistance by applying a 1000-volt megohmmeter between each end of the loop lead-in and the nearest reliable electrical ground. If no available ground exists, establish a ground for the measurement. Record the location and megohmmeter readings and submit readings and test equipment data to the CO. Replace the loop if:

* The insulation resistance measured to earth ground is less than 100 megohms at 500 volts DC;
* The inductance is less than 50 microhenries or more than 800 microhenries;
* Wire resistance is less than 1.75 ohms per 700 feet; or
* The loop quality (Q) factor is less than 5 at 50 kilohertz.

Ensure installed inductive loops have dedicated saw cuts and separate PVC conduits for each sensor lead-in cable from the edge of pavement to the first pull box.

*INCLUDE CLAUSE $$636.09A FOR TRAFFIC LOOPS VERIFICATION TESTING (SEE INSTRUCTIONS FOR CLAUSES $$636.08D AND $$636.09B)*

$$636.09A

636.09. Delete the third paragraph and substitute the following:

Conduct an on-site verification test according to ASTM E2300, Type I-2 with a 10 percent tolerance with the following exceptions:

* The test should allow for 15 minutes and a minimum of 50 vehicles of counting with two human observers for each loop tested; and
* Test vehicles may be used if the test would likely last longer than 30 minutes to reach the 50-vehicle threshold.

Conduct the test at a date and time agreed to by the CO.

*INCLUDE CLAUSE $$636.09B FOR TRAFFIC DETECTOR’S FULL SCALE OPERATION DEMONSTRATION TEST; TYPICALLY, WHEN A FULL TRAFFIC COUNTER SYSTEM IS INSTALLED (SEE INSTRUCTIONS FOR CLAUSE $$636.08D)*

*FOR PROJECTS WITH WIRE LOOPS REPLACEMENTS/REPAIRS ONLY, DO NOT INCLUDE CLAUSE $$636.09B (CLAUSES $$636.08D AND $$636.09A ARE SUFFICIENT FOR WIRE LOOPS TESTING)*

$$636.09B

After completing traffic counter system construction, conduct a full-scale operation demonstration test for a 30-day period to assess the adequacy of the installation and operation of the equipment. Correct any defects and make any adjustments deemed necessary by the CO during the 30-day demonstration period. If failures occur during the demonstration period, make necessary repairs within 48 hours of being notified. Stop the demonstration period if repairs are not completed within 72 hours of notification and resume only after such repairs and replacement of materials have been made, inspected, and approved. Repair or replace any material and equipment that becomes defective, lost, or damaged during the demonstration period. If the equipment does not operate according to the specifications or manufacturer’s recommendations during the demonstration period, the CO has the option of returning the equipment at the Contractor’s cost.

*INCLUDE CLAUSE $$636.10A IF EITHER CLAUSE $$636.10B OR $$636.10C IS USED*

$$636.10A

636.10. Add the following:

*INCLUDE CLAUSE $$636.10B WHEN THE CONTRACTOR WILL BE INSTALLING NEW CABINET FOR TRAFFIC COUNTERS - IF THE NEW CABINET WILL BE INSTALLED BY OTHERS AFTER THE PROJECT IS COMPLETED, USE CLAUSE $$636.10C INSTEAD (VERIFY WITH PARTNER AGENCY IF THE CABINET WILL BE CONSTRUCTED BY THE CONTRACTOR OR OTHERS)*

$$636.10B

Within each cabinet, store one laminated copy of the cabinet wiring diagram and the field wiring diagram showing loops, pull boxes, and conduit runs inside two one-gallon re-sealable storage bags, one inside the other. Provide an electronic copy of each document to the CO.

*INCLUDE CLAUSE $$636.10C IF THE NEW CABINET WILL BE INSTALLED BY OTHERS AFTER THE PROJECT IS COMPLETED (IF THIS CLAUSE IS USED, DO NOT INCLUDE CLAUSE $$636.10B)*

$$636.10C

In addition to the as-built drawings required by Subsection 104.03(c), provide the following to the CO:

* Field wiring diagram showing loops, pull boxes, and conduit runs inside two one-gallon re-sealable storage bags, one inside the other; and
* An electronic copy of each document.