Sample Project Special: 614tlpatr

4/26/2011

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REVISION OF SECTION 614

TRAFFIC LOOPS AND PIEZOS AT AUTOMATED

TRAFFIC RECORDER (ATR) SITES

Section 614 of the Standard Specifications is hereby revised for this project to include the following:

**DESCRIPTION**

This work consists of the removal and replacement of loop detector wires, or loops and piezoelectric axle sensors (piezo) for the Automatic Traffic Recorder (ATR), where the loops, piezos or both have been removed within a project site. Work shall be in accordance with this specification and as shown on the plans.

**MATERIALS**

Loop detector wire shall consist of specified loop wire encased in ¼ inch OD, 3/16 inch ID vinyl or polyethylene tubing. (14-1/C Loop detector cable 19 STR. PVC/Nylon/PVC Tube 600v IMSA 51-5)

Loops shall be sealed with a two-part self-curing, self-bonding weatherproof epoxy approved for sealing loops. Loops shall be 6 feet by 6 feet.

The piezo shall be class II and 6 feet in length. The piezo shall have sufficient lead in cable, so the lead in cable can be pulled in to the cabinet without splicing.

Grout or epoxy for the installation of the loops and piezos shall conform to manufacturer’s recommendations.

Pull boxes shall be in accordance with Section 613.

**CONSTRUCTION**

1. *General.* A minimum of five days prior to installation, the contractor shall submit a schedule of installation activities including alternative scheduling to the CDOT Project Manager and the Traffic Data Collection (TDC) Manager (Mike DelCupp 303-757-9816 robert.delcupp@dot.state.co.us). The installation instructions from the manufacturer shall also be submitted for approval. Installation of loops and piezos shall not begin until approval has been received from the Engineer.

The Contractor shall install the loops and piezos as close to the locations shown on the plans as possible. Exact locations, dimensions, and configurations may vary based on site conditions, and shall be as approved by the Engineer.

All work will be inspected by the Traffic Data Collection Unit (TDC) during installation. Acceptance will be based on the testing and operation of the piezos and loops under actual traffic conditions, in which one week of actual data will be collected. The volume and vehicle class shall be within ±10 percent for the site compared to historical data for the same time period. There shall be no more than 1 percent sensor misses in any one lane for the same time period.

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1. *Installation of loops.* Loops shall be centered in the travel lane with two sides parallel to lane striping.

The saw cut for the loops shall be made 3/8 inch wide and 3-½ inches deep. The saw slot shall be as straight as possible and shall not vary more than ½ inch when checked with a straightedge. No more than one set of loop lead wires shall be placed in one saw slot. Saw cuts shall be hydro-blasted with a mixture of water and air and then blown free of water and debris with compressed air, using a large capacity air compressor of at least 150 CFM. The cuts shall be dry prior to placement of loop wire.

1. The contractor shall locate all buried utilities, which may interfere with the planned location of the ATR site. The Contractor shall contact the Utility Notification Center of Colorado (UNCC) at 811 or 1-800-922-1987 for location of member utilities at least three working days prior to any excavation, not including the day of actual notice.

The Contractor shall also locate non-member utilities, such as storm sewer and ditch. Any utility conflicts encountered with the proposed installation shall be brought to the attention of the Engineer

After the saw slot is cleaned of debris and dried, the wire shall be placed for the loop by pushing it into the slot with a blunt non-metallic object. A screwdriver or other sharp tool will not be permitted. Care shall be used to avoid abrading or damaging the insulation.

All loop corners shall be rounded using a 1-½ inch hole drilled to a minimum depth of 3-½ inches. Loop leads shall be drilled when leaving the roadway surface at a 45 degree angle 8 inches from pavement edge out through the side or bottom of roadway, the drilled hole shall be no larger than ¾ of an inch. All holes shall be spaced a minimum of three inches from one another. No more than one set of loop lead wires shall be placed in one drill hole.

One continuous length of loop wire shall be used for each loop from pull box or cabinet around the loop with 4 turns and back to the pull box or cabinet with no splices. The wires shall be seated in the bottom of the saw slot. A ½-inch backer-rod shall be installed to insure wires do not float to the surface during grouting. Backer-rod shall be installed in 4 to 6 inch pieces with 1 to 2 foot gaps in-between, to insure the sealant will come in contact with the loop wire. One continuous piece of backer-rod will not be allowed.

Prior to sealing the loop, loop lead and feeder slots, a loop continuity test will be performed. The test will be performed by the TDC representative. Loop continuity shall be no higher than 1 ohm. Loop continuity higher than 1 ohm shall be cause for replacement of the loop. Replacement shall be at the Contractor’s expense.

After the loops are properly seated and tested, the slots shall be filled with a two-part self-curing, self-bonding epoxy or grout, as recommended by the manufacturer. Excess epoxy shall be removed to avoid unnecessary high spots, and level with the roadway surface.

Loop leads shall be pulled into cabinet without splices to match original installation when applicable.

All detector loops shall measure six feet by six feet.

Installation at an ATR count or classification site shall consist of one loop or one loop set (two loops) within a single lane. The loop sets shall be separated by 10 feet, plus or minus 1 inch, resulting in a distance of sixteen feet from the leading edge of the first loop in the direction of travel to the leading edge of the second loop.

Loop and loop leads shall be installed directly into the pavement, to pavement edge, pull box or cabinet. If loops are installed during asphalt paving, the loops shall be installed before the final lift is placed.

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Loop lead wires from pavement edge to pull box shall be enclosed in ¾ inch PVC conduit or ¾ inch rubber hose to protect wire from abrasion. Loop lead-in pairs from pavement edge, to pull box, shall be symmetrically twisted 5 turns per 1 foot. Pull boxes or cabinet shall contain a minimum of 3 feet of loop lead wire for splicing. All loop and loop leads shall be clearly labeled in all pull boxes and or cabinet. The Contractor shall be responsible for all trenching and digging from pavement edge to pull box.

All splices shall be made with approved waterproof pressure connector. All splices shall be capable of satisfactory operation under continuous submersion in water.

1. *Piezo Installation*

The piezo shall be permanently installed by grouting into the roadway, flush to 1/16 of an inch above the roadway surface by grouting into a concrete roadway or the final lift of asphalt.

Piezo sensors shall be installed in compliance with the manufacturer’s recommendations.

The piezo shall be tested for capacitance and dissipation factor, prior to and after installation using a LCR meter. Capacitance and dissipation shall be within ±20 percent of the data sheet supplied with the piezo.

Prior to acceptance of the site, the TDC will test the piezo for voltage and signal quality with live traffic. Voltage shall be no lower than 80 millivolts on the front axle of a class II vehicle (car).

At an ATR axle classification site, one 6 foot piezo sensor per lane shall be installed at the exact midpoint between the two loops and to the right or left side of the line, centered in the wheel path.

The saw cut shall be as straight as possible and shall not vary more than ½ inch when checked with a straightedge. The size of the saw cut shall be to the manufacturer’s specifications and not vary more then 1/8 of an inch in width. The slot for the piezo lead wire shall be 3 inches deep and 3/8 of an inch wide. Only one piezo lead wire shall be placed in the saw slot.

Piezo lead shall be drilled when leaving the roadway surface at a 45 degree angle 8 inches from the pavement edge out through the side or bottom of the roadway, the drilled hole shall be no larger than ¾ of an inch. All holes shall be spaced a minimum of 3 inches from one another. No more than one piezo lead wires shall be placed in one drill hole.

Saw cuts shall be hydro-blasted with a mixture of water and air and then blown free of water and debris with compressed air, using a large capacity air compressor of at least 150 cubic feet per minute. The cuts shall be dry and cleaned with acetone prior to placement of the piezo.

The piezo shall not be installed if roadway surface temperature is not above the manufacturer’s recommended minimum temperature, or cannot be maintained above this temperature for a minimum of two hours after installation. The piezo shall not be installed if roadway surface temperature is above the manufacturer’s highest recommended temperature for grout installation.

The piezo lead wire shall be placed in the saw slot with a blunt non-metallic object. ½ inch backer-rod shall be installed to insure the wire does not float to the surface during grouting. Backer-rod shall be installed in 4 to 6 inch pieces with 1 to 2 foot gaps in-between, to insure the sealant will come in contact with the piezo lead wire. One continuous piece of backer-rod will not be allowed.

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The sealant for the piezo lead wire shall be the same as used for loops.

Piezo lead wire shall be pulled into the cabinet without splices, unless the length exceeds 300 feet.

Only one lead wire shall be placed in a saw slot.

Piezo lead wires from pavement edge to pull box shall be enclosed in ¾ inch PVC conduit or ¾ inch rubber hose, to protect wire from abrasion. Pull boxes or cabinet shall contain a minimum of three feet of piezo lead wire for splicing. Lead wire shall be clearly labeled as approved by the Engineer and the TDC.

All splices in piezo wiring shall be soldered and enclosed in a resin filled splice kit.

1. *Pull Boxes* All pull boxes on the shoulder of the roadway surface shall be raised to finished grade or level with the surrounding ground. If the shoulder has been raised to the point that the conduit is below the bottom of the pull box, then the conduit shall be raised. All wiring splices for existing wiring shall be a minimum of 12 inches in length above the conduit.

All existing pull boxes that are found to be damaged shall be replaced.

1. *Water Valves.* A minimum of two feet of slack shall be provided on the loop and piezo wires that are contained in water valves.

No splices shall be allowed in water valves.

1. *Pull Rope.* A 1/8 inch nylon pull rope shall be installed in all new conduits and all existing conduits where a wire or cable is added or an existing wire or cable is replaced.
2. *Conduit*. The contractor shall seal all conduits with a sealing compound where a wire or cable is added or an existing wire or cable is replaced. The sealing compound shall be UL tested and approved for use. Sealing compound shall be a permanently soft, fibrous, non-staining sealer that can be easily applied and removed by hand at all working temperatures. Sealing compound shall be designed to seal out weather, moisture, dust rodents and atmospheric conditions both indoors and outdoors. No foam sealant will be allowed.

**METHOD OF MEASUREMENT**

Loop Detector Wire will be measured as the actual number of linear feet of wire that is installed and accepted, including splices and lead wire.

Piezos will be measured as the actual number that are installed and accepted.

**BASIS OF PAYMENT**

Payment will be made under:

**Pay Item Pay Unit**

Loop Detector Wire Linear Foot

Piezo (Electric) (Class II) Each

Payment will be full compensation for all work, materials, and equipment required to install the loop detector wire and piezos.

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Grout, epoxy and sealant will not be measured and paid for separately, but shall be included in the work.

Trenching and drilling, as required, will not be measured and paid for separately, but shall be included in the work.

Splices for the piezo lead wire will not be measured and paid for separately, but shall be included in the work.

Pull boxes will be measured and paid for in accordance with Section 613.