TO:

SUPERSEDED BY EI 84-017 EFFECTIVE 9/6/84

ENGINEERING INSTRUCTION

NEW YORK STATE DEPARTMENT OF TRANSPORTATION

SUBJECT: INDUCTANCE LOOP VEHICLE DETECTOR INSTALLATIONS

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Field investigations done by the Engineering Research and Development Bureau under Research Project 169-1, "Evaluation and Improvement of Inductive Loop Detectors", determined that a large number of signal loop failures were caused by wire failures, augmented by sealant failure and poor installation techniques. Current average loop life was found to be about 2 years. This work is continuing; however, at this time the results of the research work and other laboratory work by the Materials Bureau indicate that significantly improved loop performance can be obtained by making the following changes to our loop design:

1. Use encased loop wire which consists of 14 AWG stranded single conductor wire loosely encased in a continuous vinyl or polyethylene plastic tube.

2. Use improved roadway loop embedding sealer.

3. Use chipped out or cored corners instead of diagonal sawcuts at the corners of the loop cutouts in the pavement.

The encased wire reduces the chance of wire breakage due to thermal changes, pavement movement, and displacement at cracks and joints, by providing longer lengths of unrestrained wire over which any wire movement and length changes can occur. The improved sealants and different corner treatment will provide better retention of the wire in the loop slots.

In order to implement these findings, the following changes are being made:

1. Standard Sheet 680-9, Inductance Loop Vehicle Detector Installation Details, is superseded by new Standard Sheet 680-9R1 of the same title.

2. Subsection 680-3.26, Inductance Loop Installation, is superseded by a new Subsection 680-3.26.

3. Subsection 724-20, Inductance Loop Wire, is superseded by a new Subsection 724-20.

4. Subsection 724-22, Roadway Loop Embedding Sealer, is superseded by a new Subsection 724-22.

A copy of the new standard sheet is attached. Also attached is a copy of a note containing the specification changes. This note will be inserted in contract proposals by the Final Plan Review Bureau.

This Engineering Instruction is effective with the letting of June 9, 1983.

INDUCTANCE LOOP

Make the following changes to the Standard Specifications of January 2, 1981:

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Delete §680-3.26, Inductance Loop Installation, in its entirety and substitute the following:

"680-3.26 Inductance Loop Installation. Loops shall be installed in accordance with the details specified on the plans, Standard Sheets or as directed by the Engineer. Loop dimensions shall be as specified on the plans.

Pullboxes, conduits and curb cuts shall be completed before beginning the loop installation.

The loop shall be outlined on the pavement to conform to the specified configuration. A power saw shall be used to cut a slot in the pavement. The cut shall be 3/8 inch in width and of the depth specified on the standard sheets. The corners shall be cored, drilled or chipped out as shown on the standard sheets. Sharp edges in the corners shall be smoothed. All saw cuts and corners shall be of the same depth.

Immediately after sawing, the slot and pavement shall be flushed with clean water to remove the saw slurry. Filtered compressed air shall be used to remove all dust and moisture from the slot. If the slot is damp, do not proceed with the installation until it is dry. Hot air may be used to dry the saw slot.

At the edge of pavement or curb a one inch minimum diameter, Metal Steel Conduit, Zinc Coated, Flexible Liquid-Tight Steel Conduit or Rigid Plastic Conduit shall be installed between the pavement and pullbox in accordance with details specified on the standard sheets.

The loop wire shall be installed starting at the roadside pullbox around the loop for the specified number of turns and back to the pullbox. Splices shall not be permitted outside the pullbox. The wire shall be depressed in the slot without the use of sharp objects which might damage the wire insulation. The loop shall be held in place every two feet with one inch (approximate) strips of rubber, neoprene, flexible tubing or foam backer rod as approved by the Engineer. These hold down strips shall be left in place when the slot is filled with Roadway Loop Embedding Sealer.

The ends of the vinyl or plastic tubing, encasing the wire, shall be given a waterproof seal immediately after placing the wire to prevent moisture from entering the tube. Where the loop wires cross pavement joints and cracks, the loop wires shall be protected using the method specified on the Standard Sheets.

The pair of loop wires between the edge of pavement and the splice to the shielded lead-in cable in the pullbox shall be twisted together with at least two turns per foot.

The splice between the loop wires (twisted pair) and the shielded lead-in cable shall be moisture proof and shall have a dielectric strength at least equal to that of the original insulation.

Moisture shall be excluded from the splice during the operation and the work shall be done in dry weather or under shelter. All parts of the splices and tools involved shall be clean and dry. Individual splices in each wire shall be staggered in a manner so as to minimize the outside diameter of the finished splice. The bared conductor ends shall be either twisted and soldered or joined using an uncoated solderless type connector of the correct size using an appropriate crimping tool. The splice shall be reinsulated using an electrical grade fast drying sealant and plastic polyvinyl chloride tape or heat shrinkable polyolefin tubing. The reinsulation shall extend approximately one inch onto the adjacent insulation at each end. Sufficient layers of tape shall be applied to equal one and one half time the thickness of the original insulation. The polyolefin tubing shall be at least as thick as the original insulation on the finished splice.

Reinsulation of the outer jacket shall be accomplished in a similar manner except that the reinsulation shall extend approximately four inches onto the adjacent jacket at each end.

The loop wires (twisted pair) and the splice to the shielded lead-in cable within the pullbox shall be held by wire hangers as near as possible to the top of the box in order to prevent their immersion in water. The shielded lead-in cable shall be continuous (no splices) from the splice to the loop wires to the controller cabinet terminals. The drain or ground wire in the shielded cable shall be grounded at the controller cabinet terminals only.

The completed loop installation including the shielded lead-in to the controller cabinet shall have a minimum of 50 megohms leakage resistance to ground. This resistance shall be tested before the loop is sealed in the pavement and after the splice is made between the loop wires (twisted pair) and shielded lead-in. Resistance to ground shall be tested in accordance with the Insulation Resistance Test in §680-3.32.

When it is determined that the resistance to ground requirements are met, the slot shall be filled with Roadway Loop Embedding Sealer. The pavement temperature shall be 40°F and rising before the sealer is placed. All work involving the sealer shall be done in compliance with the manufacturer's specifications. When the Loop Embedding Sealer has set sufficiently to open the loop to traffic, but the surface remains tacky, the loop may be dusted with cement dust to facilitate opening the loop to traffic."

Delete §724-20, INDUCTANCE LOOP WIRE, in its entirety and substitute the following:

"724-20 INDUCTANCE LOOP WIRE

SCOPE. This specification covers the material requirements for wire used in inductance loop vehicle detectors.

MATERIALS AND CONSTRUCTION. The inductance loop wire shall consist of No. 14 AWG, National Electrical Code Type THHN-THWN or XHHW stranded single conductor copper wire. The exterior jacket of the wire shall be marked at regular intervals with the proper type letter or letters, the manufacturer's name or trademark, the AWG size, and the maximum rated voltage.-

The loop wire shall be protected by a continuous flexible vinyl or polyethylene plastic tubing of .184 inch minimum I.D., .031 inch minimum wall thickness, and 0.26 inch maximum O.D., having a smooth bore. The tubing shall not adhere to the loop wire in any way and shall be capable of resisting deterioration from oils, solvents and temperatures up to 100°C. The tubing shall also be highly abrasion resistant and remain flexible from -30°C to 100°C.

BASIS OF ACCEPTANCE. Acceptance of inductance loop wire will be based on manufacturer's certification of compliance with these specification requirements."

Also, delete 724-22, ROADWAY LOOP EMBEDDING SEALER, in its entirety and substitute the following:

724-22 ROADWAY LOOP EMBEDDING SEALER

SCOPE: This specification covers the material requirements for Roadway Loop Embedding Sealer used when installing inductance loops.

MATERIALS AND CONSTRUCTION: Roadway Loop Embedding Sealer shall be used to encapsulate Traffic Signal Loop Wires embedded in highway materials. The sealer shall be cold applied and may be a one or two component system, the viscosity of which shall be sufficient to allow the material to be either poured or placed under pressure and fully encapsulate the loop wires. The Sealer shall be curable at temperatures of 40F and above.

When the Sealer is bonded to common paving materials, it shall have sufficient strength and resiliency to withstand stresses due to vibrations and differences in expansion and contraction as a result of temperature changes or traffic conditions. The Sealer shall be compatible with the sheathing or covering of loop inductance wires.

Chemical Resistance: Cured Sealer shall be resistant to most chemicals and solvents, including salts, acids, hydrocarbons, etc.

Packaged stability of each component in original unopened containers, stored in temperatures between 32F and 100F shall be a minimum of six months.

REQUIREMENTS:

Requirements for materials with a Shore A hardness between 15 and 40:

Property	Requirements Minimum	Maximum	Test Method
Pot Life, minutes @ 72F	15	-	DOT Test Method 724-40E
Curing Time (tack free surface) hours @ 72F	-	2	DOT Test Method 724-40E
Tensile Strength, psi	50	-	ASTM D412
Elongation, percent	150	-	ASTM D412
Hardness, Shore A	15	40	ASTM D2240
Water Absorption, percent	-	1.0	DOT Test Method 724-40E
Adhesion to Asphalt Concrete, lbs.	200	-	DOT Test Method 724-40E
Adhesion to Concrete, lbs.	50	-	DOT Test Method 724-40E
Extension, inches	.25	-	DOT Test Method 724-40E
Accelerated Weathering	No cracking, checking, chalking, shrinkage, or breaking - 180° bend at 0F Per DOT Test Method TM 724-40E		

724-22 ROADWAY LOOP EMBEDDING SEALER

Requirements for materials with a hardness between Shore A 50 and Shore D 65:

Property	Requirements Minimum	Maximum	Test Method
Pot Life, minutes @ 72F	15	-	DOT Test Method 724-40E
Curing Time (tack free surface), hours @ 72F	-	2	DOT Test Method 724-40E
Tensile Strength, psi	400	-	ASTM D412
Elongation, percent	20	-	ASTM D412
Hardness, Shore A	50	-	DOT Test Method 724-40E
Shore D	-	65	DOT Test Method 724-40E
Water Absorption, percent	-	1.0	DOT Test Method 724-40E
Adhesion to Asphalt Concrete, lbs.	500	-	DOT Test Method 724-40E
Adhesion to Concrete, lbs.	300	-	DOT Test Method 724-40E
Extension, inches	.12	-	DOT Test Method 724-40E
Accelerated Weathering	No cracking, checking, chalking or shrinkage Per DOT Test Method TM 724-40E		

BASIS OF ACCEPTANCE: Applications for approval of Roadway Loop Embedding Sealer shall be submitted to the Materials Bureau by the manufacturer accompanied by a one gallon sample of the product and all pertinent sealer information including, but not limited to, manufacturer's sealant test results, sealant application procedures and safety precautions. Upon approval by the Materials Bureau, the name of the product will be placed on an "approved list" of Roadway Loop Embedding Sealers for use on asphalt and/or concrete pavements based on the compatibility of the sealer with the pavement material. The product may then be accepted on the basis of the name brand labeled on the container.