RESEARCH PAYS OFF

NEW YORK STATE DEPARTMENT OF TRANSPORTATION

NYSDOT Improves Materials and Installation Methods for Loop Detectors

Inductive loop detectors at signalized intersections, which go unnoticed by most drivers, are an integral part of today's highway systems. These detectors provide information to signal controller microprocessors about waiting or approaching vehicles, which permits changes in signal timing to accommodate changing traffic demands, in some cases for a single intersection and in other instances for a whole network. When this equipment performs successfully, motorists can save significant amounts of time and fuel. When it fails, inconvenience and serious delays to the traveling public can result.

The loop detectors operate on the principle of inductance. A small electrical current passes through a loop of wire buried in the pavement. Vehicles

The process of sawing the slot for installation of encapsulated signal wire is improved by using an 18-hp saw rather than a 9.2-hp saw, and by "wet sawing," which reduces hazards to workers and the public due to dust and debris.

Installation of encased signal wire is as simple as using single-jacketed wire; however, life expectancy of the loop is significantly increased.

traveling through the resultant magnetic field cause a change in the overall inductance of the loop circuit. The detector senses this change and sends a signal to the traffic controller circuit, which responds appropriately to the information received.

Most modern signal systems depend on the continuing operation of these detectors. The operation of computer-controlled signal systems in many cities is dependent on detectors; in states in which signal networks or vehicle-actuated intersection controllers are operated, the detectors are increasingly used. The New York State Department of Transportation (NYSDOT) maintains about 15,000 individual loops.

Problem

Although loop detectors are widely used, several factors adversely affect their reliability. In the past, according to experience in New York, most of the loops did not require maintenance for about 2 years after installation. Typically, systems would then begin to experience a 25 percent failure rate. Studies traced the difficulties to nonuniformity of installation methods and materials, or to unsuitable conditions at the time of installation. Consequently, NYSDOT tried to find ways to increase the reliability and life expectancy of loop detectors. Research conducted in cooperation with the Federal Highway Administration led to some answers.

Solution

The study of installation methods revealed that making several modifications in the installation process could provide improved reliability. First, it was found that making pavement cuts for the loops with simple square corners rather than large angled corners would reduce pavement failures. Other improvements included the following: using proper hold-downs to prevent wire "float"; improving splices at curb connections; and enhancing sealer bond by better cleaning and drying in slots. Additional changes in methods resulted in improved speed, safety, and efficiency in installation.

The study also led to changes in the type of wire materials and sealants used. On the basis of laboratory and field test evaluations, procedures for which were developed in the study, hot bituminous-based sealants were replaced by an approved list of cold-applied sealers for embedding the loops. An encased wire, to decrease breakage and water infiltration, is now used. In sum, major specification changes included the use of (a) No. 14 AWG stranded, single-conductor wire encased in a continuous vinyl or polyethylene plastic tube; (b) improved loop-embedding sealer; and (c) chipped-out or cored corners instead of diagonal sawcuts in the slots cut for the loops.

Application

As the first step in encouraging standardized loop installation methods, NYSDOT prepared both a report for an informational seminar and a research report. Representatives from various regional construction and maintenance crews attended a 1-day presentation and a 1-day demonstration of field techniques. A videotape showing correct installation techniques was also prepared for the Federal Highway Administration. The report for the seminar *(Special Report 75),* the videotape and its script *(Special Report 81),* and the project report *(Research Report 119)* are all available from NYSDOT.

Benefits

The benefits of the project have already been demonstrated. The new standardized techniques have brought about safer and more efficient work conditions. The combination of better materials and installation methods has resulted in greater reliability and longer life.

Although none of the test loops has failed, some have been removed because of road reconstruction; thus an accurate prediction of the increase in loop life is not possible. Early results indicate that new materials and installation techniques will at least double the trouble-free life of traffic loops. Researchers anticipate that most savings will come from decreased replacement costs. It is expected that when these new installations make up the majority of loops, about one-half of the current 1,450 annual loop replacements will not be necessary. Because loop installations each cost about $1,500, an annual reduction of 700 loop replacements will save the department more than $1 million each year. Additional savings, resulting from decreases in motorist delay and inconvenience, are anticipated but are difficult to estimate.

For information about the availability of the videotape and project reports, contact Gerald Anania, Engineering Research and Development Bureau, NYSDOT, Building 5, State Office Campus, Albany, New York 12232 (telephone: 518-457-5826).

In addition, the Federal Highway Administration has developed a Traffic Detector Handbook and Field Manual for technicians, which reflect many of the New York findings. For copies please contact David Gibson, HRT-20, Federal Highway Administration, Office of Implementation, 6300 Georgetown Pike, McLean, Virginia 22201 (telephone: 703-285-2378).