Project Summary

Texas Department of Transportation

0-4664: Develop and Implement Traffic Monitoring Equipment Evaluation Facility

Background

The Transportation Planning and Programming Division (TPP) of the Texas Department of Transportation (TxDOT) is responsible for collecting, analyzing, and reporting traffic data throughout the state. As part of that responsibility, TPP is also responsible for the evaluation, selection, purchase, installation, and maintenance of automated traffic monitoring equipment. Automated traffic monitoring equipment is used for counting axles or vehicles; measuring vehicle speed, headway, and gap; classifying vehicles by length and/or axle spacing; and weighing vehicles in-motion.

TPP does not have a dedicated testing facility where traffic monitoring equipment can be tested and evaluated under real weather and traffic conditions. A dedicated evaluation facility would enhance TPP's capabilities to conduct more rigorous evaluations leading to more informed decisions about the investment for new or replacement traffic monitoring equipment.

This project sought to: (1) locate and conceptually design a traffic monitoring equipment evaluation facility, (2) identify funding sources, (3) evaluate the accuracy and performance of Kistler LINEAS quartz piezoelectric sensors, and (4) gather information on the type and minimum pavement depths for weigh-in-motion sensor installation.

What the Researchers Did

Researchers reviewed available literature and contacted several states. The literature search focused on general criteria for weigh-in-motion (WIM) installation. Other state departments of transportation (DOT) staff were contacted regarding facilities they use for traffic monitoring equipment testing. Researchers also interviewed TxDOT staff responsible for testing traffic monitoring equipment.

The research team investigated possible funding sources for the design and construction of the traffic monitoring equipment evaluation facility. To locate the facility, the research team developed and weighted 21 criteria by which candidate sites would be judged.

Researchers developed a conceptual design for the traffic monitoring equipment evaluation facility. This conceptual design was located at a grade-separated highway interchange. This configuration allowed the use of a bridge structure both as an overhead mount for non-intrusive equipment and to provide pedestrian access to equipment in both highway roadbeds. The conceptual plans called for one roadbed to be continuously reinforced concrete pavement and the other a full-depth asphalt concrete pavement.

For evaluating quartz piezoelectric sensors, two approaches were used. In the first approach, the research team contacted state DOTs to gather, compare, and contrast their experiences with installing, maintaining, and evaluating Kistler quartz sensors.

Research Performed by:

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In the second approach, the research team and TPP crews installed one lane of sensors at each of three locations in Central and South Texas. For each site, the research team collected and analyzed calibration and polled data. Researchers used a custom Microsoft Excel® application to assist with data processing and analysis of front axle and gross vehicle weights for Class 9 trucks (3S2). In addition, the research team made condition surveys and contacted a representative from a state DOT, an academician, and a vendor to determine minimum depths of asphalt and concrete pavements for placing various WIM sensors.

What They Found

Several locations along I-35 in north Williamson County and south Bell County were graded against the selection criteria. A site located at south Bell County (within the Waco District) was selected, but reconstruction plans at this site would not accommodate needed design changes to reduce roadway grade issues that were a concern.

In coordinating with the Waco District, researchers learned about another option—a rest area located one mile north of the selected site. However, after a seven-month period of coordination, the teams agreed that the rest area was no longer a viable option, due to competing interests. The selection process finally settled on a downsized site just south of the rest area which would still accommodate four cabinets on each side of I-35 and small parking pads for vehicular access to cabinets.

Researchers found other state DOTs' experiences to be generally positive with respect to the quartz piezoelectric sensors. DOTs consulted had between 1.5 and 8 years experience with these sensors. In each case, the DOTs conveyed the importance of following details during installation. Some indicated manufacturing defects and other failures that prompted changes to the manufacturer's installation procedures. Many states indicated interest in additional installations with one state citing that the sensor accuracy was the overriding factor prompting continued use. The cost and accuracy of quartz piezoelectric sensors is comparable to that of bending plate systems, but the quartz piezoelectric sensors require less intensive installation methods. The in-ground evaluation at the three Texas sites indicated good condition performance of the equipment.

What This Means

The researchers recommend:

- Continue planning, development, and construction of an evaluation facility in the I-35 corridor in the Waco District.
- Scale the facility to meet the constraints of the selected site.
- Expand the test by installing one lane of quartz sensors in asphalt pavement.
- Continue to monitor and document performance until failure of the sensors already installed.
- Install bending plate systems only in concrete pavements with depths not less than 12 inches.
- Install Kistler LINEAS quartz piezoelectric sensors in minimum 10-inch-depth asphalt pavement or minimum 8-inch-depth concrete pavement.

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