Pooling Our Research: Evaluating Non-Intrusive Traffic Detection Technologies

What Was the Need?
Transportation agencies collect traffic data to spot areas of congestion and forecast future infrastructure investments. Today, the most commonly used technology for traffic monitoring is the inductive loop detector. While accurate, loop detectors require road closures for installation and maintenance. Non-intrusive sensors provide an alternative that meets the accuracy of loop detectors and offers other benefits. Rather than requiring installation in the pavement, these sensors are placed above, beneath or to the side of the roadway. This means safer installation and maintenance, no disruption in traffic flow, and the added bonus of gathering more than vehicle-presence data.

Mn/DOT’s interest in non-intrusive traffic detection dates back to 1994, when it collaborated with the Federal Highway Administration to launch the first of two projects that evaluated emerging technologies; a second study concluded in 2002. The two projects evaluated 26 sensors representing eight technologies and compared them to roadway-embedded technologies.

FHWA’s national Transportation Pooled Fund Program provided an optimal method for Mn/DOT to lead a coalition of states to further pursue this line of research.

What Was Our Goal?
The objective of this pooled fund study was to conduct field tests of the latest generation of non-intrusive traffic sensors to assess their accuracy in detecting volume, speed and vehicle classification by length and axle configuration under a variety of conditions.

What Did We Do?
Researchers conducted a literature search to identify sensors to include in the study. Among the five products tested were:

- Two optical sensors that are installed on the side of the roadway: Peek Traffic Corporation’s AxleLight and the Transportable Infra-Red Traffic Logger, or TIRTL, side-fire laser sensor from Control Specialists Company. Both of these systems are axle-based sensors that detect vehicle presence when wheels break the laser’s beam, and can also collect speed and classification data.

- Miovision Technologies Inc.’s Video Collection Unit, a video sensor that includes a telescoping mast that can be attached to an existing pole or mounted as a part of a stand-alone tripod system and a sensor that performs similarly to loop detectors.

- Canoga Microloop sensors from Global Traffic Technologies. These magnetic sensors are installed under the roadway in conduit bored from the roadway shoulder and gather data on volume, speed and vehicle length.

- SmartSensor HD (Model 125) from Wavetronix LLC, a radar sensor with a detection range of 250 feet that measures volume, speed, classification and other traffic parameters.
Researchers evaluated four types of data: volume, axle-based classification, length-based classification and speed. Much of the testing occurred at Mn/DOT’s permanent test site located near downtown Minneapolis.

An additional test evaluated the Miovision sensor’s ability to perform for intersection turning movement counts. Researchers conducted hourly and 24-hour testing during periods of heavy congestion and varying weather and lighting conditions. Baseline data collected at the Mn/DOT test site using loop detectors, video cameras and manual counts were compared with results from the sensors tested.

What Did We Learn?

While the sensors tested in the current project performed better than sensors tested in Phase I and Phase II with regard to accuracy of speed and volume data, the additional classification capabilities generated mixed results. The length-based sensors were generally able to report accurate vehicle lengths. However, the lack of a presence detector caused axle-based sensors to erroneously classify tailgating passenger vehicles as four-axle trucks. A presence sensor can be used in conjunction with axle-based laser sensors to overcome classification irregularities, or an agency can modify its classification algorithm to properly reflect traffic flow.

What’s Next?

Mn/DOT and many other agencies are already using some of the technologies tested in this study. Mn/DOT offices and programs with an interest in traffic detection—including traffic engineering, traffic forecasting and analysis, Minnesota Guidestar, Mn/DOT’s Intelligent Transportation Systems program and the Regional Transportation Management Center—can use these research results to validate current use of the tested technologies, make adjustments to data analysis recommended by the research or make the case for deployment of a new technology.