Award-Winning System Uses Pavement Sensors to Avoid Dangerous Intersection Collisions

Safety Measure for Intersections With Limited Sight Distance

Pennsylvania's Department of Transportation (PennDOT) recently received an "Excellence in Highway Design Award" from the Federal Highway Administration for the installation of a crash avoidance system (CAS) which uses pavement sensors to identify the presence of vehicles on a minor road at an approach to an intersection with a major road. The PennDOT project involved two locations along State Route 38 in Butler county that posed safety concerns within the local community.

Concerns about the safety of the two intersections centered on the speeds of approaching vehicles on the mainline (SR 38), and the physical attributes of the roadway (vertical crest curve) that restrict the stopping sight distance for vehicles approaching the intersections on SR 38, and restrict the corner sight distance for vehicles attempting to enter the intersections from side roads. Although the speed limit of SR 38 is posted at 35 mph along this stretch of the highway, traffic typically approaches at much higher speeds. Enforcement had been an effective remedial measure, but only temporarily. Drivers, including those of school buses, felt uncomfortable traveling across SR 38 at the intersections because of the speeds of approaching vehicles and the restricted sight distance.

A warning sign on a major road (SR 38) at an approach to an intersection with a minor road. The sign indicates a vehicle approaching the intersection as well as the direction of the approach on the minor road. (Photo: Courtesy of PennDOT)

Accidents at the intersections were caused by drivers entering onto SR 38 too soon, improper turning, or excess speed on SR 38.

Warning sign facing a minor road approach to an intersection with a major road (SR 38). The sign indicates vehicles on the major road are approaching the intersection from both sides. (Photo: Courtesy of PennDOT)

The local community requested that PennDOT install traffic signals at both intersections and/or reconstruct them to provide more sight distance. Both these measures have engineering challenges associated with them as well as other adverse effects that could result and, therefore, were not feasible to improve the locations. However, PennDOT immediately developed a list of several improvements to lessen the potential for intersection crashes. These included improving pavement markings, asking commercial heavy haulers to reduce speeds, and placing advisory warning signs on SR 38. In addition, PennDOT researched the feasibility of a CAS that had been used at a location in Virginia with similar characteristics to those on SR 38. This was the first and only application in the United States at that point in time. With the approval of local municipal officials and legislative officials, the CAS was selected as the best alternative for the community to reduce the potential for crashes at the intersections.

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Arterial Contraflow Lane a Success in Honolulu

Users Reduce Travel Time by 10-20 Minutes

An arterial contraflow lane, opened on Nimitz Highway in Honolulu about a year ago, has proven to be an all-around success, according to the Hawaii Department of Transportation. The Hawaii DOT designed and implemented the contraflow lane to alleviate congestion along Nimitz Highway, a three-lane-per-direction arterial which services downtown Honolulu. The 2-mile long contraflow lane creates an additional (fourth) lane during the morning peak between 5:30 a.m. and 8:30 a.m. and operates as an HOV lane, with a 3-plus occupancy restriction between 5:30 and 7 a.m. and a 2-plus restriction between 7 and 8:30 a.m.

Conveniently, Nimitz Highway changes from a three-lane to a four-lane arterial at the point where the contraflow lane ends. This means that traffic using the contraflow lane does not have to merge into congested peak hour traffic but can cross the median into an exclusive fourth lane, which is separated from the other three lanes by cones for a short distance.

Travel time reduction as a result of the contraflow lane is estimated at between 10 and 20 minutes. Presently, about 1,000 vehicles use the facility in the peak hour. Eventually, the contraflow lane will connect with a contraflow lane on the H1 freeway in Honolulu.

The contraflow lane exit on Nimitz Highway in Honolulu. (Photo: Courtesy of Hawaii DOT)

The lane is delineated by means of plastic cones and pylons (see photo). Overhead signals provide traffic control for contraflow lane traffic at intersections. Vehicles cannot exit once they are in the contraflow lane until they reach the end of the lane. Implementation cost of the lane was $1 million, which includes signing, signals, and some restriping of lanes. The operational cost associated with the lane is $30,000 per month.

According to the Hawaii DOT they have no crash on record that is related to the contraflow lane.

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Award-Winning System Uses Pavement Sensors

The installation of the CAS provides approaching motorists a warning that a vehicle on a minor road is approaching a downstream intersection with SR 38 before the vehicles on SR 38 are within sight distance of the intersection with the minor road. This type of warning consists of LED signs that illuminate a "TRAFFIC AHEAD" sign and, in addition, displays an LED picture of a car located on the right and/or left side of the Crossroad sign to provide an awareness of the side of the intersection from which the vehicle on the minor road is approaching the intersection with SR 38.

There are also special LED signs located at each minor road approach to the intersection with SR 38. It illuminates "CROSSING TRAFFIC" when a vehicle is approaching the intersection within the distance needed to safely cross the intersection. It also provides a moving image of a car traveling in the direction from which the vehicle is approaching. This information can be used by the motorist on the minor road approach awaiting clearance to enter into the intersection to determine when it is safe to do so. The CAS's pending software advancements may also provide the District with a tool for traffic monitoring along the SR 38 corridor.

PennDOT is pursuing a detailed evaluation of the effectiveness of the CAS in reducing approach speeds of vehicles, but presently has no supportive data because of the newness of the system. However, within the community where the CAS was installed, citizens have provided PennDOT with positive feedback, saying that they feel much more comfortable and safe traveling through these intersections.

The operating software for CAS was a major hurdle for the construction contractor to acquire. Many computer software developers were hesitant to design and program software to run the CAS. Software design firms were concerned because of possible tort liability associated with a system malfunction. Vehicular crashes could possibly occur if the system failed to identify approaching vehicles. Ultimately, the system was designed with a battery back-up system in case of an electricity outage that would power the LEDs to flash, which will provide motorists with the knowledge that the system is malfunctioning. The CAS was installed at two intersections on SR 38 in November 2003.

Since installation, the speeds of vehicles approaching these intersections are lower and no accidents have taken place.

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