Traffic signals have come a long way in Baltimore, since the first traffic signal was introduced to the city in 1923. With the beginning of the new millennium, Baltimore decided it needed to upgrade an aging traffic infrastructure to improve traffic flow and reduce congestion. The first steps involved upgrading the traffic controllers and cabinets citywide and implementing a central software system. The implementation of these began in 2004. Once the implementation of the central software system and controller cabinets was underway, Baltimore recognized that the next improvement was to upgrade its aging vehicle detection system.

In the 1980’s, Baltimore deployed a radar based detection system throughout the city. Over time, the city was unable to continue to support these systems as they become obsolete and parts were no longer available. In 2006, while considering the traditional options of inductive loops or video detection, Baltimore was introduced to the concept of Sensys Networks wireless magnetometers. Baltimore was intrigued by this style of detection, as it promised a cost effective method combining the detection accuracy of a well-tuned and installed inductive loop, while offering minimal to no maintenance.

In August of 2006, Baltimore tested the performance of wireless magnetometer at their traffic signal test bed located near their signal shop. For this test, wireless magnetometers were colocated with brand new inductive loops in close proximity to rail crossing. This allowed Baltimore to validate the percent lane occupancy of the wireless sensor versus a loop, as well as introduce randomly stopped vehicles during the presence of a train. Using the count features within their new controllers, they were able to validate the performance of the wireless sensors was 99% accurate compared to inductive loops. After the system was closely monitored throughout the winter months, Baltimore concluded that the system was not impacted by winter weather.

In May 2007, Baltimore deployed a complete intersection of wireless sensors at an intersection near their signal shop. The purpose of the larger pilot was to verify the presence detection capabilities, deter-
Wireless Sensors Keeps Baltimore Moving . . . Continued from page 44

mining the optimal sensor configuration for future deployments, identify the proper detector sensitivity and observe its performance with vehicles parked in close proximity to the sensors. This intersection, located at the base of a freeway exit ramp near the port, experienced a wide variety of traffic, complete with a large number of eighteen wheeled trucks. These trucks caused significant damage to loops over time due to pavement migration.

The test intersection validated the presence detection operation of the system. As semi-actuation is the most common actuation mode in Baltimore for intersection under central system control, most intersections required 8 sensors located at the stop bar. The parking test was interesting as Baltimore’s control strategy mandated that a vehicle which parked close to (or over) a sensor had to be tuned out over a reasonably short time period. In addition, when the vehicle left, it needed to quickly return to normal operation. After monitoring the site for performance in these critical areas over several months, Baltimore became convinced that wireless sensors were a viable detection platform for them.

The final test was a pilot deployment along a nine intersection, mile long corridor in September 2007. Wireless sensors were deployed along a heavily traveled corridor which operated under semi-actuation with coordination along the main arterial. The pilot deployment was a great success, with travel times reduced by 1 to 1½ minutes. In addition, the pilot deployment provided the right environment to fully understand the best practices for installation, to minimize both set up and time in the field.

Baltimore’s installation methodology became a three step process. The first step was a site survey, in which a trained technician visited the intersection, drew a quick sketch and determined proper placement of the Access Point (AP) and the sensors. Back at the shop, a technician completed the third step by kitting the AP, sensors and contact closure cards for the intersection, including programming the RF channels, sensor sensitivities and detector output channels. Then each component was labeled with a corresponding notation on the intersection sketch. The final step was the physical installation of the equipment in the field by an installation crew. This included coring 4” diameter holes, 2.5 inches deep where the sensor will be installed, placing the sensor inside the hole and then sealing it with a fast drying epoxy. AP’s were mounted in the air, typically near the top of the signal arm nearest the traffic signal cabinet. An Ethernet cable is run from the cabinet to the AP. This cable provides power to the AP and communications from the AP to the contact closure card.

This process has proven to be very effective and repeatable. With the kitting stage taking less than an hour per intersection and the physical installation averaging 90 minutes per intersection. “We can bang these out pretty quick” said Paul Manik, Signal Shop Superintendent at the City of Baltimore “we typically install 4 intersections of wireless sensors in a day. With lane closures typically lasting less than 20 minutes per lane, we are able to treat it as a maintenance activity, greatly reducing the impact on both our staff and the motoring public”.

In the nearly five years since the pilot deployment, Baltimore has deployed wireless detection at over 185 intersections throughout the agency, with additional expansion planned. “With the cost of the wireless sensors being slightly more than half the price of video for our applications, we can deploy detection at nearly twice as many intersections” per Manik.

Baltimore has seen very high detector availability with a very low sensor failure rate. In addition, wireless sensors have been advantageous during milling projects. “Loops are a large target and are easy to destroy. Before a milling project comes through, we remove the sensors and re-install them after the milling project is complete” per Manik.

Offering Baltimore a cost effective, reliable detection system with rapid installation, wireless sensors have empowered Baltimore to keep traffic moving through its streets. Manik says “wireless sensors have exceeded our expectations.”

Baltimore Facts . . .

1350 Total intersections 960 on central system
16 Signal Technicians at the shop
1st signal installed in Baltimore 1923
1st actuated signal in Baltimore 1929

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