Mid-Block Detection: The Performance and Cost Saving Advantages of Radar

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Introduction
Radar-based, all-weather sensor solutions, including the Remote Traffic Microwave Sensor (RTMS), have proven their effectiveness and accuracy for traffic detection and measurement on roadways since the early 1990s. More than its non-intrusive, virtually maintenance free application, radar-based detection is recognized as a critical enabling technology for traffic responsive and adaptive signal control strategies – particularly in mid-block detection applications. In addition, with a single pole-mounted unit, a radar-based sensor can replace an entire array of inductive loop detectors, including the required traffic cabinet without lane closures to install. Perhaps more compelling is the automated reporting capabilities necessary for future highway and Intelligent Transportation Systems (ITS) funding programs.

What’s Driving the Adoption of Radar Detection?
The simplest answer is the age of data driven ITS. As the vehicle miles traveled (VMT) continues to increase and place greater demands on highway systems. The two primary means by which transportation agencies and metropolitan planning organizations (MPO) have addressed the resulting traffic congestion is to build more road capacity (construct more highway lane-miles) or increase the efficiency of existing roadways through technology. More specifically, increasing existing roadway efficiency by leveraging and deploying ITS.

From 1980 through 2005, automobile VMT increased 94 percent and commerce-related truck VMT increased 105 percent, while new highway lane-miles only increased by 3.5 percent during the same period1. With most urban road networks already at the limit for increased roadway capacity through construction, the growth of highway lane-miles does not appear that it will increase anytime soon in urban areas.

For many agencies, the only viable option to effectively address the added demands on their cities’ roadways is through ITS. Moreover, leveraging ITS can help transportation agencies accomplish more with the same level of resources – of particular importance during these times of budget constraints and/or cutbacks.

Implementing an ITS strategy has proven effective in increasing mobility, public safety, and productivity, while reducing vehicle-born pollution in some of the most challenging urban traffic congestion conditions. In addition to network communications and traffic management/control systems, vehicle sensors and detectors arguably play the most important role in powering ITS. Without vehicle detection, signalized intersections would operate on a timed basis without any consideration to traffic volume or flow. Installing radar-based detection at mid-block locations can help increase the effectiveness of active management or urban traffic control, especially in the case of adaptive signal control strategies.

Detection Technology for Mid-Block Applications

Currently, inductive loop detectors still represent approximately 65 percent of the installed vehicle detection market2. Undoubtedly, in the early days of actuated signal control (1960s), the inductive loop – the oldest traffic surveillance sensor technology – was the technology that provided vehicle demand detection for traffic signal systems. However, in the age of ITS and adaptive signal control, the need for a dynamic detection solution that can provide

RTMS Leveraged for Mid-Block Detection in ‘Midtown In Motion’ Project

The ITS America award winning Midtown in Motion is a technology-based traffic congestion relief project deployed in Manhattan, NY. The first phase of the project addressed 110-square blocks from 2nd to 6th Avenues and from 42nd to 57th Streets in Midtown Manhattan, and resulted in an overall 10 percent travel speed improvement3. The program included a suite of new traffic monitoring equipment, including 100 RTMS detection systems that are leveraged to monitor and measure traffic volumes, occupancy and speed at mid-block locations. The new system enables New York City DOT traffic engineers to identify traffic incidents and congestion in real-time, and then make immediate signal timing adjustments from the traffic management center (TMC).

The second phase of the project will now include 270-square blocks from 1st to 9th Avenues and from 42nd to 57th Streets, more than doubling the original service area. Plans for this phase include installation of an additional 110 RTMS units. All of the traffic data and information is transmitted wirelessly, further showcasing the non-intrusive installation and operation of the technology. NYC DOT has also noted that the new equipment is more weather-resistant and requires less maintenance. To read more about the Midtown in Motion project: http://www.nyc.gov/html/dot/html/pr2012/pr12_25.shtml

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In a mid-block urban roadway application, loop detectors can be impractical. The costs associated with trenching, wiring and installation can be $100, or more, per linear foot. This does not include the disruption to traffic (as lane closure for each loop is required for installation), or another traffic cabinet to house the extra loop detection controller. With maintenance costs reoccurring approximately every three years, costs can quickly exceed tens of thousands of dollars for an array of loops in one mid-block application. In addition, the damage to the roadway and sidewalk from loop systems compromises the integrity of the road surface and often create a less than pleasing roadway appearance.

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additional and more accurate traffic data with lower system life-cycle and installation costs is readily apparent. This dynamic detection solution is available today with radar-based detection.

The traffic information and data that can be gleaned from radar-based detectors and detection control systems can be vastly more useful in today’s ITS programs. Radar-based detection provides sampled real-time data for traffic volume, speed, queue length, vehicle classification, etc. that are essential to actively managing traffic flow, especially for adaptive signal control systems. Moreover, when combined with an automated data collection management system (DCMS), radar-based detection in mid-block applications can also provide comprehensive historical data to help with quick and detailed report generation required for Federal Highway Administration (FHWA) and other funding sources.

Today, a single radar sensor can provide detection coverage up to 12 separate lanes, replacing 12 individual loops without the intrusive installation and maintenance associated with inductive loops.

**The Installation and Maintenance Advantage of Radar**

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Installation of an RTMS unit on an existing pole – note no disruption to traffic required during installation.
On the other hand, radar-based sensors are a compact, self-contained unit that requires no routine maintenance. With zero setback, these sensors can be mounted on most existing roadside poles with no disruption to traffic during installation. More importantly, radar-based detection sensors provide data output to existing controllers via integrated wireless communications – no trenching or installing conduits and no pull boxes. This means installation for detection of up to 12 lanes can be completed in less than a day with no lane closures.

**Upgrading Mid-Block Detection From Loops to Radar**

Inductive loops and subsequent maintenance can compromise the surface of the roadway, not to mention negatively impact aesthetics.

What if there are already loops installed for mid-block detection? Upgrading to radar-based mid-block detection has never been easier or more cost effective. By leveraging a simple presence in-lane detection event-reporting hub, all data from several remote radar-based sensors is concentrated to the single hub via point-to-multipoint digital spread spectrum wireless technology. This approach utilizes the existing cabinet, intersection controllers and wireless communications, eliminating the need for the fixed communication lines and maintaining loop detectors, especially after repaving the roadway where mainline loops are typically destroyed. There is also an interface card upgrade that provides a cost effective gradual migration path from loops to radar detection. An interface card upgrade enables the deployment of a radar sensor as part of a loop maintenance program with no changes to existing hardware or software.

**ITS Benefits of Radar-Based Detection**

In addition to the performance and cost saving benefits over loops, radar-based detection can provide enhanced levels of ITS capabilities. Radar-based detection can offer a node event warning capability that monitors road activity and sends warnings of traffic irregularities (queuing, stopped traffic, incidents, etc.) to drivers and engineers by triggering dynamic message signs, flashers, and notifying the traffic operations center. This is a vital capability to any urban traffic control system where stopped traffic, for any reason, can be disastrous to inner-city traffic flow.

Radar-based sensors can also provide urban traffic control real-time traffic measurement and data over the entire radar sensor network through integration with an automated DCMS. This capability can be leveraged as an enterprise-level automated, full-time traffic study solution capable of monitoring traffic in thousands of locations, providing engineers and planners uninterrupted traffic data needed to make informed decisions, as well as the reporting that satisfies federal and state requirements. How is this accomplished? Multiple radar sensor stations in a specific area measure traffic. This data can then be sent by external modem or concentrated by a Wireless Cluster Hub and cost-effectively transmitted to the DCMS for user-specified reporting. Or, it can be sent using existing communication networks, such as fiber, Ethernet networks, using integrated TCP/IP. This flexibility in communications is ideal for large-scale transportation projects, including traffic responsive management and adaptive signal control in grid applications.

**The Time for Radar is Now**

With VMTs not expected to decrease significantly anytime soon, and construction of additional roadway miles in urban settings already at the limit in many locations, enhancing efficiencies of existing roadways through ITS will undoubtedly be a primary strategy for transportation agencies and MPOs going forward. Therefore, the need for a proven, more dynamic detection solution that provides the requisite vehicle and traffic data to drive ITS will need to be adopted, particularly for mid-block applications in urban traffic control programs. Radar-based detection with its accuracy and data-rich capabilities combined with a lower lifecycle cost, has already supplanted the inductive loop in one of the most important urban mobility projects – Midtown in Motion. The time for radar-based detection is now.

**Sources**

1 – US Census Bureau; Population Division. Federal Highway Administration
2 – 2010 IMS Detection Sensor Research – America Market
3 – New York City DOT