

Emergency response

As well as assisting medical, police and fire services, traffic signal priority systems are accepted as an appropriate measure for growing concerns about population increases, density congestion, flow costs and limited resources

Research has indicated that traffic signal priority platforms have the capability to reduce response times by an average of 20 percent, while also improving safety at intersections for both emergency vehicles and the general public.

In the USA, the National Fire Protection Association (NFPA) in 2001 set six minutes as the first national standard for the response to a fire call: six minutes or less from the moment the call is received to the arrival of the first fire services at the site.

A victim in cardiac arrest, meanwhile, has a six-times better survival rate if aid arrives within four minutes. But research has also shown that dispatched emergency vehicles converging at intersections represent the single greatest threat to their own safety and the safety of civilians in the area.

PRIORITY COMPLEX

A recent study conducted by the National Transportation Safety Board and the Federal Highway Administration (FHWA) reported on three intersection-priority systems to increase the awareness of stakeholders – including fire, police and emergency medical services (EMS) – about the benefits of emergency vehicle pre-emption.

The Fairfax County system in Virginia permits emergency vehicles along US 1 to pass through high-volume intersections more quickly with fewer conflicts, saving 30-45 seconds per intersection. The city of Plano in Texas has dramatically reduced the number of emergency vehicle crashes, from an average of 2.3 a year to less than one every five years. And emergency vehicle pre-emption in St Paul, Minnesota, has permitted police, fire and rescue and EMS vehicles to reach the scenes of incidents faster with a reduced risk for accidents.

Although rapid response is critical, increasing traffic congestion compromises that: maintaining flow efficiency and mobility has become a constant challenge across the USA in the face of growing traffic.

Travel miles continue to grow and are estimated to have jumped 60 percent from 1970 to 2000 – from 1.1 trillion to 2.75 trillion miles. Traffic densities are increasing and suburban expansion is altering traffic patterns, causing more congestion.

Studies indicate that costs associated with traffic delays – wasted fuel, lost productivity, environmental impact – are enormous, rising, and amount to US\$63.1 billion in 2003 compared to US\$61.5 billion in 2002.

The population is aging and, according to one study, elderly drivers are over-represented at intersection accidents. Furthermore, as intersections have become more sophisticated with left-turn phasing, eight phasing, allowable right-turn-on-red indicators and actuated signals, the confusion and conflict level has risen for drivers and pedestrians.

Such problems demonstrate a critical need for secure, reliable and effective tools

that give emergency vehicles an advantage under all conditions, without causing unnecessary delay to regular traffic.

BROWARD COUNTY

Broward County in southeast Florida is rapidly approaching saturation density. The county covers 423 square miles, with 30 individual municipalities and a total population of over 1.6 million.

The traffic engineering functions of Broward County and its cities were merged in 1976. The County Traffic Engineering Division has full traffic engineering agreements with 28 cities and modified agreements with the remaining two, maintaining all county traffic signals. More than 300 emergency vehicles from 28 stations use the its 1,300 intersections.

The Broward County Board of Commissioners has as its stated mission to make the county the most forward-looking



☛ Traffic congestion is compromising the critical need for emergency response services



→ Emergency services can benefit from traffic signal control to help reach their destination quicker



and best-run in the USA. As a result of high population density, the commission has long paid careful attention to traffic congestion and mass transit. As there is literally no way to build significant new road capacity, a vow has been taken to make the current system as efficient as possible, to facilitate effective emergency response and to increase the emphasis on mass transit.

County traffic professionals were charged with the responsibility of identifying a fresh solution to preferential vehicle management, which could safely deliver better response times for fire and rescue and apply ITS technology relative to vehicle location. The solution also had to provide the opportunity to offer bus green-time extension for mass transit, while also offering flexibility to accommodate as yet undefined needs.

In 1999, a county-wide review committee consisting of representatives from the Florida DOT, Broward County Traffic Engineering, and the municipalities and fire departments scrutinized several base technologies: infrared, audio and GPS. The committee's mission was to identify a solution that would bring uniformity across municipal boundaries and aid timely emergency vehicle response, while maintaining safety at the most natural point of contact: the intersection.

At the time, no GPS-based system was commercially available. So Broward County encouraged the company 3M – which had a GPS system under development and was already under consideration for adoption of its infrared 3M Opticom System – to move forward with the new technology. The committee felt that a GPS system would be more accurate than current signal pre-emption and control tools, while its activation would not be dependent on line-of-sight, which was considered to be a plus. In addition, it was thought that GPS would offer the flexibility to adapt to other types of authorized vehicles, including signal priority for buses.

The cooperation between Broward County and 3M was beneficial to both. County engineers were able to provide input on software and hardware design, and 3M had a ready partner for deployment.

LAUNCHING THE GPS SYSTEM

Phase I, a pilot program, was initiated in 1999: 20 intersections and 20 emergency vehicles were selected and equipped with the new 3M Opticom GPS priority control system. Initial tests were successful and Phase II saw the addition of 278 intersections and the equipping of 125 vehicles. Ten of the county's 30 communities have GPS-equipped vehicles at present. Phase III is about to get underway, involving an additional 256 intersections and more vehicles. By the end of Phase III, 43 percent of Broward's intersections will be equipped.

The Broward County system is all locally funded: the county buys, installs and maintains the intersection equipment. Participating municipalities purchase and maintain the on-vehicle equipment.

Intersections selected for traffic priority are 'logically defined'. The county started by equipping the routes most commonly used to access its three trauma centers – one each in the north, central and south areas. The next sequence of intersections is being mapped with secondary hospitals in mind, routes that will be equipped in Phase III.

HOW DOES IT WORK?

Like any GPS receiver, a unit on board the emergency vehicle uses Department of Defense (DOD) satellites to determine position, speed and heading. This information is transmitted to the upcoming intersection using a 2.4GHz spread-spectrum radio, programmed to avoid interference by hopping among frequencies. This protocol makes hacking difficult and helps secure transmissions.

At the intersection, equipment sends the priority request from the vehicle to the controller cabinet, which grants green-light priority through normal controller functions. The system transmits the authorized vehicle's latitude, longitude, speed and estimates the vehicle's time of arrival and duration in the intersection.

So, whether it's a slower-moving fire truck or a rapidly moving rescue unit, the signal controller receives real-time information to determine the most efficient appropriation of green time at that specific

intersection for that vehicle and at that moment. Traffic interruption is minimized, yet response time and intersection safety is substantially improved. The technology also monitors and transmits the vehicle's turn signal status to the intersection. With that information, priority requests advance 'around corners' to provide timely green lights at the next intended signalized intersection. Only left-turn arrows are displayed for vehicles that are turning left, allowing traffic in the opposite direction to be stopped only when necessary. 'Distributed intelligence' such as this helps provide green right of way to authorized vehicles as needed, in real time, and efficiently employs signal progression and pre-programmed controller parameters.

The system specifically identifies each vehicle under one of two priority levels by agency and class, and is capable of recognizing 250 agency IDs in 15 classes of 10,000 vehicles each.



↑ Offering emergency services intersection-priority technology, such as 3M's Opticom, enables a more rapid response and often be the difference between life and death



↕ Sensors are used to deploy signal control

GPS PRIORITY AND MASS TRANSIT

As two levels of priority are available, the system is also useful for lower-priority applications. Mass transit buses, for example, could request green extensions on arterials for greater efficiency and faster commutes. As both levels are integrated, conflict at intersections is eliminated. Emergency vehicle pre-emption always has priority.

The Broward County Mass Transit Division is in the process of developing a pilot project to test the use of equipped intersections for bus transit signal priority. As complete 'build out' nears, the county knows it cannot meet future traffic needs with expanded roadways. Intersection priority is considered to be a way to increase the efficiency and reliability, thus making it a more attractive alternative.

At present, the county operates 275 buses and had 36 million riders in 2004. About 25 buses are being added, some of which are articulated.

To fund improvements in mass transit, the county has changed 'concurrency rules' from roadway to transit-oriented emphasis. Broward County buses are equipped with Automatic Vehicle Location (AVL) provided by Orbital Sciences Corporation. Only 'conditional' priority is being considered for mass transit. Green priority under this system will activate only when a bus is running behind schedule.

It is even possible to use the system with automatic passenger counting as a criterion to be considered in activating the system. In other words, if a bus has low ridership at a given point, priority may not be given, even if the bus is behind schedule.

GPS-GENERATED DATA ALREADY PROVES VALUABLE

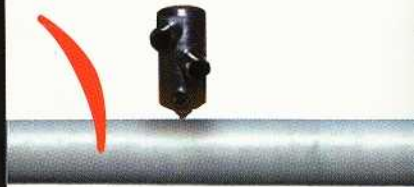
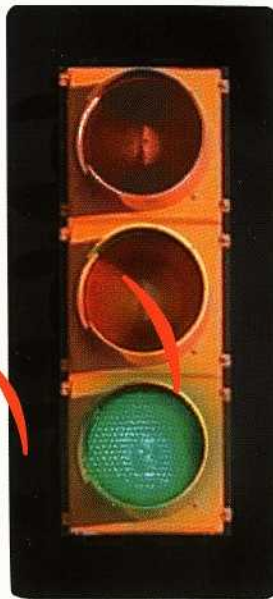
Even at intersections kitted out with the GPS equipment, accidents between emergency and non-emergency vehicles still occasionally do occur. One major benefit

offered by the GPS priority control systems, though, is the data that it generates and stores concerning activities at all equipped intersections. In recent years, there have been three accidents in the county at GPS priority-controlled intersections. In all three cases, the accidents have been reconstructed in great detail and the emergency vehicle drivers exonerated of any responsibility.

Having a 3M Opticom GPS unit at almost every major intersection throughout Broward County both facilitates and integrates mobility, safety and security. Indeed, it is a more than positive step towards a better and safer emergency response and life-saving service. And, as indicated, its future-forward capabilities promise important added benefit. ■

Jihad El Eid is director, Broward County Traffic Engineering Division; past president, Florida Section, Institute of Transportation Engineers. To find out more about 3M's products, please visit the company's website at www.mmm.com

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