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Street Smarts:
How Intelligent Transportation Systems Save Money, Lives and the Environment

The ability to move goods and people from place to place is critical to industrial society's survival. So, it comes as no surprise that transportation is a subject that's top-of-mind from coast to coast, throughout Europe and the Pacific Rim.

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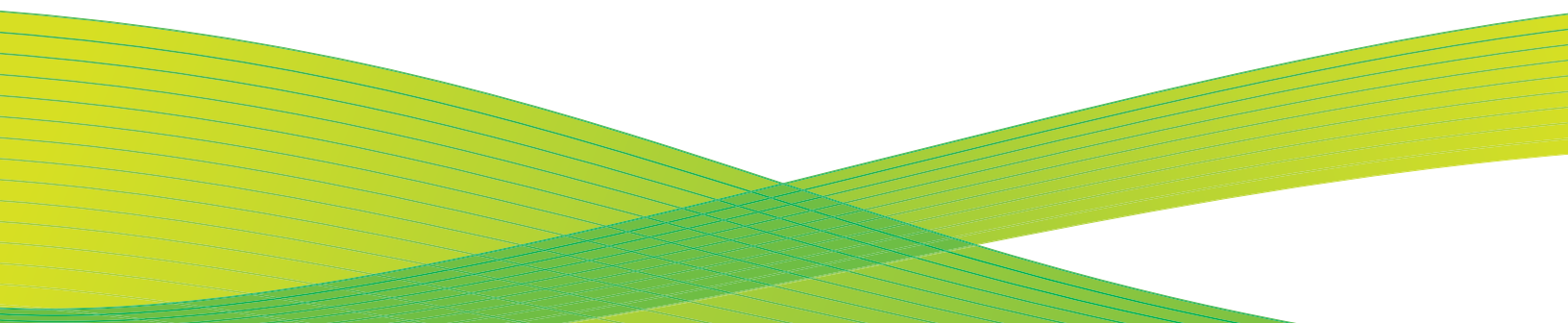

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In the United States, the Obama Administration has turned the spotlight on expanding and repairing the nation's infrastructure. The American Recovery and Reinvestment Act will pipe almost $30 billion into state budgets through the Department of Transportation. The goal is not only to revitalize a sagging economy, but also to counter the national transportation crisis that has been looming in the background. There's been a growing gap between
available dollars and the estimated $245 billion to $340 billion needed to fund new highway and transit projects and repairs to the existing system. A sagging economy and escalating gas prices expanded the gap. In the past year, people drove 4.8 percent less, which "drove" a corresponding reduction in the state and federal fuel taxes used to fund surface transportation projects. The net-net? A fuel-based tax system simply cannot keep pace with the budgetary need.

At the same time, environmental concerns are once again front and center. Peak travel demand leads to traffic congestion, the increasing emission of pollutants and the proliferation of greenhouse gases. The average rush-hour commuter spends the equivalent of one full week of every year stuck in traffic. That weighs in at a national cost of $78 billion, wasting time while wasting fuel.

More vehicles mean more accidents, spreading limited emergency response resources even thinner and, more significantly, costing lives. According to the U.S. Department of Transportation statistics, every year, 42,000 traffic-related fatalities and 2.7 million injuries cost the economy $230 billion. The price paid by the victims of those accidents extends well beyond any measurable number.

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So, the question becomes: How can public agencies improve surface transportation safety, reduce internal costs, increase funding revenue – and protect the environment in the process? The answer lies in working smarter through Intelligent Transportation Systems (ITS).

The Brainpower Behind ITS

Intelligent Transportation Systems use advanced wireless and wire-based communications technologies to improve transportation mobility and safety and, ultimately, reduce costs. These technologies are integrated within transportation systems, and within the vehicles themselves, to create a sort of cyber-dialogue between driving machine and the open road.

Although the concept may sound George Jetson-esque, the technology has been in development for more than two decades. In 1991, special federal funding pumped billions of dollars into the research and development of these systems. Because of that foresight, these tools are viable, available and already producing benefits in various engagements worldwide.

It's important to note that ITS is not a single system but an array of different systems that can be used in any combination to solve specific transportation challenges – in a big way. Estimates indicate that by using the tools available today, the number of traffic fatalities, injuries and the costs associated with both could be reduced by a jaw-dropping 50 percent in the next 10 years. Each system offers significant benefits for both the agency and the constituent in a variety of key areas.

A Little Car Talk

The best way to reduce the costs and pain associated with accidents is to find a way to prevent them from happening – and that's precisely the goal of collision-avoidance and dynamic-warning systems. These systems are key parts of the Vehicle Infrastructure Integration (VII) Initiative – a cooperative effort between the automobile industry and federal and state transportation agencies to improve safety through the use of technology.

Devices are installed at intersections, on roadsides and within vehicles themselves through permanent installations of transient Direct Short-Range Communications (DSRC) devices. Using the new DSRC 5.9 GHz radio frequency, this system provides over-the-air communication between vehicles and the roadside infrastructure to let drivers know what's coming up at an intersection or on the open road ahead of them, so they can avoid crashes and help reduce congestion caused by them. In a sense, it works much like the automated guidance system on airplanes – but is applied to surface transportation.

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By adding in vehicle-to-vehicle communications, the potential for accident prevention is dramatically increased. For example, let's say a driver is approaching a slow-moving vehicle in his lane. The system would warn him of the danger ahead and could even automatically brake the vehicle.

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DSRC technology is already in place in many cars for toll collection and in the future will be installed in the vehicle as an OEM or after-market device. Also appearing in vehicles are GPS devices in the form of in-dash navigational systems, satellite radio and security communications systems. Cell phones can also be used as receiving devices. Eventually, these devices will be built into all vehicles. The transition will be similar to that of ABS brakes and air bags – proven safety features that quickly moved from an optional to a standard feature.

The Road Less Traveled

A less futuristic but equally valuable ITS application involves the efficient delivery of real-time traffic information. In this solution, traffic management centers use Automated Traffic Management Systems (ATMS) to synthesize – in one location – data from a variety of sensors, closed-circuit televisions, weather stations, roadside and in-pavement detectors and other sources. Dispatchers at the management center view these real-time images and information and use these data to alert drivers about everything from a traffic tie-up to a stalled car to an approaching hailstorm. They are also able to dispatch the right response teams to clear the incident and restore traffic flow. On the simplest level, this information can be broadcast through the media and to the driver through direct communications links, including 511 communications systems. Going one step further, these messages can be pushed directly to the drivers' cell phones or in-vehicle navigational devices for a continual, real-time update, along with integrated Dynamic Route Guidance that actually instructs them on the fastest, accident-free routes to their destination.

By preventing accidents with collision-avoidance systems and by efficiently routing people around the now-reduced number of accidents to decrease congestion, public agencies can keep travelers safer and the air cleaner.

This type of solution directly supports the green initiative. Statistics show that 50 percent of pollution-generating traffic congestion is caused by nonrecurring incidents – mostly by traffic accidents. By preventing accidents with collision-avoidance systems and by efficiently routing people around the now-reduced number of accidents to decrease congestion, public agencies can keep travelers safer and the air cleaner.

For Whom the Technology Tolls

The concept of all-electronic toll collection makes sense on a variety of levels. Automated License Plate Recognition (ALPR) technology, coupled with DSRC, enables drivers to travel toll roads, bridges and tunnels at highway speeds without the need to stop and pay the toll. Instead of tollbooths, this system uses Automated Vehicle Identification and Classification (AVI/AVC) technology mounted on overhead gantries or roadside structures to identify the vehicle and calculate the correct toll. Readers and cameras automatically capture the vehicle information and transmit the data to a back office for collection of the toll through pre-paid accounts, or accept payment within a few days of use. The license plate numbers are matched against the vehicle registration information supplied by the driver, and those who choose not to pay are identified through an automated interface with state motor vehicle agency records. Participants can pay tolls in a number of convenient ways, including by phone or Internet. This solution enables transportation agencies to decrease toll collection costs through automation, as well as reduce the congestion and subsequent pollution caused by slowing, waiting and passing through toll booths.

Taking this to the next level, agencies can actually change the price of tolls collected on specific roads, based on time of day or even actual traffic conditions. They can also create high-occupancy toll, or HOT, lanes or express toll lanes, which enable drivers to achieve a predictable, congestion-free trip by paying a fee for using dedicated lanes during busy times.

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By charging fees to use roadway facilities and increasing the cost during peak periods, these agencies can accomplish two things: change drivers' behavior by encouraging travel during off-peak times or the use of public transportation, which eases congestion and reduces pollution; and increase revenue from those drivers who continue to use the facility – revenues that can be used to fund other transportation improvement projects. This concept has been used worldwide, with great success. After initiating a fully automated, electronic variable-charge system, Singapore, for example, reduced its traffic by 13 percent, while vehicle speed increased by 22 percent.

This same technology, used in tandem with GPS, also provides government agencies the option of collecting driver fees based on the number of miles driven, instead of relying on the gas tax for future funding needs.

Giving Signal Synchronization the Green Light

How many times have you been sitting at a red light with no traffic coming in the other direction or have traveled through a green light only to be stopped just up the road at a red light? How many complaints come in about that red light that seems to last forever? Traffic Signal Synchronization can make great headway in solving these problems.

Instead of preprogrammed traffic signals, this solution uses sensors to adjust the timing pattern of signal light changes in real time. In other words, the lights stay green longer if there is more traffic or are timed in sequence to allow traffic to flow through a busy corridor. Everything works to reduce delays and provide the most efficient flow of vehicles.

If the signal light is located near a stadium, concert hall or other similar venue, it can be remotely controlled by personnel in a command center who can physically see the traffic situation, using camera technology at the site, and change the light synchronization to get the traffic moving. Not only does this reduce accidents and traffic tie-ups, but it also eliminates the need to pull law enforcement personnel off the streets to direct traffic.

Another One Rides the Bus

Another iteration of ITS technology gives transit vehicles, like buses, signal-light priority and ample time to get through the green light before the signal changes. Using a wireless network, the transit vehicle "communicates" with the traffic signal upon its approach, so the light can turn green by the time it reaches the intersection. By keeping the buses and other transit vehicles moving, emissions are reduced significantly. In addition, a more efficient mass transit system drives ridership, which benefits the environment by reducing the number of vehicles on the road.

Computer-aided, GPS-based dispatch systems work to increase the efficiency of mass transit and to better communicate with waiting riders. Electronic signs at bus stops, for example, provide accurate information about when the next bus will arrive. Add in a reloadable smart card system for fare collection, and using mass transit becomes faster and more convenient – again, increasing adoption.

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Specific groups of constituents, such as the elderly or the physically disabled, need transit services that provide door-to-door transportation to doctors' appointments, jobs and senior centers. Although these constituents must be served, sending a full-size bus wastes fuel, which increases emissions, and those vehicles are often ill-equipped to meet the specialized needs of these individuals.

Demand Response Transit Service avoids the use of large transit vehicles by using technology to dispatch smaller, more-efficient vehicles to serve specific client groups. Constituents can electronically schedule a vehicle online or through an interactive voice response system. Dispatchers schedule vehicles based on the most efficient routes to save fuel and deliver the highest service levels to their users.

Seeing Red, Saving Lives

According to the Insurance Institute for Highway Safety, motorists are more likely to be injured in urban crashes caused by red-light-running than in any other type of accident. In 2006, in the U.S. alone, close to 900 people were killed and an estimated 144,000 injured in these T-bone, or right-angle, crashes. To deter such accidents, cities are turning to well-marked, well-publicized red light, photo-enforcement programs.

These solutions use digital technology downloaded to a centralized processing center for review and audit. When activated, the camera takes the "A" shot of the car crossing the red-light line; the "B" shot of the car in the middle of the intersection, with the light clearly red; and video that makes the violation indisputable. As the camera is photographing the violation, a second aperture captures all relevant information on the data box and burns that information directly onto the negative. The automatic integration of images and violation data results in tamper-proof photographic evidence, without the possibility of data-entry errors.

According to the Insurance Institute for Highway Safety, motorists are more likely to be injured in urban crashes caused by red-light-running than in any other type of accident.

It's a program that delivers on its promise. Statistics show that these solutions reduce accidents in targeted areas by an average of between 40 and 50 percent.

In addition to capturing red-light violations, this photo-enforcement system can also be set up to calculate the speed of each vehicle crossing the detection loops, using a time-distance calculation to capture speeding violations. And it can be used to keep construction workers safe – an application of particular interest now, given the expectation that road construction will increase as a result of the Obama Administration's economic stimulus plan.

Prior to entering construction zones, electronic signs are posted, telling drivers to slow down and indicating the reduced speed. The same technology used for photo- and speed-enforcement will take pictures of speeding drivers' license plates. The construction workers themselves are given a buzzer device that goes off when a vehicle comes through at higher-than-posted speeds, so they can get safely out of the way.

Automated red-light and speed-enforcement systems free enforcement personnel for other priorities and raise needed revenue for state and local governments.

Keep On Trucking

When trucks have to pull over at weigh stations, they waste fuel, waste time and slow delivery of goods to market, and they can cause traffic delays and create safety problems exiting and re-entering the highway. ITS freight and fleet technologies, such as the ACS-operated PrePass® system, allow participating transponder-equipped commercial vehicles to bypass designated weigh stations, port-of-entry facilities and agricultural interdiction facilities. Cleared vehicles may proceed at highway speed, eliminating the need to stop. That means greater efficiency, reduced emission pollutants and improved safety for all highway users.

This system is used in more than 281 locations in 29 U.S. states.

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Making Parking a Walk in the Park

The benefits of getting somewhere more efficiently with fewer emissions can be negated by the simple act of driving up and down a street or up and down the levels of an airport garage, trying to find a place to park. The slow-down-and-search approach clogs traffic, irritates other drivers, reduces pedestrian safety in urban areas, wastes fuel and contributes to pollution.

Intelligent parking guidance and information systems eliminate the need to cruise for a space, by employing technology either to allow a driver to make a reservation for a parking space or to provide real-time information about the location of available parking spaces in the area. Electronic signs can direct drivers with messages such as, "Six available spaces on the next block." In some applications, such as airport parking, a visible green light is displayed above the empty space.

Cities that wish to employ a reservation-type service can charge a premium fee for this service, again generating revenue, while delivering a true time-saver to their constituents.

Intelligent Transportation Systems Are a Smart Choice

Intelligent Transportation Systems deliver a wide range of benefits, from keeping drivers safe to reducing greenhouse gas emissions to keeping traffic moving along – all while reducing costs and, in some cases, generating revenue for government agencies.

ACS is the leading provider of transportation services, including ITS, to governments worldwide, using integrated technology and expert support to solve surface transportation challenges and save lives. From fare collection to toll solutions, from back-office processing to infrastructure installations, ACS provides systems and services that help governments solve their intractable transportation problems in a way that benefits everyone: the smart way.

You can learn more about us at www.acs-inc.com.

About the Author

Parker F. Williams, Vice President, Electronic Payment Systems within the ACS Transportation Solutions Group, has over 25 years of public and private sector transportation experience. He is currently focused on securing toll system installation and operating contracts in the growing congestion pricing and public-private partnership market. Williams previously served as Administrator of the Maryland State Highway Administration (SHA).