Ready for the High-Tech Road

Intelligent transportation technologies, fiber-optic networks and data help governments and motorists keep traffic moving.

Some of the most exciting technologies for governments are being developed and deployed to improve one of the most vexing public sector challenges: transportation. And while the futuristic technologies of autonomous vehicles may generate the most buzz, several technologies on the near-term horizon will also produce significant benefits for governments and citizens.

Better traffic flow. In Detroit, 40 percent of intersections have video cameras and networked traffic lights that can adjust signal timing based on vehicle, bicyclist and pedestrian behavior. Over time, the data collected will help transportation planners improve intersection design.[1] New technology for traffic-system controllers supports vehicle-to-infrastructure (V2I) connectivity, allowing cars to inform drivers of signal status and timing as they approach or wait at an intersection. Dynamic signaling can also reduce congestion and the associated pollution throughout an area.

Enhanced safety measures. Network-connected video cameras and sensors alongside and embedded in roads can deliver much better insights into potential hazards. Las Vegas combines sensors and video cameras with analytics to identify traffic behaviors and patterns that indicate needed street improvements. For example, the ability to count wrong-way vehicles and correlate that data with other information will help the city better plan signage and street design.[2]

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In construction and accident zones, network-connected traffic cones increase safety by providing automated lane-closure information to navigation systems and apps. Because drivers receive this alert before they arrive at the scene, the expectation is they will take an alternate route or move to another lane sooner — improving safety for themselves, other motorists and workers.

Improved incident response. Weather, road conditions and lane closures can all create incidents that need immediate response to minimize traffic impact. More road sensors and video cameras, as well as more data to analyze, can help traffic managers better schedule, coordinate and stage response resources such as snowplows, de-icing and tow trucks, law enforcement, and fire and medical aid vehicles.

Better motorist experience. The infotainment systems installed in today's automobiles and commercial vehicles offer connectivity for real-time traffic alerts and other valuable driving and navigation information. Governments that provide this data will improve the motorist experience for everyday driving and be better equipped to reroute drivers due to road closures, natural disasters or evacuations. Additionally, automated "no-stop" weigh stations for trucks provide time savings that reduce business costs and keep commerce moving.

To fully capture the benefits of new transportation technologies, government networks will need the capacity, performance levels, coverage and scalability to support connectivity and tremendous real-time data volumes. Following is an example of how the state of Colorado prepared its network to embrace the advantages of intelligent transportation systems (ITS) — an approach that agencies throughout the country can easily replicate.

ITS DEPLOYMENT TODAY

A 2018 Center for Digital Government (CDG) survey of nearly 150 state and local government decision-makers found that 49 percent either have technology in place to monitor public infrastructure (including transportation) or will adopt it in the near future. These new infrastructure technologies are already delivering benefits – 57 percent of respondents cited improvements in safety. Other positive impacts reported were cost savings, improved customer service, and more efficient maintenance and use of infrastructure assets.

ACTIVE ITS ADOPTION IN COLORADO

Colorado drivers encounter a variety of traffic difficulties, from rush-hour congestion to heavy snow and wind to roaming wildlife. Finding better ways to address these challenges is the goal of the Colorado Department of Transportation (CDOT) as it explores new technologies and the wealth of data they offer.

"Drivers expect the roads and transportation systems to be efficient, quick and safe," says Bob Fifer, CDOT Acting Branch Manager for Intelligent Transportation Systems. "This expectation means our department needs the ability to collect data that helps drivers make decisions. We also need data to help us detect an incident as soon as it happens so we can dispatch the right people and resources to take care of it and restore traffic quickly."

CDOT has already deployed or is actively exploring various ITS technologies that are bringing benefits to the state. For example, automated analysis of video camera streams sends alerts to the CDOT command center when it appears a vehicle has gone off the road. The alert information and video capture helps incident teams identify the type of tow truck or rescue apparatus needed, enabling a faster, more effective and cost-efficient response.

Data from video cameras and road sensors along a mountainous stretch of I-70 also provides better information to detect congestion and problems caused by weather, accidents or high traffic volumes. Infrared technology that detects and alerts drivers to the presence of animals may help reduce vehicle and wildlife crashes that often block the only road in a rural area. And smart traffic cone technology in construction zones uses the CDOT network to send alerts to roadside digital signs and in-vehicle displays.

Finally, CDOT is planning an adaptive signal technology trial to better manage the flow through busy intersections. This technology allows cross-traffic to travel in the gaps between "platoons" or groupings of vehicles on a primary road, reducing overall congestion.

All of these technology implementations are guided by the department's 10-year, statewide Smart Mobility Plan.

"We developed this plan in cooperation with local and regional transportation planning boards, local government consortia and regional

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transportation engineers to obtain input on which technologies would be the most beneficial in each area," says Fifer. "As a result, the plan also helps local and regional agencies make better technology decisions for their own needs and challenges."

THE COLORADO NETWORK AND DATA DESIGN

The CDOT fiber network is critical to enable ITS innovation throughout the state. This network currently extends 1,400 miles, although expansion will continue to eventually achieve statewide coverage. For network connectivity and management, CDOT uses optical transport and Ethernet switching solutions from Ciena.

The I-70 portion of the network positions the department to begin testing communications for connected vehicles by placing radios in the CDOT fleet.

"Initially, we'll use these radios only to transmit information about vehicle status and behavior, such as slipping tires that might indicate an icy road," says Fifer. "In the future, we will send information to these radios about incidents and road conditions that will give drivers better situational awareness. This communication will also help us prepare for two-way information exchange with autonomous vehicles."

CDOT is storing all collected data in the cloud, so it will be easier to access via analytics tools. Cloud storage will also allow local governments to access and benefit from the data. For example, local public works, public safety and traffic management employees can obtain information from towns already impacted by an arriving storm.

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BUILDING THE ITS FOUNDATION

The evolution to intelligent transportation will be a lengthy effort for most governments. Based on experience in Colorado and other areas, the following recommendations can make the process easier.

Prepare the network. A broadband, fiber-optic network with routes and connectivity points along key streets and highways is essential. To accommodate all the real-time data generated by ITS technologies, this network will need adequate fiber bandwidth and capacity in the multiplexing systems.

"Bandwidth will become even more important as more smart cars, generating more data, come onto the road," says Keith Glose, Account Director–SLED for CenturyLink.

It's important to architect the network to support adaptable connectivity for new and diverse devices, services, users, applications and data. Another consideration for network design includes the ability to connect with remote devices that have their own data storage and computing capabilities. It's also important to support device and system connectivity across jurisdictions.

"Transportation managers are concerned about how much communication they'll need with autonomous vehicles as well as thousands of sensors and base stations on the road," says Mark Jencks, Sales Director of Partner Business Development & Strategy for the CenturyLink Global Account Team. "The future of transportation requires a network that is highly reliable, available and scalable, and has the ability to handle applications that haven't been invented yet."

Deploying fiber-optic transport with Ethernet switching as core technologies enable governments to create a modern, flexible and scalable network that also supports migration from a legacy network. Ciena packet-optical platforms cost-effectively deliver both existing

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and emerging services across the network from access to backbone. The Ciena carrier-class Ethernet switch platform delivers the capacity, reliability and quality-of-service capabilities (QoS) needed to support high-bandwidth, real-time data and applications.

Streamline data access and storage. Take advantage of cloud, virtualization and other new technologies to streamline IT operations for storing and managing transportation data. Cloud applications and infrastructure can also support gradual migration from a government’s legacy systems and networks.

Make use of the new data. “With enough historical data, you can run analyses and use machine learning technology that help you predict patterns and issues so you can develop proactive responses,” says Fifer. “For example, video or sensor analytics can detect the number of trucks hauling heavy loads, which will help us predict road wear and when repaving will be needed.”

Develop plans as a cooperative effort. “Each locality, region and state has different needs, so an important strategy is to look at where your biggest problems are and focus on using technology to solve those first,” says Chip Swisher, Smart Solutions Practice Director for CenturyLink.

Engage with the community and motorists to obtain input and buy-in with transportation plans, including the collection and use of more data. Showing the value to motorists, such as better traffic flows and information for navigation apps and in-vehicle systems, can help garner support of ITS plans.

Expect culture change. Fifer indicates that technologies are developing and changing fast, and transportation departments may not be accustomed to that pace. He recommends conducting pilot projects to test a few units of a particular technology, then moving on quickly to another choice if that test is not successful.

“Choose the outcome you want first, then find the technology that best gets you there,” he says. “When trialing technology, be open to failing the technology fast if it isn’t achieving the desired outcomes, as it is more expensive to continue to force it to work than failing it and moving on to another technology or vendor.”

KEEP AN EYE ON THE FUTURE, BUT ACT FOR TODAY

Certainly, it’s important to plan for future technologies such as autonomous vehicles. Yet the planning effort shouldn’t overlook the benefits to be gained from the improved network and ITS technologies that are available today.

As Colorado’s Fifer notes, “Technology is cheaper than widening a road, plus both government and citizens get the benefits of improvements in transportation operations now.”

This piece was developed and written by the Center for Digital Government Content Studio, with information and input from Ciena and CenturyLink.

Endnotes:

1. http://www.govtech.com/fs/Detroits-Smart-Intersections-Which-Can-Update-Like-Smartphones-Could-Save-Lives.html
2. http://www.govtech.com/fs/automation/Las-Vegas-Partners-with-NTT-to-Study-IoT-Impact-on-transportation.html

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