



Photo: USDOT

## Smart highways reduce congestion and save lives

Next generation Intelligent Transportation Systems (ITS) can reduce congestion, pollution, and speeding drivers, and help get goods safely to their destination.

White Paper

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Alcatel·Lucent   
Enterprise

## Today's congestion costs the economy and the environment

Across the U.S., state transportation departments struggle with their mission to provide safe, economical and effective transportation in the face of increasing traffic. Over the past 30 years, public road use has increased approximately 95 percent, while the number of lane miles increased by only nine percent (Source: <https://www.pcb.its.dot.gov/eprimer/module1.aspx#fn1>). The resulting congestion and gridlock, especially in the country's busy metropolitan areas and high traffic corridors, has a significant impact on the American economy and environment.

By 2030 traffic congestion will cost the U.S. \$187 billion USD annually, according to a 2013 study conducted by The Center for Economics and Business Research and INRIX. The cumulative cost over the 17-year period (2013–2030) is projected to be \$2.8 trillion – the same amount Americans collectively paid in U.S. taxes in 2014.

Traffic congestion also impacts the environment by increasing pollution as drivers slow down, speed up and idle. Emissions are much higher in these conditions than when vehicles move along at a steady speed. A Harvard Center for Risk Analysis study of 83 U.S. cities estimates that by 2030 emissions caused by traffic congestion could result in 1,900 premature deaths and \$17 billion in social costs annually.

## It's also about saving lives

While reducing traffic congestion can smooth traffic and speed people and goods to their destinations, ultimately, reducing accidents and saving lives is the top goal of every transportation agency and department. The European Union's "Vision Zero" initiative has a target of 50% reduction in fatalities and serious injuries by 2030, while the U.S. state Departments of Transportation (DOT) have similar programs to eliminate fatalities including the "Road to Zero" coalition between the U.S. DOT and the National Safety Council.

## ITS can reduce congestion, save lives and enhance infrastructure investments

The good news is that developments in ITS, the Internet of Things (IoT), Artificial Intelligence (AI) and advances in exciting areas such as driverless cars and vehicle-to-vehicle (V2V) communication will help alleviate congestion, reduce accidents and increase safety. As states struggle to balance funding priorities, including transportation, ITS technology and the emerging IoT ecosystem can enhance investments in transportation infrastructure, which is critical to the economic and social fabric of the U.S. and safe travel.

For example, active traffic management, which includes advance notice about traffic conditions to motorists using variable speed limits, lane management signs and overhead message signs, has reduced collisions and congestion in the Seattle I-5 corridor. Similar initiatives are emerging elsewhere. Around the world the ITS ecosystem is making a difference.

Hangzhou, a city in China with a metropolitan population of nearly 23 million, was the country's fifth most congested city. Using big data, IoT, and machine learning, the city was able to manage the flow of traffic by adjusting traffic lights and signage in response to real-time needs. Traffic now moves 11% faster, and emergency response times have been cut in half.



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These are just some of the capabilities that the next generation ITS ecosystem is beginning to deliver today. And the future is even brighter with vehicles, sensors, cameras and other devices connected to each other and to the infrastructure. Drivers will get timely and accurate transportation condition information on their phones before their journey including route suggestions, predicted travel time, and public transportation alternatives. Updates will occur during the journey and will present themselves in the Infotainment system of the vehicle. Signage and signaling will adjust in real-time to traffic volume, weather conditions and other incidents, alleviating congestion and speeding drivers and getting goods safely to their destination.

Imagine [connected vehicles](#) talking with each other and to people to provide up-to-the-minute conditions on the road ahead and sharing this information with connected highways to update signage, alert traffic control centers, and provide individuals with public transit options and information.

We have barely scratched the surface of what will be possible thanks to advancements in analytics and AI. The future is bright if we are serious about laying the proper infrastructure foundation to take advantage of emerging technology.

## The ITS “rubber meets the road” at the network edge

The proliferation of Connected Autonomous Vehicles (CAV) and advancements in safety that result from the technological innovations that are underway will be visible for all to see. These are outcomes that require transforming the existing foundation upon which ITS is built. Integrating the devices and systems that enable the ITS ecosystem to function demands fast, reliable and secure connections. Transportation data networks must be IoT aware to seamlessly connect sensors, cameras, signage and traffic control systems together. A vital part of these networks is at the edge, in remote roadside cabinets or at intersections. It is here that critical information, such as weather, video feeds, road conditions and collisions, is gathered and then relayed to operation centers and control systems and in some cases to drivers.

The challenge for many state DOTs is that the Ethernet switches currently deployed at the edge of their networks are not up to the task. They cannot provide enough power to cameras and sensors and they use older protocols such as Spanning Tree, which has limitations in failover speed, scalability, flexibility, and in the constricted usage of valuable fiber optic connection assets. Most of the switches presently deployed are not IoT-ready and do not support the advanced protocols, automation features, and intelligent traffic separation suitable to accommodate the needs of emerging ITS technologies.

Network management in many instances is relatively primitive at best and is not able to provide in-depth monitoring and controlling of switch and other endpoint assets such as sensors, information displays and cameras. Because remote configuration and device management are limited, reconfiguration or addressing fault conditions often requires an expensive and time-consuming technician visit to geographically remote sites to fix issues that could have been addressed from the Network Operations Center (NOC).

“Access to data is a critical enabler for the safe, efficient, and accessible integration of Automated Vehicles (AV) into the transportation system. Lack of access to data could impede AV integration and delay their safe introduction.”

U.S. Department of Transportation (U.S. DOT)

## Delivering a fast, secure and reliable edge for next generation ITS

Alcatel-Lucent Enterprise provides IoT ready network technology that enables state DOTs to get the most from next generation ITS to accomplish their missions. The recently extended hardened Ethernet switches, including the [Alcatel-Lucent OmniSwitch® 6865 Hardened Ethernet Switch](#), were designed to run in harsh environments and provide cost effective, worry-free set up and management, especially for challenging network edge environments on roads and highways.



This high-performance 10 gigabit switch provides 75 watts of power to each port, more than enough to connect cameras, digital signage, sensors, wireless access points, and more. Configuration provisioning is seamless and ongoing operational overhead is minimized by an extremely sophisticated monitoring and configuration tool, the [Alcatel-Lucent OmniVista® 2500 Network Management System \(NMS\)](#), which enables the management of both ALE switches and third-party SNMP devices. [Shortest Path Bridging \(SPB-M\)](#), ideally suited to IoT environments, which are at the heart of advanced ITS networks, provides a resilient network that is easily provisioned, can grow quickly, and reliably carries critical data to where it needs to go on a predictable, consistent basis. This not only means the network can quickly heal itself, it could make the difference in saving a life.

Cybersecurity is also vitally important to protect data and the integrity of the network. The ALE solution uses secure diversified code to improve network integrity and provide added security against network cyber-attacks. Secure diversified code protects networks from intrinsic vulnerabilities, code exploits, malware and potential back doors that could compromise mission-critical operations. ALE also provides finger printing for IoT to identify each device, including vehicles, sensors and cameras to ensure they do not pose a security threat to the DOT network. The ALE in-depth security strategy has received the highest levels of certification from governmental agencies, including Common Criteria (EAL2 and NDcPP), JITC, FIPS 140-2 and NIST.

ALE further enhances the reliability of the DOT network by integrating the Alcatel-Lucent Rainbow™ Communications Platform-as-a-Service (CPaaS) with the network, enabling DOT employees to be sent alerts via phones, tablets and laptops, about events and alarms in the remote roadside data cabinets. DOT employees can quickly chat and collaborate to solve problems and save valuable time.



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While technology and quality are important, so are knowledge, skills and experience. The ALE teams of engineers and technicians provide an unequalled level of partnership and support that ensures the customer and mission are at the center of every design, sale and installation. The combination of partnership and leading-edge products is why the Nevada Department of Transportation (NDOT) chose Alcatel-Lucent Enterprise to enable the state's next generation ITS.

## **Nevada DOT – helping drivers stay safe with ITS**

Looking to the future, NDOT wanted to lay the right foundation for its next generation ITS to make it easier to connect and manage the growing mesh of IoT devices on the state's highways. The objective was to increase safety on the state's roads by offering drivers real-time information on road, traffic and weather conditions. NDOT required a network, especially at the edge, that could withstand harsh weather conditions, support SPB and be remotely managed.

ALE was chosen because it could deliver the products that met NDOT's stringent requirements and support NDOT as a partner through every phase of the process. The OS6865 provided the reliability and resiliency demanded in the harsh conditions at the edge of the network. The switch can be remotely managed, power IoT devices and even support monitoring and rebooting of the devices. This generated a big savings for NDOT in both time and money, freeing up personnel to focus on other critical tasks. Because the OS6865 supports SPB, the IT team can create a scalable network and quickly roll out new devices, services and applications.

“The new solution makes it simpler to provide the best services throughout the 25 billion miles traveled by our road users annually, providing the right information for safe travel and ultimately reducing the time spent on the road. ALE went above and beyond throughout the entire process.”

Gary Molnar, ITS Network Manager,  
Nevada Department of Transportation

NDOT is not alone in its adoption of the OS6865 hardened Ethernet switch, a platform that has become an integral part of deployments by Michigan DOT and Oklahoma DOT as well.

## **Enabling a brighter transportation future**

The challenges of saving lives, managing congestion and furthering economic development are high priorities of State DOTs across the U.S. Next generation ITS will be at the heart of meeting these challenges and helping states make the best use of their transportation infrastructure dollars. While it may not always be practical or feasible to increase lane miles across the country, the ability to use ITS to innovatively and cost effectively address demand and congestion offers a future of safer travel, zero fatalities, strong economic growth and a high quality of life. ALE stands ready to help enable this future through its people, innovation and spirit of service.