



California Department of Transportation District 11 Traffic Management Center Drives Its **Intelligent Transportation System** into the 21st Century

Customer View

“The deployment of this project was viewed as an opportunity to provide a network infrastructure that would include CalTrans field elements. We were able to capitalize on the advantages of using IP-based communications, and now have a solution that is scalable, manageable, and provides an elegant integration path to future technologies.”

— Ernie Fermin, P.E., CalTrans Communications Support

As owner and operator of the 15,000-mile California State Highway System, the California Department of Transportation (CalTrans) is responsible for ensuring that drivers get where they need to go as quickly and as safely as possible. The almost 75 percent increase in traffic congestion on California’s roadways in the past seven years has put more pressure on CalTrans networked solutions and strained its networks. CalTrans looked to Cisco Systems® to help develop a solution to the aging and inadequate traffic monitoring infrastructure.

Background

In 1996, the Federal Highway Commission made an offer to Departments of Transportation (DOTs) across the United States. The Commission would pay a majority of the costs for any city that implemented an Intelligent Transportation System (ITS) designed to enhance traffic flow, increase safety, and reduce time spent on the road. DOTs nationwide began investing in solutions, including Asynchronous Transfer Mode (ATM) switching infrastructure and Integrated Services Digital Network (ISDN) technology. Using video cameras installed at strategic locations along the roadways, this solution helped the DOTs monitor and react to traffic flow.

Typically, these solutions were standalone analog systems with minimal communications capabilities that offered little flexibility. Today, transportation departments recognize the need for integration and are looking at networked ITS solutions that will enable

communication and share current information about congestion, weather, accidents, and other traffic problems.

Challenge

Headquartered in Sacramento, CalTrans is responsible for operational improvements that include projects associated with the Transportation Management Center (TMC). These projects encompass field elements such as fiber communications, Ramp Meters (RMS), Closed-Circuit Cameras (CCTV), Changeable Message Signs (CMS), Loop Detectors, Highway Advisory Radio (HAR), and Microwave Vehicle Detection Systems (MVDS). To improve traffic flow, CalTrans, in cooperation with the California Highway Patrol, helps coordinate the operations of the Freeway Service Patrol during peak traffic periods by assisting motorists through the removal of disabled vehicles and vehicles involved in minor accidents on the freeways.

In the past, CalTrans had used everything from one-pair dial to ATM and Sonet networks throughout its various TMC infrastructure solutions to monitor freeway cameras and capture field element data. The ATM solutions, however, were expensive and somewhat inflexible in an ever-changing environment. In addition, dial and ISDN were too slow and unreliable to offer the higher quality video images required to manage the volume of traffic on the roadways today.

During the past seven years, traffic on California's roadways has increased almost 75 percent, while road infrastructure has expanded only about 1 percent, leading to gridlock on some freeways during peak traffic hours. CalTrans needed to increase the quality of the video pictures and expand the field elements of the solution that enable them to monitor traffic, weather, accidents, and other situations. This scalability would help to quickly assess any given situation and make decisions to reroute or take other actions to improve traffic flow.

The CalTrans team looked at several alternatives, including the possibility of upgrading the existing ATM infrastructure or moving to an IP solution. "After CalTrans conducted an internal ROI analysis on the IP vs. ATM solutions, they concluded that the IP solution offered by Cisco would result with about a 30 percent cost savings over a similar ATM solution," says James Delia, Cisco Major Account Manager. "And the technology would produce comparable picture quality, higher speed, and greater flexibility."

Solution

CalTrans identified three key field elements that were critical to the success of this initiative: changeable message signs, ramp metering systems, and video surveillance. To achieve this vision, the new Cisco IP solution successfully integrated a pre-existing heterogeneous ITS infrastructure that encompasses a secure, unified, standards-based communications foundation. With this new foundation, future ITS solutions, such as wireless communications and IP telephony, can be consolidated across CalTrans' traffic operations network.

The infrastructure consists of Cisco Catalyst® 6509/6513s and 2948L3 switches connected to CalTrans' existing fiber network. The Cisco Catalyst 6509 Series switches are deployed at the farthest distribution points of the region and connected back to the TMC core Catalyst 6513 location. The Cisco team conducted a proof of concept test that consisted of 22 sites, replacing the existing ATM infrastructure with IP Encoders/Decoders, and connecting the media converters to the fiber and across to the Cisco 6500 Series switches. The foundation now enables more than 100 IP Encoded Analog Video Cameras, which will eventually increase to over 500. Over the next three to five years, Cisco 6500 Series switches will be installed in each of the ten District 11 distribution hubs.

"The Cisco solution had most of the components required to accomplish our goals," says Ernie Fermin, P.E., CalTrans Communications Support. "The network management tools and scalability of the equipment has provided us with numerous advantages."

Results

CalTrans' new ITS solution is more stable, reliable, and flexible. By lowering its equipment and operating costs, CalTrans has achieved greater operational efficiency. "The new infrastructure allows us to run the system with fewer people," Fermin says. "And the amount of space required for equipment that delivers services is small, compared to other alternatives. We're now able to offer the same services with less space and provide our customers with seamless service."

- **Better Access to Data**—Networked Field Elements enable CalTrans immediate access to data and the ability to respond to the situations in real-time.
- **Enhanced security**—By controlling the network perimeter both on the roadway and in the operations center, Cisco Cyber Security embeds security throughout the entire network, a strategy that has proven to be more effective than standalone point solutions. These safeguards protect critical data and keep traffic operations running smoothly.
- **Cost-effective infrastructure**—A converged network allows CalTrans to use the same network for Video Surveillance, Traffic Telemetry, Data, and Voice communications while offering high reliability, even in the event of a disaster.
- **Operational efficiencies**—Electronic fare payment typically results in increased revenue of up to 30 percent, due to fewer toll evasions, and at the same time improves capacity by 200 to 300 percent when compared to attended lanes.
- **Driver benefits**—Advanced traffic surveillance and signal control systems result in travel time improvements of up to 25 percent. Freeway management systems have reduced crashes by up to 50 percent and can handle 8 to 22 percent more traffic at speeds 13 to 48 percent faster than preexisting congested conditions. Incident management programs can reduce delays associated with incident-related congestion by 10 to 45 percent.

Networked video surveillance provides visual information that enables both CalTrans and the California Highway Patrol to make effective real-time transportation management decisions. "We are able to share information more quickly with our local partners," Fermin says, adding that even the local news stations have broadcast the video images that CalTrans provides to them. "This has benefited the traveling public because they can make better informed decisions about their travel."

Next Steps

Wireless solutions are next on CalTrans' radar screen to enable untethered network access anywhere, anytime, and to provide communications even in tunnels and on bridges, where fiber cannot be installed. Emergency response employees will be able to send and receive information from the site of an incident, and highway workers will be able to immediately communicate updates on road conditions.

The Cisco team is beginning to implement proof-of-concept tests at 12 sites in Central California. "We're installing fog sensors and MVDS detectors, which transmit weather conditions and vehicle counts respectively, to a nearby Cisco wireless LAN BR350 Bridge," Delia says. "From there, the data is brought back to a TMC. If we have a line of sight, pole-to-pole, we can get up to a 20-mile range with each bridge link."



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