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I-70 Glenwood Canyon Corridor Colorado Department of Transportation (CDOT)

CDOT Implements Dual Variable Speed Limits to Reduce Accidents

The twelve-mile Glenwood Canyon portion of I-70, completed in 1992, is an engineering marvel that took twelve years and \$490M to complete. One of the biggest challenges was how to replace a two-lane highway located within the narrow canyon, and followed the course a historic wagon trail, with a four-lane Interstate – all with minimal environmental impact. The solution was to elevate one section of the Interstate over the other. The majority of I-70 eastbound lanes are cantilevered over the Colorado River. In contrast, most of the westbound lanes are suspended over the eastbound lanes, and a viaduct, just a few feet above the canyon floor. Through the canyon, the Interstate hugs the north bank of the Colorado River, while the Union Pacific Railroad runs along the south canyon wall.

The Colorado Department of Transportation (CDOT) has a command center located inside the Hanging Lake tunnel (within the canyon) to monitor the flow of traffic, weather conditions, road obstructions, and accidents. CDOT's safety assessment revealed that the Glenwood Canyon corridor is prone to a high number of crashes involving fixed objects, especially during inclement weather.

Variable Conditions, Variable Speeds

Mountain road conditions can change in the blink of an eye. During the summer, a sudden downpour can generate mudslides or even deposit giant boulders onto the roadway. Rain can turn to ice. And blizzard conditions can hit with little notice. Those road conditions - along with maintenance activities and construction - can delay traffic and cause accidents.

A 2011 CDOT speed study revealed that traffic throughout the canyon demonstrated a speed differential of approximately 10 mph between passenger vehicles and commercial vehicles. Considering the grades and curves through Glenwood Canyon, CDOT determined 50 mph as a safe speed for commercial vehicles greater than 26,000 GVWR and 60 mph for cars. When there is an accident, adverse weather conditions, or construction, CDOT lowers the speed limits, keeping passenger and commercial vehicle speed limits the same.

Goals for the CDOT project along the Glenwood Canyon corridor were to:

- Warn drivers of adverse conditions, thus generating a safer traffic flow to decrease accidents in the canyon.
- Increase the standard speed limit during suitable conditions to 60 mph compared to 50 mph in most areas of the canyon.
- Lower the speed limit to assist with incident management, conditions created by inclement weather, or maintenance and construction.



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Customized Solution

Variable Speed Limit Project Elements

To support the variable speed limit goals, the project required enhancing CDOT's Intelligent Transportation Systems (ITS) infrastructure - including the installation of LED variable speed limit (VSL) signs along I-70 in the Glenwood Canyon corridor. Specific enhancements include:

- Installing

- 17 new Skyline Products LED full-color, dualspeed, variable speed limit signs
- Three weather stations for live monitoring and reporting of weather conditions
- 73 standard static signs
- Nine closed-circuit cameras for live monitoring and viewing of roadway conditions
- Replacing five single variable speed limit signs
- Removing 38 existing static signs

- Adding other surface and subsurface conduit, and related improvements to guide the display of the variable speed limits

Customized Full-Color, Dual Speed Signs

CDOT personnel continuously monitor I-70 along Glenwood Canyon and adjusts speeds based on current road conditions, weather, accidents, maintenance activities, and construction. The project required a variable, dual-speed, full-color sign – the top of which displays two digits for cars and below that, two digits for trucks over 26k GVWR . Most standard, off-the-shelf VSL signs show only one speed.

By using Skyline's design-build process, CDOT had the freedom to specify unique needs and requirements for the project. Skyline then designed, engineered, and built a tailored solution that thoroughly addressed CDOT's specifications – including a single, 10' tall housing that protects the sign and provides a sleek presentation.

Harsh, corrosive, roadside environments can destroy electronic signs. Skyline signs are engineered to the most extreme standards – incorporating governmentgrade specifications and military-grade materials – to provide CDOT durable, ITS-grade signs that can last up to 20 years.



Skyline VSL Signs

Features

- Fully NTCIP, NEMA TS4, AASHTO, and MUTCD compliant
- Message Display Verification[™] feedback: WYSIWYG+
- Front access
- NEMA 3R Cabinet Rating
- Operating temperature range -40 degrees C to +74 degrees C
- Configurable for coordinated movements or individual movements depending on the direction
- Local or remote control and programming via hardwire, telephone, fiberoptics, wireless, or cellular modem
- ITS-grade[®] durability and reliability
- ISO9001:2015 certified manufacturing

Available technologies

- LED: Auto-dimming, 256 brightness levels, and fully Programmable speeds
- Scrolling Film: Retro-reflective background and up to seven custom speed limits



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Robust Sign Feedback and Remote Diagnostics

Sign Feedback and Diagnostics

With thousands of motorists traveling through the Glenwood Canyon corridor daily, assurance that the signs are operating as desired is critical. Skyline's EnvoyDMS software module provides robust, remote feedback capabilities to CDOT – giving staff the confidence that speed limits sent to the signs posted accurately.

Additionally, Skyline's Message Display Verification[™] feedback software measures each LED string and reports any errors to the CDOT staff in an easy-to-see visual representation.

If a VSL sign does experience a failure, the CDOT staff can remotely diagnose the problem and provide the maintenance crew everything they need to know, including required parts, before they get to the malfunctioning sign. The system will even notify staff of possible failures – giving staff time to provide required maintenance before a failure occurs. These diagnostics are particularly crucial in the canyon, where the maintenance crews must close a lane to work on a sign. Remotely diagnosing the problem and determining the required parts minimizes the crew's exposure to just one trip.

The Results

At the time of publishing this case study, September 2020, CDOT had concluded initial testing and went live with the system. Moving forward, the CDOT team will collect at least one year of data to determine the project's effectiveness and evaluate if the variable speed limits help meet their goal to reduce accidents in the Glenwood Canyon corridor.

Regarding their experience with Skyline Products, CDOT Project Engineer Mike Curtis shared, "The entire Skyline Products team was great to work with - including the sales staff, design group, and installation crew. We received excellent customer service during the installation, testing, and configuration of the VSL signs."



