Nevada DOT High Wind Warning System

The Nevada Department of Transportation (DOT) operates a high wind warning system on a seven-mile (11-kilometer) section of US Route 395. This highway segment, which is located in the Washoe Valley between Carson City and Reno, often experiences very high crosswinds (up to 70 mph or 113 kph) that pose risks to high-profile vehicles. The system provides drivers with advanced warning of high wind conditions and prohibits travel of designated vehicles during severe crosswinds.

System Components: An Environmental Sensor Station (ESS) is installed on the highway to collect and transmit environmental data to a central control computer in the Traffic Operations Center. The ESS measures wind speed and direction, precipitation type and rate, air temperature and humidity, as well as pavement temperature and condition (i.e., wet, snow or ice). During high wind conditions advisory or regulatory messages are displayed on Dynamic Message Signs (DMS) located at each end of the valley. Traffic managers may also broadcast pre-recorded messages via three Highway Advisory Radio transmitters in the area.

High Wind Warning on DMS

System Operations: The central control computer polls the ESS every ten minutes to compare average wind speeds and maximum wind gust speeds to preestablished threshold values. If the average speed exceeds 15 mph (or 24 kph) or the maximum wind gust is over 20 mph (or 32 kph) the computer prompts display of messages as shown in the table below. This is accomplished through an interface with a DMS computer, which runs proprietary software to control the roadside signs. Roadway access to high-profile vehicles is restricted when winds are extreme. Static signs identify critical vehicle profiles and direct specified vehicles to exit the highway and travel on an alternate route when "PROHIBITED" messages are displayed.

Nevada DOT High Wind Warning System Messages

Conditions		Displayed Messages
Average Wind Speeds	**Maximum Wind Gust Speeds**	
15 mph to 30 mph	20 mph to 40 mph	High-profile vehicles "NOT ADVISED"
Greater than 30 mph (48 kph)	Greater than 40 mph (or 64 kph)	High-profile vehicles "PROHIBITED"

Transportation Outcome: Dissemination of traveler information and access restriction have enhanced safety by significantly reducing high-profile vehicle crashes caused by instability in high winds.

Implementation Issues: In the early 1980s the first high wind warning system was constructed on US Route 395. It was comprised of an anemometer (or wind speed sensor), message signs, a relay, and a timer. Because this legacy system needed extensive repairs, it was replaced in the 1990s. A solar-powered ESS was installed in place of the anemometer and relay components, and each message sign was substituted with a DMS.

While developing equipment requirements and operational procedures for the system upgrade, the DOT worked with the University of Nevada to determine warning threshold values. The University analyzed the stability of various vehicle profiles, configurations, and loadings to calculate critical wind speeds (i.e., sufficient speeds to blow vehicles over).

In 1996 the DOT's statewide telephone communication system and Very High Frequency radio network were replaced with a digital, wireless radio communication system. A Wide Area Network (WAN) facilitated the integration of voice, video, and data using open system protocols. The WAN also allowed dissemination of traveler information via the Internet (*www.nvroads.com)* and through telephone systems (*1-877-NVROADS*) with interactive voice response technologies. The computing and communication networks were designed with the flexibility to easily incorporate new technologies or components.

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Keywords: wind, high-profile vehicles, high wind warning system, freeway management, traffic management, control strategy, access restriction, advisory strategy, traveler information, internet/website, environmental sensor station (ESS), dynamic message signs (DMS), highway advisory radio (HAR), safety