# RESEARCH PAYS OFF

# Nevada's Winter Strategy Keeps Roads and Environment Clean

One of the most frequently visited areas in Nevada is the Lake Tahoe Basin. Visitors to this region expect a high level of service from Nevada's transportation network during the summer and winter seasons. Because many winter visitors do not have much experience with driving on snow- and ice-covered roadways, the Nevada Department of Transportation strives to maintain a safe driving surface during winter storms to help avoid delays. The natural beauty of the Lake Tahoe Basin, however, poses environmental concerns that demand special attention when abrasives and chemicals are used during snow- and ice-control operations.

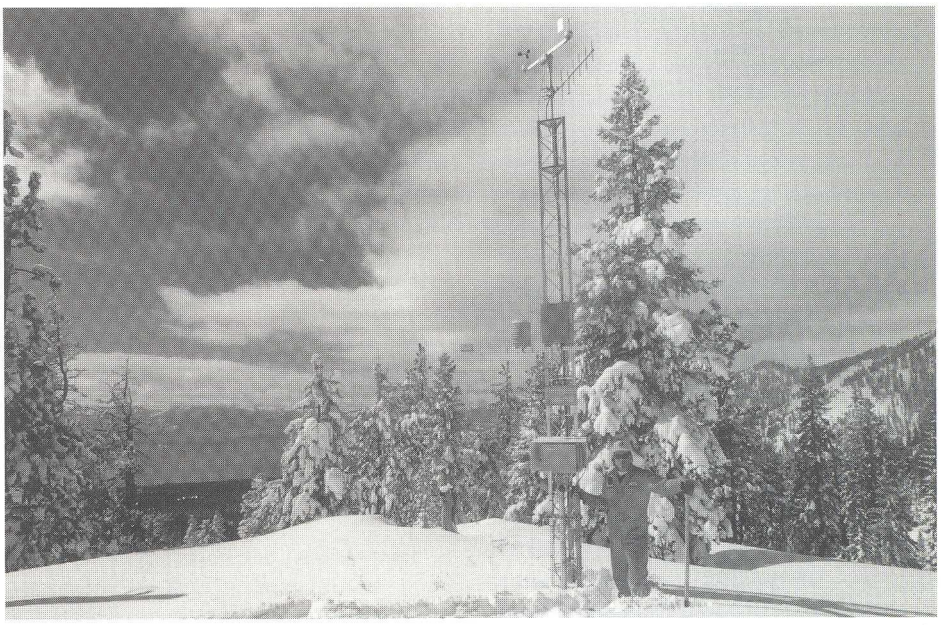
## Problem

In 1989 concern was expressed about the declining condition of the forest in the Lake Tahoe Basin. In response to this environmental concern, NDOT attempted to identify the probable causes. Salt used in winter maintenance was identified as a contributor to the problem. In addition, sand used as an abrasive was identified as a potential source of particulate matter in the air. NDOT needed to develop a winter maintenance strategy that would balance the safety requirements of the traveling public against the environmental needs of the Lake Tahoe Basin.

NDOT's goal was to provide roadways cleared as close to bare pavement as possible while preserving the environment for tourists and Nevadans to enjoy. The fragile alpine environment of the Lake Tahoe Basin with its winding two-lane mountain highways presented an unusual winter maintenance challenge.

## Solution

A Road Weather Information System (RWIS) consisting of two remote weather stations was installed in the Reno area to test its effectiveness in predicting icing



Project engineer stands beside remote weather station used to predict icing conditions in Lake Tahoe Basin area, Nevada.

conditions on bridge decks. Application of this system was considered appropriate in a test program on the use of deicing chemicals on US-395 north of Reno. If the techniques proved effective, they could be recommended for use in the Lake Tahoe Basin.

At the same time the results of the Strategic Highway Research Program's snow and ice control research encouraged states to participate in projects using anti-icing techniques. NDOT made use of this opportunity and blended these efforts to develop a more effective winter maintenance strategy.

## Application

Anti-icing is the application of a chemical to the pavement surface just before the start of a snowstorm. This procedure has been proven to keep the pavement from icing during short-duration storms and makes it easier to remove snow and ice that does accumulate. On the basis of weather information received, which includes data on intensity, duration, and character of storms, overall winter maintenance strategies are developed several days in advance of a storm. As a storm approaches, pavement condition forecasts provided by RWIS are monitored to determine the potential for icing conditions and used to fine-tune the site-specific strategy. Approximately two hours before pavement icing, the anti-icing chemical application equipment is readied. When the pavement temperature reaches 33° to 35° Fahrenheit (1° to 2°Celsius) in the presence of moisture, the first application of the liquid chemical is made. The pavement surface condition is monitored to ensure that the applied chemical remains effective. If conditions warrant, reapplications are made. Under extreme conditions, conventional chemicals (salt) and abrasives (sand) are used to ensure safety for motorists.

During the first season of testing, weather forecasters predicted a storm for the Reno area, but RWIS indicated that no icing conditions were expected. Maintenance crews did not apply chemicals to the US-395 northbound lanes but applied approximately 5200 kg (11,400 lb) of salt and sand to the 20 km (12.4 ml) of the southbound lanes. No difference in the condition of the driving surfaces of the north- and southbound lanes was noted. During the next storm, the anti-icing strategy was used because RWIS indicated that pavement icing conditions would exist. The 20 km of northbound lanes received approximately 600 kg (1,300 lb) of anti-icing chemical. The southbound lanes received 24 000 kg (52,800 lb) of salt and sand. The pavement condition of the northbound lanes was slightly better during the storm. The time and effort required to clear the snow from the roadway were greatly reduced, indicating that NDOT's new winter maintenance strategy was effective. Continuation of this practice for the remaining storms of the season confirmed the benefits of using RWIS information.

Availability of RWIS and its acceptance by the maintenance crews were the two key ingredients of NDOT's successful winter maintenance strategy. Nevada has undertaken a phased project to construct an RWIS network of approximately 25 weather stations along the eastern Sierra Nevada covering the Lake Tahoe Basin and the major routes leading to the area.

## Benefit

RWIS technology has enabled NDOT to develop an effective winter maintenance strategy that has potential for saving significant amounts of money and providing motorists a safe driving surface without compromising the environmental quality of the Lake Tahoe Basin. The new strategy has enabled NDOT to reduce (*a*) the amount of chemicals used, ensuring minimal waste and effect on the environment; (*b*) the amount of abrasives used, improving air quality by decreasing particulate matter; and (*c*) manpower and equipment needs. In addition, intangible benefits accrue to motorists because of the reduction in accidents and delays, a reduction caused by improved communications with the public on road conditions.

NDOT has estimated the socioeconomic costs of alternative winter maintenance strategies for the next 25 years,


Motorist advisory variable sign on State Route 431, Lake Tahoe Basin area, Nevada.

taking into account costs to the agency, the environment, and motorists. The alternatives considered were to use chemicals with RWIS, avoid the use of chemicals, or make no change in current practice. The cost of using alternative chemicals or salt with RWIS was approximately $25 million; the option of avoidance of chemicals was the most expensive, costing $83 million. The cost of maintaining current practice was $32 million. NDOT has the potential for realizing a net savings of $7 million during the next 25 years by using current practice with RWIS technology.

*For further information contact Richard Nelson or Thor Dyson, Nevada Department of Transportation, 310 Galletti Way, Sparks, Nevada 89431 (telephone 702-688-1250).*

Suggestions for "Research Pays Off" topics are welcome. Contact G. P. Jayaprakash, Transportation Research Board, 2101 Constitution Avenue, N.W., Washington, D.C. 20418 (telephone 202-334-2952).