



## RESEARCH PAYS OFF

Blowing and drifting snow creates serious problems on Wyoming highways. Snow removal is becoming more expensive (\$10.2 million expended during 1983-1984 to clear 10,000 km of paved highways) as costs of equipment, labor, and fuel increase, while the safety of motorists is jeopardized by poor visibility and reduced traction on ice- or snow-covered roads. Road closures, particularly on the Interstate Highway System, delay travelers and cause significant economic losses resulting from the additional fuel required to reroute freight, the delay of critical shipments, and the spoilage of perishable foods.

**Problem** The need for improved snow-control methods became apparent in 1970 soon after the opening of a newly constructed section of Interstate 80, 124 km long, between Laramie and Walcott Junction in southeastern Wyoming. Because the new highway was in a sparsely populated region not previously traversed by highway or railroad, there was little previous knowledge of weather conditions. Installation of snow fences was not planned for this section of highway because it was thought that snow plows could provide adequate snow control. The first winter of operation, however, revealed excessive snow-removal costs owing to large drifts forming on the highway. Frequent ground blizzards caused poor visibility and required the highway to be closed to traffic for a total of 8.4 days.

As a result of the first winter's experience, highway engineers assigned high priority to the construction of snow fences to reduce the drifts that formed in road cuts. Although 2-m-tall snow fences have been used in Wyoming for more than 100 years, it was recognized that existing snow-fence criteria were inadequate to solve a snowdrifting problem of this magnitude.

**Solution** Because U.S. Forest Service scientists had been studying the use of snow fences to augment water supplies for more than 10 years, the Wyoming Highway Department requested their assistance in solving the problem on I-80. With \$20,000 provided by the Wyoming Highway Department, Dr. Ronald Tabler of the Rocky Mountain Forest and

# BLOWING SNOW — FENCING PARRIES WINTER'S THRUST



Range Experiment Station designed fences for the highest-priority sites using new criteria.

On the basis of Dr. Tabler's work, the amount of blowing snow arriving at the site of each snow-fence installation could be estimated from an equation relating the snow transfer coefficient, the transport distance, and the precipitation received over the contributing distance. Another equation made it possible to compute the cross-sectional area of the saturated lee drift behind a Wyoming State Highway Department standard plan fence.

Innovations included the use of tall (3.8-m) fences of a new design, and designing each fence system for a specific storage capacity based on upwind contributing distance (or "fetch"), mean winter precipitation, and natural snow retention over the fetch distance, taking into account the evaporation

from the blowing snow particles. Fences were carefully located to take advantage of the topography and to prevent drift encroachment on the road, and long fences (300 to 500 m) were used wherever possible. Special attention was given to the length of the fences to ensure that they would provide protection over the anticipated range of wind directions. Continuing studies of the I-80 snow fences have allowed all criteria to be thoroughly tested and refined.

**Application** Snow fences at a total cost of \$2 million have been installed on the initial problem section of Interstate 80. In addition, more than \$2 million have been spent for new snow fences on other highways in Wyoming. Other states applying the new snow fence engineering include Alaska, Arizona, Colorado, and Montana.

**Benefits** Documented benefits on Wyoming I-80 include a reduction in snow-removal costs of more than one-third, and a 70 percent reduction in accidents during blowing snow conditions. For a winter with average precipitation and 1980-1981 traffic volume, it is estimated that 54 accidents and 35 injuries would be prevented attributable to the improved visibility and road surface conditions in the areas protected by snow fences.

It is estimated that fence construction expenses are financed in full within 10 years through reduced winter maintenance costs and property damage.

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