

SNOW PROBLEMS ON MOUNTAIN HIGHWAYS IN WASHINGTON STATE

By

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It is recalled that seven years ago the writer had the privilege of appearing before your distinguished organization at Penticton, B. C. at the end of one of the roughest winters experienced during the past thirteen years. That winter we had extremely heavy snowfall in the Cascade Mountains, blizzards with 60 m.p.h. winds, hazardous avalanches crossing state highways. It is hoped that our Highway Department may enjoy another seven years of moderate to light winters as far as our cross-mountain highways are concerned.

Review of Problems in the Past

I would like to review the problems of winter maintenance of mountain highways for a few minutes. Problems are defined as the complete or partial closure of a highway or conditions likely to cause accidents with the possible loss of life or destruction of vehicles.

Let me list these problems, all having to do with snow or the result of snow in the order of their destructive effect to traffic on mountain highways:

1. Avalanches - Of the five major Cascade Mountain highways of Mt. Baker Lodge, Stevens Pass, Snoqualmie Pass, Cayuse Pass and White Pass, only White Pass does not have avalanche courses crossing the highway.
2. Highways washed out because of heavy run-off of snow due to phenomenal warm weather accompanied by Chinook winds and heavy rains.
3. Snow slides or sluffs, usually involving relatively small quantities of snow closing the highway temporarily.
4. Earth and rock slides caused by melting snow, because of unseasonal warm weather.
5. Excessively heavy snowfall, with high winds, that drifts faster than equipment can remove it.

Steps Taken to Prevent Problems

In order to prevent closure of east-west routes through the Cascade Mountains in Washington, the following steps have been taken:

I. Snoqualmie Pass

1. Constructed snow sheds where small avalanches or snow slides occurred most frequently. One snow shed 500 feet in length was constructed in 1950. A snow shed 1300 feet long, located 1.2 miles west of the summit of Snoqualmie Pass was also completed that year. Both of these sheds are reinforced concrete and will accommodate two 12-foot wide lanes. During periods of snow slides, traffic is diverted from four lanes into two through the sheds.

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2. Constructed a divided highway of four 12-foot lanes over the Pass area. Final Interstate 90 plans call for a divided four-lane facility between Seattle and Spokane. This construction has in effect solved the problem of complete closure of this route so that even though snow will still slide across two to three lanes of highway in places, traffic has been able to use the outer lanes with little delay. As a matter of record this highway has not been completely closed to traffic since November, 1959, when a combination of snow melted by Chinook winds and warming temperature, plus a heavy rain of cloud-burst proportion caused the south fork of the Snoqualmie River to reach a record peak. This caused debris to block a rather narrow channel in the river approximately 12.8 miles west of the Pass summit. The river found a new channel adjacent to the highway and in a few hours washed out all four lanes. After being closed 18 days, 19 hours and 28 minutes, traffic was re-established on a two-lane detour road bulldozed out of the mountain side above the washed out section. At one time this detour road was endangered by the erosion of the receding flood waters of the river. It may be of interest to you that the cost to repair this washout of Interstate 90 amounted to \$1,801,779.26. This included three contracts, four emergency force account contracts, Maintenance Division expenditures, and rights of way acquisition costs. One of the contracts, recently completed, enlarged the narrow channel of the river and the building of a diversion dam so that the river will not use the new channel it made for itself in 1959.

Our records indicate that during the 1956-57 winter or immediately before Snoqualmie Pass was completed to a four-lane facility, traffic was restricted to one lane or one-way traffic for a total of 1 day, 22 hours and 16 minutes because of earth and snow slides and traffic accidents.

When this total time for one year is compared to the one-way restrictions during the following five years of total of one hour and 45 minutes, it is realized the new construction has in part helped to solve one feature of mountain pass problems.

II. Stevens Pass

1. Widened Roadway - In 1961 the roadway from the summit to a point 2-1/2 miles east was widened from a 22-foot two-lane highway with 4 to 6-foot shoulders to four-12-foot lanes with a minimum of 10 foot shoulders. The purpose of this improvement was to provide additional roadside parking for vehicles, and lanes for slow moving trucks. Since widening, traffic has been delayed very little, if any, because of stalled vehicles. Widening of the highway on the east side is scheduled for completion in September, 1963. It is believed this improvement will not only provide additional roadside parking and truck lanes, but will make room for smaller snow slides or sluffs on the steep mountain side on the west side of Stevens Pass. Four of six potential avalanche courses cross the highway along this 2-1/2 mile section. If an avalanche evades detection of the avalanche control crew or a snow ledge is shot off by the department, it will be easier and less time-consuming to plow a lane along the outside of the roadway in order to re-establish the movement of traffic. It is believed the same advantages found with the wider section on Snoqualmie Pass will be realized on Stevens Pass.
2. Avalanche Control - For the past four years a system of avalanche control has been in effect on Stevens Pass. The procedure is to place, during the late summer, caches of sticks of dynamite in three places at the heads of the avalanche courses, or where "overhangs"

form. Next a party consisting of three to four young men, who are good skiers, are recruited usually from our district engineering personnel and given training by the U. S. Forest Service Ranger. When alerted by the U. S. Forest Service Snow Station at Stevens Pass, the crew is assembled as quickly as possible and they proceed to the upper ends of the avalanche courses. Next the Pass foreman located on the highway below is advised by walkie talkie radio of the location and to close the roadway to traffic. The foreman then places rotary plows and other equipment on each side of the avalanche course and when ready directs the crew on the mountain side to proceed with detonation of the dynamite. The shock of the explosion apparently shakes up or compacts the mass of snow with the result the snow slide is not as violent as compared to a natural slide. In many cases the snow mass does not reach the highway and hangs up along the avalanche path. In a few cases the past four years the snow mass has reached the highway the day following the detonation and has merely moved at a slow speed out onto the highway.

The use of a field rifle, similar to the one used in Colorado and elsewhere, was considered to control avalanches but since the head of the courses cannot be seen from the highway, this plan was abandoned. A field rifle is used by the U. S. Forest Service in avalanche control in the Ski Basin at Stevens Pass with good results. This method is less arduous, faster and, considering the labor involved, less expensive than the method used by the Highway Department.

- III. New and Heavy Duty Equipment - During the past seven years, the majority of snow removal equipment, including push plow trucks, sanding trucks, motor patrol patrol blades and rotary snow plows, has been "beefed up" with larger and more powerful units. Also we are in the process of specifying diesel engines in new replacement units for mountain pass work. In the past, probably half of the reasons for down time of trucks in snow removal work was ignition trouble. Since diesel engines do not use an ignition system, this trouble is eliminated. Diesel engines as manufactured today have more torque under heavy load, more flexibility of operating R.P.M.'s and less expensive to operate due to the differential in cost of diesel oil. Examples of this are the purchase of two 40,000 GVW, 4-wheel drive, 4-wheel steer with torque convertor units for tractors of rotary plow units for Stevens Pass in 1957. The power for the Sno-go rotary plow is also diesel. The six lighter 100 h.p. motor patrol blades used for plowing snow from the pavement on Snoqualmie Pass have been replaced by super heavy duty blades with 160 h.p. motors. These motor patrol units have an operating speed uphill under full load of approximately 18 m.p.h. and are the "work horse" of the fleet. Two years ago five 30,000 4 x 2 G.V.W. trucks with G.M.C. diesel motors were purchased to replace 26,000 G.V.W. trucks that are used with 5-6 c.y. sanding bodies and push plows that work with and compliment the motor patrol blades in removing snow on Snoqualmie Pass. The replacement of 16,000 and 22,000 G.V.W. trucks used in the past for push plow work with a minimum of 28,000 G.V.W. units is the policy of this department at the present time. Also the 3/4 c.y. front-end loaders used for loading sanding trucks and snow removal when needed are being replaced with 1-1/2 c.y. units. While the initial cost of all these larger units is greater, it has been proven the length of the useable life is extended, the down time on the job for repairs is less and the work is performed more quickly with the result the cost of maintenance has been reduced and better service has been given the traveling public.
- IV. Diversion Dam on Snoqualmie Pass Highway - To prevent the South Fork of the Snoqualmie River from again washing out this most important east-west highway in Washington, a diversion dam was constructed in 1962 to force the river back into its old channel. The narrow channel down stream from the dam was widened and deepened to prevent an overflow and provide a roadway from which equipment can work if log jams clog the channel in future years.

- V. Man Power at Mountain Pass Area - It is believed that no one will disagree with the statement that the very finest and powerful equipment manufactured is useless on our mountain pass highways without operators. The key to the successful maintenance of Washington's winter time snow and ice control is a corps of dedicated men who at times risk their lives eight to twelve hours per day to keep pass highways open and as safe as possible for all drivers. The crews will range from 14 to 40 men, who work a normal eight-hour shift and longer if needed during periods of storms. All passes are operated on the basis of two eight-hour shifts with staggered hours for some of the employees. Men and equipment will be in service a minimum of twenty hours for emergency work and leaving the pass areas unattended only four hours each day when there are no storms. During storms the men work overtime so that snow plowing or sanding operations continue twenty-four hours per day if needed.

The fact there is very little turn-over in the personnel has always been a source of wonderment to the writer and it is concluded these men, like this type of work and enjoy battling the elements. The writer wishes to pay sincere tribute to these men for they are in danger much of the time not only from natural elements of snow and ice but from drivers of vehicles using the highways twenty-four hours per day. The majority of accidents in which department equipment is involved, indicates the drivers of the privately owned vehicles are unfamiliar with slippery conditions.

- VI. Present Problems Due to Snow on Mountain Highways - Conditions have changed by the use of higher capacity and more powerful equipment. Closure of highways or delay of traffic due to snow falling and drifting has been practically eliminated.

The present danger is from the following reasons:

1. Sections of highways being washed out by extremely high run-off from melting snows. The White Pass highway was washed out twice during this past winter due to excessively warm weather and rain which caused flooding conditions near the Summit.
2. Earth and rock slides due to extremely high moisture content of side-hill cuts caused by fast melting snow and heavy extended rain storms. There are so many areas on mountain highways where slides could occur it is impossible to predetermine where the next slippage will take place.

CONCLUSIONS

It is true that during the past seven years a really severe winter has not occurred and the precautions noted may not be adequate to prevent problems or closure of highways in future years. During the storms the last three days of March, 1963, a total of 70 inches of snow fell on one mountain pass highway, with a maximum of 32" of new snow in a twenty-four hour period, the equipment was adequate to remove snow and keep traffic moving. When we consider the fact no closures of our two major passes have been necessary because of heavy snowfall during the past seven years and compare this fact with the closures that lasted from a few hours to several days fifteen years ago, it is believed the department has made progress in solving mountain road problems. During the years prior to 1950, equipment failure at critical times during severe storms allowed the snow to pile up on the road surface and was responsible for some of the closures. At the present time additional units of equipment cannot be justified in this wild, alpine area of the Cascade Mountains where most anything can happen and sometimes does.