ENGINEERING

Out of the White

Job of Getting Highways Free of Drifts That Rise Up to 80 Feet Keeps Plows Busy; Snow Fences Ready

See Front Cover

WHEN winter settles down upon the highways of thirty-six states which make up America's great snow belt, an army of plows begins the annual battle against the blockade of the national transportation system, and ten thousand miles of snow fence are standing guard against the onslaught of snow-laden gales. So indispensable has become the unimpeded movement of an endless caravan of motor vehicles in the delivery of goods and passengers to otherwise isolated communities that winter maintenance is now a function of tremendous public consequence, and a problem which the highway engineer must face intelligently and stubbornly.

The good roads movement, which started with the cry of "get us out of the mud," has in many localities been supplanted by the "open roads" movement and the cry of "get us out of the snow." In some states to answer this cry means that the plows never cease to operate from one end of the winter to the other, except to stop for fuel or repairs. For twenty-four hours a day these faithful servants of the highway pass back and forth on their endless journey, cutting through the drifts again and again as fresh-falling flakes or whirling clouds of white obliterate what has been accomplished with such difficulty and expense.

Eighty Feet Deep

The motorist who is so helpless in his efforts to combat a snowfall of only a few inches can scarcely conceive of encountering drifts eighty feet deep. But on the famed Rim Road encircling Crater Lake in Oregon such giant drifts are not uncommon, but because they interfere in no way with the nation's commerce they are not disturbed until the month of June, when tourist traffic must be provided for. At this time of year springtime thaws have reduced the drifts to comparatively modest heights, but there is still thirty feet of hard-packed snow with the consistency of ice, and this must be blasted with dynamite before the propellers of the heavy rotary plow can hurl the remains into the air and down the mountain-side. So tremendous has been the task of opening these Oregon roads that one year it was late in August before traffic was finally able to pass, and a snowstorm the following week closed the road again for the winter.

Preparedness

It is a well known axiom in the business of snow removal that preparedness is half the battle, and when storm warnings are hoisted there is great advantage in having both operators and equipment standing by in readiness to go into action with the storm. For this reason there is need for constant communication with the Weather Bureau, and for an intelligent distribution of plows throughout the area patrolled. In the mountainous sections of Washington, where depths of snow vary from 18 to 48 feet, the rotary outfits are equipped with two-way short-wave radios, and communication is maintained with the base station in order that reports of weather conditions and emergencies such as snow-slides may be received and sent.

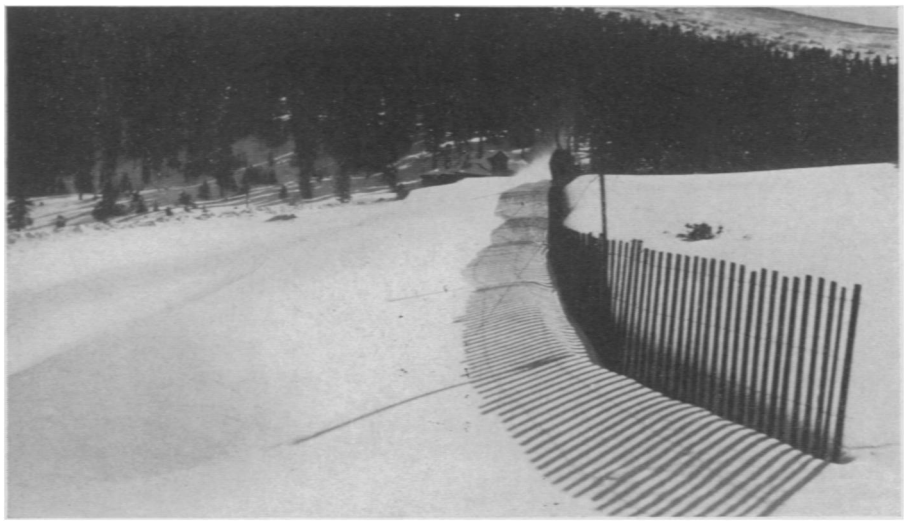
Preparedness also requires that there be immediately available a sanding crew who can arrive without delay at positions which are reported to be endangering traffic with ice formation. It is customary for the highway department to transport quantities of abrasives such as cinders or coarse sand, and leave them in stock-piles along the road before the arrival of winter. Trucks will then have fresh supplies near at hand, and speed in covering the danger spots will be possible. The addition of calcium chloride or salt has been found beneficial in this part of the snow program, provided the chemicals are used with due precaution against possible action on the pavement, since the consequent melting of the ice allows the gritty substance to become firmly embedded in the road surface. This not only increases traction, but prevents the wind from blowing the sand away.

Prevent Drifts

Of all methods used to prepare for the battle against snow drifting, the best is that of trying to prevent drift forma-

THROWING IT UP

The propellers of the rotary plow hurl the snow high into the air and back from the traveled way.



STANDS GUARD

A vertical-slat snow fence piles up snowdrifts before they can barricade Berthoud Pass, Colorado. Photograph through courtesy of the U. S. Bureau of Public Roads.

tion. An ounce of prevention in the form of snow fences is worth many tons of heavy plows. It has been observed that snow drifting occurs on the highway when there are buildings or fences or certain types of bushes close to the right of way. These are all types of wind barriers which slow the velocity of the snow-laden gale and force it to deposit its load. Such observations led to the erection of wind obstructions in the proper places, so that the drifts of snow, which form on the leeward side of the object, will pile up away from the road.

At Michigan State College tests of drift control by means of artificial snow fences were made in a wind tunnel ten feet long, sawdust and mica flakes being used for snow. The floor of the tunnel was laid with sandpaper to produce as nearly as possible natural ground conditions. Wind velocities as high as 45 miles per hour were generated by propellers, and miniature snow fences erected across the tunnel.

Best Proportions

Observation of the sawdust and mica drifts formed by various types of fence revealed that the width of the slats in the open-type fence should be approximately the same as the spaces between slats, both for the horizontal and vertical fences. For each foot of fence height there should be about fifteen feet of distance from the roadway; that is, an ordinary four-foot fence should be sixty feet back from the highway. It was also found that when raised about six inches from the ground and inclined with the wind, a snow fence will be kept free of snow at its base, and will be able to pile up drifts twice its own height.

Snow fences are ordinarily made of wood, though galvanized metal is not uncommon, and they are usually of the open type except on narrow rights-of-way where solid fences are sometimes used to pile up drifts on the windward side. The problem of storage during the summer is an important one, and entails a large proportion of the total cost of the fence. It is complained that if the frames are piled at the side of the road instead of in storage houses, well-meaning neighbors use them for kindling wood and house repairs, or they will be found the following autumn serving as pens for babies or pigs.

Tree Barriers

The prevention of snow drifting was studied a good number of years ago by the railroads, and instead of using artificial control methods, natural barriers of trees were planted to keep the tracks clear. Today the widespread interest which has been aroused in highway landscaping has given prominence to this natural barrier method of snow control which at the same time can be made a part of the roadside beautification program. Where trees are already close to the road, pruning them to proper heights to allow the wind to blow unimpeded across the road has been of advantage in the creation of a sweeping action.

New plantings may be made in the form of hedges of trees or shrubs which will deposit the snow on the windward side like the solid artificial barrier, or they may be spaced farther apart to simulate conditions with the open-type fence. Several rows of parallel plantings will create a reservoir which will hold the snow. Among the natural barriers which have proved successful in snow control work, conifers such as pines, spruces and cedars have given good results. Low, spreading shrubs are also used in combinations, and include bushy willow, barberry, box-elder, and buckthorn.

New Road Design

An important method of snow control is in the actual design of new roads and their location. Where the ground is flat, the level of the road should be above that of the surrounding country by an amount equal to the expected snow line during the winter. In western states this method has been widely adopted on new construction projects, eliminating the trench-like reservoir which resulted from plowing a highway beneath the surrounding snow line. Ample space should be allowed for storing the snow along the side of the road by the provision of wide shoulders and shallow ditches, whereas shallow cuts should be avoided, and slopes should be flattened and planted with shrubs that will catch the snow and prevent slides.

A considerable variety of snow-fighting equipment is in use in the various regions of the snow belt. Today the trend seems to be toward the lighter, faster types, such as the ordinary blade plow and truck. When the snow is heavy, however, the lighter plows are used to follow up the tractor plows. The latter are often of the V type, pushing the snow to both sides. Tractors can get through eight to ten feet of snow, if it is not wet, and if depths are greater the plow is raised and the tractor allowed to travel over part of the snow to make a first cut.

Last Resort

The rotary plow is in most cases considered a last resort in the attempt to open a road, but when trucks must hit the drifts to get through, it is much more economical to use the heavy, slow equipment, for breakage of the smaller plows and trucks runs into considerable money. Rotary plows are equipped with propellers whose whirling action hurls the snow to the side of the road, the snow ascending as high as forty to fifty feet into the air. On city streets snow loaders are used to remove the accumulations piled up at the gutters, this being accomplished by a belt conveyor onto

which the snow bank is forced by the forward movement of the self-propelled loader. The snow is elevated on the belt and dumped into waiting trucks.

The clearing of city streets, to be effective, must be accomplished before traffic has been able to compact the snow too hard for the plows to take hold, and before a drop in temperature turns slush into solid ice. It is for this reason that New York City may hire 100,000 men and spend as much as a million dollars in one day's snow removal of only a few inches.

The question has been asked whether there is justification for the tremendous outlay of money for snow control and snow removal programs. Studies have been made of the increased gasoline tax revenues which have been received in recent years when highways have been kept open during the winter. Comparison of expenditures and tax receipts reveal that snow removal operations actually produce a profit for the highway fund. But receipts from gasoline taxes are a minor item compared to the economic importance of assuring all-year-round transportation by motor vehicles.

Health Value

Moreover, the snow removal program promotes the health and safety of those living in otherwise inaccessible places. On this we cannot set a monetary value. Finally, the highways of the Nation represent an enormous capital investment, as do also the 26 million vehicles which move over them, and to have a very large percentage of both these investments idle during three or four months of the year would entail an economic loss which in comparison with the cost of keeping the transportation system functioning would be enormous.

With the increased use of closed cars, insulated bodies, and automobile heaters, highway travel in winter has become as comfortable as in the summer months, and scientific attack upon snow problems has been forced to keep in stride with the motorist's demand that roads be not only passable, but that travel be made swift and, as far as possible, free from hazard.

New Trends

Whereas a few years ago almost the total expenditure and effort applied in the winter maintenance program was for the removal of snow as it lay on the highway, the trend has now definitely become one of preventive steps before the snow arrives, and safety measures after it has been cleared away. The study of drainage control has been found of special importance in keeping melted snows off the traveled way, and attention is being given to the roadbed beneath the pavement to prevent subgrade water from seeping through the pavement joints and freezing on the surface.

Adequate facilities for weather prediction and reporting are looked upon as a prime essential, and study is made in the various localities of a single snow removal region to ascertain local conditions of the direction of prevailing winds, wind velocities, temperature ranges, and figures of winter precipitation. Attention is also given to methods of snow removal which will cause least damage to the pavement, and construction methods which will eliminate as far as possible the destruction of roads by frost heaving and faulting in the spring.

Dangerous conditions developing as a result of sleet storms and the freezing of drainage from melting snow banks are lessened by the erection of guard rails, but since the wooden type rail was found to act as a snow fence which deposited drifts on the roadway, new guard rail installation is of the wire cable type.

The opinion so often voiced by old-timers that we no longer have the winters we used to experience would be contested by the highway engineer. For winter still piles up what appear to be insurmountable drifts, and sub-zero weather still makes removal a task for only the red-blooded men on the maintenance crews. Last winter, record snowfalls in all parts of the country sounded a warning to the highway profession that equipment must be up-to-date, and that the snowplows available must be of the type and size suitable in the locality where it is stationed or it will be of no more consequence than "two small boys throwing snowballs."

Science News Letter, January 16, 1937

SAFETY ENGINEERING

Foolproof Hood Saves Welder's Eyes

TO PROTECT the eyes of the welder from the blinding light of the electric welding arc—construction industry's most important "knitting needle"—a Lexington, Ky., inventor, H. F. Montague, has invented and just obtained a patent (No. 2,058,169) for a new type of foolproof welder's hood.

The instant the wearer of such a hood touches the piece of metal with the welding rod, a protective screen instantaneously covers the window of the hood to filter out the blinding rays that would otherwise reach the welder's eyes. The moment he lifts the rod—stops welding—the screen snaps away from the window so that without tilting or lifting the hood the welder can inspect the work.

Operation of the screen is made automatic by special electric mechanism in the hood, which is controlled by the current that operates the arc.

Science News Letter, January 16, 1937