

WINTER ROAD MAINTENANCE
FROM A USER'S POINT OF VIEW

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ABSTRACT

This paper describes the conditions which a motorist can expect to find on Ontario highways during the winter. The factors which affect these conditions are examined, including organization, planning, equipment, materials and the road information system. Future potential for improved service and reduced costs as a result of current research, is also noted.

A winter highway is a hazardous environment. In general, most highways in Ontario are almost always bare and dry during the winter months. During snow storms and for a short length of time after a storm, the highway will be snow covered and may be slippery. The Ministry has allocated staff and equipment to achieve the specified service levels within twenty-four hours of the end of a storm.

On all highways with greater than 1000 vehicles per day in Southern Ontario, and 800 vehicles per day in Northern Ontario, we endeavour to bare off the road within twenty-four hours of the end of the storm. On highways with fewer vehicles per day, we will accept a centre bare highway after twenty-four hours until conditions are right to bare the road off easily. On highways with less than 400 vehicles per day, we will tolerate snow packed road conditions. The Trans-Canada Highway, because of its importance as a commercial corridor, is given bare pavement service throughout its length, even though the traffic volumes fall below the required limits in some sections in the north. On highways with traffic volumes in excess of 10,000, the objective is to bare the road as soon as possible.

Manpower and Equipment Complements

In order to control expenditures and meet the Quality Standards, it was necessary to establish formulas to calculate the complement of people and equipment which can be deployed in each area. The typical Ministry snowplow is a 200 h.p. (150 kW) diesel engined truck of 34,000 lbs. (15 400 kg) g.v.w. 750 of these trucks are operated throughout the province. These trucks operate out of 264 patrol yards across the province. These patrol yards are strategically located in order to provide optimum service.

This formula is used to determine the number of plow vehicles at each location:

$$\text{No. of plow vehicles} = \text{single lane km} \times \frac{\text{snowfall rate (cm/h)}}{\text{plowing speed (km/h)} \times \text{maximum allowable snow accumulation (cm)}}$$

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The design speed is 32 km/h, which is 55% of the actual operating speed, but allows for lost time at traffic lights, stop signs, turn arounds, etc.

Single lane kilometres are the total distance to be plowed on each patrol.

The snowfall rate is taken from the following chart which shows the percent of all storms where the snowfall rate will not be exceeded.

The level of service to be provided on each highway in the province depends on the traffic volumes, location and the nature of the highway, as noted earlier.

WINTER MAINTENANCE SERVICE LEVEL CLASSIFICATIONS

LEVEL OF SERVICE		HIGHWAY TYPE AND W.A.D.T.	M.A.A.* (cm)	PERCENT STORMS SERVICED**	SNOWFALL RATE (cm/h)
CLASS	TYPE				
1A	Bare Pavement	Multi-Lane divided, and others with W.A.D.T. over 10 000	2.5	98	1.91
1B	Bare Pavement	Trans-Canada System, and others with W.A.D.T. 2000-9999 (South) and 1500-9999 (North)	2.5	95	1.40
2	Bare Pavement	1000-1999 (South) 800-1499 (North)	4.0	95	1.40
3	Centre Bare Pavement	500-999 (South) 400-799 (North)	5.0	90	1.02
4	Snow Packed	Under 500 (South) Under 400 (North)	7.0	75	0.53

* M.A.A.: Maximum Allowable Snow Accumulation - the maximum depth in centimetres permitted to accumulate on the road.

** Percent Storms Serviced - the percentage of storms during which no more than the maximum allowable snow accumulation is permitted to accumulate on the road.

This formula results in a range of from 42 to 417 single lane kilometres per truck.

The availability of accurate data on snowfall for all locations throughout the province, would facilitate allocation of equipment in order to equalize the service level throughout the province.

Similar calculations are done to determine the number of sand spreaders at each location. The Ministry owns approximately 750 of these. Spreaders are usually mounted on contractors' trucks which are readily available during the winter.

Material

This past winter, the Ministry spread 402,000 t (tonnes) of salt and 727,000 t of sand on provincial highways. This was a reduction of 17% in the use of salt and 28% in the use of sand from the previous winter, due to the mild weather. The use of salt may cause groundwater contamination, corrosion of vehicles, damage to structures and may affect vegetation and crops. As a result, the Ministry is closely following the current research into alternative deicing materials.

In 1980, a study prepared for the Federal Highway Administration, identified calcium magnesium acetate (C.M.A.) as the best alternative to sodium chloride. Tests are being conducted by the F.H.W.A. to evaluate the environmental acceptability of C.M.A., develop manufacturing technology, study the ideal composition of the material, study the effects of C.M.A. on bridge and automobile corrosion, study the corrosion and chemical effects on pavement and other highway materials, and study the deicing, handling, application and storage properties under field conditions. In addition, the M.T.C. is supporting a University of Toronto study to evaluate the potential production of this material from sewage. M.T.C. has carried out a small demonstration of the material.

We also conducted a trial using a mixture of sand, salt and calcium chloride solution during the past winter, to determine if the total amount of salt used could be reduced.

A number of municipalities have claimed some success with these mixtures. The sand provides traction while the salt provides melting action. The calcium chloride solution helps the mixture adhere to the highway and speeds up the melting action. This winter's trials proved that it is very difficult to draw firm conclusions about the effectiveness of any winter maintenance material due to the number of factors which affect the performance. Adequate mixing of the components was identified as a major problem.

Minimizing the Effect of Salt on the Environment

The Ministry has introduced a number of policies, procedures and equipment modifications to minimize the potential effects of salt on the environment.

- Operating Instructions have been developed detailing when, where and how much salt is to be used.
- Comprehensive reporting procedures have been instituted to monitor the use of salt and sand.
- All Ministry personnel who are involved in winter maintenance must attend formal training programs and are tested on their knowledge of winter maintenance procedures.
- All salt is stored indoors.
- Domes are constructed at all new patrol yards to cover sand piles.
- All salt spreaders are equipped with electronic controls to ensure that a fixed amount of material per kilometre is applied.
- All salt spreaders are calibrated annually to ensure that the correct application rates are applied.
- All wells at Ministry patrol yards are tested regularly to monitor salt in the groundwater.

Winter Road Reporting System

There are a limited number of times each winter when the roads are hazardous. If all motorists restricted their driving during those times, or at least drove according to the weather conditions, the problems would be greatly reduced. Ministry patrol supervisors report that problems are caused by drivers who do not drive according to the prevailing conditions. In order to assist the motorists, the Ministry provides up-to-date information on road conditions throughout the day.

Five times every day, each of the 18 Districts reports to the Head Office Information Section on road conditions. These reports are based on regular reports from each patrol in the District. The local patrol supervisor collects information from his people on the road and forwards it to the District Office. The comprehensive reports cover precipitation, operations in progress, temperature, wind, visibility and road conditions. These reports are then passed on to 117 radio and television stations throughout the province. The information is also made available to the public through a telephone road information system. By making use of this information and scheduling their driving accordingly, the public can greatly reduce the inconvenience of inclement winter conditions.