THE SNOW PROBLEM IN MONTREAL

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It is indeed a pleasure and a great honour for me to address such a learned audience. When reading your program, I became aware of the high standard of discussion the Eastern Snow Conference undertakes.

My subject is more of the layman's type, and it was intended to be so, because too little thought is given such problems that need research, when large cities could benefit from new ideas and better ways of improving services to the community.

Montreal, the Metropolis of Canada, is situated on an island of which it covers one quarter or 50.7 square miles. More precisely, it is located by 45°30' latitude north, and 73°35' longitude west, at an altitude of 187 feet, taken on the campus of McGill University.

Our fair City is favoured by a beautiful lonely mountain which dominates the scene, and 840 miles of paved streets, bordered by 1400 miles of sidewalks spread out at its feet. Its highest point, at an elevation of 870 feet, gives a perfect view of what was once Ville-Marie, founded in 1642 by Monsieur Paul de Chomedey de Maisonneuve.

The mountain and other topographical features give approximately 80 miles of street that require particular attention because they have grades varying from 6% to 24%.

The weather being our ally and foe, here is how we understand it in Montreal. (The following is an extract from the annual Meteorological Summary from Dorval, Quebec).

The climate of Montreal can be considered as a continental type having relatively warm summers and cold and humid winters. Temperatures range from a mean of 70°F. in July, to a mean of 15 degrees in January. Precipitation is fairly well spread throughout the year, and averages around 38 inches of which 10 inches occur as snow between the months of November and April.

The winter season extends from December to March with average monthly temperatures below 32°. The frost free season extends from the middle of May to the end of September.

The St-Lawrence River Valley, formed by the Laurentian Plateau to the north and the Appalachians to the south, creates a gigantic funnel through which the wind blows parallel to it, either from the west-southwest or the northeast.

During winter, Montreal is often affected by storms which develop along the Atlantic coast and move north or north-northeast. Our heaviest snow-falls are caused by such storms.

Throughout the winter season, the area to the west and north is the source of frequent invasions of very cold dry air, and temperatures may drop quickly with the passage of a cold front.

Centers of low pressure moving in from the west are usually accompanied by snow-storms rarely exceeding 4 inches, while temperatures are usually low. We have seen storms come up at 5 degrees below zero.

Winds from the south or the southwest usually bring warmer and moister air from the United States, causing snow or rain with mild temperatures in winter.

As mentioned before, the most intense storms come up from the south at higher temperatures, and they are closely watched for they usually mean trouble.

Our snow precipitation records for the last ten years show an annual maximum of 121.1 inches, an annual minimum of 59.6 inches, and an average annual of 96.5 inches.

Our population has reached the 1.5 million mark. This means that traffic to and from the business and industrial areas has increased over the years, and is very close to the saturation point.

The center of Montreal has undergone and is still undergoing considerable change. Slum areas are cleared to make place for multiple story low rent apartments and the business district is seeing majestic skyscrapers overlooking the City. These great buildings will no doubt create other problems, among them, a substantial increase in office population and a considerable rise in the traffic density.

The City will undertake the construction of 21.4 miles of subway which will no doubt contribute in a big way to clear our streets.

Of the 350,000 dwellings in Montreal, only 30,000 are cottages. The majority are multiple buildings for which no off-street parking was planned. Twe five years ago, this was not too serious, but today, each dwelling represents an automobile and the street is its garage. This explains the high degree of congestion in our streets during a storm.

Within our City limits, 385,000 vehicles are registered and some 50,000 are on visit. Furthermore, the annual increase is in the neighbourhood of 18,000 cars. More than half the number of these vehicles are parked on our streets day and night.

Keeping all streets open during a major storm is the department's main worry. To plow and remove snow from narrow streets, lined with parked cars, bumper to bumper, adds to the problem. To tackle the job in an orderly way, streets are classified into two main categories: A - arteries which include bus routes, and B - residential streets.

Arteries and bus routes are given first priority in spreading of salt or abrasives and plowing. Residential streets receive second priority in plowing. Snow loading is given first priority on highly commercial streets and on very narrow residential streets.

The pricrities mentioned are somewhat arbitrary because for most storms, even for a ten-inch fall, practically all streets have been plowed twelve hours after the end of such storms.

At this stage, it would be well to explain the work territories of the Department. The City is divided into five districts whose mileage is proportional to the population density of the areas. Each district is subdivided into sections also in relation to the population density. A section in a congested area may have 8 to 10 miles of streets while another section, in a residential area, may represent 25 to 30 miles of streets or even more.

In each section, work routes are predetermined for each operation, that is sanding of sidewalks, spreading of salt and/or abrasives, plowing or loading.

To get parked cars off main streets during plowing operations, we tried a general parking ban in congested areas of the central business district. It was called "Snow-Emergency". Due to the uncertainty of precipitation, its announcement and enforcement were not practical and the plan was abandoned. It was later decided that the "Snow-Emergency" would exist throughout the season and would apply on certain bus routes only, in the event of serious storms.

We have observed that the public does not mind too much driving through snow, knowing that within 12 hours the streets are all plowed. This was made possible by awarding part of the work to contractors.

Contracts for different types of snow clearing were originally awarded on a yearly basis. Since last year, call for tenders is on a three year basis, which seems to work out well.

Two types of contracts are called for. Type A is for plowing of pavement and sidewalks, loading and hauling the snow to dumps maintained by the City. Type B is for plowing of the pavement only. Thus, contractors plow 78% of our pavements, 47% of our sidewalks and they load 40% of the total street mileage.

Considering the City mileage, the amount of remaining snow that must be removed is approximately 2.5 million tons. This is equivalent to 500,000 truck-loads. These figures give an idea of the magnitude of winter street maintenance.

To set in motion personnel and equipment to cope with any type of storm takes a good communications system. Our three-way radio network helps considerably in getting information to and from supervision. The announcement of a storm is first received by a central radio control station. For a possible precipitation of over one inch, this central control will notify the central planning engineer who in turn will telephone each district engineer. Subsequently, the control station will notify, at night, by telephone, the foreman in charge of each district. Furthermore, he will give the meteorological report over the air by radio. This requests all section foremen, who have service trucks equipped with radios, to organize for the coming storm. Others are notified by telephone so that all supervision knows what to expect. Auxiliary labor is then called in, equipment is made ready and loaders for salt and/or abrasives are positioned at stock piles. In the meantime, contractors are warned of the coming storm.

Section foremen helped by special inspectors will patrol contractors' territories to see that they have sent out the required equipment or if they are out at all. If any contractor fails to start plowing in a reasonable time, the foreman will report to his supervisor, who may, after consultation with his engineer, order City equipment to do the contractor's work. Should the City intervene in the same contract on three separate occasions during one season, the contractor may see his contract cancelled.

Although meteorology is a precise science, it is influenced by so many undetermined factors that a forecast is somewhat questionable. The report of any important precipitation is nevertheless taken as a certainty. Should it not substantiate, a minimum of 3 hours must be paid, by labor agreement, to any additional help called in.

Meteorological reports are received from two sources. The Federal Weather Bureau at Dorval is our main source of information. To be on the safe side, the City has hired the services of a private forecaster who issues regular bulletins, and special bulletins in the event of a coming storm. This firm also issues, twice daily, charts showing fronts and centers of low and high pressures with corresponding directions and locations. From these charts copies of which are sent to each district, we can evaluate the chances of a storm.

Loading operations usually follow plowing. The contractor has 72 hours to do his loading and must work day and night to get through in time.

Loading snow requires the putting up of signs to notify the public that loading will start either from 7 a.m. to 7 p.m., or from 7 p.m. to 7 a.m. A City by-law states that cars cannot park at night for more than four hours on streets, where parking is permitted. This means that our signs must be up 4 hours before loading can start. Of course, for night work, signs must be put up during the day, and for day work, signs must be up not later than 6 p.m. the previous evening. 15,000 of these coloured signs are used both by the City and by contractors, and a colour scheme identifies who does the loading.

Each loading gang includes one or more tow-trucks boarded by a policeman who issues parking tickets to cars illegaly parked. These cars are usually towed to a nearby street where snow has already been removed.

The disposal of such a large quantity of snow is becoming a real problem. Ten years ago, sufficient vacant land was available and disposal was an easy matter. Since then, the continuous development of our City has taken up this land. Today, we hardly manage with 15 dumps taking from 30,000 to 40,000 loads of snow each. Five years from now, we may loose more than half this number.

It should be mentioned here that a certain amount of snow is disposed of in our trunk sewers. This is permitted only if sufficient water is flowing to carry the snow away. Usually, it limits their use to day time work when the flow is acceptable. Blocking such sewers can have serious consequences such as flooding neighbouring cellars. In the center of the City, on one particular street, this work is performed at night by feeding untreated water from the river to increase the flow.

In the majority of places, where this type of disposal is used, the snow is pushed through circular manholes, either by hand shovel or with sidewalk tractors. In all cases, close supervision is necessary to avoid trouble.

The equipment used for spreading, plowing and loading is of the standard type. Pavement spreading equipment numbers 53 units of different makes, and we have 61 sidewalk sanders. Additional spreading, either for pavement or sidewalk, is done manually with ordinary rented trucks. Our plowing equipment consists of 4 power-graders; 52 heavy trucks with blade and plow; 23 plows; 26 wheel front-end loaders of 1 c.y.; 152 wheel and crawler type sidewalk tractors; 13 bulldozers from 4 to 11 tons and finally 84 snow blowers of different capacities. The total number of City-owned snow fighting equipment is therefore 468 units. Excluding contractors' equipment, we need an additional 1000 pieces of rented equipment for an 8 to 10 inch storm.

A storm, accompanied by drifting, which started on the 19th of December last and ceased on the 21st, layed close to 10 inches of snow that had to be plowed and picked up. This required 2425 pieces of equipment and 3370 men. By Christmas Eve, all work was completed.

Materials used during and after a storm are of four types: rock salt which is spread at the very beginning of a storm, and if the temperature is high, it is used generously. At temperatures below 20° its action is slow and abrasives must be added in the form of 1/4 inch stone and cinders, if they can be obtained. As soon as the snow accumulates, spreading is stopped and plowing starts. Spreading will then resume following the plows.

It must be mentioned that sanding of sidewalks becomes a very big job in the event of freezing rain. Fourteen hundred miles of concrete strip averaging 5 feet wide must be sanded simultaneously and the operation repeated as long as icing persists. Five hundred private trucks may be called in for this purpose.

Montreal must stock-pile these materials during summer, making provision for 35,000 tons of salt under cover, 1,000 tons of cinders and 50,000 tons of sand in open piles at strategic points. Twenty thousand tons of 1/4 inch stone are ordered as required from the quarry during the season. We are trying out manufactured sand this season but it is still too early to pass judgment.

The snow disposal equipment consists of crawler type bulldozers ranging from 140 hp. to 320 hp., with preference for the heavier machine. Some 40 of these rented tractors are distributed on our snow dumps and operate continuously during the loading period.

The secret of successful snow removal operations in a large City lies in the timing. Spreading must start with precipitation. A fifteen minute delay may be too late. Should a heavy snow-fall coincide with traffic peak hours, then plowing should be delayed, otherwise the equipment will only contribute to the confusion.

The continuous increase in the number of vehicles on our streets has made snow clearing operations more difficult. This difficulty has been lessened by increasing the number of one-way streets, by implementing alternate parking and by prohibiting parking on arteries and certain commercial streets. The City is using to full capacity all available off-street parking facilities.

Snow disposal is no doubt our main problem and it will become serious in the near future. It would seem that Montreal, being built on an island, could use the Rivière des Prairies along our north limit and the St. Lawrence River along our south limit. Unfortunately, access to these rivers is very limited. To the

north, the river surface freezes solid. Even if it could be opened at certain points, the presence of a hydro-electric station would probably prohibit large amounts of snow being dumped.

Along the St. Lawrence River, possible disposal points are taken up by the Harbor, and piers have nearly all sheds built over them. Other places are occupied by commercial or industrial organizations. Presently, we have two disposal points along the Harbor, one on an open pier with open water practically throughout the season due to fast currents, and the other along an open pier parallel to the river. Unfortunately, the water may freeze at these locations. Telescoping of the ice in the river will form a dam, the water will rise and the ice comes up to the pier or even rises 10 to 15 feet above it.

Snow must then be dumped on the pier and taken up by blowers and shot over this ice barrier. This will reduce the dump capacity by four-fifths during 50% of the season.

Should access be given us, future use of both rivers as snow dumps for the entire winter season may be possible by applying the technique of ice prevention by air bubbling. On this matter, I am referring you to a summary of information on this subject prepared by G. P. Williams, Research Officer, Division of Building Research, National Research Council of Canada, Ottawa.

We have, as a matter of fact, contacted a Montreal firm that specializes in this type of installation. They offer a patented discharge gun having a 12-inch diameter barrel that will deliver or bring up two million gallons of water per day. Circumstances did not permit us to try this equipment.

Serious thought is now given to other means of disposal; amongst them, melting the snow. Melting equipment has appeared on the market, but is still of limited capacity. Such a machine would have to be much larger to take the feed of one blower which is between 10 and 15 cu.y. per min., or 240 to 360 t per hour.

We have had on trial a 25 t. per h. melter. Water was run from the discharge into the gutter and we were surprised to see that most of the water ran to the catch-basin 100 feet away at an air temperature of 10°F.

We would like to see a mobile melter capable of taking the output of a blower. It would eliminate hauling charges and the necessity for dumps and their costly maintenance.

Another project under study is the building of large melting ponds near our incinerators, thus using waste heat.

American technology has literally produced miracles. Would it not be within the realm of the possible to foresee some kind of chemical or material which, when incorporated into bituminous road surfaces, would permanently give out heat when snow fell upon them ?

May I leave you thinking about these problems, with the hope that your active minds will help find better ways and means of removing and disposing of snow from our City streets, faster and in an economical way.