

# Natural Hazard Research

## ANNOTATED BIBLIOGRAPHY ON SNOW AND ICE PROBLEMS

prepared by

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1968



Working Paper #2

## PREFACE

This paper is one in a series on research in progress in the field of human adjustments to natural hazards. It is intended that these papers will be used as working documents by the group of scholars directly involved in hazard research as well as inform a larger circle of interested persons. The series is now being supported from funds granted by the U.S. National Science Foundation to the University of Chicago and Clark University. Authorship of papers is not necessarily confined to those working at these institutions.

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## A. BIBLIOGRAPHIES AND GENERAL STUDIES

The American City. New York:  
c. 1909 - , monthly.  
Journal which devotes part of  
its coverage to street and  
highway maintenance and  
improvement. Contains articles  
on methods, planning and  
organization of snow removal  
and ice control particularly  
for the U.S.A.

Bell, C. The Wonder of Snow.  
New York: Hill and Wang, 1967

Canada. National Research  
Council. Bibliography of Snow  
and Ice, compiled by D.C.  
Pearce. NRC 2534. Ottawa:  
undated.  
Available on loan only.

\_\_\_\_\_. Literature Survey of  
Use of Heat for Keeping Roads,  
Sidewalks, etc. Clear of Snow  
and Ice, by B.G. White  
(revised by P.T. Hodgins,  
1957). NRC B.8. Ottawa:  
1954.

Canada. National Research  
Council. Division of Building  
Research. Available Snow and  
Ice Publications.  
(Mimeographed.)  
Publications from 1950's to  
1967.

\_\_\_\_\_. Climatological Atlas  
of Canada, prepared by Morley  
K. Thomas. NRC 3151, DBR 41.  
Ottawa: December, 1953.  
Section 4 on snow deals with  
maximum recorded depths of  
snow, snow loads, mean annual  
and mean monthly snowfalls.

\_\_\_\_\_. Snow and Ice Problems  
in Canada and the U.S.A., by  
Marcel R. DeQuervain.  
Technical Report No. 5  
(DBR 15). Ottawa: February,  
1950.

A report indicating the path  
which future snow and ice  
research in Canada should  
take. Discusses problems  
such as snowdrifts, avalanches,  
snow clearing, etc., and snow  
and ice research in various  
countries.

Canada. National Research  
Council. Division of Building  
Research. Department of  
Transport. Meteorological  
Branch. A Bibliography of  
Canadian Climate 1763-1957,  
compiled by Morley K. Thomas.  
NRC 6521. Ottawa: Queen's  
Printer, 1961.  
Nearly 1400 references, ranging  
from journals of early voyages  
of exploration to current  
government publications  
concerning climatic factors  
in all parts of Canada.

Cronin, F. "Snow: The Two-  
Faced Giant." Imperial Oil  
Review, XL (October, 1956),  
21-5.

Public Works. Ridgewood, N.J.:  
August, 1896 - , monthly.  
A monthly journal containing  
many articles on snow and ice,  
methods of removal, planning  
and organization and some  
costs, particularly for U.S.  
cities and highways.

Rapp, R.R., and Huschke, R.E.  
Weather Information: Its Uses,  
Actual and Potential. Santa  
Monica, Calif.: The Rand  
Corporation, 1964.

U.S. Army. Cold Regions  
Research and Engineering  
Laboratory. Bibliography on  
Snow, Ice and Frozen Ground.  
1951 - , annually.  
Includes annotated bibliography  
of snow and snow removal for  
publications from most regions  
of the world.

## B. METEOROLOGICAL AND CLIMATOLOGICAL STUDIES

Anderson, Harry W.  
"Integrating Snow Zone  
Management with Basin  
Management." Water Research.  
Edited by Allen V. Kneese and  
Stephen C. Smith. Baltimore:  
for Resources for the Future,  
Inc. by Johns Hopkins Press,  
1966.  
Present forestry techniques  
are discussed in relation to  
the management of water from  
snowmelt in Western United  
States.

Boughner, C.C., and Potter, J.G.  
"Snow Cover in Canada."  
Weatherwise, VI, 12 (1953),  
155-59.

Bradley, G.E. "The Snowbelt  
in Western Ontario."  
Unpublished B.A. dissertation,  
Department of Geography,  
University of Toronto, 1962.  
Contains 4 tables, 9 figures,  
25 maps. Discussion of  
snowfall amounts and  
frequencies in the area  
bordering and between Lake Erie  
and Lake Huron.

Canada. National Research  
Council. Associate Committee  
on Soil and Snow Mechanics.  
"Meteorology of Snow and Ice."  
by K.T. McLeod. Snow Removal  
and Ice Control. Technical  
Memorandum No. 83. Ottawa:  
October, 1964.

Weather information needed by  
winter maintenance  
organizations is discussed  
and an appraisal of the  
present forecasting and other  
services is made.

Canada. National Research  
Council. Division of Building  
Research. The Avalanche  
Hazard Evaluation and Prediction  
at Rogers Pass, by P. Schaerer.  
Technical Paper No. 142.  
Ottawa: 1962.

Includes assessment of terrain  
and climate, discussion of  
measurement of avalanche  
hazard, forecasting and the  
avalanche warning service. 24  
figures, 12 tables.

\_\_\_\_\_. Current Research on  
Ice Control, by L.W. Gold.  
Technical Paper No. 202.  
Ottawa: July, 1965.  
Organized under such headings  
as ice formation and detection,  
prevention of ice formation,  
removal of ice and ice control  
measures for vehicles. P. 5,  
some costs given for various  
facets of winter maintenance  
in Ontario.

\_\_\_\_\_. Icing Observations, 1965-66: Second Progress Report, prepared by D.W. Boyd. Technical Note No. 479. Ottawa: February, 1967. Study of icing of wires and towers from information on "Icing Report Forms" filled out in cases of damage to equipment. 3 tables, 1 map.

\_\_\_\_\_. Maximum Snow Depths and Snow Loads on Roofs in Canada, by D.W. Boyd. Research Paper No. 142. Ottawa: December, 1961. Analysis of the maximum loads to be expected on roofs and the design requirements regarding snow loads.

\_\_\_\_\_. A Method of Computing Maximum Snow Loads, by Morley K. Thomas. Research Paper No. 15 (NRC 3559). Ottawa: March, 1955. (Reprinted from the Engineering Journal, vol. 38, February, 1955.) Computing of snow loads from snow and rainfall data, 1941-50. Loads found to be comparable with those in building codes in 20 cities in Canada. 4 maps, 1 table.

\_\_\_\_\_. Snow Accumulations in Canada: Case Histories: I, by W.R. Schriever, Y. Faucher, and D.A. Lutes. Technical Paper No. 237 (NRC 9287). Ottawa: January, 1967. First in a projected series to aid designers by recording "interesting nonuniform snow loads" on roofs. Contains 30 case histories with pictures and diagrams of roofs and snow loads.

Canada. Department of Transport. Meteorological Branch. Areal Variation of Snowfall in Metropolitan Toronto, by J.G. Potter. CIR-3431, TEC-342, January 6, 1961. (Mimeographed.) Describes differences in recorded snowfall at stations in Toronto. There are significant variations of up to 20%.

\_\_\_\_\_. The Climate of Toronto, by L. Shenfield and D.F.A. Slater. CIR-3352, TEC-327, June 8, 1960. Gives snowfall averages (for 30-year period) by month as well as recorded extremes. P. 47-8, brief discussion of snowfall.

\_\_\_\_\_. The Climate of Vancouver, by Kenneth F. Harry and John B. Wright. CIR-2985, TEC-258. Toronto: November 15, 1957. The climate of Vancouver is taken month by month. There is also a discussion of various factors within climate, e.g. precipitation, wind. 6 figures.

\_\_\_\_\_. General Summaries of Hourly Weather Observations in Canada. Toronto: 1946 - . A series of publications which tabulate the number of occurrences of specific conditions over a 10-year period, e.g. snow, blowing snow. Available for many stations in Canada.

\_\_\_\_\_. Snow Cover, by J.G. Potter. Climatological Studies No. 3. Ottawa: Queen's Printer, 1965. Discusses beginning and end of snow cover season, depth and duration of snow cover for all regions of Canada.

\_\_\_\_\_. Snow Cover Data: Canada. Toronto: 1954-5 - .  
Data for Eastern Canada only from 1954-5, for all Canada from 1962-3 to present. Gives snow depths on one or two days each month and water equivalents for selected stations.

\_\_\_\_\_. Snowfall in Canada, by Morley K. Thomas. CIR-3977, TEC-503. Toronto: January 24, 1964.  
Measurement of snowfall and mean monthly snowfalls in Canada for cities and airports. 3 maps. Pp. 13-6, list of references on snowfall in Canada.

\_\_\_\_\_. Water Content of Freshly Fallen Snow, by J.G. Potter. CIR-4232, TEC-569. Toronto: May 12, 1965.  
Methods for estimating the water content of freshly fallen snow and for comparing early snow data with that obtained since a new form of snow gauge was introduced in 1960.

\_\_\_\_\_. Winter Season Snowfall Data, by Morley K. Thomas. CIR-2994, CLI-17. Toronto: December 16, 1957.  
Contains 16 pages of data on snowfall averages and extremes of annual snowfall. P. 6, bibliography on snowfall and snow cover -- 34 references.

\_\_\_\_\_. Winter Snowfall Averages and Extremes at Synoptic Observing Stations, [prepared by Morley K. Thomas]. Climatic Data Sheet No. 3-60. Toronto: February 5, 1960.  
Appended to Winter Season Snowfall Data to bring information up to date for 1958-59.

Currie, Balfour Watson. Prairie Provinces and Northwest Territories--Snowfall. Department of Physics Monograph. Regina: University of Saskatchewan, November, 1953. (Mimeographed.)  
Discusses some snow depths, etc., and also describes some of the adjustments to the snow hazard, such as barn siting. 6 tables, 3 maps, 1 diagram.

Gartska, W.V. "Snow and Snow Survey." Handbook of Applied Hydrology. Edited by Ven te Chou. New York: McGraw-Hill, 1964.  
Discusses meteorology and hydrology of snow and ice. Includes a list of 200 references (pp.10-49 to 10-57), mainly on snowfall in the United States.

International Union of Geodesy and Geophysics: International Association of Scientific Hydrology. "Mean Duration and Accumulation of Snow Cover in Canada," by J.G. Potter. Proceedings of the General Assembly: Toronto: 1957. Vol. IV. Gentbrugge, Belgium: 1958.  
The duration and depth of snowfall as determined from the data of 15 winters.

\_\_\_\_\_. "Variability of Physical Characteristics of Snow Cover Across Canada," by G.P. Williams. Proceedings of the General Assembly: Toronto: 1957. Vol. IV. Gentbrugge, Belgium: 1958.  
Snow densities and snow hardness and probabilities are examined.

Kingery, W.D., ed. Ice and Snow: Properties, Processes and Applications. Proceedings of a conference at Massachusetts Institute of Technology, February 12-16, 1962. Cambridge, Mass.: M.I.T. Press, 1963. Deals mainly with technical, engineering and climatic features of snow under the headings: Ice Properties, Glacier Flow, Bearing Capacity of Sea Ice, Snow Properties, and Ablation.

Ludlum, D.M. "Extremes of Snowfall in the United States." Weatherwise, XV, 6 (1962), 246-62.

McKay, G.A., and Thompson, H.A. Snow Cover in the Prairie Provinces. Presented at the 60th Annual Meeting of the American Society of Agricultural Engineers meeting jointly with the Canadian Society of Agricultural Engineering, Saskatoon, Sask., June 27-30, 1967. Snow depths, densities, cover and duration are described and return periods are calculated for snow depths.

Namais, J. "Snowfall over Eastern United States: Factors Leading to its Monthly and Seasonal Variations." Weatherwise, XIII, 6 (1960), 238-47.

Potter, J.G. "Changes in Seasonal Snowfall in Cities." Canadian Geographer, V, 1 (1961), 37-42.

A study of snowfall patterns of several Canadian cities over the past 100 years. Indicates a decrease in snowfall at Toronto and Montreal attributable to a general change in climate and to urban expansion.

Thomas, Morley K. "Toronto's Winter of Minimum Snowfall." Weather, IX (April, 1954), 110-11.

Thompson, J.C. "The Snow Probability Factor." The American City, LXXIV (December, 1959), 80.

U.S. Army. Corps of Engineers. Arctic Construction and Frost Effects Laboratory. Depth of Snow Cover in the Northern Hemisphere. Boston: 1954.

The University of Michigan. Great Lakes Research Division. A Survey of Great Lakes Snowfall, by Morley K. Thomas. Publication No. 11. [Ann Arbor, Mich.]: 1964. The causes, types, amounts and extremes of snowfall, and the "Lake Effect".

Veyret, P. "La neige au Canada." Revue de géographie alpine, XXXIX, 3 (1951), 533-70.



C. STUDIES OF THE IMPACT OF SNOWFALLS

"Big Storm Gave Manitoba's Merchants \$16 Million Bill." Financial Post. Toronto: March 19, 1966.

Rooney, John Francis, Jr. "The Urban Snow Hazard: An Analysis of the Disruptive Impact of Snowfall at Ten Cities in the Central and Western United States." Unpublished Ph.D. dissertation, Clark University, Worcester, Mass., 1966.

An examination of the disruption caused by snowfall in urban areas based on content analysis of newspapers and records, plus field survey. A qualitative scale of disruptions is developed. The level of disruption is highly correlated with annual snowfall, depth and wind.

\_\_\_\_\_. "The Urban Snow Hazard in the United States: An Appraisal of Disruptions." Geographical Review, LVII (October, 1967), 538-9.

Seven cities are studied to determine the impact of snow through an analysis of snow's disruptive effects, community adjustment and attitudes toward the snow hazard. 1 map, 3 diagrams, 6 tables.

Russo, J.A.; Trend-Thouern, K.; Ellis, R.H.; et al. The Operational and Economic Impact of Weather on the Construction Industry of the United States. Hartford, Connecticut: The Travellers Research Center, Inc., 1965.

"Snow Drifts 20 Feet Deep Isolate Ontario Towns for a Week." Roads and Bridges, LXXXV (March, 1947), 84-88 and 134-38.

Description of snowfall, roads blocked by snow (maps) and clearance.

"Snow: Latest Enemy in World Cities." U.S. News and World Report, L (February 20, 1961), 10-11.

D. PERCEPTION OF THE SNOW HAZARD

Bickert, Carl Von E., and Browne, Theodore D. "Perception of the Effects of Weather on Manufacturing: A Study of Five Firms." Human Dimensions of Weather Modification. Edited by W.R. Derrick Sewell. Department of Geography Research Paper No. 105. Chicago: Dept. of Geography, Univ. of Chicago, 1966. Five companies in Eastern Colorado are studied as to perception and adjustments to snow and ice (among other climatic factors), costs and effects of weather and the use of weather forecasting.

E. METHODS AND COSTS OF SNOW REMOVAL AND ICE CONTROL

American Public Works Association. Proceedings: Northeast Conference on Urban Snow Removal, compiled and edited by Donald M. Fairlie. Special Report No. 25. Washington, D.C.: 1962. Transcript of discussion of emergency regulations and traffic problems, regional co-ordination, snow removal operations and research. Information on methods and legal aspects. Also includes a proposal for a research study and report on snow removal and ice control in urban areas.

\_\_\_\_\_. Reports of the APWA Committee on Street Cleaning and Snow Removal. Special Reports Nos. 6 and 10. Chicago: 1949-50. Information on costs of snow clearance in the United States and Canadian cities in 1949 and general discussions on snow removal methods.

\_\_\_\_\_. Snow Removal and Ice Control in Urban Areas, compiled and edited by Robert K. Lockwood. Research Project No. 114, I. Chicago: 1965. A detailed study of the efficiency of methods currently used and of their benefits and costs. Also includes discussion of organization, ordinances and measuring the cost of performance.

Askwith, F.C. "How Ottawa Handles Snow Problem." The Canadian Engineer, LXXVII (October 17, 1939), 40, 44, 46.

Includes information on sidewalk and roadway plowing, equipment used, snow removal and ice control and costs.

Bergeron, A. "Winter Maintenance of Roads in the Province of Quebec." The Canadian Engineer, LXIII (November 8, 1932), 13-6.

Methods and their costs in Quebec Province, Montreal and Ontario.

Biles, George H. "Keep the Main Roads Open in Winter." The Canadian Engineer, XXXV (December 12, 1918), 518-9.

Methods in the days of the horse-drawn plow--costs \$50.00 to \$200.00 per mile in Pennsylvania.

Canada. National Research Council. Associate Committee on Soil and Snow Mechanics. Snow Removal and Ice Control, compiled by L.W. Gold and G.P. Williams. Technical Memorandum No. 83 (NRC 8146). Ottawa: October, 1964.

Includes 15 papers on the methods and costs of snow removal throughout Canada and for individual Canadian cities, on the provincial highways of Quebec and Ontario, for railways and airfields.

\_\_\_\_\_. "CN's Fight with Snow," by E.H. Fisher and E.T. Hurley. Ibid., 58-61. Equipment and practices used for winter maintenance of main line, yards, terminals and automatic classification yards are described for Canada and some specific problem areas noted. The high capital investments required for snow removal equipment is pointed out.

\_\_\_\_\_. "Mechanical Equipment Trends in Airport Snow Removal at Department of Transport Airports," by H.E.A. Devitt. Ibid., 97-100. Reasons for increased standard of winter maintenance at Canadian airports are given. Some of the snow removal equipment used is described and comments are presented as to factors that should be taken into consideration in the design and development of equipment.

\_\_\_\_\_. "Snow and Ice Control on the Provincial Highway System of Ontario," by D.R. Brohm, W.G. Cooke and A. Leslie. Ibid., 64-84. Contains 6 tables on costs for the Department of Highways of Ontario. Discussion of methods and equipment used.

\_\_\_\_\_. "Snow Clearing in Montreal," by J.-V. Arpin. Ibid., 33-40. Includes practices and costs of snow removal and ice control in Montreal. Information on the contract system is given and the problem of disposal of plowed snow is discussed.

\_\_\_\_\_. "Snow Removal and Ice Control, Edmonton," by H. Gray. Ibid., 41-5. Methods used, the problem of compacting of snow and some costs are discussed.

\_\_\_\_\_. "Snow Removal and Ice Control in Canada, with a note on Snow and Ice Research," by R.F. Legget and G.P. Williams. Ibid., 5-15. Information on the total costs and unit costs throughout Canada is given and trends in the costs are analyzed.

\_\_\_\_\_. "Snow Removal and Ice Control in Fredericton," by W.L. Barrett. Ibid., 46-8. A discussion of the methods of snow removal used and conditions affecting the cost of snow removal.

\_\_\_\_\_. "Snow Removal and Ice Control, Toronto," by A.D. Ford. Ibid., 49-52. Principal factors that determine cost of winter maintenance in urban areas are listed. Legislation now under consideration, to control traffic during snow emergency period, is described. Information is presented on current snow removal and ice control practices in the city of Toronto.

\_\_\_\_\_. "Snow Removal and Ice Control, Winnipeg," by W.D. Hurst. Ibid., 53-5. A discussion of general methods used in Winnipeg with estimates of cost for a winter.

\_\_\_\_\_. "Winter Maintenance Practices in Canada--1963," by M.A. LaSalle. Ibid., 85-9. Discussion of Technical Publication No. 20 of the Canadian Good Roads Association, Ottawa, 1964. General methods.

The Canadian Engineer. Toronto and Montreal: 1893- . This journal became Roads and Bridges shortly after World War II. Contains a number of articles of historical interest--pre-war methods and costs of clearance for provincial highways. See particularly November issues of vols. 63, 65, 67, 69 and 71, November 3, 1936 is devoted entirely to snow removal problems.

Canadian Good Roads Association. Proceedings of the Annual Convention. 1914- . Contains a survey of roads maintenance in each province, sometimes giving details of winter maintenance costs.

\_\_\_\_\_. "A Review of Current Practice for Snow and Ice Control," by O.A. Mathieu. Proceedings. October, 1956. A survey of costs of snow and ice control on Canadian highways.

\_\_\_\_\_. Winter Maintenance Practice in Canada: 1963. Technical Publication No. 20. Ottawa: January, 1964. Discusses methods used and gives some details of costs by provinces. Table of methods used, their dependence on warning, public demand and policies.

Eidt, Conrad H. "Winter Maintenance." The Municipal World, LXXIII (November, 1963), 323-7.

Discussion of methods--snow fences, salt and other chemicals, sanding, plowing, pavement patching and spring cleanup--for Ontario. P.327, breakdown of costs per mile, 1959-60, for salt, sand, etc.

Financial Post. Toronto: March 27, 1965.

Details of expenditure of Department of Highways of Ontario.

Fulton, W.J. "Winter Maintenance." The Municipal World, LXXI (March, 1961), 99-101.

Based on talk to Ontario Good Roads Association. Information on early legislation, equipment and costs (1934). Breakdown of costs 1958-9 by government levels. General discussion of Department of Highways of Ontario philosophy of winter maintenance.

Hubbard, W.C. "Modernized Winter Maintenance Operations Bring Results." Public Works, XCIV (October, 1963), 129-30. Costs 1958-63 at Springfield Mass. and methods used.

Hunter, L.M. "Snow Cleaning and Removal in Ottawa." The Canadian Engineer, XXXIV (February 14, 1918), 137-8. Chart of organization, removal of snow by the Ottawa Electric Railway Company, breakdown of costs of snow removal for business and residential sections by item.

Legget, R.F., and Gold, L.W. "Snow Removal and Ice Control in Cities." Habitat, VIII (September-October: November-December, 1965), 26-30.

General discussion of methods and costs of snow removal in Canada--based on NRC conference held in 1964.

Lennon, J.T. "Cost Analysis of Snow and Ice Control Operations." American Public Works Association Year Book 1967. Chicago, 1967.

Discusses factors affecting costs of control, methods for assessing costs and performance of control operations, and suggests measures for improving the efficiency of operations through planning management and organization.

McLeod, Norman W. "What's Going on in Highway Research." The Municipal World, LXXII (March, 1962), 93-9.

Expenditures on snow removal research in U.S. \$1 million for five year program and \$400,000 for one year.

Primarily concerns American Association of State Highways Officials Road Test.

Mercier, P.E. "Snow Removal in Montreal." The Canadian Engineer, XXXI (July, 1916), 71-2.

Some details of costs involved and methods used.

Miller, Warren C. "Snow Removal and Ice Control." The Municipal World, LXXV (January 1965), 4-7.

Figures on tonnage of snow removal in Ontario and costs (1949 and 1961) for various Canadian cities. P. 6, Winter Maintenance Chart--type of snow and ice treatment for various climatic conditions. (Review of 1964 NRC conference on Snow Removal and Ice Control.)

Miller, Warren C. "Winter Maintenance II." The Municipal World, LXXIII (December, 1963), 354-7.

General discussion on costs and methods with comments for various Ontario municipal and county areas. Some discussion of legal and economic situation.

O'Leary, T.J. "Snow Removal and Ice Control." American Public Works Association Year Book: 1960. Chicago: 1960. Deals with costs and the methods used in Boston.

Robbins, C.A. "Winter Maintenance of Public Highways." The Canadian Engineer, LXIII (September 20, 1932), 109-10. Methods employed in Ontario for drift prevention by fences, snow removal by plows, dealing with ice, maintenance of surface.

"Snow Removal at Canada's Airports." The Canadian Engineer, LXXVII (October 17, 1939), 105-8. Details of costs by labour, material and removal and capital cost for 19 airports.

"Snow Removal is Profitable." The Canadian Engineer, LXXV (October 18, 1938), 18-24. Organization methods in Ontario and British Columbia. Gasoline taxes offset expenditures. P. 18, "... snow removal is so obviously beneficial as to make opposition at any time appear foolish."

"\$3,100,000 Profit from Plowing." The Canadian Engineer, LXXVII (October 17, 1939), 12.

Expenditure on winter maintenance given for some north-eastern states and the State of Washington. Considered to be justified because of returns in gas tax and reduction of traffic accidents.

Trudeau, R.T. "Winter Maintenance in the Laurentians-- Expensive but Essential." Public Works, XCVIII (February, 1967), 103-5. Expenditures considered justified but no analysis. Details of methods used and costs.

U.S. Army. Cold Regions Research and Engineering Laboratory. Snow Removal and Ice Control, by M. Mellor. Report II-A3B, April, 1965. Summarizes current ideas, climatic factors, principles of snow removal, snow properties, equipment, cost of clearance, organization and planning of removal operations.

F. METHODS OF SNOW REMOVAL (Not Including Data on Costs)

American Public Works Association. Snow Removal Practices in Cities under 200,000 Population and Snow and Ice Control. Chicago: 1950.

Caffrey, G.P. "Plows, Salt and Promptness." The American City, LXXI (September, 1956), 123.

Canada. National Research Council. Associate Committee on Soil and Snow Mechanics. "Characteristics of Snow and Ice Relevant to Snow Removal and Ice Control," by L.W. Gold. Snow Removal and Ice Control. Technical Memorandum No. 83 (NRC 8146). Ottawa: October, 1964, 22-8. The effects of different types of snowfalls and ice storms on snow and ice control operations are presented and discussed.

Canada. National Research Council. Associate Committee on Geotechnical Research. Snow and Ice Subcommittee. Working Group on Urban Snow Removal. Manual on Snow Removal and Ice Control in Urban areas. Technical Memorandum No. 93, NRC 9904 (November, 1967). Guide to present snow removal practices in Canada issued as a result of the Snow and Ice Control conference held in 1964 (NRC Technical Memorandum No. 83). Deals with preparation, conduct, budgeting and assessment of snow removal operations; plus by-laws and regulations of snow emergency traffic routes, and the use of chemicals for de-icing and melting systems for snow disposal. Detailed bibliography on chemicals, pp.103-5; detailed bibliography on snow melting, pp. 122-4.

Canada. National Research Council. Division of Building Research. Avalanche Defences for the Trans-Canada Highway at Rogers Pass, by P. Schaerer. Technical Paper No. 141. Ottawa: November, 1962.

Classification of avalanches, discussion of general defence methods and defence plan for the area. 18 figures plus tables.

\_\_\_\_\_. Current Research on Ice Control, by L.W. Gold. Technical Paper No. 202. Ottawa: July, 1965. For annotation see listing in Section B.

Canadian Good Roads Association. "Development and Use of Winter Maintenance Equipment by the Department of Highways of Ontario," by L. Westlake. Proceedings of the 40th Convention: Vancouver: 1958. Ottawa: 1959. Includes listing of types of equipment such as trucks and snow-blowers, etc., and their use.

Caro, L.H. "Administration of Snow and Ice Removal Operations." American Public Works Association Year Book 1959. Chicago: 1959. Deals with problem in Illinois and the organization of snow removal.

Davidson, W.D. "Ways to Win the Snow Battle This Year." Civic Administration, XV, 10 (1953), 53-5. Discusses organization, communication and planning of snow removal operations in general terms.

Dembiske, F.E. "Snow Removal Operations in the Province of B.C." Proceedings of Western Snow Conference. Santa Barbara, Calif.: April, 1957. Discusses problems of different types of snow, scarcity of skilled labour, snow slides, winter communications and political pressure groups.

"18 Pages of the Latest Snow Removal Equipment." Roads and Bridges, C (November, 1962), 45-63. Discusses efficiency of various methods of removal.

Grimm, A. "A Snow and Ice Program that Works: Des Moines, Iowa." The American City, LXXV (August, 1960), 115.

Hamblin, G.D. "Salt is Still the Best." The American City, LXXIV (August, 1959), 152.

Hedges, W.E. "Emergency Plan Saves the Day." The American City, LXXV (February, 1960), 116.

Highway Research Board. Current Practices for Highway Snow and Ice Control. Current Road Problems No. 9-4R. Washington, D.C.: 1962.

Holster, W. "Snow Removal Needs New Ideas." The American City, LXXI (October, 1956), 125.

Keiss, E.W. "Planning and Organization Make up for a Lack of Equipment." The American City, LXXV (January, 1960), 29.

Lang, C.H., and Dickinson, W.E. "Snow and Ice Control with Chemical Mixtures and Abrasives." Highway Research Record. No. 61 (1964), 14-18.

Lucia, F.J. "Snow Removal and Ice Control in Urban Areas." American Public Works Association Year Book 1964. [Chicago]: 1964. Deals mainly with methods used in New York City.

Michigan Municipal League. Snow and Ice Removal Practices in Michigan Municipalities, by E.G. Moody. Information Bulletin No. 58. November, 1948. Based on a questionnaire survey. Data on methods and costs, policies and equipment.

Michigan Municipal League. Snow Removal and Ice Control Practices in Michigan Municipalities. 1959.

Ministry of Public Buildings and Works. Winter Building. London: Her Majesty's Stationery Office, 1963. Examines effects of cold weather, frost and snow on winter building operations in Britain in general forms.

Odbert, Eugene. "Modern Snow Removal Methods." The Municipal World, LXI (December, 1959), 370-1. General descriptive article on requirements for adequate and economic snow removal. Some references to Portage, Wisconsin (population 7,300).

Pecore, R. "Seventeen Hour Parking Ban Aids Snow Plowing." The American City, LXXVIII (September, 1963), 22.

Rheinfrank, W.J. "Procedures for the Removal of Light and Heavy Snows." The American City, LXVII (November, 1953), 106.



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