Icing Observations, 1965-1966: Second Progress Report

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Publisher's version / Version de l'éditeur:
https://doi.org/10.4224/20358952
Technical Note (National Research Council of Canada. Division of Building Research), 1967-02-01

NATIONAL RESEARCH COUNCIL OF CANADA

DIVISION OF BUILDING RESEARCH

No. 479

TECHNICAL NOTE

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DATE February 1967

PREPARED FOR Inquiry and Record

SUBJECT ICING OBSERVATIONS, 1965-1966
SECOND PROGRESS REPORT

The weight of ice or snow that may accumulate on towers or wires is one of the loads that is usually considered in the design of aerials, communication lines, and power transmission lines. There seems, however, to be very little information available on the actual thickness or weight of ice that may accumulate on wires or structures in various parts of Canada.

In 1964 the Subcommittee on General Requirements of the Canadian Standards Association Committee on Aerial Joint Use of Poles and the Division of Building Research co-operated in drawing up and distributing over 1800 "Icing Report Forms" which were to be filled in and returned if icing conditions were sufficiently serious to damage any equipment. Many forms were returned and a progress report on the first winter was prepared(1).

This report included a brief outline of the reasons for adopting this method of collecting icing information and a tabulation of information abstracted from the Icing Reports. A map of Canada showing the mean annual number of hours with freezing drizzle and freezing rain was reproduced in the Note on the assumption that there should be some correlation between ice thickness and hours of freezing precipitation.

ICING REPORTS

During the winter of 1965-66 a total of 74 reports was received. These included a number of "Tower Failure Reports" made available by the Radio Regulations Division of the Federal Department of Transport and a few others that were not on the Icing Report form.

As in the previous winter there were some forms that reported "no icing" or "failure caused by wind." Nine such reports have been filed without abstracting. The information contained in the remaining 65 reports has been summarized and is presented in tables in this report.

Table I is an abstract of the 25 reports of glaze or rime icing during the past winter. Table II is an abstract of the 16 cases of snow or frost that were reported. No reports of snow or frost were tabulated in the first progress report because none reported any damage. This year, however, almost half of the snow and frost reports included some report of damage; the others were abstracted for comparison.

Table III consists of 24 reports of icing in earlier winters.

The condensation of 65 reports into 3 tables has necessitated some averaging and interpretation, but the original reports are on file if more details are required. Some of the comments in the reports have been abbreviated to one or a few words to keep the tables as short as possible. These abbreviations are expanded or explained in the following paragraphs.

The location in the first column is usually the nearest populated place but in a few cases it is only one of several places affected by an icing storm.

The elevation in feet above sea level is only approximate in most cases and in a few cases is an average for a considerable range of elevations.

The author of each icing report is identified only by the main business of his company.

The date is the day on which the ice began to form. If the year only is given it means the winter ending in that year. The approximate duration in hours is tabulated in the next column.

The wind speed can seldom be measured at the location where the icing is observed but some indication of wind speed is given by the answers to the questions: "Was there a strong wind during the icing storm? following the storm?" "Yes" in a wind column indicates strong winds; a number indicates a wind speed in miles per hour; a number following the letter "G" indicates the speed of peak gusts.

The type of ice is indicated in the next column. Glaze ice is generally clear and dense. Rime is milky and granular and may occasionally be almost as dense as glaze. Hoar, or frost, is feathery and generally quite light. The snow in Tables II and III was usually described as wet and in some cases froze to the wires. S and ZR means a mixture of snow and freezing rain. The exact meaning of sleet in Table III is not clear.

When two values for the thickness of the ice were given in the original report, only the larger has been tabulated.

In many cases the exposure was described quite completely in the reports and the single words used here are intended only as a general indication of the type of terrain.

Poles and wires in the last column indicate that many of these were damaged; towers, however, indicate two or three antenna towers. Falling tree limbs or falling ice when melting begins often cause more damage than the ice load on the wires or towers.

DISCUSSION

The reports abstracted in Table I indicate that the 1965-66 season was somewhat less severe than the previous winter. Two of the storms in the first progress report were described as the worst in many years. The storm in Nova Scotia that continued from about 28 December 1964, until 5 January 1965, is reported again in this note in Table III. Inverness County in Cape Breton and Antigonish County on the mainland seem to have suffered the most. Ice 2 inches thick on wires and 10 inches on towers was reported. The May storm in Alberta also covered a considerable area. Thicknesses of 1 inch on wires and 6 inches on the windward sides of poles were reported from Sedgewick.

The worst icing in Table I this year is $1\frac{1}{2}$ inches of rime near Courtenay, B.C., and two reports of 1 inch of glaze near the Straits of Canso, N.S. The number of reports of glaze and rime is a few more than the previous winter.

The reports of frost and snow tabulated in Table II are interesting because these types of storms caused no reported damage in the previous winter. Wet snow occasionally accumulates on wires in most parts of Canada, but it is believed that this snow usually falls off before the weight becomes sufficient to cause damage. In British Columbia it seems that wet snow with very light winds is more common and more damaging. The snow and freezing rain reported from Alberni and Bella Coola in Table III may be the same phenomena described in different words.

Two reports of hoarfrost $1\frac{1}{2}$ to 2 inches thick breaking communication lines seem rather surprising. Deloraine, Manitoba, and North Portal, Saskatchewan, are about a hundred miles apart; both reported damage by hoarfrost on 11 December.

The earlier reports from British Columbia in Table III are generally the most severe storms in the memory of the observers. Some of the DOT tower failure reports also represent the most severe storm in many years. The severity of the icing in Nova Scotia and Newfoundland early in 1965 is confirmed by several reports of ice 10 to 15 inches thick on towers.

To illustrate the geographical distribution of the reports of icing on wires a map has been prepared (Figure 1). This is based on reports for the two winters 1964-65 and 1965-66. Icing on structures other than wires has not been used. Snow and hoarfrost have been excluded because their thicknesses are much greater for the same load. Thicknesses of 1/8 inch or less were considered negligible. Table I in DBR Tech. Note No. 459 (1) provided 14 reports of more than 1/8 inch of ice in the winter of 1964-65 and 3 more for the same winter were taken from Table III in this note. For the winter of 1965-66 there were 20 reports from Table I of this note.

These 37 reports have been plotted on the map (Figure 1) using symbols to indicate the approximate thickness of ice. Two winter's reports cannot be expected to delineate areas of different icing severity but it is tempting to point out some similarities between this map and the map of mean annual number of hours with freezing precipitation published in Tech. Note No. 459 in 1965. The Cape Breton - Antigonish storm affected mainly the area within the 60-hours-per-year isopleth on the freezing precipitation map but this may have been fortuitous. The 60- to 150-hours-per-year area in

Newfoundland reported no wire damage in these two winters, but the tower failures early in 1965 indicate that severe icing occurred in this area.

The large number of reports from the Hamilton, Ontario, to Joliette, Quebec, area may be due to the population density in this region, but it also fits nicely with the over 40-hours-per-year region on the freezing precipitation map. The reports from British Columbia do not correspond with any area of frequent freezing precipitation. Perhaps the wet snow near the west coast will have to be treated separately. On the other hand it may be that these winters were exceptional, and future years will change the pattern on this map.

The conclusion is the same as it was a year ago. Only a small percentage of the occurrences of freezing precipitation cause damage to power or communication lines but not all the damaging storms are being reported to us. The reliability of any map based on icing reports will depend almost entirely on how well the country is covered by conscientious observers. We are grateful to all those who have assisted with this project in the last two winters, and we hope that more will join us in the winters to come.

REFERENCE

1. Boyd, D. W. Icing Observations 1964-65 - First Progress Report. National Research Council, Division of Building Research, Tech. Note No. 459, September 1965.

TABLE I

ICING REPORTS

1965-66

LOCATION	PROV.	ELEV. feet	CO.	DATE	HRS.	WIND mph	WIND LATER mph	TYPE	THICKNESS inches WIRE	THICKNESS inches OTHER	EXPOSURE	DAMAGE
				1965								
Joliette	Que.	108	Phone	Nov.15	12	No	---	Rime	1/4	---	Flat	Poles and wires
Bells Corners	Ont.	250	Rlwy.	Nov.17	10	Yes	Yes	Glaze	3/8	---	Flat	Poles and wires
Manotick	Ont.	325	Rlwy.	Nov.17	10	Yes	Yes	Glaze	1/4	---	Flat	Poles and wires
Berthierville	Que.	---	Rlwy.	Nov.17	12	Yes	Yes	Glaze	1/2	---	Flat	Poles and wires
Pembroke	Ont.	380	Phone	Nov.27	12	20G40	10G40	Glaze	1/8	---	Flat	Trees
Hull	Que.	200	Rlwy.	Nov.27	12	Yes	Yes	Glaze	1/4	---	Flat	Two poles
Ste.Scholastique	Que.	---	Phone	Nov.27	15	No	No	Glaze	1/2	Few	Flat	Poles and wires
Ste.Scholastique	Que.	225	Phone	Nov.27	24	No	No	Glaze	1/2	2½	Flat	Poles and wires
Ste.Therese	Que.	---	Rlwy.	Nov.27	8	Yes	Yes	Glaze	1/2	1/2	Flat	Poles and wires
Courtenay	B.C.	2000	Power	Dec. 8	6	Yes	No	Rime	1½	---	Mountain	Poles and wires
Toronto	Ont.	---	Met.	Dec.11	20	No	---	Glaze	1/4	1/4	City	Little
Milton	Ont.	550	Rlwy.	Dec.12	16	No	Yes	Glaze	1/2	1/2	Hilly	Wires
Regina	Sask.	---	Rlwy.	Dec.13	72	No	---	Rime	3/4	---	Flat	Shorted by sag
St.Johns	Que.	---	Phone	Dec.13	6	No	No	Glaze	1/8	---	Flat	None
Toronto	Ont.	---	Met.	Dec.25	2	No	Yes	Glaze	Thin	Thin	City	None
Sackville	N.B.	Low	Radio	Dec.26	7	No	No	Glaze	1/8	---	Flat	None
				1966								
Moncton	N.B.	233	Met.	Jan.24	5	20	---	Glaze	1/8	1/8	Flat	None
Fraser Mountain	B.C.	3758	Phone	Feb. 1	144	20	30	Glaze	1/2	1/2	Plateau	Little
St.Jean de Matha	Que.	---	Phone	Mar. 5	2	Yes	Yes	Glaze	3/8	---	Hilly	---
Whitehead	N.S.	100	Power	Mar. 5	17	No	No	Glaze	1	---	Flat	Poles and wires
Port Hawkesbury	N.S.	100	Power	Mar. 5	16	---	No	Glaze	1	---	Hilly	Poles and wires
St.Calixte Nord	Que.	---	Phone	Mar. 6	8	No	No	Rime	1/2	---	Hilly	Poles
Scarborough	Ont.	---	Phone	Mar.12	14	No	No	Glaze	3/16	---	Nr.Bluff	None
Stettler	Alta.	---	Phone	Mar.13	72	No	No	Rime	1/4	---	Flat	None
Stettler	Alta.	---	Phone	Apr.11	48	No	---	Glaze	1/4	---	Flat	Wires

TABLE II

FROST AND SNOW REPORTS

1965-66

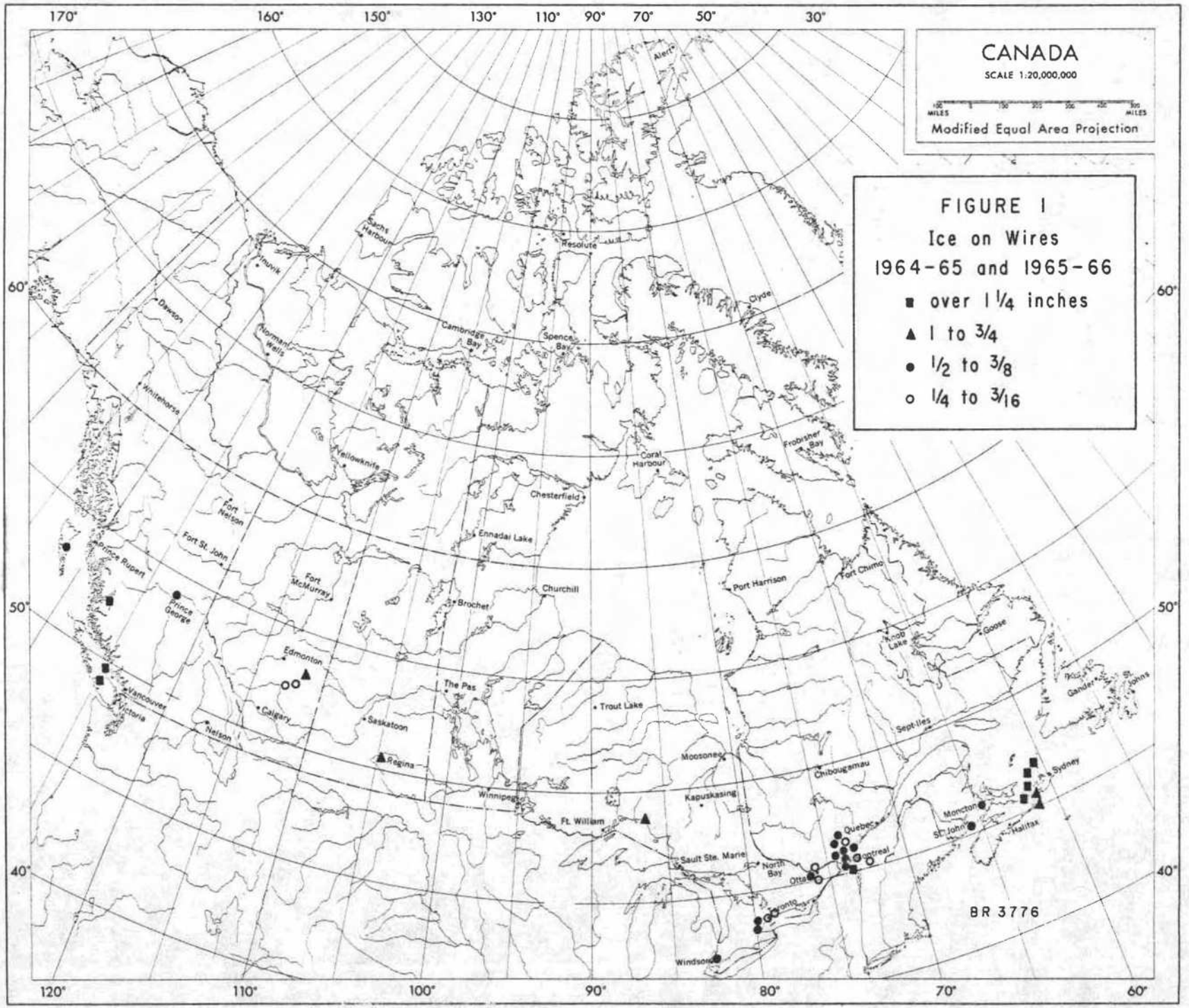
LOCATION	PROV.	ELEV. feet	CO.	DATE	HRS.	WIND mph	WIND LATER mph	TYPE	THICKNESS inches WIRE	THICKNESS inches OTHER	EXPOSURE	DAMAGE
				1965								
Thompson Mtn.	B.C.	6500	Phone	Nov.29	---	Yes	---	Hoar	1	1	Hilly	None
Terrace	B.C.	700	Power	Dec. 3	11	G15	No	Snow	2	---	Benches	Wires
North Portal	Sask.	---	Rlwy.	Dec.11	10	No	No	Hoar	1½	---	Flat	Wires
Deloraine	Man.	---	Phone	Dec.11	72	No	No	Hoar	2	---	Flat	Wires
Stettler	Alta.	---	Phone	Dec.14	48	No	No	Hoar	1/2	---	Flat	None
Campbell River	B.C.	Low	Phone	Dec.24	24	15	No	Snow	2½	---	Flat	Wires
Sutton Pass	B.C.	800	Power	Dec.27	4	No	No	Snow	5	---	Mountain	Shorting
				1966								
Stettler	Alta.	---	Phone	Jan. 1	72	No	No	Hoar	1¼	---	Flat	None
Sunset Beach	B.C.	400	Power	Jan. 4	---	No	No	Snow	2	---	Hilly	Shorted by sag
Lake Cowichan	B.C.	800	Power	Jan. 9	10	No	No	Snow	2	---	Hilly	Shorted by sag
Wetaskiwin	Alta.	2497	Phone	Feb. 1	---	No	No	Hoar	1	---	Flat	None
Stettler	Alta.	---	Phone	Feb. 8	13	No	No	Hoar	1/4	---	Flat	None
Prince George	B.C.	---	Power	Few	---	---	---	Snow	---	---	---	None
Stewart	B.C.	---	Power	Once	---	No	---	Snow	2	---	---	None
Prince Rupert	B.C.	---	Power	Once	---	---	---	Snow	4	---	---	None

TABLE III

REPORTS FROM EARLIER WINTERS

LOCATION	PROV.	ELEV. feet	CO.	YEAR	DATE	HRS.	WIND mph	TYPE	THICKNESS inches WIRE	OTHER	EXPOSURE	DAMAGE
Langley	B.C.	---	Power	1935	Jan.21	6	No	Glaze	2½	---	Flat	Poles & wires
Matsqui	B.C.	---	Power	1949	---	3	No	Glaze	1/2	---	Flat	Wires
Little Current	Ont.	975	DOT	1954	Mar. 1	---	NW29	S&ZR	---	1½	Hilly	Tower
Caledonia Mtn.	N.B.	1300	DOT	1956	Jan.	wk	No	Glaze	---	5	Hilly	Tower
St. John's	Nfld.	---	Met.	1958	Feb.27	46	---	Glaze	1	1¼	---	Poles & wires
Vanderhoof	B.C.	---	Power	1959	Dec.	48	No	Sleet	2½	---	Sheltered	None
Fort St. John	B.C.	2200	Power	1960	May 23	48	40	Snow	1 3/4	---	Flat	Poles & wires
St. Constant	Que.	100	DOT	1961	Feb.25	---	G70	Glaze	---	2	Flat	Towers
100 Mile House	B.C.	3180	Power	1961	Fall	12	No	Rime	1/8	---	Rolling	Shorted by sag
Fort Nelson	B.C.	1300	Met.	1962	Jan.11	14	No	Snow	1/2	---	Sheltered	None
St. Lawrence	Nfld.	96	DOT	1962	Feb.	---	SE40	Glaze	---	3/4	---	Antenna
Clinton	B.C.	---	Power	1962	---	---	---	Snow	3	---	---	---
Terrace	B.C.	300	Power	1963	Dec.21	24	No	Rime	2	---	Hilly	Wires
Ecum Secum	N.S.	100	DOT	1964	Mar.27	---	Yes	Glaze	---	3	Hilly	Antenna
Alberni	B.C.	1000	Power	1964	Dec.18	24	No	S&ZR	3	---	Mountain	None
Sandspit	B.C.	60	Power	1964	Dec.26	3	NW60	Glaze	1/2	---	Varied	None
Bella Coola	B.C.	50	Power	1964	Dec.31	18	5	S&ZR	1½	---	Sheltered	None
Antigonish	N.S.	1020	DOT	1965	Jan. 3	---	No	Glaze	---	10	Hilly	Tower
Brown's Mtn.	N.S.	---	News	1965	Jan. 5	---	G40	Glaze	---	10	Hilly	Tower bent
Lascie	Nfld.	330	DOT	1965	Jan. 6	---	W40	Glaze	---	15	Flat	Tower
Port aux Basques	Nfld.	185	DOT	1965	Feb.	---	50	Glaze	---	1	Hilly	Towers
Cook's Harbour	Nfld.	450	DOT	1965	Mar. 5	---	G105	Glaze	---	12	Hilly	Towers
Nakusp	B.C.	---	Power	Some	---	Few	No	Snow	3	---	---	None
Torbay	Nfld.	525	DOT	*1964	Feb.	---	G75	Glaze	---	12	Flat	Tower

* late report; out of chronological order.


CANADA
SCALE 1:20,000,000
Modified Equal Area Projection
FIGURE 1
Ice on Wires
1964-65 and 1965-66
over 1 1/4 inches
1 to 3/4
1/2 to 3/8
1/4 to 3/16
BR 3776
170°
160°
150°
130°
110°
90°
70°
50°
30°
60°
50°
40°
120°
110°
100°
90°
80°
70°
60°
Alert
Resolute
Inuvik
Sachs Harbour
Dawson
Norman Wells
Cambridge Bay
Spence Bay
Clyde
Whitehorse
Yellowknife
Coral Harbour
Frobisher Bay
Chesterfield
Fort Nelson
Fort St. John
Prince Rupert
Ennadai Lake
Fort McMurray
Churchill
Brochet
Port Harrison
Fort Chimo
Prince George
Edmonton
Knob Lake
Goose
Gander
St. Johns
Vancouver
Victoria
The Pas
Trout Lake
Calgary
Saskatoon
Nelson
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