Snow Accumulations in Canada: Case Histories: I

Schriever, W. R.; Faucher, Y.; Lutes, D. A.

Technical Paper (National Research Council of Canada. Division of Building Research), 1967-01

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CANADA

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CASE HISTORIES: I

COMPILED BY

W. R. SCHRIEVER, Y. FAUCHER, AND D. A. LUTES

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On a well-sheltered horizontal surface, such as a flat roof of a house in a forest clearing, snow will produce nearly uniformly-distributed loads which can be predicted statistically with reasonable accuracy. Actual snow loads on exposed roofs are, however, nonuniform and are difficult to predict because they are affected by numerous influences.

In many areas of Canada wind has a profound effect on the magnitude and distribution of snow loads on roofs. Wind produces snow drifting, i.e., removes snow from open and exposed areas on roofs and deposits it in other areas in the lee of obstructions. Thus it is absolutely essential in determining the proper design snow load for a given roof to take into account the effects of wind and the shape of the roof. Other factors such as the possibility of sliding of snow from roofs of different slope must also be considered. These factors, then, must be used to modify the basic load given by the snow load on the ground, (see Supplement No. 1 to the National Building Code of Canada, 1965).

Guidance with regard to the influence of wind and other factors on the roof loads is now provided in the 1965 Code, and particularly in the Chapter "Coefficients for Snow Loads on Roofs" in Supplement No. 3 to the Code. This guidance, however, can only deal with the relatively common types and shapes of roofs. Many unusual types of roofs and conditions will have to be considered by designers. In an effort to provide further guidance to designers, who are responsible for making the best possible estimate of the probable snow load, the Division is starting to publish case records of interesting nonuniform snow loads. This report is the first in the series.

Determination of Minimum Design Snow Load

The minimum design snow load, s, on the roof or any other area above ground which is subject to snow accumulation is obtained by multiplying the snow load on the ground, g, specified

for the municipality or area* considered, by the snow load coefficient (shape factor), C_s, applicable to the particular roof area considered.

$$s = C_s g$$

where

s = design snow load, psf
g = ground snow load, psf
C_s = snow load coefficient.

The basic snow load coefficient is 0.8, except that for roofs exposed to the wind, under certain conditions described below, this value may be reduced to 0.6. These coefficients are to be modified (increased or decreased) to account for the following influences:

(a) decrease of snow loads because of the effect of slope for roof slopes exceeding 30°;

(b) accumulation of unbalanced snow loads on gable and hip roofs;

(c) accumulation of nonuniform and unbalanced snow loads on arched and curved roofs;

(d) accumulation of increased snow loads in valleys of butterfly as well as multispan curved or sloped roofs;

(e) accumulation of increased nonuniform snow loads due to drifting snow on the lower of two-level or multi-level roofs, such as a canopy, marquee or porch roof, provided the upper roof is part of the same building or of an adjacent building not more than 15 feet away;

(f) accumulation of increased nonuniform snow loads on areas adjacent to roof projections, such as penthouses, large chimneys, and ventilating equipment;

(g) accumulation of increased snow or ice loads on areas

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*Recommended ground snow loads and other climatic information for building design for many municipalities in Canada are published in Supplement No. 1 to the National Building Code of Canada. Values for other locations in Canada may be obtained from the Secretary of the Associate Committee on the N.B.C., National Research Council, Ottawa.

due to snow sliding onto these areas from an adjacent roof sloping towards this area or due to melt water draining onto it. The magnitude and distribution of the increase should be appropriate to the relative positions and sizes of the surfaces.

Exposed Roofs

Numerous observations, in many areas of Canada, have shown that where a roof, or part of a roof, is fully exposed to wind, part of the snow is blown off under most conditions. The coefficients for such exposed roofs may be reduced by 25 per cent (from 0.8 to 0.6) if the following conditions are fulfilled:

(a) The roof is fully exposed to the winds on all sides, that is, not shielded on any side from the direct action of the wind by numerous trees higher than the roof, or by higher roofs of the same or of neighbouring buildings.

(b) The roof does not have projections, such as parapet walls, which prevent the snow from being blown off.

(c) The building is not located in a region of low winter season wind speeds.

Influence of Shape of Roof

Snow load coefficients, C_s, for some fairly common roof shapes are given in Figures 2-1 to 2-7, of Chapter 2, "Coefficients for Snow Loads on Roofs," of Supplement No. 3 to the N. B. C.; explanations on their use appear in Sections III and IV on pages 32 to 36 of the Appendix to the Supplement. Somewhat naturally only the more common shapes of roofs have been covered in the Supplement. Every designer should try to obtain the latest and most appropriate information available and, consequently, other snow load coefficients, if considered to be more appropriate in a particular case and if based on applicable field observations or on model tests, should be used in lieu of, or in addition to, those given in the Supplement.

Case Histories

To make information from the Division's survey on actual snow loads on roofs available to designers, this collection of case histories of some of the more unusual snow load accumulations is being published. The information for these case histories was obtained by volunteer observers and DBR staff who made depth measurements on roofs and the surrounding ground when an unusually interesting snow condition attracted their attention. The date of each case history is therefore only incidental. For comparison purposes, the NBC ground load and basic design roof load (80% value) are also given. The NBC ground load taken from Supplement No. 1 is the load due to snow which will be exceeded on the average once in 30 years, plus the load due to the maximum one-day rainfall in the late winter or early spring.

It is intended that this collection be expanded and amplified in the future. Descriptions of any large or peculiar snow loads and roof failures which may occur during the coming winters would therefore be greatly appreciated. They should be sent to:

Building Structures Section,
Division of Building Research,
National Research Council,
Ottawa 7, Ontario.

List of Case Histories

Case History No.	Location	Roof Description					Page
		Flat	Sloped	Arched	Multi Level	Other	
59-1	Winnipeg, Man.	x			x		5, 6
61-1	Sarnia, Ont.			x	x		5, 6
61-2	Ottawa, Ont.	x					7, 8
61-4	Halifax, N.S.		x				7, 8
62-2	Hull, P.Q.	x		x	x		9
62-3	Ottawa, Ont.	x					9
62-4	Ottawa, Ont.	x			x		10, 11
62-6	Dorval, P.Q.	x			x		11
63-2	Gander, Nfld.	x			x		12
63-4	Ottawa, Ont.	x			x		12
64-3	St. Catharines, Ont.	x		x	x		13
64-4	London, Ont.	x		x	x		13
64-5	Arvida, P.Q.	x			x		14
64-6	Inuvik, N.W.T.	x	x		x		14
65-1	Edmonton, Alta.	x			x		15
65-3	North Vancouver, B.C.					x	15
65-4	Ottawa, Ont.		x		x		16, 17
65-5	Rogers Pass, B.C.		x				16
65-7	Rogers Pass, B.C.		x				18, 19
65-9	Rogers Pass, B.C.	x	x		x		18, 19
65-10	Glacier, B.C.					x	20, 21
65-12	Ottawa, Ont.	x			x		20, 22
65-14	Sarnia, Ont.	x		x	x		23
65-15	Sarnia, Ont.			x			23
66-1	Ottawa, Ont.	x			x		24, 25
66-2	Ottawa, Ont.	x			x		24, 25
66-3	Ottawa, Ont.	x	x		x		26, 27
66-4	Ottawa, Ont.	x	x		x		26, 27
66-5	Ottawa, Ont.	x			x		28, 29
66-6	Quebec, P.Q.	x			x		28

Date January 1959
Location Winnipeg, Manitoba

Failure : No
Accumulation : Yes

No: 59-1

ROOF AND BUILDING DESCRIPTION

Type of structure and use : Flat roof between two higher flat roofs. Repair shop, office and warehouse.

Building Heated : Yes Roof Insulated: –

Shelter Conditions: Building exposed. Low flat roof sheltered by adjacent higher flat roofs.

ROOF SNOW LOADS (psf)

NBC (1960): 36
Avg. Obsd.: –
Max. Obsd.: 100

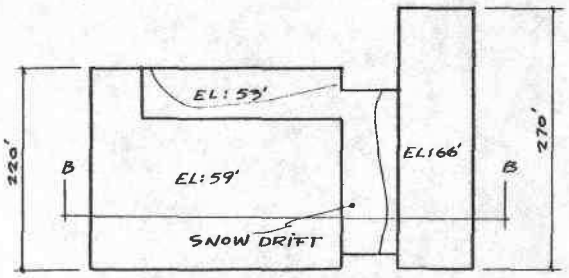
GROUND SNOW LOADS (psf)

NBC (1960): 45
Avg. Obsd.: 25

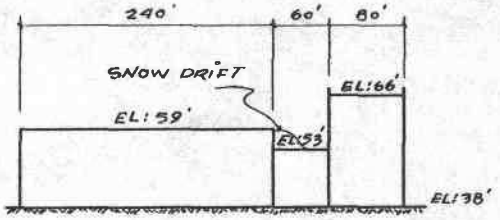
SNOW LOAD DISTRIBUTION

Severe drifting from higher office flat roof to lower flat roof caused triangular drift 6 ft high to edge of upper roof.

ROOF DESCRIPTION



PLAN



SECTION B-B

Date 6 January 1961
Location Sarnia, Ontario.

Failure : Yes
Accumulation: Yes

No: 61-1

ROOF AND BUILDING DESCRIPTION

Type of structure and use : Truck loading canopy adjacent to a large arched roof. Slope angle 30° at the edge.

Building Heated: No Roof Insulated: No

Shelter Conditions : Sheltered from the north by adjacent arch roof.

ROOF SNOW LOADS (psf)

NBC (1960): 24
Avg. Obsd.: 30
Max. Obsd.: —

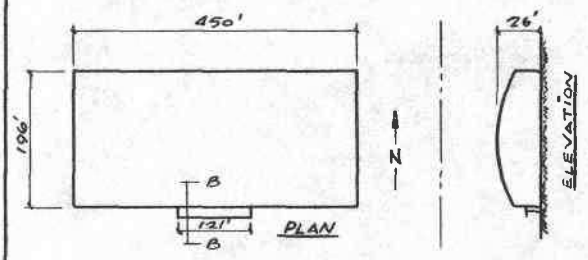
GROUND SNOW LOADS (psf)

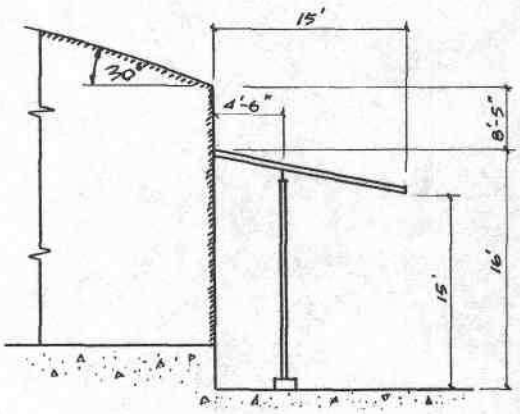
NBC (1960): 30
Avg. Obsd.: --

SNOW LOAD DISTRIBUTION

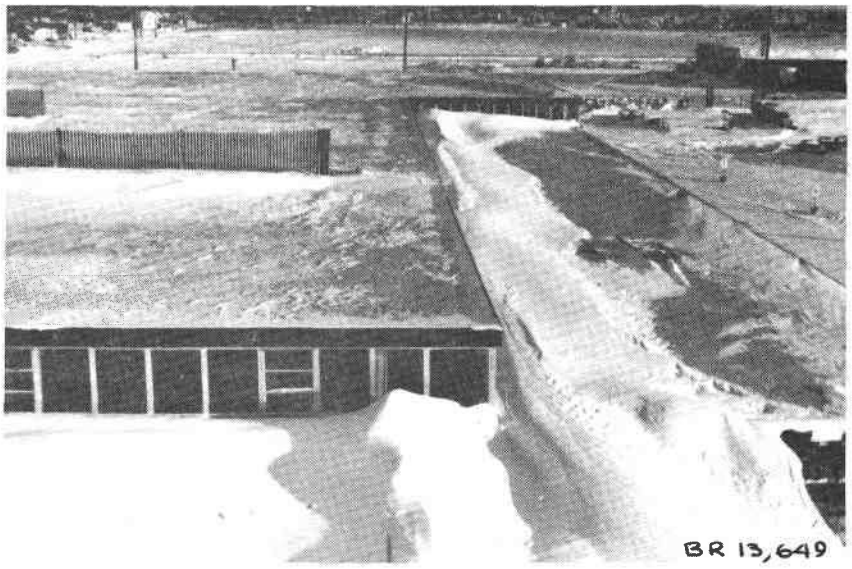
9 to 23 inches of snow on main roof slid off onto canopy. Load distribution on canopy not known.

ROOF DESCRIPTION

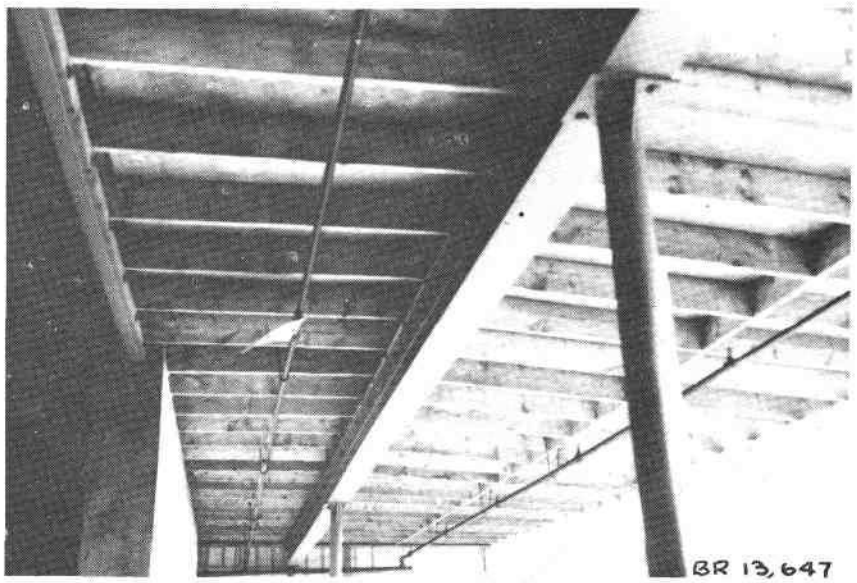




SECTION B-B



59-1. Large triangular drifts caused by blowing snow from higher large flat roof.



61-1. Damage to structure caused by snow sliding off from main arched roof.

Date 15 February 1961
Location Ottawa, Ontario

Failure : No
Accumulation : Yes

No: 61-2

ROOF AND BUILDING DESCRIPTION

Type of structure and use: Supermarket with large flat roof.

Building Heated : Yes Roof Insulated: Yes

Shelter Conditions : Building exposed

ROOF SNOW LOADS (psf)

NBC (1960): 48
Avg. Obsd.: 20
Max. Obsd.: 30

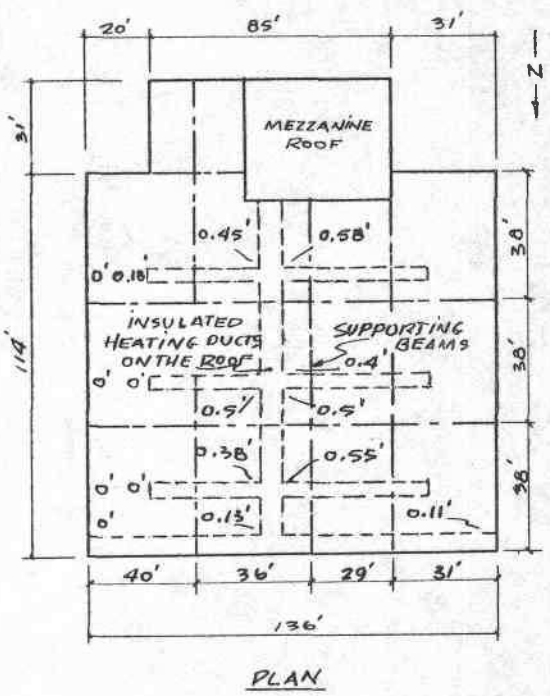
GROUND SNOW LOADS (psf)

NBC (1960): 60
Avg. Obsd.: 12

SNOW LOAD DISTRIBUTION

Poor drainage caused large portion of roof to be covered by ice up to 6 in. thick. Ice was deepest in centre of bays.

ROOF DESCRIPTION



PLAN

Date 9 March 1961
Location Halifax, N.S.

Failure : No
Accumulation : Yes

No: 61-4

ROOF AND BUILDING DESCRIPTION

Type of structure and use: Residence with shed roof.

Building Heated : Yes Roof Insulated: No

Shelter Conditions: Sheltered by trees surrounding the house.

ROOF SNOW LOADS (psf)

NBC (1960): 36
Avg. Obsd.: —
Max. Obsd.: 60

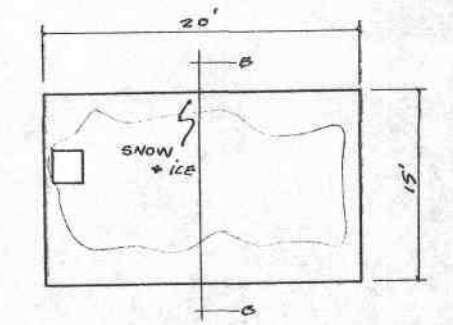
GROUND SNOW LOADS (psf)

NBC (1960): 45
Avg. Obsd.: —

SNOW LOAD DISTRIBUTION

Centre of roof bare. Snow and ice accumulations along the edges show the effect of heat loss.

ROOF DESCRIPTION



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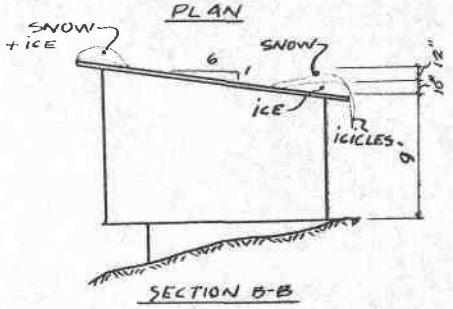


SECTION B-B

61-2. Ice loads caused by poor drainage on flat roof (note thickness of loose ice removed to improve drainage).

61-4. Accumulation of ice and snow on the overhang of an uninsulated roof.

Date 8 March 1962
Location Hull, Quebec

Failure : No
Accumulation : Yes

No: 62-2

ROOF AND BUILDING DESCRIPTION

Type of structure and use: Large arch roof with two adjacent lean-to flat roofs. Hockey arena.

Building Heated : No Roof Insulated : No

Shelter Conditions: The arena is not sheltered but canopies are by main arch roof.

ROOF SNOW LOADS (psf)

NBC (1960): 48
Avg. Obsd.: 70
Max. Obsd.: 140

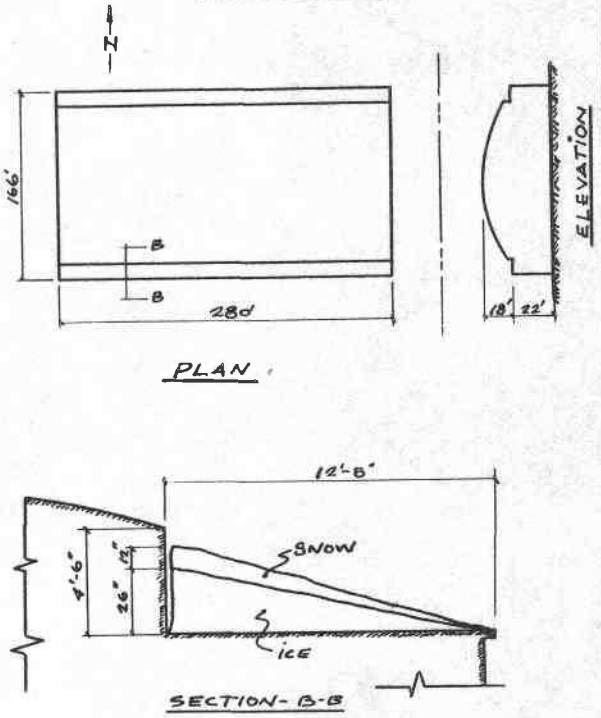
GROUND SNOW LOADS (psf)

NBC (1960): 60
Avg. Obsd.: 20

SNOW LOAD DISTRIBUTION

Main arch roof bare. Heavy load on lean-to roofs from snow blowing and melting off the main arch roof and refreezing on canopies.

ROOF DESCRIPTION



Date 6 March 1962
Location Ottawa, Ontario

Failure : No
Accumulation: Yes

No: 62-3

ROOF AND BUILDING DESCRIPTION

Type of structure and use: Flat roof surrounded by parapet wall 2 feet high. Laboratory building.

Building Heated: Yes Roof Insulated: Yes

Shelter Conditions : Building exposed. Roof sheltered from east and south by higher roofs of the same building.

ROOF SNOW LOADS (psf)

NBC (1960): 48
Avg. Obsd.: 21
Max. Obsd.: 70

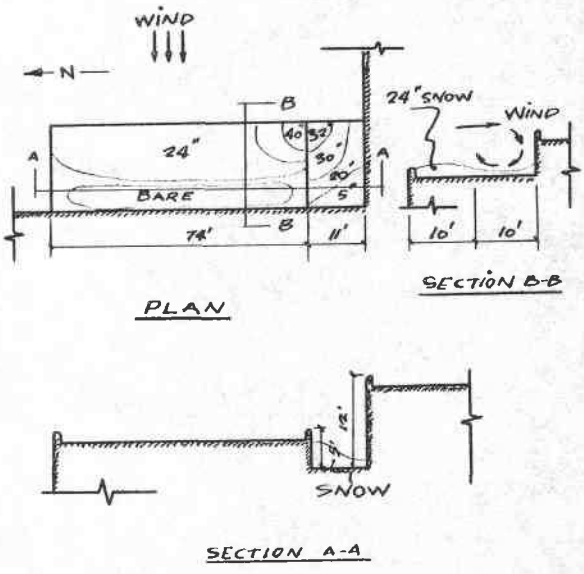
GROUND SNOW LOADS (psf)

NBC (1960): 60
Avg. Obsd.: 44

SNOW LOAD DISTRIBUTION

Because of the higher roof located on the lee side (west) the distribution behind the parapet wall was not triangular as usual, but rather uniformly distributed over half the span.

ROOF DESCRIPTION



Date 6 March 1962
Location Ottawa, Ontario

Failure : No
Accumulation : Yes

No: 62-4

ROOF AND BUILDING DESCRIPTION

Type of structure and use: Flat roof adjacent to higher flat roof with two ventilators present. Laboratory Building.

Building Heated : Yes Roof Insulated: Yes

Shelter Conditions: Building exposed. Low roof sheltered from east winds by the 6 foot higher flat roof.

ROOF SNOW LOADS (psf)

NBC (1960): 48
Avg. Obsd.: 9
Max. Obsd.: 64

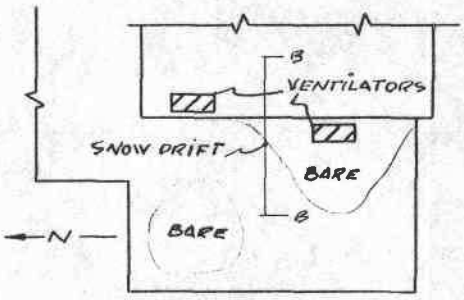
GROUND SNOW LOADS (psf)

NBC (1960): 60
Avg. Obsd.: 35

SNOW LOAD DISTRIBUTION

Large triangular drift fairly localized in lee of higher roof. Part of drift melted away by warm air from exhaust.

ROOF DESCRIPTION



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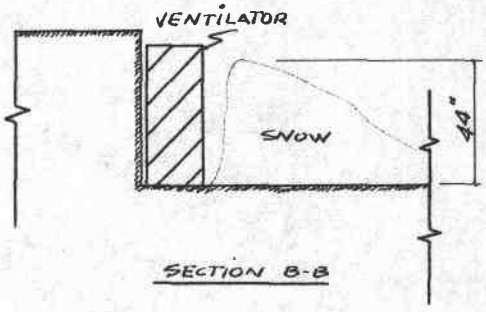


SECTION B-B

Date March 1962
Location Dorval, Quebec

Failure : Yes
Accumulation : Yes

No: 62-6

ROOF AND BUILDING DESCRIPTION

Type of structure and use: Flat roof adjacent to higher very large flat roof. Overhaul and maintenance base.

Building Heated: Yes Roof Insulated: Yes

Shelter Conditions : Building exposed. Low roof sheltered from east winds by higher roof.

ROOF SNOW LOADS (psf)

NBC (1960): 43
Avg. Obsd.: –
Max. Obsd.: 262

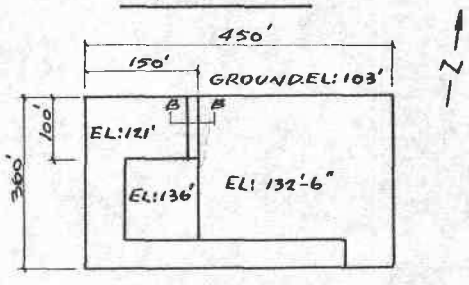
GROUND SNOW LOADS (psf)

NBC (1960): 54
Avg. Obsd.: 50

SNOW LOAD DISTRIBUTION

Large triangular drift up to 14 feet deep on low roof of corridor adjacent to large upper roof 12 feet higher.

ROOF DESCRIPTION



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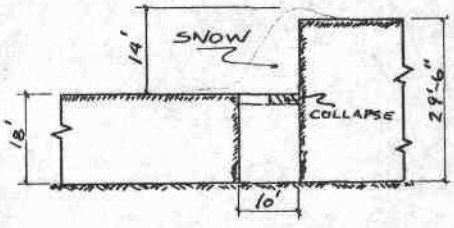
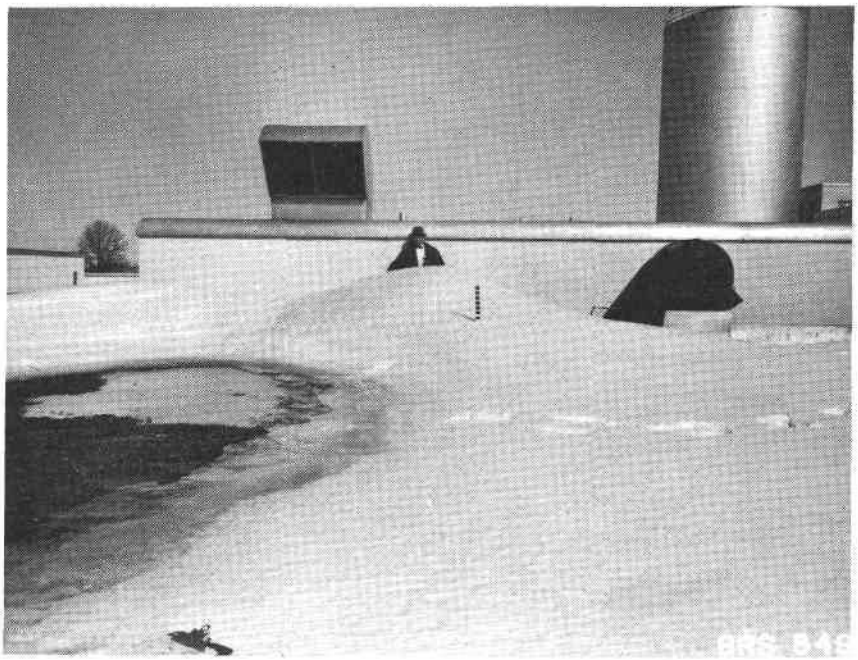


SECTION B-B



62-4. Front view of drift also shown in lower photograph. Note bare spot caused by warm air from exhaust at left.

62-4. Side view of large triangular drift in lee of higher roof, cut back by melting by warm air from exhaust at right.

Date 27 February 1963
Location Gander, Newfoundland

Failure : No
Accumulation: Yes

No: 63-2

ROOF AND BUILDING DESCRIPTION

Type of structure and use: Complicated multi-level flat roof with penthouse and lean-to. Air terminal.

Building Heated: Yes Roof Insulated: Yes

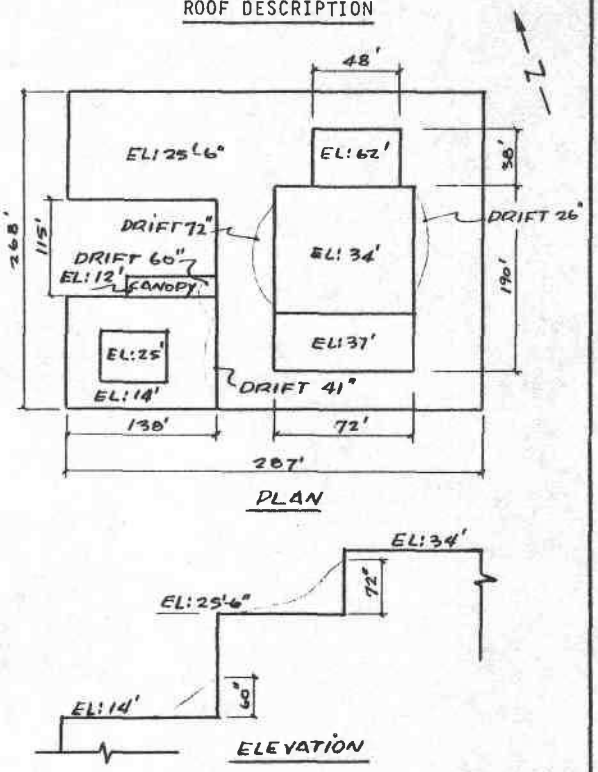
Shelter Conditions: Building exposed. Various roof areas sheltered by higher roofs.

ROOF SNOW LOADS (psf)		GROUND SNOW LOADS (psf)	
NBC (1960):	50	NBC (1960):	62
Avg. Obsd.:	6	Avg. Obsd.:	27
Max. Obsd.:	112		

SNOW LOAD DISTRIBUTION

Triangular drifts up to 6 feet deep caused by adjacent higher roofs.

ROOF DESCRIPTION



Date 21 March 1963
Location Ottawa, Ontario

Failure : No
Accumulation : Yes

No: 63-4

ROOF AND BUILDING DESCRIPTION

Type of structure and use : Large flat roof with two small canopies. Retail store and super market.

Building Heated: Yes Roof Insulated: Yes

Shelter Conditions : Building exposed. Two small canopies sheltered from west winds by higher roof.

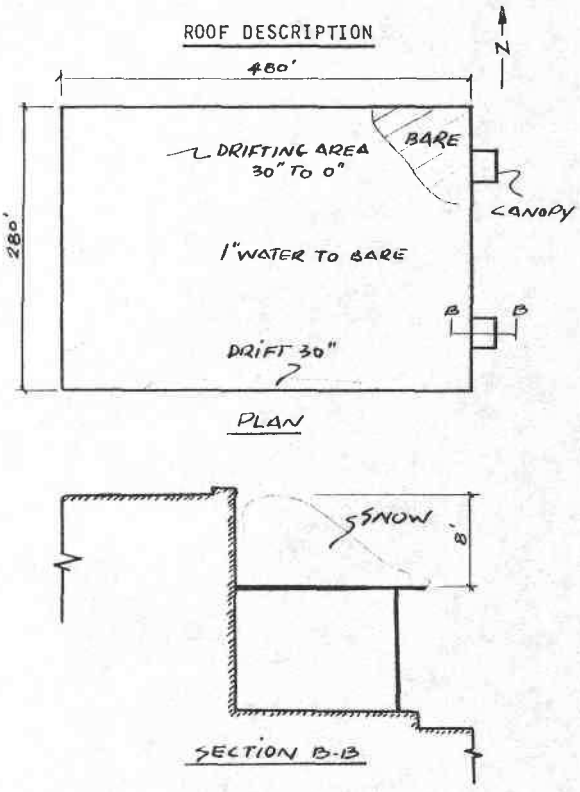
ROOF SNOW LOADS (psf)		GROUND SNOW LOADS (psf)	
NBC (1960):	48	NBC (1960):	60
Avg. Obsd.:	88*	Avg. Obsd.:	35
Max. Obsd.:	117*		

SNOW LOAD DISTRIBUTION

Triangular drifts up to 8 feet on canopy adjacent to the large flat roof 480 feet long.

* Snow loads on canopy.

ROOF DESCRIPTION



Date 2 January 1964
Location St-Catharines, Ontario

Failure : No
Accumulation: Yes

No: 64-3

ROOF AND BUILDING DESCRIPTION

Type of structure and use: Large arch roof with canopy on one side. Bowling Alley.

Building Heated: Yes Roof Insulated: Yes

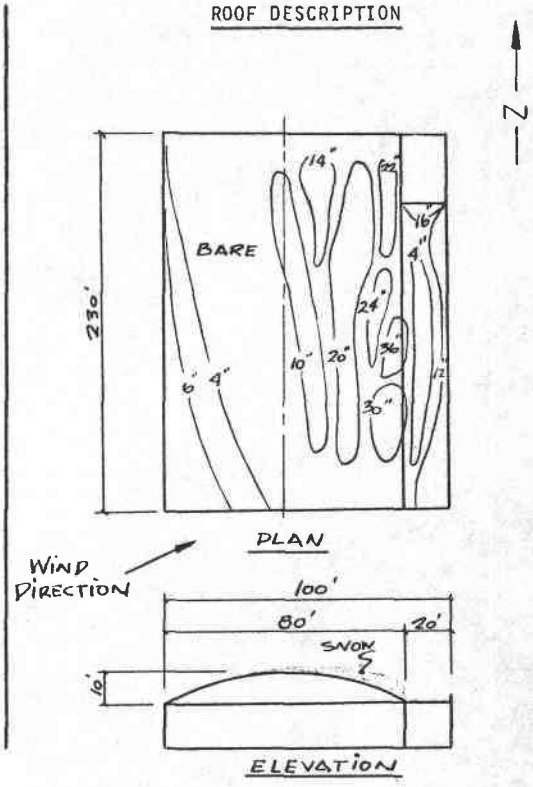
Shelter Conditions : Building exposed.

ROOF SNOW LOADS (psf)		GROUND SNOW LOADS (psf)	
NBC (1960):	30	NBC (1960):	38
Avg. Obsd.:	10	Avg. Obsd.:	—
Max. Obsd.:	35		

SNOW LOAD DISTRIBUTION

Unbalanced load on arch with maximum depth along eave (snow fell under calm conditions, producing 8" uniform snow cover, and was redistributed by a 15 mph wind the next day as shown).

ROOF DESCRIPTION



Date 3 January 1964
Location London, Ontario

Failure : No
Accumulation : Yes

No: 64-4

ROOF AND BUILDING DESCRIPTION

Type of structure and use: Large arch roof with raised section on one side near middle of building. Curling rink.

Building Heated: – Roof Insulated : –

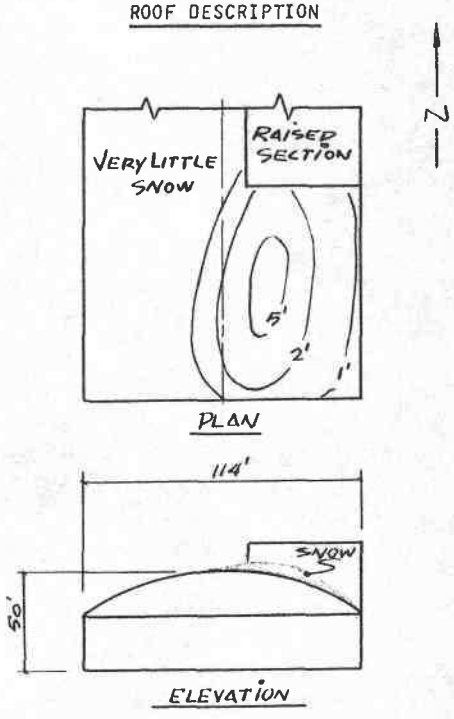
Shelter Conditions : –

ROOF SNOW LOADS (psf)		GROUND SNOW LOADS (psf)	
NBC (1960):	34	NBC (1960):	42
Avg. Obsd.:	20	Avg. Obsd.:	20
Max. Obsd.:	75		

SNOW LOAD DISTRIBUTION

Unbalanced load on arch.
(Information not very complete).

ROOF DESCRIPTION



Date 22 January 1964
Location Arvida, Quebec

Failure : No
Accumulation : Yes

No: 64-5

ROOF AND BUILDING DESCRIPTION

Type of structure and use: Flat roof adjacent to another flat roof, forming corner. Aluminum plant.

Building Heated : Yes Roof Insulated: Yes

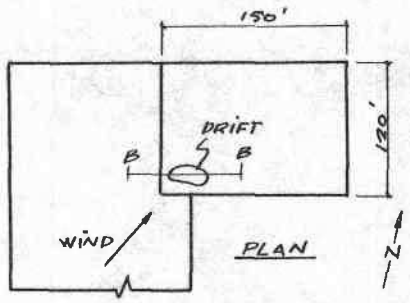
Shelter Conditions: Building exposed. Lower roof sheltered by higher roof.

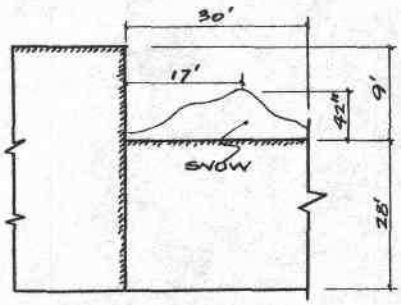
ROOF SNOW LOADS (psf)		GROUND SNOW LOADS (psf)	
NBC (1960):	60	NBC (1960):	75
Avg. Obsd.:	27	Avg. Obsd.:	20
Max. Obsd.:	70		

SNOW LOAD DISTRIBUTION

Drift formed some distance away from roof, perhaps because of corner effect.

ROOF DESCRIPTION





SECTION B-B

Date 1 February 1964
Location Inuvik, N.W.T.

Failure : No
Accumulation : Yes

No: 64-6

ROOF AND BUILDING DESCRIPTION

Type of structure and use: Flat roof adjacent to higher roof sloped towards the former. School.

Building Heated: Yes Roof Insulated: Yes

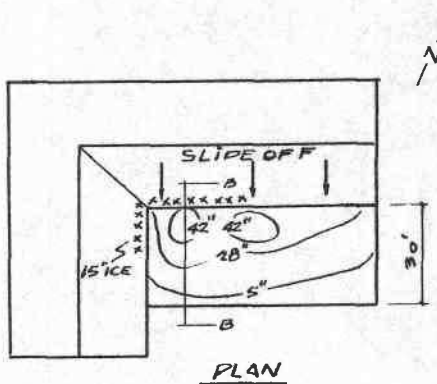
Shelter Conditions : Building exposed. Flat roof sheltered by higher sloped roof.

ROOF SNOW LOADS (psf)		GROUND SNOW LOADS (psf)	
NBC (1960):	37	NBC (1960):	46
Avg. Obsd.:	30	Avg. Obsd.:	16
Max. Obsd.:	50		

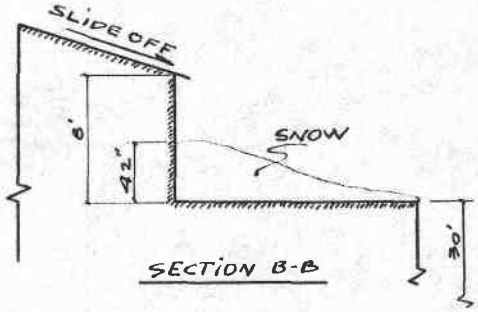
SNOW LOAD DISTRIBUTION

Sliding snow from upper sloped roof produced heavy load on lower roof.

ROOF DESCRIPTION



PLAN



SECTION B-B

Date 1 December 1964
Location Edmonton, Alberta

Failure : No
Accumulation : Yes

No: 65-1

ROOF AND BUILDING DESCRIPTION

Type of structure and use: Large flat roof with penthouse surrounded by a parapet wall 4'2" high. Administration Building.

Building Heated: Yes Roof Insulated: Yes

Shelter Conditions : Yes

ROOF SNOW LOADS (psf)

NBC (1960): 22
Avg. Obsd.: 5
Max. Obsd.: 13

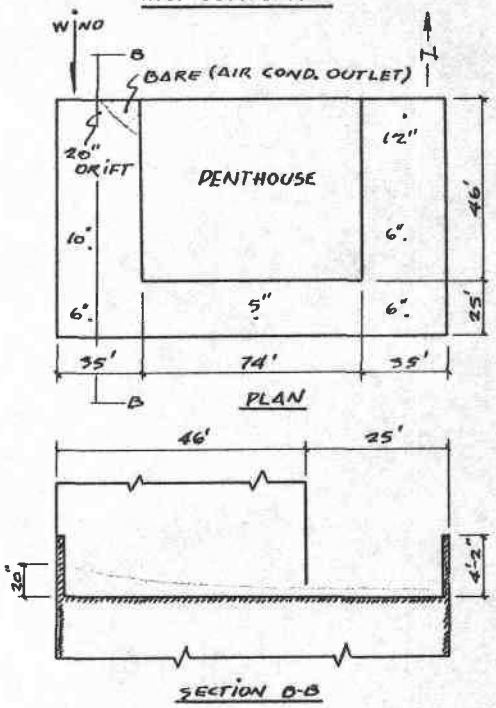
GROUND SNOW LOADS (psf)

NBC (1960): 27
Avg. Obsd.: 7

SNOW LOAD DISTRIBUTION

Accumulation of snow behind parapet wall decreasing gradually towards leeward side of building.

ROOF DESCRIPTION



Date 21 January 1965
Location North Vancouver, B.C.

Failure :No
Accumulation:Yes

No: 65-3

ROOF AND BUILDING DESCRIPTION

Type of structure and use : Various residential roofs located on mountain side at elevations from 30 to 1,290 feet above sea level.

Building Heated: Yes Roof Insulated : Yes

Shelter Conditions : Yes

ROOF SNOW LOADS (psf)

NBC (1960): 27
Avg. Obsd.: } See below
Max. Obsd.: }

GROUND SNOW LOADS (psf)

NBC (1960): 34
Avg. Obsd.: See below

SNOW LOAD DISTRIBUTION

Roof loads very uniform and similar to ground loads. Ground load varied from about 15 psf at sea level to 50 psf at 1,290 feet, showing clearly the increase with elevation.

ROOF DESCRIPTION

Date 28 January 1965
Location Ottawa, Ontario

Failure : No
Accumulation : Yes

No: 65-4

ROOF AND BUILDING DESCRIPTION

Type of structure and use: Roof with two lower lean-to sections west and east of main roof. Hockey rink.

Building Heated : No Roof Insulated: No

Shelter Conditions: Main roof not sheltered. Lower roofs sheltered by upper roof from one side each.

ROOF SNOW LOADS (psf)

NBC (1960): 48
Avg. Obsd.: 13
Max. Obsd.: 75

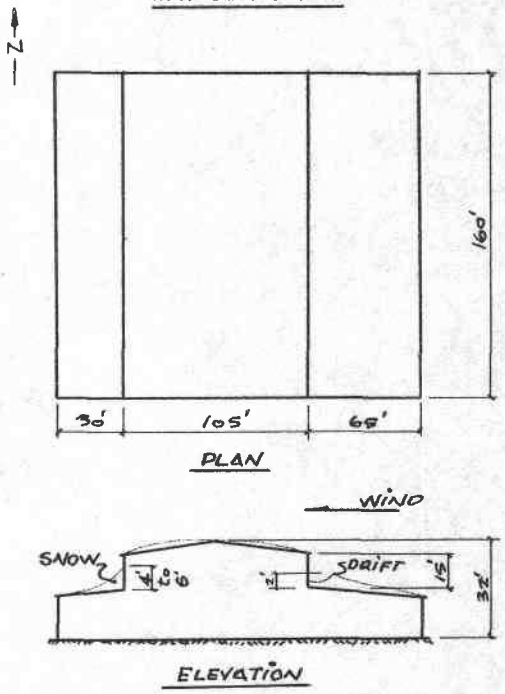
GROUND SNOW LOADS (psf)

NBC (1960): 60
Avg. Obsd.: 11

SNOW LOAD DISTRIBUTION

High roof covered by less than 5 in. of snow. On windward lower roof (east) average depth about 10 inches with drifts up to 26 inches. On leeward lower roof (west) drifts up to 6 feet occurred at one point but drifts are usually about 4 feet.

ROOF DESCRIPTION



Date 30 January 1965
Location Rogers Pass, B.C. (Elevation 4300 ft.)

Failure : No
Accumulation : Yes

No: 65-5

ROOF AND BUILDING DESCRIPTION

Type of structure and use : Steep metal roof in high mountain area. Small camp building store.

Building Heated: No Roof Insulated: Yes

Shelter Conditions : Sheltered from north east winds by a small camp building. Very calm area.

ROOF SNOW LOADS (psf)

NBC (1960): 129
Avg. Obsd.: 44
Max. Obsd.: 68

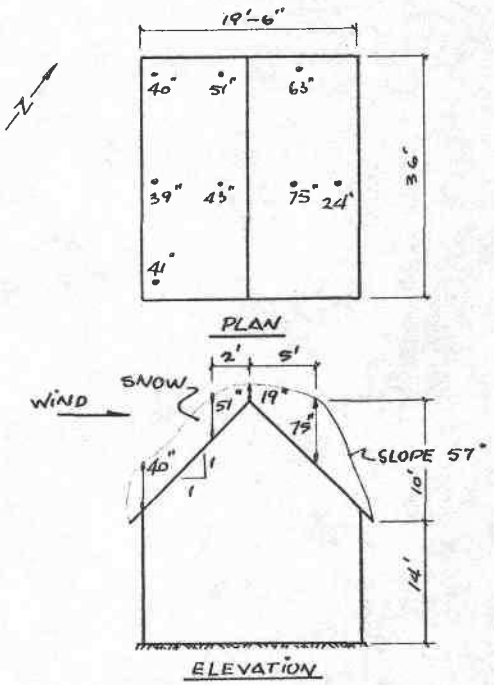
GROUND SNOW LOADS (psf)

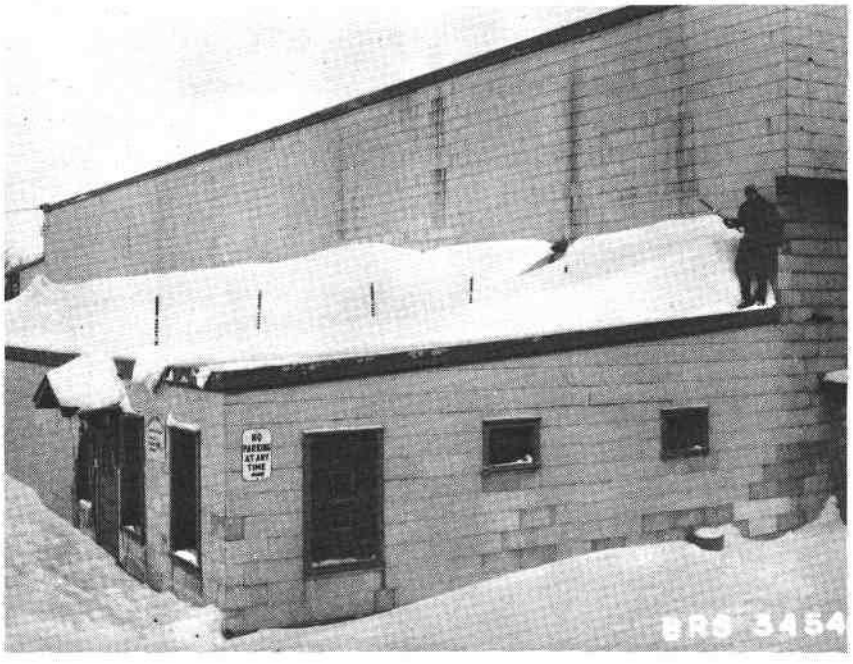
NBC (1960): 161
Avg. Obsd.: 81

SNOW LOAD DISTRIBUTION

Very uniform distribution on windward side (40 inches), with slight increase on leeward side to 75 inches of snow.

ROOF DESCRIPTION





65-4. Drifts up to 6 feet on lean-to roof adjacent (west) to higher main roof.

Date 30 January 1965
Location Rogers Pass, B.C. (4300')

Failure : No
Accumulation : Yes

No: 65-7

ROOF AND BUILDING DESCRIPTION

Type of structure and use: Steep metal roof. Small store building.

Building Heated : No Roof Insulated: Yes

Shelter Conditions: Sheltered by trees and other buildings.

ROOF SNOW LOADS (psf)

NBC (1960): 129
Avg. Obsd.: 62
Max. Obsd.: 89

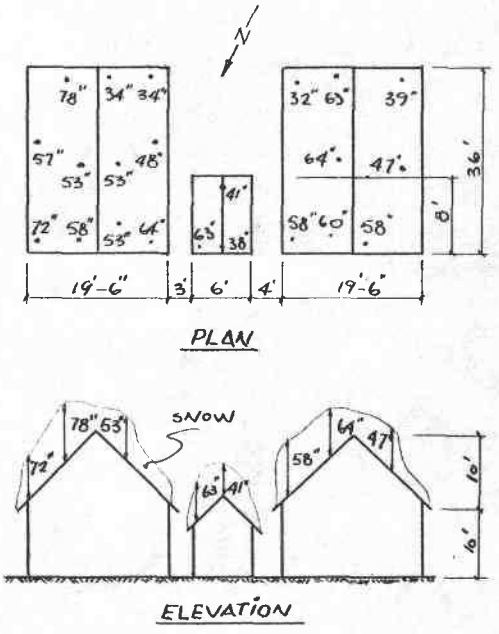
GROUND SNOW LOADS (psf)

NBC (1960): 161
Avg. Obsd.: 81

SNOW LOAD DISTRIBUTION

Very uniform distribution on steep aluminum roofs (slope angle up to 45°) Snow did not slide off, probably because building was not heated.

ROOF DESCRIPTION



Date 2 February 1965
Location Rogers Pass, B.C. (Elev. 4300')

Failure : No
Accumulation: Yes

No: 65-9

ROOF AND BUILDING DESCRIPTION

Type of structure and use : Flat roof adjacent to peaked steep roofs. Lodge.

Building Heated: Yes Roof Insulated: Yes

Shelter Conditions : Partly sheltered only (On east side).

ROOF SNOW LOADS (psf)

NBC (1960): 129
Avg. Obsd.: 115
Max. Obsd.: 278

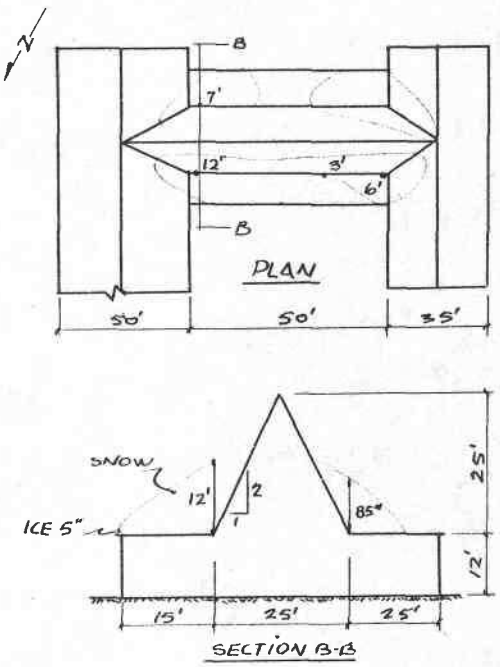
GROUND SNOW LOADS (psf)

NBC (1960): 161
Avg. Obsd.: 83

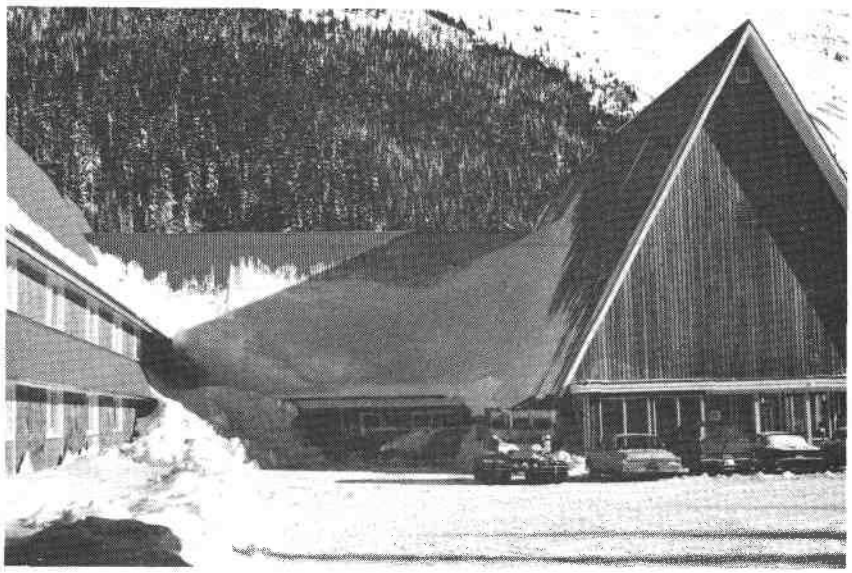
SNOW LOAD DISTRIBUTION

Snow slides off from the steep roofs and accumulates on the flat roof to great depths.

ROOF DESCRIPTION



65-7. Very uniform snow cover on steep aluminum roofs in calm mountain area. Slope angle 45°.



65-9. Accumulations of snow on flat roof caused by sliding snow from higher steep roofs.

Date 7 February 1965
Location Glacier, B.C. (Elev. 3860')

Failure : No
Accumulation: Yes

No: 65-10

ROOF AND BUILDING DESCRIPTION

Type of structure and use: Gable roof with asphalt shingles. Empty residence in mountains.

Building Heated : No Roof Insulated: Yes

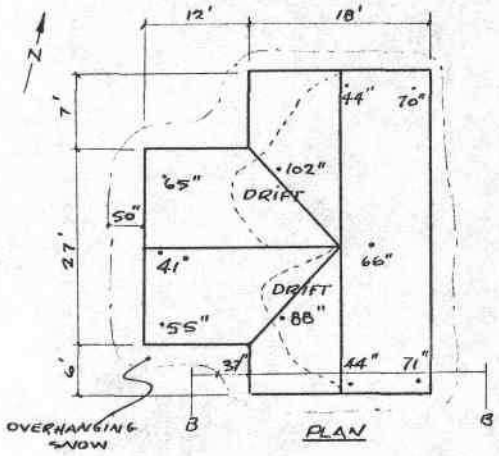
Shelter Conditions: Fairly well sheltered by trees.

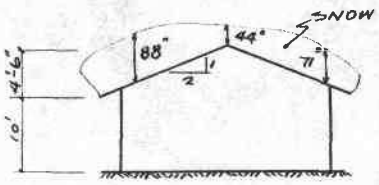
ROOF SNOW LOADS (psf)	GROUND SNOW LOADS (psf)
NBC (1960): 129	NBC (1960): 161
Avg. Obsd.: 70	Avg. Obsd.: 125
Max. Obsd.: 120	

SNOW LOAD DISTRIBUTION

Fairly uniform load with large snow overhangs over gable ends.

ROOF DESCRIPTION





Date 8 February 1965
Location Ottawa, Ontario

Failure : No
Accumulation: Yes

No: 65-12

ROOF AND BUILDING DESCRIPTION

Type of structure and use : Flat roof west of higher flat roof. High School.

Building Heated: Yes Roof Insulated: Yes

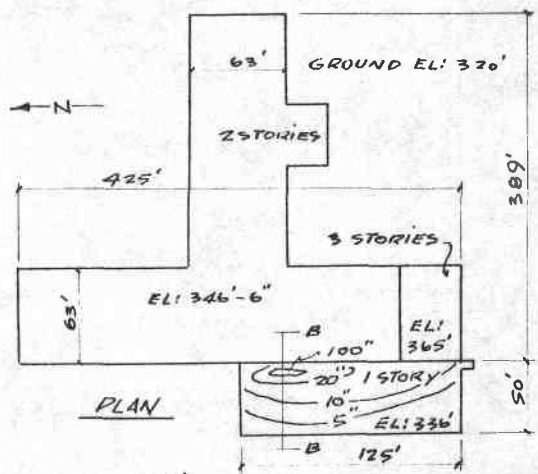
Shelter Conditions : Building exposed. Lower roof sheltered from east winds by higher roof.

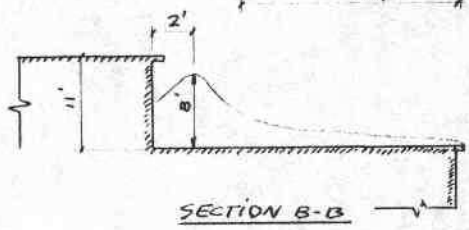
ROOF SNOW LOADS (psf)	GROUND SNOW LOADS (psf)
NBC (1960): 48	NBC (1960): 60
Avg. Obsd.: 27	Avg. Obsd.: 16
Max. Obsd.: 182	

SNOW LOAD DISTRIBUTION

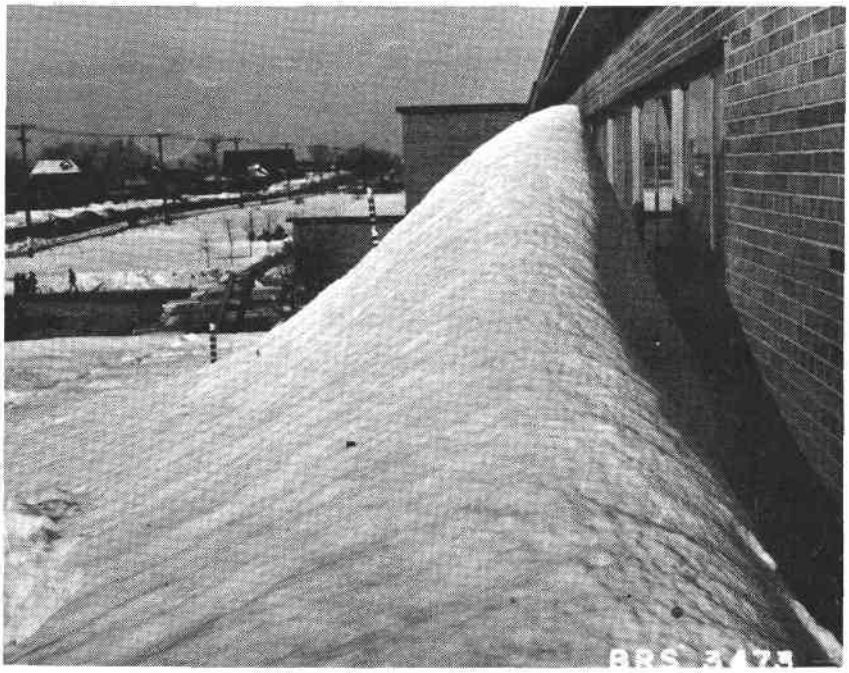
Very deep triangular drift load (up to 8 feet deep) on lower flat roof adjacent to large flat roof. Ratio of maximum drift load to ground load was 12.

ROOF DESCRIPTION





65-10. Fairly uniform snow cover with large snow overhangs over gable ends.



65-12. Side view of triangular drift 8 feet deep on lean-to roof adjacent (west) to higher very large flat roof.

65-12. Front view of drift shown in upper figure. Note four 3-ft gauges and one 6-ft gauge held by observer.

Date 25 February 1965
Location Sarnia, Ontario

Failure : Yes
Accumulation : Yes

No: 65-14

ROOF AND BUILDING DESCRIPTION

Type of structure and use : Large arched roofs. Warehouse.

Building Heated : No Roof Insulated: No

Shelter Conditions : Building exposed.

ROOF SNOW LOADS (psf)

NBC (1960): 24
Avg. Obsd.: –
Max. Obsd.: 40 to 90 (estimated)

GROUND SNOW LOADS (psf)

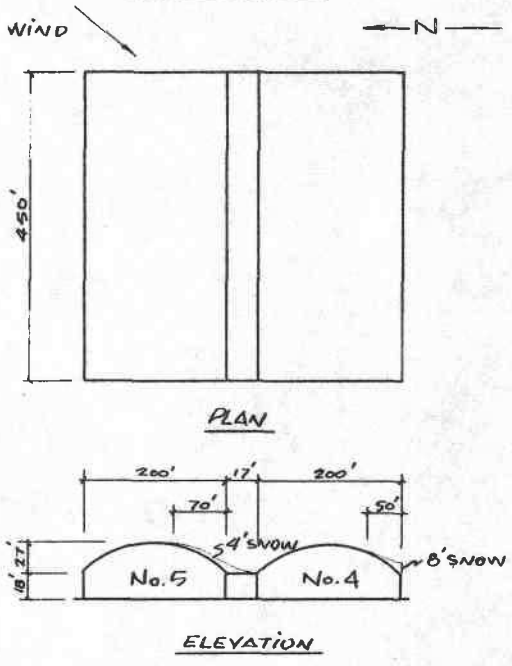
NBC (1960): 30
Avg. Obsd.: 13

SNOW LOAD DISTRIBUTION

Snow accumulation on leeward side of building No. 5 caused collapse.

Collapse occurred after about 10 inches of snow had fallen in about 12 hours.

ROOF DESCRIPTION



Date 25 February 1965
Location Sarnia, Ontario

Failure : No
Accumulation : Yes

No: 65-15

ROOF AND BUILDING DESCRIPTION

Type of structure and use : Large arched roof. Warehouse.

Building Heated: No Roof Insulated : No

Shelter Conditions : No

ROOF SNOW LOADS (psf)

NBC (1960): 24
Avg. Obsd.: 12
Max. Obsd.: 50 (estimated)

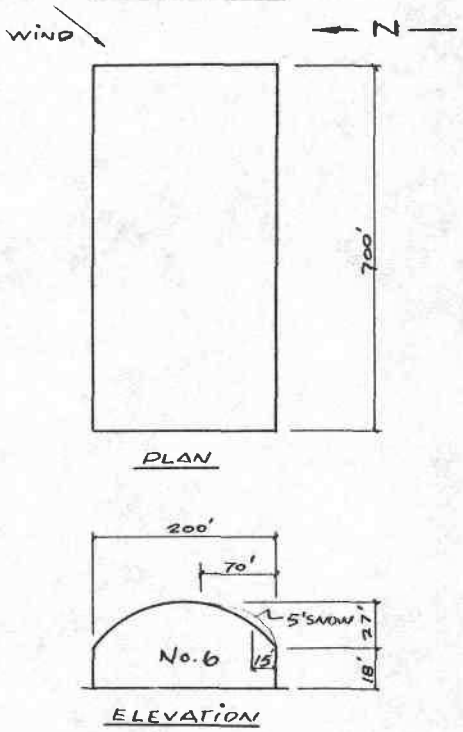
GROUND SNOW LOADS (psf)

NBC (1960): 30
Avg. Obsd.: 13

SNOW LOAD DISTRIBUTION

Drift up to 4 or 5 feet on leeward side of the warehouse. No failure occurred in this warehouse, but some bowing of the truss members was observed.

ROOF DESCRIPTION



Date 2 February 1966
Location Ottawa, Ontario

Failure : No
Accumulation : Yes

No: 66-1

ROOF AND BUILDING DESCRIPTION

Type of structure and use: Barrel canopies adjacent to flat roof between higher flat roofs. Townhouses.

Building Heated: Yes* No** Roof Insulated: Yes* No**

Shelter Conditions : Building exposed. Low roofs sheltered by higher roofs.

ROOF SNOW LOADS (psf)

NBC (1965):48 psf
Avg. Obsd.: –
Max. Obsd.:48 psf on flat roof
36 psf on barrel canopy

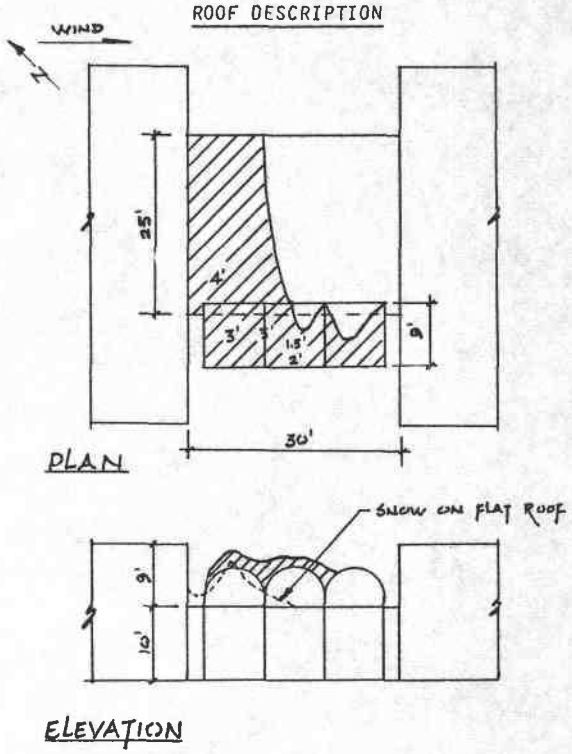
GROUND SNOW LOADS (psf)

NBC (1965): 60 psf
Avg. Obsd.: 12 psf

SNOW LOAD DISTRIBUTION

Very little snow on higher flat roof with large drift 4' on lower flat roof and barrel canopies.

ROOF DESCRIPTION



* flat roof
**barrel canopies

Date 3 February 1966
Location Ottawa, Ontario

Failure : No
Accumulation : Yes

No: 66-2

ROOF AND BUILDING DESCRIPTION

Type of structure and use : Canopy attached to a large flat roof. Retail store.

Building Heated : No Roof Insulated : No

Shelter Conditions: Building exposed. Canopy sheltered by adjacent higher flat roof.

ROOF SNOW LOADS (psf)

NBC (1965):48 psf
Avg. Obsd.:36 psf
Max. Obsd.:66 psf

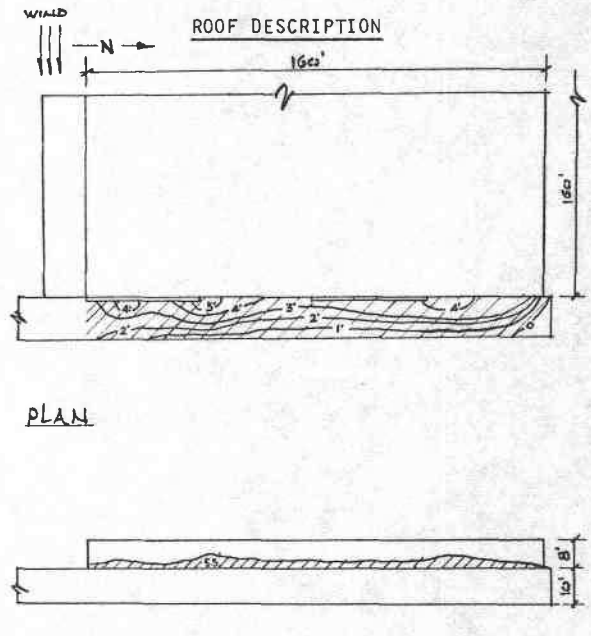
GROUND SNOW LOADS (psf)

NBC (1965): 60 psf
Avg. Obsd.: 13 psf

SNOW LOAD DISTRIBUTION

Deep drift load (up to 66") on canopy adjacent to large flat roof with very small snow load (approx. ¼").

ROOF DESCRIPTION



66-1. Large drift on barrel canopies and flat roof adjacent to higher flat roof.

66-2. Drifts up to $5\frac{1}{2}$ feet on canopy adjacent to large flat roof with very small snow load.

Date 2 February 1966
Location Ottawa, Ontario

Failure : No
Accumulation : Yes

No: 66-3

ROOF AND BUILDING DESCRIPTION

Type of structure and use : Carport attached to the gable wall of a low slope house roof.

Building Heated : No Roof Insulated : No

Shelter Conditions: Carport sheltered by adjacent gable roof.

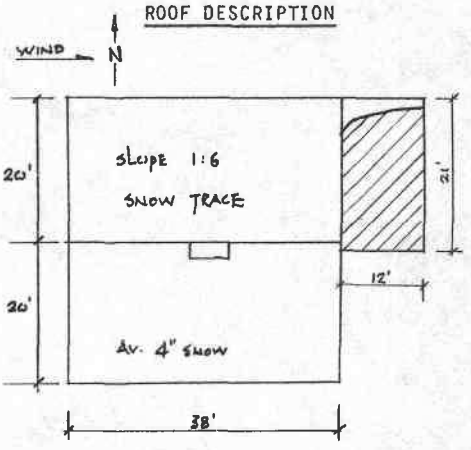
ROOF SNOW LOADS (psf) GROUND SNOW LOADS (psf)

NBC (1965): 48 psf NBC (1965): [illegible]
Avg. Obsd.: 42 psf Avg. Obsd.: 12.4 psf
Max. Obsd.: 54 psf

SNOW LOAD DISTRIBUTION

Large drift on Carport with approx. 6" drift on the South side of main roof. A trace on the north side of main roof.

ROOF DESCRIPTION



PLAN

ELEVATION

Date 2 February 1966
Location Ottawa, Ontario

Failure : No
Accumulation : Yes

No: 66-4

ROOF AND BUILDING DESCRIPTION

Type of structure and use : Flat lean-to sheltered on West and North by the main roof. Hockey arena.

Building Heated : Yes Roof Insulated: Yes

Shelter Conditions: Building exposed. Low flat roof sheltered by adjacent sloped roof.

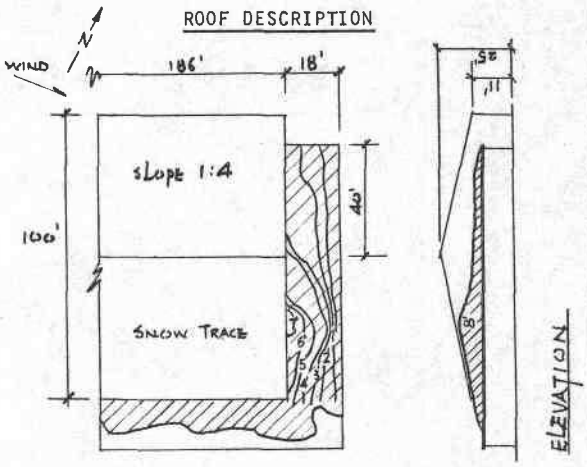
ROOF SNOW LOADS (psf) GROUND SNOW LOADS (psf)

NBC (1965): 48 psf NBC (1965): 60 psf
Avg. Obsd.: 30 psf Avg. Obsd.: 12 psf
Max. Obsd.:128 psf

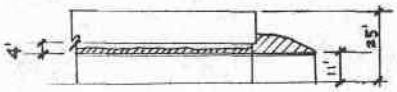
SNOW LOAD DISTRIBUTION

Large drift up to 8' on the flat lean-to roof along the gable wall.

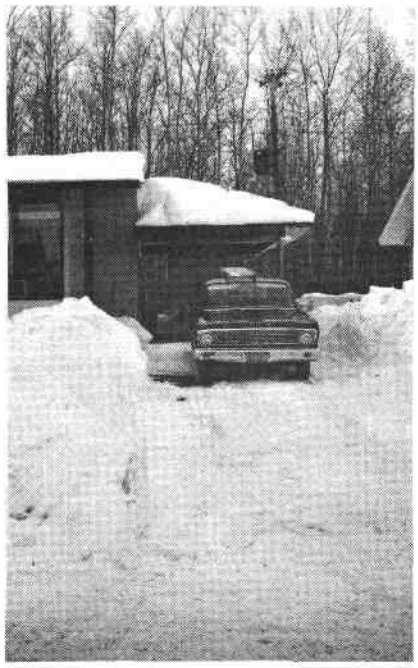
ROOF DESCRIPTION



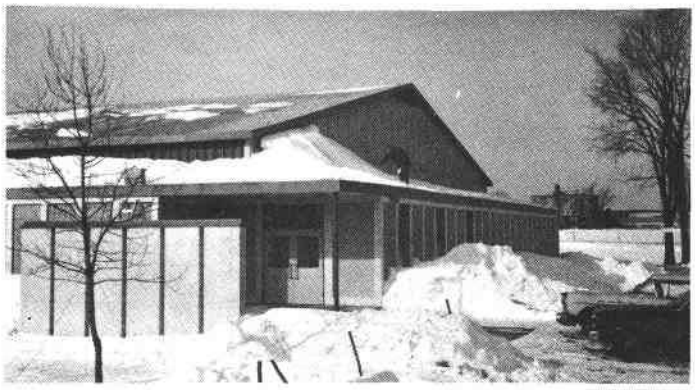
PLAN



ELEVATION



66-3. Large drift on car port caused by wind over higher low-pitch roof.



66-4. Large drift up to 8 feet on flat lean-to roof along the gable wall of a hockey arena.

Date 2 February 1966
Location Ottawa, Ontario

Failure : No
Accumulation : Yes

No: 66-5

ROOF AND BUILDING DESCRIPTION

Type of structure and use: One-storey flat roof sheltered on West by two-storey flat roof. Recreation Centre.

Building Heated : Yes Roof Insulated : Yes

Shelter Conditions: Building exposed. Low flat roof sheltered by adjacent higher flat roof.

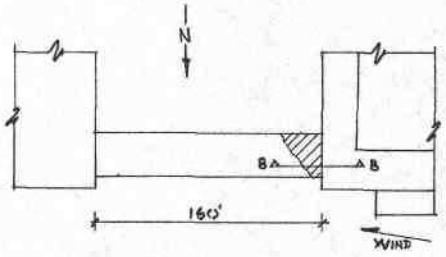
ROOF SNOW LOADS (psf) GROUND SNOW LOADS (psf)

NBC (1965): 48 psf NBC (1965): 60 psf
Avg. Obsd.: very small Avg. Obsd.: 12 psf
Max. Obsd.: 66 psf

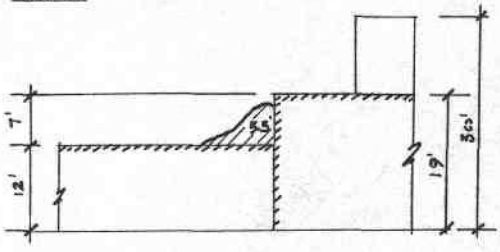
SNOW LOAD DISTRIBUTION

Large drift at the junction of upper and lower roofs.

ROOF DESCRIPTION



PLAN



SECTION B-B

Date 17 March 1966
Location Quebec, P. Q.

Failure : No
Accumulation : Yes

No: 66-6

ROOF AND BUILDING DESCRIPTION

Type of structure and use: Multilevel flat roofs with low roof sheltered by higher roofs. Laboratory.

Building Heated : Yes Roof Insulated : Yes

Shelter Conditions: Building exposed. Low roof sheltered by higher roofs.

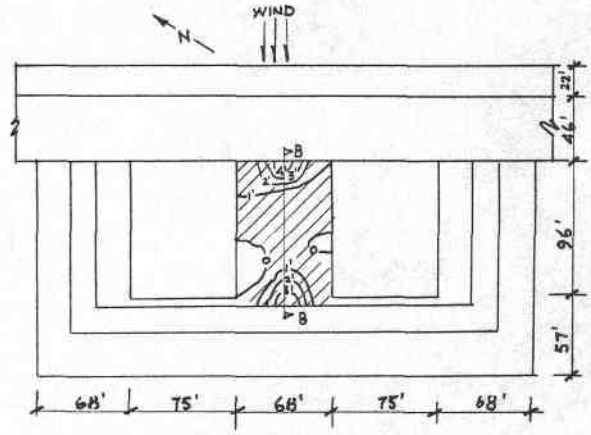
ROOF SNOW LOADS (psf) GROUND SNOW LOADS (psf)

NBC (1965): 67 psf NBC (1965): 84 psf
Avg. Obsd.: 21 psf Avg. Obsd.: 62 psf
Max. Obsd.: 94 psf

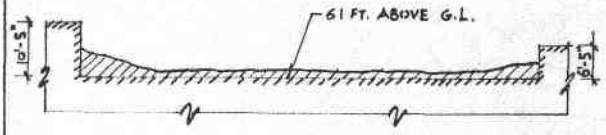
SNOW LOAD DISTRIBUTION

Large snow drifts (up to 50") behind upper roofs.

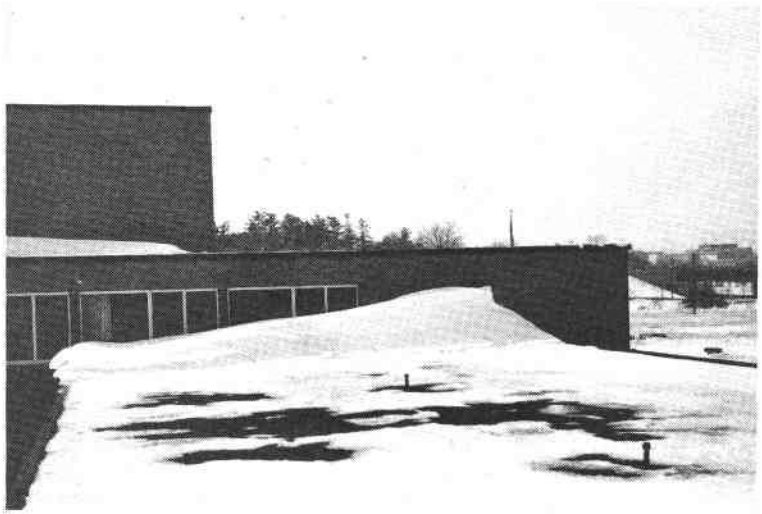
ROOF DESCRIPTION



PLAN



SECTION B-B



66-5. Large drift caused by blowing snow from a higher, large flat roof.