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Proposed Change 2048

Code Reference(s):	**NBC20 Div.B 9.4.2. (first printing)** **NBC20 Div.B 9.6.1.3. (first printing)** **NBC20 Div.B 9.23.3.4.(3) (first printing)** **NBC20 Div.B 9.23.3.5. (first printing)** **NBC20 Div.B 9.23.6.1. (first printing)** **NBC20 Div.B 9.23.13.1. (first printing)** **NBC20 Div.B 9.23.13.2. (first printing)** **NBC20 Div.B 9.23.13.3. (first printing)** **NBC20 Div.B 9.23.16.1. (first printing)** **NBC20 Div.B 9.23.16.5. (first printing)** **NBC20 Div.B 9.27.5.4.(2) (first printing)**
Subject:	Structural Design (Part 9)
Title:	Specified Wind and Snow Loads in Part 9
Description:	This proposed change aligns Part 9 with the proposed changes in Part 4 to wind and snow loading to account for potential loading changes resulting from climate change.
Related Proposed Change(s):	PCF 1979, PCF 1980, PCF 2018

This change could potentially affect the following topic areas:

- [ ] Division A
- [ ] Division C
- [ ] Building operations
- [x] Small Buildings
- [ ] Fire Protection
- [ ] Accessibility
- [ ] Building Envelope
- [ ] Heating, Ventilating and Air Conditioning
- [x] Division B
- [x] Design and Construction
- [x] Housing
- [ ] Large Buildings
- [ ] Occupant safety in use
- [x] Structural Requirements
- [ ] Energy Efficiency
- [ ] Plumbing
- [ ] Construction and Demolition Sites

Problem

Climate change effects not yet addressed in the NBC

In the 2020 and previous editions of the National Building Code of Canada (NBC), it was assumed that climatic data statistics used in structural design did not change over time (or were stationary). Accordingly, the climatic design data in the NBC have been updated for each Code cycle using past weather observations collected and analyzed by Environment and Climate Change Canada (ECCC) under the assumption that past statistics will continue to be applicable to the future. In the face of extensive evidence that the climate is changing across Canada, this practice raises real safety concerns regarding the design of the main structural systems and envelope of buildings to withstand climatic loads such as those due to snow and wind.

In addition, in the current edition of the NBC, wind data are based mainly on synoptic wind observations and do not account for the different existing climatic influences in Canada, where some regions are more prone to local convective thunderstorms. This phenomenon is expected to be exacerbated in the future with climate warming.

PCF 1979 proposes to update the climatic data in Table C-2, Climatic Design Data for Selected Locations in Canada.

Further to PCF 1979, this proposed change develops an approach for the design of Part 9 buildings using the new climatic data, which reflects expected changes to the climate in future.

Uniform hazard approach in load calculations yields non-uniform probability of failure

An additional problem identified is that the current methodology for the structural design of buildings in the NBC uses what has been termed a “uniform hazard” approach. In this approach, reference design wind and snow loads at various locations across Canada are specified at an annual probability of exceedance of 1/50, corresponding to a 50-year return period in a stationary climate. The minimum safety criterion adopted in the NBC corresponds to a probability of failure (i.e., probability that the effects of loads are higher than the resistance of a structural member in a building) of 0.001 during the 50-year assumed service life of a building in the Normal Importance Category. To provide an acceptable probability of failure, the “specified design loads” or so-called “service loads” taken at the 50-year return period have been multiplied by load factors (i.e., 1.5 for snow and 1.4 for wind) to obtain the “ultimate loads” applied in design calculations. These load factors are influenced by the target safety criteria and the variability of the load, and historically have been taken as constant across all regions of Canada. However, reliability studies [1] have shown that this approach leads to a non-uniform probability of failure across the country, due to the different behaviour of wind and snow events in Canada’s various regions and the localized variation in these loads. The probability of failure can differ by as much as a factor of 10, depending on where the project is located, and this variability could be further exacerbated by climate change.

Justification

Adjusting loads to account for non-stationarity in a future changing climate

Results obtained using RCP8.5, corresponding to 2.5°C global warming, were adopted to establish future climatic loads for structural design. Comparisons were made based on a building constructed in 2025 having a service life of 50 years, and the differences between the four RCP scenarios included in the ECCC study [2] remained within a narrow range. The decision to adopt the most extreme RCP8.5 scenario reflects a prudent approach, as there is uncertainty in the 50-year estimate. Recent studies [1] revealed the statistical significance of the non-stationarity of extreme wind speeds and ground snow loads based on the future projections provided by ECCC [2] for many regions across Canada.

Therefore, a non-stationary extreme-value analysis approach, known as the “Minimax Method,” is proposed to design for the worst-case year of the building’s service life. This approach ensures that the annual probability of failure remains acceptably low during the entire service life. For instance, future projections for wind loads mostly predict increases in reference pressure, making the last year of service life the worst case; conversely, for ground snow loads, future projections mostly show decreases, making the first year of service life the worst case.

Using ECCC’s climate projections [2], regional climate change factors have been developed that can be applied to the wind and snow reference values in different regions across the country. These factors were used to determine the reference values tabulated in NBC Table C-2, Climatic Design Data for Selected Locations in Canada.

Introducing the uniform risk approach in ultimate limit state (ULS) design

To address the variability of the probability of failure across the country, a so-called “uniform risk” approach is proposed in which “ultimate loads” are specified directly for each location with load factors of 1.0. This approach is similar to the approach used for earthquake design in the NBC and other approaches adopted internationally. Notably, ASCE/SEI 7, “Minimum Design Loads for Buildings and Other Structures,” has used uniform risk for wind loads since the 2010 edition [3] (and more recently for snow loads since the 2022 edition), and the Australian Building Code [4] many years before.

Climate change factors were calculated by comparing the future design levels, determined using the Minmax approach, with design levels based on the conventional stationary approach. For reference design wind pressures, most areas in Canada have a climate change factor of 1.05, while locations in Ontario, the Atlantic provinces, and west of 120°W in British Columbia have a climate change factor of 1.1. For ground snow loads, the northern territories have a climate change factor of 1.05, while most regions have a climate change factor of 1.0 (see [5] and PCF 1979).

In deriving climate change factors for the "uniform risk" approach, target annual probabilities of exceedance of 1/500 for wind and 1/1 000 for snow were selected. With the proposed uniform risk approach, the targeted probabilities are applied with a load factor of 1.0, as opposed to the present method of using a 1/50 target and increasing it by a load factor across the country. The 1/500 and 1/1 000 annual probabilities of exceedance were selected to maintain the average risk of failure across the country. As a result, the same target probability of failure of approximately 1/1 000 is set, but with more precise estimates from location to location.

Calibration studies and benefits of the uniform risk approach

From the wind load perspective, regional variations in probability of failure may be significantly reduced by adopting the uniform risk approach. Analysis [1] demonstrates that the differences in the probability of failure and safety criteria between locations substantially decreases by adopting ultimate return periods (1/500 annual probability of exceedance) for reference wind pressure with a load factor of 1.0. To illustrate the benefits of the new approach, the following two cases were considered:

- a uniform hazard case, with a return period of 50 years and wind load factor of 1.4, which matches that currently used in the NBC 2020, and
- a uniform risk case, with a return period of 500 years and a wind load factor of 1.0.

Building cases that consider Low, Normal, High and Post-disaster Importance Categories were investigated. For the uniform hazard case, the range in reliability index, β, is 1.6 when comparing between high- and low-variability data. For the uniform risk case, the range of reliability index narrows significantly to 0.7 for the same data. For a range of variability applicable to most locations in Canada, the uniform hazard approach shows a range in β of 0.7, while the uniform risk approach shows a range that narrows to 0.25.

New load combinations based on uniform risk

In moving to the uniform risk approach for wind and snow loads, new load calibrations have been carried out to update the various design load combinations needed for both the ultimate limit state (ULS) and the serviceability limit state (SLS). The roof snow load combination 1.0E + 0.25S has been reassessed and updated to 1.0E + 0.15S, where S is now based on the 1/1 000 probability of exceedance rather than 1/50 for Normal Importance Category buildings. The 0.15 coefficient was selected to keep the total value equivalent to the current value prescribed in the NBC 2020 for most locations. Load factors for SLS required no changes because revised importance factors for SLS in NBC Table 4.1.6.2. for snow and NBC Table 4.1.7.3. for wind essentially keep the snow and wind serviceability loads close to what they were before.

References

(1) RWDI Report No. 1702484, 2020, Development of Climate Change Provisions for Structural Design of Buildings and Implementation Plan in the National Building Code.

(2) Cannon, A.J., Jeong, D.I., Zhang, X., and F. W. Zwiers. (2020). Climate-Resilient Buildings and Core Public Infrastructure: An Assessment of the Impact of Climate Change on Climatic Design Data in Canada. Government of Canada, Ottawa, ON. 106 p. (https://climate-scenarios.canada.ca/?page=buildings-report-overview).

(3) ASCE 7-22, Minimum Design Loads for Buildings and Other Structures.

(4) Australian/New Zealand Standard (AS/NZS) 1170.2:2002, Structural design actions. Part 2: Wind actions.

(5) Li S.H., Irwin P., Lounis Z., Attar A., Dale J., Gibbons M., Beaulieu, S. (2022). Effects of Nonstationarity of Extreme Wind Speeds and Ground Snow Loads in a Future Canadian Changing Climate. *Nat Hazard Rev.* 23(4):04022022.

PROPOSED CHANGE

NBC20 Div.B 9.4.2. (first printing)

[9.4.2.] 9.4.2. Specified Loads

[9.4.2.1.] 9.4.2.1. Application

[9.4.2.2.] 9.4.2.2. Specified Snow Loads

(See Note A-9.4.2.1. and 9.4.2.2.)

[1] **1)** Except as provided in Sentences (2) to (4), specified snow loads shall be not less than those calculated using the following formula:

$$S = C_b S_s + S_r$$

$$S = \frac{C_b S_{s,1/1000}}{1.5} + \frac{S_{r,1/1000}}{1.5}$$

where

S = specified snow load,

C_b = basic snow load roof factor, which is 0.45 where the entire width of the roof does not exceed 4.3 m and 0.55 for all other roofs,

$S_{s,1/1\,000}$ = 1-in-~~50~~1 000 annual probability ~~-year~~ ground snow load in kPa, determined according to Subsection 1.1.3., and

$S_{r,1/1\,000}$ = associated 1-in-~~50~~1 000 annual probability ~~-year~~ rain load in kPa, determined according to Subsection 1.1.3.

[2] **2)** In no case shall the specified snow load be less than 1 kPa.

[3] **--)** Where the specified snow load, S, as calculated in Sentence (1) is used to design structural members and their connections in accordance with Part 4 and Subclause 9.4.1.1.(1)(c)(i), it shall be multiplied by a factor of 1.5.

[4] **3)** Bow string, arch or semi-circular roof trusses having an unsupported span greater than 6 m shall be designed in conformance with the snow load requirements in Subsection 4.1.6.

[5] **4)** Where the height of a roof step at the intersection of an upper level roof and a lower level roof is greater than 2 m, and the upper level roof has a slope less than 1 in 6 and an area greater than 600 m^2, the specified snow load on the lower level roof shall be

[a] a) for distances from the roof step that are less than or equal to the drift length, x_d, calculated in accordance with Sentence (5), not less than 1.5 times the specified snow load, S, calculated using the formula in Sentence (1) with C_b equal to 0.55, and

[b] b) for distances from the roof step that are greater than the drift length, x_d, calculated in accordance with Sentence (5), as specified in Sentence (1).

[6] **5)** For the purposes of Sentence (4), the drift length, x_d, in m, shall be calculated as follows:

$$x_d = 5\left(h - \frac{0.55S_s}{\gamma}\right)$$

where

h	= height of the roof step, in m, and
γ	= specific weight of snow as specified in Clause 9.4.2.1.(1)(f).

[9.4.2.3.] --- Reference Hourly Wind Pressure

[1] --) The reference hourly wind pressure (RHWP) referred to in this Part shall be calculated as follows:

$$\text{RHWP} = \frac{q_{1/500}}{1.4}$$

where

$q_{1/500}$	=1-in-500 annual probability wind pressure, in kPa, determined in accordance with Subsection 1.1.3.

[2] --) Where the RHWP, as calculated in Sentence (1), is used to design structural members and their connections in accordance with Part 4 and Subclause 9.4.1.1.(1)(c)(i), it shall be multiplied by a factor of 1.4.

[9.4.2.4.] 9.4.2.3. Platforms Subject to Snow and Occupancy Loads

[9.4.2.5.] 9.4.2.4. Attics and Roof Spaces

NBC20 Div.B 9.6.1.3. (first printing)

[9.6.1.3.] 9.6.1.3. Structural Sufficiency of Glass

[1] 1) Except as provided in Sentence (2), glass shall be designed in conformance with
- [a] a) CAN/CGSB-12.20-M, "Structural Design of Glass for Buildings",or
- [b] b) ASTM E1300, "Standard Practice for Determining Load Resistance of Glass in Buildings". (See also Article 4.3.6.1.)

[2] 2) Where the *building* has an essentially uniform distribution of paths for air leakage, including operable openings, but no large openings that would permit wind gusts to rapidly enter the *building* and the *building* is not in an exceptionally exposed location such as a hilltop, the maximum area of individual panes of glass for windows shall conform to
- [a] a) Tables 9.6.1.3.-A to 9.6.1.3.-C, where the *building* has a height from *grade* to the uppermost roof of 12 m or less, and is located in a built-up area, no less than 120 m away from the boundary between this area and open terrain, or
- [b] b) Tables 9.6.1.3.-D to 9.6.1.3.-F.

(See Note A-9.6.1.3.(2).)

Table [9.6.1.3.-A] 9.6.1.3.-A
Maximum Glass Area for Windows in Areas for which the ~~1-in-50~~Reference Hourly Wind Pressure (RHWP) is less than 0.55 kPa (1)
Forming Part of Clause 9.6.1.3.(2)(a)

Type of Glass	Maximum Glass Area, m^2							
	Glass Thickness, mm							
	2.5	3	4	5	6	8	10	12
Annealed	0.58	0.96	1.47	2.04	2.84	4.74	6.65	9.74
Factory-sealed insulated glass (IG) units (2)	1.02	1.71	2.68	3.74	5.24	7.93	9.92	13.92
Heat-strengthened or tempered	1.24	1.93	2.60	3.18	3.99	5.55	6.99	9.74
Wired	0.27	0.45	0.68	0.93	1.31	2.15	3.07	5.03

Notes to Table [9.6.1.3.-A] 9.6.1.3.-A:

(1) ~~The maximum hourly wind pressure with one chance in fiftyof being exceeded in any one year, as provided in Appendix C~~See Sentence 9.4.2.3.(1)-2025 for the calculation of RHWP.

(2) Maximum glass area values apply to IG units of two identical lites (annealed, heat-strengthened or tempered) spaced at 12.7 mm.

Table [9.6.1.3.-B] 9.6.1.3.-B
Maximum Glass Area for Windows in Areas for which the ~~1-in-50~~Reference Hourly Wind Pressure (RHWP) is less than 0.75 kPa (1)
Forming Part of Clause 9.6.1.3.(2)(a)

Type of Glass	Maximum Glass Area, m^2							
	Glass Thickness, mm							
	2.5	3	4	5	6	8	10	12
Annealed	0.42	0.68	1.02	1.42	2.04	3.34	4.70	7.65
Factory-sealed insulated glass (IG) units (2)	0.72	1.19	1.85	2.56	3.64	6.01	8.35	11.83
Heat-strengthened	0.88	1.46	2.21	2.71	3.39	4.73	5.92	8.29
Tempered	1.18	1.64	2.21	2.71	3.39	4.73	5.92	8.29
Wired	0.20	0.32	0.50	0.68	0.94	1.55	2.19	3.60

Notes to Table [9.6.1.3.-B] 9.6.1.3.-B:

(1) ~~The maximum hourly wind pressure with one chance in fiftyof being exceeded in any one year, as provided in Appendix C~~See Sentence 9.4.2.3.(1)-2025 for the calculation of RHWP.

(2) Maximum glass area values apply to IG units of two identical lites (annealed, heat-strengthened or tempered) spaced at 12.7 mm.

Table [9.6.1.3.-C] 9.6.1.3.-C
Maximum Glass Area for Windows in Areas for which the ~~1-in-50~~Reference Hourly Wind Pressure (RHWP) is less than 1.00 kPa (1)
Forming Part of Clause 9.6.1.3.(2)(a)

Type of Glass	Maximum Glass Area, m²							
	Glass Thickness, mm							
	2.5	3	4	5	6	8	10	12
Annealed	0.30	0.50	0.77	1.05	1.45	2.40	3.40	5.62
Factory-sealed insulated glass (IG) units (2)	0.52	0.86	1.31	1.86	2.57	4.30	6.10	9.89
Heat-strengthened	0.65	1.04	1.63	2.26	2.92	4.07	5.10	7.14
Tempered	1.01	1.42	1.90	2.33	2.92	4.07	5.10	7.14
Wired	0.16	0.26	0.38	0.52	0.71	1.15	1.63	2.69

Notes to Table [9.6.1.3.-C] 9.6.1.3.-C:

(1) ~~The maximum hourly wind pressure with one chance in fiftyof being exceeded in any one year, as provided in Appendix C~~See Sentence 9.4.2.3.(1)-2025 for the calculation of RHWP.

(2) Maximum glass area values apply to IG units of two identical lites (annealed, heat-strengthened or tempered) spaced at 12.7 mm.

Table [9.6.1.3.-D] 9.6.1.3.-D
Maximum Glass Area for Windows in Areas for which the ~~1-in-50~~Reference Hourly Wind Pressure (RHWP) is less than 0.55 kPa – OPEN TERRAIN (1)
Forming Part of Clause 9.6.1.3.(2)(b)

Type of Glass	Maximum Glass Area, m²							
	Glass Thickness, mm							
	2.5	3	4	5	6	8	10	12
Annealed	0.46	0.75	1.16	1.60	2.25	3.76	5.32	8.70
Factory-sealed insulated glass (IG) units (2)	0.80	1.34	2.11	2.93	4.10	6.90	9.66	12.53
Heat-strengthened	0.98	1.74	2.33	2.86	3.59	5.00	6.26	8.78
Tempered	1.25	1.74	2.33	2.86	3.59	5.00	6.26	8.78
Wired	0.22	0.36	0.55	0.76	1.05	1.75	2.47	4.09

Notes to Table [9.6.1.3.-D] 9.6.1.3.-D:

(1) ~~The maximum hourly wind pressure with one chance in fiftyof being exceeded in any one year, as provided in Appendix C~~See Sentence 9.4.2.3.(1)-2025 for the calculation of RHWP.

(2) Maximum glass area values apply to IG units of two identical lites (annealed, heat-strengthened or tempered) spaced at 12.7 mm.

Table [9.6.1.3.-E] 9.6.1.3.-E
Maximum Glass Area for Windows in Areas for which the 1-in-50Reference Hourly Wind Pressure (RHWP) is less than 0.75 kPa –
OPEN TERRAIN (1)
Forming Part of Clause 9.6.1.3.(2)(b)

Type of Glass	Maximum Glass Area, m^2							
	Glass Thickness, mm							
	2.5	3	4	5	6	8	10	12
Annealed	0.33	0.54	0.83	1.14	1.61	2.67	3.75	6.14
Factory-sealed insulated glass (IG) units (2)	0.57	0.94	1.47	2.04	2.85	4.75	6.72	10.97
Heat-strengthened	0.70	1.15	1.79	2.44	3.06	4.36	5.34	7.47
Tempered	1.06	1.48	1.99	2.44	3.06	4.36	5.34	7.47
Wired	0.16	0.26	0.40	0.55	0.76	1.24	1.77	2.93

Notes to Table [9.6.1.3.-E] 9.6.1.3.-E:

(1) The maximum hourly wind pressure with one chance in fiftyof being exceeded in any one year, as provided in Appendix CSee Sentence 9.4.2.3.(1)-2025 for the calculation of RHWP.

(2) Maximum glass area values apply to IG units of two identical lites (annealed, heat-strengthened or tempered) spaced at 12.7 mm.

Table [9.6.1.3.-F] 9.6.1.3.-F
Maximum Glass Area for Windows in Areas for which the 1-in-50Reference Hourly Wind Pressure (RHWP) is less than 1.00 kPa –
OPEN TERRAIN (1)
Forming Part of Clause 9.6.1.3.(2)(b)

Type of Glass	Maximum Glass Area, m^2							
	Glass Thickness, mm							
	2.5	3	4	5	6	8	10	12
Annealed	0.25	0.40	0.62	0.84	1.17	1.94	2.75	4.50
Factory-sealed insulated glass (IG) units (2)	0.42	0.68	1.04	1.46	2.05	3.41	4.87	7.92
Heat-strengthened	0.51	0.84	1.30	1.79	2.52	3.69	4.60	6.44
Tempered	0.92	1.28	1.72	2.10	2.63	3.69	4.60	6.44
Wired	0.12	0.20	0.30	0.41	0.57	0.94	1.31	2.18

Notes to Table [9.6.1.3.-F] 9.6.1.3.-F:

(1) ~~The maximum hourly wind pressure with one chance in fiftyof being exceeded in any one year, as provided in Appendix C~~See Sentence 9.4.2.3.(1)-2025 for the calculation of RHWP.

(2) Maximum glass area values apply to IG units of two identical lites (annealed, heat-strengthened or tempered) spaced at 12.7 mm.

[3] **3)** The maximum area of individual panes of glass for doors shall conform to Table 9.6.1.3.-G.

Table [9.6.1.3.-G] 9.6.1.3.-G
Glass Area for Doors
Forming Part of Sentence [9.6.1.3.] 9.6.1.3.([3] 3)

Glass Thickness, mm	Maximum Glass Area, m^2 (1)						
	Type of Glass						
	Annealed	Annealed, Multiple-Glazed, Factory-Sealed Units	Laminated	Wired	Heat-Strengthened	Fully Tempered	Fully Tempered, Multiple-Glazed, Factory-Sealed
3	0.50	0.70	(2)	(2)	1.00	1.00	2.00
4	1.00	1.50	(2)	(2)	1.50	4.00	4.00
5	1.50	1.50	(2)	(2)	1.50	No limit	No limit
6	1.50	1.50	1.20	1.00	1.50	No limit	No limit

Notes to Table [9.6.1.3.-G] 9.6.1.3.-G:

(1) See Note A-Table 9.6.1.3.-G.

(2) Not generally available.

NBC20 Div.B 9.23.3.4.(3) (first printing)
[9.23.3.4.] 9.23.3.4. Nailing of Framing

[1] **3)** Where the ~~1-in-50~~reference hourly wind pressure (RHWP), as calculated in Sentence 9.4.2.3.(1)-2025, is equal to or greater than 0.8 kPa, roof rafters, joists or trusses shall be tied to the wall framing with connectors that will resist a factored uplift load of 3 kN.

NBC20 Div.B 9.23.3.5. (first printing)
[9.23.3.5.] 9.23.3.5. Fasteners for Sheathing or Subflooring

[1] **1)** Except as provided in Sentences (2) to (4), fastening of sheathing and subflooring shall conform to Table 9.23.3.5.-A where the reference hourly wind pressure (RHWP), as calculated in Sentence 9.4.2.3.(1)-2025, is less than 0.8 kPa and the seismic spectral acceleration, $S_a(0.2)$, is equal to or less than 0.70.

Table [9.23.3.5.-A] 9.23.3.5.-A
Fasteners for Subflooring and for Sheathing where the ~~1-in-50~~ Reference Hourly Wind Pressure (RHWP) < 0.8 kPa and $S_a(0.2) \leq 0.70$
Forming Part of Sentence [9.23.3.5.] 9.23.3.5.([1] 1)

Element	Minimum Length of Fasteners, mm				Minimum Number or Maximum Spacing of Fasteners
	Common or Spiral Nails	Ring Thread Nails or Screws	Roofing Nails	Staples	
Board lumber 184 mm or less wide	51	45	n/a	51	2 per support
Board lumber more than 184 mm wide	51	45	n/a	51	3 per support
Fibreboard sheathing up to 13 mm thick	n/a	n/a	44	28	150 mm o.c. along edges and 300 mm o.c. along intermediate supports
Gypsum sheathing up to 13 mm thick	n/a	n/a	44	n/a	
Plywood, OSB or waferboard up to 10 mm thick	51	45	n/a	38	
Plywood, OSB or waferboard over 10 mm and up to 20 mm thick	51	45	n/a	51	
Plywood, OSB or waferboard over 20 mm and up to 25 mm thick	57	51	n/a	n/a	

[2] **2)** Fastening of roof sheathing and sheathing in required *braced wall panels* shall conform to Table 9.23.3.5.-B, where

[a] a) the ~~1-in-50~~ ~~hourly wind pressure (~~RHWP~~)~~, as calculated in Sentence 9.4.2.3.(1)-2025, is equal to or greater than 0.8 kPa and less than 1.2 kPa and the seismic spectral acceleration, $S_a(0.2)$, is not more than 0.90, or

[b] b) the seismic spectral acceleration, $S_a(0.2)$, is greater than 0.70 and not more than 0.90.

Table [9.23.3.5.-B] 9.23.3.5.-B
Fasteners for Sheathing where 0.8 kPa ≤ ~~1-in-50~~ Reference Hourly Wind Pressure (RHWP) < 1.2 kPa and $S_a(0.2)$ ≤ 0.90 or where 0.70 < $S_a(0.2)$ ≤ 0.90
Forming Part of Sentence [9.23.3.5.] 9.23.3.5.([2] 2)

Element	Minimum Length of Fasteners, mm			Minimum Number or Maximum Spacing of Fasteners
	Common, Spiral or Ring Thread Nails	Screws	14-gauge Staples	
Board lumber 184 mm or less wide	63	51	63	2 per support
Board lumber more than 184 mm wide	63	51	63	3 per support
Plywood, OSB or waferboard up to 20 mm thick (1)	63	51	63	150 mm o.c. along edges and 300 mm o.c. along intermediate supports; and for roof sheathing where 0.8 kPa ≤ RHWP < 1.2 kPa ~~is equal to or greater than 0.8 kPa and less than 1.2 kPa~~, 50 mm o.c. within 1 m of the edges of the roof
Plywood, OSB or waferboard over 20 mm and up to 25 mm thick	63	57	n/a	

Note to Table [9.23.3.5.-B] 9.23.3.5.-B:

(1) See Note A-Table 9.23.3.5.-B.

[3] 3) Fastening of roof sheathing and sheathing in required *braced wall panels* shall conform to Table 9.23.3.5.-C, where

[a] a) the ~~1-in-50~~ ~~hourly wind pressure (~~RHWP~~)~~, as calculated in Sentence 9.4.2.3.(1)-2025, is equal to or greater than 0.8 kPa and less than 1.2 kPa and the spectral acceleration, $S_a(0.2)$, is not more than 1.8, or

[b] b) the seismic spectral acceleration, $S_a(0.2)$, is greater than 0.90 and not more than

1.8.

Table [9.23.3.5.-C] 9.23.3.5.-C
Fasteners for Sheathing where 0.8 kPa ≤ 1-in-50Reference Hourly Wind Pressure (RHWP) < 1.2 kPa and $S_a(0.2)$ ≤ 1.8 or where 0.90 < $S_a(0.2)$ ≤ 1.8
Forming Part of Sentence [9.23.3.5.] 9.23.3.5.([3] 3)

Element	Minimum Length of Fasteners, mm		Minimum Number or Maximum Spacing of Fasteners
	Common, Spiral or Ring Thread Nails	Screws	
Plywood, OSB or waferboard up to 20 mm thick (1)	63	51	75 mm o.c. along edges and 300 mm o.c. along intermediate supports; and for roof sheathing where 1-in-500.8 kPa ≤ RHWP < 1.2 kPais equal to or greater than 0.8 kPa and less than 1.2 kPa, 50 mm o.c. within 1 m of the edges of the roof
Plywood, OSB or waferboard over 20 mm and up to 25 mm thick	63	57	

Note to Table [9.23.3.5.-C] 9.23.3.5.-C:

(1) See Note A-Table 9.23.3.5.-B.

[4] 4) Fastening of sheathing shall conform to Part 4,
- [a] a) where the 1-in-50 hourly wind pressure RHWP, as calculated in Sentence 9.4.2.3.(1)-2025, is equal to or greater than 1.2 kPa, or
- [b] b) for required *braced wall panels*, where the seismic spectral acceleration, $S_a(0.2)$, is greater than 1.8.

[5] 5) Staples shall not be less than 1.6 mm in diameter or thickness, with not less than a 9.5 mm crown driven with the crown parallel to framing.

[6] 6) Roofing nails for the attachment of fibreboard or gypsum sheathing shall not be less than 3.2 mm in diameter with a minimum head diameter of 11.1 mm.

[7] 7) Flooring screws shall not be less than 3.2 mm in diameter.

[8] 8) The edges of sheathing in a *braced wall panel* shall be supported and fastened to wood blocking where
- [a] a) the seismic spectral acceleration, $S_a(0.2)$, is greater than 1.2, or
- [b] b) the *braced wall panel* supports more than a roof of lightweight construction.

NBC20 Div.B 9.23.6.1. (first printing)

[9.23.6.1.] 9.23.6.1. Anchorage of Building Frames

[1] 1) Except as required by Sentence 9.23.6.3.(1), *building* frames shall be anchored to the *foundation* unless a structural analysis that considers wind and earthquake loads and lateral earth pressures shows that anchorage is not required.

[2] 2) Except as provided in Sentences (3) to (6), anchorage shall be provided by

[a] a) embedding the ends of the first floor joists in concrete, or

[b] b) fastening the sill plate to the *foundation* with not less than 12.7 mm diam anchor bolts spaced not more than 2.4 m o.c.

[3] **3)** For *buildings* with 2 or more floors supported by frame walls that are in areas where the seismic spectral acceleration, $S_a(0.2)$, is not greater than 0.70 or the ~~1-in-50~~reference hourly wind pressure (RHWP), as calculated in Sentence 9.4.2.3.(1)-2025, is equal to or greater than 0.80 kPa but not greater than 1.20 kPa, anchorage shall be provided by fastening the sill plate to the *foundation* with not less than two anchor bolts per *braced wall panel*, where all anchor bolts used are

[a] a) not less than 15.9 mm in diameter, located within 0.5 m of the end of the *foundation*, and spaced not more than 2.4 m o.c, or

[b] b) not less than 12.7 mm in diameter, located within 0.5 m of the end of the *foundation*, and spaced not more than 1.7 m o.c.

[4] **4)** For *buildings* supported by frame walls that are in areas where the seismic spectral acceleration, $S_a(0.2)$, is greater than 0.70 but not greater than 1.8 and the ~~1-in-50 hourly wind pressure (~~RHWP~~)~~, as calculated in Sentence 9.4.2.3.(1)-2025, is not greater than 1.20 kPa, anchorage shall be provided by fastening the sill plate to the *foundation* with not less than two anchor bolts per *braced wall panel* located within 0.5 m of the end of the *foundation* and spaced in accordance with Table 9.23.6.1.

Table [9.23.6.1.] 9.23.6.1.
Anchor Bolt Spacing where the ~~1-in-50~~ Reference Hourly Wind Pressure (RHWP) ≤ 1.20 kPa and 0.70 < $S_a(0.2)$ ≤ 1.8
Forming Part of Sentence [9.23.6.1.] 9.23.6.1.([4] 4)

Anchor Bolt Diameter, mm	**$S_a(0.2)$**	**Maximum Spacing of Anchor Bolts Along *Braced Wall Band*, m**				
		Light Construction			**Heavy Construction** (1)	
		Number of Floors Supported (2)				
		1	**2**	**3**	**1**	**2**
12.7	0.70 < $S_a(0.2)$ ≤ 0.80	2.4	2.3	1.8	2.4	2.0
	0.80 < $S_a(0.2)$ ≤ 0.90	2.4	2.3	1.8	2.4	2.0
	0.90 < $S_a(0.2)$ ≤ 1.0	2.4	2.2	1.5	2.4	1.8
	1.0 < $S_a(0.2)$ ≤ 1.1	2.4	2.1	1.4	2.4	1.6
	1.1 < $S_a(0.2)$ ≤ 1.2	2.4	2.0	1.3	2.4	1.5
	1.2 < $S_a(0.2)$ ≤ 1.3	2.4	1.9	1.3	2.4	1.5
	1.3 < $S_a(0.2)$ ≤ 1.35	2.4	1.8	1.2	2.3	1.4

Anchor Bolt Diameter, mm	$S_a(0.2)$	Maximum Spacing of Anchor Bolts Along *Braced Wall Band*, m				
		Light Construction			Heavy Construction (1)	
		Number of Floors Supported (2)				
		1	2	3	1	2
	$1.35 < S_a(0.2) \le 1.8$	2.4	1.8	1.1	2.3	1.4
15.9Table9.23.6.1	$0.70 < S_a(0.2) \le 0.80$	2.4	2.4	2.2	2.4	2.4
	$0.80 < S_a(0.2) \le 0.90$	2.4	2.4	2.2	2.4	2.4
	$0.90 < S_a(0.2) \le 1.0$	2.4	2.4	2.1	2.4	2.3
	$1.0 < S_a(0.2) \le 1.1$	2.4	2.4	1.9	2.4	2.3
	$1.1 < S_a(0.2) \le 1.2$	2.4	2.4	1.9	2.4	2.2
	$1.2 < S_a(0.2) \le 1.3$	2.4	2.4	1.8	2.4	2.1
	$1.3 < S_a(0.2) \le 1.35$	2.4	2.3	1.7	2.4	2.0
	$1.35 < S_a(0.2) \le 1.8$	2.4	2.2	1.6	2.4	1.9

Notes to Table [9.23.6.1.] 9.23.6.1.:

(1) See Note A-9.23.13.2.(1)(a)(i).

(2) All constructions include support of a roof load in addition to the indicated number of floors.

[5] **5)** Anchor bolts referred to in Sentences (2) to (4) shall be
- [a] a) fastened to the sill plate with nuts and washers,
- [b] b) embedded not less than 100 mm in the *foundation*, and
- [c] c) so designed that they may be tightened without withdrawing them from the *foundation*.

[6] **6)** Where the seismic spectral acceleration, $S_a(0.2)$, is greater than 1.8 or the ~~1-in-50 hourly wind pressure~~ RWHP, as calculated in Sentence 9.4.2.3.(1)-2025, is equal to or greater than 1.2 kPa, anchorage shall be designed according to Part 4.

NBC20 Div.B 9.23.13.1. (first printing)

[9.23.13.1.] 9.23.13.1. Requirements for Low to Moderate Wind and Seismic Forces (See Note A-9.23.13.1.)

[1] **1)** This Article applies in locations where the seismic spectral acceleration, $S_a(0.2)$, is not more than 0.70 and the ~~1-in-50~~reference hourly wind pressure (RHWP), as calculated in Sentence 9.4.2.3.(1)-2025, is less than 0.80 kPa.

[2] **2)** Bracing to resist lateral loads shall be designed and constructed as follows:
- [a] a) exterior walls shall be
  - [i] i) clad with panel-type cladding in accordance with Section 9.27.,
  - [ii] ii) sheathed with plywood, OSB, waferboard, fibreboard, gypsum board or diagonal lumber sheathing complying with Subsection 9.23.17. and fastened in accordance with Table 9.23.3.5.-A, or
  - [iii] iii) finished on the interior with a panel-type material in accordance with the requirements of Section 9.29., or
- [b] b) in accordance with
  - [i] i) Articles 9.23.13.4. to 9.23.13.7.,
  - [ii] ii) Part 4, or
  - [iii] iii) good engineering practice such as that provided in CWC 2014, "Engineering Guide for Wood Frame Construction".

Note A-9.23.13.1.

Bracing to Resist Lateral Loads in Low Load Locations

Of the 679 locations identified in Appendix C, 614 are locations where the seismic spectral acceleration, $S_a(0.2)$, is less than or equal to 0.70 and the ~~1-in-50~~reference hourly wind pressure (RHWP), as calculated in Sentence 9.4.2.3.(1)-2025, is less than 0.80 kPa. For buildings in these locations, Sentence 9.23.13.1.(2) requires only that exterior walls be braced using the acceptable materials and fastening specified. There are no spacing or dimension requirements for braced wall panels in these buildings.

NBC20 Div.B 9.23.13.2. (first printing)

[9.23.13.2.] 9.23.13.2. Requirements for High Wind and Seismic Forces

[1] **1)** Except as provided in Article 9.23.13.1., this Article applies in locations where
- [a] a) the seismic spectral acceleration, $S_a(0.2)$, is greater than 0.70 but not more than 1.8 and
  - [i] i) the lowest exterior frame wall supports not more than 1 floor in *buildings* of heavy construction (see Note A-9.23.13.2.(1)(a)(i)), or
  - [ii] ii) the lowest exterior frame wall supports not more than 2 floors in other types of construction, and
- [b] b) the ~~1-in-50~~reference hourly wind pressure (RHWP), as calculated in Sentence 9.4.2.3.(1)-2025, is less than 1.20 kPa.

[2] **2)** Bracing to resist lateral loads shall be designed and constructed in accordance with
- [a] a) Articles 9.23.13.4. to 9.23.13.7.,
- [b] b) Part 4, or
- [c] c) good engineering practice such as that provided in CWC 2014, "Engineering Guide for Wood Frame Construction".

NBC20 Div.B 9.23.13.3. (first printing)

[9.23.13.3.] 9.23.13.3. Requirements for Extreme Wind and Seismic Forces

[1] **1)** Except as provided in Articles 9.23.13.1. and 9.23.13.2., this Article applies in locations where
- [a] a) the seismic spectral acceleration, $S_a(0.2)$, is
  - [i] i) greater than 1.8,
  - [ii] ii) greater than 0.70 and the lowest exterior frame wall supports more than 2 floors in *buildings* of light construction, or
  - [iii] iii) greater than 0.70 and the lowest exterior frame wall supports more than 1 floor in *buildings* of heavy construction, or
- [b] b) the ~~1-in-50~~reference hourly wind pressure (RHWP), as calculated in Sentence

9.4.2.3.(1)-2025, is equal to or greater than 1.20 kPa.

[2] **2)** Bracing to resist lateral loads shall be designed and constructed in accordance with

[a] a) Part 4, or

[b] b) good engineering practice such as that provided in CWC 2014, "Engineering Guide for Wood Frame Construction".

NBC20 Div.B 9.23.16.1. (first printing)

[9.23.16.1.] 9.23.16.1. Required Roof Sheathing

[1] **1)** Except where the 1-in-50reference hourly wind pressure (RHWP), as calculated in Sentence 9.4.2.3.(1)-2025, is less than 0.8 kPa and the seismic spectral acceleration, $S_a(0.2)$, is less than or equal to 0.70, continuous lumber or panel-type roof sheathing shall be installed to support the roofing.

NBC20 Div.B 9.23.16.5. (first printing)

[9.23.16.5.] 9.23.16.5. Lumber Roof Sheathing

[1] **1)** Lumber roof sheathing shall not be more than 286 mm wide and shall be applied so that all ends are supported with end joints staggered.

[2] **2)** Lumber roof sheathing shall be installed diagonally, where

[a] a) the seismic spectral acceleration, $S_a(0.2)$, is greater than 0.70 but not greater than 1.2, or

[b] b) the 1-in-50reference hourly wind pressure (RHWP), as calculated in Sentence 9.4.2.3.(1)-2025, is equal to or greater than 0.80 kPa but less than 1.20 kPa.

[3] **3)** Lumber roof sheathing shall be designed according to Part 4, where

[a] a) the seismic spectral acceleration, $S_a(0.2)$, is greater than 1.2, or

[b] b) the 1-in-50 hourly wind pressureRHWP, as calculated in Sentence 9.4.2.3.(1)-2025, is equal to or greater than 1.20 kPa.

NBC20 Div.B 9.27.5.4.(2) (first printing)

[9.27.5.4.] 9.27.5.4. Size and Spacing of Fasteners

[1] **2)** Screw size and spacing for the attachment of cladding, trim and furring members to the web fastening strips of flat wall insulating concrete form (ICF) units shall conform to Table 9.27.5.4.-B where the 1-in-50reference hourly wind pressure (RHWP), as calculated in Sentence 9.4.2.3.(1)-2025, is less than or equal to 0.60 kPa. (See Note A-9.27.5.4.(2).)

Note A-9.27.5.4.(2) Attachment of Cladding to Flat Wall ICF Units where the 1-in-50Reference Hourly Wind PressureHWP Exceeds 0.60 kPa.

For locations where the 1-in-50reference hourly wind pressure (RHWP), as calculated in Sentence 9.4.2.3.(1)-2025, is greater than 0.60 kPa, the results of testing fasteners to ASTM D1761, "Standard Test Methods for Mechanical Fasteners in Wood and Wood-Based Materials", must be obtained from a testing facility or from the insulating concrete form manufacturer to confirm their ultimate strengths for both direct withdrawal and lateral shear. In accordance with limit states design as described in Subsection 4.1.3., the factored resistances of the fastener must be equal to or greater than the factored loads on the fastener at the spacing proposed by the designer. In order to align with the limit states design procedures used to develop Table 9.27.5.4.-B, the factored resistances must be calculated by applying a reduction factor of $\Phi = 0.35$ to the fastener's ultimate strengths, and the factored loads must lie within the area under the line of linear interaction in a diagram that plots the factored lateral shear resistance of the fastener against its factored direct withdrawal resistance.

Impact analysis

Refer to the supporting document titled "Cost impact of climatic load changes on Part 9: Adopting Part 4 proposed new return periods in PCF 2048" for the full cost analysis. A summary is reproduced here.

Cost impact on Part 9 buildings of updated hourly wind pressure with longer return periods

As a result of the new 1-in-500 annual probability hourly wind pressure data and the introduction of a "reference hourly wind pressure" in this proposed change to replace 1-in-50 annual probability hourly wind pressure, the value decreased for six locations, remained the same for eight locations, and increased for the remaining 666 locations out of the 680 locations in Table C-2 included in PCF 1979.

For the structural sufficiency of glass (NBC Sentence 9.6.1.3.(2)), a 128.5 m^2, two-storey detached house was used as the building archetype, which contained five differently sized windows with areas of glass between 0.57 m^2 and 1.43 m^2. In 620 of the 680 locations in Table C-2, the 1-in-50 annual probability hourly wind pressure remained below the maximum limits provided in NBC Tables 9.6.1.3.-A, 9.6.1.3.-B and 9.6.1.3.-C before and after the change, resulting in no impact. In three of the 60 locations with potential impact — Cowley, AB; Cape Race, NL; and Resolution Island, NU — the reference hourly wind pressure before and after the proposed change exceeded the maximum value of 1.0 kPa provided in the prescriptive table in the NBC, which would require consultation with the window manufacturer for glass thickness. For the remaining 57 locations, windows increased in cost between $126.98 and $353.51.

For the nailing of framing — roof trusses, rafters and joists to wall framing (NBC Sentence 9.23.3.4.(3)), a 120 m^2 bungalow was used as the building archetype. Due to the proposed change, two new locations — Channel-Port aux Basques and St. John's, NL — had reference hourly wind pressure that was equal to or exceeded 0.8 kPa, where roof trusses, rafters or joists would be required to be tied to wall framing with connectors that can resist 3 kN of roof uplift. In these locations, the number of required galvanized-steel connectors was calculated to be approximately 72, resulting in a cost increase of $437.04.

For fasteners for sheathing (NBC Article 9.23.3.5.), a 128.5 m^2, two-storey detached house was used as the building archetype. In 671 of the 680 locations in Table C-2, the 1-in-50 annual probability hourly wind pressure and reference hourly wind pressure remained below 0.8 kPa, resulting in no impact. Seven of the nine remaining locations had a 1-in-50 annual probability hourly wind pressure and reference hourly wind pressure greater than 0.8 kPa, resulting in no impact. The same remaining two locations noted above exceeded 0.8 kPa as a result of the proposed change, having the following impact:

- For roof sheathing, the two locations would require larger size fasteners and fasteners spaced at 50 mm within 1 m of the roof edge. The cost increase using common wire nails is estimated to be $468.68 for each location.
- For wall sheathing, the two locations would require braced wall panels with wood-based wall sheathing, resulting in a cost increase of $1,125.30 for each location.

For the anchorage of building frames (NBC Sentence 9.23.6.1.(3)), the same two locations noted above had a 1-in-50 annual probability hourly wind pressure that exceeded 0.8 kPa, resulting in an increase in the number of anchor bolts by 15 for a total cost increase of $94.20.

For required roof sheathing (NBC Sentence 9.23.16.1.(1)), a 128.5 m^2 two-storey detached bungalow was used. Similar to the above results, the same two locations would be impacted by the proposed change and be required to meet NBC Subsection 9.23.16. The cost increase from sheathing deemed too thin for truss spacing in NBC Sentence 9.23.16.7.(2) to compliant plywood sheathing is approximately $168.82.

For lumber roof sheathing (NBC Article 9.23.16.5.), the roof area of a 128.5 m^2, two-storey detached house was used as the building archetype. Similar to the above results, the same two locations would be impacted by the proposed change and be required to install lumber roof sheathing diagonally instead of horizontally in accordance with NBC Sentence 9.23.16.5. This results in a cost increase of approximately $311.67 for each location.

For the attachment of cladding to flat ICF wall units (NBC Sentence 9.27.5.4.(2), a 128.5 m^2, two-storey detached house was used. In 619 of the 680 locations in Table C-2, the 1-in-50 annual probability hourly wind pressure and reference wind pressure was equal to or less than 0.6 kPa before and after the change, resulting in no impact. In 34 of the remaining 61 locations, the 1-in-50 annual probability hourly wind pressure and reference hourly wind pressure were greater than 0.6 kPa before and after the change, so the impact is assumed to be minimal and would account for additional fasteners. The greatest impact is assumed to occur at locations where the 1-in-50 annual probability hourly wind pressure is equal to or less than 0.60 kPa and the reference hourly wind pressure is more than 0.6 kPa after the change, which occurred in the remaining 27 locations. This resulted in approximate cost increases of $2,009.15 in these locations, representing the different material costs of fasteners into concrete, additional labour, and reduced daily output to attach the furring through the flat wall ICF units into the solid concrete backup wall.

Cost impact on Part 9 buildings of updated snow loads with longer return periods

As a result of the new 1-in-1 000 annual probability snow load data and modification to the calculation of specified snow loads in this proposed change, out of the 680 locations in Table C-2 of PCF 1979, the specified snow load remained the same in 41 locations (neutral), increased in 154 locations (adverse), and decreased in the remaining 485 locations (beneficial).

For platforms subject to snow and occupancy loads (NBC Sentence 9.4.2.3.(1)), a 3.5 m × 4 m archetype exterior platform was assessed. Before and after the change, 483 out of the 680 locations had specified snow loads less than 1.9 kPa, resulting in no impact. Of the 197 remaining locations, 115 locations had specified snow loads that remained between the same range before and after the change, resulting in no impact. Using the archetype, NBC Span Tables, and costs from RSMeans, 16 of the 82 remaining locations experienced a cost increase ranging from $47.77 to $291.81, and 37 locations experienced a cost decrease ranging from $47.77 to $126.43. In 24 locations, the same joist and built-up beam size was sufficient before and after the change, resulting in no impact.

For the performance of windows, doors and skylights (NBC Sentence 9.7.3.1.(2)), the magnitude of the cost impact could not be determined without industry knowledge about the structural design of skylights, including the capacity of the skylight frames and glazing, for the 154 locations where snow loads increase.

For columns (NBC Subclause 9.17.1.1.(1)(b)(ii)), a 2.44 m × 4 m exterior platform raised 3 m from the ground by three columns was assessed. In 657 of the 680 locations, the sum of the specified snow load and the occupancy load remained below 4.8 kPa before and after the change, resulting in no impact. In 19 of the 23 remaining locations, the same column size was applicable before and after the change, resulting in no impact. In three of the remaining locations, there was a cost decrease of $290.86. One location experienced a cost increase of $290.86.

For ridge support (NBC Sentence 9.23.14.8.(5) and Table 9.23.14.8.), a 120 m^2 bungalow was used as the building archetype. In 481 of the 680 locations, the specified snow load remained within the same range, resulting in no impact. Of the 199 remaining locations, 58 were not impacted because the same number of nails were sufficient before and after the change. In the remaining 141 locations, 112 experienced a decrease in the required number of nails (maximum three nails less), and 29 experienced an increase in the number of nails (maximum three nails more) resulting in additional material costs of $5.54.

For ICF lintels (NBC Sentence 9.20.17.4.(3) and Tables 9.20.17.4.-A, 9.20.17.4.-B and 9.20.17.4.-C), a 120 m^2 bungalow was used assuming 150 mm thick ICF walls. ICF lintel sizes before and after the change where the ground snow load exceeded 3.33 kPa were analyzed. In six locations, the ground snow load before and after the change remained below or equal to 1.5 kPa, resulting in no impact. In

105 locations the ICF lintel size was sufficient to support the snow load before and after the change, resulting in no impact. In 62 locations, the ground snow load exceeded both the values in the NBC Span Tables and those provided by an ICF manufacturer, which would likely require a structural engineer to design using Part 4 and additional material and labour costs. For the remaining 507 locations, there was an increased cost for ICF lintels of between $6.71 and $88.46.

For spans for joists, rafters and beams (NBC Sentence 9.23.4.2.(1)), a 120 m^2 bungalow was used. In 589 of the 680 locations, the specified snow load before and after the change remained in the same range, resulting in no impact. The impact on the remaining 91 locations was the following:

- For roof joists (NBC Tables 9.23.4.2.-D and 9.23.4.2.-E), 37 of the 91 locations did not experience an impact because the same roof joist size was sufficient before and after the change. The cost impact was not determined for five locations where the specified snow load exceeded 4.0 kPa and the NBC Span Tables could not be used to determine the size of roof joists required either before or after the change. Of the remaining locations, 10 experienced a cost increase of approximately $1,850.00, while 39 locations experienced a cost decrease of the same amount.
- For roof rafters (NBC Tables 9.23.4.2.-F and 9.23.4.2.-G), 26 of the 91 locations did not experience an impact because the size of the roof rafters was sufficient before and after the change. The cost impact was not determined for five locations where the specified snow load exceeded 4.0 kPa and the NBC Span Tables could not be used to determine the size of roof rafters required either before or after the change. Of the remaining locations, 16 experienced a cost increase of between $255.30 and $1,342.89, while 44 locations experienced a cost decrease of between $255.30 and $1,342.89.
- For built-up ridge beams and lintels supporting the roof (NBC Table 9.23.4.2.-L), 12 of the 91 locations did not experience an impact because the size of the built-up ridge beam was sufficient before and after the change. The cost impact was not determined for nine locations where the specified snow load exceeded 3.0 kPa and the NBC Span Tables could not be used to determine the size of roof rafters required either before or after the change. Of the remaining locations, 17 experienced a cost increase of between $140.24 and $262.66, while 53 locations experienced a cost decrease of the same amount.
- For lintels for various wood species (NBC Tables 9.23.12.3.-A, 9.23.12.3.-B, 9.23.12.3.-C and 9.23.12.3.-D), the cost impact was not determined for nine locations where the specified snow load exceeded 3.0 kPa and the NBC Span Tables could not be used to determine the size of the lintel required either before or after the change. Of the remaining locations, 18 experienced a cost increase of between $32.13 and $84.47, while 64 locations experienced a cost decrease of the same amount.

Enforcement implications

There are no foreseeable enforcement implications.

Who is affected

Designers, architects, building regulators and building owners.

Supporting Document(s)

Cost impact of climatic load changes on Part 9: Adopting Part 4 proposed new return periods in PCF 2048 (cost_impact_of_pcf_2048.pdf)

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

NBC20 Div.B 9.4.2. (first printing)

[9.4.2.1.] **9.4.2.1. ([1] 1) no attributions**

[9.4.2.2.] **9.4.2.2. ([1] 1) [F20-OS2.1,OS2.3] [F22-OS2.3]**

[9.4.2.2.] **9.4.2.2. ([1] 1) [F20-OP2.1,OP2.3] [F22-OP2.3]**

[9.4.2.2.] **9.4.2.2. ([1] 1) [F22-OH1.1,OH1.2,OH1.3]**

[9.4.2.2.] **9.4.2.2. ([2] 2) [F20-OS2.1]**

[9.4.2.2.] **9.4.2.2. ([2] 2) [F20-OP2.1]**

[9.4.2.2.] -- ([3] --) [F20-OS2.1,OS2.3] [F22-OS2.3]

[9.4.2.2.] -- ([3] --) [F20-OP2.1,OP2.3] [F22-OP2.3]

[9.4.2.2.] -- ([3] --) [F22-OH1.1,OH1.2,OH1.3]

[9.4.2.2.] **9.4.2.2. ([4] 3) no attributions**

[9.4.2.2.] **9.4.2.2. ([5] 4) [F20-OS2.1,OS2.3] [F22-OS2.3]**

[9.4.2.2.] **9.4.2.2. ([5] 4) [F20-OP2.1,OP2.3] [F22-OP2.3]**

[9.4.2.2.] **9.4.2.2. ([5] 4) [F22-OH1.1,OH1.2,OH1.3]**

[9.4.2.2.] **9.4.2.2. ([6] 5) no attributions**

[9.4.2.3.] -- ([2] --) [F20-OS2.1,OS2.3] [F22-OS2.3]

[9.4.2.3.] -- ([2] --) [F20-OP2.1,OP2.3] [F22-OP2.3]

[9.4.2.3.] -- ([2] --) [F22-OH1.1,OH1.2,OH1.3]

[9.4.2.4.] **9.4.2.3. ([1] 1) [F20-OS2.1]**

[9.4.2.4.] **9.4.2.3. ([1] 1) [F20-OP2.1]**

[9.4.2.5.] **9.4.2.4. ([1] 1) [F20-OS2.1]**

[9.4.2.5.] **9.4.2.4. ([1] 1) [F20-OP2.1]**

NBC20 Div.B 9.6.1.3. (first printing)

[9.6.1.3.] **9.6.1.3. ([1] 1) [F20-OS2.1]**

[9.6.1.3.] **9.6.1.3. ([2] 2) [F20-OS2.1]**

[9.6.1.3.] **9.6.1.3. ([3] 3) [F30-OS3.1] [F10-OS3.7]**

NBC20 Div.B 9.23.3.4.(3) (first printing)

[9.23.3.4.] **9.23.3.4. ([1] 3) [F20-OS2.1] [F20,F22-OS2.3] [F20,F22-OS2.5]**

[9.23.3.4.] **9.23.3.4. ([1] 3) [F20-OP2.1,OP2.5] [F20,F22-OP2.3] [F22-OP2.4,OP2.5]**

[9.23.3.4.] **9.23.3.4. ([1] 3) [F20,F22-OH1.1,OH1.2,OH1.3]**

[9.23.3.4.] **9.23.3.4. ([1] 3) [F20,F22-OS1.2]** Applies to assemblies required to provide fire resistance.

NBC20 Div.B 9.23.3.5. (first printing)

[9.23.3.5.] **9.23.3.5. ([1] 1) [F22-OH4]** Applies to floors and elements that support floors.

[9.23.3.5.] **9.23.3.5. ([1] 1) [F20,F22-OS1.2]** Applies to assemblies required to provide fire resistance.

[9.23.3.5.] **9.23.3.5. ([1] 1) [F22-OS3.1]** Applies to floors and elements that support floors. **[F22-OS3.7]** Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.

[9.23.3.5.] **9.23.3.5. ([1] 1) [F20-OS2.1] [F20,F22-OS2.5] [F20,F22-OS2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.3.5.] **9.23.3.5. ([1] 1) [F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.3.5.] **9.23.3.5. ([1] 1) [F20,F22-OH1.1,OH1.2,OH1.3]** Applies to elements that support or are part of an environmental separator.

[9.23.3.5.] **9.23.3.5. ([2] 2) [F22-OH4]** Applies to floors and elements that support floors.

[9.23.3.5.] **9.23.3.5. ([2] 2) [F22-OS3.1]** Applies to floors and elements that support floors.**[F22-OS3.7]** Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.

[9.23.3.5.] **9.23.3.5. ([2] 2) [F20-OS2.1] [F20,F22-OS2.5] [F20,F22-OS2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.3.5.] **9.23.3.5. ([2] 2) [F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.3.5.] **9.23.3.5. ([2] 2) [F20,F22-OH1.1,OH1.2,OH1.3]** Applies to elements that support or are part of an environmental separator.

[9.23.3.5.] **9.23.3.5. ([3] 3) [F22-OH4]** Applies to floors and elements that support floors.

[9.23.3.5.] **9.23.3.5. ([3] 3) no attributions**

[9.23.3.5.] **9.23.3.5. ([3] 3) [F22-OS3.1]** Applies to floors and elements that support floors.**[F22-OS3.7]** Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.

[9.23.3.5.] **9.23.3.5. ([3] 3) [F20-OS2.1] [F20,F22-OS2.5] [F20,F22-OS2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.3.5.] **9.23.3.5. ([3] 3) [F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.3.5.] **9.23.3.5. ([3] 3) [F20,F22-OH1.1,OH1.2,OH1.3]** Applies to elements that support or are part of an environmental separator.

[9.23.3.5.] **9.23.3.5. ([4] 4) no attributions**

[9.23.3.5.] **9.23.3.5. ([5] 5) [F20-OS2.1] [F20,F22-OS2.5] [F20,F22-OS2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.3.5.] **9.23.3.5. ([5] 5) [F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.3.5.] **9.23.3.5. ([5] 5) [F20,F22-OH1.1,OH1.2,OH1.3]** Applies to elements that support or are part of an environmental separator.

[9.23.3.5.] **9.23.3.5. ([5] 5) [F22-OH4]** Applies to floors and elements that support floors.

[9.23.3.5.] **9.23.3.5. ([5] 5) [F20,F22-OS1.2]** Applies to assemblies required to provide fire resistance.

[9.23.3.5.] **9.23.3.5. ([5] 5) [F22-OS3.1]** Applies to floors and elements that support floors. **[F22-OS3.7]** Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.

[9.23.3.5.] **9.23.3.5. ([6] 6) [F20-OS2.1] [F20,F22-OS2.5] [F20,F22-OS2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.3.5.] **9.23.3.5. ([6] 6) [F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.3.5.] **9.23.3.5. ([6] 6) [F20,F22-OH1.1,OH1.2,OH1.3]** Applies to elements that support or are part of an environmental separator.

[9.23.3.5.] **9.23.3.5. ([6] 6) [F22-OH4]** Applies to floors and elements that support floors.

[9.23.3.5.] **9.23.3.5. ([6] 6) [F20,F22-OS1.2]** Applies to assemblies required to provide fire resistance.

[9.23.3.5.] **9.23.3.5. ([6] 6) [F22-OS3.1]** Applies to floors and elements that support floors. **[F22-OS3.7]** Applies to walls, and elements that support walls, that contain doors or windows required for emergency egress.

[9.23.3.5.] **9.23.3.5. ([7] 7) [F20,F22-OS2.1]**

[9.23.3.5.] **9.23.3.5. ([7] 7) [F20-OP2.1] [F22-OP2.4]**

[9.23.3.5.] **9.23.3.5. ([7] 7) [F22-OH4]** Applies to floors and elements that support floors.

[9.23.3.5.] **9.23.3.5. ([7] 7) [F22-OS3.1]** Applies to floors and elements that support floors.

[9.23.3.5.] **9.23.3.5. ([7] 7) [F20-OS1.2]** Applies to assemblies required to provide fire resistance.

[9.23.3.5.] **9.23.3.5. ([8] 8) [F20-OS2.1] [F20,F22-OS2.5] [F20,F22-OS2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.3.5.] **9.23.3.5. ([8] 8) [F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.3.5.] **9.23.3.5. ([8] 8) [F20,F22-OH1.1,OH1.2,OH1.3]** Applies to elements that support or are part of an environmental separator.

NBC20 Div.B 9.23.6.1. (first printing)

[9.23.6.1.] **9.23.6.1. ([1] 1) [F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.6.1.] **9.23.6.1. ([1] 1) [F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.6.1.] **9.23.6.1. ([1] 1) [F20-OH1.1,OH1.2,OH1.3]** Applies to elements that support or are part of an environmental separator.

[9.23.6.1.] **9.23.6.1. ([1] 1) [F22-OH4]** Applies to floors and elements that support floors.

[9.23.6.1.] **9.23.6.1. ([1] 1) [F20-OS3.1]** Applies to floors and elements that support floors.

[9.23.6.1.] **9.23.6.1. ([2] 2) [F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.6.1.] **9.23.6.1. ([2] 2) [F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.6.1.] **9.23.6.1. ([2] 2) [F20-OH1.1,OH1.2,OH1.3]** Applies to elements that support or are part of an environmental separator.

[9.23.6.1.] **9.23.6.1. ([2] 2) [F22-OH4]** Applies to floors and elements that support floors.

[9.23.6.1.] **9.23.6.1. ([2] 2) [F20-OS3.1]** Applies to floors and elements that support floors.

[9.23.6.1.] **9.23.6.1. ([3] 3) [F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.6.1.] **9.23.6.1. ([3] 3) [F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.6.1.] **9.23.6.1. ([3] 3) [F20-OH1.1,OH1.2,OH1.3]** Applies to elements that support or are part of an environmental separator.

[9.23.6.1.] **9.23.6.1. ([3] 3) [F22-OH4]** Applies to floors and elements that support floors.

[9.23.6.1.] **9.23.6.1. ([3] 3) [F20-OS3.1]** Applies to floors and elements that support floors.

[9.23.6.1.] **9.23.6.1. ([4] 4) [F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.6.1.] **9.23.6.1. ([4] 4) [F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.6.1.] **9.23.6.1. ([4] 4) [F20-OH1.1,OH1.2,OH1.3]** Applies to elements that support or are part of an environmental separator.

[9.23.6.1.] **9.23.6.1. ([4] 4) [F22-OH4]** Applies to floors and elements that support floors.

[9.23.6.1.] **9.23.6.1. ([4] 4) [F20-OS3.1]** Applies to floors and elements that support floors.

[9.23.6.1.] **9.23.6.1. ([5] 5) [F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.6.1.] **9.23.6.1. ([5] 5) [F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.6.1.] **9.23.6.1. ([5] 5) [F20-OH1.1,OH1.2,OH1.3]** Applies to elements that support or are part of an environmental separator.

[9.23.6.1.] **9.23.6.1. ([5] 5) [F22-OH4]** Applies to floors and elements that support floors.

[9.23.6.1.] **9.23.6.1. ([5] 5) [F20,F22-OS3.1]** Applies to floors and elements that support floors.

[9.23.6.1.] **9.23.6.1. ([6] 6) [F20-OS2.1,OS2.5] [F22-OS2.5] [F20,F22-OS2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.6.1.] **9.23.6.1. ([6] 6) [F20-OP2.1,OP2.5] [F22-OP2.4,OP2.5] [F20,F22-OP2.3]** Applies to elements that support or are part of an environmental separator.

[9.23.6.1.] **9.23.6.1. ([6] 6) [F20-OH1.1,OH1.2,OH1.3]** Applies to elements that support or are part of an environmental separator.

[9.23.6.1.] **9.23.6.1. ([6] 6) [F22-OH4]** Applies to floors and elements that support floors.

[9.23.6.1.] **9.23.6.1. ([6] 6) [F20-OS3.1]** Applies to floors and elements that support floors.

NBC20 Div.B 9.23.13.1. (first printing)

[9.23.13.1.] **9.23.13.1. ([1] 1) no attributions**

[9.23.13.1.] **9.23.13.1. ([2] 2) [F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.4,OS2.5]**

[9.23.13.1.] **9.23.13.1. ([2] 2) [F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]**

[9.23.13.1.] **9.23.13.1. ([2] 2) [F20,F22-OH1.1,OH1.2,OH1.3]**

[9.23.13.1.] **9.23.13.1. ([2] 2) [F20,F22-OS1.2]** Applies to assemblies required to provide fire resistance.

[9.23.13.1.] **9.23.13.1. ([2] 2) [F22-OS3.1]** Applies to walls that support floors.
[F22-OS3.7] Applies to walls that contain doors or windows required for emergency egress.

[9.23.13.1.] **9.23.13.1. ([2] 2) [F20,F22-OH4]** Applies to walls that support floors.

NBC20 Div.B 9.23.13.2. (first printing)

[9.23.13.2.] **9.23.13.2. ([1] 1) no attributions**

[9.23.13.2.] **9.23.13.2. ([2] 2) no attributions**

NBC20 Div.B 9.23.13.3. (first printing)

[9.23.13.3.] **9.23.13.3. ([1] 1) no attributions**

[9.23.13.3.] **9.23.13.3. ([2] 2) no attributions**

NBC20 Div.B 9.23.16.1. (first printing)

[9.23.16.1.] **9.23.16.1. ([1] 1) [F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.4,OS2.5]**

[9.23.16.1.] **9.23.16.1. ([1] 1) [F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]**

[9.23.16.1.] **9.23.16.1. ([1] 1) [F20,F22-OH1.1,OH1.2,OH1.3]**

NBC20 Div.B 9.23.16.5. (first printing)

[9.23.16.5.] **9.23.16.5. ([1] 1) [F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.5]**

[9.23.16.5.] **9.23.16.5. ([1] 1) [F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.5]**

[9.23.16.5.] **9.23.16.5. ([1] 1) [F20,F22-OH1.1,OH1.2,OH1.3]**

[9.23.16.5.] **9.23.16.5. ([1] 1) [F20,F22-OS1.2]** Applies to assemblies required to provide fire resistance.

[9.23.16.5.] **9.23.16.5. ([2] 2) [F20-OS2.1,OS2.3,OS2.5] [F22-OS2.3,OS2.4,OS2.5]**

[9.23.16.5.] **9.23.16.5. ([2] 2) [F20-OP2.1,OP2.3,OP2.5] [F22-OP2.3,OP2.4,OP2.5]**

[9.23.16.5.] **9.23.16.5. ([2] 2) [F20,F22-OS1.2]** Applies to assemblies required to provide fire resistance.

[9.23.16.5.] **9.23.16.5. ([2] 2) [F20,F22-OH1.1,OH1.2,OH1.3]**

[9.23.16.5.] **9.23.16.5. ([3] 3) no attributions**

NBC20 Div.B 9.27.5.4.(2) (first printing)

[9.27.5.4.] **9.27.5.4. ([1] 2) [F20-OH1.1,OH1.2,OH1.3]**

[9.27.5.4.] 9.27.5.4. ([1] 2) [F20-OS2.1,OS2.3]