CODES CANADA

Impact Analysis for PCF 2061: Overheating in New Dwelling Units

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Executive Summary

The proposed change described in PCF 2061 is recommending that the National Building Code of Canada mandate the addition of an acceptable upper indoor temperature that must be maintained in a single living space within each dwelling unit by the addition of mechanical cooling and/or by passive design measures. This report summarizes the impact analysis for implementing a maximum indoor air temperature for a single living space in a dwelling unit by the addition of mechanical cooling.

The benefits of reducing indoor air temperatures by installing single room ductless mini-split air conditioning (DMSAC) units in Part 9 dwelling units, and apartment type dwelling units, followed a pattern typical of preventive interventions, with the direct costs incurred up front and a delay before the full benefits are experienced. The direct benefits included the number of overheating related deaths prevented and any treatment costs avoided following the reduction in indoor air temperatures. The results of the analysis were presented in two parts:

I. Example case: single room DMSAC units in dwelling units, including apartment type dwelling units, built in 1 year
II. Full analysis: single room DMSAC units in dwelling units, including apartment type dwelling units, built over a 20-year period, the lifespan of the DMSAC units.

The methodology used to estimate the benefits provided by installing a DMSAC unit in a single living space in each dwelling unit, including apartment type dwelling units, was defined as follows:

- Two estimates (lower and upper) of current overheating related deaths associated with extreme heat events (estimated using a cutoff of 2.5th temperature percentile)
- Expected 100% effectiveness of the DMSAC in new dwelling units, assuming use by the occupants, in reducing illness and death associated with extreme heat events only.
- 20-year service life of the DMSAC

The annual cost for the 12 months period between July 1, 2021 and June 30, 2022 for installing a 9000 BTU/hr single room DMSAC units in 221,492 dwellings of all types, including apartment type dwellings, is estimated to be $475,398,711. The estimated operational costs over the 1-year period is estimated to be $43,123,518. It is estimated that the lifespan of a DMSAC will be 20 years with minimal maintenance. The total cost of both the initial installation and operation costs at the end of the 20-year time period is estimated to be $1,337,869,100. The total treatment costs for illnesses related to overheating during extreme heat events over the 20-year time period is estimated to range between $2,430,920 and $14,853,880 for the lower and upper estimates, respectively. The cumulative number of overheating related deaths prevented over 20-year period during extreme heat events was estimated to be 2,520 and 17,290 for the lower and upper estimates, respectively, in the residents of all dwellings completed over 20 years following the installation of the DMSAC.

The impact analysis on installing a DMSAC unit in a single living space in each dwelling unit, including apartment type dwellings, demonstrates that the main benefit would be preventing 2,520 to 17,290 overheating associated deaths during extreme heat events in Canada over 20 years should the proposed change be adopted. Although the costs incurred for installing DMSAC units in all dwelling types, including apartment type dwellings, always exceeded the savings from preventing cases requiring overheating related illness treatment during extreme heat events, the cumulative cost per overheating death prevented decreased steeply after implementation and was lower than the Treasury Board of Canada Secretariat VSL after 1 year to 9 years for direct cost comparisons, and after 1 year to 19 years for direct and indirect cost comparisons.

Scope

This report summarizes the impact analysis for PCF 2061 on maximum indoor air temperature for dwelling units. The staff led proposed change is recommending that the National Building Code mandate the addition of an acceptable upper indoor temperature that must be maintained in a single living space within each dwelling unit by the addition of mechanical cooling.

Method

The Standing Committee on Housing and Small Buildings (SC-HSB) agreed to limit the requirements for mechanical cooling to a single room in a dwelling unit. The analysis is based on the evaluation of the costs and benefits of installing single room ductless mini-split air conditioning (DMSAC) units in Part 9 and apartment type dwelling units built in a single year. The single year cost demonstrates the benefits from reducing overheating over time and are experienced over the lifespan of the air conditioning unit. The method is depicted in Figure 1.

The benefits of reducing indoor temperatures from installing a DMSAC for a single living space per dwelling unit follows a pattern typical of preventive interventions, where the costs are incurred up front while there is a delay before the full benefits are experienced. The direct benefits include the number of deaths related to overheating prevented and the associated medical treatment costs avoided by the reduction of exposure to high indoor temperatures with the installation of mechanical cooling in dwelling units.

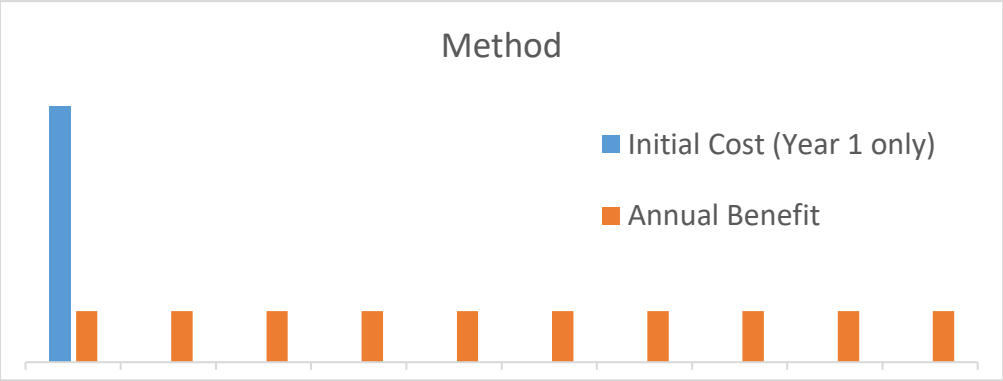

Figure 1: Method for direct cost/benefit analysis for ductless min-split air conditioning

Service Life of DMSAC

The service life of a DMSAC is estimated to be 20 years. For this analysis, the service life represents the expected lifespan of the unit with minimal maintenance. (1)

Quantitative Initial Direct Costs

The most recent data available was used to determine the quantitative direct costs for this analysis: based on the 2022 cost estimates for the installation of a 9,000 BTU/hr (3/4 ton) ductless mini split air conditioning system (2)and the third and fourth quarter 2021/ first and second quarter 2022 CMHC data on new housing completions (3).

Construction Cost per Dwelling Unit

The average costs per dwelling unit were calculated using RSMeans Online with data for 2022 (2). A 9,000 BTU/hr (3/4 ton) DMSAC was used for costing as they are much more common on the market with costing of a 6,000 BTU/hr (1/2 ton) unit not available through RSMeans. An additional unit cost was provided for the upgrade form a 100 amp electrical panel to a 200 amp panel.

This system will be used for the cost/benefit analysis as it meets the requirements of cooling a single room at a lower cost to that of a central air conditioning system. Furthermore, a DMSAC can be installed where a ducted HVAC system has not been installed.

Table 1 contains national unit costs per dwelling unit for the DMSAC. Appendix 1 contains the individual items included in the US national average costing estimates, which were adjusted to provide the slightly lower Canadian national average estimate (see Appendix A).

	Ductless Mini Split A/C for one room
RSMeans (CDN National Average)	$2,107

Table 1: National costs for installation of a single 9000 BTU/hr DMSAC

National and Regional Annual Construction Costs

National and regional new housing construction completions for all Part 9 and apartment type dwellings are summarized in Table 2. These were obtained from the CMHC quarterly data reports for the third and fourth quarters of 2021 and the first and second quarters of 2022 (3). Housing completions for the North are not supplied as there is no data available.

Regional	**Total**
CANADA	**221,492**
British Columbia (BC)	43157
Alberta (AB)	27,804
Saskatchewan and Manitoba	11240
Ontario (ON)	75101
Quebec (QC)	54407
Atlantic (NB, NS, PEI, NFLD)	9,783

Table 2: National and regional building construction completions for 2021/2022

The annual national and regional costs for the installation DMSAC units for Part 9 and apartment type dwelling units, in Canada between July 1, 2021 and June 30, 2022. Table 3 was derived by combining the values from Table 1 with those from Table 2.

National/Region	Regional Cost
CANADA	**$475,398,740**
BC	$ 93,207,711
Alberta	$ 60,163,009
Saskatchewan/ Manitoba	$ 22,405,443
Ontario	$ 164,943,443
Quebec	$ 114,992,778
Atlantic (NS.NB, PEI, NFLD)	$ 19,686,357

Table 3: Annual national and regional costs for installation of a 9000 BTU/hr DMSAC for 2021/2022

Quantitative Indirect Costs

Operating Costs

The use of air conditioning to cool a room will use electricity to do so. An annual cost has been determined to do so using the following assumptions:

- The DMSAC unit operates 24 hours/day during the summer.
- The air conditioner will operate throughout the summer months (summer is on average 93.6 days in the northern hemisphere).
- The seasonal energy efficiency rating (SEER) will be 14.3 which is common for a basic ductless mini split air conditioning unit.
- An average daily unit energy cost is collected from Electricity Prices in Canada 2023 (4). 2023 values were used as 2022 values were not readily available for all provinces.

The following formula was used to calculate the annual energy costs for operating a 9000 BTU/hr ductless mini split unit (5):

(**Cost**, $/year) = (**unit size**, BTU/h) × (**hours per year**, h) × (**energy cost**, $/kW·h) ÷ (**SEER**, BTU/W·h) ÷ (1000, W/kW)

Table 4 shows the national and regional annual costs to operate the air conditioning unit in question with average unit costs for electricity.

Region	Annual cost for mini split ($)
CANADA	**$ 43,123,518**
BC	$ 7,059,882
Alberta	$ 10,293,624
Saskatchewan/ Manitoba	$ 2,182,021
Ontario	$ 15,195,191
Quebec	$ 6,089,627
Atlantic (NS.NB, PEI, NFLD)	$ 2,303,173

Table 4: Annual national and regional 2023 operating costs of a 9000 BTU/hr DMSAC for 2021/2022 housing completions

Greenhouse Gas Emissions (GHGe)

The electricity used to operate a DMSAC is created in different ways across Canada. These methods can be coal, gas, nuclear, and renewable sources with wind and solar being examples. Certain methods of electricity generation will produce more GHGe than others. Table 5 shows the national and regional annual GHGe required to power the air conditioning unit in question.

National/Region	Regional Annual GHGe of 9000 BTU/hr mini-split (tonnes CO2/year)
CANADA	**13.17**
BC	0.05
Alberta	3.55
Saskatchewan/ Manitoba	3.49
Ontario	0.15
Quebec	0.01
Atlantic (NS.NB, PEI, NFLD)	5.92

Table 5: Annual national and regional 2023 GHGe from 9000 BTU/hr DMSAC for 2021/2022 housing completions

Qualitative Indirect Costs

An increased load on the electrical grid would be expected from operating the DMSAC during a high heat event. There could be the potential for grid failure during a high heat event depending on the current infrastructure and the number of dwelling units on the grid. This could also potentially lead to a need to increase the capacity of an electrical grid over its current state to address the increased load.

An example at the dwelling unit level of a grid increase may be the need to increase the transformers and electrical cabling that service individual dwelling units. However, there could potentially be the need for an increase to the electrical grid at a much larger scale.

Quantitative Monetary Annual Benefits

Method

Table 6 shows two estimates for the percentage of deaths attributed to extreme heat based on Canadian data that have been reported during the last decade. The lower estimate of 0.27% of total annual mortality (6) was based on an analysis of temperature and death data from 1986-2009 in 21 cities in Canada, which showed that about half the 0.54% of total deaths reported were due to extreme heat and half to moderate heat. The upper estimate of 1.66% was derived from the 740 excess deaths due to extreme heat reported from June 25 – July 2, 2021 in BC in the recently publication 'The case for adapting to extreme heat: Costs of the 2021 B.C. heat wave' (7). Statistics Canada reported that the annual number of deaths in B.C. in 2021 was 44,587 (8). The percentage of decedents aged over 70 years was similar for the deaths attributed to the B.C. heat wave and for the total annual deaths in B.C. in 2021. The upper estimate of the number of excess deaths, excess hospitalizations, excess emergency department (ED) visits and excess ambulance trips attributable to extreme heat among residents living in new housing completions between July 1, 2021 and June 30, 2022 are presented in Table 7 below (see details in the following paragraph). The lower estimate for these quantities were determined using the ratio of the lower to upper estimates of the percentage of deaths attributable to extreme heat. The associated healthcare system costs were calculated using the average per person costs, at $11,845 per hospitalization, $323 per ED visit and $461 per ambulance trip (see Appendix B).

Healthcare system use and costs	Upper estimate	Lower estimate
% deaths attributable to extreme heat	1.66%	0.27%
# excess deaths attributable to extreme heat	76	12
# excess hospitalizations	55	9
Cost of excess hospitalization	$651,477	$106,605
# excess emergency department (ED) visits	134	22
Cost of excess ED visits	$43,242	$7,099
# excess ambulance trips	104	17
Cost of excess ambulance trips	$47,975	$7,842
Total cost of healthcare	$742,694	$121,546

Table 6: Deaths and healthcare system use and costs attributed to extreme heat for residents of new housing completions between July 1, 2021 and June 30, 2022

Upper estimate derived from 2021 BC heat dome	Total BC 2021	Total Canada[1] Q3_2021 - Q2_2022	New housing completions Canada[2] Q3_2021 - Q2_2022
# excess deaths	740	5,354	76
# excess hospitalizations	530	3,835	55
# excess ED visits[3]	1,300	9,406	134
# excess ambulance trips	1,009	7,301	104

Table 7: Upper estimate of deaths and excess healthcare system uses due to extreme heat

The total number of excess deaths, excess hospitalizations, excess emergency department (ED) visits and excess ambulance trips attributable to extreme heat were conservatively estimated to be the values reported for the 2021 B.C. heat wave (7). The total number of deaths and healthcare system uses due to extreme heat in Canada between July 1, 2021 and June 30, 2022 were estimated using the ratio of deaths reported in Canada during that period to deaths in BC in 2021 (322,615 /44,587). The number of healthcare system uses for residents of the new housing completions in Canada was estimated using the average number of residents per dwelling from the number of private dwellings occupied by usual residents and the population for the 10 provinces in the 2021 Census (9) and the percentage of Canadian population residing in the new housing completions (1.426%).

Quantitative Direct Cost/Benefits Comparison

Table 8 and Figure 2 depict the initial costs for the installation of DMSAC units for Part 9 and apartment type dwelling units in Canada, completed between July 1, 2021 and June 30, 2022, as well as the annual upper and lower estimated healthcare costs prevented over the expected 20-year lifespan of the DMSAC.

Year	**Annual construction costs ($)**	**Annual excess healthcare costs prevented ($)**	
		upper estimate	lower estimate
1	475,398,740	742,694	121,546
2		742,694	121,546
3		742,694	121,546
4		742,694	121,546
5		742,694	121,546
6		742,694	121,546
7		742,694	121,546
8		742,694	121,546
9		742,694	121,546
10		742,694	121,546
11		742,694	121,546
12		742,694	121,546
13		742,694	121,546
14		742,694	121,546
15		742,694	121,546
16		742,694	121,546
17		742,694	121,546
18		742,694	121,546
19		742,694	121,546
20		742,694	121,546

Table 8: Direct annual costs and excess healthcare costs prevented for new housing completions built between July 1, 2021 and June 30, 2022.

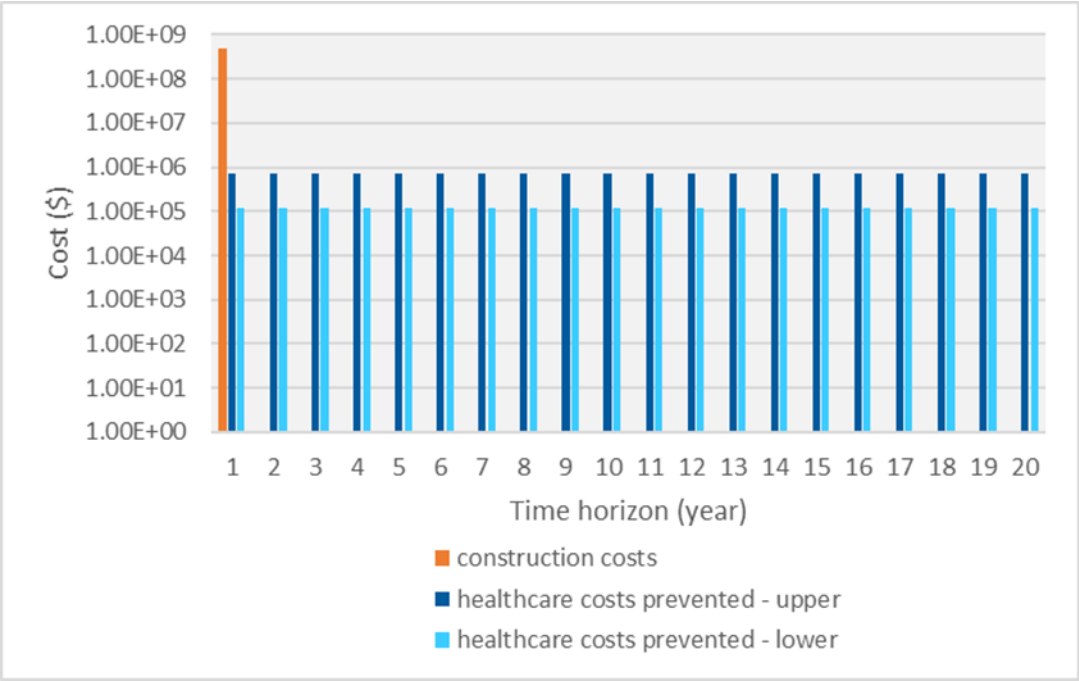

Figure 2: Direct annual costs and excess healthcare costs prevented for new housing completions built between July 1, 2021 and June 30, 2022.

Table 9 and Figure 3 depict the cumulative costs for the installation of DMSAC units for Part 9 and apartment type dwelling units completed in Canada over a 20-year time horizon, as well as the cumulative upper and lower estimated healthcare costs prevented over the same timeframe. A 1% increase in both the population growth and housing completions have been assumed in Table 9, following the average population increase between the 2001-2021.

Year	Cumulative construction costs ($)	Cumulative healthcare costs prevented ($)	
		upper estimate	lower estimate
1	475,398,740	742,694	121,546
2	955,551,467	2,235,509	365,853
3	1,440,505,721	4,485,946	734,149
4	1,930,309,518	7,501,581	1,227,674
5	2,425,011,353	11,290,066	1,847,680
6	2,924,660,206	15,859,130	2,595,432
7	3,429,305,548	21,216,579	3,472,207
8	3,938,997,343	27,370,297	4,479,295
9	4,453,786,056	34,328,247	5,617,999
10	4,973,722,656	42,098,471	6,889,635
11	5,498,858,622	50,689,092	8,295,532
12	6,029,245,948	60,108,314	9,837,033
13	6,564,937,147	70,364,423	11,515,494
14	7,105,985,258	81,465,788	13,332,285
15	7,652,443,850	93,420,862	15,288,789
16	8,204,367,028	106,238,182	17,386,403
17	8,761,809,438	119,926,370	19,626,538
18	9,324,826,272	134,494,135	22,010,619
19	9,893,473,274	149,950,273	24,540,085
20	10,467,806,746	166,303,668	27,216,390

Table 9: Cumulative direct costs and excess healthcare costs prevented for new housing completions built over 20 years

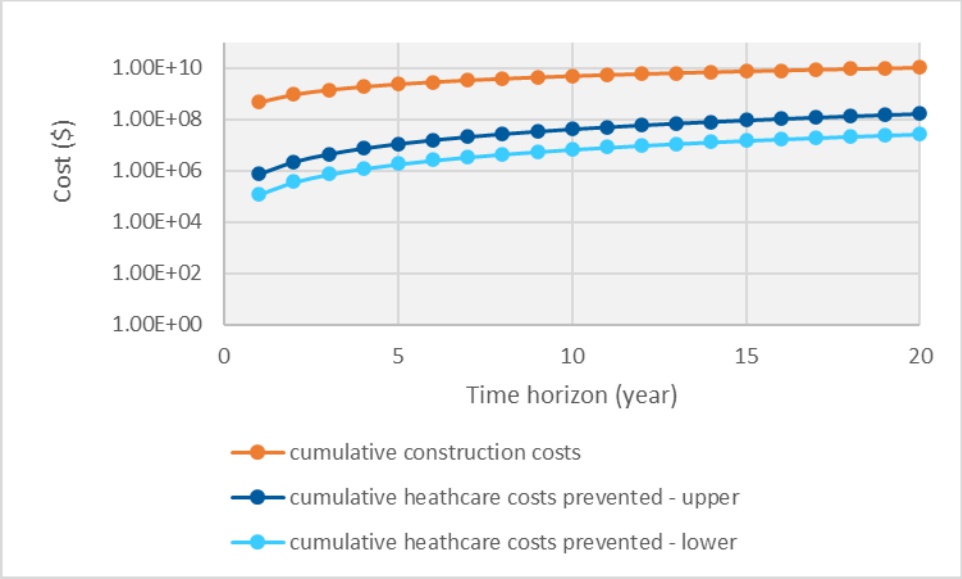

Figure 3: Cumulative direct costs and excess healthcare costs prevented for new housing completions built over 20 years

Quantitative Direct and Indirect Cost/Benefit Comparison

Table 10 and Figure 4 depict the initial costs for the installation of DMSAC units in a single year for Part 9 and apartment type dwelling units completed in Canada between July 1, 2021, and June 30, 2022, as well as the yearly operational costs over the expected 20-year lifespan of the DMSAC. These estimated numbers are compared with the annual upper and lower estimated healthcare costs prevented over the same timeframe. A 1% increase in both the population growth and housing completions have been assumed in Table 10, following the average population increase between the 2001-2021.

Year	**Annual construction costs ($)**	**Annual operational costs ($)**	**Annual healthcare costs prevented ($)**	
			upper estimate	lower estimate
1	475,398,740	43,123,518	742,694	121,546
2		43,123,518	742,694	121,546
3		43,123,518	742,694	121,546
4		43,123,518	742,694	121,546
5		43,123,518	742,694	121,546
6		43,123,518	742,694	121,546
7		43,123,518	742,694	121,546
8		43,123,518	742,694	121,546
9		43,123,518	742,694	121,546
10		43,123,518	742,694	121,546
11		43,123,518	742,694	121,546
12		43,123,518	742,694	121,546
13		43,123,518	742,694	121,546
14		43,123,518	742,694	121,546
15		43,123,518	742,694	121,546
16		43,123,518	742,694	121,546
17		43,123,518	742,694	121,546
18		43,123,518	742,694	121,546
19		43,123,518	742,694	121,546
20		43,123,518	742,694	121,546

Table 10: Direct and indirect annual costs and excess healthcare costs prevented for new housing completions built between July 1, 2021 and June 30, 2022.

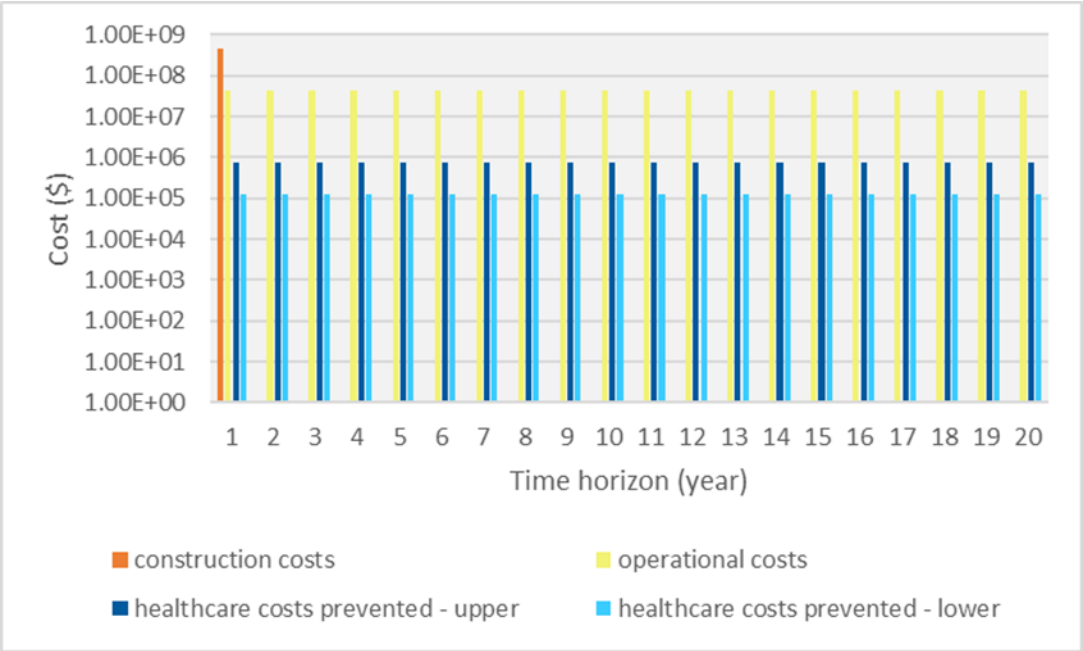

Figure 4: Direct and indirect annual costs and excess healthcare costs prevented for new housing completions built between July 1, 2021 and June 30, 2022

Table 11 and Figure 5 depict the cumulative costs for the installation of DMSAC units for Part 9 and apartment type dwelling units completed in Canada from for a 20-year time horizon, as well as the cumulative upper and lower potential healthcare costs prevented over the same time period. A 1% increase in both the population growth and housing completions have been assumed in Table 11, following the average population increase between the 2001-2021.

Year	Cumulative construction costs ($)	Cumulative operational costs ($)	Cumulative healthcare costs prevented ($)	
			upper estimate	lower estimate
1	475,398,740	43,123,518	742,694	121,546
2	955,551,467	129,801,789	2,235,509	365,853
3	1,440,505,721	260,470,361	4,485,946	734,149
4	1,930,309,518	435,569,137	7,501,581	1,227,674
5	2,425,011,353	655,542,419	11,290,066	1,847,680
6	2,924,660,206	920,838,952	15,859,130	2,595,432
7	3,429,305,548	1,231,911,969	21,216,579	3,472,207
8	3,938,997,343	1,589,219,235	27,370,297	4,479,295
9	4,453,786,056	1,993,223,092	34,328,247	5,617,999
10	4,973,722,656	2,444,390,506	42,098,471	6,889,635
11	5,498,858,622	2,943,193,113	50,689,092	8,295,532
12	6,029,245,948	3,490,107,265	60,108,314	9,837,033
13	6,564,937,147	4,085,614,077	70,364,423	11,515,494
14	7,105,985,258	4,730,199,476	81,465,788	13,332,285
15	7,652,443,850	5,424,354,248	93,420,862	15,288,789
16	8,204,367,028	6,168,574,087	106,238,182	17,386,403
17	8,761,809,438	6,963,359,644	119,926,370	19,626,538
18	9,324,826,272	7,809,216,576	134,494,135	22,010,619
19	9,893,473,274	8,706,655,597	149,950,273	24,540,085
20	10,467,806,746	9,656,192,528	166,303,668	27,216,390

Table 11: Cumulative direct and indirect costs and excess healthcare costs prevented for new housing completions built over 20 years

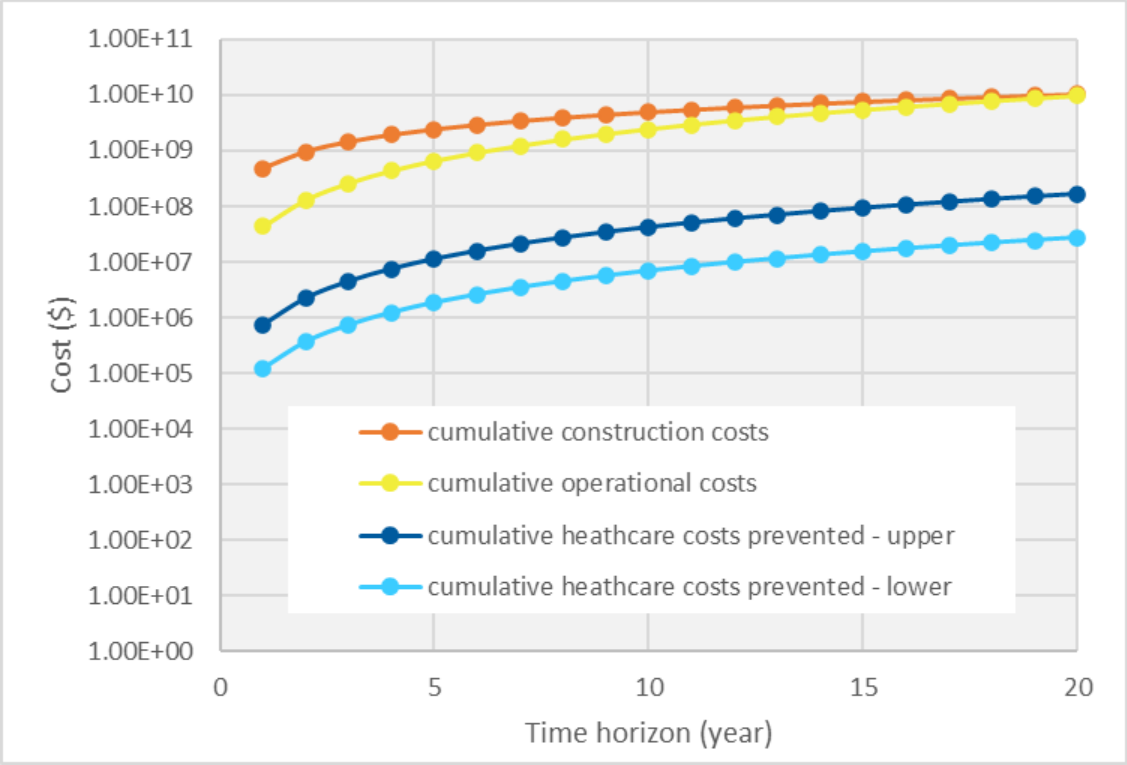

Figure 5: Cumulative direct and indirect costs and excess healthcare costs prevented for new housing completions built over 20 years

Quantitative Number of Overheating Deaths Prevented

Deaths Prevented

The proposed change of installing a DMSAC unit in a single living space within each Part 9 and apartment type dwelling units will have the benefit of reducing the number of deaths related to overheating. Table 12 and Figure 6 depicts the comparison of the upper and lower estimates of the cumulative number of deaths during extreme heat events that would be prevented by the proposed change. Cumulative values are determined by assuming the proposed change implemented in 1 year will continue to prevent deaths during extreme heat events annually for 20 years, while in year 2 will continue to reduce deaths annually for the next 19 years, and so on. A 1% increase in both the population growth and housing completions have been assumed in Table 11, following the average population increase between the 2001-2021.

Year	Number of preventable deaths	
	Upper estimate	Lower estimate
1	76	12
2	229	36
3	460	72
4	770	120
5	1,160	180
6	1,631	252
7	2,184	336
8	2,820	432
9	3,540	540
10	4,345	660
11	5,236	792
12	6,214	936
13	7,280	1,092
14	8,435	1,260
15	9,680	1,440
16	11,016	1,632
17	12,444	1,836
18	13,965	2,052
19	15,580	2,280
20	17,290	2,520

Table 12: Upper and lower estimates of the cumulative number of preventable deaths

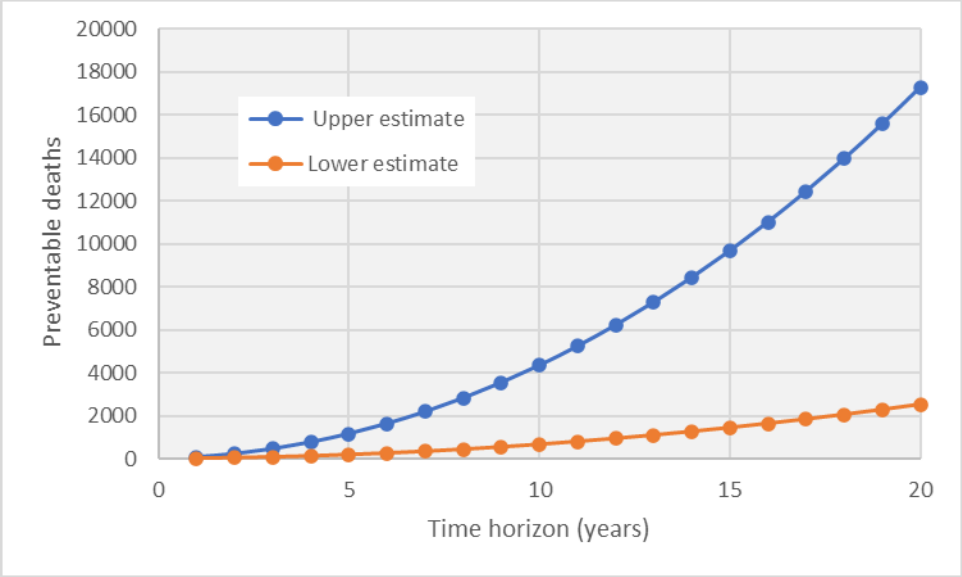

Figure 6: Upper and lower estimates of the cumulative number of preventable deaths

Cost Comparison

The cumulative cost per overheating death prevented provides a useful comparison of the costs and the benefits of installing DMSAC units for Part 9 and apartment type dwelling units. The cumulative cost per overheating death prevented decrease rapidly and then stabilize.

The TBS' cost-benefit analysis guide describes the Value of Statistical Life (VSL) as the aggregation of the estimated willingness to pay for a small reduction in mortality risk across many individuals in an exposed population (10). The VSL does not represent the value of an individual human life, but the marginal value of mortality risk reductions in a population. A value of 8.3 million in 2021 Canadian dollars was obtained for the VSL by indexing the 2007 value of $6.5 million (10) using the Statistics Canada Consumer price index (11).

Direct Cost Comparison

Table 13 and Figure 7 present the estimates for the example case of direct costs per death prevented for 1 year of installation of DMSAC units for Part 9 and apartment type dwelling units, for both the lower and upper estimates of overheating deaths prevented. The cumulative values are calculated for each year over the expect 20-year lifespan of the DMSAC.

The cost per death prevented was lower than the VSL for the first year for the upper estimate of deaths prevented, and dropped below the VSL after the 9th year for the lower estimate of deaths prevented.

Year	**Direct cost per death prevented ($)**	
	For upper estimate of deaths prevented	For lower estimate of deaths prevented
1	6,245,474	39,606,433
2	4,162,952	26,532,934
3	3,121,782	19,996,827
4	2,497,153	16,075,682
5	2,080,794	13,462,020
6	1,783,446	11,595,495
7	1,560,480	10,195,933
8	1,387,102	9,107,681
9	1,248,434	8,237,348
10	1,135,011	7,525,505
11	1,040,521	6,932,529
12	960,595	6,430,992
13	892,112	6,001,302
14	832,782	5,629,090
15	780,891	5,303,580
16	735,124	5,016,532
17	694,462	4,761,538
18	658,098	4,533,536
19	625,387	4,328,479
20	595,807	4,143,091

Table 13: Direct costs per death prevented for new housing completions built between July 1, 2021 and June 30, 2022 over a 20-year time period.

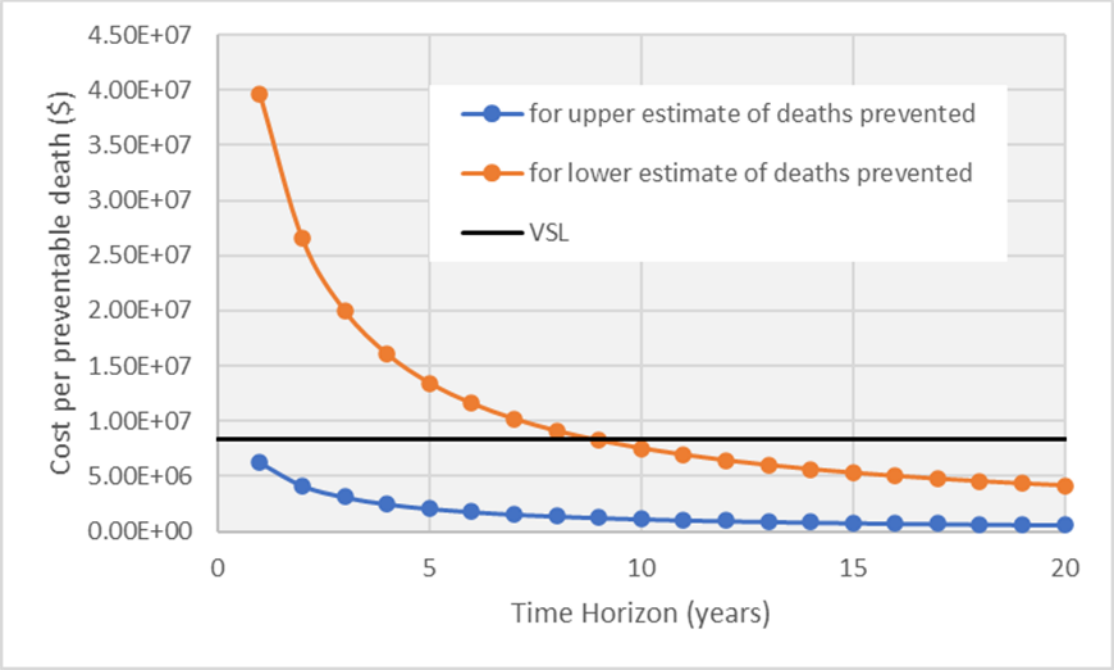

Figure 7: Direct costs per death prevented for new housing completions built between July 1, 2021 and June 30, 2022 over a 20-year time period.

Direct and Indirect Cost Comparison

Table 14 and Figure 8 present the estimates for the example case of the combination of direct and indirect costs per death prevented for 1 year of installation of DMSAC units for Part 9 and apartment type dwelling units, for both the lower and upper estimates of overheating deaths prevented. The cumulative values are calculated for each year over the expect 20-year lifespan of the DMSAC.

The cost per death prevented was lower than the VSL for the first year for the upper estimate of deaths prevented, and dropped below the VSL after the 19th year for the lower estimate of deaths prevented.

Year	Cost per death prevented ($)		Number of preventable deaths	
	lower estimate	upper estimate	Upper estimate	Lower estimate
1	6,812,889	43,200,059	76	12
2	4,729,772	30,138,539	229	36
3	3,688,022	23,614,471	460	72
4	3,062,827	19,705,425	770	120
5	2,645,917	17,103,923	1,160	180
6	2,348,032	15,249,618	1,631	252
7	2,124,543	13,862,337	2,184	336
8	1,950,655	12,786,429	2,820	432
9	1,811,492	11,928,502	3,540	540
10	1,697,587	11,229,127	4,345	660
11	1,602,628	10,648,682	5,236	792
12	1,522,247	10,159,740	6,214	936
13	1,453,322	9,742,707	7,280	1,092
14	1,393,565	9,383,216	8,435	1,260
15	1,341,258	9,070,493	9,680	1,440
16	1,295,089	8,796,296	11,016	1,632
17	1,254,038	8,554,217	12,444	1,836
18	1,217,297	8,339,197	13,965	2,052
19	1,184,222	8,147,188	15,580	2,280
20	1,154,291	7,974,914	17,290	2,520

Table 14: Direct and indirect costs per death prevented for new housing completions built between July 1, 2021 and June 30, 2022 over a 20-year time period.

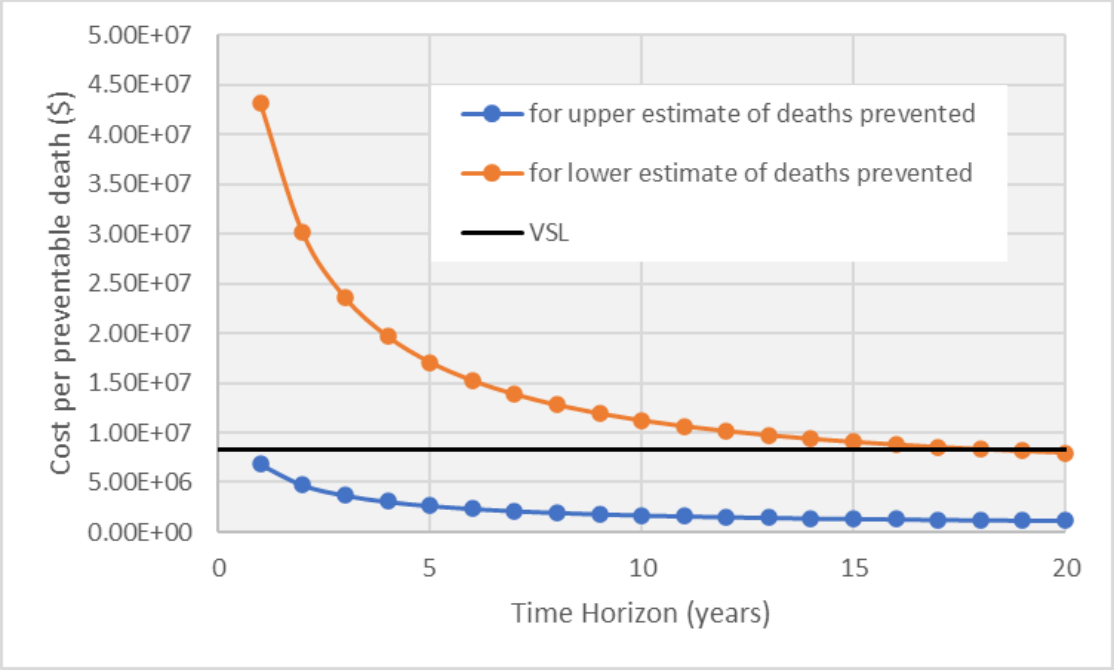

Figure 8: Direct and indirect costs per death prevented for new housing completions built between July 1, 2021 and June 30, 2022 over a 20-year time period.

Limitations

During the development of the impact analysis, assumptions were made regarding data and calculation methods used.

Deaths in Canada Related to Overheating

Deaths related to overheating in Canada have been reported from both a complex epidemiological analysis and from a study based on identification of individual deaths due to heat related illness by the BC Coroners Service for the 2021 BC heat event. However, these values result from both the time period evaluated and the population exposed. Provinces do not usually identify overheating as a cause of death. The range shown for deaths prevented in this analysis are based on published data for overheating deaths during extreme heat events, including the 2021 BC heat dome. US data is more plentiful, but their climate is quite different and cannot be used as a direct comparison for Canada.

Analysis of Northern Regions

The analysis supplied does not include values for the Yukon, Northwest Territories, or Nunavut. CMHC does not track housing completions as used in the analysis, and the housing starts are only tracked for Yellowknife and Whitehorse, which does not give a clear picture of construction in the North. In addition, the death data available for the North from Statistics Canada is incomplete.

Indirect Costs

Operational costs for the DMSAC units, and the assumptions for the calculations, have been supplied in the analysis. The assumptions used to determine the monetary values are based on conservative values of the unit running 24 hours per day for the entire summer. It is expected that the units may not be required to operate continuously, and the value may be lower, but the actual values for the conditions being addressed by PCF 2061 were not available while creating the impact analysis.

The load on the electrical grid has been identified as a qualitative indirect cost. However, this is very difficult to quantify as the effect related to PCF 2061 will vary greatly across Canada depending on the age and robustness of an area's electrical grid, as well as current municipal requirements. For this reason, it is identified as a qualitative indirect cost.

Points for Consideration That Do Not Affect the Analysis

Current Installation Rate for Air Conditioners in New Construction

Not all new construction would be void of a permanent air conditioner at the time of occupancy. Some new home buyers are having permanent air conditioning units installed during construction. Statistics Canada shows that 61% of home shad air conditioners in 2019 and 64% in 2021 (12). However, a couple considerations related to this data include the following:

- The data was for all air conditioners, which could also have included window mounted, non-permanent, air conditioners. Central air conditioners were present in 42% of homes in 2019, and 38% of homes in 2021, showing a slight drop in installations.
- There was no data available to determine whether any of the percentage of air conditioning units above the value reported as central air conditioning units were DMSAC units, so we conservatively assumed that data did not include any DMSAC units.

A builder from Alberta was asked for information on their company's rate of installation of air conditioning units related to the approximately 130 m^2 to 160 m^2 housing stock that the CBHCC would be considering for their affordable home archetypes. The current installation rate for new construction in these home sizes was only 13.75%, with an additional 2% installing air conditioning rough ins for future completion.

This information is useful to determine how many new home owners may not be directly affected by the proposed change. However, this data was not used in the analysis as the installation of a permanently affixed air conditioner is still voluntary, and the recent trend of fewer new home owners opting to do so.

Conclusion

The annual cost for the 12 months period between July 1, 2021 and June 30, 2022 for installing a 9000 BTU/hr single room DMSAC unit in 221,492 Part 9 and apartment type dwelling units is estimated to be $475,398,711. The estimated operational costs over the 1-year period are estimated to be $43,123,518. It is estimated that the lifespan of a DMSAC will be 20 years with minimal maintenance. The total cost of both the initial installation and operation costs at the end of the 20-year time period is estimated to be $1,337,869,100. The total treatment cost for illnesses related to overheating during extreme heat events over the 20-year time period is estimated to range between $2,430,920 and $14,853,880 for the lower and upper estimates, respectively. The cumulative number of overheating related deaths prevented during extreme heat events was estimated to be 2,520 and 17,290 for the lower and upper estimates, respectively, in the residents of all dwellings completed over 20 years following the installation of the DMSAC.

The impact analysis for PCF 2061 on installing a DMSAC unit in a single living space within each dwelling unit, including apartment type dwellings, demonstrates that the main benefit would be preventing 2,520 to 17,290 overheating associated deaths during extreme heat events in Canada over 20 years should the proposed change be adopted. Although the costs incurred for installing DMSAC units in all dwelling types, including apartment type dwellings, always exceeded the savings from preventing cases requiring overheating related illness treatment during extreme heat events, the cumulative cost per overheating death prevented decreased steeply after implementation and was lower than the Treasury Board of Canada Secretariat VSL after 1 year to 9 years for direct cost comparisons and after 1 year to 19 years for direct and indirect cost comparisons.

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Costs based on RSMeans data

COST ESTIMATE REPORT
DATE: 11/22/2023

Estimate Name: LFB-Spatial Separation

ESTIMATE INFORMATION

Client Name:
Estimate Address:

Type: Unit
Measurement System: US Standard

Notes:

COST DATA

Estimate Summary:

	Material	Labor	Equipment	Total*
Base Total	$ 8,392.80	$ 5,248.80	$ -	$ 13,641.60
Total O&P	$ 9,228.00	$ 8,560.80	$ -	$ 17,788.80

**"Total" column values include the cost of Exception lines that may not be included in the Material, Labor and Equipment totals.*

Catalog: Commercial New Construction
Format: MasterFormat 2018
Release: Year 2023
Labor Type: Open Shop
City Cost Index: ONTARIO / OTTAWA (C21)

LEGEND

Line Source:
U - User defined line item
A - Adjustment/Modifier
E - Exception lines

ESTIMATE

Quantity	LineNumber	Line Source	SubContracted Ind.	Description	Crew	Daily Output	Labor Hours	Unit	Material	Labor	Equipment	Total	Ext. Mat.	Ext. Labor	Ext. Equip.	Ext. Total	Mat. O&P	Labor O&P	Equip. O&P	Total O&P	Ext. Mat. O&P	Ext. Labor O&P	Ext. Equip. O&P	Ext. Total O&P	Labor Type	Notes
600.00	061110405040			Wall framing, plates, untreated, 2" x 6"	2 Carp	750	0.021	L.F.	$ 1.66	$ 0.80	$ -	$ 2.46	$ 996.00	$ 480.00	$ -	$ 1,476.00	$ 1.82	$ 1.31	$ -	$ 3.13	$ 1,092.00	$ 786.00	$ -	$ 1,878.00	OPN	
1.00	061110405040	A		Contingencies, at conceptual design stage		0	0	Project	$ 0.33	$ 0.16	$ -	$ 0.49	$ 199.20	$ 96.00	$ -	$ 295.20	$ 0.36	$ 0.26	$ -	$ 0.62	$ 218.40	$ 157.20	$ -	$ 375.60	OPN	[Adjusted by 012116500020]
200.00	061110405160			Wall framing, studs, 2" x 6", 8' high wall	2 Carp	1000	0.016	L.F.	$ 1.66	$ 0.60	$ -	$ 2.26	$ 332.00	$ 120.00	$ -	$ 452.00	$ 1.82	$ 0.98	$ -	$ 2.80	$ 364.00	$ 196.00	$ -	$ 560.00	OPN	
1.00	061110405160	A		Contingencies, at conceptual design stage		0	0	Project	$ 0.33	$ 0.12	$ -	$ 0.45	$ 66.40	$ 24.00	$ -	$ 90.40	$ 0.36	$ 0.20	$ -	$ 0.56	$ 72.80	$ 39.20	$ -	$ 112.00	OPN	[Adjusted by 012116500020]
1000.00	061110420605			Furring, wood, on walls, on wood, 1" x 3", pneumatic nailed	1 Carp	710	0.011	L.F.	$ 0.45	$ 0.43	$ -	$ 0.88	$ 450.00	$ 430.00	$ -	$ 880.00	$ 0.49	$ 0.68	$ -	$ 1.17	$ 490.00	$ 680.00	$ -	$ 1,170.00	OPN	
1.00	061110420605	A		Contingencies, at conceptual design stage		0	0	Project	$ 0.09	$ 0.09	$ -	$ 0.18	$ 90.00	$ 86.00	$ -	$ 176.00	$ 0.10	$ 0.14	$ -	$ 0.24	$ 98.00	$ 136.00	$ -	$ 234.00	OPN	[Adjusted by 012116500020]
1600.00	074213300300			Steel siding, galvanized, corrugated or ribbed, on steel frame, 26 gauge, incl. fasteners	G3	790	0.041	S.F.	$ 2.57	$ 1.58	$ -	$ 4.15	$ 4,112.00	$ 2,528.00	$ -	$ 6,640.00	$ 2.82	$ 2.60	$ -	$ 5.42	$ 4,512.00	$ 4,160.00	$ -	$ 8,672.00	OPN	
1.00	074213300300	A		Contingencies, at conceptual design stage		0	0	Project	$ 0.51	$ 0.32	$ -	$ 0.83	$ 822.40	$ 505.60	$ -	$ 1,328.00	$ 0.56	$ 0.52	$ -	$ 1.08	$ 902.40	$ 832.00	$ -	$ 1,734.40	OPN	[Adjusted by 012116500020]
1600.00	061636104620			Sheathing, oriented strand board, 1/2" thick, on walls	2 Carp	1195	0.013	S.F.	$ 0.69	$ 0.51	$ -	$ 1.20	$ 1,104.00	$ 816.00	$ -	$ 1,920.00	$ 0.77	$ 0.82	$ -	$ 1.59	$ 1,232.00	$ 1,312.00	$ -	$ 2,544.00	OPN	
1.00	061636104620	A		Contingencies, at conceptual design stage		0	0	Project	$ 0.14	$ 0.10	$ -	$ 0.24	$ 220.80	$ 163.20	$ -	$ 384.00	$ 0.15	$ 0.16	$ -	$ 0.32	$ 246.40	$ 262.40	$ -	$ 508.80	OPN	[Adjusted by 012116500020]
Grand Total												***$ 13.14***	***$ 8,392.80***	***$ 5,248.80***	***$ -***	***$ 13,641.60***				***$ 16.93***	***$ 9,228.00***	***$ 8,560.80***	***$ -***	***$ 17,788.80***		

Costs based on RSMeans data

COST ESTIMATE REPORT
DATE: 11/22/2023

Estimate Name: LFB-Spatial Separation

ESTIMATE INFORMATION

Client Name:
Estimate Address:

Type: Unit
Measurement System: US Standard

Notes:

COST DATA

Estimate Summary:

	Material	Labor	Equipment	Total*
Base Total	$ 16,610.40	$ 6,247.20	$ -	$ 22,857.60
Total O&P	$ 18,252.00	$ 10,173.60	$ -	$ 28,425.60

"Total" column values include the cost of Exception lines that may not be included in the Material, Labor and Equipment totals.

Catalog: Commercial New Construction
Format: MasterFormat 2018
Release: Year 2023
Labor Type: Open Shop
City Cost Index: ONTARIO / OTTAWA (C21)

LEGEND

Line Source:
U - User defined line item
A - Adjustment/Modifier
E - Exception lines

ESTIMATE

Quantity	LineNumber	Line Source	SubContracted Ind.	Description	Crew	Daily Output	Labor Hours	Unit	Material	Labor	Equipment	Total	Ext. Mat.	Ext. Labor	Ext. Equip.	Ext. Total	Mat. O&P	Labor O&P	Equip. O&P	Total O&P	Ext. Mat. O&P	Ext. Labor O&P	Ext. Equip. O&P	Ext. Total O&P	Labor Type	Notes
1600.00	092910302000			Gypsum wallboard, on walls, standard, 5/8" thick, finish excluded	2 Carp	2000	0.008	S.F.	$ 0.38	$ 0.30	$ -	$ 0.68	$ 608.00	$ 480.00	$ -	$ 1,088.00	$ 0.41	$ 0.48	$ -	$ 0.89	$ 656.00	$ 768.00	$ -	$ 1,424.00	OPN	
1.00	092910302000	A		Contingencies, at conceptual design stage		0	0	Project	$ 0.08	$ 0.06	$ -	$ 0.14	$ 121.60	$ 96.00	$ -	$ 217.60	$ 0.08	$ 0.10	$ -	$ 0.18	$ 131.20	$ 153.60	$ -	$ 284.80	OPN	[Adjusted by 012116500020]
600.00	061110405040			Wall framing, plates, untreated, 2" x 6"	2 Carp	750	0.021	L.F.	$ 1.66	$ 0.80	$ -	$ 2.46	$ 996.00	$ 480.00	$ -	$ 1,476.00	$ 1.82	$ 1.31	$ -	$ 3.13	$ 1,092.00	$ 786.00	$ -	$ 1,878.00	OPN	
1.00	061110405040	A		Contingencies, at conceptual design stage		0	0	Project	$ 0.33	$ 0.16	$ -	$ 0.49	$ 199.20	$ 96.00	$ -	$ 295.20	$ 0.36	$ 0.26	$ -	$ 0.63	$ 218.40	$ 157.20	$ -	$ 375.60	OPN	[Adjusted by 012116500020]
200.00	061110405160			Wall framing, studs, 2" x 6", 8' high wall	2 Carp	1000	0.016	L.F.	$ 1.66	$ 0.60	$ -	$ 2.26	$ 332.00	$ 120.00	$ -	$ 452.00	$ 1.82	$ 0.98	$ -	$ 2.80	$ 364.00	$ 196.00	$ -	$ 560.00	OPN	
1.00	061110405160	A		Contingencies, at conceptual design stage		0	0	Project	$ 0.33	$ 0.12	$ -	$ 0.45	$ 66.40	$ 24.00	$ -	$ 90.40	$ 0.36	$ 0.20	$ -	$ 0.56	$ 72.80	$ 39.20	$ -	$ 112.00	OPN	[Adjusted by 012116500020]
1600.00	072116201340			Blanket insulation, for walls or ceilings, mineral wool batts, 5-1/2" thick, R23	1 Carp	1600	0.005	S.F.	$ 3.90	$ 0.22	$ -	$ 4.12	$ 6,240.00	$ 352.00	$ -	$ 6,592.00	$ 4.29	$ 0.36	$ -	$ 4.65	$ 6,864.00	$ 576.00	$ -	$ 7,440.00	OPN	
1.00	072116201340	A		Contingencies, at conceptual design stage		0	0	Project	$ 0.78	$ 0.04	$ -	$ 0.82	$ 1,248.00	$ 70.40	$ -	$ 1,318.40	$ 0.86	$ 0.07	$ -	$ 0.93	$ 1,372.80	$ 115.20	$ -	$ 1,488.00	OPN	[Adjusted by 012116500020]
1600.00	061636104620			Sheathing, oriented strand board, 1/2" thick, on walls	2 Carp	1195	0.013	S.F.	$ 0.69	$ 0.51	$ -	$ 1.20	$ 1,104.00	$ 816.00	$ -	$ 1,920.00	$ 0.77	$ 0.82	$ -	$ 1.59	$ 1,232.00	$ 1,312.00	$ -	$ 2,544.00	OPN	
1.00	061636104620	A		Contingencies, at conceptual design stage		0	0	Project	$ 0.14	$ 0.10	$ -	$ 0.24	$ 220.80	$ 163.20	$ -	$ 384.00	$ 0.15	$ 0.16	$ -	$ 0.32	$ 246.40	$ 262.40	$ -	$ 508.80	OPN	[Adjusted by 012116500020]
1000.00	061110420605			Furring, wood, on walls, on wood, 1" x 3", pneumatic nailed	1 Carp	710	0.011	L.F.	$ 0.45	$ 0.43	$ -	$ 0.88	$ 450.00	$ 430.00	$ -	$ 880.00	$ 0.49	$ 0.68	$ -	$ 1.17	$ 490.00	$ 680.00	$ -	$ 1,170.00	OPN	
1.00	061110420605	A		Contingencies, at conceptual design stage		0	0	Project	$ 0.09	$ 0.09	$ -	$ 0.18	$ 90.00	$ 86.00	$ -	$ 176.00	$ 0.10	$ 0.14	$ -	$ 0.23	$ 98.00	$ 136.00	$ -	$ 234.00	OPN	[Adjusted by 012116500020]
1600.00	074213300300			Steel siding, galvanized, corrugated or ribbed, on steel frame, 26 gauge, incl. fasteners	G3	790	0.041	S.F.	$ 2.57	$ 1.58	$ -	$ 4.15	$ 4,112.00	$ 2,528.00	$ -	$ 6,640.00	$ 2.82	$ 2.60	$ -	$ 5.42	$ 4,512.00	$ 4,160.00	$ -	$ 8,672.00	OPN	
1.00	074213300300	A		Contingencies, at conceptual design stage		0	0	Project	$ 0.51	$ 0.32	$ -	$ 0.83	$ 822.40	$ 505.60	$ -	$ 1,328.00	$ 0.56	$ 0.52	$ -	$ 1.08	$ 902.40	$ 832.00	$ -	$ 1,734.40	OPN	[Adjusted by 012116500020]
Grand Total												***$ 18.90***	***$ 16,610.40***	***$ 6,247.20***	***$ -***	***$ 22,857.60***				***$ 23.58***	***$ 18,252.00***	***$ 10,173.60***	***$ -***	***$ 28,425.60***		

Accessibility, Visitability and Adaptability of Dwelling Units

Problem

Accessibility first appeared in the National Building Code of Canada (NBC) in 1965 as optional guidelines for public buildings. Over the past decades, these accessibility requirements slowly progressed until more significant contents were developed between 2010 and 2020. However, dwelling units are still exempted from these accessibility requirements, causing great difficulty and not meeting the basic needs of seniors, persons with disabilities, and other affected groups. In November 2022, the provinces and territories identified visitable and adaptable dwelling units as a priority and agreed to expand accessibility requirements to dwelling units.

Many Canadians have reported having a disability; the prevalence of disabilities increases with age: more than 20% of Canadians over 15 years old and nearly 40% of Canadians over 65 years old report having a disability (Statistics Canada, 2022). Where disabilities were reported, the severity (i.e., limitation on how frequently and effectively a person can perform the activities of daily living) varied; approximately 37% were reported as mild, 20% as moderate, 21% as severe and 22% as very severe (Statistics Canada, 2017).

Because the needs of people change over time, the features of a dwelling unit that were once suitable for an occupant may become inaccessible or present unnecessary hardship as the occupant ages. Strategies are needed to allow Canadians to easily and affordably retrofit their dwelling units to accommodate their changing health status and live at home for as long as possible.

Additionally, persons with disabilities encounter obstacles when visiting the homes of friends and family because they may not be able to access the living areas of the dwelling unit or use a washroom. Significant health risks have been associated with social isolation.

This package of proposed changes is a necessary step toward making dwelling units more accessible to a larger portion of the population in Canada (both to occupants and their visitors), especially as population demographics shift.

Justification

This package of proposed changes addresses basic adaptability and visitability features for dwelling units and also expands the application of the accessibility objective to dwelling units. In reviewing the package of PCFs, the following should be noted.

These PCFs should be reviewed holistically before providing comments on individual changes, as application requirements cannot function without technical provisions and technical requirements cannot be implemented without application provisions.

In the 2025 Code cycle, adaptability-related requirements focused on low-cost/no-cost changes in relation to the cost of renovations with broad application (i.e., to most dwelling units, including houses). Because of the broad application and cost considerations, the proposed changes have a similar application as the adaptability requirements in Nova Scotia, but differ from those in other provinces, where application is more restricted (including Alberta, British Columbia, Manitoba, Ontario and Quebec) and where technical requirements are much more stringent.

A framework to include technical requirements for visitability and related application statements is also proposed in PCF 1881. Note that the specific technical requirements for visitability are planned for the Spring 2024 public review. These requirements focus on spaces where a barrier-free path of travel is already required to access the entrance of the dwelling unit (i.e., most units in multi-unit residential buildings, especially Part 3 buildings).

This package of PCFs is a starting point. It is not comprehensive, and work is expected to continue into the next Code cycle.

The Table 1 provides a brief overview of the individual PCFs in this package. PCFs 1882, 2031, 1884, 1958 and 2030 are part of the Spring 2024 public review. PCFs 1880, 1881, 1883, 1957 and 2028 were part of the Winter 2024 public review and are linked as a supporting document.

Table 1. Summary of Proposed Changes with the Subject Accessibility, Adaptability and Visitability of

Dwelling Units

PCF #	Title	Purpose and notes
NBC Objectives (Division A)		
1880	Expanding the Application of the Accessibility Objective to All Dwelling Units	Provide a framework for technical requirements related to accessibility to apply to houses and other dwelling units currently exempted from the OA objectives.
NBC Framework (Division B, Part 3)		
1881 ***(Technical revision planned)***	Application of Adaptability Requirements	Clarify the application of adaptability and visitability requirements to dwelling units. Note that: · adaptability requirements are to be applied to most dwelling units, and · visitability requirements apply to a subset of dwelling units (visitable dwelling units also comply with adaptability requirements). **Note: this PCF requires a further technical change that adds the following as Sentence (3), in addition to the changes proposed for the winter 2024 public review:** **"3) Except as provided in Sentence (4), the requirements of this Section do not apply to detached houses, semi-detached houses, houses with a *secondary suite*, duplexes, triplexes, townhouses, row houses and boarding houses. (See Note A-1.4.1.2.(1) of Division A, Secondary Suite.)"** **The proposed Sentences that follow will be renumbered Sentences (4) and (5), respectively. This PCF may be re-submitted for public review pending the recommendation of the Standing Committee.**
2028	Expanding the Scope the Accessibility Requirements	Revise the scope of NBC Section 3.8. to include new Subsections for the adaptability and visitability of dwelling units (Subsections 3.8.4. and 3.8.5., respectively).
Adaptability of Dwelling Units (Division B, Part 3): new Subsection 3.8.4. that applies broadly to dwelling units with some exceptions		
1883	Adaptable Dwelling Entrances	Reduce the challenge and expense of increasing the entrance doorway width to accommodate the use of mobility aids by requiring a minimum door size for at least one entrance to a dwelling unit.
1957	Reachable Controls in Dwelling Units	Introduce requirements for the installation height of common controls in dwelling units to enhance their access for persons with disabilities related to balance, mobility or movement. This proposed change reduces the need for future burdensome renovations and electrical work.
1882	Reinforcing Stud Walls in Water-Closet Rooms for the Future Installation of Grab Bars: Showers and Bathtubs	Require backing or blocking around the walls of the bathtub and shower for the present or future installation of grab bars in a range of locations that meet the NBC requirements for structural strength.
2031	Reinforcing Stud Walls in Water-Closet Rooms for the Future Installation of Grab	Require backing or blocking in the walls around a water closet for the present or future installation of grab bars in a range of locations that meet the NBC requirements for structural strength.

	Bars: Water Closets	
Visitability of Dwelling Units (Division B, Part 3): new Subsection 3.8.5. that also complies with Subsection 3.8.4.		
1884	Paths of Travel in Visitable Dwelling Units	Introduce requirements for a path of travel in visitable dwelling units that provides basic amounts of space for maneuvering with a mobility aid.
1958	Water-Closet Rooms in Visitable Dwelling Units	Introduce basic requirements (e.g., clear floor space, suggested design considerations) for a water-closet room in visitable dwelling units.
Adaptability of Dwelling Units (Division B, Part 9)		
2030	Reinforcing Stud Walls in Washrooms for the Future Installation of Grab Bars: Structural Strength	Clarify that where reinforcement to stud walls in washrooms for grab bars is present, it needs to be designed to allow grab bars to meet the NBC requirements for structural strength. Provides prescriptive compliance options for designers who wish to use them (with clarity that people can still use the performance requirement if they do not wish to use the prescriptive option).

Impact Analysis

This package of PCFs focuses on elements of dwelling units that have low or no costs when implemented at the time of initial design and construction, but would be burdensome to implement as part of a renovation to accommodate the changing needs of an occupant or their guests.

The PCFs aim to make dwelling units more accessible from the start and to make it easier for people to adapt their homes to meet their changing needs, and to receive visitors.

Several provinces already have similar requirements in their building codes. Therefore, the impact of these proposed changes would be the greatest in provinces and territories that do not currently have such provisions in their codes. As a starting point with these PCFs, provinces and territories noted that flexibility in determining the breadth of application of the technical requirements should be provided so that implementation can be based on each jurisdiction's level of need and readiness.

Specific impact analyses are included with each individual PCF.

Enforcement implications

The proposed changes can be enforced with common measurement tools and visual inspection.

Who is affected

The following are affected:

- Designers and architects, who would need to incorporate these features in their plans for dwelling units.
- Builders, who would need to be aware of these new requirements for dwelling units.
- Authorities having jurisdiction, who would need to determine the extent of application of the requirements in multi-unit residential buildings.
- Building officials, who would need to ensure that requirements are met.
- Building occupants and their friends and family, who would be able to adapt dwelling units more readily to suit their needs.

Attached Supporting Material

- PCFs 1880, 1881, 1883, 1957 and 2028

Submit a comment

Proposed Change 1880

Code Reference(s):	**NBC20 Div.A 2.1.1.2. (first printing)**
Subject:	Accessibility, Visitability and Adaptability of Dwelling Units
Title:	Expanding the Application of the Accessibility Objective to All Dwelling Units
Description:	This proposed change removes the exemption for houses from the application of the accessibility objective.
Related Proposed Change(s):	PCF 1881, PCF 1883, PCF 1957, PCF 2028

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Accessibility, Visitability and Adaptability of Dwelling Units.

Problem

The National Building Code of Canada (NBC) is an objective-based model code in which most technical requirements address at least one of five objectives: safety, health, accessibility, fire and structural protection of buildings, and environment.

The current NBC accessibility objective specifically exempts houses from its application, which prevents the addition of any accessibility requirements to the NBC for these buildings.

Exempting these dwelling units from the application of the accessibility objective means that these buildings will continue to present significant accessibility challenges for persons with disabilities. Some persons with disabilities are unable to access many homes, meaning they often cannot reside in them without costly renovations, or visit friends or family.

Limiting access to houses for persons with disabilities could be seen as discriminatory and should be corrected.

Justification

This proposed change removes the exemption for houses from the application of the accessibility objective in Division A of the NBC. This proposed change would create a framework for technical provisions related to accessibility to be considered for houses. While the NBC has accessibility requirements for many different types of buildings, it does not currently have any that apply to houses because these buildings are exempted from requirements based on the application of the accessibility objective.

This proposed change is a necessary step toward making houses accessible to a larger portion of the population in Canada, especially as population demographics shift.

Many Canadians have reported having a disability, as shown in Table 1. Furthermore, the prevalence of disabilities increases with age: over 20% of Canadians over 15 years old and nearly 40% of Canadians over 65 years old report having a disability (Statistics Canada, 2022). Where disabilities were reported, the severity (i.e., limitation on how frequently and effectively a person can perform the activities of daily living) varied; approximately 37% were reported as mild, 20% as moderate, 21% as severe, and 22% as very severe (Statistics Canada, 2017).

Table 1. Percentage of Canadian Population Aged 15 Years Old and Older, with a Disability in 2017 (adapted from Statistics Canada, 2017)

Type of Disability	Men	Women
Developmental	1.54%	0.77%
Memory	3.78%	3.63%
Dexterity	3.92%	4.95%
Learning	4.33%	3.54%
Seeing	4.91%	5.70%
Hearing	5.70%	3.92%
Mental health-related	6.01%	8.03%
Mobility	8.56%	10.12%
Flexibility	9.77%	9.90%
Pain-related	13.44%	15.00%

Strategies are needed to support aging in place and remove barriers to accessibility in houses; and this proposed change provides a framework in the NBC to address accessibility through technical requirements.

References

Statistics Canada, "A demographic, employment and income profile of Canadians with disabilities aged 15 years and over, 2017".
https://www150.statcan.gc.ca/n1/pub/89-654-x/89-654-x2018002-eng.htm

PROPOSED CHANGE

[2.1.1.2.] 2.1.1.2. Application of Objectives
(See Note A-2.2.1.1.(1).)

[1] 1) Except as provided in Sentences (2) to (6), the objectives described in this Part apply

[a] a) to all *buildings* covered in this Code (see Article 1.1.1.1.), and

[b] b) only to the extent that they relate to compliance with this Code as required in Article 1.2.1.1.

[2] 2) Objective OS4, Resistance to Unwanted Entry, applies only to *dwelling units* in *buildings* covered in Part 9 of Division B. (See Article 1.3.3.3.)

[3] 3) Objective OH3, Noise Protection, applies only to *dwelling units*.

[4] 4) Objective OH5, Hazardous Substances Containment, applies only to the extent defined in

[a] a) the National Plumbing Code, and

[b] b) the National Fire Code.

[5] 5) Objective OA, Accessibility (including Objectives OA1, Barrier-Free Path of Travel, and OA2, Barrier-Free Facilities), does not apply to

[a] a) ~~detached houses, semi-detached houses, houses with a *secondary suite*, duplexes, triplexes, townhouses, row houses and boarding houses (see Appendix , Secondary Suite),~~

[b] b) *buildings* of Group F, Division 1 *major occupancy*, and

[c] c) *buildings* that are not intended to be occupied on a daily or full-time basis, including automatic telephone exchanges, pumphouses and substations.

[6] 6) Objective OE, Environment (including Objectives OE1, Resources, and OE1.1, Excessive Use of Energy), applies only to

[a] a) *buildings* of *residential occupancy* to which Part 9 of Division B applies,

[b] b) *buildings* containing *business and personal services*, *mercantile* or *low-hazard industrial occupancies* to which Part 9 of Division B applies whose combined total *floor area* does not exceed 300 m^2, and

[c] c) *buildings* containing a mix of the *residential* and non-*residential occupancies* described in Clauses (a) and (b).

(See Note A-2.1.1.2.(6).) (See also Article 1.3.3.3.)

Impact analysis

Financial Impact

No new costs are introduced by expanding the application of the accessibility objective to include previously exempted houses because the proposed change does not, on its own, change the current application of the accessibility requirements for buildings that were not exempted, i.e., dwelling units in Parts 3 and 9.

Part 9 directs Code users to Section 3.8. of Division B of the NBC, where houses are exempted from the application of the accessibility requirements. For example,

- Sentence 9.5.2.1.(1) explains that "Except as provided in Articles 9.5.2.3. and 3.8.2.1., every *building* shall be designed in conformance with Section 3.8."
- Sentence 3.8.2.1.(1) explains how exceptions apply to "detached houses, semi-detached houses, houses with a *secondary suite*, duplexes, triplexes, townhouses, row houses and boarding houses."

Future technical requirements related to accessibility (which are beyond the scope of this proposed change) that apply to houses may impact construction costs. Those proposed requirements will be evaluated separately and will include impact analyses specific to the proposed technical requirements in question.

Usage Impact

By expanding the application of the accessibility objective to include previously exempted houses, this proposed change provides the necessary framework for the potential addition of future accessibility-related technical requirements, which could help to achieve the intent of "limit[ing] the probability that, as a result of the design or construction of a house, a person with a physical or sensory limitation will be unacceptably impeded from accessing or using a house or its facilities."

Future accessibility requirements that apply to houses may impact the usability of these buildings; the proposed changes will be assessed accordingly.

Enforcement implications

Expanding the accessibility objective to include the application to previously exempted houses does not in itself introduce any technical requirements that would require enforcement by the authorities having jurisdiction.

Who is affected

The proposed change could affect:

- regulators and authorities having jurisdiction, who would need to be aware of the expanded scope of the accessibility objective and the potential future addition of technical requirements related to accessibility in houses,
- architects, engineers and builders, whose approach to home design and construction may be affected as future requirements for accessibility (which are beyond the scope of the objective change described in this proposed change) are developed for houses, and
- persons with disabilities and their caregivers, who may benefit from future minimum performance requirements for accessibility that apply to houses, which would be enabled by the proposed change to the NBC framework.

Submit a comment

Proposed Change 1881

Code Reference(s):	**NBC20 Div.B 3.8. (first printing)**
Subject:	Accessibility, Visitability and Adaptability of Dwelling Units
Title:	Application of Accessibility Requirements
Description:	This proposed change revises the application of Section 3.8. that exempts dwelling units from the accessibility requirements.
Related Proposed Change(s):	PCF 1880, PCF 1883, PCF 1957, PCF 2028

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Accessibility, Visitability and Adaptability of Dwelling Units.

Problem

The National Building Code of Canada (NBC) consolidates technical requirements for accessibility in Section 3.8. of Division B. While placing accessibility requirements in one section helps Code users to locate these requirements in the Code, the current structure and application of Section 3.8. creates the following two problems for identifying and applying the technical requirements that address various levels of accessibility of dwelling units:

1. Clause 3.8.2.1.(1)(a) exempts from the Section 3.8. accessibility requirements several types of dwelling units, including detached houses, semi-detached houses, houses with a secondary suite, duplexes, triplexes, townhouses, row houses and boarding houses. This is a problem because persons with disabilities may not be able to access or use the facilities of many houses, thereby making it difficult for these persons to:
    - remain in their own dwelling unit without requiring costly alterations, and
    - visit the dwelling units of friends or family.
2. Section 3.8. was written in consideration of the exemption in Clause 3.8.2.1.(1)(a).

New technical requirements would need to be consolidated to address the need to:

- reduce the cost of renovating the dwelling units to address a person's changing needs or progressing disability, and
- facilitate access to the dwelling units of friends or family during visits (i.e., visitability).

As a result, new Subsections in the NBC are needed.

Justification

The proposed change modifies the framework in Section 3.8. to:

1. alter the exemption in Clause 3.8.2.1.(1)(a) to allow Section 3.8. to apply to all types of dwelling units,
2. create new Subsections that consolidate technical requirements for the adaptability and visitability of dwelling units (Subsections 3.8.4. and 3.8.5., respectively), and
3. define the application of new Subsections 3.8.4. and 3.8.5.

This proposed structure is supported through the following related PCFs:

- PCF 1880 proposes to expand the accessibility objectives in the NBC to include all types of dwelling units,
- PCF 2028 proposes to revise the scope of Section 3.8. to include new Subsections 3.8.4. and 3.8.5.,
- PCFs 1883 and 1957 propose technical requirements that apply broadly to dwelling units and that address low-cost elements of adaptable housing, forming the basis of proposed Subsection 3.8.4. Other PCFs (PCFs 1882 and 2031) related to technical requirements for adaptable housing are tentatively planned to be included in the Spring 2024 public review, and
- Additional PCFs (1884 and 1958) propose technical requirements for visitability that form the basis of proposed Subsection 3.8.5. and are tentatively scheduled for the Spring 2024 public review. These requirements focus on ensuring that visitable dwelling units are designed with adequate space for a person using a wheelchair to access and use the living spaces on the entrance level of the dwelling unit, including the living room, dining room and washroom.

During the current public review, PCF 1881 should be read with the assumption that the technical requirements in proposed Subsection 3.8.5. would also be included in the NBC 2025; thus, the reader should focus on the proposed framework that would introduce visitability requirements to multi-unit residential buildings as required by the authority having jurisdiction.

By deleting the exempted houses in Clause 3.8.2.1.(1)(a), this proposed change creates a framework for applying technical requirements that apply the accessibility objective to a larger range of dwelling units. This is a critical step toward introducing minimum requirements in the NBC that address the accessibility of dwelling units for persons with disabilities, including the 10% of Canadians with disabilities related to mobility, the 5% of Canadians with disabilities related to dexterity, and the many Canadians with other types of disabilities that limit their access to facilities in the home[1].

By creating new Subsections 3.8.4. and 3.8.5. to address the basic adaptability and visitability of dwelling units, the new structure makes it easy for Code users to locate these requirements in the Code.

By defining the application of Subsections 3.8.4. and 3.8.5. in Article 3.8.2.1., Code users can quickly see where these requirements do and do not apply. In this Code cycle, adaptability is intended to focus on low-cost technical requirements that reduce or eliminate the expense and inconvenience of alterations for accessibility and is intended to be applied broadly (i.e., to all houses and some units in multi-unit residential buildings (MURBs), as required by the authority having jurisdiction). Visitability focuses on dwelling units where a barrier-free path of travel is already required to access the entrance to the unit (e.g., most units in MURBs) and as required by the authority having jurisdiction.

Several frameworks that delineate levels of accessibility in housing position adaptability ahead of visitability (i.e., requirements for adaptability are more stringent than those for visitability and include features such as height-adjustable counters), for example, in Manitoba[2]. Other frameworks address adaptability through mandatory requirements but do not address visitability (for example, Nova Scotia), implying that visitability is more stringent because it is not mandated in the Code. In the context of the NBC, the broader application of proposed adaptability requirements, combined with the focus on low-cost provisions to reduce the expense of alterations, resulted in technical requirements that were less stringent than those proposed under visitability.

To reduce confusion for Code users and simplify integration with provincial and territorial codes, proposed Subsection 3.8.4. uses the term "dwelling units" without specifying “adaptability,” since the application is intended to be broad. Proposed Subsection 3.8.5. refers to visitability through use of the term "visitable dwelling units."

Finally, many provinces (including Quebec, Alberta and Nova Scotia) have adopted a structure similar to that of this proposed change, where most or all of the accessibility requirements related to dwelling units are addressed in stand-alone Subsections within Section 3.8. As such, the proposed change is expected to advance harmonization goals by simplifying the integration of accessibility requirements related to dwelling units in the provincial and territorial codes as they are currently structured.

References

(1) Statistics Canada (2017), “New data on disability in Canada 2017”. Retrieved 12 May 2023 from:
https://www150.statcan.gc.ca/n1/en/pub/11-627-m/11-627-m2018035-eng.pdf?st=v5UqujRh

(2) Manitoba Housing and Renewal Corporation, "Visitable Housing: Community Building Through Visitable and Adaptable Housing", 2006. Retrieved Oct. 31, 2023 from:
https://www.gov.mb.ca/housing/progs/pdf/visitable-housing-visitable-housing-community-building.pdf

PROPOSED CHANGE

[3.8.] 3.8. Accessibility

(See Note A-3.8.)

[3.8.1.] 3.8.1. Scope

[3.8.1.1.] 3.8.1.1. Scope

[3.8.2.] 3.8.2. Application

[3.8.2.1.] 3.8.2.1. Exceptions

(See Note A-3.8.2.1.)

[1] 1) Except as provided in Sentences (2) to (4), ~~T~~the requirements of this Section apply to all *buildings*. ~~except~~

[a] a) ~~detached houses, semi-detached houses, houses with a *secondary suite*, duplexes, triplexes, townhouses, row houses and boarding houses (see Appendix A of Division A, Secondary Suite),~~

[b] b) ~~*buildings* of Group F, Division 1 *major occupancy*, and~~

[c] c) ~~*buildings* that are not intended to be occupied on a daily or full-time basis, including automatic telephone exchanges, pumphouses and substations.~~

[2] --) The requirements of this Section do not apply to

[a] --) *buildings* of Group F, Division 1 *major occupancy*, and

[b] --) *buildings* that are not intended to be occupied on a daily or full-time basis, including automatic telephone exchanges, pumphouses and substations.

[3] --) The requirements of Subsection 3.8.4. (PCFs 1883 and 1957 of the current public review; and PCFs 1882 and 2031, tentatively planned for the Spring 2024 public review) apply to

[a] --) detached houses, semi-detached houses, houses with a *secondary suite*, duplexes, triplexes, townhouses, row houses and boarding houses, and

[b] --) other *dwelling units* where required by federal, provincial or territorial regulations or municipal bylaws. (See Note 3.8.2.1.(3) and (4).)

[4] --) The requirements of Subsections 3.8.4. (PCFs 1883 and 1957, and PCFs 1882 and 2031) and 3.8.5. (PCFs 1884 and 1958, tentatively planned for the Spring 2024 public review) apply to *dwelling units* required to be visitable by federal, provincial or territorial regulations or municipal bylaws. (See Note 3.8.2.1.(3) and (4).)

[3.8.3.15.] 3.8.3.15. Water-Closet Stalls and Urinals for Persons with Limited Mobility

[3.8.3.16.] 3.8.3.16. Lavatories and Mirrors

[3.8.3.17.] 3.8.3.17. Showers

[3.8.3.18.] 3.8.3.18. Accessible Bathtubs

[3.8.3.19.] 3.8.3.19. Assistive Listening Systems

[3.8.3.20.] 3.8.3.20. Counters

[3.8.3.21.] 3.8.3.21. Telephones

[3.8.3.22.] 3.8.3.22. Spaces in Seating Area

[3.8.4.] -- Dwelling Units

[3.8.5.] -- Visitable Dwelling Units

Note A-3.8.2.1.(3) and (4) Application to Dwelling Units.

Subsection 3.8.4. (PCFs 1883 and 1957 of the current public review; and PCFs 1882 and 2031, tentatively planned for the Spring 2024 public review) focuses on technical requirements that eliminate the need for, or reduce the cost and difficulty of, common modifications to a dwelling unit for accessibility, thereby making the dwelling unit more easily adaptable to a person's needs.

Subsection 3.8.5. (PCFs 1884 and 1958, tentatively planned for the Spring 2024 public review) is founded on the principle of visitability, i.e., providing basic accessibility features to allow persons with disabilities related to mobility to visit others in their dwellings. These features include barrier-free paths of travel in the main living spaces of a dwelling unit and washrooms that are large enough for a person using a wheelchair to maneuver in that space.

Impact analysis

The proposed changes to the structure of Section 3.8. and the removal of the exemptions for most types of dwelling units does not in itself introduce new costs because the proposed change does not introduce new technical requirements, nor does it expand the application of existing technical requirements for accessibility. Technical requirements that fit within the proposed structure may have different impacts on dwelling units in terms of cost, space demand, accessibility and safety. These requirements and their impact would be evaluated outside the scope of this proposed change under regular procedures for Code development, including coordination with relevant technical committees and public reviews.

This proposed change provides the necessary framework for future technical requirements related to accessibility to apply to detached houses, semi-detached houses, houses with a secondary suite, duplexes, triplexes, townhouses, row houses and boarding houses. It is also expected to simplify the application of adaptability and visitability requirements by consolidating those related to dwelling units into distinct subsections.

Finally, this proposed change preserves critical flexibility for uptake into provincial and territorial codes with different frameworks and applications of adaptability requirements by using the generic term "dwelling units" in Subsection 3.8.4. to address basic requirements that meet the goals of adaptability for this Code cycle.

Enforcement implications

Expanding the accessibility framework to all types of dwelling unit does not introduce new technical requirements. As such, the proposed change can be enforced with the existing Code enforcement infrastructure.

By consolidating the requirements for adaptability and visitability into distinct Subsections with clear application statements, this proposed change is expected to simplify the enforcement of the technical requirements within these Subsections.

Authorities having jurisdiction would need to be aware that the language used to describe adaptability and visitability in their jurisdiction may differ from that of the NBC.

Who is affected

The proposed change could affect:

- regulators and authorities having jurisdiction, who would need to be aware of the change to the application of Section 3.8. and the new requirements for adaptability and visitability for dwelling units,
- architects, engineers and builders, whose approach to design and construction may be affected as future requirements for the adaptability and visitability of dwelling units (which are beyond the scope of the change to NBC framework described in this proposed change) are developed for housing, and
- persons with disabilities and their caregivers, who may benefit from future minimum performance requirements for the adaptability and visitability of dwelling units, which would be enabled by the proposed change to the NBC framework.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.8.1.1.] 3.8.1.1. ([1] 1) no attributions

[3.8.1.1.] 3.8.1.1. ([2] 2) no attributions

[3.8.2.1.] 3.8.2.1. ([1] 1) no attributions

[3.8.2.1.] -- ([2] --) no attributions

[3.8.2.1.] -- ([3] --) no attributions

[3.8.2.1.] -- ([4] --) no attributions

[3.8.2.2.] 3.8.2.2. ([1] 1) [F73-OA1]

[3.8.2.2.] 3.8.2.2. ([2] 2) no attributions

[3.8.2.2.] 3.8.2.2. ([3] 3) no attributions

[3.8.2.2.] 3.8.2.2. ([4] 4) [F73-OA1]

[3.8.2.3.] 3.8.2.3. ([1] 1) [F73-OA1]

[3.8.2.3.] 3.8.2.3. ([2] 2) no attributions

[3.8.2.3.] 3.8.2.3. ([3] 3) [F74-OA2]

[3.8.2.3.] 3.8.2.3. ([4] 4) [F74-OA2]

[3.8.2.3.] 3.8.2.3. ([5] 5) [F74-OA2]

[3.8.2.3.] 3.8.2.3. ([5] 5) [F10-OS3.7]

[3.8.2.3.] 3.8.2.3. ([6] 6) [F74-OA2]

[3.8.2.4.] 3.8.2.4. ([1] 1) [F73-OA1]

[3.8.2.4.] 3.8.2.4. ([2] 2) [F73-OA1]

[3.8.2.5.] 3.8.2.5. ([1] 1) [F73-OA1]

[3.8.2.5.] 3.8.2.5. ([2] 2) [F73-OA1]

[3.8.2.5.] 3.8.2.5. ([3] 3) no attributions

[3.8.2.6.] 3.8.2.6. ([1] 1) no attributions

[3.8.2.7.] 3.8.2.7. ([1] 1) [F73-OA1]

[3.8.2.7.] 3.8.2.7. ([2] 2) no attributions

[3.8.2.7.] 3.8.2.7. ([3] 3) no attributions

[3.8.2.8.] 3.8.2.8. ([1] 1) [F74-OA2]

[3.8.2.8.] 3.8.2.8. ([1] 1) [F72-OH2.1] [F71-OH2.3]

[3.8.2.8.] 3.8.2.8. ([2] 2) [F74-OA2]

[3.8.2.8.] 3.8.2.8. ([2] 2) [F72-OH2.1] [F71-OH2.3]

[3.8.2.8.] 3.8.2.8. ([2] 2) no attributions

[3.8.2.8.] 3.8.2.8. ([3] 3) no attributions

[3.8.2.8.] 3.8.2.8. ([4] 4) [F72-OH2.1]

[3.8.2.8.] 3.8.2.8. ([4] 4) [F73-OA1]

[3.8.2.8.] 3.8.2.8. ([5] 5) no attributions

[3.8.2.8.] 3.8.2.8. ([6] 6) no attributions

[3.8.2.8.] 3.8.2.8. ([7] 7) no attributions

[3.8.2.8.] 3.8.2.8. ([8] 8) no attributions

[3.8.2.8.] 3.8.2.8. ([9] 9) no attributions

[3.8.2.8.] 3.8.2.8. ([10] 10) no attributions

[3.8.2.8.] 3.8.2.8. ([11] 11) no attributions

[3.8.2.8.] 3.8.2.8. ([12] 12) no attributions

[3.8.2.8.] 3.8.2.8. ([13] 13) [F74-OA2]

[3.8.2.8.] 3.8.2.8. ([13] 13) no attributions

[3.8.2.8.] 3.8.2.8. ([14] 14) no attributions

[3.8.2.8.] 3.8.2.8. ([15] 15) no attributions

[3.8.2.8.] 3.8.2.8. ([15] 15) [F74-OA2]

[3.8.2.9.] 3.8.2.9. ([1] 1) no attributions

[3.8.2.9.] 3.8.2.9. ([2] 2) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([1] 1) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([1] 1) no attributions

[3.8.2.10.] 3.8.2.10. ([2] 2) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([3] 3) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([3] 3) no attributions

[3.8.2.10.] 3.8.2.10. ([4] 4) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([4] 4) no attributions

[3.8.2.11.] 3.8.2.11. ([1] 1) [F74-OA2]

[3.8.2.11.] 3.8.2.11. ([1] 1) no attributions

[3.8.2.12.] 3.8.2.12. ([1] 1) [F74-OA2]

[3.8.2.12.] 3.8.2.12. ([1] 1) no attributions

[3.8.3.1.] 3.8.3.1. ([1] 1) no attributions

[3.8.3.2.] 3.8.3.2. ([1] 1) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([2] 2) no attributions

[3.8.3.2.] 3.8.3.2. ([3] 3) ([a] a),([b] b) [F30-OS3.1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([a] a),([b] b) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([c] c),([d] d) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([e] e),([f] f) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([e] e),([f] f) [F30-OS3.1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([c] c),([d] d) [F30-OS3.1]

[3.8.3.2.] 3.8.3.2. ([4] 4) no attributions

[3.8.3.2.] 3.8.3.2. ([5] 5) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([6] 6) [F73-OA1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([a] a) [F73-OA1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([a] a) [F30-OS3.1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([b] b) [F73-OA1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([c] c)

[3.8.3.3.] 3.8.3.3. ([1] 1) ([d] d) [F30-OS3.1]

[3.8.3.4.] 3.8.3.4. ([1] 1) ([a] a) [F74-OA2]

[3.8.3.4.] 3.8.3.4. ([1] 1) ([b] b) [F73-OA1]

[3.8.3.4.] 3.8.3.4. ([1] 1) ([c] c) [F74-OA2]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([b] b),([e] e) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([d] d) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([c] c) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([d] d) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([e] e),([f] f)

[3.8.3.5.] 3.8.3.5. ([1] 1) ([b] b),([e] e) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([a] a)

[3.8.3.5.] 3.8.3.5. ([1] 1) ([c] c) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([2] 2) no attributions

[3.8.3.5.] 3.8.3.5. ([3] 3) no attributions

[3.8.3.5.] 3.8.3.5. ([4] 4) ([a] a) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([4] 4) ([b] b),([c] c) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([5] 5) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([1] 1) no attributions

[3.8.3.6.] 3.8.3.6. ([2] 2) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([3] 3) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([3] 3) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([4] 4) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([4] 4) [F10-OS3.7]

[3.8.3.6.] 3.8.3.6. ([5] 5) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([5] 5) [F10-OS3.7]

[3.8.3.6.] 3.8.3.6. ([6] 6) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([7] 7) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([8] 8) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([9] 9) no attributions

[3.8.3.6.] 3.8.3.6. ([10] 10) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([10] 10) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([10] 10) no attributions

[3.8.3.6.] 3.8.3.6. ([11] 11) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([12] 12) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([12] 12) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([13] 13) no attributions

[3.8.3.6.] 3.8.3.6. ([14] 14) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([15] 15) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([16] 16) no attributions

[3.8.3.6.] 3.8.3.6. ([17] 17) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([17] 17) [F10-OS3.7]

[3.8.3.7.] 3.8.3.7. ([1] 1) [F73-OA1]

[3.8.3.7.] 3.8.3.7. ([1] 1) [F74-OA2]

[3.8.3.7.] 3.8.3.7. ([1] 1) [F30-OS3.1] [F10-OS3.7]

[3.8.3.8.] 3.8.3.8. ([1] 1) [F74-OA2]

[3.8.3.8.] 3.8.3.8. ([1] 1) [F10-OS3.7]

[3.8.3.9.] 3.8.3.9. ([1] 1) no attributions

[3.8.3.9.] 3.8.3.9. ([1] 1) [F74-OA2]

[3.8.3.9.] 3.8.3.9. ([1] 1) [F73-OA1]

[3.8.3.9.] 3.8.3.9. ([2] 2) [F74-OA2]

[3.8.3.9.] 3.8.3.9. ([2] 2) [F73-OA1]

[3.8.3.9.] 3.8.3.9. ([3] 3) [F74-OA2]

[3.8.3.9.] 3.8.3.9. ([3] 3) [F73-OA1]

[3.8.3.10.] 3.8.3.10. ([1] 1) [F74-OA2]

[3.8.3.10.] 3.8.3.10. ([2] 2) [F74-OA2]

[3.8.3.11.] 3.8.3.11. ([1] 1) [F74-OA2]

[3.8.3.11.] 3.8.3.11. ([2] 2) [F74-OA2]

[3.8.3.12.] 3.8.3.12. ([1] 1) [F74-OA2]

[3.8.3.12.] 3.8.3.12. ([1] 1) [F72-OH2.1]

[3.8.3.12.] 3.8.3.12. ([1] 1) ([d] d)([i] i) [F74-OA2]

[3.8.3.12.] 3.8.3.12. ([1] 1) ([f] f),([g] g) [F30,F20-OS3.1]

[3.8.3.12.] 3.8.3.12. ([1] 1) ([f] f) and ([g] g)

[3.8.3.12.] 3.8.3.12. ([1] 1) ([h] h) [F30-OS3.1]

[3.8.3.12.] 3.8.3.12. ([1] 1) no attributions

[3.8.3.13.] 3.8.3.13. ([1] 1) [F74-OA2]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([b] b) [F10-OS3.7]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([c] c)

[3.8.3.13.] 3.8.3.13. ([1] 1) ([d] d)

[3.8.3.13.] 3.8.3.13. ([1] 1) ([f] f)

[3.8.3.13.] 3.8.3.13. ([1] 1) ([g] g) [F30-OS3.1]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([i] i) [F74-OA2]

[3.8.3.13.] 3.8.3.13. ([1] 1) [F72-OH2.1] [F71-OH2.3]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([b] b) [F74-OA2]

[3.8.3.13.] 3.8.3.13. ([2] 2) [F72-OH2.1] [F71-OH2.3]

[3.8.3.14.] 3.8.3.14. ([1] 1) [F74-OA2]

[3.8.3.14.] 3.8.3.14. ([1] 1) [F72-OH2.1]

[3.8.3.15.] 3.8.3.15. ([1] 1) [F74-OA2]

[3.8.3.15.] 3.8.3.15. ([1] 1) ([d] d) [F30-OS3.1]

[3.8.3.15.] 3.8.3.15. ([1] 1) ([a] a)

[3.8.3.15.] 3.8.3.15. ([2] 2) [F74-OA2]

[3.8.3.15.] 3.8.3.15. ([2] 2) ([f] f) [F30-OS3.1]

[3.8.3.15.] 3.8.3.15. ([2] 2) ([c] c)

[3.8.3.16.] 3.8.3.16. ([1] 1) [F74-OA2]

[3.8.3.16.] 3.8.3.16. ([1] 1) [F71-OH2.3]

[3.8.3.16.] 3.8.3.16. ([1] 1) ([f] f) [F31-OS3.2]

[3.8.3.16.] 3.8.3.16. ([2] 2) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([1] 1) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([1] 1) ([d] d),([e] e) [F30-OS3.1]

[3.8.3.17.] 3.8.3.17. ([1] 1) ([f] f) [F30-OS3.1]

[3.8.3.17.] 3.8.3.17. ([1] 1) ([h] h) [F31-OS3.2]

[3.8.3.17.] 3.8.3.17. ([2] 2) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([2] 2) [F71-OH2.3]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([a] a) [F73-OA1]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([b] b) [F10-OS3.7]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([b] b) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([g] g) [F74-OA2]

[3.8.3.18.] 3.8.3.18. ([1] 1) [F74-OA2]

[3.8.3.19.] 3.8.3.19. ([1] 1) [F74-OA2]

[3.8.3.19.] 3.8.3.19. ([1] 1) [F11-OS3.7]

[3.8.3.19.] 3.8.3.19. ([2] 2) [F74-OA2]

[3.8.3.20.] 3.8.3.20. ([1] 1) [F74-OA2]

[3.8.3.21.] 3.8.3.21. ([1] 1) [F74-OA2]

[3.8.3.21.] 3.8.3.21. ([2] 2) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([1] 1) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([1] 1) [F30-OS3.1]

[3.8.3.22.] 3.8.3.22. ([1] 1) ([d] d) [F10-OS3.7]

[3.8.3.22.] 3.8.3.22. ([2] 2) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([2] 2) [F30-OS3.1]

[3.8.3.22.] 3.8.3.22. ([3] 3) ([a] a) [F10-OS3.7]

[3.8.3.22.] 3.8.3.22. ([3] 3) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([4] 4) [F10-OS3.7]

Submit a comment

Proposed Change 1883

Code Reference(s):	**NBC20 Div.B 3.8. (first printing)**
Subject:	Accessibility, Visitability and Adaptability of Dwelling Units
Title:	Adaptable Dwelling Entrance
Description:	This proposed change increases the clear width of an entrance to a dwelling unit to accommodate the use of mobility devices.
Related Proposed Change(s):	PCF 1880, PCF 1881, PCF 1957, PCF 2028

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Accessibility, Visitability and Adaptability of Dwelling Units.

Problem

Being able to enter and exit one’s dwelling unit is fundamental to participating in several activities of daily living. However, for Canadians who regularly use wheeled mobility aids (e.g., wheelchairs), the NBC minimum width requirements for door entrances to dwelling units are not wide enough to accommodate most devices: approximately 10% of modern wheelchairs cannot fit through a doorway width that complies with the current NBC requirements (i.e., clear width of 745 mm, corresponding to a door width of 810 mm)(1).

As a result, some dwelling units are challenging to enter and exit, and some others are entirely inaccessible. Additionally, where a person using a mobility aid can, with difficulty, enter a dwelling unit, the level of impedance presents a concern during emergency egress. This level of impedance is unacceptable and needs to be addressed by the NBC.

Because the mobility needs of people evolve over time, the entrance of a dwelling unit that was once suitable for the occupant's level of mobility may become inaccessible or present unnecessary hardship as the occupant ages. As a result, occupants may be required to alter their dwelling units to accommodate their changing level of mobility or, if the scope of the alteration is too large, or if the dwelling unit is rented, occupants may need to move to a more suitable dwelling unit, engaging costs and associated stress. Both of these issues can be addressed by introducing NBC requirements for a wider entrance to dwelling units to reduce the need for and costs of alterations for accessibility.

Justification

This proposed change introduces a new requirement that every dwelling unit have at least one entrance with a minimum clear width of 850 mm when the door is in the open position. By requiring at least one entrance that provides a clear width of 850 mm (achievable using a standard 915 mm door opened to approximately 100 to 110 degrees), this proposed change would permit approximately 99% of modern wheelchairs to pass through(1). This proposed change would help to limit the probability that a person who uses a wheeled mobility aid would be unable to enter or exit the dwelling unit and use its facilities.

Introducing requirements for larger entrances for dwelling units would also reduce the costs of alteration to owners should they need to modify their dwelling unit for accessibility as their needs evolve.

Approximately 10% of Canadians have a disability related to mobility(2), while 1% of Canadians in the community regularly use wheelchairs or scooters(3). However, the prevalence of disabilities related to mobility and the associated use of assistive aids increases with age, with over 18% of community-dwelling Canadians over the age of 75 regularly using canes or walking sticks, 14% regularly using walkers and rollators, and 4% regularly using wheelchairs or scooters(3,4). As such, many Canadians will use assistive aids for mobility at some point in their lives and will require larger entrances to access their home.

While the proposed change does not address every aspect of the alteration of dwelling units for accessibility, this change is expected to contribute to reducing the costs of alterations to persons who require larger entrances for accessing their home.

References:

(1) Steinfeld, E., Maisel, J., Feathers, D., and D'Souza, C. (2010). Anthropometry and standards for wheeled mobility: an international comparison. *Assistive Technology*, *22*(1), 51-67.

(2) Statistics Canada. (2020). Canadians with a mobility disability. https://www150.statcan.gc.ca/n1/pub/11-627-m/11-627-m2020085-eng.htm

(3) Smith, E. M., Giesbrecht, E. M., Mortenson, W. B., and Miller, W. C. (2016). Prevalence of wheelchair and scooter use among community-dwelling Canadians. *Physical Therapy*, *96*(8), 1135-1142.

(4) Charette, C., Best, K. L., Smith, E. M., Miller, W. C., and Routhier, F. (2018). Walking aid use in Canada: prevalence and demographic characteristics among community-dwelling users. *Physical Therapy*, *98*(7), 571-577.

PROPOSED CHANGE

[3.8.] 3.8. Accessibility

(See Note A-3.8.)

[3.8.1.] 3.8.1. Scope

[3.8.1.1.] 3.8.1.1. Scope

[3.8.2.] 3.8.2. Application

[3.8.2.1.] 3.8.2.1. Exceptions

[3.8.2.2.] 3.8.2.2. Entrances

[3.8.2.3.] 3.8.2.3. Areas Requiring a Barrier-Free Path of Travel

[3.8.2.4.] 3.8.2.4. Access to Storeys Served by Escalators and Moving Walks

[3.8.2.5.] 3.8.2.5. Exterior Barrier-Free Paths of Travel to Building Entrances and Exterior Passenger-Loading Zones

[3.8.2.6.] 3.8.2.6. Controls

[3.8.2.7.] 3.8.2.7. Power Door Operators

[3.8.2.8.] 3.8.2.8. Plumbing Facilities

[3.8.2.9.] 3.8.2.9. Assistive Listening Systems

[3.8.2.10.] 3.8.2.10. Signs and Indicators

[3.8.2.11.] 3.8.2.11. Counters

[3.8.2.12.] 3.8.2.12. Telephones

[3.8.3.] 3.8.3. Design

[3.8.3.1.] 3.8.3.1. Design Standards

[3.8.3.2.] 3.8.3.2. Barrier-Free Path of Travel

[3.8.3.3.] 3.8.3.3. Exterior Walks

[3.8.3.4.] 3.8.3.4. Exterior Passenger-Loading Zones

[3.8.3.5.] 3.8.3.5. Ramps

[3.8.3.6.] 3.8.3.6. Doorways and Doors

[3.8.3.7.] 3.8.3.7. Passenger-Elevating Devices

[3.8.3.8.] 3.8.3.8. Controls

[3.8.3.9.] 3.8.3.9. Accessible Signs

[3.8.3.10.] 3.8.3.10. Drinking Fountains

[3.8.3.11.] 3.8.3.11. Water-Bottle Filling Stations

[3.8.3.12.] 3.8.3.12. Accessible Water-Closet Stalls

[3.8.3.13.] 3.8.3.13. Universal Washrooms

[3.8.3.14.] 3.8.3.14. Water Closets

[3.8.3.15.] 3.8.3.15. Water-Closet Stalls and Urinals for Persons with Limited Mobility

[3.8.3.16.] 3.8.3.16. Lavatories and Mirrors

[3.8.3.17.] 3.8.3.17. Showers

[3.8.3.18.] 3.8.3.18. Accessible Bathtubs

[3.8.3.19.] 3.8.3.19. Assistive Listening Systems

[3.8.3.20.] 3.8.3.20. Counters

[3.8.3.21.] 3.8.3.21. Telephones

[3.8.3.22.] 3.8.3.22. Spaces in Seating Area

[3.8.4.] -- Dwelling Units

[3.8.4.1.] --- Entrance Doorway Width

[1] --) The minimum clear width of at least one entrance doorway of a *dwelling unit* shall be 850 mm when the entrance door is in the open position. (See Note A-3.8.4.1.)

Note A-3.8.4.1. Location of Entrance Required by Article 3.8.4.1.

For dwelling units having multiple entrances, care should be exercised when selecting an appropriate location for the doorway that is wide enough for use with common mobility aids. Relevant factors include, but are not limited to, proximity to parking, ease of access from the outside and from the main living space inside, and adequate clearance available to open the entrance door after installation.

Impact analysis

Cost Impact

The overall cost impact of this proposed change considers the following factors:

1. The new clear width requirement would require wider entrance doors that may have a different price than doors compliant with the NBC 2020.
2. The wider entrance doors would reduce the amount of exterior wall that needs to be constructed.

1. Cost Increase of Wider Entrance Doors

Tables 1 to 3 present regional retail cost comparisons of entrance doors that comply with NBC 2020 (810 mm) and entrance doors that comply with this proposed change (850 mm clear width ≈ 915 mm door width), for select door material types.

Table 1. Exterior Door Width and Cost Comparison: Fibreglass

Location	Cost of 810 mm Door(1)(2)	Cost of 915 mm Door(1)(2)	Max. Difference(3)
Saskatoon	$759	$759	–
Calgary	$759	$759	–
Nanaimo	$759	$759	–
Toronto	$759	$759	–
Moncton	$766	$767	$1
Montréal	$766	$767	$1
Halifax	$766	$767	$1
Winnipeg	$759	$759	–

Notes to Table 1

(1) Source of price information for Saskatoon, Calgary and Nanaimo: https://www.homedepot.ca/product/masonite-36-inch-x-80-inch-craftsman-6-lite-primed-fibreglass-smooth-prehung-front-door/1000784545

(2) Source of price information for Toronto, Moncton, Montréal, Halifax and Winnipeg: https://www.homedepot.ca/product/masonite-32-inch-x-80-inch-craftsman-6-lite-primed-fibreglass-smooth-prehung-front-door/1000784539

(3) For the selected fibreglass options, only a few locations priced the wider selection $1 higher, which is insignificant.

Table 2. Exterior Door Width and Cost Comparison: Steel

Location	Cost of 810 mm Door(1)	Cost of 915 mm Door(1)	Max. Difference(2)
Saskatoon	$698	$798	$100
Calgary	$698	$798	$100
Nanaimo	$698	$798	$100
Toronto	$698	$798	$100
Moncton	$698	$798	$100
Montréal	$698	$798	$100
Halifax	$698	$798	$100
Winnipeg	$698	$798	$100

Notes to Table 2

(1) Source of price information: https://www.homedepot.ca/product/masonite-36-inch-x-80-inch-x-4-9-16-inch-full-lite-clear-single-primed-steel-prehung-front-door-rh/1001057069?rrec=true

(2) For the selected steel options, the wider door was consistently retail priced $100 more.

Table 3. Exterior Door Width and Cost Comparison: Wood

Location	Cost of 810 mm Door[(1)(2)]	Cost of 915 mm Door[(1)(2)]	Max. Difference[(3)]
Saskatoon	$2,595	$2,595	–
Calgary	$2,595	$2,595	–
Nanaimo	$2,595	$2,595	–
Toronto	$2,595	$2,595	–
Moncton	$2,595	$2,595	–
Montréal	$2,595	$2,595	–
Halifax	$2,595	$2,595	–
Winnipeg	$2,595	$2,595	–

Notes to Table 3

(1) Source of price information for Saskatoon, Nanaimo, Moncton, Halifax and Winnipeg: https://www.homedepot.ca/product/krosswood-doors-36-in-x-80-in-right-hand-modern-hemlock-black-stain-solid-wood-single-prehung-front-door/1001749971

(2) Source of price information for Calgary, Toronto and Montréal: https://www.homedepot.ca/product/krosswood-doors-32-in-x-80-in-right-hand-modern-hemlock-black-stain-solid-wood-single-prehung-front-door/1001751924

(3) For the selected wood options, the retail price was unchanged between the two door widths.

Given the information in Tables 1 to 3, a $100 difference will be assumed between the entrance doors that comply with the NBC 2020 and those that comply with this proposed change because this represents the worst-case scenario, even though Tables 1 to 3 show that many of these products do not vary in price for different width options.

2. Cost Decrease Related to Construction of Reduced Exterior Wall

Table 4 presents costing data (from RSMeans) per linear metre of typical exterior wall assembly, which is used to determine the cost savings from installing a wider doorway that reduces the amount of exterior wall to be built.

Table 4. Cost of Typical Exterior Wall per Linear Metre

Component	Quantity	Unit Cost	Total Cost, ≈ $/m
11 mm OSB sheathing	2.44 m^2	$12.59/$m^2$	30.70
38 × 140 mm @ 400 mm stud wall			
38 x 140 mm plates (2 top, 1 btm)	3.00 m	$7.05/m	21.16
38 x 140 mm studs	6.10 m	$6.17/m	37.63
Fibreglass batt insulation (R21)	2.21 m^2	$13.13/$m^2$	28.99
12.7 mm gypsum wall board	2.44 m^2	$14.31/$m^2$	34.92
Total			153.39

As shown in Table 4, the cost per linear metre of a typical exterior wall is $153.39.

Cost decrease from constructing less exterior wall = (Typical exterior wall cost per linear metre) × (proposed change compliant door width − NBC 2020 compliant door width) = (153.39 $/m) × (0.915 − 0.810) m

Cost decrease from constructing less exterior wall = $16.11

3. Overall Cost

Cost of this proposed change = (cost increase of a wider entrance door) − (cost decrease from constructing less exterior wall) = ($100.00) − ($16.11)

Cost of this proposed change = $83.89

Therefore, based on the regional retail costing data for entrance doors that comply with NBC 2020 and this proposed change, it is expected that this change could present an increase in cost of $83.89 per applicable dwelling unit.

Limitations of the Cost Analysis

1. To comply with the proposed change, a standard 915 mm door would need to be open to approximately 100 to 105 degrees, corresponding to approximately 15 cm to 20 cm of additional clearance relative to opening the same door to 90 degrees. This may affect the layout of certain types of entrances (along with other parts of the dwelling unit), particularly for townhouses with narrow entrances.
2. The proposed change may result in the need for greater production of 915 mm doors, at the possible expense of smaller doors. It is noted that the proposed change applies to a minimum of one entrance, meaning that smaller exterior doors could still be used for other entrances where included in the design of the dwelling unit.
3. Door costs are based on retail prices, but may be priced differently if procured at a large scale.

Benefit Impact

Based on the NBC minimum width requirement of 810 mm for the entrance door of a dwelling unit, this requirement estimates the clear width of the doorway by subtracting 65 mm (i.e., 45 mm door thickness + 20 mm exterior door jamb stop width = 65 mm reduction of doorway width by obstruction). Table 5 compares the reported percentages of wheelchairs that would not be able to fit through doorways of NBC 2020-compliant entrance doors having a clear width of 745 mm, and those compliant with this proposed change having a clear width of 850 mm.

Table 5. Percentages of Wheelchairs that Cannot Be Accommodated by Various Clear Widths of Doorways and Impact of the Proposed Change

Wheelchairs not accommodated by listed clear width, %			Wheelchairs not accommodated by the NBC 2020 clear width, but accommodated by the proposed change in PCF 1883, %	
Source	745 mm (NBC 2020)	850 mm (PCF 1883)	Source	850 mm
Seeger et al., AUS	4.1	0.9	Seeger et al., AUS	77.8

UDI, Canada	2.9	0.0	UDI, Canada	100.0
DfT, UK	4.1	2.4	DfT, UK	42.5
IDEA Center, USA	5.1	1.0	IDEA Center, USA	80.1

According to the information in Table 5, this proposed change would allow 42.5% to 100% of wheelchairs to enter a dwelling unit of those that cannot currently pass through a minimum NBC 2020-compliant entrance door.

Limitations of the Benefit Analysis

While this proposed change addresses the width of an entrance door, it does not include any requirements for the threshold of the doorway, which could still present an obstacle for mobility devices, though there are some products available on the market that can help address this.

Enforcement implications

The proposed change is expected to be enforceable using a combination of a measuring tape and visual inspection. Authorities having jurisdiction would need to become familiar with the proposed change. Suites in Part 3 buildings (including dwelling units) require entrance doors with a clear width of 850 mm (Clause 3.3.1.13.(1)(b)), and similar methods could be used to enforce the proposed change in houses and other types of dwelling units.

Who is affected

Builders and designers would need to be aware of the proposed change and potentially modify the layout of the dwelling unit to accommodate the need for increased space by the affected door.

Occupants (including owners) may gain a larger entrance and avoid the need to increase the doorway width should their mobility needs change.

Regulators and authorities having jurisdiction would need to be aware of and enforce the proposed change.

Door manufacturers and distributors might need to plan for changes to the production of exterior doors that comply with the proposed change.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.8.1.1.] 3.8.1.1. ([1] 1) no attributions

[3.8.1.1.] 3.8.1.1. ([2] 2) no attributions

[3.8.2.1.] 3.8.2.1. ([1] 1) no attributions

[3.8.2.2.] 3.8.2.2. ([1] 1) [F73-OA1]

[3.8.2.2.] 3.8.2.2. ([2] 2) no attributions

[3.8.2.2.] 3.8.2.2. ([3] 3) no attributions

[3.8.2.2.] 3.8.2.2. ([4] 4) [F73-OA1]

[3.8.2.3.] 3.8.2.3. ([1] 1) [F73-OA1]

[3.8.2.3.] 3.8.2.3. ([2] 2) no attributions

[3.8.2.3.] 3.8.2.3. ([3] 3) [F74-OA2]

[3.8.2.3.] 3.8.2.3. ([4] 4) [F74-OA2]

[3.8.2.3.] 3.8.2.3. ([5] 5) [F74-OA2]

[3.8.2.3.] 3.8.2.3. ([5] 5) [F10-OS3.7]

[3.8.2.3.] 3.8.2.3. ([6] 6) [F74-OA2]

[3.8.2.4.] 3.8.2.4. ([1] 1) [F73-OA1]

[3.8.2.4.] 3.8.2.4. ([2] 2) [F73-OA1]

[3.8.2.5.] 3.8.2.5. ([1] 1) [F73-OA1]

[3.8.2.5.] 3.8.2.5. ([2] 2) [F73-OA1]

[3.8.2.5.] 3.8.2.5. ([3] 3) no attributions

[3.8.2.6.] 3.8.2.6. ([1] 1) no attributions

[3.8.2.7.] 3.8.2.7. ([1] 1) [F73-OA1]

[3.8.2.7.] 3.8.2.7. ([2] 2) no attributions

[3.8.2.7.] 3.8.2.7. ([3] 3) no attributions

[3.8.2.8.] 3.8.2.8. ([1] 1) [F74-OA2]

[3.8.2.8.] 3.8.2.8. ([1] 1) [F72-OH2.1] [F71-OH2.3]

[3.8.2.8.] 3.8.2.8. ([2] 2) [F74-OA2]

[3.8.2.8.] 3.8.2.8. ([2] 2) [F72-OH2.1] [F71-OH2.3]

[3.8.2.8.] 3.8.2.8. ([2] 2) no attributions

[3.8.2.8.] 3.8.2.8. ([3] 3) no attributions

[3.8.2.8.] 3.8.2.8. ([4] 4) [F72-OH2.1]

[3.8.2.8.] 3.8.2.8. ([4] 4) [F73-OA1]

[3.8.2.8.] 3.8.2.8. ([5] 5) no attributions

[3.8.2.8.] 3.8.2.8. ([6] 6) no attributions

[3.8.2.8.] 3.8.2.8. ([7] 7) no attributions

[3.8.2.8.] 3.8.2.8. ([8] 8) no attributions

[3.8.2.8.] 3.8.2.8. ([9] 9) no attributions

[3.8.2.8.] 3.8.2.8. ([10] 10) no attributions

[3.8.2.8.] 3.8.2.8. ([11] 11) no attributions

[3.8.2.8.] 3.8.2.8. ([12] 12) no attributions

[3.8.2.8.] 3.8.2.8. ([13] 13) [F74-OA2]

[3.8.2.8.] 3.8.2.8. ([13] 13) no attributions

[3.8.2.8.] 3.8.2.8. ([14] 14) no attributions

[3.8.2.8.] 3.8.2.8. ([15] 15) no attributions

[3.8.2.8.] 3.8.2.8. ([15] 15) [F74-OA2]

[3.8.2.9.] 3.8.2.9. ([1] 1) no attributions

[3.8.2.9.] 3.8.2.9. ([2] 2) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([1] 1) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([1] 1) no attributions

[3.8.2.10.] 3.8.2.10. ([2] 2) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([3] 3) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([3] 3) no attributions

[3.8.2.10.] 3.8.2.10. ([4] 4) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([4] 4) no attributions

[3.8.2.11.] 3.8.2.11. ([1] 1) [F74-OA2]

[3.8.2.11.] 3.8.2.11. ([1] 1) no attributions

[3.8.2.12.] 3.8.2.12. ([1] 1) [F74-OA2]

[3.8.2.12.] 3.8.2.12. ([1] 1) no attributions

[3.8.3.1.] 3.8.3.1. ([1] 1) no attributions

[3.8.3.2.] 3.8.3.2. ([1] 1) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([2] 2) no attributions

[3.8.3.2.] 3.8.3.2. ([3] 3) ([a] a),([b] b) [F30-OS3.1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([a] a),([b] b) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([c] c),([d] d) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([e] e),([f] f) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([e] e),([f] f) [F30-OS3.1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([c] c),([d] d) [F30-OS3.1]

[3.8.3.2.] 3.8.3.2. ([4] 4) no attributions

[3.8.3.2.] 3.8.3.2. ([5] 5) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([6] 6) [F73-OA1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([a] a) [F73-OA1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([a] a) [F30-OS3.1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([b] b) [F73-OA1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([c] c)

[3.8.3.3.] 3.8.3.3. ([1] 1) ([d] d) [F30-OS3.1]

[3.8.3.4.] 3.8.3.4. ([1] 1) ([a] a) [F74-OA2]

[3.8.3.4.] 3.8.3.4. ([1] 1) ([b] b) [F73-OA1]

[3.8.3.4.] 3.8.3.4. ([1] 1) ([c] c) [F74-OA2]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([b] b),([e] e) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([d] d) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([c] c) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([d] d) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([e] e),([f] f)

[3.8.3.5.] 3.8.3.5. ([1] 1) ([b] b),([e] e) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([a] a)

[3.8.3.5.] 3.8.3.5. ([1] 1) ([c] c) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([2] 2) no attributions

[3.8.3.5.] 3.8.3.5. ([3] 3) no attributions

[3.8.3.5.] 3.8.3.5. ([4] 4) ([a] a) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([4] 4) ([b] b),([c] c) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([5] 5) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([1] 1) no attributions

[3.8.3.6.] 3.8.3.6. ([2] 2) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([3] 3) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([3] 3) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([4] 4) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([4] 4) [F10-OS3.7]

[3.8.3.6.] 3.8.3.6. ([5] 5) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([5] 5) [F10-OS3.7]

[3.8.3.6.] 3.8.3.6. ([6] 6) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([7] 7) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([8] 8) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([9] 9) no attributions

[3.8.3.6.] 3.8.3.6. ([10] 10) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([10] 10) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([10] 10) no attributions

[3.8.3.6.] 3.8.3.6. ([11] 11) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([12] 12) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([12] 12) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([13] 13) no attributions

[3.8.3.6.] 3.8.3.6. ([14] 14) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([15] 15) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([16] 16) no attributions

[3.8.3.6.] 3.8.3.6. ([17] 17) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([17] 17) [F10-OS3.7]

[3.8.3.7.] 3.8.3.7. ([1] 1) [F73-OA1]

[3.8.3.7.] 3.8.3.7. ([1] 1) [F74-OA2]

[3.8.3.7.] 3.8.3.7. ([1] 1) [F30-OS3.1] [F10-OS3.7]

[3.8.3.8.] 3.8.3.8. ([1] 1) [F74-OA2]

[3.8.3.8.] 3.8.3.8. ([1] 1) [F10-OS3.7]

[3.8.3.9.] 3.8.3.9. ([1] 1) no attributions

[3.8.3.9.] 3.8.3.9. ([1] 1) [F74-OA2]

[3.8.3.9.] 3.8.3.9. ([1] 1) [F73-OA1]

[3.8.3.9.] 3.8.3.9. ([2] 2) [F74-OA2]

[3.8.3.9.] 3.8.3.9. ([2] 2) [F73-OA1]

[3.8.3.9.] 3.8.3.9. ([3] 3) [F74-OA2]

[3.8.3.9.] 3.8.3.9. ([3] 3) [F73-OA1]

[3.8.3.10.] 3.8.3.10. ([1] 1) [F74-OA2]

[3.8.3.10.] 3.8.3.10. ([2] 2) [F74-OA2]

[3.8.3.11.] 3.8.3.11. ([1] 1) [F74-OA2]

[3.8.3.11.] 3.8.3.11. ([2] 2) [F74-OA2]

[3.8.3.12.] 3.8.3.12. ([1] 1) [F74-OA2]

[3.8.3.12.] 3.8.3.12. ([1] 1) [F72-OH2.1]

[3.8.3.12.] 3.8.3.12. ([1] 1) ([d] d)([i] i) [F74-OA2]

[3.8.3.12.] 3.8.3.12. ([1] 1) ([f] f),([g] g) [F30,F20-OS3.1]

[3.8.3.12.] 3.8.3.12. ([1] 1) ([f] f) and ([g] g)

[3.8.3.12.] 3.8.3.12. ([1] 1) ([h] h) [F30-OS3.1]

[3.8.3.12.] 3.8.3.12. ([1] 1) no attributions

[3.8.3.13.] 3.8.3.13. ([1] 1) [F74-OA2]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([b] b) [F10-OS3.7]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([c] c)

[3.8.3.13.] 3.8.3.13. ([1] 1) ([d] d)

[3.8.3.13.] 3.8.3.13. ([1] 1) ([f] f)

[3.8.3.13.] 3.8.3.13. ([1] 1) ([g] g) [F30-OS3.1]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([i] i) [F74-OA2]

[3.8.3.13.] 3.8.3.13. ([1] 1) [F72-OH2.1] [F71-OH2.3]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([b] b) [F74-OA2]

[3.8.3.13.] 3.8.3.13. ([2] 2) [F72-OH2.1] [F71-OH2.3]

[3.8.3.14.] 3.8.3.14. ([1] 1) [F74-OA2]

[3.8.3.14.] 3.8.3.14. ([1] 1) [F72-OH2.1]

[3.8.3.15.] 3.8.3.15. ([1] 1) [F74-OA2]

[3.8.3.15.] 3.8.3.15. ([1] 1) ([d] d) [F30-OS3.1]

[3.8.3.15.] 3.8.3.15. ([1] 1) ([a] a)

[3.8.3.15.] 3.8.3.15. ([2] 2) [F74-OA2]

[3.8.3.15.] 3.8.3.15. ([2] 2) ([f] f) [F30-OS3.1]

[3.8.3.15.] 3.8.3.15. ([2] 2) ([c] c)

[3.8.3.16.] 3.8.3.16. ([1] 1) [F74-OA2]

[3.8.3.16.] 3.8.3.16. ([1] 1) [F71-OH2.3]

[3.8.3.16.] 3.8.3.16. ([1] 1) ([f] f) [F31-OS3.2]

[3.8.3.16.] 3.8.3.16. ([2] 2) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([1] 1) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([1] 1) ([d] d),([e] e) [F30-OS3.1]

[3.8.3.17.] 3.8.3.17. ([1] 1) ([f] f) [F30-OS3.1]

[3.8.3.17.] 3.8.3.17. ([1] 1) ([h] h) [F31-OS3.2]

[3.8.3.17.] 3.8.3.17. ([2] 2) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([2] 2) [F71-OH2.3]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([a] a) [F73-OA1]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([b] b) [F10-OS3.7]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([b] b) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([g] g) [F74-OA2]

[3.8.3.18.] 3.8.3.18. ([1] 1) [F74-OA2]

[3.8.3.19.] 3.8.3.19. ([1] 1) [F74-OA2]

[3.8.3.19.] 3.8.3.19. ([1] 1) [F11-OS3.7]

[3.8.3.19.] 3.8.3.19. ([2] 2) [F74-OA2]

[3.8.3.20.] 3.8.3.20. ([1] 1) [F74-OA2]

[3.8.3.21.] 3.8.3.21. ([1] 1) [F74-OA2]

[3.8.3.21.] 3.8.3.21. ([2] 2) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([1] 1) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([1] 1) [F30-OS3.1]

[3.8.3.22.] 3.8.3.22. ([1] 1) ([d] d) [F10-OS3.7]

[3.8.3.22.] 3.8.3.22. ([2] 2) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([2] 2) [F30-OS3.1]

[3.8.3.22.] 3.8.3.22. ([3] 3) ([a] a) [F10-OS3.7]

[3.8.3.22.] 3.8.3.22. ([3] 3) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([4] 4) [F10-OS3.7]

[3.8.4.1.] -- ([1] --) [F73-OA1]

Submit a comment

Proposed Change 1957

Code Reference(s):	**NBC20 Div.B 3.8. (first printing)**
Subject:	Accessibility, Visitability and Adaptability of Dwelling Units
Title:	Reachable Controls in Dwelling Units
Description:	This proposed change introduces new requirements for controls in dwelling units to make them reachable from a seated or standing position.
Related Proposed Change(s):	PCF 1880, PCF 1881, PCF 1883, PCF 2028

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Accessibility, Visitability and Adaptability of Dwelling Units.

Problem

The ability to access controls and receptacles (e.g., light switches) in the dwelling is essential for people to live independently. However, as people age, disabilities become more common, and Canadians over the age of 65 are nearly twice as likely to be disabled compared to those who are 20–64 years old [1].

Consequently, controls that were once accessible when a person moved into a dwelling may no longer be accessible as the person's health status evolves. This situation can create problems for persons with disabilities related to balance and mobility (particularly those who use wheelchairs or scooters while seated, as well as those at a higher risk of falls while reaching up or bending down) as they may not be able to reach controls in the dwelling that have been installed too high or too low. Persons who use mobility aids (including walkers and rollators) also experience difficulty in reaching controls when the controls are located in the inside corners of a room and the mobility aid is blocked by the adjacent wall.

When renovating a dwelling unit, repositioning certain controls for accessibility is possible. However, repositioning hard-wired controls, such as light switches, is expensive and labour intensive relative to installing the controls in accessible locations when the dwelling is first built.

Justification

This proposed change introduces new requirements for the design and installation of controls in dwelling units so that they can be more easily reached by persons with disabilities related to balance and mobility. Specifically, this proposed change constrains the installation location of certain types of controls (e.g., light switches, electrical outlets and regularly operated components of security systems) in a dwelling unit to be within a height range of 400 mm to 1 200 mm above the finished floor or ground surface. Moreover, where controls are to be installed in inside corners of a room, this proposed change would require them to be located at least 300 mm from the inside corner.

Approximately 10% of Canadians report having a disability related to mobility [1], while 1% of Canadians who live in the community regularly use wheelchairs or scooters [2]. Restricting the height range of the installation location of certain types of controls would also benefit many older adults and persons with disabilities related to balance who do not use wheelchairs or scooters by reducing the need to reach extensively to access controls located in high positions or to squat, stoop or crouch to access controls located in low positions. These are activities that increase the risk of balance loss and subsequent fall or injury in older adults and persons with disabilities related to balance [3–6]. Similarly, placing restrictions on the location of controls in the inside corners of the room would make it easier for persons who use mobility aids, such as walkers or rollators (in addition to wheelchairs or scooters), to reach the controls while also using their mobility aid. By constraining the installation location of controls in dwelling units, this proposed change would limit the probability that persons with disabilities related to balance and mobility cannot safely access the building's facilities.

This proposed change complements the existing requirements in the National Building Code of Canada (NBC) for the accessible design of controls in most units in multi-unit residential buildings, as outlined in Section 3.8. of Division B. The current requirements in the NBC differ from this proposed change in that they address dexterity and focus on all controls, whereas this proposed change strictly addresses height and proximity to an inside corner for a limited range of controls. As such, this proposed change would generally affect houses and other dwelling units that do not need to comply with Section 3.8.

By focusing on specific controls that are frequently used by occupants and are expensive to relocate once installed relative to the initial installation cost, this proposed change is expected to address critical controls used in a dwelling unit while simplifying enforcement and Code compliance. This proposed change also maintains flexibility in the design of controls that are typically installed in an accessible location (e.g., door hardware and faucets) unless occupants choose to install them elsewhere.

PROPOSED CHANGE

[3.8.] 3.8. Accessibility

(See Note A-3.8.)

[3.8.1.] 3.8.1. Scope

[3.8.1.1.] 3.8.1.1. Scope

[3.8.2.] 3.8.2. Application

[3.8.2.1.] 3.8.2.1. Exceptions

[3.8.2.2.] 3.8.2.2. Entrances

[3.8.2.3.] 3.8.2.3. Areas Requiring a Barrier-Free Path of Travel

[3.8.2.4.] 3.8.2.4. Access to Storeys Served by Escalators and Moving Walks

[3.8.2.5.] 3.8.2.5. Exterior Barrier-Free Paths of Travel to Building Entrances and Exterior Passenger-Loading Zones

[3.8.2.6.] 3.8.2.6. Controls

[3.8.2.7.] 3.8.2.7. Power Door Operators

[3.8.2.8.] 3.8.2.8. Plumbing Facilities

[3.8.2.9.] 3.8.2.9. Assistive Listening Systems

[3.8.2.10.] 3.8.2.10. Signs and Indicators

[3.8.2.11.] 3.8.2.11. Counters

[3.8.2.12.] 3.8.2.12. Telephones

[3.8.3.] 3.8.3. Design

[3.8.3.1.] 3.8.3.1. Design Standards

[3.8.3.2.] 3.8.3.2. Barrier-Free Path of Travel

[3.8.3.3.] 3.8.3.3. Exterior Walks

[3.8.3.4.] 3.8.3.4. Exterior Passenger-Loading Zones

[3.8.3.5.] 3.8.3.5. Ramps

[3.8.3.6.] 3.8.3.6. Doorways and Doors

[3.8.3.7.] 3.8.3.7. Passenger-Elevating Devices

[3.8.3.8.] 3.8.3.8. Controls

[3.8.3.9.] 3.8.3.9. Accessible Signs

[3.8.3.10.] 3.8.3.10. Drinking Fountains

[3.8.3.11.] 3.8.3.11. Water-Bottle Filling Stations

[3.8.3.12.] 3.8.3.12. Accessible Water-Closet Stalls

[3.8.3.13.] 3.8.3.13. Universal Washrooms

[3.8.3.14.] 3.8.3.14. Water Closets

[3.8.3.15.] 3.8.3.15. Water-Closet Stalls and Urinals for Persons with Limited Mobility

[3.8.3.16.] 3.8.3.16. Lavatories and Mirrors

[3.8.3.17.] 3.8.3.17. Showers

[3.8.3.18.] 3.8.3.18. Accessible Bathtubs

[3.8.3.19.] 3.8.3.19. Assistive Listening Systems

[3.8.3.20.] 3.8.3.20. Counters

[3.8.3.21.] 3.8.3.21. Telephones

[3.8.3.22.] 3.8.3.22. Spaces in Seating Area

[3.8.4.] -- Dwelling Units

[3.8.4.2.] --- Operating Controls and Electrical Receptacles

[1] --) Where they are mounted on a wall and intended for regular use by the occupant, switches, electrical receptacles and security controls shall be located with their centre lines

[a] --) between 400 mm and 1 200 mm above the finished floor or ground surface, and

[b] --) at least 300 mm from the inside wall corner.

(See Note A-3.8.4.2.-2025.)

Note A-3.8.4.2.-2025 Operating Controls and Electrical Receptacles.

Sentence 3.8.4.2.(1) is not intended to apply where the operating controls and electrical receptacles are not for regular use or are installed outside of the prescribed distance ranges for use with dedicated equipment or appliances.

Impact analysis

Impact on accessibility

Being able to access controls (e.g., light switches and electrical outlets) profoundly affects one's independence while living in a dwelling unit.

This proposed change is expected to improve accessibility by facilitating the reaching of controls from a seated or standing position. Approximately 10% of Canadians over 15 years old have a disability related to mobility [1], with 1% of community-dwelling Canadians being regular users of wheelchairs and scooters [2]. While the proposed height range was originally established to facilitate persons reaching from a seated position, the proposed change would also improve the safety of persons accessing controls while standing and reduce the need for stooping, squatting or crouching to reach low positions—all of which are activities that are associated with balance loss and potential falls, even in older adults without disabilities related to balance [3–6]. Similarly, the proposed requirements for the location of controls in inside corners (i.e., at least 300 mm from the inside corner) are expected to improve the safety of persons accessing controls while using a mobility aid (e.g., walkers, rollators, wheelchairs, scooters). By requiring that controls be installed in an accessible location irrespective of wheelchair or scooter use, this proposed change would make it easier for occupants to access these controls throughout the dwelling.

Impact on financial costs

This proposed change is not expected to increase the costs of building new dwelling units, as the change would only affect the mounting location of the controls. However, implementing the proposed change to the installation height and location ranges of controls is expected to reduce the need for individuals to modify the location of controls to make them more reachable from a wheelchair or a standing position after the dwelling unit has been built. This proposed change should result in cost and time savings related to complex adjustments, such as changing the location of hard-wired electrical outlets and light switches. Designers and builders would need to be aware of the change and apply it in practice.

Impact on the provinces and territories

The impact of this proposed change would differ across provinces and territories based on (a) the type of dwelling unit, where existing requirements for the accessible design of controls in dwelling units currently apply; and (b) the specific technical components of these requirements.

This proposed change is mostly a relaxation of the adaptability requirements for controls in the Nova Scotia Building Code, Article 3.8.4.6., which apply to the design and construction of all dwelling units, including houses. Specifically, the Nova Scotia Building Code already addresses dexterity requirements (which impact the geometry and operating force of controls) and defines "controls" much more broadly. On the other hand, the Nova Scotia Building Code does not address the position of controls with respect to inside corners, whereas this proposed change does.

In the Quebec Construction Code, all dwelling units not exempt from the accessibility requirements in Section 3.8. (i.e., dwelling units in multi-unit residential buildings [MURBs]) would have to comply with this proposed change. The one key difference is that this proposed change would apply throughout the dwelling unit, whereas the current requirements in Quebec only apply to controls that are within or are adjacent to the barrier-free path of travel. The NBC proposes a broader application to address the needs of persons with mobility disabilities who do not use wheelchairs in the home, in addition to those who do.

Other provinces and territories have similar requirements for the location of controls in their provisions for accessible dwelling units, which typically apply to a percentage of units in MURBs but do not apply to houses.

Finally, the NBC 2020 requires that all buildings (including dwelling units) that are not subject to the exemptions outlined in Section 3.8. (e.g., houses) comply with the requirements for controls stated in Article 3.8.3.8. (which prescribes a height range for installation, clearance

requirements around the controls to allow a wheelchair to approach and turn, and requirements to allow a person with a disability related to dexterity to operate the controls using low force and a closed fist). Thus, this proposed change would mostly affect houses; however, the requirements are relaxed compared to those for MURBs.

References

[1] Statistics Canada. (2017). "New data on disability in Canada 2017." https://www150.statcan.gc.ca/n1/en/pub/11-627-m/11-627-m2018035-eng.pdf?st=v5UqujRh

[2] Smith, E., Giesbrecht, E., Mortenson, W., and Miller, W. (2016). Prevalence of wheelchair and scooter use among community-dwelling Canadians. *Physical Therapy*, *96*, 1135–1142.

[3] Glinka, M. N., Weaver, T. B., and Laing, A. C. (2015). Age-related differences in movement strategies and postural control during stooping and crouching tasks. *Human Movement Science*, *44*, 246–257.

[4] Hernandez, M. E., Ashton-Miller, J. A., and Alexander, N. B. (2013). Age-related differences in maintenance of balance during forward reach to the floor. *Journals of Gerontology Series A: Biomedical Sciences and Medical Sciences*, *68*(8), 960–967.

[5] Huang, M. H., and Brown, S. H. (2013). Age differences in the control of postural stability during reaching tasks. *Gait & Posture*, *38*(4), 837–842.

[6] Nasarwanji, M. F., Paquet, V. L., and Steinfeld, E. (2012). Age differences in postural strategies for low forward reach. In M. M. Soares and F. Rebelo (Eds.), *Advances in Usability Evaluation–Part I*: pp. 97–118. CRC Press, Boca Raton, FL.

Enforcement implications

This proposed change could be enforced using existing Code enforcement methods for accessible controls in Part 3 buildings, including the use of a measuring tape to measure installation height.

Authorities having jurisdiction would need to be made aware of this proposed change and its distinction from existing requirements for accessible controls in Article 3.8.3.8. (which apply to a broader range of controls and also address dexterity).

Who is affected

Designers, builders, engineers and homeowners would need to be aware of this proposed change and select controls to comply with the proposed requirements.

Manufacturers would need to be aware of the expanded requirements for accessible controls in Canada.

Authorities having jurisdiction would need to be aware of this proposed change when evaluating building compliance.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

[3.8.1.1.] 3.8.1.1. ([1] 1) no attributions

[3.8.1.1.] 3.8.1.1. ([2] 2) no attributions

[3.8.2.1.] 3.8.2.1. ([1] 1) no attributions

[3.8.2.2.] 3.8.2.2. ([1] 1) [F73-OA1]

[3.8.2.2.] 3.8.2.2. ([2] 2) no attributions

[3.8.2.2.] 3.8.2.2. ([3] 3) no attributions

[3.8.2.2.] 3.8.2.2. ([4] 4) [F73-OA1]

[3.8.2.3.] 3.8.2.3. ([1] 1) [F73-OA1]

[3.8.2.3.] 3.8.2.3. ([2] 2) no attributions

[3.8.2.3.] 3.8.2.3. ([3] 3) [F74-OA2]

[3.8.2.3.] 3.8.2.3. ([4] 4) [F74-OA2]

[3.8.2.3.] 3.8.2.3. ([5] 5) [F74-OA2]

[3.8.2.3.] 3.8.2.3. ([5] 5) [F10-OS3.7]

[3.8.2.3.] 3.8.2.3. ([6] 6) [F74-OA2]

[3.8.2.4.] 3.8.2.4. ([1] 1) [F73-OA1]

[3.8.2.4.] 3.8.2.4. ([2] 2) [F73-OA1]

[3.8.2.5.] 3.8.2.5. ([1] 1) [F73-OA1]

[3.8.2.5.] 3.8.2.5. ([2] 2) [F73-OA1]

[3.8.2.5.] 3.8.2.5. ([3] 3) no attributions

[3.8.2.6.] 3.8.2.6. ([1] 1) no attributions

[3.8.2.7.] 3.8.2.7. ([1] 1) [F73-OA1]

[3.8.2.7.] 3.8.2.7. ([2] 2) no attributions

[3.8.2.7.] 3.8.2.7. ([3] 3) no attributions

[3.8.2.8.] 3.8.2.8. ([1] 1) [F74-OA2]

[3.8.2.8.] 3.8.2.8. ([1] 1) [F72-OH2.1] [F71-OH2.3]

[3.8.2.8.] 3.8.2.8. ([2] 2) [F74-OA2]

[3.8.2.8.] 3.8.2.8. ([2] 2) [F72-OH2.1] [F71-OH2.3]

[3.8.2.8.] 3.8.2.8. ([2] 2) no attributions

[3.8.2.8.] 3.8.2.8. ([3] 3) no attributions

[3.8.2.8.] 3.8.2.8. ([4] 4) [F72-OH2.1]

[3.8.2.8.] 3.8.2.8. ([4] 4) [F73-OA1]

[3.8.2.8.] 3.8.2.8. ([5] 5) no attributions

[3.8.2.8.] 3.8.2.8. ([6] 6) no attributions

[3.8.2.8.] 3.8.2.8. ([7] 7) no attributions

[3.8.2.8.] 3.8.2.8. ([8] 8) no attributions

[3.8.2.8.] 3.8.2.8. ([9] 9) no attributions

[3.8.2.8.] 3.8.2.8. ([10] 10) no attributions

[3.8.2.8.] 3.8.2.8. ([11] 11) no attributions

[3.8.2.8.] 3.8.2.8. ([12] 12) no attributions

[3.8.2.8.] 3.8.2.8. ([13] 13) [F74-OA2]

[3.8.2.8.] 3.8.2.8. ([13] 13) no attributions

[3.8.2.8.] 3.8.2.8. ([14] 14) no attributions

[3.8.2.8.] 3.8.2.8. ([15] 15) no attributions

[3.8.2.8.] 3.8.2.8. ([15] 15) [F74-OA2]

[3.8.2.9.] 3.8.2.9. ([1] 1) no attributions

[3.8.2.9.] 3.8.2.9. ([2] 2) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([1] 1) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([1] 1) no attributions

[3.8.2.10.] 3.8.2.10. ([2] 2) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([3] 3) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([3] 3) no attributions

[3.8.2.10.] 3.8.2.10. ([4] 4) [F74-OA2]

[3.8.2.10.] 3.8.2.10. ([4] 4) no attributions

[3.8.2.11.] 3.8.2.11. ([1] 1) [F74-OA2]

[3.8.2.11.] 3.8.2.11. ([1] 1) no attributions

[3.8.2.12.] 3.8.2.12. ([1] 1) [F74-OA2]

[3.8.2.12.] 3.8.2.12. ([1] 1) no attributions

[3.8.3.1.] 3.8.3.1. ([1] 1) no attributions

[3.8.3.2.] 3.8.3.2. ([1] 1) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([2] 2) no attributions

[3.8.3.2.] 3.8.3.2. ([3] 3) ([a] a),([b] b) [F30-OS3.1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([a] a),([b] b) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([c] c),([d] d) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([e] e),([f] f) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([e] e),([f] f) [F30-OS3.1]

[3.8.3.2.] 3.8.3.2. ([3] 3) ([c] c),([d] d) [F30-OS3.1]

[3.8.3.2.] 3.8.3.2. ([4] 4) no attributions

[3.8.3.2.] 3.8.3.2. ([5] 5) [F73-OA1]

[3.8.3.2.] 3.8.3.2. ([6] 6) [F73-OA1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([a] a) [F73-OA1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([a] a) [F30-OS3.1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([b] b) [F73-OA1]

[3.8.3.3.] 3.8.3.3. ([1] 1) ([c] c)

[3.8.3.3.] 3.8.3.3. ([1] 1) ([d] d) [F30-OS3.1]

[3.8.3.4.] 3.8.3.4. ([1] 1) ([a] a) [F74-OA2]

[3.8.3.4.] 3.8.3.4. ([1] 1) ([b] b) [F73-OA1]

[3.8.3.4.] 3.8.3.4. ([1] 1) ([c] c) [F74-OA2]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([b] b),([e] e) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([d] d) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([c] c) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([d] d) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([e] e),([f] f)

[3.8.3.5.] 3.8.3.5. ([1] 1) ([b] b),([e] e) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([1] 1) ([a] a)

[3.8.3.5.] 3.8.3.5. ([1] 1) ([c] c) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([2] 2) no attributions

[3.8.3.5.] 3.8.3.5. ([3] 3) no attributions

[3.8.3.5.] 3.8.3.5. ([4] 4) ([a] a) [F73-OA1]

[3.8.3.5.] 3.8.3.5. ([4] 4) ([b] b),([c] c) [F30-OS3.1]

[3.8.3.5.] 3.8.3.5. ([5] 5) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([1] 1) no attributions

[3.8.3.6.] 3.8.3.6. ([2] 2) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([3] 3) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([3] 3) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([4] 4) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([4] 4) [F10-OS3.7]

[3.8.3.6.] 3.8.3.6. ([5] 5) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([5] 5) [F10-OS3.7]

[3.8.3.6.] 3.8.3.6. ([6] 6) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([7] 7) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([8] 8) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([9] 9) no attributions

[3.8.3.6.] 3.8.3.6. ([10] 10) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([10] 10) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([10] 10) no attributions

[3.8.3.6.] 3.8.3.6. ([11] 11) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([12] 12) [F30-OS3.1]

[3.8.3.6.] 3.8.3.6. ([12] 12) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([13] 13) no attributions

[3.8.3.6.] 3.8.3.6. ([14] 14) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([15] 15) [F73-OA1]

[3.8.3.6.] 3.8.3.6. ([16] 16) no attributions

[3.8.3.6.] 3.8.3.6. ([17] 17) [F74-OA2]

[3.8.3.6.] 3.8.3.6. ([17] 17) [F10-OS3.7]

[3.8.3.7.] 3.8.3.7. ([1] 1) [F73-OA1]

[3.8.3.7.] 3.8.3.7. ([1] 1) [F74-OA2]

[3.8.3.7.] 3.8.3.7. ([1] 1) [F30-OS3.1] [F10-OS3.7]

[3.8.3.8.] 3.8.3.8. ([1] 1) [F74-OA2]

[3.8.3.8.] 3.8.3.8. ([1] 1) [F10-OS3.7]

[3.8.3.9.] 3.8.3.9. ([1] 1) no attributions

[3.8.3.9.] 3.8.3.9. ([1] 1) [F74-OA2]

[3.8.3.9.] 3.8.3.9. ([1] 1) [F73-OA1]

[3.8.3.9.] 3.8.3.9. ([2] 2) [F74-OA2]

[3.8.3.9.] 3.8.3.9. ([2] 2) [F73-OA1]

[3.8.3.9.] 3.8.3.9. ([3] 3) [F74-OA2]

[3.8.3.9.] 3.8.3.9. ([3] 3) [F73-OA1]

[3.8.3.10.] 3.8.3.10. ([1] 1) [F74-OA2]

[3.8.3.10.] 3.8.3.10. ([2] 2) [F74-OA2]

[3.8.3.11.] 3.8.3.11. ([1] 1) [F74-OA2]

[3.8.3.11.] 3.8.3.11. ([2] 2) [F74-OA2]

[3.8.3.12.] 3.8.3.12. ([1] 1) [F74-OA2]

[3.8.3.12.] 3.8.3.12. ([1] 1) [F72-OH2.1]

[3.8.3.12.] 3.8.3.12. ([1] 1) ([d] d)([i] i) [F74-OA2]

[3.8.3.12.] 3.8.3.12. ([1] 1) ([f] f),([g] g) [F30,F20-OS3.1]

[3.8.3.12.] 3.8.3.12. ([1] 1) ([f] f) and ([g] g)

[3.8.3.12.] 3.8.3.12. ([1] 1) ([h] h) [F30-OS3.1]

[3.8.3.12.] 3.8.3.12. ([1] 1) no attributions

[3.8.3.13.] 3.8.3.13. ([1] 1) [F74-OA2]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([b] b) [F10-OS3.7]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([c] c)

[3.8.3.13.] 3.8.3.13. ([1] 1) ([d] d)

[3.8.3.13.] 3.8.3.13. ([1] 1) ([f] f)

[3.8.3.13.] 3.8.3.13. ([1] 1) ([g] g) [F30-OS3.1]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([i] i) [F74-OA2]

[3.8.3.13.] 3.8.3.13. ([1] 1) [F72-OH2.1] [F71-OH2.3]

[3.8.3.13.] 3.8.3.13. ([1] 1) ([b] b) [F74-OA2]

[3.8.3.13.] 3.8.3.13. ([2] 2) [F72-OH2.1] [F71-OH2.3]

[3.8.3.14.] 3.8.3.14. ([1] 1) [F74-OA2]

[3.8.3.14.] 3.8.3.14. ([1] 1) [F72-OH2.1]

[3.8.3.15.] 3.8.3.15. ([1] 1) [F74-OA2]

[3.8.3.15.] 3.8.3.15. ([1] 1) ([d] d) [F30-OS3.1]

[3.8.3.15.] 3.8.3.15. ([1] 1) ([a] a)

[3.8.3.15.] 3.8.3.15. ([2] 2) [F74-OA2]

[3.8.3.15.] 3.8.3.15. ([2] 2) ([f] f) [F30-OS3.1]

[3.8.3.15.] 3.8.3.15. ([2] 2) ([c] c)

[3.8.3.16.] 3.8.3.16. ([1] 1) [F74-OA2]

[3.8.3.16.] 3.8.3.16. ([1] 1) [F71-OH2.3]

[3.8.3.16.] 3.8.3.16. ([1] 1) ([f] f) [F31-OS3.2]

[3.8.3.16.] 3.8.3.16. ([2] 2) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([1] 1) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([1] 1) ([d] d),([e] e) [F30-OS3.1]

[3.8.3.17.] 3.8.3.17. ([1] 1) ([f] f) [F30-OS3.1]

[3.8.3.17.] 3.8.3.17. ([1] 1) ([h] h) [F31-OS3.2]

[3.8.3.17.] 3.8.3.17. ([2] 2) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([2] 2) [F71-OH2.3]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([a] a) [F73-OA1]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([b] b) [F10-OS3.7]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([b] b) [F74-OA2]

[3.8.3.17.] 3.8.3.17. ([2] 2) ([g] g) [F74-OA2]

[3.8.3.18.] 3.8.3.18. ([1] 1) [F74-OA2]

[3.8.3.19.] 3.8.3.19. ([1] 1) [F74-OA2]

[3.8.3.19.] 3.8.3.19. ([1] 1) [F11-OS3.7]

[3.8.3.19.] 3.8.3.19. ([2] 2) [F74-OA2]

[3.8.3.20.] 3.8.3.20. ([1] 1) [F74-OA2]

[3.8.3.21.] 3.8.3.21. ([1] 1) [F74-OA2]

[3.8.3.21.] 3.8.3.21. ([2] 2) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([1] 1) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([1] 1) [F30-OS3.1]

[3.8.3.22.] 3.8.3.22. ([1] 1) ([d] d) [F10-OS3.7]

[3.8.3.22.] 3.8.3.22. ([2] 2) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([2] 2) [F30-OS3.1]

[3.8.3.22.] 3.8.3.22. ([3] 3) ([a] a) [F10-OS3.7]

[3.8.3.22.] 3.8.3.22. ([3] 3) [F74-OA2]

[3.8.3.22.] 3.8.3.22. ([4] 4) [F10-OS3.7]

[3.8.4.2.] -- ([1] --) [F30-OS3.1]

[3.8.4.2.] -- ([1] --) [F74-OA2]

Submit a comment

Proposed Change 2028

Code Reference(s):	**NBC20 Div.B 3.8.1. (first printing)**
Subject:	Accessibility, Visitability and Adaptability of Dwelling Units
Title:	Expanding the Scope of the Accessibility Requirements
Description:	This proposed change expands the scope of the accessibility requirements in Section 3.8. to include proposed Subsections 3.8.4. and 3.8.5.
Related Proposed Change(s):	PCF 1880, PCF 1881, PCF 1883, PCF 1957

This change could potentially affect the following topic areas:

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

General information

See the summary for subject Accessibility, Visitability and Adaptability of Dwelling Units.

Problem

Technical requirements in the general area of the adaptability and visitability of dwelling units have been developed for consideration in the 2025 edition of the National Building Code of Canada (NBC). A complementary proposed change, PCF 1881, proposes to include these technical requirements in new Subsections 3.8.4. and 3.8.5.

However, the scope of Section 3.8. (as stated in Article 3.8.1.1.) is currently limited to Subsections 3.8.2. and 3.8.3. The scope of Section 3.8. needs to be expanded to include proposed Subsections 3.8.4. and 3.8.5. that address the design of dwelling units with respect to adaptability and visitability.

Justification

This proposed change expands the scope of Section 3.8. (as stated in Article 3.8.1.1.) to include proposed Subsections 3.8.4. and 3.8.5.

This proposed change would allow different levels of technical requirements related to the adaptability and visitability of dwelling units to explicitly fall within the scope of Section 3.8.

PROPOSED CHANGE

NBC20 Div.B 3.8.1. (first printing)

[3.8.1.] 3.8.1. Scope

[3.8.1.1.] 3.8.1.1. Scope

[1] 1) This Section is concerned with the *barrier-free* design of *buildings*.

[2] 2) Except as provided in Sentence (3), ~~B~~*buildings* and their facilities required to be *barrier-free* in accordance with Subsection 3.8.2. shall be designed in accordance with Subsection 3.8.3.

[3] --) *Dwelling units* required to comply with Sentences 3.8.2.1.(3) and (4) (PCF 1881) shall be designed in accordance with Subsections 3.8.4. and 3.8.5.

Impact analysis

This proposed change does not, on its own, introduce any new costs because it simply expands the NBC framework to explicitly include proposed Subsections 3.8.4. and 3.8.5. within the scope of Section 3.8. These proposed Subsections are necessary to position new technical requirements for the adaptability and visitability of dwelling units. However, the future introduction of specific technical requirements that are related to accessibility, but are beyond the scope of this proposed change, may introduce costs. These future technical requirements would be developed through separate proposed changes (with stand-alone impact analyses) that would undergo typical cross-committee coordination and public review procedures so that the members of Code committees and Code users can make informed recommendations on the progression of such proposed changes.

This proposed change is necessary to explicitly include new Subsections 3.8.4. and 3.8.5. within the scope of Section 3.8. Enabling the NBC framework to include these proposed Subsections, which are related to the adaptable and visitable design of dwelling units, would simplify use of the NBC for Code users.

Enforcement implications

No enforcement implications are expected as a result of this proposed change, as it simply expands the scope of NBC Section 3.8. to include proposed Subsections 3.8.4. and 3.8.5.

Who is affected

This proposed change does not directly affect Code users because expanding the scope of NBC Section 3.8. does not present new technical requirements.

However, the expanded framework to consolidate the proposed requirements for the adaptable and visitable design of dwelling units (facilitated by this proposed change to the scope of Section 3.8.) should simplify use of the NBC for Code users by allowing them to find relevant accessibility requirements in stand-alone Subsections 3.8.4 and 3.8.5.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

NBC20 Div.B 3.8.1. (first printing)

[3.8.1.1.] 3.8.1.1. ([1] 1) no attributions

[3.8.1.1.] 3.8.1.1. ([2] 2) no attributions

[3.8.1.1.] 3.8.1.1. ([2] 2) no attributions

Cost impact of climatic load changes on Part 9: Adopting Part 4 proposed new return periods in PCF 2048

Currently, the 1-in-50-year snow loads are used to calculate the specific snow load in Part 9, which is used in various requirements to define the application of a requirement or in tables where structural members are selected based on the specified snow load. The 1-in-50-year wind loads (hourly wind pressures) are used directly in several requirements to define the application.

To align Part 9 with the Part 4 approach, which introduces longer return periods for snow and wind loads under PCF 1980, reference is made to the 1-in-1000-year snow loads for the calculation of specified snow loads and the 1-in-500-year hourly wind pressures. PCF 2048 introduces these longer return periods in Part 9 and the resulting cost impact is summarized in this document.

The specified snow loads are used in the following requirements:

- Platforms subject to snow and occupancy loads (Sentence 9.4.2.3.(1))
- Performance of windows, doors and skylight (Sentence 9.7.3.1.(2))
- Columns (Subclause 9.17.1.1.(1)(b)(ii))
- Ridge support (Sentence 9.23.14.8.(5) and Table 9.23.14.8., Rafter-to-joist nailing (unsupported ridge))
- ICF lintels (Sentence 9.20.17.4.(3) and Span Tables 9.20.17.4.-A, 9.20.17.4.-B and 9.20.17.4.-C)
- Spans for joists, rafters and beams (Sentence 9.23.4.2.(1))
    - Roof joists (Span Tables 9.23.4.2.-D and 9.23.4.2.-E)
    - Roof rafters (Span Tables 9.23.4.2.-F and 9.23.4.2.-G)
    - Built-up ridge beams and lintels supporting the roof (Span Table 9.23.4.2.-L)
    - Lintels for various wood species (Span Tables 9.23.12.3.-A, 9.23.12.3.-B, 9.23.12.3.-C and 9.23.12.3.-D)

The hourly wind pressures are used in the following requirements:

- Structural sufficiency of glass (Sentence 9.6.1.3.(2))
- Nailing of framing – roof trusses, rafters and joists to wall framing (Sentence 9.23.3.4.(3))
- Fasteners for sheathing (Article 9.23.3.5.)
- Anchorage of building frames (Sentence 9.23.6.1.(3))
- Required roof sheathing (Sentence 9.23.16.1.(1))
- Lumber roof sheathing (Article 9.23.16.5.)
- Attachment of cladding to flat ICF wall units (Sentence 9.27.5.4.(2))

General approach

As per the Policies and Procedures, Appendix G, the unit cost of material, labour and overhead/profit are obtained from RS Means. RS Means' cost database is a comprehensive collection of industry construction cost data that can be used to develop estimates for construction projects. All costs contained herein have been converted from the US national average cost to Canadian national average. The costs are based on 2023 construction cost data.

To determine overall costs, material quantities are calculated using archetypes and measured in AutoCAD to obtain lengths, areas, etc. Each archetype is described in the sections below.

First, all costs are calculated for a given archetype based on the climatic data in Table C-2 of Appendix C in NBC 2020 (herein this will be referred to as "before the change"). Then, the costs are recalculated using the new climatic data provided in the proposed change form, PCF 1979, for the 1-in-1000-year snow loads and the 1-in-500-year hourly wind pressures (herein this will be referred to as "after the change") referenced in PCF 2048. The difference between the costs is determined, which gives the cost impact of the proposed change.

Snow loads

The new 1-in-1000-year snow load data results in a change in specified snow loads in most of the 680 locations in Table C-2 of PCF 1979. However, not all specified snow loads increase because a modification to the calculation of specified snow loads is proposed in PCF 2048, which divides the current formula by 1.5. As a result, the specified snow load remains the same in 41 locations (neutral), goes up in 154 locations (adverse) and goes down in the remaining 485 locations (beneficial).

Platforms subject to snow and occupancy loads (Sentence 9.4.2.3.(1))

The approach used to assess the cost impact of the proposed change on exterior platforms is to use an archetype exterior platform, in this case, a 3.5 m by 4 m long exterior platform. Sentence 9.4.2.3.(1) requires that exterior platforms be designed for a use and occupancy load of 1.9 kPa or the specified snow load, whichever is greater.

For locations where the specified snow load is less than 1.9 kPa before and after the change, there will be no impact. This is the case for exterior platform design in a total of 483 out of the 680 locations in Table C-2 in PCF 1979.

For the remaining 197 locations, there is potential impact. For the design of exterior platforms, the span tables can be used to select the required wood joists and built-up beams needed based on the specified snow load in a given location. The span tables provide values for specified snow loads of 1.0 kPa, 1.5 kPa, 2.0 kPa, 2.5 kPa, 3.0 kPa and for 3.5kPa and 4.0 kPa by way of an appendix note.

For locations where the specified snow load before and after the change remains between the same range (e.g., between 1.0 kPa and 1.5 kPa), there is no impact. This is the case for 115 locations. This leaves 82 locations out of a total of 680 locations in Table C-2 in PCF 1979 with potential impact resulting from PCF 2048.

Assessment of these 82 locations using the archetype, span tables and costs from RS Means, found that there are 16 locations that experience a cost increase (see Table below), ranging from $47.77 to $291.81, and 37 locations that experience a cost decrease (see Table below), ranging from $47.77 to $126.43. Note, there are 24 additional locations to those noted above that are not impacted because the same joist and built-up beam size is sufficient before and after the proposed change, based on the spans used in the archetype.

Province and Location	Province	Cost **NBC 2020**	Cost **PCF1979/ PCF 2048**	Cost Difference
Alberni	BC	$542.61	$590.38	$47.77
Burns Lake	BC	$669.04	$590.38	-$78.66
Campbell River	BC	$542.61	$669.04	$126.43
Greenwood	BC	$669.04	$590.38	-$78.66
Lytton	BC	$542.61	$590.38	$47.77
Mackenzie	BC	$817.80	$716.81	-$100.99
McBride	BC	$716.81	$669.04	-$47.77
Nakusp	BC	$716.81	$669.04	-$47.77
Ocean Falls	BC	$716.81	$1,008.62	$291.81
Port Alberni	BC	$542.61	$590.38	$47.77
Prince George	BC	$669.04	$590.38	-$78.66
Salmon Arm	BC	$669.04	$542.61	-$126.43
Smithers	BC	$669.04	$590.38	-$78.66
North Vancouver	BC	$542.61	$669.04	$126.43
Bancroft	ON	$669.04	$590.38	-$78.66
Bracebridge	ON	$669.04	$590.38	-$78.66
Earlton	ON	$669.04	$590.38	-$78.66
Timmins	ON	$669.04	$542.61	-$126.43
Amos	QC	$669.04	$542.61	-$126.43
Kuujjuarapik	QC	$716.81	$669.04	-$47.77
Loretteville	QC	$716.81	$669.04	-$47.77
Malartic	QC	$669.04	$542.61	-$126.43
Montmagny	QC	$669.04	$590.38	-$78.66
Nitchequon	QC	$669.04	$590.38	-$78.66
Noranda	QC	$669.04	$542.61	-$126.43
Québec	QC	$716.81	$669.04	-$47.77
Sainte-Foy	QC	$716.81	$669.04	-$47.77
Rivière-du-Loup	QC	$716.81	$669.04	-$47.77
Rouyn	QC	$669.04	$542.61	-$126.43
Saguenay (Jonquière)	QC	$669.04	$542.61	-$126.43
Saguenay (Kénogami)	QC	$669.04	$542.61	-$126.43
Saint-Hubert-de-Rivière-du-Loup	QC	$817.80	$716.81	-$100.99
Saint-Nicolas	QC	$716.81	$669.04	-$47.77
Senneterre	QC	$669.04	$590.38	-$78.66
Shawinigan	QC	$669.04	$590.38	-$78.66
Thetford Mines	QC	$716.81	$669.04	-$47.77
Val-d'Or	QC	$669.04	$590.38	-$78.66
Victoriaville	QC	$669.04	$590.38	-$78.66
Boiestown	NB	$716.81	$669.04	-$47.77
Grand Falls	NB	$716.81	$669.04	-$47.77
Louisbourg	NS	$542.61	$590.38	$47.77
Argentia	NL	$669.04	$590.38	-$78.66

Province and Location	Province	Cost **NBC 2020**	Cost **PCF1979/ PCF 2048**	Cost Difference
Grand Bank	NL	$669.04	$590.38	-$78.66
Twin Falls	NL	$817.80	$716.81	-$100.99
Watson Lake	YT	$542.61	$590.38	$47.77
Fort McPherson	NT	$542.61	$590.38	$47.77
Inuvik	NT	$542.61	$590.38	$47.77
Norman Wells	NT	$542.61	$590.38	$47.77
Tungsten	NT	$669.04	$716.81	$47.77
Arviat	NU	$542.61	$590.38	$47.77
Iqaluit	NU	$542.61	$590.38	$47.77
Kangiqiniq / Rankin Inlet	NU	$542.61	$590.38	$47.77
Kugluktuk / Coppermine	NU	$542.61	$669.04	$126.43

Performance of windows, doors and skylight (Sentence 9.7.3.1.(2))

In the 154 locations where the snow loads increase, there is potential for impact on the structural design of skylights. The magnitude of the cost impact could not be determined without industry knowledge on the structural design of skylights including the capacity of the skylight frames and glazing.

Columns (Subclause 9.17.1.1.(1)(b)(ii))

To assess the cost impact of the proposed change on columns an exterior platform with dimensions of 2.44 m by 4 m is used; it is assumed to be raised from the ground by 3 m. Three columns are used to support a beam at the front edge of the deck along the 4 m length.

Subclause 9.17.1.1.(1)(b)(ii) limits the application of Section 9.17. to columns supporting exterior platforms where the sum of the specified snow load and the occupancy load (1.9 kPa) does not exceed 4.8 kPa. Therefore, in locations where the sum of the specified snow load and the occupancy load remains below 4.8 kPa before and after the change, there will be no impact. This is the case for 657 out of the 680 locations in Table C-2 in PCF 1979.

Assessment of the remaining 23 location using the archetype, Part 4 column design and costs from RS Means found that 1 location experiences an increase in cost of **$290.86**, while 3 locations experience a decrease in cost of the same amount (see Table 4). The other 19 locations experience neither an increase or decrease because the same column size is applicable both before and after the proposed change.

Province and Location	Province	Cost Difference
Mackenzie	BC	-$290.86
Ocean Falls	BC	$290.86
Saint-Hubert-de-Rivière-du-Loup	QC	-$290.86
Twin Falls	NL	-$290.86

Ridge support (Sentence 9.23.14.8.(5) and Table 9.23.14.8., rafter-to-joist nailing (unsupported ridge))

To assess the cost impact of the proposed change on the nailed connection between a roof rafter and ceiling joist or collar tie, a 120 m^2 bungalow is used as an archetype (see Figure 1).

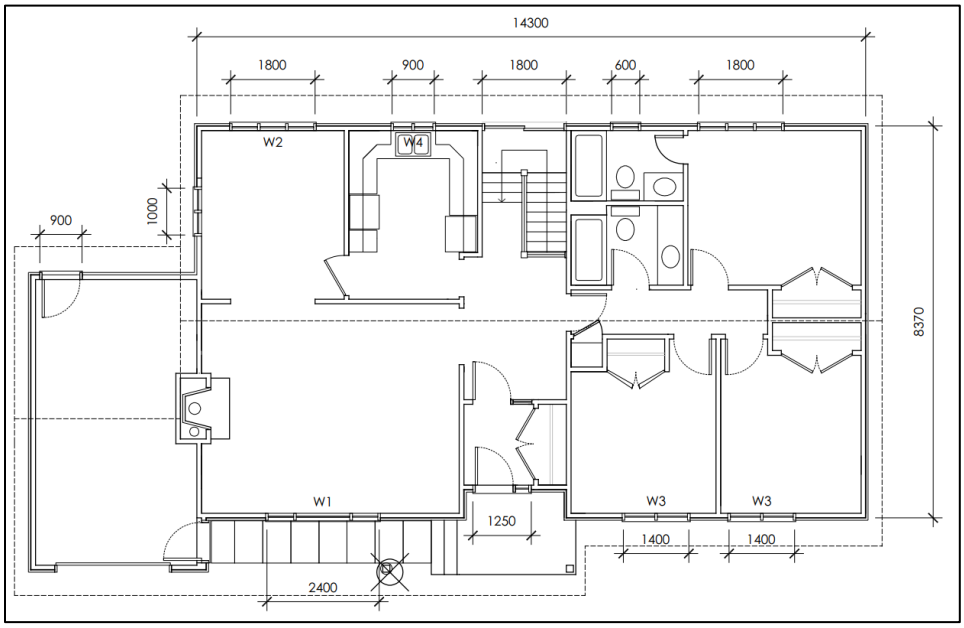

Figure 1 – 120 m^2 bungalow archetype

Table 9.23.14.8. provides the number of nails to be used at the rafter-to-joist connection for a 1.0 kPa, 1.5 kPa and 2.0 kPa specified snow load. In locations where the specified snow load remains within the same range there is no impact. This is the case for 481 locations. Of the remaining 199 locations, 29 experience an increase in the number of nails (maximum 3 additional nails), 112 experience a decrease in required number of nails (maximum 3 less nails) and an additional 58 are not impacted because the same number of nails are sufficient before and after the change.

Table 9.23.14.8. is used in the analysis to determine the number of nails in locations less than or equal to 2.0 kPa, while connection design using CSA O86-19 is used for locations with a specified snow load greater than 2.0 kPa.

Based on the archetype, adding 3 additional nails to each rafter-to-joist connection results in an additional material cost of **$5.54** for a 120 m^2 bungalow with wood framed construction.

Location	Province	Required Number of Nails (Part 4 Design) **NBC 2020**	Required Number of Nails (Part 4 Design) **PCF 2048**	Additional Nails Required
Abbotsford	BC	10	11	1
Agassiz	BC	13	14	1
Bamfield	BC	7	10	3
Bella Bella	BC	15	16	1

Location	Province	Required Number of Nails (Part 4 Design) **NBC 2020**	Required Number of Nails (Part 4 Design) **PCF 2048**	Additional Nails Required
Bella Coola	BC	20	21	1
Burns Lake	BC	14	13	-1
Campbell River	BC	13	14	1
Castlegar	BC	16	15	-1
Chetwynd	BC	11	10	-1
Crescent Valley	BC	16	15	-1
Dease Lake	BC	11	10	-1
Fernie	BC	17	16	-1
Glacier	BC	31	28	-3
Golden	BC	15	14	-1
Gold River	BC	14	15	1
Greenwood	BC	14	13	-1
Mackenzie	BC	19	18	-1
McLeod Lake	BC	16	15	-1
Montrose	BC	15	14	-1
Nakusp	BC	16	15	-1
Nelson	BC	16	15	-1
Ocean Falls	BC	18	19	1
Port Hardy	BC	7	10	3
Prince George	BC	14	13	-1
Revelstoke	BC	24	22	-2
Salmon Arm	BC	14	13	-1
Sandspit	BC	10	11	1
Sechelt	BC	10	11	1
Smithers	BC	14	13	-1
Smith River	BC	11	10	-1
Stewart	BC	30	29	-1
Trail	BC	15	14	-1
Ucluelet	BC	7	10	3
Burnaby (Simon Fraser Univ.)	BC	15	16	1
New Westminster	BC	10	11	1
North Vancouver	BC	13	14	1
Victoria (Mt Tolmie)	BC	10	11	1
Whistler	BC	35	34	-1
Youbou	BC	17	18	1
Cold Lake	AB	10	7	-3
Hinton	AB	11	10	-1
Assiniboia	SK	7	10	3
Broadview	SK	10	7	-3
Dafoe	SK	10	7	-3

Location	Province	Required Number of Nails (Part 4 Design) **NBC 2020**	Required Number of Nails (Part 4 Design) **PCF 2048**	Additional Nails Required
Estevan	SK	7	10	3
Meadow Lake	SK	10	7	-3
Melville	SK	10	7	-3
Lynn Lake	MB	11	10	-1
Split Lake	MB	11	10	-1
Thompson	MB	11	10	-1
Alliston	ON	11	10	-1
Aurora	ON	11	10	-1
Bancroft	ON	14	13	-1
Bracebridge	ON	14	13	-1
Burlington	ON	10	7	-3
Cavan	ON	11	10	-1
Earlton	ON	14	13	-1
Embro	ON	11	10	-1
Forest	ON	11	10	-1
Fort Frances	ON	11	10	-1
Hamilton	ON	10	7	-3
Hastings	ON	11	10	1
Hornepayne	ON	15	14	-1
Kitchener	ON	11	10	-1
Mattawa	ON	11	10	-1
Mississauga	ON	10	7	-3
Mississauga (Lester B. Pearson Int'l Airport)	ON	10	7	-3
Newmarket	ON	11	10	-1
Oakville	ON	10	7	-3
Peterborough	ON	11	10	-1
Picton	ON	11	10	-1
Sarnia	ON	10	7	-3
Schreiber	ON	15	14	-1
Shelburne	ON	14	13	-1
Etobicoke	ON	10	7	-3
Vaughan (Woodbridge)	ON	10	7	-3
Waterloo	ON	11	10	-1
Wawa	ON	15	14	-1
Alma	QC	15	14	-1
Amos	QC	14	13	-1
Baie-Saint-Paul	QC	16	15	-1
Beauport	QC	16	15	-1
Dolbeau	QC	15	14	-1

Location	Province	Required Number of Nails (Part 4 Design) **NBC 2020**	Required Number of Nails (Part 4 Design) **PCF 2048**	Additional Nails Required
Gagnon	QC	18	17	-1
Gaspé	QC	19	18	-1
Havre-Saint-Pierre	QC	18	17	-1
Inukjuak	QC	16	15	-1
Joliette	QC	14	13	-1
Kuujjuarapik	QC	17	16	-1
La Malbaie	QC	15	14	-1
La Tuque	QC	15	14	-1
Loretteville	QC	17	16	-1
Malartic	QC	14	13	-1
Matane	QC	16	15	-1
Montmagny	QC	14	13	-1
Nitchequon	QC	15	13	-2
Noranda	QC	14	13	-1
Port-Cartier	QC	17	16	-1
Puvirnituq	QC	17	16	-1
Ancienne-Lorette	QC	16	15	-1
Lévis	QC	16	15	-1
Québec	QC	16	15	-1
Sainte-Foy	QC	17	16	-1
Sillery	QC	15	14	-1
Roberval	QC	15	14	-1
Rock Island	QC	11	10	-1
Rouyn	QC	13	12	-1
Saguenay (Jonquière)	QC	14	13	-1
Saguenay (Kénogami)	QC	14	13	-1
Sainte-Agathe-des-Monts	QC	15	14	-1
Saint-Félicien	QC	15	14	-1
Saint-Hubert-de-Rivière-du-Loup	QC	19	18	-1
Saint-Nicolas	QC	16	15	-1
Senneterre	QC	14	13	-1
Shawinigan	QC	14	13	-1
Tadoussac	QC	16	15	-1
Val-d'Or	QC	14	13	-1
Victoriaville	QC	14	13	-1
Bathurst	NB	18	17	-1
Edmundston	NB	16	15	-1
Miramichi	NB	16	15	-1
Moncton	NB	15	14	-1
Shippagan	NB	16	15	-1

Location	Province	Required Number of Nails (Part 4 Design) **NBC 2020**	Required Number of Nails (Part 4 Design) **PCF 2048**	Additional Nails Required
Buchans	NL	20	19	-1
Corner Brook	NL	17	16	-1
Gander	NL	17	16	-1
Grand Falls	NL	16	15	-1
Labrador City	NL	18	17	-1
St. Anthony	NL	24	23	-1
Twin Falls	NL	19	18	-1
Wabana	NL	15	16	1
Wabush	NL	18	17	-1
Tungsten	NT	16	17	1
Arctic Bay	NU	10	11	1
Baker Lake	NU	14	15	1
Eureka	NU	7	10	3
Igluligaarjuk / Chesterfield Inlet	NU	14	16	2
Kanngiqtugaapik / Clyde River	NU	16	17	1
Kugluktuk / Coppermine	NU	13	14	1
Resolution Island	NU	20	21	1
Salliq / Coral Harbour	NU	15	16	1

ICF lintels (Sentence 9.20.17.4.(3) and Span Tables 9.20.17.4.-A, 9.20.17.4.-B and 9.20.17.4.-C)

To assess the cost impact of the proposed change on insulating concrete form (ICF) lintels, an approximate 120 m^2 bungalow is used assuming 150 mm thick ICF walls (see Figure 1 above).

The three largest windows with openings of 2.4 m, 1.8 m and 1.4 m along with patio door and front entrance door, both of equal to or similar size opening to the window opening sizes, are analysed. ICF lintel sizes before and after the proposed change were determined using the ICF span tables in the NBC and using lintel span tables from an ICF manufacturer where the ground snow load, S_s, is more than 3.33 kPa (the upper limit of the ICF span tables in the NBC). Where the ground snow load exceeds 5.15 kPa, the size of lintels was not determined.

In locations where the ground snow load before and after the proposed change remains below or equal to 1.5 kPa, there will be no impact. This occurs in only 6 locations. In locations where the ICF lintel size is sufficient to support the snow load before and after the change, there will be no impact. This occurs in 105 out of the 680 locations in Table C-2 of PCF 1979. Sixty-two (62) locations have a ground snow load that exceeds both the span tables in the NBC and those provided by an ICF manufacturer. In these locations, concrete beam design using Part 4 is needed, which likely requires a structural engineer and additional material and labour costs.

For the remaining 507 locations not accounted for above, the proposed change results in an increased cost for the ICF lintels between **$6.71** to **$88.46** for a 120 m^2 bungalow with 150 mm thick ICF walls.

Spans for joists, rafters and beams (Sentence 9.23.4.2.(1))

As per above, to assess the impact of the future projected climatic data on the span tables (roof joists, roof rafters, built-up ridge beams and lintels) in Part 9 an approximate 120 m^2 bungalow is used (refer to Figure 1). Each of the span tables for wood members supporting snow loads provide member sizes for specified snow loads of 1.0 kPa, 1.5 kPa, 2.0 kPa, 2.5 kPa, 3.0 kPa; and, 3.5 kPa and 4.0 kPa by way of an appendix note. For locations where the specified snow load before and after the change remains between the same range (e.g., between 1.0 kPa and 1.5 kPa), there is no impact. This the case for 589 locations out of the 680 locations in Table C-2 of PCF 1979.

The impact of the proposed change on roof joists, roof rafters, built-up ridge beams and lintels, for the remaining 91 locations are summarized below.

Roof joists (Span Tables 9.23.4.2.-D and 9.23.4.2.-E)

Ten of the of the 91 locations experience a cost increase of approximately $1,850.00, while 39 locations experience a cost decrease of the same amount (see Table below). Thirty-seven locations do not experience an impact because the same roof joist size is sufficient before and after the proposed change, based on the spans used in the archetype. Five locations have a specified snow load that exceeds 4.0 kPa and cannot use the span tables to determine the size of roof joists required either before or after the proposed change, so the cost impact was not determined for these locations.

Location	Province	Cost **NBC 2020**	Cost **PCF 2048**	Cost Difference
Bamfield	BC	$6,725.16	$8,579.88	$1,854.72
Burns Lake	BC	$10,429.56	$8,579.88	-$1,849.68
Campbell River	BC	$8,579.88	$10,429.56	$1,849.68
Greenwood	BC	$10,429.56	$8,579.88	-$1,849.68
Mackenzie	BC	$12,164.01	$10,429.56	-$1,734.45
Ocean Falls	BC	$10,429.56	$12,164.01	$1,734.45
Port Hardy	BC	$6,725.16	$8,579.88	$1,854.72
Prince George	BC	$10,429.56	$8,579.88	-$1,849.68
Salmon Arm	BC	$10,429.56	$8,579.88	-$1,849.68
Smithers	BC	$10,429.56	$8,579.88	-$1,849.68
Ucluelet	BC	$6,725.16	$8,579.88	$1,854.72
North Vancouver	BC	$8,579.88	$10,429.56	$1,849.68
Cold Lake	AB	$8,579.88	$6,725.16	-$1,854.72
Assiniboia	SK	$6,725.16	$8,579.88	$1,854.72
Broadview	SK	$8,579.88	$6,725.16	-$1,854.72
Dafoe	SK	$8,579.88	$6,725.16	-$1,854.72
Estevan	SK	$6,725.16	$8,579.88	$1,854.72
Meadow Lake	SK	$8,579.88	$6,725.16	-$1,854.72
Melville	SK	$8,579.88	$6,725.16	-$1,854.72
Bancroft	ON	$10,429.56	$8,579.88	-$1,849.68
Bracebridge	ON	$10,429.56	$8,579.88	-$1,849.68

Location	Province	Cost **NBC 2020**	Cost **PCF 2048**	Cost Difference
Burlington	ON	$8,579.88	$6,725.16	-$1,854.72
Earlton	ON	$10,429.56	$8,579.88	-$1,849.68
Hamilton	ON	$8,579.88	$6,725.16	-$1,854.72
Mississauga	ON	$8,579.88	$6,725.16	-$1,854.72
Mississauga (Lester B. Pearson Int'l Airport)	ON	$8,579.88	$6,725.16	-$1,854.72
Oakville	ON	$8,579.88	$6,725.16	-$1,854.72
Sarnia	ON	$8,579.88	$6,725.16	-$1,854.72
Timmins	ON	$10,429.56	$8,579.88	-$1,849.68
Etobicoke	ON	$8,579.88	$6,725.16	-$1,854.72
Vaughan (Woodbridge)	ON	$8,579.88	$6,725.16	-$1,854.72
Amos	QC	$10,429.56	$8,579.88	-$1,849.68
Malartic	QC	$10,429.56	$8,579.88	-$1,849.68
Montmagny	QC	$10,429.56	$8,579.88	-$1,849.68
Nitchequon	QC	$10,429.56	$8,579.88	-$1,849.68
Noranda	QC	$10,429.56	$8,579.88	-$1,849.68
Rouyn	QC	$10,429.56	$8,579.88	-$1,849.68
Saguenay (Jonquière)	QC	$10,429.56	$8,579.88	-$1,849.68
Saguenay (Kénogami)	QC	$10,429.56	$8,579.88	-$1,849.68
Saint-Hubert-de-Rivière-du-Loup	QC	$12,164.01	$10,429.56	-$1,734.45
Senneterre	QC	$10,429.56	$8,579.88	-$1,849.68
Shawinigan	QC	$10,429.56	$8,579.88	-$1,849.68
Val-d'Or	QC	$10,429.56	$8,579.88	-$1,849.68
Victoriaville	QC	$10,429.56	$8,579.88	-$1,849.68
Argentia	NL	$10,429.56	$8,579.88	-$1,849.68
Grand Bank	NL	$10,429.56	$8,579.88	-$1,849.68
Twin Falls	NL	$12,164.01	$10,429.56	-$1,734.45
Eureka	NU	$6,725.16	$8,579.88	$1,854.72
Kugluktuk / Coppermine	NU	$8,579.88	$10,429.56	$1,849.68

Roof rafters (Span Tables 9.23.4.2.-F and 9.23.4.2.-G)

Sixteen of the 91 locations experience an increase in roof rafter costs between **$255.30** and **$1,342.89** and 44 locations experience a decrease in roof rafter costs between **$255.30** and **$1,342.89** (see Table below). Twenty-six additional locations are not impacted because the size of the roof rafters is sufficient before and after the proposed change, based on the spans used in the archetype. Five locations have a specified snow load that exceeds 4.0 kPa and cannot use the span tables to determine the size of roof rafters required either before or after the proposed change, so the cost impact was not determined for these locations.

Province and Location	Province	Cost **NBC 2020**	Cost **PCF 2048**	Cost Difference
Abbotsford	BC	$5,082.92	$6,425.81	$1,342.89
Bamfield	BC	$4,827.62	$5,082.92	$255.30
Chetwynd	BC	$6,425.81	$5,082.92	-$1,342.89
Dease Lake	BC	$6,425.81	$5,082.92	-$1,342.89
Mackenzie	BC	$8,262.36	$7,768.70	-$493.66
McBride	BC	$7,768.70	$6,425.81	-$1,342.89
Nakusp	BC	$7,768.70	$6,425.81	-$1,342.89
Ocean Falls	BC	$7,768.70	$8,262.36	$493.66
Parksville	BC	$5,082.92	$6,425.81	$1,342.89
Port Hardy	BC	$4,827.62	$5,082.92	$255.30
Qualicum Beach	BC	$5,082.92	$6,425.81	$1,342.89
Sandspit	BC	$5,082.92	$6,425.81	$1,342.89
Sechelt	BC	$5,082.92	$6,425.81	$1,342.89
Smith River	BC	$6,425.81	$5,082.92	-$1,342.89
Ucluelet	BC	$4,827.62	$5,082.92	$255.30
New Westminster	BC	$5,082.92	$6,425.81	$1,342.89
Victoria (Mt Tolmie)	BC	$5,082.92	$6,425.81	$1,342.89
Cold Lake	AB	$5,082.92	$4,827.62	-$255.30
Hinton	AB	$6,425.81	$5,082.92	-$1,342.89
Assiniboia	SK	$4,827.62	$5,082.92	$255.30
Broadview	SK	$5,082.92	$4,827.62	-$255.30
Dafoe	SK	$5,082.92	$4,827.62	-$255.30
Estevan	SK	$4,827.62	$5,082.92	$255.30
Meadow Lake	SK	$5,082.92	$4,827.62	-$255.30
Melville	SK	$5,082.92	$4,827.62	-$255.30
Lynn Lake	MB	$6,425.81	$5,082.92	-$1,342.89
Split Lake	MB	$6,425.81	$5,082.92	-$1,342.89
Thompson	MB	$6,425.81	$5,082.92	-$1,342.89
Barriefield	ON	$6,425.81	$5,082.92	-$1,342.89
Bradford	ON	$6,425.81	$5,082.92	-$1,342.89
Burlington	ON	$5,082.92	$4,827.62	-$255.30
Cornwall	ON	$6,425.81	$5,082.92	-$1,342.89
Fort Frances	ON	$6,425.81	$5,082.92	-$1,342.89
Gananoque	ON	$6,425.81	$5,082.92	-$1,342.89
Hamilton	ON	$5,082.92	$4,827.62	-$255.30
Kingston	ON	$6,425.81	$5,082.92	-$1,342.89
Mattawa	ON	$6,425.81	$5,082.92	-$1,342.89
Mississauga	ON	$5,082.92	$4,827.62	-$255.30
Mississauga (Lester B. Pearson Int'l Airport)	ON	$5,082.92	$4,827.62	-$255.30
North Bay	ON	$6,425.81	$5,082.92	-$1,342.89
Norwood	ON	$6,425.81	$5,082.92	-$1,342.89
Oakville	ON	$5,082.92	$4,827.62	-$255.30

Province and Location	Province	Cost **NBC 2020**	Cost **PCF 2048**	Cost Difference
Sarnia	ON	$5,082.92	$4,827.62	-$255.30
Tavistock	ON	$6,425.81	$5,082.92	-$1,342.89
Etobicoke	ON	$5,082.92	$4,827.62	-$255.30
Vaughan (Woodbridge)	ON	$5,082.92	$4,827.62	-$255.30
Kuujjuarapik	QC	$7,768.70	$6,425.81	-$1,342.89
Loretteville	QC	$7,768.70	$6,425.81	-$1,342.89
Québec	QC	$7,768.70	$6,425.81	-$1,342.89
Sainte-Foy	QC	$7,768.70	$6,425.81	-$1,342.89
Rivière-du-Loup	QC	$7,768.70	$6,425.81	-$1,342.89
Saint-Hubert-de-Rivière-du-Loup	QC	$8,262.36	$7,768.70	-$493.66
Saint-Nicolas	QC	$7,768.70	$6,425.81	-$1,342.89
Thetford Mines	QC	$7,768.70	$6,425.81	-$1,342.89
Boiestown	NB	$7,768.70	$6,425.81	-$1,342.89
Grand Falls	NB	$7,768.70	$6,425.81	-$1,342.89
Twin Falls	NL	$8,262.36	$7,768.70	-$493.66
Tungsten	NT	$6,425.81	$7,768.70	$1,342.89
Arctic Bay	NU	$5,082.92	$6,425.81	$1,342.89
Eureka	NU	$4,827.62	$5,082.92	$255.30

Built-up ridge beams and lintels supporting the roof (Span Table 9.23.4.2.-L)

Seventeen out of the 91 locations experience an increase in built-up ridge beam costs between $140.24 and $262.66 and 53 locations experience a decrease in cost between $140.24 and $262.66 (see Table below). Twelve locations are not impacted because the size of the built-up ridge beam is sufficient before and after the proposed change, based on the archetype and assuming the 14.3 m long built-up ridge beam is supported every 2.86 m. Nine locations have a specified snow load that exceeds 3.0 kPa and cannot use the span tables to determine the size of the built-up ridge beam required either before or after the proposed change, so the cost impact was not determined for these locations.

Location	Province	Cost **NBC 2020**	Cost **PCF 2048**	Difference
Abbotsford	BC	$645.40	$908.06	$262.66
Bamfield	BC	$505.16	$645.40	$140.24
Burns Lake	BC	$1,061.91	$908.06	-$153.85
Campbell River	BC	$908.06	$1,061.91	$153.85
Chetwynd	BC	$908.06	$645.40	-$262.66
Dease Lake	BC	$908.06	$645.40	-$262.66
Greenwood	BC	$1,061.91	$908.06	-$153.85
Parksville	BC	$645.40	$908.06	$262.66
Port Hardy	BC	$505.16	$645.40	$140.24

Location	Province	Cost **NBC 2020**	Cost **PCF 2048**	Difference
Prince George	BC	$1,061.91	$908.06	-$153.85
Qualicum Beach	BC	$645.40	$908.06	$262.66
Salmon Arm	BC	$1,061.91	$908.06	-$153.85
Sandspit	BC	$645.40	$908.06	$262.66
Sechelt	BC	$645.40	$908.06	$262.66
Smithers	BC	$1,061.91	$908.06	-$153.85
Smith River	BC	$908.06	$645.40	-$262.66
Ucluelet	BC	$505.16	$645.40	$140.24
New Westminster	BC	$645.40	$908.06	$262.66
North Vancouver	BC	$908.06	$1,061.91	$153.85
Victoria (Mt Tolmie)	BC	$645.40	$908.06	$262.66
Cold Lake	AB	$645.40	$505.16	-$140.24
Hinton	AB	$908.06	$645.40	-$262.66
Assiniboia	SK	$505.16	$645.40	$140.24
Broadview	SK	$645.40	$505.16	-$140.24
Dafoe	SK	$645.40	$505.16	-$140.24
Estevan	SK	$505.16	$645.40	$140.24
Meadow Lake	SK	$645.40	$505.16	-$140.24
Melville	SK	$645.40	$505.16	-$140.24
Lynn Lake	MB	$908.06	$645.40	-$262.66
Split Lake	MB	$908.06	$645.40	-$262.66
Thompson	MB	$908.06	$645.40	-$262.66
Bancroft	ON	$1,061.91	$908.06	-$153.85
Barriefield	ON	$908.06	$645.40	-$262.66
Bracebridge	ON	$1,061.91	$908.06	-$153.85
Bradford	ON	$908.06	$645.40	-$262.66
Burlington	ON	$645.40	$505.16	-$140.24
Cornwall	ON	$908.06	$645.40	-$262.66
Earlton	ON	$1,061.91	$908.06	-$153.85
Fort Frances	ON	$908.06	$645.40	-$262.66
Gananoque	ON	$908.06	$645.40	-$262.66
Hamilton	ON	$645.40	$505.16	-$140.24
Kingston	ON	$908.06	$645.40	-$262.66
Mattawa	ON	$908.06	$645.40	-$262.66
Mississauga	ON	$645.40	$505.16	-$140.24
Mississauga (Lester B. Pearson Int'l Airport)	ON	$645.40	$505.16	-$140.24
North Bay	ON	$908.06	$645.40	-$262.66
Norwood	ON	$908.06	$645.40	-$262.66
Oakville	ON	$645.40	$505.16	-$140.24
Sarnia	ON	$645.40	$505.16	-$140.24

Location	Province	Cost **NBC 2020**	Cost **PCF 2048**	Difference
Tavistock	ON	$908.06	$645.40	-$262.66
Timmins	ON	$1,061.91	$908.06	-$153.85
Etobicoke	ON	$645.40	$505.16	-$140.24
Vaughan (Woodbridge)	ON	$645.40	$505.16	-$140.24
Amos	QC	$1,061.91	$908.06	-$153.85
Malartic	QC	$1,061.91	$908.06	-$153.85
Montmagny	QC	$1,061.91	$908.06	-$153.85
Nitchequon	QC	$1,061.91	$908.06	-$153.85
Noranda	QC	$1,061.91	$908.06	-$153.85
Rouyn	QC	$1,061.91	$908.06	-$153.85
Saguenay (Jonquière)	QC	$1,061.91	$908.06	-$153.85
Saguenay (Kénogami)	QC	$1,061.91	$908.06	-$153.85
Senneterre	QC	$1,061.91	$908.06	-$153.85
Shawinigan	QC	$1,061.91	$908.06	-$153.85
Val-d'Or	QC	$1,061.91	$908.06	-$153.85
Victoriaville	QC	$1,061.91	$908.06	-$153.85
Argentia	NL	$1,061.91	$908.06	-$153.85
Grand Bank	NL	$1,061.91	$908.06	-$153.85
Arctic Bay	NU	$645.40	$908.06	$262.66
Eureka	NU	$505.16	$645.40	$140.24
Kugluktuk / Coppermine	NU	$908.06	$1,061.91	$153.85

Lintels for various wood species (Span Tables 9.23.12.3.-A, 9.23.12.3.-B, 9.23.12.3.-C and 9.23.12.3.-D)

The archetype bungalow includes six different opening sizes for the front entrance door, rear patio door, rear garage entrance door and the 8 windows.

Eighteen of the 91 locations experience a lintel cost increase between $32.13 and $84.47 and 64 locations experience a cost decrease between $32.13 and $84.47 (see Table below) as a result of the proposed change, based on the archetype. Nine locations have a specified snow load that exceeds 3.0 kPa and cannot use the span tables to determine the size of the lintel required either before or after the proposed change, so the cost impact was not determined for these locations.

Province and Location	Province	Cost Difference
Abbotsford	BC	$32.13
Bamfield	BC	$41.82
Burns Lake	BC	-$53.88
Campbell River	BC	$53.88
Chetwynd	BC	-$32.13
Dease Lake	BC	-$32.13

Province and Location	Province	Cost Difference
Greenwood	BC	-$53.88
McBride	BC	-$84.47
Nakusp	BC	-$84.47
Parksville	BC	$32.13
Port Hardy	BC	$41.82
Prince George	BC	-$53.88
Qualicum Beach	BC	$32.13
Salmon Arm	BC	-$53.88
Sandspit	BC	$32.13
Sechelt	BC	$32.13
Smithers	BC	-$53.88
Smith River	BC	-$32.13
Ucluelet	BC	$41.82
New Westminster	BC	$32.13
North Vancouver	BC	$53.88
Victoria (Mt Tolmie)	BC	$32.13
Cold Lake	AB	-$41.82
Hinton	AB	-$32.13
Assiniboia	SK	$41.82
Broadview	SK	-$41.82
Dafoe	SK	-$41.82
Estevan	SK	$41.82
Meadow Lake	SK	-$41.82
Melville	SK	-$41.82
Lynn Lake	MB	-$32.13
Split Lake	MB	-$32.13
Thompson	MB	-$32.13
Bancroft	ON	-$53.88
Barriefield	ON	-$32.13
Bracebridge	ON	-$53.88
Bradford	ON	-$32.13
Burlington	ON	-$41.82
Cornwall	ON	-$32.13
Earlton	ON	-$53.88
Fort Frances	ON	-$32.13
Gananoque	ON	-$32.13
Hamilton	ON	-$41.82
Kingston	ON	-$32.13
Mattawa	ON	-$32.13
Mississauga	ON	-$41.82
Mississauga (Lester B. Pearson Int'l Airport)	ON	-$41.82
North Bay	ON	-$32.13
Norwood	ON	-$32.13

Province and Location	Province	Cost Difference
Oakville	ON	-$41.82
Sarnia	ON	-$41.82
Tavistock	ON	-$32.13
Timmins	ON	-$53.88
Etobicoke	ON	-$41.82
Vaughan (Woodbridge)	ON	-$41.82
Amos	QC	-$53.88
Kuujjuarapik	QC	-$84.47
Loretteville	QC	-$84.47
Malartic	QC	-$53.88
Montmagny	QC	-$53.88
Nitchequon	QC	-$53.88
Noranda	QC	-$53.88
Québec	QC	-$84.47
Sainte-Foy	QC	-$84.47
Rivière-du-Loup	QC	-$84.47
Rouyn	QC	-$53.88
Saguenay (Jonquière)	QC	-$53.88
Saguenay (Kénogami)	QC	-$53.88
Saint-Nicolas	QC	-$84.47
Senneterre	QC	-$53.88
Shawinigan	QC	-$53.88
Thetford Mines	QC	-$84.47
Val-d'Or	QC	-$53.88
Victoriaville	QC	-$53.88
Boiestown	NB	-$84.47
Grand Falls	NB	-$84.47
Argentia	NL	-$53.88
Grand Bank	NL	-$53.88
Tungsten	NT	$84.47
Arctic Bay	NU	$32.13
Eureka	NU	$41.82
Kugluktuk / Coppermine	NU	$53.88

Hourly wind pressures

The new 1-in-500-year hourly wind pressure data results in a change in hourly wind pressures in all 680 locations in Table C-2 of PCF 1979. However, to align the new return period with the prescriptive solutions existing in Part 9, the proposed change, PCF 2048, introduces a new equation to determine the "reference hourly wind pressure". The reference hourly wind pressure is the 1-in-500-year hourly wind pressure divided by 1.4. The reference hourly wind pressure is proposed to replace the existing 1-in-50-year hourly wind pressure and when comparing the two, the data still increase for most of the 680 locations, but decreases for 6 locations and remains the same in 8 locations. The order of magnitude for the increase in data is 0.8% to 11.4%.

Structural sufficiency of glass (Sentence 9.6.1.3.(2))

To assess the impact of the proposed change on the structural sufficiency of glass, a 128.5 m^2, two storey detached home is used as the archetype (see Figure 2). The detached home contains five different sized windows with glass areas between 0.57 m^2 and 1.43 m^2.

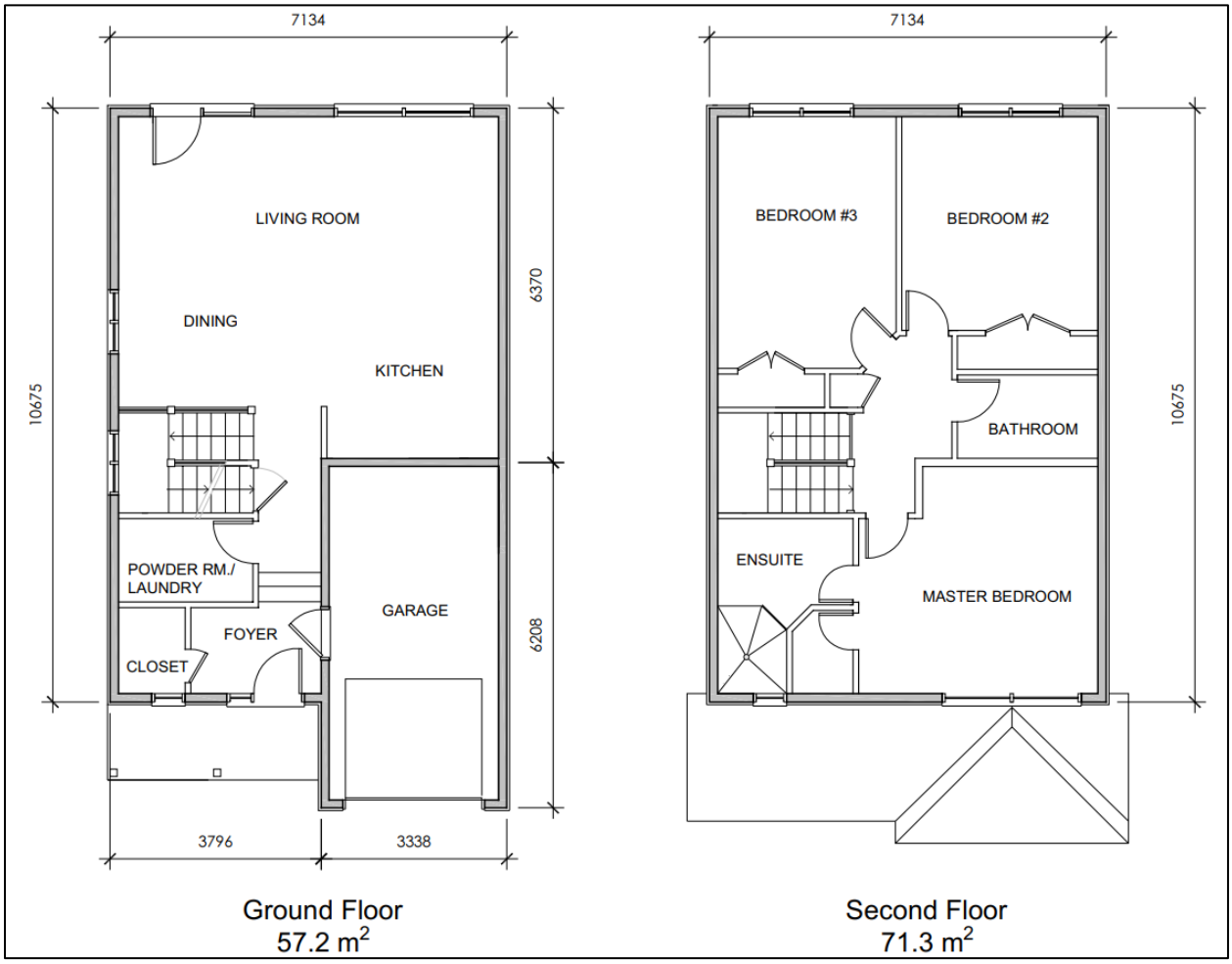

Figure 2 – 128.5 m^2, 2-storey detached house archetype

Tables 9.6.1.3.-A, 9.6.1.3.-B and 9.6.1.3. provide the maximum glass area for windows in locations in Table C-2 with 1-in-50 hourly wind pressures of less than 0.55 kPa, less than 0.75 kPa and less than 1.0 kPa, respectively. For the impact analysis, factory-sealed insulated glass (IG) units are assumed.

For locations where the reference hourly wind pressures remain below the maximum limits provided in the tables before and after the change, there will be no impact. This is the case for 620 out of 680 locations in Table C-2 of PCF 1979. For the remaining 60 locations, there is potential impact. Three locations—Cowley, AB; Cape Race, NL; and Resolution Island, NU—have a reference hourly wind pressure, before and after the proposed change, that exceeds the maximum value of 1.0 kPa provided in the prescriptive table in the NBC. These locations would need to consult the window manufacturer for glass thickness. For the remaining 57 locations out of 60, the proposed change results in an increased cost for windows between **$126.98** to **$353.51** (see Table below) for the 128.5 m^2, 2-storey detached archetype.

Province and Location	Province	Cost Difference
Agassiz	BC	$126.98
Bamfield	BC	$126.98
Prince Rupert	BC	$126.98
Squamish	BC	$126.98
Tofino	BC	$353.51
Ucluelet	BC	$353.51
Battrum	SK	$126.98
Estevan	SK	$126.98
Moose Jaw	SK	$126.98
Swift Current	SK	$126.98
Boissevain	MB	$126.98
Morden	MB	$126.98
Ailsa Craig	ON	$126.98
Ajax	ON	$126.98
Brighton	ON	$126.98
Centralia	ON	$126.98
Cobourg	ON	$126.98
Colborne	ON	$126.98
Embro	ON	$126.98
Exeter	ON	$126.98
Forest	ON	$126.98
Goderich	ON	$126.98
Ingersoll	ON	$126.98
Kincardine	ON	$126.98
Lion's Head	ON	$126.98
Lucan	ON	$126.98
Mississauga (Port Credit)	ON	$126.98
Nanticoke (Jarvis)	ON	$126.98
Nanticoke (Port Dover)	ON	$126.98

Province and Location	Province	Cost Difference
Newcastle	ON	$126.98
Newcastle (Bowmanville)	ON	$126.98
Oshawa	ON	$126.98
Parkhill	ON	$126.98
Pickering (Dunbarton)	ON	$126.98
Picton	ON	$126.98
Port Elgin	ON	$126.98
Port Hope	ON	$126.98
Southampton	ON	$126.98
Thamesford	ON	$126.98
Thedford	ON	$126.98
Whitby	ON	$126.98
Mont-Joli	QC	$126.98
Port-Cartier	QC	$126.98
Rimouski	QC	$126.98
Sept-Îles	QC	$126.98
Tadoussac	QC	$126.98
Moncton	NB	$126.98
Sackville	NB	$126.98
Saint John	NB	$126.98
Antigonish	NS	$126.98
Greenwood (CFB)	NS	$126.98
Kentville	NS	$126.98
Stewiacke	NS	$126.98
Wolfville	NS	$126.98
Grand Bank	NL	$353.51
Echo Bay / Port Radium	NT	$126.98
Baker Lake	NU	$126.98

Nailing of framing – roof trusses, rafters and joists to wall framing (Sentence 9.23.3.4.(3))

To assess the impact of the proposed change on the nailing of framing, specifically for roof truss, rafter or joist connections to wall framing, a 120 m^2 bungalow is used as the archetype (see Figure 1 above).

Currently, where the 1-in-50-year hourly wind pressure is equal to or exceeds 0.8 kPa, roof trusses, rafters or joists are required to be tied to wall framing with connectors than can resist 3 kilonewtons (kN) of roof uplift. Galvanized-steel straps that are 50 mm wide, no less than 0.91 mm thick and allow for fastening at each end with four 63 mm nails are deemed to comply with the roof uplift requirement.

Currently, there are 7 locations out of 680 locations in Table C-2 with a 1-in-50 hourly wind pressure and reference hourly wind pressure that is equal to or exceeds 0.80 kPa. As a result of the climatic data in PCF 1979 and revised requirements in PCF 2048, 2 additional locations would exceed 0.80 kPa.

Using the 120m^2 bungalow archetype, the number of required galvanized-steel connectors are calculated to be approximately 72, resulting in a cost increase for these 2 new locations of **$437.04** (see Table below).

Province and Location	Province	Total Cost Increase
Channel-Port aux Basques	NL	$437.04
St. John's	NL	

Fasteners for sheathing (Article 9.23.3.5.)

To assess the impact of the proposed change on fastening of both roof and wall sheathing, the 128.5 m^2, 2-storey detached house (see Figure 2) is used as an archetype.

Currently, the NBC provides three prescriptive tables to determine fastener size and spacing for sheathing. Application of each table depends on the 1-in-50-year hourly wind pressure and seismic spectral acceleration in a given location. For location where the 1-in-50-year hourly wind pressure is less than 0.8 kPa requirement for fasteners are less stringent than locations with a 1-in-50-year hourly wind pressure that is equal to or exceeds 0.8 kPa.

For locations where the 1-in-50-year hourly wind pressure and the reference hourly wind pressure are both below 0.8 kPa, there will be no impact. This is the case for 671 out of 680 locations. As noted above, there are 7 locations with a 1-in-50 hourly wind pressure (NBC 2020) and reference hourly wind pressure (PCF 1980 and 2048) that is equal to or exceeds 0.80 kPa so there will be no impact in these locations. However, the same 2 locations noted above will exceed 0.8 kPa as a result of PCF 2048 and the data in PCF 1979 and could experience cost increases for both roof and wall sheathing fasteners.

Roof sheathing

As a result of the proposed change, roof sheathing in the 2 new locations would now require larger size fasteners and fasteners spaced at 50 mm within 1 m of the roof edge. For the cost impact analysis common wire nails are assumed. Based on the increase in nail size (51 mm to 63 mm), additional fasteners at the edge of the roof and the size of the archetype roof, a cost increase of **$468.68** is estimated for the 6 new locations (see Table below).

Province and Location	Province	Total Cost Increase
Channel-Port aux Basques	NL	$468.68
St. John's	NL	

Wall sheathing

The impact of the proposed change on fasteners for wall sheathing occurs when braced wall panels are required per Subsection 9.23.13 in the NBC. Similar to the prescriptive tables for roof sheathing, a 1-in-50-year hourly wind pressure of 0.8 kPa acts as a threshold for when braced wall panels with wood-based wall sheathing are required. As a result of the future projected climate data, the same 2 locations

identified above will need to follow the NBC requirements for high wind forces (Article 9.23.13.2.) resulting in a cost increase of **$1,125.30** (see Table below).

To determine the above cost impact, the length of braced wall panels is calculated for the 128.5 m^2 2-storey detached archetype using the braced wall panel spacing and length requirements in Table 9.23.13.5. A total length of 28.2 m is calculated. For the cost assessment, it is assumed that the archetype is constructed without wood-based exterior sheathing (e.g., sheathed with rigid insulation) before the proposed change and now requires some percentage of wood-based sheathing at exterior wall and the interior, end garage wall. In this case, the cost impact is dictated by the requirement for wood-based sheathing (11 mm thick OSB assumed), which requires specific size and spacing of wall sheathing fasteners.

Province and Location	Province	Total Cost Increase
Channel-Port aux Basques	NL	$1,125.30
St. John's	NL	

Anchorage of building frames (Sentence 9.23.6.1.(3))

Similar to the fasteners for wall sheathing, a cost increase for anchorage of building frames is dictated by the need for braced wall panels when the 1-in-50-year hourly wind pressure exceeds 0.8 kPa, which is the case for the 2 new locations noted above. The spacing and length of braced wall panels is calculated as described above. Sentence 9.23.6.1.(3) requires that two anchor be provided for each braced wall panel and that the anchor bolts are either 15.9 mm diameter spaced at 2.4 m or 12.7 mm diameter spaced at 1.7 m. Between braced wall panels the regular requirement for 12.7 mm diameter anchor bolts at 2.4 m is maintained.

For the cost assessment, braced wall panel anchorage with 12.7 mm diameter anchor bolts at 1.7 m is used. As a result of the future projected climatic data in PCF 1979 and the need for braced wall panels, the number of anchor bolts is estimated to increase by 15 for a total cost increase of **$94.20** in the 2 new locations noted (see Table below).

Province and Location	Province	Total Cost Increase
Channel-Port aux Basques	NL	$94.20
St. John's	NL	

Required roof sheathing (Sentence 9.23.16.1.(1))

To assess the impact of the proposed change on required roof sheathing, the 128.5 m^2 2-storey detached bungalow is used. It is assumed that trusses are spaced at 600 mm and before the proposed change the roof is sheathed with panel-type material that would not comply with Subsection 9.23.16. (i.e., sheathing that is too thin for the truss spacing—7.5 mm plywood).

Sentence 9.23.16.1. requires that continuous lumber or panel-type roof sheathing be installed to support the roofing when the 1-in-50 hourly wind pressure is equal to or exceeds 0.8 kPa. Similar to above, 2 locations would be impacted by the change to reference hourly wind pressure and increases in

data and would be required to follow the roof sheathing requirements in Subsection 9.23.16. For this cost assessment, 9.5 mm plywood sheathing, supported at edges, to comply with Subsection 9.23.16. The resulting cost increase from a sheathing that would be deemed to thin for the truss spacing in Sentence 9.23.16.7.(2) to a compliant plywood sheathing is approximately **$168.82**.

Province and Location	Province	Total Cost Increase
Channel-Port aux Basques	NL	$168.82
St. John's	NL	

Lumber roof sheathing (Article 9.23.16.5.)

To assess the impact of the proposed change on lumber roof sheathing the roof area of the 128.5 m^2, 2-storey detached archetype is used.

Currently, Sentence 9.23.16.5. requires that lumber roof sheathing be installed diagonally when the 1-in-50-year hourly wind pressure is equal to or exceeds 0.8 kPa. Therefore, the same 2 locations will be impacted by a change to reference hourly wind pressure and increase above 0.8 kPa as a result of PCF 2048. The cost impact for lumber roof sheathing in these 2 locations is approximately **$311.67** and represents the difference between installing lumber roof sheathing horizontally versus diagonally.

Province and Location	Province	Total Cost Increase
Channel-Port aux Basques	NL	$311.67
St. John's	NL	

Attachment of cladding to flat ICF wall units (Sentence 9.27.5.4.(2)

To assess the impact of the proposed change on the attachment of cladding to flat wall insulating concrete form (ICF) units, the 128.5m^2, 2-storey detached archetype is used. Sentence 9.27.5.4.(2) and Table 9.27.5.4.-B provide the screw size and spacing requirements for the attachment of cladding, trim and furring members to the web fastening strips of flat wall ICF and, currently, limits the application to locations where the 1-in-50-year hourly wind pressure is equal to or less than 0.60 kPa.

For the impact analysis, it is assumed that the cladding is attached to furring that is attached to either the flat wall ICF web fastening strips when permitted or to the solid concrete core of the ICF where the 1-in-50-year hourly wind pressure or the reference hourly wind pressure exceeds 0.6 kPa.

For locations where the 1-in-50-year hourly wind pressure and the reference hourly wind pressure are equal to or less than 0.6 kPa, there will be no impact. This is the case for locations in 619 out of the 680 locations in Table C-2 of PCF 1979. For the remaining 61 locations there is potential impact requiring further assessment.

For locations where the 1-in-50-year hourly wind pressure and reference hourly wind pressure is greater than 0.6 kPa, the impact is assumed to be minimal and would account for additional fasteners. This is the case for 34 of the remaining 61 locations.

The greatest impact is assumed to occur when the 1-in-50-year hourly wind pressure is equal to or less than 0.60 kPa and the reference hourly wind pressure is more than 0.6 kPa. This is the case for 27 locations. The resulting cost increase in these locations for the attachment of cladding to flat ICF walls is approximately **$2,009.15** (see Table below), which represents the different material costs for fasteners into concrete and the additional labour and reduced daily output to attach the furring through the flat wall ICF units into the solid concrete backup wall.

Province and Location	Province	Cost Difference for Strapping
Ocean Falls	BC	
Claresholm	AB	
Kuujjuaq	QC	
Puvirnituq	QC	
Bridgewater	NS	
Digby	NS	
Dartmouth	NS	
Halifax	NS	
Lockeport	NS	
New Glasgow	NS	
North Sydney	NS	
Pictou	NS	
Sydney	NS	
Tatamagouche	NS	$2,009.15
Yarmouth	NS	
Charlottetown	PE	
Souris	PE	
Summerside	PE	
Buchans	NL	
Cape Harrison	NL	
Gander	NL	
Grand Falls	NL	
Stephenville	NL	
Destruction Bay	YT	
Mould Bay	NT	
Isachsen	NU	
Kangiqiniq / Rankin Inlet	NU	

Impact of PCF 2048 on major city centres in each province/territory.

As provided herein, not all locations for each requirement that includes reference to specified snow loads or hourly wind pressures are impacted by the change in return periods. In some cases, major Canadian cities are not impacted by the proposed change. Appendix A provides a table summarizing the results of the cost impact analysis detailed herein for major city centres in each province/territory.

Appendix A

Impact of PCF 2048 on major city centres in each province/territory.

			Climatic Data						Requirements using Snow Loads							
Location	Province	2021 Census Populations	Snow Load, kPa 1/50 Ss NBC 2020	Snow Load, kPa 1/50 Ss PCF 1979	Specified Snow Load (Part 9) S = CbSs + Sr NBC 2020	Specified Snow Load (Part 9) S = CbSs + Sr PCF 1979	Hourly Wind Pressure 1/50 (kPa) NBC 2020	Hourly Wind Pressure 1/50 (kPa) PCF 1979	Impact on Article 9.4.2.3. Platforms	Impact on Article 9.17.1.1. Columns	Impact on Sentence 9.23.14.8.(5) Rafter Nailing	Impact on Sentence 9.20.17.4.(3) ICF Lintels	Impact on Sentence 9.23.4.2.(1) Roof Joists	Impact on Sentence 9.23.4.2.(1) Roof Rafters	Impact on Sentence 9.23.4.2.(4) Built-up Ridge Beam and Lintels	Impact on Sentence 9.23.12.3.(1) Lintels
Kelowna	BC	222162	1.7	1.7	1.04	1.04	0.40	0.42	$0.00	$0.00	$0.00	**$16.51**	$0.00	$0.00	$0.00	$0.00
Vancouver (City Hall)	BC	2642825	1.8	1.8	1.19	1.19	0.45	0.50	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Victoria	BC	397237	1.1	1.1	0.81	0.81	0.57	0.63	$0.00	$0.00	$0.00	**$30.52**	$0.00	$0.00	$0.00	$0.00
Calgary	AB	1481806	1.1	1.1	0.71	0.71	0.48	0.50	$0.00	$0.00	$0.00	**$14.01**	$0.00	$0.00	$0.00	$0.00
Edmonton	AB	1418118	1.7	1.7	1.04	1.04	0.45	0.47	$0.00	$0.00	$0.00	**$16.51**	$0.00	$0.00	$0.00	$0.00
Lethbridge	AB	123847	1.2	1.2	0.76	0.76	0.66	0.69	$0.00	$0.00	$0.00	**$30.52**	$0.00	$0.00	$0.00	$0.00
Prince Albert	SK	45718	1.9	1.9	1.15	1.15	0.38	0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Regina	SK	249217	1.4	1.4	0.87	0.87	0.49	0.51	$0.00	$0.00	$0.00	**$30.52**	$0.00	$0.00	$0.00	$0.00
Saskatoon	SK	317480	1.7	1.7	1.04	1.04	0.46	0.48	$0.00	$0.00	$0.00	**$16.51**	$0.00	$0.00	$0.00	$0.00
Brandon	MB	54268	2.1	2.1	1.36	1.36	0.49	0.51	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Steinbach	MB	17806	2.0	2.0	1.30	1.30	0.40	0.42	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Winnipeg	MB	834678	1.9	1.9	1.25	1.25	0.45	0.47	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Hamilton	ON	785184	1.1	1.1	1.01	1.01	0.46	0.51	$0.00	$0.00	**$5.54**	**$14.01**	$0.00	**-$255.30**	**-$140.24**	**-$41.82**
Ottawa (City Hall)	ON	1135014	2.4	2.4	1.72	1.72	0.41	0.45	$0.00	$0.00	$0.00	**$39.34**	$0.00	$0.00	$0.00	$0.00
Toronto (City Hall)	ON	6202225	0.9	0.9	0.90	0.90	0.44	0.48	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Montréal (City Hall)	QC	4291732	2.6	2.6	1.83	1.83	0.44	0.46	$0.00	$0.00	$0.00	**$54.90**	$0.00	$0.00	$0.00	$0.00
Québec	QC	839311	3.6	3.6	2.58	2.58	0.41	0.43	**-$47.77**	$0.00	**-$5.54**	**$33.56**	$0.00	**-$1,342.89**	$0.00	**-$84.47**
Sherbrooke	QC	227398	2.2	2.2	1.81	1.81	0.32	0.34	$0.00	$0.00	$0.00	**$6.71**	$0.00	$0.00	$0.00	$0.00
Fredericton	NB	108610	3.1	3.1	2.31	2.31	0.38	0.42	$0.00	$0.00	$0.00	**$57.78**	$0.00	$0.00	$0.00	$0.00
Moncton	NB	157717	3.0	3.0	2.25	2.25	0.50	0.55	$0.00	$0.00	**-$5.54**	**$64.49**	$0.00	$0.00	$0.00	$0.00
Saint John	NB	130613	2.3	2.3	1.87	1.87	0.53	0.58	$0.00	$0.00	$0.00	**$39.34**	$0.00	$0.00	$0.00	$0.00
Halifax	NS	465703	1.9	1.9	1.65	1.65	0.58	0.64	$0.00	$0.00	$0.00	$0.00	**-$1,854.72**	$0.00	$0.00	$0.00
New Glasgow	NS	34397	2.2	2.2	1.81	1.81	0.55	0.61	$0.00	$0.00	$0.00	**$6.71**	$0.00	$0.00	$0.00	$0.00
Truro	NS	46157	2.0	2.0	1.70	1.70	0.48	0.53	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Charlottetown	PE	78858	2.7	2.7	2.09	2.09	0.56	0.62	$0.00	$0.00	$0.00	**$54.90**	$0.00	$0.00	$0.00	$0.00
Summerside	PE	18157	3.1	3.1	2.31	2.31	0.60	0.66	$0.00	$0.00	$0.00	**$81.75**	$0.00	$0.00	$0.00	$0.00
Corner Brook	NL	29762	3.7	3.7	2.64	2.64	0.55	0.61	$0.00	$0.00	**-$5.54**	$0.00	$0.00	$0.00	$0.00	$0.00
Grand Falls	NL	13853	3.4	3.4	2.47	2.47	0.60	0.66	$0.00	$0.00	**-$5.54**	**$49.12**	$0.00	**-$1,342.89**	$0.00	**-$84.47**
St. John's	NL	212579	2.9	2.9	2.30	2.30	0.78	0.86	$0.00	$0.00	$0.00	**$64.49**	$0.00	$0.00	$0.00	$0.00
Dawson	YK	1577	2.9	3.0	1.70	1.75	0.31	0.33	$0.00	$0.00	$0.00	**$64.49**	$0.00	$0.00	$0.00	$0.00
Whitehorse	YK	31913	2.0	2.1	1.20	1.26	0.38	0.40	$0.00	$0.00	$0.00	**$6.71**	$0.00	$0.00	$0.00	$0.00
Hay River	NT	3169	2.4	2.5	1.42	1.48	0.35	0.37	$0.00	$0.00	$0.00	**$54.90**	$0.00	$0.00	$0.00	$0.00
Inuvik	NT	3137	3.1	3.3	1.81	1.92	0.40	0.42	**$47.77**	$0.00	$0.00	**$81.75**	$0.00	$0.00	$0.00	$0.00
Yellowknife	NT	20340	2.2	2.3	1.31	1.37	0.40	0.42	$0.00	$0.00	$0.00	**$39.34**	$0.00	$0.00	$0.00	$0.00
Iqaluit	NU	7429	2.9	3.0	1.80	1.85	0.65	0.68	**$47.77**	$0.00	$0.00	**$88.46**	$0.00	$0.00	$0.00	$0.00
Kangiqiniq / Rankin Inlet	NU	2975	3.0	3.2	1.85	1.96	0.60	0.63	**$47.77**	$0.00	$0.00	**$88.46**	$0.00	$0.00	$0.00	$0.00

			Climatic Data						Requirements using 1-in-50 Hourly Wind Pressure							
Location	Province	2021 Census Populations	Snow Load, kPa 1/50 Ss NBC 2020	Snow Load, kPa 1/50 Ss PCF 1979	Specified Snow Load (Part 9) S = CbSs + Sr NBC 2020	Specified Snow Load (Part 9) S = CbSs + Sr PCF 1979	Hourly Wind Pressure 1/50 (kPa) NBC 2020	Hourly Wind Pressure 1/50 (kPa) PCF 1979	Impact on Article 9.6.1.3. Glass	Impact on Sentence 9.23.3.4.(3) Roof Connectors	Impact on Article 9.23.3.5. Fasteners for roof sheathing	Impact on Article 9.23.3.5. Fasteners for wall sheathing	Impact on Sentence 9.23.16.1.(1) Anchorage of building frames	Impact on Sentence 9.23.16.1.(1) Required roof sheathing	Impact on Article 9.23.16.5. Lumber roof sheathing	Impact on Sentence 9.27.5.4.(2) Attachment of cladding to ICF
Kelowna	BC	222162	1.7	1.7	1.04	1.04	0.40	0.42	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Vancouver (City Hall)	BC	2642825	1.8	1.8	1.19	1.19	0.45	0.50	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Victoria	BC	397237	1.1	1.1	0.81	0.81	0.57	0.63	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Calgary	AB	1481806	1.1	1.1	0.71	0.71	0.48	0.50	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Edmonton	AB	1418118	1.7	1.7	1.04	1.04	0.45	0.47	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Lethbridge	AB	123847	1.2	1.2	0.76	0.76	0.66	0.69	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Prince Albert	SK	45718	1.9	1.9	1.15	1.15	0.38	0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Regina	SK	249217	1.4	1.4	0.87	0.87	0.49	0.51	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Saskatoon	SK	317480	1.7	1.7	1.04	1.04	0.46	0.48	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Brandon	MB	54268	2.1	2.1	1.36	1.36	0.49	0.51	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Steinbach	MB	17806	2.0	2.0	1.30	1.30	0.40	0.42	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Winnipeg	MB	834678	1.9	1.9	1.25	1.25	0.45	0.47	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Hamilton	ON	785184	1.1	1.1	1.01	1.01	0.46	0.51	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Ottawa (City Hall)	ON	1135014	2.4	2.4	1.72	1.72	0.41	0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Toronto (City Hall)	ON	6202225	0.9	0.9	0.90	0.90	0.44	0.48	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Montréal (City Hall)	QC	4291732	2.6	2.6	1.83	1.83	0.44	0.46	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Québec	QC	839311	3.6	3.6	2.58	2.58	0.41	0.43	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Sherbrooke	QC	227398	2.2	2.2	1.81	1.81	0.32	0.34	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Fredericton	NB	108610	3.1	3.1	2.31	2.31	0.38	0.42	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Moncton	NB	157717	3.0	3.0	2.25	2.25	0.50	0.55	**$126.98**	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Saint John	NB	130613	2.3	2.3	1.87	1.87	0.53	0.58	**$126.98**	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Halifax	NS	465703	1.9	1.9	1.65	1.65	0.58	0.64	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	**$2,009.15**
New Glasgow	NS	34397	2.2	2.2	1.81	1.81	0.55	0.61	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Truro	NS	46157	2.0	2.0	1.70	1.70	0.48	0.53	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Charlottetown	PE	78858	2.7	2.7	2.09	2.09	0.56	0.62	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	**$2,009.15**
Summerside	PE	18157	3.1	3.1	2.31	2.31	0.60	0.66	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	**$2,009.15**
Corner Brook	NL	29762	3.7	3.7	2.64	2.64	0.55	0.61	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Grand Falls	NL	13853	3.4	3.4	2.47	2.47	0.60	0.66	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	**$2,009.15**
St. John's	NL	212579	2.9	2.9	2.30	2.30	0.78	0.86	$0.00	**$437.04**	**$468.68**	**$1,125.30**	**$94.20**	**$133.64**	**$168.82**	$0.00
Dawson	YK	1577	2.9	3.0	1.70	1.75	0.31	0.33	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Whitehorse	YK	31913	2.0	2.1	1.20	1.26	0.38	0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Hay River	NT	3169	2.4	2.5	1.42	1.48	0.35	0.37	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Inuvik	NT	3137	3.1	3.3	1.81	1.92	0.40	0.42	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Yellowknife	NT	20340	2.2	2.3	1.31	1.37	0.40	0.42	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Iqaluit	NU	7429	2.9	3.0	1.80	1.85	0.65	0.68	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Kangiqiniq / Rankin Inlet	NU	2975	3.0	3.2	1.85	1.96	0.60	0.63	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	**$2,009.15**

Alteration of Existing Buildings

Problem

The National Model Codes continually evolve to remain responsive to current and emerging issues; new technologies, materials, construction practices, research and social policy; and the changing needs of Canadian society. The 2020 edition of the National Building Code of Canada (NBC) addresses the objectives of safety, health, accessibility, fire and structural protection of buildings, and environment (energy-use efficiency).

While NBC requirements apply to the alteration of existing buildings, an evaluation process is often undertaken during the application of these requirements to existing buildings to balance their implementation costs with their relative importance in achieving the overall objectives of the Code. Advances made over time to Code requirements to meet the Code objectives may therefore result in some older buildings lagging behind more recently constructed ones in building performance and functionality.

How any particular requirement should be interpreted and the degree to which it may be relaxed when applied to an existing building, without affecting the intended level of performance with respect to the objectives of the Code, requires considerable judgment on the part of the designer and the authority having jurisdiction, respectively. If the Code requirements that apply to existing buildings are too onerous, there is a risk that alteration activities will not be undertaken or will be conducted without notifying the authority having jurisdiction.

Harmonization

The absence of clear requirements for existing buildings has resulted in a patchwork approach to dealing with alterations across Canada, which causes confusion for the industry, regulators and building owners/operators.

Authorities having jurisdiction and the industry have expressed the desire for a set of National Model Code requirements that can consistently be applied to existing buildings under alteration to ensure an acceptable level of safety and building performance, and that also removes ambiguity as to the degree of work required on the rest of the building. A process for the consistent application of these requirements would help reduce unnecessary variation in enforcement levels in different jurisdictions.

Economy

Although the renovation market represents approximately 40% of Canada's construction activity[1], there is a lack of consistent requirements for this sector. The unqualified application of Code requirements to existing buildings could result in costly and onerous alterations that far outreach the scope of the planned alteration, or could risk deterring Code users from undertaking alterations.

Affordability

Applying Code requirements that are mostly intended for new construction to existing buildings without consideration of constructability and practicality may result in an expansion of scope of the alterations, which may have costly outcomes.

Opportunity

The voluntary alteration of an existing building represents an opportunity to upgrade the building’s performance. Without a set of practical and cost-effective requirements that would apply to voluntary alterations, the opportunity for performance improvement when significant repairs or alterations are made may be missed and the cost of performing the same upgrades later may be increased.

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[1] Statistics Canada, Table 34-10-0175-01, Investment in Building Construction, September 2022 - January 2023, https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3410017501

Justification

The development of provisions for existing buildings in the National Model Codes could be key to improving the performance of existing buildings (without worsening performance in other areas) at the time of alteration. National, provincial and territorial long-term policy goals could also be advanced.

Harmonization

Collaboration between provincial, territorial and federal governments is important to reduce variation, eliminate barriers for industry and enable sustainable economic growth. A model code for the alteration of existing buildings would help guide improvements that could be made when renovating buildings and provide harmonized provisions for adoption by the Provinces and Territories.

Economy

Construction in Canada is a $141 billion industry that employed over 1.4 million people in 2021[1]. Investment in retrofitting has been shown to be a strong job creator that provides direct local benefits.

Affordability

Most building owners and architects estimate that the costs of retrofitting commercial and institutional buildings for energy performance are regained in less than 10 years, according to data from the Canada Green Building Council. Residential energy-efficiency improvements helped Canadians save $12 billion in energy costs in 2013, which was an average savings of $869 per household[2].

Opportunity

The voluntary alteration of an existing building represents an opportunity to upgrade the building’s performance. When significant repairs or alterations need to be made is the ideal time to consider upgrading performance where it is cost-effective to do so, thereby minimizing the incremental cost of the upgrade.

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[1] Canadian Construction Association article, https://www.cca-acc.com/about-us/value-of-industry/

[2] Pan-Canadian Framework on Clean Growth and Climate Change, https://www.canada.ca/en/services/environment/weather/climatechange/pan-canadian-framework/climate-change-plan.html

Attached Supporting Material

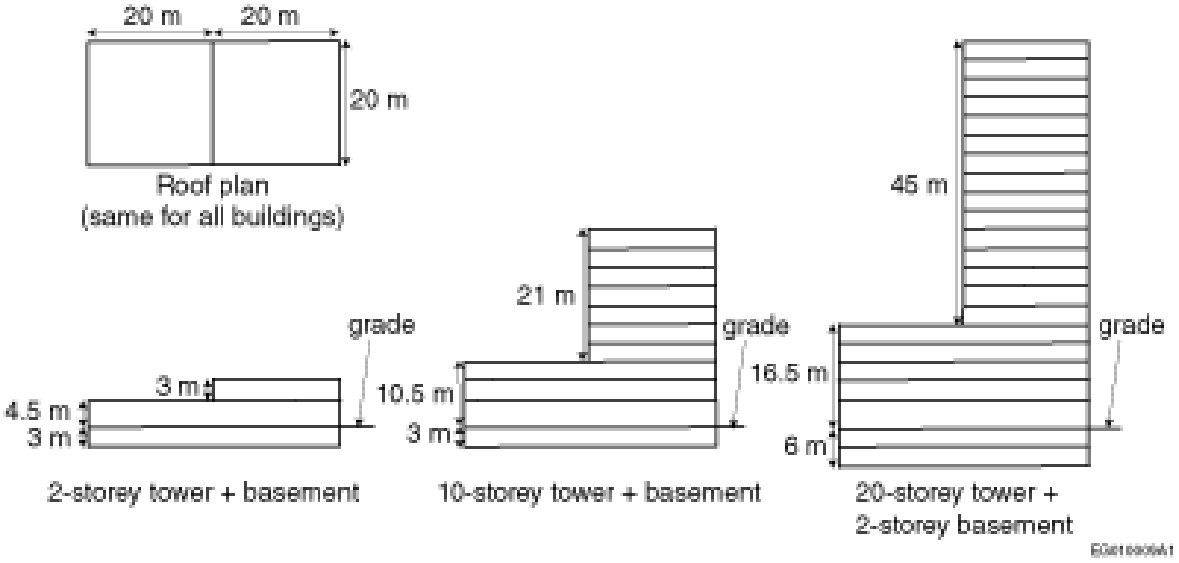
none

Cost Impact on Roof Drainage Systems in NPC

To evaluate the expected cost impact due to an increase in 15-min rainfall intensity as a result of the proposed changes, the pipe size increase of the combined primary/emergency drainage systems in the buildings shown in Figure 1 was considered. This does not account for the impact of the proposed change on alternative acceptable solutions, such as scuppers.

Three building forms of 2-storeys, 10-storeys, and 20-storeys were considered, each with the same total roof area of 800 m^2. These building types were intended to represent typical building forms commonly seen on commercial or multi-unit residential buildings across Canada.

Figure 1 – Building archetypes: 2-storey, 10-storey, and 20-storey towers with podium sections.



It was assumed that each of the two 20 m × 20 m roofs for each building has two combined primary/emergency drainage systems using Schedule 40 PVC pipes. In each system, there is a 1.5 m primary roof drain connected to a leader sized for 200% of the calculated hydraulic load and the emergency roof drain is attached to the leader. The nominal pipe sizes were determined by the maximum permitted hydraulic load per Table 2.4.10.11. in the NPC. The hydraulic load was calculated as the maximum 15-min rainfall multiplied by the sum of area of the horizontal projection of the surface that is to be drained and one-half of the area of the largest adjacent vertical surface, per Sentence 2.4.10.4.(1).

Table 2 presents the locations impacted as well as the total cost difference per building where the sizes of the primary roof drain pipe and the leader had to be increased due to an increase in rainfall intensity according to the proposed change.

Table 2 – Locations impacted and total cost difference of increased size of leaders per building

	2-storey				10-storey				20-storey			
	Locations impacted	Min. cost diff. ($)	Max. cost diff. ($)	Avg. cost diff. ($)	Locations impacted	Min. cost diff. ($)	Max. cost diff. ($)	Avg. cost diff. ($)	Locations impacted	Min. cost diff. ($)	Max. cost diff. ($)	Avg. cost diff. ($)
NU[(1)]	9	-	-	-	13	-	-	-	16	-	-	-
NT	17	45	743	546	16	55	2094	1503	17	45	6253	3988
YT	9	41	680	325	9	673	1770	1161	9	41	5729	2569
BC	103	45	741	384	107	55	1928	986	104	45	6241	2686
AB	42	65	2000	506	44	65	4845	1308	52	65	9600	2364
SK	26	91	1846	1319	28	82	5206	2780	28	1283	8862	5575
MB	7	91	1665	478	18	82	5184	1247	9	1277	8742	2632
ON	181	100	2029	1764	229	91	5722	3968	181	1410	9741	8711
QC	109	63	1953	1581	112	87	4732	3502	122	63	10733	6744
NB	13	90	1832	1092	12	82	4439	1897	18	1273	10070	3676
PE	1	55	55	55	4	1439	1495	1453	1	55	55	55
NS	10	62	94	65	16	1514	1670	1625	17	62	1327	657
NL	13	60	688	130	12	151	1789	1144	18	60	5790	787

Notes to Table 1:

(1) Cost data for Nunavut not available.

Cost Impact on Part 9 of Updated Moisture Index Values

NBC 9.3.2.9. Termite and Decay Protection

NBC Clause 9.3.2.9.(3)(b) requires structural wood elements to be pressure-treated with a preservative to resist decay where they are not protected from exposure to precipitation, the configuration is conducive to moisture accumulation, and the moisture index is greater than 1.00.

To provide an example of the potential cost increase associated with the updated moisture index values, the material cost for a sample 3.5 m × 4 m wood deck is considered.

The cost difference of using preservative-treated instead of untreated lumber for the entire wood deck assembly was calculated and shown in Table 1.

It is assumed that fasteners, connectors, other hardware, and labour remain unchanged and would not contribute to the cost increase associated with the updated moisture index values.

Table 1 – Cost increase for using pressure-treated wood for sample deck by province/territory

	Northern					Prairies				Atlantic				
	NT	NU	YT	BC	AB	SK	MB	ON	QC	NB	PE	NS	NL	National
Total locations impacted [(1)]	0	0	0	4	0	0	0	2	37	8	2	0	3	56
Cost diff. per deck ($)	n/a	n/a	n/a	289.20	n/a	n/a	n/a	271.91	435.24	444.62	444.62	n/a	544.17	415.89

Notes to Table 1:

[(1)] Locations where moisture index increased to greater than 1.00 due to this PCF.

NBC 9.27.2.2. Minimum Protection from Precipitation Ingress

NBC Sentence 9.27.2.2.(5) requires exterior walls exposed to precipitation to be protected against precipitation ingress by an exterior cladding assembly consisting of a first plane of protection and a second plane of protection incorporating a capillary break, where the number of degree-days is less than 3400 and the moisture index is greater than 0.90, or the number of degree-days is 3400 or more, and the moisture index is greater than 1.00.

To determine the cost increase for locations needing to incorporate a capillary break for exterior walls due to the updated moisture index values, the walls of a 128.5 m^2 2-storey detached dwelling unit with basement will be used as the archetype (see Appendix A).

For the cost analysis, it is assumed that the only additional material needed to incorporate capillary breaks are 19 mm × 38 mm vertical strapping to go between the cladding and sheathing. The exterior walls are also assumed to have no openings for the determination of the total length of vertical strapping needed, which results in a more conservative cost than with the openings included.

NBC Sentence 9.27.2.2.(4) requires exterior walls exposed to precipitation to be protected against precipitation ingress by an exterior cladding assembly consisting of a first plane of protection and a

second plane of protection, where such walls enclose spaces of residential occupancy or spaces that directly serve spaces of residential occupancy. Consequently, it is also assumed that flashing is already required for the second plane of protection per NBC Sentence 9.27.3.1(a) and therefore would not contribute to the cost increase.

The total cost for material and installation of vertical strapping in order to add a capillary break for all exterior walls of the archetypal house are calculated and shown in Table 3. The national average unit cost increase is $1391. Table 2 depicts the material requirements, while Table 3 shows the national and regional unit cost increases of the proposed change.

Table 2 – Length of furring strips needed for archetypal house

	Side Wall A	Side Wall B	Garage Side Wall A	Garage Side Wall B	Front Wall	Back Wall	
Wall length (mm)	10675	10675	1903	1903	7134	7134	
Wall height (mm)	5816	5816	3416	3416	5816	5816	
Number of furring strips [(1)]	19	19	5	5	13	13	**TOTAL**
Length of furring strips (mm)	110504	110504	17080	17080	75608	75608	406 m

Note to Table 2:

[(1)] Furring spaced at 600 mm o.c. per Clause 9.27.5.3.(3)(b).

Table 3 – Cost of vertical strapping for capillary break per unit by province/territory

	Northern					Prairies				Atlantic				
	NT	NU	YT	BC	AB	SK	MB	ON	QC	NB	PE	NS	NL	National
Total locations Impacted	0	0	0	1	0	0	0	2	37	8	2	0	3	53
Cost per unit [(1)] ($)	n/a	n/a	n/a	1706	n/a	n/a	n/a	1666	1653	1226	1226	n/a	1520	1391

Notes to Table 3:

[(1)] Cost for length of furring strip determined in Table 2.

Cost Impact on Part 9 of Updated Driving Rain Wind Pressure (DRWP) Values

NBC Clause 9.27.3.8.(4)(c) requires flashing to terminate at each end with an end-dam with a height not less than 25 mm or 1/10 the value of the 1-in-5 driving rain wind pressure, and at the same height extending to the face of the adjacent cladding.

To determine the cost increase for locations needing to extend the height of the end-dams for flashing due to the updated driving rain wind pressure values, the windows of the 128.5 m^2 2-storey detached dwelling unit with basement (see Appendix A) are considered.

For the cost analysis, it is assumed that flashing is installed above and below all eight windows and all flashings terminate at each end with an end-dam. The end-dams are taken to be at the ends of the length of a flashing. The height of each flashing is assumed to be 175 mm, accounting for 50 mm minimum upstand per NBC Clause 9.27.3.8.(4)(a), 10 mm minimum lap over element below per NBC Clause 9.27.3.8.(4)(d), 5 mm minimum offset from outer face of building element below per NBC Clause 9.27.3.8.(4)(e), 10 mm for hemmed drip edge, and 100 mm extending from inboard to beyond cladding.

Table 4 depicts the regional and national locations impacted as well as the unit cost increases of the proposed change.

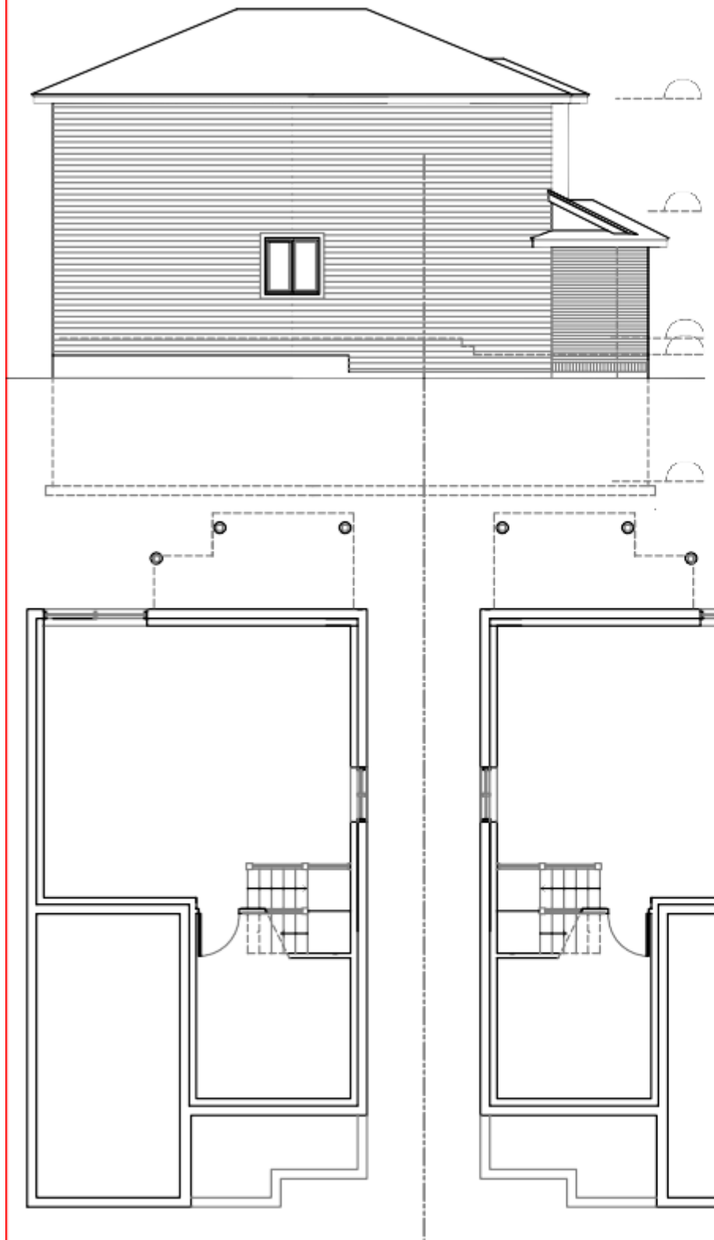
Table 3 – Cost of extra flashing per unit by province/territory

	Northern					Prairies				Atlantic				
	NT	**NU**	**YT**	**BC**	**AB**	**SK**	**MB**	**ON**	**QC**	**NB**	**PE**	**NS**	**NL**	**National**
Total locations impacted	0	4	1	21	0	3	1	0	9	3	4	16	12	74
Total cost of extra flashing per unit ($)	n/a	(1)	4.09	4.96	n/a	1.43	1.36	n/a	2.86	2.04	2.67	1.42	3.54	1.88

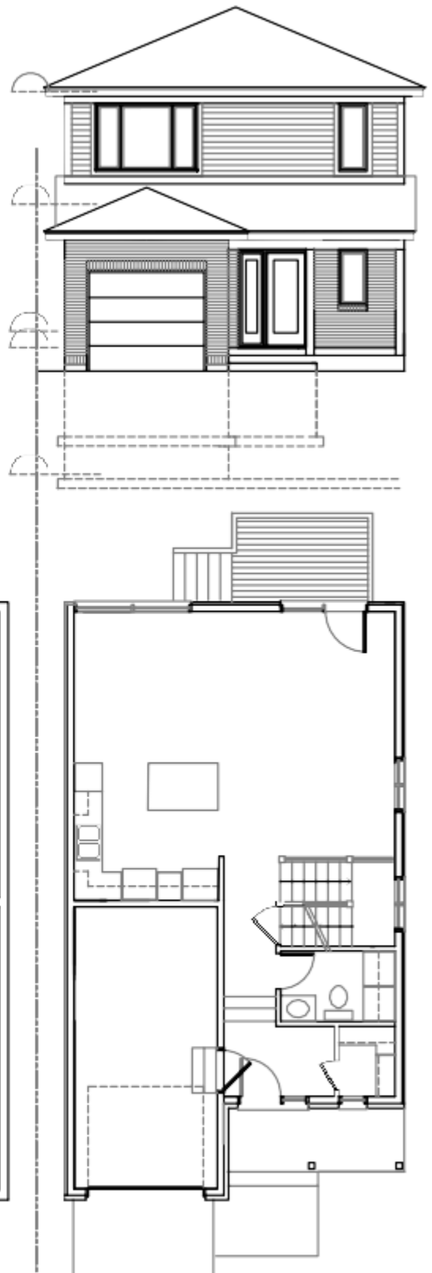
Notes to Table 4:

(1) Cost data for Nunavut not available.

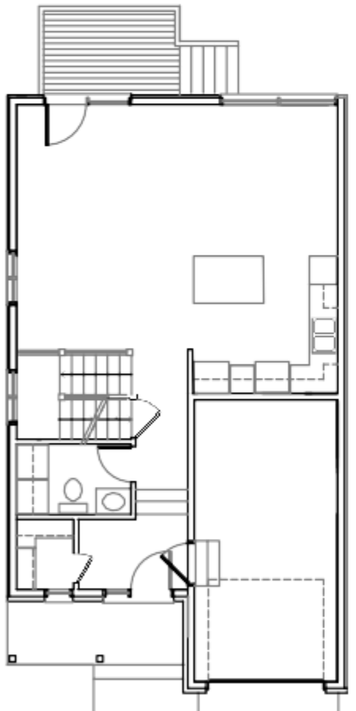
30' x 100' property

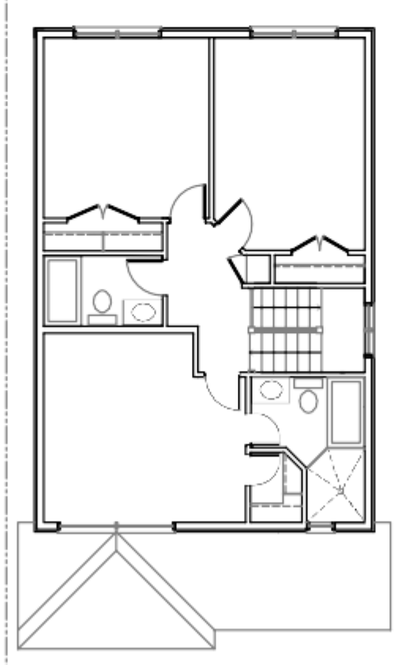


Bsmt.
53.4 m2

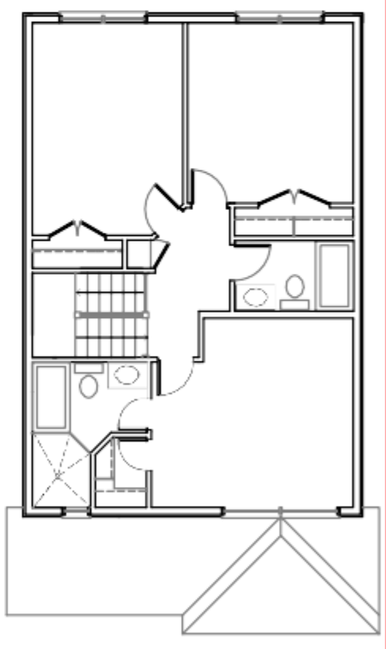


Gnd. fl.
57.2 m2
Detached 23'-8" wide
128.5 m2 / 1383 sf





2nd. fl.
71.3 m2



Cost impact of climatic load changes on Part 9: Future projected climate data for snow and wind loads (PCF 1979)

Currently, the 1-in-50-year snow loads are used to calculate the specific snow load in Part 9, which is used in various requirements to define the application of a requirement or in tables where structural members are selected based on the specified snow load. The 1-in-50-year wind loads (hourly wind pressures) are used directly in several requirements to define the application.

The specified snow loads are used in the following requirements:

- Platforms subject to snow and occupancy loads (Sentence 9.4.2.3.(1))
- Performance of windows, doors and skylight (Sentence 9.7.3.1.(2))
- Columns (Subclause 9.17.1.1.(1)(b)(ii))
- Ridge support (Sentence 9.23.14.8.(5) and Table 9.23.14.8., Rafter-to-joist nailing (unsupported ridge))
- ICF lintels (Sentence 9.20.17.4.(3) and Span Tables 9.20.17.4.-A, 9.20.17.4.-B and 9.20.17.4.-C)
- Spans for joists, rafters and beams (Sentence 9.23.4.2.(1))
    - Roof joists (Span Tables 9.23.4.2.-D and 9.23.4.2.-E)
    - Roof rafters (Span Tables 9.23.4.2.-F and 9.23.4.2.-G)
    - Built-up ridge beams and lintels supporting the roof (Span Table 9.23.4.2.-L)
    - Lintels for various wood species (Span Tables 9.23.12.3.-A, 9.23.12.3.-B, 9.23.12.3.-C and 9.23.12.3.-D)

The 1-in-50-year hourly wind pressures are used in the following requirements:

- Structural sufficiency of glass (Sentence 9.6.1.3.(2))
- Nailing of framing – roof trusses, rafters and joists to wall framing (Sentence 9.23.3.4.(3))
- Fasteners for sheathing (Article 9.23.3.5.)
- Anchorage of building frames (Sentence 9.23.6.1.(3))
- Required roof sheathing (Sentence 9.23.16.1.(1))
- Lumber roof sheathing (Article 9.23.16.5.)
- Attachment of cladding to flat ICF wall units (Sentence 9.27.5.4.(2)

This document summarizes the cost impact resulting from changes proposed in PCF 1979, which includes future projected data (50-year time horizon) for the 1-in-50-year snow loads and hourly wind pressures.

General approach

As per the Policies and Procedures, Appendix G, the unit cost of material, labour and overhead/profit are obtained from RS Means. RS Means' cost database is a comprehensive collection of industry construction cost data that can be used to develop estimates for construction projects. All costs contained herein have been converted from the US national average cost to Canadian national average. The costs are based on 2023 construction cost data.

To determine overall costs, material quantities are calculated using archetypes and measured in AutoCAD to obtain lengths, areas, etc. Each archetype is described in the sections below.

First, all costs are calculated for a given archetype based on the climatic data in Table C-2 of Appendix C in NBC 2020 (herein this will be referred to as "before the change"). Then, the costs are recalculated using the revised climatic data provided in the proposed change form, PCF 1979 (herein this will be referred to as "after the change"). The difference between the costs is determined, which gives the cost impact of the proposed change.

Snow loads

The future projected 1-in-50-year snow loads increase only in the Yukon, Northwest Territories and Nunavut. There are a total of 42 locations out of 680 in Table C-2 within the territories. Snow load data in all other locations do not change in PCF 1979, so there is no impact on the remaining 638 locations.

Platforms subject to snow and occupancy loads (Sentence 9.4.2.3.(1))

The approach used to assess the cost impact of the proposed change on exterior platforms is to use an archetype exterior platform, in this case, a 3.5 m by 4 m long exterior platform. Sentence 9.4.2.3.(1) requires that exterior platforms be designed for a use and occupancy load of 1.9 kPa or the specified snow load, whichever is greater.

For locations where the specified snow load is less than 1.9 kPa before and after the change, there will be no impact. This is the case for exterior platform design in a total of 29 out of the 42 locations in Table C-2 for the Yukon, Northwest Territories and Nunavut.

For the remaining 13 locations, there is potential impact. For the design of exterior platforms, the span tables can be used to select the required wood joists and built-up beams needed based on the specified snow load in a given location. The span tables provide values for specified snow loads of 1.0 kPa, 1.5 kPa, 2.0 kPa, 2.5 kPa, 3.0 kPa and for 3.5 kPa and 4.0 kPa by way of an appendix note.

For locations where the specified snow load before and after the change remains between the same range (e.g., between 1.0 kPa and 1.5 kPa), there is no impact. This is the case for 6 locations. This leaves 7 locations out of a total of 680 locations in Table C-2 with potential impact.

Assessment of these 7 locations using the archetype, span tables and costs from RS Means found that there are 2 locations that experience a cost increase (see Table below), ranging from $47.77 to $126.43, as a result of PCF 1979. Note, there are 5 additional locations to those noted above that are not impacted because the same joist and built-up beam size is sufficient before and after the proposed change, based on the spans used in the archetype.

Province and Location	Province	Cost **NBC 2020**	Cost **PCF 1979**	Cost Difference
Watson Lake	YT	$542.61	$542.61	$0.00
Fort McPherson	NT	$542.61	$542.61	$0.00
Inuvik	NT	$542.61	$542.61	$0.00

Tungsten	**NT**	**$669.04**	**$716.81**	**$47.77**
Arviat	NU	$542.61	$542.61	$0.00
Kangiqiniq / Rankin Inlet	NU	$542.61	$542.61	$0.00
Kugluktuk / Coppermine	**NU**	**$542.61**	**$669.04**	**$126.43**

Performance of windows, doors and skylight (Sentence 9.7.3.1.(2))

In the 42 locations where the snow loads increase, there is potential for impact on the structural design of skylights. The magnitude of the cost impact could not be determined without industry knowledge on the structural design of skylights including the capacity of the skylight frames and glazing.

Columns (Subclause 9.17.1.1.(1)(b)(ii))

To assess the cost impact of the proposed change on columns an exterior platform with dimensions of 2.44 m by 4 m is used; it is assumed to be raised from the ground by 3 m. Three columns are used to support a beam at the front edge of the deck along the 4 m length.

Subclause 9.17.1.1.(1)(b)(ii) limits the application of Section 9.17. to columns supporting exterior platforms where the sum of the specified snow load and the occupancy load (1.9 kPa) does not exceed 4.8 kPa. Therefore, in locations where the sum of the specified snow load and the occupancy load remains below 4.8 kPa before and after the change, there will be no impact. This is the case for all 42 locations except for one—Resolution Island, NU.

Assessment of this one location using the archetype, Part 4 column design and costs from RS Means (see Table 3) found that it experiences neither an increase or decrease in cost because the same column size is applicable both before and after the proposed change.

Ridge support (Sentence 9.23.14.8.(5) and Table 9.23.14.8., Rafter-to-joist nailing (unsupported ridge))

To assess the cost impact of the proposed change on the nailed connection between a roof rafter and ceiling joist or collar tie, a 120 m^2 bungalow is used as an archetype (see Figure 1).

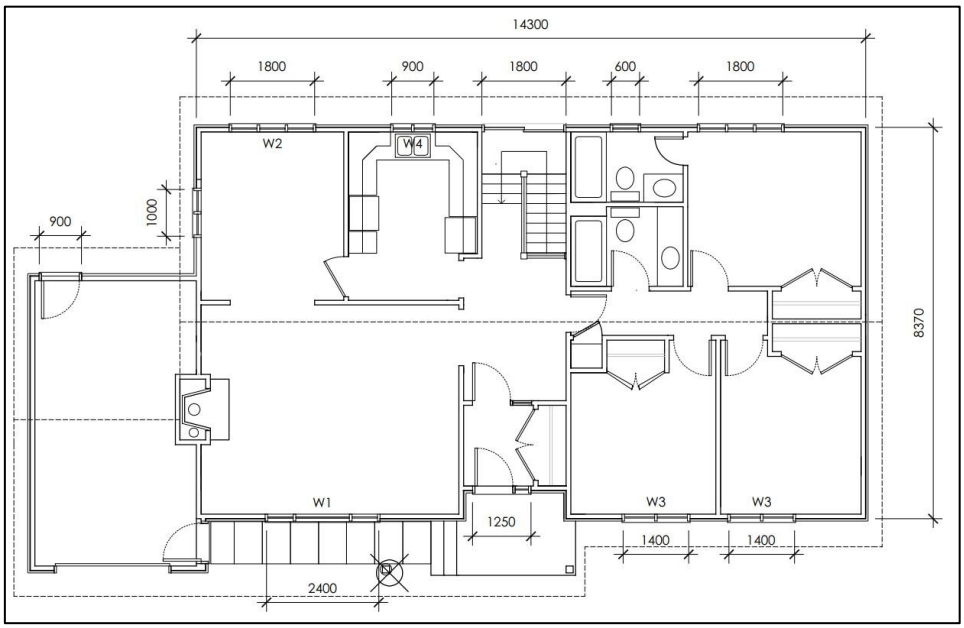


Figure 1 – 120 m^2 bungalow archetype

Table 9.23.14.8. provides the number of nails to be used at the rafter-to-joist connection for a 1.0 kPa, 1.5 kPa and 2.0 kPa specified snow load. In locations where the specified snow load remains within the same range there is no impact. This is the case for 32 locations. Of the remaining 10 locations, 7 experience an increase in the number of nails (maximum 3 additional nails) and an additional 3 locations are not impacted because the same number of nails are sufficient before and after the change.

Table 9.23.14.8. is used in the analysis to determine the number of nails in locations less than or equal to 2.0 kPa, while connection design using CSA O86-19 is used for locations with a specified snow load greater than 2.0 kPa.

Based on the archetype, adding 3 additional nails to each rafter-to-joist connection results in an additional material cost of **$5.54** for a 120 m^2 bungalow with wood framed construction.

Province and Location	Province	Required Number of Nails (Part 4 Design) **NBC 2020**	Required Number of Nails (Part 4 Design) **PCF 1979**	Additional Nails Required
Fort Smith	NT	10	11	1
Eureka	**NU**	**7**	**10**	**3**
Igluligaarjuk / Chesterfield Inlet	NU	14	15	1
Kanngiqtugaapik / Clyde River	NU	16	17	1
Kugluktuk / Coppermine	NU	13	14	1
Resolution Island	NU	20	21	1
Salliq / Coral Harbour	NU	15	16	1

ICF lintels (Sentence 9.20.17.4.(3) and Span Tables 9.20.17.4.-A, 9.20.17.4.-B and 9.20.17.4.-C)

To assess the cost impact of the proposed change on insulating concrete form (ICF) lintels, an approximate 120 m^2 bungalow is used assuming 150 mm thick ICF walls (see Figure 1 above).

The three largest windows with openings of 2.4 m, 1.8 m and 1.4 m along with patio door and front entrance door, both of equal to or similar size opening to the window opening sizes, are analysed. ICF lintel sizes before and after the proposed change were determined using the ICF span tables in the NBC and using lintel span tables from an ICF manufacturer where the ground snow load, S_s, is more than 3.33 kPa (the upper limit of the ICF span tables in the NBC). Where the ground snow load exceeds 5.15 kPa, the size of lintels was not determined and in practice these locations would likely need the assistance of a professional engineer to design the ICF lintels.

In locations where the ICF lintel size is sufficient to support the snow load before and after the change, there will be no impact. This occurs in 31 out of the 42 locations in the Yukon, Northwest Territories and Nunavut. One location (Resolution Island, NU) has a ground snow load that exceeds both the span tables in the NBC and those provided by an ICF manufacturer. In this location, concrete beam design using Part 4 is needed, which likely requires a structural engineer and additional material and labour costs.

For the remaining 10 locations not accounted for above, the proposed change results in an increased cost for the ICF lintels between **$6.71** to **$32.63** for a 120 m^2 bungalow with 150 mm thick ICF walls.

Location	Province	Total Cost Difference
Teslin	YT	$6.71
Watson Lake	YT	$32.63
Echo Bay / Port Radium	NT	$6.71
Fort McPherson	NT	$32.63
Mould Bay	NT	$14.01
Norman Wells	NT	$6.71
Arviat	NU	$6.71
Baker Lake	NU	$15.56
Kangiqiniq / Rankin Inlet	NU	$6.71
Kugluktuk / Coppermine	NU	$15.56

Spans for joists, rafters and beams (Sentence 9.23.4.2.(1))

As per above, to assess the impact of the future projected climatic data on the span tables (roof joists, roof rafters, built-up ridge beams and lintels) in Part 9 an approximate 120 m^2 bungalow is used (refer to Figure 1). Each of the span tables for wood members supporting snow loads provide member sizes for specified snow loads of 1.0 kPa, 1.5 kPa, 2.0 kPa, 2.5 kPa, 3.0 kPa; and, 3.5 kPa and 4.0 kPa by way of an appendix note. For locations where the specified snow load before and after the change remains between the same range (e.g., between 1.0 kPa and 1.5 kPa), there is no impact. This the case for 38 locations out of the 42 locations where snow loads change as a result of PCF 1979.

The impact of the proposed change on roof joists, roof rafters, built-up ridge beams and lintels, for the remaining 4 locations—Fort Smith, NT; Tungsten, NT; Eureka, NU; and, Kugluktuk, NU—are summarized below.

Roof joists (Span Tables 9.23.4.2.-D and 9.23.4.2.-E)

Two of the of the 4 locations experience a cost increase of approximately $1,850.00 (see Table below). Two locations do not experience an impact because the same roof joist size is sufficient before and after the proposed change, based on the spans used in the archetype.

Province and Location	Province	Cost **NBC 2020**	Cost **PCF 1979**	Cost Difference
Fort Smith	NT	$8,579.88	$8,579.88	$0.00
Tungsten	NT	$10,429.56	$10,429.56	$0.00
Eureka	**NU**	**$6,725.16**	**$8,579.88**	**$1,854.72**
Kugluktuk	**NU**	**$8,579.88**	**$10,429.56**	**$1,849.68**

Roof rafters (Span Tables 9.23.4.2.-F and 9.23.4.2.-G)

Three of the 4 locations experience an increase in roof rafter costs between $255.30 and $1,342.89 (see Table below). One additional location is not impacted because the size of the roof rafters is sufficient before and after the proposed change, based on the spans used in the archetype.

Province and Location	Province	Cost **NBC 2020**	Cost **PCF 1979**	Cost Difference
Fort Smith	**NT**	**$5,082.92**	**$6,425.81**	**$1,342.89**
Tungsten	**NT**	**$6,425.81**	**$7,768.70**	**$1,342.89**
Eureka	**NU**	**$4,827.62**	**$5,082.92**	**$255.30**
Kugluktuk	NU	$6,425.81	$6,425.81	$0.00

Built-up ridge beams and lintels supporting the roof (Span Table 9.23.4.2.-L)

Similar to the result for roof rafters, three out of the 4 locations experience an increase in built-up ridge beam costs between $140.24 and $262.66 (see Table below). Again, one additional location is not impacted because the size of the built-up ridge beam is sufficient before and after the proposed change, based on the archetype and assuming the 14.3 m long built-up ridge beam is supported every 2.86 m.

Province and Location	Province	Cost **NBC 2020**	Cost **PCF 2048**	Difference
Fort Smith	**NT**	**$645.40**	**$908.06**	**$262.66**
Tungsten	NT	$1,061.91	$1,061.91	$0.00

Eureka	**NU**	**$505.16**	**$645.40**	**$140.24**
Kugluktuk	**NU**	**$908.06**	**$1,061.91**	**$153.85**

Lintels for various wood species (Span Tables 9.23.12.3.-A, 9.23.12.3.-B, 9.23.12.3.-C and 9.23.12.3.-D)

The archetype bungalow includes six different opening sizes for the front entrance door, rear patio door, rear garage entrance door and the 8 windows.

All four locations identified above experience a lintel cost increase between $32.13 and $84.47 (see Table below) as a result of the proposed change, based on the archetype.

Province and Location	Province	Overall Cost Impact **NBC 2020 – PCF 1979**
Fort Smith	NT	$32.13
Tungsten	NT	$84.47
Eureka	NU	$41.82
Kugluktuk / Coppermine	NU	$53.88

Hourly wind pressures

The future project climatic data provided in PCF 1979 results in an increase in the 1-in-50-year hourly wind pressure in all 680 locations in Table C-2. The order of magnitude of the increases are between 4.1% and 11.4%.

Structural sufficiency of glass (Sentence 9.6.1.3.(2))

To assess the impact of the proposed change on the structural sufficiency of glass, a 128.5 m^2 2-storey detached home is used as the archetype (see Figure 2). The detached home contains five different sized windows with glass areas between 0.57 m^2 and 1.43 m^2.

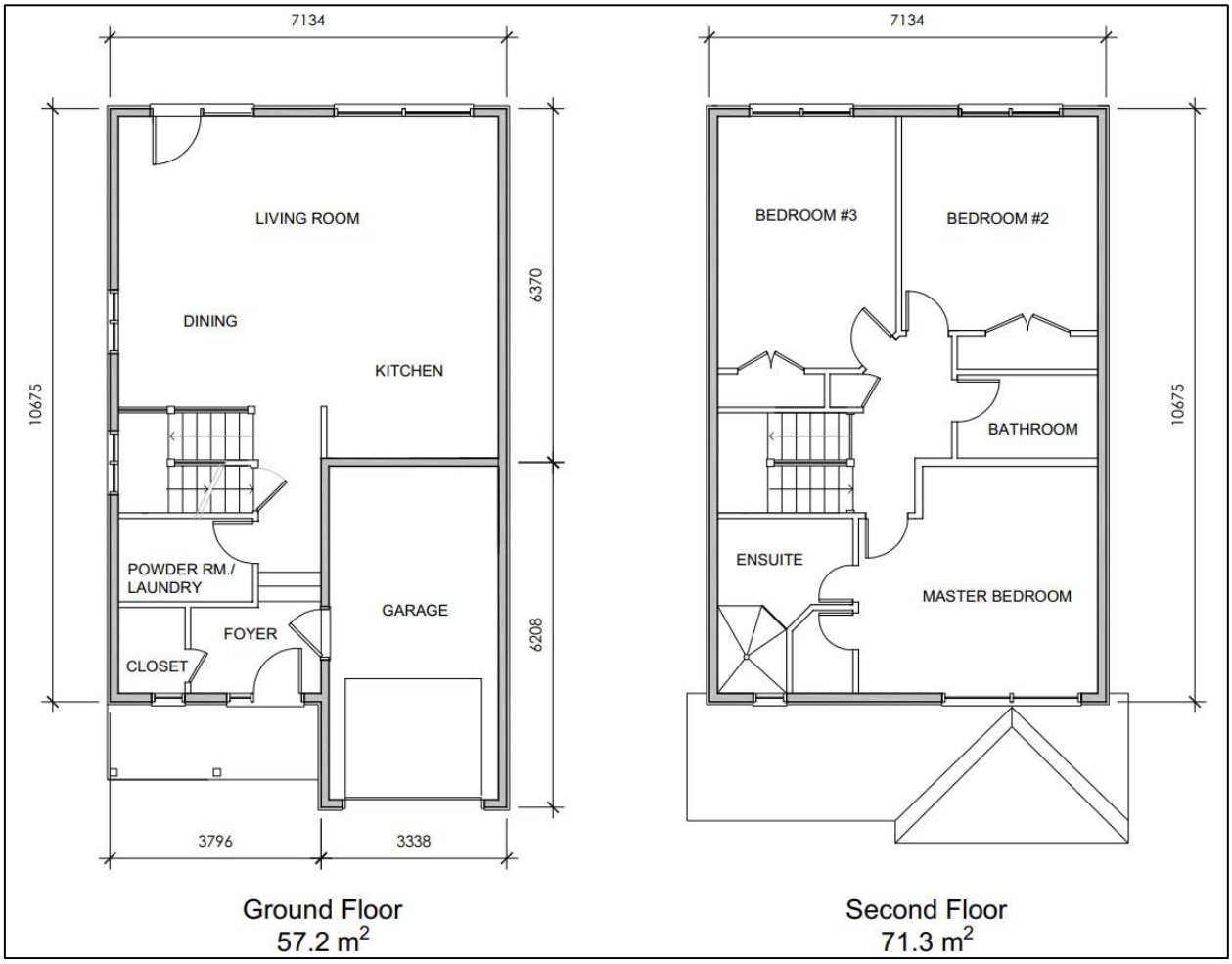


Figure 2 – 128.5 m^2, 2-storey detached house archetype

Table 9.6.1.3.-A, 9.6.1.3.-B and 9.6.1.3.-C provide the maximum glass area for windows in locations in Table C-2 with 1-in-50-year hourly wind pressures of less than 0.55 kPa, less than 0.75 kPa and less than 1.0 kPa, respectively. For the impact analysis, factory-sealed insulated glass (IG) units are assumed.

For locations where the 1-in-50-year hourly wind pressures remain below the maximum limits provided in the tables before and after the change, there will be no impact. This is the case for 649 out of 680 locations in Table C-2. For the remaining 31 locations, there is potential impact. Three locations—Cowley, AB; Cape Race, NL; and Resolution Island, NU—have a 1-in-50-year hourly wind pressure, before and after the proposed change, that exceeds the maximum value of 1.0 kPa provided in the prescriptive table in the NBC. These locations would need to consult the window manufacturer for glass thickness. The 1-in-50-year hourly wind pressure increases in all three locations by approximately 5% to 10% so there is likely a cost impact. For the remaining 28 locations out of 31, the proposed change results in an increased cost for windows between **$126.98** to **$353.51** (see Table below) for the 128.5 m^2 2-storey detached archetype.

Province and Location	Province	Total Cost Difference
Bamfield	BC	$126.98
Bella Bella	BC	$126.98
Port Renfrew	BC	$126.98
Prince Rupert	BC	$126.98

Squamish	BC	$126.98
Tofino	BC	$353.51
Ucluelet	BC	$353.51
Battrum	SK	$126.98
Estevan	SK	$126.98
Moose Jaw	SK	$126.98
Swift Current	SK	$126.98
Boissevain	MB	$126.98
Morden	MB	$126.98
Mont-Joli	QC	$126.98
Port-Cartier	QC	$126.98
Rimouski	QC	$126.98
Sept-Îles	QC	$126.98
Tadoussac	QC	$126.98
Moncton	NB	$126.98
Saint John	NB	$126.98
Antigonish	NS	$126.98
Greenwood (CFB)	NS	$126.98
Kentville	NS	$126.98
Stewiacke	NS	$126.98
Wolfville	NS	$126.98
Grand Bank	NL	$353.51
Echo Bay / Port Radium	NT	$126.98
Baker Lake	NU	$126.98

Nailing of framing – roof trusses, rafters and joists to wall framing (Sentence 9.23.3.4.(3))

To assess the impact of the proposed change on the nailing of framing, specifically for roof truss, rafter or joist connections to wall framing, a 120 m^2 bungalow is used as the archetype (see Figure 1 above).

Where the 1-in-50-year hourly wind pressure is equal to or exceeds 0.8 kPa, roof trusses, rafters or joists are required to be tied to wall framing with connectors that can resist 3 kilonewtons (kN) of roof uplift. Galvanized-steel straps that are 50 mm wide, no less than 0.91 mm thick and allow for fastening at each end with four 63 mm nails are deemed to comply with the roof uplift requirement.

Currently, there are 7 locations out of 680 locations in Table C-2 with a 1-in-50-year hourly wind pressure that is equal to or exceed 0.80 kPa. As a result of the future projected climatic data in PCF 1979, 6 additional locations would exceed 0.80 kPa.

Using the 120 m^2 bungalow archetype, the number of required galvanized-steel connectors are calculated to be approximately 72, resulting in a cost increase for these 6 new locations of **$437.04** (see Table below).

Province and Location	Province	Total Cost Increase
Argentia	NL	$437.04
Channel-Port aux Basques	NL	
Grand Bank	NL	
St. John's	NL	
Wabana	NL	
Nottingham Island	NU	

Fasteners for sheathing (Article 9.23.3.5.)

To assess the impact of the proposed change on fastening of both roof and wall sheathing, the 128.5 m^2 2-storey detached house (see Figure 2) is used as an archetype.

The NBC provides three prescriptive tables to determine fastener size and spacing for sheathing. Application of each table depends on the 1-in-50-year hourly wind pressure and seismic spectral acceleration in a given location. For locations where the 1-in-50-year hourly wind pressure is less than 0.8 kPa requirement for fasteners are less stringent than locations with a 1-in-50-year hourly wind pressure that is equal to or exceeds 0.8 kPa.

For locations where the 1-in-50-year hourly wind pressure remains below 0.8 kPa, there will be no impact. This is the case for 667 out of 680 locations. As noted above, there are 7 locations in the current Table C-2 with a 1-in-50-year hourly wind pressure greater than 0.8 kPa so there will be no impact in these locations. However, the same 6 locations noted above will exceed 0.8 kPa as a result of the future projections and could experience cost increases for both roof and wall sheathing fasteners.

Roof Sheathing

As a result of the proposed change, roof sheathing in the 6 new locations would now require larger size fasteners and fasteners spaced at 50 mm within 1 m of the roof edge. For the cost impact analysis common wire nails are assumed. Based on the increase in nail size (51 mm to 63 mm), additional fasteners at the edge of the roof and the size of the archetype roof, a cost increase of **$468.68** is estimated for the 6 new locations (see Table below).

Province and Location	Province	Total Cost Increase
Argentia	NL	$468.68
Channel-Port aux Basques	NL	
Grand Bank	NL	
St. John's	NL	
Wabana	NL	
Nottingham Island	NU	

Wall Sheathing

The impact of the proposed change on fasteners for wall sheathing occurs when braced wall panels are required per Subsection 9.23.13 in the NBC. Similar to the prescriptive tables for roof sheathing, a 1-in-50-year hourly wind pressure of 0.8 kPa acts as a threshold for when braced wall panels with wood-based wall sheathing are required. As a result of the future projected climate data, the same 6 locations identified above will need to follow the NBC requirements for high wind forces (Article 9.23.13.2.) resulting in a cost increase of **$1,125.30** (see Table below).

To determine the above cost impact, the length of braced wall panels is calculated for the 128.5 m^2 2-storey detached archetype using the braced wall panel spacing and length requirements in Table 9.23.13.5. A total length of 28.2 m is calculated. For the cost assessment, it is assumed that the archetype is constructed without wood-based exterior sheathing (e.g., sheathed with rigid insulation) before the proposed change and now requires some percentage of wood-based sheathing at exterior wall and the interior, end garage wall. In this case, the cost impact is dictated by the requirement for wood-based sheathing (11 mm thick OSB assumed), which requires specific size and spacing of wall

sheathing fasteners.

Province and Location	Province	Total Cost Increase
Argentia	NL	$1,125.30
Channel-Port aux Basques	NL	
Grand Bank	NL	
St. John's	NL	
Wabana	NL	
Nottingham Island	NU	

Anchorage of building frames (Sentence 9.23.6.1.(3))

Similar to the fasteners for wall sheathing, a cost increase for anchorage of building frames is dictated by the need for braced wall panels when the 1-in-50-year hourly wind pressure exceeds 0.8 kPa, which is the case for the 6 new locations noted above. The spacing and length of braced wall panels is calculated as described above. Sentence 9.23.6.1.(3) requires that two anchors be provided for each braced wall panel and that the anchor bolts are either 15.9 mm diameter spaced at 2.4 m or 12.7 mm diameter spaced at 1.7 m. Between braced wall panels the regular requirement for 12.7 mm diameter anchor bolts at 2.4 m is maintained.

For the cost assessment, braced wall panel anchorage with 12.7 mm diameter anchor bolts at 1.7 m is used. As a result of the future projected climatic data in PCF 1979 and the need for braced wall panels, the number of anchor bolts is estimated to increase by 15 for a total cost increase of **$94.20** in the 6 new locations noted (see Table below).

Province and Location	Province	Total Cost Increase
Argentia	NL	$94.20
Channel-Port aux Basques	NL	
Grand Bank	NL	
St. John's	NL	
Wabana	NL	
Nottingham Island	NU	

Required roof sheathing (Sentence 9.23.16.1.(1))

To assess the impact of the proposed change on required roof sheathing, the 128.5 m^2 2-storey detached bungalow is used. It is assumed that trusses are spaced at 600 mm and before the proposed change the roof is sheathed with panel-type material that would not comply with Subsection 9.23.16. (i.e., sheathing that is too thin for the truss spacing—7.5 mm plywood).

Sentence 9.23.16.1. requires that continuous lumber or panel-type roof sheathing be installed to support the roofing when the 1-in-50-year hourly wind pressure is equal to or exceeds 0.8 kPa. Similar to above, 6 locations would be impacted by the future projected climatic data increases and would be required to follow the roof sheathing requirements in Subsection 9.23.16. For this cost assessment, 9.5 mm plywood sheathing, supported at edges, to comply with Subsection 9.23.16. The resulting cost increase from a sheathing that would be deemed too thin for the truss spacing in Sentence 9.23.16.7.(2) to a compliant plywood sheathing is approximately **$168.82**.

Province and Location	Province	Total Cost Increase
Argentia	NL	$168.82
Channel-Port aux Basques	NL	
Grand Bank	NL	
St. John's	NL	
Wabana	NL	
Nottingham Island	NU	

Lumber roof sheathing (Article 9.23.16.5.)

To assess the impact of the proposed change on lumber roof sheathing the roof area of the 128.5 m^2, 2-storey detached archetype is used.

Sentence 9.23.16.5. requires that lumber roof sheathing be installed diagonally when the 1-in-50-year hourly wind pressure is equal to or exceeds 0.8 kPa. Therefore, the same 6 locations will be impacted by an increase in 1-in-50-year hourly wind pressure above 0.8 kPa as a result of PCF 1979. The cost impact for lumber roof sheathing in these 6 locations is approximately **$311.67** and represents the difference between installing lumber roof sheathing horizontally versus diagonally.

Province and Location	Province	Total Cost Increase
Argentia	NL	$311.67
Channel-Port aux Basques	NL	
Grand Bank	NL	
St. John's	NL	
Wabana	NL	
Nottingham Island	NU	

Attachment of cladding to flat ICF wall units (Sentence 9.27.5.4.(2)

To assess the impact of the proposed change on the attachment of cladding to flat wall insulating concrete form (ICF) units, the 128.5 m^2, 2-storey detached archetype is used. Sentence 9.27.5.4.(2) and Table 9.27.5.4.-B provide the screw size and spacing requirements for the attachment of cladding, trim and furring members to the web fastening strips of flat wall ICF and limits the application to locations where the 1-in-50-year hourly wind pressure is equal to or less than 0.60 kPa.

For the impact analysis, it is assumed that the cladding is attached to furring that is attached to either the flat wall ICF web fastening strips when permitted or to the solid concrete core of the ICF where the 1-in-50-year hourly wind pressure exceeds 0.6 kPa.

For locations where the 1-in-50-year hourly wind pressure is equal to or less than 0.6 kPa before and after the change, there will be no impact. This is the case for locations in 612 out of the 680 locations in Table C-2. For the remaining 68 locations there is potential impact requiring further assessment.

Similarly, for locations where the 1-in-50-year hourly wind pressure is greater than 0.6 kPa before and after the change, the impact is assumed to be minimal and would account for additional fasteners. This is the case for half (34) of the remaining 68 locations.

The greatest impact is assumed to occur when the future projected climatic data for 1-in-50-year hourly wind pressure moves from equal to or less than 0.60 kPa before the proposed change to more than

0.6 kPa after the change. This is the case for 34 locations, representing the other half of the 68 locations.

The resulting cost increase in these locations for the attachment of cladding to flat ICF walls is approximately **$2,009.15** (see Table below), which represents the different material costs for fasteners into concrete and the additional labour and reduced daily output to attach the furring through the flat wall ICF units into the solid concrete backup wall.

Province and Location	Province	Cost Difference for Furring
Jordan River	BC	$2,009.15
Ocean Falls	BC	
Victoria	BC	
Victoria (Gonzales Hts)	BC	
Claresholm	AB	
Kuujjuaq	QC	
Puvirnituq	QC	
Bridgewater	NS	
Digby	NS	
Dartmouth	NS	
Halifax	NS	
Lockeport	NS	
New Glasgow	NS	
North Sydney	NS	
Pictou	NS	
Sydney	NS	
Tatamagouche	NS	
Yarmouth	NS	
Charlottetown	PE	
Souris	PE	
Summerside	PE	
Buchans	NL	
Cape Harrison	NL	
Corner Brook	NL	
Gander	NL	
Grand Falls	NL	
Stephenville	NL	
Destruction Bay	YT	
Mould Bay	NT	
Arviat	NU	
Isachsen	NU	
Kangiqiniq / Rankin Inlet	NU	
Resolute	NU	
Salliq / Coral Harbour	NU	

Impact of future projected climatic data (PCF 1979) on major city centres in each province/territory.

As provided herein, not all locations for each requirement that includes reference to specified snow loads or 1-in-50-year hourly wind pressures are impacted by the future-projected climatic data. In some cases, major Canadian cities are not impacted by the proposed change. Appendix A provides a table summarizing the results of the cost impact analysis detailed herein for major city centres in each province/territory.

Appendix A

Impact of future projected climatic data (PCF 1979) on major city centres in each province/territory.

			Climatic Data						Requirements using Snow Loads							
Location	Province	2021 Census Populations	Snow Load, kPa 1/50 S_s NBC 2020	Snow Load, kPa 1/50 S_s PCF 1979	Specified Snow Load (Part 9) $S = C_b S_s + S_r$ NBC 2020	Specified Snow Load (Part 9) $S = C_b S_s + S_r$ PCF 1979	Hourly Wind Pressure 1/50 (kPa) NBC 2020	Hourly Wind Pressure 1/50 (kPa) PCF 1979	Impact on Article 9.4.2.3. Platforms	Impact on Article 9.17.1.1. Columns	Impact on Sentence 9.23.14.8.(5) Rafter Nailing	Impact on Sentence 9.20.17.4.(3) ICF Lintels	Impact on Sentence 9.23.4.2.(1) Roof Joists	Impact on Sentence 9.23.4.2.(1) Roof Rafters	Impact on Sentence 9.23.4.2.(4) Built-up Ridge Beam and Lintels	Impact on Sentence 9.23.12.3.(1) Lintels
Kelowna	BC	222162	1.7	1.7	1.04	1.04	0.40	0.42	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Vancouver (City Hall)	BC	2642825	1.8	1.8	1.19	1.19	0.45	0.50	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Victoria	BC	397237	1.1	1.1	0.81	0.81	0.57	0.63	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Calgary	AB	1481806	1.1	1.1	0.71	0.71	0.48	0.50	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Edmonton	AB	1418118	1.7	1.7	1.04	1.04	0.45	0.47	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Lethbridge	AB	123847	1.2	1.2	0.76	0.76	0.66	0.69	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Prince Albert	SK	45718	1.9	1.9	1.15	1.15	0.38	0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Regina	SK	249217	1.4	1.4	0.87	0.87	0.49	0.51	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Saskatoon	SK	317480	1.7	1.7	1.04	1.04	0.46	0.48	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Brandon	MB	54268	2.1	2.1	1.36	1.36	0.49	0.51	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Steinbach	MB	17806	2.0	2.0	1.30	1.30	0.40	0.42	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Winnipeg	MB	834678	1.9	1.9	1.25	1.25	0.45	0.47	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Hamilton	ON	785184	1.1	1.1	1.01	1.01	0.46	0.51	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Ottawa (City Hall)	ON	1135014	2.4	2.4	1.72	1.72	0.41	0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Toronto (City Hall)	ON	6202225	0.9	0.9	0.90	0.90	0.44	0.48	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Montréal (City Hall)	QC	4291732	2.6	2.6	1.83	1.83	0.44	0.46	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Québec	QC	839311	3.6	3.6	2.58	2.58	0.41	0.43	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Sherbrooke	QC	227398	2.2	2.2	1.81	1.81	0.32	0.34	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Fredericton	NB	108610	3.1	3.1	2.31	2.31	0.38	0.42	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Moncton	NB	157717	3.0	3.0	2.25	2.25	0.50	0.55	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Saint John	NB	130613	2.3	2.3	1.87	1.87	0.53	0.58	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Halifax	NS	465703	1.9	1.9	1.65	1.65	0.58	0.64	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
New Glasgow	NS	34397	2.2	2.2	1.81	1.81	0.55	0.61	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Truro	NS	46157	2.0	2.0	1.70	1.70	0.48	0.53	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Charlottetown	PE	78858	2.7	2.7	2.09	2.09	0.56	0.62	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Summerside	PE	18157	3.1	3.1	2.31	2.31	0.60	0.66	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Corner Brook	NL	29762	3.7	3.7	2.64	2.64	0.55	0.61	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Grand Falls	NL	13853	3.4	3.4	2.47	2.47	0.60	0.66	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
St. John's	NL	212579	2.9	2.9	2.30	2.30	0.78	0.86	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Dawson	YT	1577	2.9	3.0	1.70	1.75	0.31	0.33	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Whitehorse	YT	31913	2.0	2.1	1.20	1.26	0.38	0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Hay River	NT	3169	2.4	2.5	1.42	1.48	0.35	0.37	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Inuvik	NT	3137	3.1	3.3	1.81	1.92	0.40	0.42	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Yellowknife	NT	20340	2.2	2.3	1.31	1.37	0.40	0.42	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Iqaluit	NU	7429	2.9	3.0	1.80	1.85	0.65	0.68	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Kangiqiniq / Rankin Inlet	NU	2975	3.0	3.2	1.85	1.96	0.60	0.63	$0.00	$0.00	$0.00	**$6.71**	$0.00	$0.00	$0.00	$0.00

			Climatic Data						Requirements using 1-in-50 Hourly Wind Pressure							
Location	Province	2021 Census Populations	Snow Load, kPa 1/50 Ss NBC 2020	Snow Load, kPa 1/50 Ss PCF 1979	Specified Snow Load (Part 9) S = CbSs + Sr NBC 2020	Specified Snow Load (Part 9) S = CbSs + Sr PCF 1979	Hourly Wind Pressure 1/50 (kPa) NBC 2020	Hourly Wind Pressure 1/50 (kPa) PCF 1979	Impact on Article 9.6.1.3. Glass	Impact on Sentence 9.23.3.4.(3) Roof Connectors	Impact on Article 9.23.3.5. Fasteners for roof sheathing	Impact on Article 9.23.3.5. Fasteners for wall sheathing	Impact on Sentence 9.23.16.1.(1) Anchorage of building frames	Impact on Sentence 9.23.16.1.(1) Required roof sheathing	Impact on Article 9.23.16.5. Lumber roof sheathing	Impact on Sentence 9.27.5.4.(2) Attachment of cladding to ICF
Kelowna	BC	222162	1.7	1.7	1.04	1.04	0.40	0.42	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Vancouver (City Hall)	BC	2642825	1.8	1.8	1.19	1.19	0.45	0.50	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Victoria	BC	397237	1.1	1.1	0.81	0.81	0.57	0.63	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	**$2,009.15**
Calgary	AB	1481806	1.1	1.1	0.71	0.71	0.48	0.50	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Edmonton	AB	1418118	1.7	1.7	1.04	1.04	0.45	0.47	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Lethbridge	AB	123847	1.2	1.2	0.76	0.76	0.66	0.69	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Prince Albert	SK	45718	1.9	1.9	1.15	1.15	0.38	0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Regina	SK	249217	1.4	1.4	0.87	0.87	0.49	0.51	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Saskatoon	SK	317480	1.7	1.7	1.04	1.04	0.46	0.48	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Brandon	MB	54268	2.1	2.1	1.36	1.36	0.49	0.51	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Steinbach	MB	17806	2.0	2.0	1.30	1.30	0.40	0.42	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Winnipeg	MB	834678	1.9	1.9	1.25	1.25	0.45	0.47	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Hamilton	ON	785184	1.1	1.1	1.01	1.01	0.46	0.51	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Ottawa (City Hall)	ON	1135014	2.4	2.4	1.72	1.72	0.41	0.45	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Toronto (City Hall)	ON	6202225	0.9	0.9	0.90	0.90	0.44	0.48	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Montréal (City Hall)	QC	4291732	2.6	2.6	1.83	1.83	0.44	0.46	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Québec	QC	839311	3.6	3.6	2.58	2.58	0.41	0.43	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Sherbrooke	QC	227398	2.2	2.2	1.81	1.81	0.32	0.34	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Fredericton	NB	108610	3.1	3.1	2.31	2.31	0.38	0.42	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Moncton	NB	157717	3.0	3.0	2.25	2.25	0.50	0.55	**$126.98**	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Saint John	NB	130613	2.3	2.3	1.87	1.87	0.53	0.58	**$126.98**	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Halifax	NS	465703	1.9	1.9	1.65	1.65	0.58	0.64	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	**$2,009.15**
New Glasgow	NS	34397	2.2	2.2	1.81	1.81	0.55	0.61	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	**$2,009.15**
Truro	NS	46157	2.0	2.0	1.70	1.70	0.48	0.53	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Charlottetown	PE	78858	2.7	2.7	2.09	2.09	0.56	0.62	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	**$2,009.15**
Summerside	PE	18157	3.1	3.1	2.31	2.31	0.60	0.66	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	**$2,009.15**
Corner Brook	NL	29762	3.7	3.7	2.64	2.64	0.55	0.61	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	**$2,009.15**
Grand Falls	NL	13853	3.4	3.4	2.47	2.47	0.60	0.66	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	**$2,009.15**
St. John's	NL	212579	2.9	2.9	2.30	2.30	0.78	0.86	$0.00	**$437.04**	**$468.68**	**$1,125.30**	**$94.20**	**$168.82**	**$311.67**	$0.00
Dawson	YT	1577	2.9	3.0	1.70	1.75	0.31	0.33	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Whitehorse	YT	31913	2.0	2.1	1.20	1.26	0.38	0.40	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Hay River	NT	3169	2.4	2.5	1.42	1.48	0.35	0.37	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Inuvik	NT	3137	3.1	3.3	1.81	1.92	0.40	0.42	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Yellowknife	NT	20340	2.2	2.3	1.31	1.37	0.40	0.42	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Iqaluit	NU	7429	2.9	3.0	1.80	1.85	0.65	0.68	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Kangiqiniq / Rankin Inlet	NU	2975	3.0	3.2	1.85	1.96	0.60	0.63	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	**$2,009.15**