FENESTRATION ASSOCIATION OF BC

Guidelines on the Use of CSA A440S1-09 (Canadian Supplement) for Determining Fenestration Performance Grades in British Columbia

This guideline document was prepared to inform responsible parties about the appropriate use and limitations of CSA A440S1-09, commonly known as the Canadian Supplement, for specifying fenestration performance grades.

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Guidelines on the Use of CSA A440S1-09 for Determining Fenestration Performance Grades in BC

This document was prepared by the Technical Committee of the Fenestration Association of BC (FENBC) to assist parties using CSA A440S1-09 to determine NAFS-08 Performance Grades for both Part 9 and Part 3 buildings in British Columbia.

Definitions

This document uses the commonly used names/acronyms on the left to refer to the standards on the right:

NAFS, NAFS-08	AAMA/WDMA/CSA 101/I.S.2/A440-08, NAFS—North American Fenestration Standard/Specification for windows, doors and skylights
Canadian Supplement	A440S1-09, Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440-08, NAFS—North American Fenestration Standard/Specification for windows, doors and skylights

Introduction and use of this document

The 2012 BC Building Code requires manufactured and pre-assembled windows, doors and skylights to conform to NAFS-08 and the Canadian Supplement[1], and goes on to say:

> Performance grades for windows, doors and skylights shall be selected according to the Canadian Supplement . . . so as to be appropriate for the conditions and geographic location in which the window, door or skylight will be installed. [2]

This guideline document was created to inform users of the Canadian Supplement about the two versions of the document, about its appropriate use and limitations, and discusses the document's problematic definitions of open and rough terrain. This guidance is needed as many parties who will rely on online calculators based on the Supplement's simplified methods to determine performance grades may not be aware of these issues and particularly the standard's limitations, and as a result may make inappropriate performance grade determinations.

1. Versions of CSA A440S1-09

CSA A440S1-09 was published in July 2009 and Update 1 was published in July 2013. The update revises Table A.1 to harmonize the 1/50 HWP data with the 2010 NBCC (and the 2012 BCBC).

Technically, the 2010 National Building Code of Canada (NBCC) and provincial codes based on the 2010 NBCC recognize versions of referenced standards published no later than 30 September 2009. Use of the updated Supplement may require official sanction in some jurisdictions.

[1] 2012 BCBC 9.7.4.2.
[2] 2012 BCBC 9.7.4.3.(1) and 5.10.2.2.(2).

2. Terrain definitions

The definitions of open and rough terrain in both the original Canadian Supplement and in Update 1 do not correspond to the definitions in the 2010 NBCC and the 2012 BCBC. Users of the Supplement are advised that the Building Code definitions are to be used.

Terrain definitions in Building Code [3]	**Terrain definitions in Supplement** [4] (Discrepancies noted in italics)
[Open] terrain is level terrain with only scattered buildings, trees or other obstructions, open water or shorelines. . .	Open terrain – level terrain with relatively few buildings, trees, or other obstructions *and relatively little open water or shoreline*.
[Rough] terrain is suburban, urban or wooded terrain extending upwind from the building uninterrupted for at least 1 km or 20 times the building height, whichever is greater.	Rough terrain – suburban, urban, or wooded terrain that extends upwind from a building and that is uninterrupted for at least 1 km or *10 times* the building height, whichever is greater.

The open terrain definition in the Supplement suggests that open water and shoreline are not examples of open terrain. This is not correct. There is no question that open water and shoreline are examples of open terrain.

3. Appropriate use and limitations

The appropriate use and limitations of CSA A440S1-09 are not clearly stated in the introduction to the document. This guidance is found in Annex A (informative), and the relevant information is summarized below (underlining added).

> **Clause A.4.1 Reference climate loads**
> "The *NBCC* and the provincial and territorial codes based on the *NBCC* specify that climate data used in the design of buildings must be in conformance with the values established by the authority having jurisdiction or, in the absence of such data, with the climatic values in Appendix C of the *NBCC*. Designers and specifiers should refer to data provided by the authority having jurisdiction, or to the applicable building code . . . . Wind load data from Appendix C of the *NBCC* are reprinted in Table A.1 in this Annex. Values for 1/10 DRWP, which are not included in the *NBCC*, are also provided in Table A.1." [5]
>
> **Clause A.4.2 Calculation of specified loads**
> "Clause A.4.2 specifies two approaches for identifying the minimum performance levels for resistance to water penetration, to wind loads, and to snow loads: the simplified method outlined in Clause 4.2 or compliance with the more detailed procedures described by the structural requirements of the applicable building code. In some cases, the

[3] 2012 BCBC, as found in 4.1.7.1.(5) and elsewhere.
[4] CSA A440S1-09, Clause 3 on page 2.
[5] CSA A440S1-09 page 15.

simplified procedure can result in higher values than those attained using building codes." [6]

Clause A.4.2.1 Calculation of specified DRWP
Under the discussion of exposure factor (C_e): "The calculation of C_e for buildings located on hills or escarpments or in transitional terrains between open and rough terrain is more complicated. For these cases, the *User's Guide—NBC 2005: Structural Commentary 1* should be consulted." [7]

Clause A.4.2.2 Calculation of specified wind load
Under the discussion of exposure factor (C_e): "The calculation of C_e for buildings located on hills or escarpments or in transitional terrains between open and rough terrain is more complicated. For these cases, the *User's Guide—NBC 2005: Structural Commentary 1* should be consulted." [8]

Under the discussion of building shape: "The shape of a building creates pressure coefficients that can increase or decrease pressures on the building. The simplified calculations provided in this Supplement use a single value of 1.5 to account for building shape . . . . The *User's Guide—NBC 2005: Structural Commentary 1* may be consulted for less stringent values that can be used for particular building shapes."

4. Recommendations for use of CSA A440S1-09 for Part 9 buildings

These recommendations are based on the statements about the appropriate use and limitations of the Canadian Supplement as summarized in section 3 above.

4.1 Consult the authority having jurisdiction for appropriate climate data

Users of the Canadian Supplement should refer to climate data provided by the authority having jurisdiction, that is, the municipal building department. In some cases local building officials may require use of climate data that differs from the Building Code, based on local history and experience. Many municipalities are not listed in the building code, and in such cases local building officials should be able to advise what climate data they deem to be appropriate for their jurisdiction.

4.2 The "simplified methods" of the Canadian Supplement apply only to level terrain

Use of the simplified methods in Clause 4.2 of the Supplement is limited to buildings on level terrain, that is, terrain with a slope no greater than 1:10. [9]

4.3 Permit use of open terrain values in transitional zones between open and rough terrain

The Canadian Supplement recognizes that buildings may be located in transitional zones between open and rough terrain, and requires the appropriate wind exposure factor C_e to

[6] CSA A440S1-09 page 15.
[7] CSA A440S1-09 page 16.
[8] CSA A440S1-09 pages 17-18.
[9] The *User's Guide—NBC 2005: Structural Commentary 1* states on page I-9 that slopes less than 1:10 are considered insignificant and would, by inference, be considered level terrain.

be determined according to the *User's Guide—NBC 2005: Structural Commentary 1*. [10] Alternatively, open terrain values may be used in transitional areas between open and rough terrain.

4.4 The "simplified methods" of the Canadian Supplement do not apply to buildings on hills, escarpments, or terrain with a slope greater than 1:10; in these cases engineering calculations are required

For buildings on hills or escarpments, or buildings located on terrain with a slope greater than 1:10, the determination of the appropriate exposure factor C_e to calculate the *specified DRWP* and the *specified wind load* for selection of NAFS-08 performance grade and water penetration resistance test pressure must be performed by individuals competent to perform calculations using the *User's Guide—NBC 2005: Structural Commentary 1*.

The individuals generally recognized as competent to perform such calculations are registered professional structural engineers, but may include other individuals who have the appropriate technical training to perform such calculations.

5. Recommendations for use of CSA A440S1-09 for Part 3 buildings

The recommendations in section 4 above apply equally to Part 3 buildings.

In addition, users of the Canadian Supplement are reminded that use of the simplified methods for determining *specified driving rain wind pressure* and *specified wind load* are optional and are less precise than using the more detailed methods in Part 4 and in the *User's Guide—NBC 2005: Structural Commentary 1*. They may also lead to more conservative (higher) design wind pressures for windows, doors and skylights than would be determined by registered professional engineers using the more detailed methods.

Since registered professional engineers are typically employed to design fenestration systems to meet the relevant structural performance requirements of Part 3 buildings under the BCBC, it is these engineers who should determine the appropriate design wind pressures for a building's shape, location, height, and terrain. Using a more detailed wind load analysis in place of NAFS performance grades determined with the simplified methods in the Canadian Supplement and rounded up to the next highest bracket may also result in more cost effective fenestration designs.

While it is permitted to use either the simplified or more detailed methods to determine Performance Grade and Water Penetration Resistance Test Pressure for the purpose of qualifying products according to NAFS-08, specifications should continue to allow the fenestration engineer to design glass, framing reinforcement and anchorage to the more detailed methods in Part 4 as was the case under the 2006 BCBC.

[10] CSA A440S1-09, Clause 4.2.1, p. 3.