CCMC CANADIAN CODE COMPLIANCE EVALUATION

CCMC EVALUATION

CCMC 13640-R

CCMC Canadian code compliance evaluation

CCMC number:	13640-R
Status:	Active
Issue date:	2012-12-11
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Evaluation holder:	**Lumon International Oy** PL 440 Kaitilankatu 11 45130 Kouvola Finland Website: www.lumon.ca Telephone: 855-458-3020 Email: info.northamerica@lumon.com
Product name:	Lumon Glazing System
Compliance:	NBC 2015, NBC 2020, OBC
Criteria:	CCMC-TG-085700-15, "CCMC Technical Guide for Balcony Glazing System" CCMC-TG-085700-20, "CCMC Technical Guide for Balcony Glazing System"

In most jurisdictions this document is sufficient evidence for approval by Canadian authorities.
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Compliance opinion

It is the opinion of the Canadian Construction Materials Centre that the evaluated product, when used as a balcony windbreak glazing system and fall-protection guard in accordance with the conditions and limitations stated in this evaluation, complies with the following codes:

National Building Code of Canada 2015

Code provision	Solution type
4.1.5.14. Loads on Guards and Handrails	Acceptable
4.1.7.1. Specified Wind Load	Acceptable
4.1.7.5.(5) For the design of balcony guards, the in ...	Acceptable
4.1.8.3.(5) All structural framing elements not cons ...	Acceptable
4.1.8.18.(14) Except as provided in Sentence 4.1.8.18. ...	Acceptable
4.3.5.1. Design Basis for Aluminum	Acceptable
9.6. Glass	Acceptable
9.8.8.2. Loads on Guards	Acceptable
9.8.8.3. Height of Guards	Acceptable
9.8.8.6. Design of Guards to Not Facilitate Climbing	Acceptable
9.8.8.7. Glass in Guards	Acceptable
9.10.17.1. Flame-Spread Rating of Interior Surfaces	Acceptable
9.20.16.1. Corrosion Resistance of Connectors	Acceptable

National Building Code of Canada 2020

Code provision	Solution type
4.1.5.14. Loads on Guards and Handrails	Acceptable
4.1.7.1. Specified Wind Load	Acceptable
4.1.7.5.(5) Except as provided in Sentence 4.1.7.5.(...	Acceptable
4.1.8.3.(5) All structural framing elements not cons ...	Acceptable
4.1.8.18.(14) Except as provided in Sentence 4.1.8.18. ...	Acceptable
4.3.5.1. Design Basis for Aluminum	Acceptable
9.6. Glass	Acceptable
9.8.8.2. Loads on Guards	Acceptable
9.8.8.3. Height of Guards	Acceptable

Code provision	Solution type
9.8.8.6. Design of Guards to Not Facilitate Climbing	Acceptable
9.8.8.7. Glass in Guards	Acceptable
9.10.17.1. Flame-Spread Rating of Interior Surfaces	Acceptable
9.20.16.1. Corrosion Resistance of Connectors	Acceptable

Ontario Building Code

Ruling No. 24-01-375 (13640-R) authorizing the use of this product in Ontario, subject to the terms and conditions contained in the Ruling, was made by the Minister of Municipal Affairs and Housing on 2024-04-29 pursuant to s.29 of the Building Code Act, 1992 (see Ruling for terms and conditions). This Ruling is subject to periodic revisions and updates.

The above opinion(s) is/are based on the evaluation by the CCMC of technical evidence provided by the evaluation holder, and is bound by the stated conditions and limitations. For the benefit of the user, a summary of the technical information that forms the basis of this evaluation has been included.

Product information

Product name

Lumon Glazing System

Product description

The product consists of two parts:

- Part 1: The glazing part, which has two options:
  - Lumon Glazing Retractable – a glazing system with sliding and hinged opening mechanisms
  - Lumon Glazing Sliding – a glazing system with a sliding glass opening mechanism

  Both of these options scale according to the space, the demands of the conditions and the customer's needs. The system is not hermetically sealed, as there are ventilation gaps between the sliding and hinged glass panels.
- Part 2: The guard part, Lumon Balcony Balustrade, which forms a balcony windbreak glazing system. The system is not hermetically sealed, as there are ventilation gaps between the glass panels.

Lumon Glazing Retractable

The Lumon Glazing Retractable system is a frameless glazing system consisting of an upper extruded aluminum telescopic loadbearing profile and a lower extruded aluminum guiding profile, which are mounted to the balcony ceiling and on the handrail or floor. Toughened glass panes, with glass beads top and bottom, are mounted between the upper and lower profiles.

The glass panels slide along the upper profile and are guided by the lower profile. The panels then fold open, with the assistance of roller bearings and hinge components that are fixed to each glazing bead. All glass panels can slide and be opened, except for one hinged panel at the end of the glass portion, which is fixed in place but can be opened by folding either inwards or outwards. A latch mechanism keeps the fixed-in-place glass panel closed or partially open for ventilation. The other glass panels can be moved laterally, swung open at 90° and locked in place with the hinges of adjacent panels.

To fully open the system, the movable glass panels can all be shifted to the end with the fixed-in-place panel. An integrated stacking device secures the glass panels while they are in the open position. A locking groove is milled to the top and bottom of the glass to ensure a fail-proof connection between the glass and the glass bead, in addition to the adhesively bonded connection. Glazing beads are cut wider than the glass panels to prevent glass-to-glass contact when in the closed position and to provide ventilation between the glass panels.

Lumon Glazing Sliding

The Lumon Glazing Sliding system is a frameless glazing system consisting of an upper extruded aluminum guiding profile and lower extruded loadbearing aluminum profile, which are mounted to the balcony ceiling and on the handrail or floor. Toughened glass panes, with glass beads top and bottom, are mounted between the upper and lower profiles. The glass panels slide along the lower profile and are guided by the upper profile, and the panels are interleading. A

locking groove is milled to the top and bottom of the glass to ensure a fail-proof connection between the glass and the glass bead, in addition to the adhesively bonded connection.

Lumon Balcony Balustrade

The Lumon Balcony Balustrade portion is composed of tempered glass in-fill panels, galvanized steel anchors and extruded aluminum handrails, posts and sills. The extruded aluminum handrail connects to the posts with stainless steel bolts and rivets, while the extruded aluminum sill connects to the posts with stainless steel bolts. The top of the glass in-fill panels is held in the track formed by the edge of the handrail. This track is lined with an ethylene propylene diene monomer (EPDM) rubber seal and a clip-in extruded aluminum retaining profile. Another extruded aluminum sill with an EPDM rubber seal holds the bottom of the glass panels in place, along with a clip-in extruded aluminum retaining profile. The extruded aluminum posts, which are connected by a friction wedge plate, fit over the top of the steel foot anchors, to which they are held with stainless steel threaded rod inserts and stainless steel cap hex nuts.

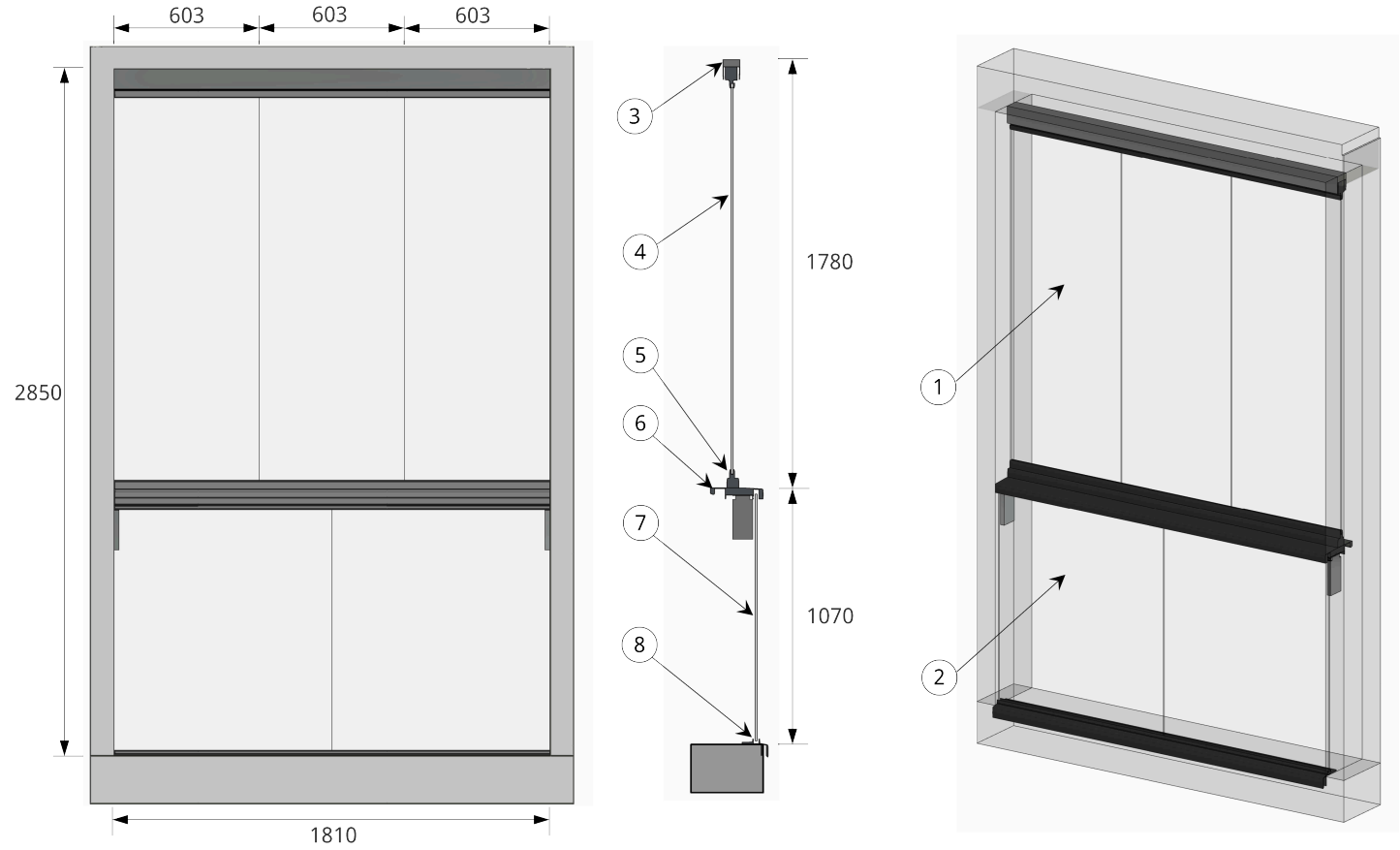

Figure 1. Lumon Glazing System: isometric view (right); cross-section view (middle); and elevation view (left) (all dimensions in millimetres)

1. Glazing part
2. Balcony guard (balustrade) part
3. Upper extruded aluminum profile (telescopic loadbearing for Glazing Retractable or guiding non-loadbearing for Glazing Sliding)
4. Glazing frameless glass panels
5. Lower extruded aluminum profile (guiding non-loadbearing for Glazing Retractable or loadbearing for Glazing Sliding)
6. Handrail
7. Cladding glass panels
8. Floor frame

Manufacturing plant

This evaluation is valid only for products produced at the following plant:

Product name	Manufacturing plant
	Woodbridge, ON, CA
Lumon Glazing System	✓

✓ Indicates that the product from this manufacturing facility has been evaluated by the CCMC

Conditions and limitations

The CCMC's compliance opinion is bound by this product being used in accordance with the conditions and limitations set out below.

- The product must be installed on balcony structures that meet the local municipal building code.
- The product is not hermetically sealed; as such, it does not create an additional conditioned living space.
- All installations must be performed by a competent installer certified by the manufacturer in accordance with their installation manual and field quality control system.
- This evaluation does not provide any specific design approach for the product. Case-specific engineering must be provided by a qualified engineer for:
  - wind, seismic and other pertinent loading calculations: if the effects of these calculated lateral loads exceed those of the horizontal loads used in the performance requirements section of this evaluation, such application is beyond the scope of this evaluation and must be treated as a case-specific engineering design;
  - the design of the connections between the product and supporting structure (i.e., connectors, fixtures, anchorage, etc.); and
  - the supporting structure: Lumon Glazing System must be installed on balcony structures that meet the requirements of the NBC 2015 or NBC 2020 for exterior balconies.

Technical information

This evaluation is based on demonstrated conformance with the following criteria:

Criteria number	Criteria name
CCMC-TG-085700-15	CCMC Technical Guide for Balcony Glazing System
CCMC-TG-085700-20	CCMC Technical Guide for Balcony Glazing System

The technical documentation provided by Lumon in the form of certifications issued by manufacturers of raw material, engineering analysis issued by qualified engineers and test reports issued by recognized laboratories is assessed by the CCMC for this evaluation, and the summary is presented below.

Prescriptive requirements

The prescriptive requirements in this evaluation are the limits for the geometry of the assembled product as well as the chemical compositions and physical properties of the materials used for the manufacture of the product, as summarized in the table below.

Table 1. Geometrical and material properties of the product

Property		Unit	Requirement	Result	Method
Height of guard		mm	≥ 1 070	Pass	Test report
Design of guards to not facilitate climbing (1)		–	Located more than 450 mm horizontally and vertically from each other	Pass	Test report
			Provide not more than a 15 mm horizontal offset	Pass	Test report
			Do not provide a toe space more than 45 mm horizontally and 20 mm vertically	Pass	Test report
			Present more than a 1-in-2 slope on the offset	Pass	Test report
Aluminum	**alloy**	–	EN AW-6063-T5 or T6	Pass	Certification (2)
	ultimate tensile strength	MPa	≥ 150	Pass	
	yield strength	MPa	≥ 110	Pass	
Glass		–	Laminated, tempered or wired safety glass	Pass	Certification (3)
Polymeric material		–	Polyamide PA66 or equivalent	Pass	Certification (4)
Fastener material		–	Stainless steel	Pass	Test report (5)

Notes:

1 Guards are deemed to comply with the requirement to not facilitate climbing when any elements protruding from the vertical, and located within the area between 140 mm and 900 mm above the floor or walking surface protected by the guard, pass the requirements in this table.

2 Third-party certification for mechanical properties and chemical composition by the supplier (Mäkelä Alu) provided by Lumon.

3 Certification in accordance with DIN EN 12600, "Glass in Building – Pendulum Tests – Impact Test Method and Classification for Flat Glass," provided for impact resistance classifications by Lumon.

4 Technical data sheet and certification provided for Grilon AZ 3 as equivalent to PA66 by Lumon.

5 The fastener material verification performed by the testing lab for the tested specimens and included in the documented quality systems by Lumon.

Performance requirements

The performance of the product in this evaluation mainly involves the ultimate limit states to ensure the resistance of the balustrade part to the applied loads as guards for fall protection. The performance of the product specimens under wind and seismic effects are provided as benchmarks for the design engineers to adopt, in correlation with their calculations for wind pressure and earthquake equivalent force based on the provisions of Part 4 of Division B of the NBC 2015 or NBC 2020. Other performance requirements to ensure the functionality and ease of operation mainly involve the glazing part, while the fire performance involves the whole system when applicable.

Table 2. Performance of the balustrade part as guard for fall protection under applied horizontal loads

Load application in laboratory testing	Tested part	Unfactored load (kN)	Factored load (kN)	Ultimate limit states		Serviceability limit states	
				Failure criteria	Result (1)	Displacement criteria	Result (2) (mm)
Horizontal point load of 0.5 kN applied to the in-fill glass at a 0.01 m^2 square	Individual in-fill glass centre	0.5	1.25 (3)	Any sign of fracture	Pass	Report deflection value under unfactored load	10.17
	Edge between two in-fill glasses	0.5	1.25	Any sign of fracture	Pass	Report deflection value under unfactored load	14.17
Horizontal concentrated load of 1.0 kN applied at any point	Top of guard railing connector	1.0	2.0 (4)	Deflection greater than h/36 (5), or permanent deflection greater than h/240	Pass	Report deflection value under unfactored load	1.65

Load application in laboratory testing	Tested part	Unfactored load (kN)	Factored load (kN)	Ultimate limit states		Serviceability limit states	
				Failure criteria	Result (1)	Displacement criteria	Result (2) (mm)
	Top of guard railing midspan	1.0	1.67 (6)	Deflection greater than h/ 36, or permanent deflection greater than h/ 240	Pass	Report deflection value under unfactored load	1.81
Vertical distributed load of 1.5 kN/m at handrail (top of guard)	At railing connector	1.36 (7)	2.72 (8)	Deflection greater than b/ 24, or permanent deflection greater than b/ 240	Pass	Report deflection value under unfactored load	2.73
	At railing midspan	1.36	2.26 (9)	Deflection greater than b/ 24, or permanent deflection greater than b/ 240	Pass	Report deflection value under unfactored load	5.38

Notes:

1 The pass/fail criterion indicates all tested specimens. If any specimen fails the failure criteria, the overall result would be "fail."

2 The result is provided as the average of three tested specimens in the test report provided by Lumon.

3 Unfactored load multiplied by load factor of 1.5 and divided by resistance factor of 0.6 (for glass) applied on a square of 0.01 m^2.

4 Unfactored load multiplied by load factor of 1.5 and divided by resistance factor of 0.75 (for connectors).

5 "h" is the height of the guard, 1 070 mm.

6 Unfactored load multiplied by load factor of 1.5 and divided by resistance factor of 0.9 (aluminum).

7 Applying this point load at quarter points of the railing span results in the same bending moment caused by the distributed load of 1.5 kN/m. This transformation was applied by the testing lab to facilitate their testing.

8 Unfactored load multiplied by load factor of 1.5 and divided by resistance factor of 0.75 (for connectors).

9 Unfactored load multiplied by load factor of 1.5 and divided by resistance factor of 0.9 (aluminum).

Table 3. Other performance requirements

Property		Part	Requirement	Observation	Result
Ease of operation – force required to initiate motion	**from closed position**	Glazing	≤ 135 N	44.8 N	Pass
	from open position			47.8 N	Pass
Ease of operation – force to maintain motion	**from closed position**		≤ 90 N	38.5 N	Pass
	from open position			40.7 N	Pass
Roller/sliding assembly operation – shock load (1)		Glazing	Avoid failure (2)	–	N/A (3)
Roller/sliding assembly operation – cycling (4)		Glazing	Avoid failure (2)	No failure	Pass
Roller/sliding assembly operation – deglazing	**top sash**	Glazing	Avoid deglazing (5)	5.1% deglazing (6)	Pass (7)
	bottom sash			5.6% deglazing (8)	
Surface flame-spread rating		System	≤ 150 (9)	5	Pass

Notes:

1 Glazing specimen with 12-mm glass tested by rolling the glazing system with supplied rollers over a 90° free edge of 6.4 mm and allow to free-fall.

2 Failure is defined by the CCMC as any breakage or permanent deformation of any roller assembly part that would cause any malfunction or impair proper operation of the moving parts.

3 Testing lab concluded in their report that since the rollers are fully enclosed in the top track of the glazing, falling away from the tracks is not possible.

4 Glazing specimen with 12 mm glass tested by sliding the panels in forward opening and closing for 2 500 cycles.

5 Deglazing occurs if the test specimen is damaged in any way that would inhibit normal operation of the glazing unit or cause glazing breakage.

6 Percentage of deglazing is the deflection recorded for the top sash under the applied load of 320 N (0.95 mm) divided by glazing engagement (18.5 mm).

7 The lab test report showed no deglazing as defined in Note 5 above.

8 Percentage of deglazing is the deflection recorded for the bottom sash under the applied load of 320 N (1.03 mm) divided by glazing engagement (18.5 mm).

9 For the interior exposed surface in accordance with CAN/ULC-S102-10, "Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies."

Other technical information

The information in this section has informative nature and must not be used as the main source for design.

The proponent has voluntarily tested the performance of a specific sample of the product with 1 660 mm length under a loading that resembles wind pressure in accordance with ASTM E330/E330M-02, "Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference," and reported the following results.

Test method	Applied load (kPa)	Maximum deflection (mm) [fraction of length]		Residual (permanent) deflection (mm) [fraction of length]	
		Track midspan	In-fill glass centre	Track midspan	In-fill glass centre
Uniform pressure resembling wind load in accordance with ASTM E330, Procedure A	+1.92	9.72 [1/170]	68.61 [1/24]	4.37 [1/380]	2.68 [1/619]
	–1.92	13.24 [1/125]	70.28 [1/24]	6.92 [1/240]	5.00 [1/332]
	+2.88	20.70 [1/80]	95.20 [1/17]	10.12 [1/164]	2.17 [1/765]
	–2.88	10.25 [1/162]	103.13 [1/16]	1.18 [1/1407]	6.33 [1/262]

In order to resemble the performance of the system under seismic loading, the proponent has voluntarily performed dynamic racking testing on three samples of the product with 1 660 mm length under the increasing displacement time-history up to 150 mm, in accordance with AAMA 501.6-09, "Recommended Dynamic Test Method for Determining the Seismic Drift Causing Glass Fallout from a Wall System." The horizontal members of the specimen were mechanically fastened to the vertical mullions of the testing frame with two M5x12 star-drive machine screws per connection. All test units employed two 10-mm-thick tempered glass units and two 6-mm-thick tempered glass units. Three anchor clips were attached using two M12x140 threaded rods with washers and nuts to a 6 × 8 steel I-beam at the base of the test apparatus. The head of the specimen was fastened to a 6 × 6 steel I-beam at the top of the testing apparatus with seven 5/16" × 2" hex head bolts with washers and nuts. Based on the results of the dynamic racking testing, the final fallout deflection of 152 mm was met for all three specimens with no glass fallout or other damage to the system.

Administrative information

Use of Canadian Construction Materials Centre (CCMC) assessments

This assessment must be read in the context of the entire CCMC Registry of Product Assessments, any applicable building code or by-law requirements, and/or any other regulatory requirements (for example, the Canada Consumer Product Safety Act, the Canadian Environmental Protection Act, etc.).

It is the responsibility of the user to confirm that the assessment they are using is current and has not been withdrawn or superseded by a later version on the CCMC Registry of Product Assessments.

Disclaimer

The National Research Council of Canada (NRC) has evaluated only the characteristics of the specific product described herein. The information and opinions in this evaluation are directed to those who have the appropriate degree of experience to use and apply its contents (such as authorities having jurisdiction, design professionals and specifiers). This evaluation is valid when the product is used as part of permitted construction, respecting all conditions and limitations stated in the evaluation, and in accordance with applicable building codes and by-laws.

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Language

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In the case of any discrepancy between the English and French version of this document, the English version shall prevail.

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The Canadian Construction Materials Centre (CCMC) assesses compliance with Canadian building, energy and safety codes. We are the only construction code compliance service supported and operated by the Government of Canada. Trusted by over 6,000 regulators across Canada.

> Most Canadian authorities having jurisdiction (AHJs) consider CCMC product assessments acceptable as evidence for product approval.

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Alliance of Canadian Building Official Associations (ACBOA)	(Alliance of Canadian Building Official Associations (ACBOA))
First Nations National Building Officers Association (FNNBOA)	(First Nations National Building Officers Association (FNNBOA))
Canadian Home Builders' Association (CHBA)	(Canadian Home Builders' Association (CHBA))
Alberta Building Officials Association (ABOA)	(Alberta Building Officials Associations (ABOA))
Saskatchewan Building Officials Association (SBOA)	(Saskatchewan Building Officials Association (SBOA))
Manitoba Building Officials Association (MBOA)	(Manitoba Building Officials Association (MBOA))
Ontario Building Officials Association (OBOA)	(Ontario Building Officials Association (OBOA))
New Brunswick Building Officials Association (NBBOA)	(New Brunswick Building Officials Association (NBBOA))
Nova Scotia Building Officials Association (NSBOA)	(Nova Scotia Building Officials Association (NSBOA))

> The CCMC provides code compliance assessments to Canadian code requirements, consulting nationwide with construction regulators to elicit regional variations in code requirements as well as provincial and local interpretations. Users are advised to review the technical information presented in CCMC assessments when making approval decisions. Learn more about how the CCMC provides a unique service for Canada.

For more information, contact the CCMC by phone at (613) 993-6189 or by email at ccmc@nrc-cnrc.gc.ca

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Code compliance as an acceptable solution

Code Compliance via Acceptable Solutions

> If a building design (e.g. material, component, assembly or system) can be shown to meet all provisions of the applicable **acceptable solutions** in Division B (e.g. it complies with the applicable provisions of a referenced standard), it is deemed to have satisfied the objectives and functional statements linked to those provisions and thus to have complied with that part of the Code.
>
> — **National Building Code of Canada, Sentence A-1.2.1.1.(1)(a)**

The CCMC has determined that compliance with this provision of the Code has been demonstrated as an **Acceptable Solution**. The evaluation report provides a summary of the basis of CCMC's compliance opinion.

CCMC's code compliance opinions

All CCMC evaluation reports are opinions of code compliance established in accordance with the National Building Code of Canada, Subsection 1.2.1. "Compliance with this Code," which requires compliance to be achieved by:

- complying with the applicable acceptable solutions in Division B, or
- using an alternative solution that will achieve at least the minimum level of performance required by Division B in the areas defined by the objective and functional statements attributed to the applicable acceptable solutions.

The CCMC assesses compliance with Canadian building, energy and safety codes, and is trusted by over 6,000 regulators across Canada.

Code compliance as an alternative solution

Code Compliance via Alternative Solutions

> Where a design differs from the acceptable solutions in Division B, then it should be treated as an "**alternative solution**." A proponent of an alternative solution must demonstrate that the alternative solution addresses the same issues as the applicable acceptable solutions in Division B and their attributed objectives and functional statements. However, because the objectives and functional statements are entirely qualitative, demonstrating compliance with them in isolation is not possible. Therefore, Clause 1.2.1.1.(1)(b) identifies the principle that Division B establishes the quantitative performance targets that alternative solutions must meet. In many cases, these targets are not defined very precisely by the acceptable solutions [...] Nevertheless, Clause 1.2.1.1.(1)(b) makes it clear that an effort must be made to demonstrate that an alternative solution will perform as well as a design that would satisfy the applicable acceptable solutions in Division B—not “well enough” but “as well as.”
>
> — **National Building Code of Canada, Sentence A-1.2.1.1.(1)(b)**

The CCMC has determined that compliance with this provision of the Code has been demonstrated as an **Alternative Solution**. The evaluation report provides a summary of the basis of CCMC's compliance opinion.

CCMC's code compliance opinions

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