Evaluation Report CCMC 14132-R
KuraStone™

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1. Opinion

It is the opinion of the Canadian Construction Materials Centre (CCMC) that "KuraStone™," when used as an exterior cladding in accordance with the conditions and limitations stated in Section 3 of this Report, complies with the National Building Code (NBC) of Canada 2015:

- Clause 1.2.1.1.(1)(a) of Division A, as an acceptable solution from Division B:
  - Article 4.3.1.1., Design Basis for Wood
  - Subsection 9.27.2., Required Protection from Precipitation

- Clause 1.2.1.1.(1)(b) of Division A, as an alternative solution that achieves at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the following applicable acceptable solutions:
  - Article 9.20.2.1., Masonry Unit Standards
  - Article 9.20.5.1., Masonry Support
  - Subsection 9.20.6., Thickness and Height

This opinion is based on the CCMC evaluation of the technical evidence in Section 4 provided by the Report Holder.

2. Description

The product is a glass-fibre reinforced cement cladding panel that is mechanically attached to a proprietary[1] engineered structural wood sheathing and stud framing design detailed in Appendix A.

The product is composed of Portland cement, sand, glass fibre, resin, a water-reducing agent, pigments, and paint. The product is cast in moulds that produce different textures, and then cured at room temperature. "KuraStone™" is available in different sizes, 260 mm, 390 mm or 650 mm in length, with 150 mm in width and approximately 35 mm in thickness. "KuraStone™" has two product profiles, "StackedStone" and "LedgeStone," shown in Figures 1 and 2, respectively. They offer different textures and patterns, with the same dimensions.

[1] The design must be in accordance with the requirements specified in Moses Structural Engineers, Inc.'s Report No. 17.206-01, dated July 8, 2019. Refer to the Kurastone Installation Guide for more information about obtaining the copy of the report.

Figure 1. "StackedStone"

Figure 2. "LedgeStone"

The "KuraStone™" products are mechanically attached to the supporting structure using metal clips and metal fasteners. The Nichiha metal starter track is attached to the bottom of the first row of "KuraStone™." The top and bottom edges of "KuraStone™" have grooves to clips that are attached to the supporting structures. The Nichiha metal clips are ZAM® (zinc-aluminum-magnesium alloy, Commercial Steel Type B, ASTM A1046M, ZMM275, Type 1, chemically treated, non-oiled) coated steel and the fasteners are minimum No. 8 × ¾ in fully threaded stainless steel wood screws. The clips are designed to create a 10-mm-deep drained and vented air space behind the cladding (i.e., a rainscreen system) and placed at each vertical joint and at the centre of the bottom of each individual piece. Figures 3 and 4 illustrate a typical installation of "KuraStone™" and a typical clip layouts, respectively.

Instead of the masonry being supported on the foundation, the product is supported by the wood frame. Therefore, the product must be installed according to the proprietary wood-frame construction details. These construction details are in Appendix A, and include increased top and bottom plates, less stud spacing, horizontal sheathing, etc.

Figure 3. A typical "KuraStone™" installation

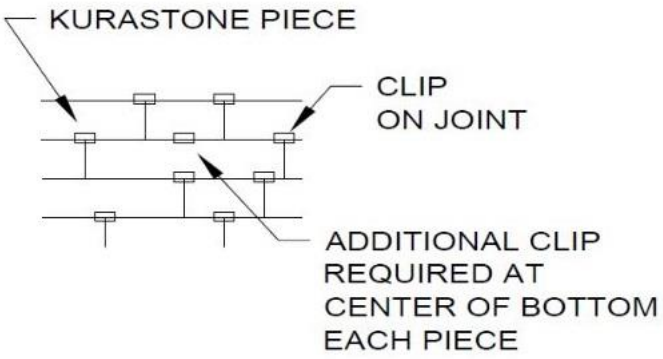

Figure 4. A typical clip layout.

3. Conditions and Limitations

The CCMC compliance opinion in Section 1 is bound by "KuraStone™" being used in accordance with the conditions and limitations set out below.

3.1 General

- The product is intended for use as an exterior cladding in new construction. It is installed on structural grade wood sheathing boards that are attached to wood framing in accordance with the backup wall design specified in Appendix A of this Report.
- The product is limited to installation on buildings not exceeding two (2) storeys, with a maximum height of 3 m per floor, with a maximum building plan of 24 m × 12 m and with a maximum floor joist clear span of 8 m. The joist span tables referred in Article 9.23.4.2., Spans for Joists, Rafters and Beams, of Division B of the NBC 2015, apply to floors supported by sawn lumber joists. If the framing is other than sawn lumber (e.g. I-joist), the floors are required to be designed in conformance with Part 4.
- The product is limited to installations in geographical areas where the 1-in-50 hourly wind pressure is ≤ 0.85 kPa and the building is Category 2 for internal pressure (C_{pi}: –0.45 to +0.30), as defined in Article 4.1.7.7., Internal Pressure Coefficient, of Division B of the NBC 2015. The wind design value has been validated for the product installed over 11-mm-thick oriented strand board (OSB) installed horizontally with blocking.
- The product must be applied in geographical areas where the spectral response acceleration $S_a(0.2)$ is 1.2 or less, and the building is on a Class C site or better, as defined in Article 4.1.8.4., Site Properties, of Division B of the NBC 2015.
- The 10-mm air space that is created by the clips must remain unobstructed to form a clear drainage layer behind the product.
- At least one layer of wall-sheathing membrane conforming to Article 9.27.3.2., Sheathing Membrane Material Standard, of Division B of the NBC 2015, must be applied beneath the cladding products. The sheathing membrane must be applied in accordance with Article 9.27.3.3., Required Sheathing Membrane and Installation, of Division B of the NBC 2015.
- The product must be installed with suitable flashing to drain water from the drainage layer to the exterior and to protect the exposed top edge of the cladding.
- Flashing must be installed in accordance with the requirements of Articles 9.27.3.7., Flashing Materials, and 9.27.3.8., Flashing Installation, of Division B of the NBC 2015.
- The impact resistance of the product makes it susceptible to hard- and soft-body impacts. However, the ease of replacing the product makes it suitable for normal use in upper floors and protected ground floors. When used at ground floors exposed to high impacts, special precautions must be taken, such as guardrails or raised gardens.
- Fire blocks must be installed in accordance with the requirements of Article 9.10.16.2., Required Fire Blocks in Wall Assemblies, of Division B of the NBC 2015.
- The product must be installed in accordance with the manufacturer's current instructions "KuraStone Installation Guide" dated September 2019.
- To obtain an acceptable performance, a high level of quality control at all stages of the exterior wall construction is imperative.
- This Evaluation Report is applicable only to products identified by the phrase "CCMC 14132-R."

3.2 Structural

- The product is to be installed on a pre-engineered wood frame designed to support this proprietary product. The installation of the product must be in accordance with the engineering analysis as prepared by Moses Structural Engineers Inc., Report No. 17.206-01, dated July 8, 2019. The pre-engineered design solutions are produced in the engineering analysis and reproduced in Appendix A of this Report along with the detailed design and construction requirements. The provided pre-engineered design solutions have the following features:
    - only applied to new construction;
    - the nailing of the top and bottom plates is increased;
    - squash blocks are required to support the I-joists; and
    - exterior sheathing is installed with the strong axis (face grain) oriented horizontally with blocking.
- When the product is used outside the scope and limitations of Moses Structural Engineers Inc.'s Report No. 17.206-01 dated July 8, 2019, a special engineering analysis must be carried out by a licensed professional engineer skilled in structural design, who must sign and seal the related analysis, confirming its conformance to Part 4, Structural Design, of Division B of the NBC 2015.
- The stud wall must consist of 38-mm × 140-mm No. 1/No. 2 grade Spruce – Pine – Fir (S – P – F) or No. 1/No. 2 grade Douglas-fir. A hole not greater than 25 mm in diameter is permitted at the centreline of the stud. The plates used in the framing of the back-up wall must be No. 2 grade S – P – F plates.
- The fasteners for sheathing must conform to the following tables:
    - Table 9.23.3.5-B "Fasteners for Sheathing where 0.8 kPa ≤ 1-in-50 HWP < 1.2 kPa and Sa(0.2) ≤ 0.90 or where 0.70 < Sa(0.2) ≤ 0.90"; or
    - Table 9.23.3.5-C "Fasteners for Sheathing where 0.8 kPa ≤ 1-in-50 HWP < 1.2 kPa and Sa(0.2) ≤ 1.8 or where 0.90 < Sa(0.2) ≤ 1.8", of Division B of the NBC 2015.

  Table 9.23.3.5-A "Fasteners for Subflooring and for Sheathing where the 1-in-50 HWP < 0.8 kPa and Sa(0.2) ≤ 0.70" must not be used.
- The clips must be attached to a minimum 12-mm-thick OSB, which is supported by untreated wood studs spaced at 600 mm or less, or 12.5-mm plywood sheathing conforming to CSA O121-08, "Douglas Fir Plywood," or CSA O151-09, "Canadian Softwood Plywood."
- A sufficient horizontal joint must be provided to mitigate adverse effects of inter-storey vertical settlement due to wood shrinkage (6.5 mm per storey).
- The clips must be ZAM® (zinc-aluminum-magnesium alloy, Commercial Steel Type B, ASTM A1046M, ZMM275, Type 1, chemically treated, non-oiled) coated steel. The fastening screws used to secure the cladding through the clips must be minimum No. 8 × ¾ in fully threaded stainless steel wood screws. A minimum of two screws must be used par clip.
- Cladding attachments must conform with Sentence 9.27.5.1.(1), Attachment (of Cladding) and Articles 9.27.5.5., Fastener Materials, and 9.27.5.7., Penetration of Fasteners, of Division B of the NBC 2015. For any other mode of attaching a cladding system to sheathing, the structural sufficiency of the sheathing and the whole backing, in conjunction with the clips and type of fasteners, must be in accordance with the engineering analysis as prepared by Moses Structural Engineers Inc. in Report 17.206-01, dated July 8, 2019.

4. Technical Evidence

The Report Holder has submitted technical documentation for the CCMC evaluation. Testing was conducted at laboratories recognized by CCMC. The corresponding technical evidence for this product is summarized below.

4.1 Requirements

4.1.1 Material Requirements

Table 4.1.1.1 Results of Testing the Prescriptive Requirements of "KuraStone™"

Property		Unit	Requirement	Result
Alkali resistance of glass fibre		–	ASTM C 1666 "Standard Specification for Alkali Resistant (AR) Glass Fiber for GFRC and Fiber-Reinforced Concrete and Cement"	Pass
Dimensional tolerances	**length**	mm	≤ ± 3	2
	width	mm	≤ ± 3	2
	thickness	%	≤ 15	Pass(1)

Property			Unit	Requirement	Result
	squareness		mm/m	≤ ± 1.3	Pass(2)
	edge straightness		mm/m	≤ ± 1.3	Pass(2)
Water absorption			%	≤ 40	9.8
Density			kg/m^3	≥ 950	1 917
Dimensional change in length			%	< 0.20	0.015
Flexural strength			MPa	> 7.0	9.4(3)
Water vapour transmission (water method)			$ng/(Pa \cdot s \cdot m^2)$	> 60	140
Watertightness			–	No drops of water	None
Warm water resistance	**loss in flexural strength**		%	≤ 15	5
	deleterious effects		–	No visible deterioration	None
Freeze-thaw resistance (unidirectional)		**loss in mass**	%	≤ 3	1
		deleterious effects	–	No visible deterioration	None
Freeze-thaw resistance (multidirectional)		**loss in flexural strength**	%	≤ 15	1

Notes to Table 4.1.1.1:

(1) Some of the products with more uneven textures did not meet the dimensional tolerance for thickness due to the difficulty of measuring thickness. However, in this case, the variance in thickness would be unlikely to affect the air space behind the cladding as the clips control the depth of air space.

(2) Some specimens had higher readings that did not meet the dimensional tolerance for squareness and edge straightness. However, the test lab confirmed that the products were always installed on the clips snugly, without being forced into them.

(3) The coefficient of variation was higher than the requirement due to an outlier measurement.

Table 4.1.1.2 Results of Testing of the Pullout, Shear and Bending Properties of Clip

Property	Unit	Requirements	P_{ult}	Factored Resistance(4)	Results
Pullout test with both cladding and clip(1)	**N**	≥ 1000	627(5)	423	Pass
Pullout test with clip only(2)	**N**	≥ 1000	863(5)	467	Pass
Shear and Bending(3)	**N**	Report Value	334	302	Pass

Notes to Table 4.1.1.2:

(1) This test is to evaluate the pullout capacity of the clip from substrate (sheathing panel) and the groove strength of the product where the clip is attached.

(2) This test is to evaluate the direct pullout capacity of the clip from substrate (sheathing panel).

(3) This test is to evaluate the capacity of the clip in resisting vertical loading.

(4) The factored resistance is calculated as per Section 9.4.2.1.1 of CAN/CSA-A370-04, "Connectors for Masonry," using either $\phi = 0.9$ for material failure of the metal components of the connector or $\phi = 0.6$ for embedment failure, failure of the fasteners, or buckling failure of the connector.

(5) The specified minimum pullout strength of 1 000 N is based on the requirements of CAN/CSA-A370 that cover specific types of masonry and clips that fall within the intent of the standard. As the spacing for the product is much closer than the standard veneer ties covered by CAN/CSA-A370, and through the engineering analysis provided for the product, the obtained ultimate and factored resistance of the product's clips are deemed to meet the intent of the established requirements.

4.1.2 Performance Requirements

Table 4.1.2.1 Results of Testing for Impact Resistance of the Product

Impact Body		Requirements		Results
		Dynamic Mass (kg)	Energy (N·m)	
Safety impact	**large soft**	50	100	Pass[1]
	hard	1	10	Pass[1]
Retention of performance impact	**large soft**	50	34	Pass
	small soft	30	60	Pass[2]
	hard	1	10	Pass[2]

Notes to Table 4.1.2.1:

(1) Some cracks were observed with several specimens; however, the specimens did not allow the impact body to penetrate through, dislogde, or fall and impair the safety of the structure. In the event of any damage resulting from the impact, the cladding units must be replaced immediately.

(2) Some cracks were observed with several specimens; however, the specimens retained the functional characteristics and overall appearance. In the event of any damage resulting from the impact, the cladding units must be replaced immediately.

Table 4.1.2.2 Results of Testing of Wind Load Resistance of the Product

Product	Frame	Stud Spacing (mm)	Fastening	Designed Wind Value (kPa)	Result
KuraStone™	8 ft × 8 ft frame was built with 2 in × 6 in S – P – F lumber and sheathed with 11.1-mm-thick OSB	610	No. 8 × 1-1/4 in stainless steel wood screws	$Q_{50} < 0.85$	Pass

Table 4.1.2.3 Deflection Measurements from the Wind Load Resistance Test

Product	Maximum Wind Pressure for Deflection Measurements (Pa)	Deflection (mm)[1]	
		Positive Pressure	Negative Pressure
KuraStone™	1 915[2]	11.79	11.56

Notes to Table 4.1.2.3:

(1) Maximum deflection values among seven sensor locations

(2) Deflection measurement was taken at the gust wind pressure

4.1.3 Fire Performance

Table 4.1.3.1 Results of Fire Performance Testing

Property	Requirement	Result
Non-combustibility [1]	CAN/ULC-S114-05	Non-combustible
Flame Spread Rating (FSR) [2]	CAN/ULC-S102-10	0
Smoke Developed Classification (SDC) [2]		0

Notes to Table 4.1.3.1:

(1) Based on Exova Test Report 14-002-219(B)

(2) Based on Exova Test Report 14-002-219(A)

Report Holder

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Disclaimer

Date modified:
2020-04-09

Appendix A: Pre-engineered Design Solutions

The pre-engineered solutions must be in full accordance with the engineering analysis prepared by Moses Structural Engineers in Report No. 17.206-01, dated July 8, 2019. Tables A1.1 to A4.1 provide the main pre-engineering solutions for buildings not exceeding two (2) storeys and with a height of 3.05 m per floor.

A1. Maximum Allowable Stud Spacing for 2 × 6 Stud Wall (S – P – F No. 1/No. 2 Lumber) for 1-in-50 Hourly Wind Pressure up to 0.65 kPa

- Exterior wall studs 2.4-m to 3.05-m long
- S – P – F No. 1/No. 2 lumber
- For 1-in-50 hourly wind pressure up to 0.65 kPa

Table A1.1 Maximum Allowable Stud Spacing for 2 × 6 Stud Wall (S – P – F No. 1/No. 2 Lumber) for 1-in-50 Hourly Wind Pressure up to 0.65 kPa

Supporting	Max. Height (m)	Design Snow Load				
		1 kPa	1.5 kPa	2 kPa	2.5 kPa	3 kPa
		Max. Stud Spacing (mm)	Max. Stud Spacing (mm)	Max. Stud Spacing (mm)	Max. Stud Spacing (mm)	Max. Stud Spacing (mm)
Roof only	2.4	600	600	600	600	600
	2.7	600	600	600	600	600
	3.05	600	600	600	600	600
Roof + one storey	2.4	600	600	600	600	400
	2.7	600	600	600	600	400
	3.05	600	600	600	600	400
Roof + two storeys	2.4	400	400	400	400	400
	2.7	400	400	400	400	400
	3.05	400	400	400	400	400

Notes to Table A1.1:

- The table is calculated using a roof dead load of 0.63 kPa, a floor dead load of 0.71 kPa, and a partition load of 1.00 kPa.
- The table is not to be used for walls that support floors with concrete topping.
- The table is calculated for a residential live load of 1.9 kPa.
- The table is calculated for an exterior wall dead load of 0.31 kPa for the height of the exterior wall.
- The table assumes 0.66 kPa self weight for "KuraStone™" panels on the full height of all exterior walls.
- The table is calculated using K_D = 0.93, KT = 1.0, and K_S = 1.0, in accordance with CSA O86-14 "Engineering Design in Wood."
- The wind calculation is based on Ce = 0.7, for ultimate limit state C_pC_g = –2.1, C_{pi} = 0.3, and C_{gi} = 2.0, and for serviceability limit state C_pC_g = –1.75, C_{pi} = 0.3, and C_{gi} = 2.0.
- Deflection is based on a limit of L/360.
- The table is for a maximum floor span of 8 m and a maximum roof span of 12 m.

A2. Maximum Allowable Stud Spacing for 2 × 6 Stud Wall (S – P – F No. 1/No. 2 Lumber) for 1-in-50 Hourly Wind Pressure up to 0.85 kPa

- Exterior wall studs 2.4-m to 3.05-m long
- S – P – F No. 1 /No. 2 lumber
- For 1-in-50 hourly wind pressure up to 0.85 kPa

Table A2.1 Maximum Allowable Stud Spacing for 2 × 6 Stud Wall (S-P F No. 1/No. 2 Lumber) for 1-in-50 Hourly Wind Pressure up to 0.85 kPa

Supporting	Max. Height (m)	Design Snow Load				
		1 kPa	1.5 kPa	2 kPa	2.5 kPa	3 kPa
		Max. Stud Spacing (mm)	Max. Stud Spacing (mm)	Max. Stud Spacing (mm)	Max. Stud Spacing (mm)	Max. Stud Spacing (mm)
Roof only	2.4	600	600	600	600	600
	2.7	600	600	600	600	600
	3.05	400	400	400	400	400
Roof + one storey	2.4	600	600	600	600	400
	2.7	600	600	600	600	400
	3.05	400	400	400	400	400
Roof + two storeys	2.4	400	400	400	400	400
	2.7	400	400	400	400	400
	3.05	400	400	400	400	400

Notes to Table A2.1:

- The table is calculated using a roof dead load of 0.63 kPa, a floor dead load of 0.71 kPa, and a partition load of 1.00 kPa.
- The table is not to be used for walls that support floors with concrete topping.
- The table is calculated for a residential live load of 1.9 kPa.
- The table is calculated for an exterior wall dead load of 0.31 kPa for the height of the exterior wall.
- The table assumes 0.66 kPa self weight for "KuraStone™" panels on the full height of all exterior walls.
- The table is calculated using K_D = 0.93, KT = 1.0, and K_S = 1.0, in accordance with CSA O86.
- The wind calculation is based on Ce = 0.7, for ultimate limit state C_pC_g = –2.1, C_{pi} = 0.3, and C_{gi} = 2.0, and for serviceability limit state C_pC_g = –1.75, C_{pi} = 0.3, and C_{gi} = 2.0.
- Deflection is based on a limit of L/360.
- The table is for a maximum floor span of 8 m and a maximum roof span of 12 m.

A3. Maximum Allowable Stud Spacing for 2 × 6 Stud Wall (Douglas-fir No. 1/No. 2 Lumber) for 1-in-50 Hourly Wind Pressure up to 0.65 kPa

- Exterior wall studs 2.4-m to 3.05-m long
- Douglas-fir No. 1/No. 2 lumber
- For 1-in-50 hourly wind pressure up to 0.65 kPa

Table A3.1 Maximum Allowable Stud Spacing for 2 × 6 Stud Wall (Douglas-fir No. 1/No. 2 Lumber) for 1-in-50 Hourly Wind Pressure up to 0.65 kPa

Supporting	Max Height (m)	Design Snow Load				
		1 kPa	1.5 kPa	2 kPa	2.5 kPa	3 kPa
		Max. Stud Spacing (mm)	Max. Stud Spacing (mm)	Max. Stud Spacing (mm)	Max. Stud Spacing (mm)	Max. Stud Spacing (mm)
Roof only	2.4	600	600	600	600	600
	2.7	600	600	600	600	600
	3.05	600	600	600	600	600
Roof + one storey	2.4	600	600	600	600	600
	2.7	600	600	600	600	600
	3.05	600	600	600	400	400
Roof + two storeys	2.4	600	600	600	400	400
	2.7	600	600	600	400	400
	3.05	400	400	400	400	400

Notes to Table A3.1:

- The table is calculated using a roof dead load of 0.63 kPa, a floor dead load of 0.71 kPa, and a partition load of 1.00 kPa.
- The table is not to be used for walls that support floors with concrete topping.
- The table is calculated for a residential live load of 1.9 kPa.
- The table is calculated for an exterior wall dead load of 0.31 kPa for the height of the exterior wall.
- The table assumes 0.66 kPa self weight for "KuraStone™" panels on the full height of all exterior walls.
- The table is calculated using K_D = 0.93, KT = 1.0, and K_S = 1.0, in accordance with CSA O86.
- The wind calculation is based on Ce = 0.7, for ultimate limit state C_pC_g = –2.1, C_{pi} = 0.3, and C_{gi} = 2.0, and for serviceability limit state C_pC_g = –1.75, C_{pi} = 0.3, and C_{gi} = 2.0.
- Deflection is based on a limit of L/360.
- The table is for a maximum floor span of 8 m and a maximum roof span of 12 m.

A4. Maximum Allowable Stud Spacing for 2 × 6 Stud Wall (Douglas-fir No. 1/No. 2 Lumber) for 1-in-50 Hourly Wind Pressure up to 0.85 kPa

- Exterior wall studs 2.4-m to 3.05-m long
- Douglas-fir No. 1/No. 2 Lumber
- For 1-in-50 hourly wind pressure up to 0.85 kPa

Table A4.1 Maximum Allowable Stud Spacing for 2 × 6 Stud Wall (Douglas-fir No. 1/No. 2 Lumber) for 1-in-50 Hourly Wind Pressure up to 0.85 kPa

Supporting	Max Height (m)	Design Snow Load				
		1 kPa	1.5 kPa	2 kPa	2.5 kPa	3 kPa
		Max. Stud Spacing (mm)	Max. Stud Spacing (mm)	Max. Stud Spacing (mm)	Max. Stud Spacing (mm)	Max. Stud Spacing (mm)
Roof only	2.4	600	600	600	600	600
	2.7	600	600	600	600	600
	3.05	600	600	600	600	600
Roof + one storey	2.4	600	600	600	600	600
	2.7	600	600	600	600	600
	3.05	400	400	400	400	400
Roof + two storeys	2.4	600	600	600	400	400
	2.7	400	400	400	400	400
	3.05	400	400	400	400	400

Notes to Table A4.1:

- The table is calculated using a roof dead load of 0.63 kPa, a floor dead load of 0.71 kPa, and a partition load of 1.00 kPa.
- The table is not to be used for walls that support floors with concrete topping.
- The table is calculated for a residential live load of 1.9 kPa.
- The table is calculated for an exterior wall dead load of 0.31 kPa for the height of the exterior wall.
- The table assumes 0.66 kPa self weight for "KuraStone™" panels on the full height of all exterior walls.
- The table is calculated using $K_D = 0.93$, KT = 1.0, and $K_S = 1.0$, in accordance with CSA O86.
- The wind calculation is based on Ce = 0.7, for ultimate limit state $C_pC_g = –2.1$, $C_{pi} = 0.3$, and $C_{gi} = 2.0$, and for serviceability limit state $C_pC_g = –1.75$, $C_{pi} = 0.3$, and $C_{gi} = 2.0$.
- Deflection is based on a limit of L/360.
- The table is for a maximum floor span of 8 m and a maximum roof span of 12 m.

A5. Exterior Sheathing Panel Layout

The exterior sheathing panel layout is illustrated in Figure A1.

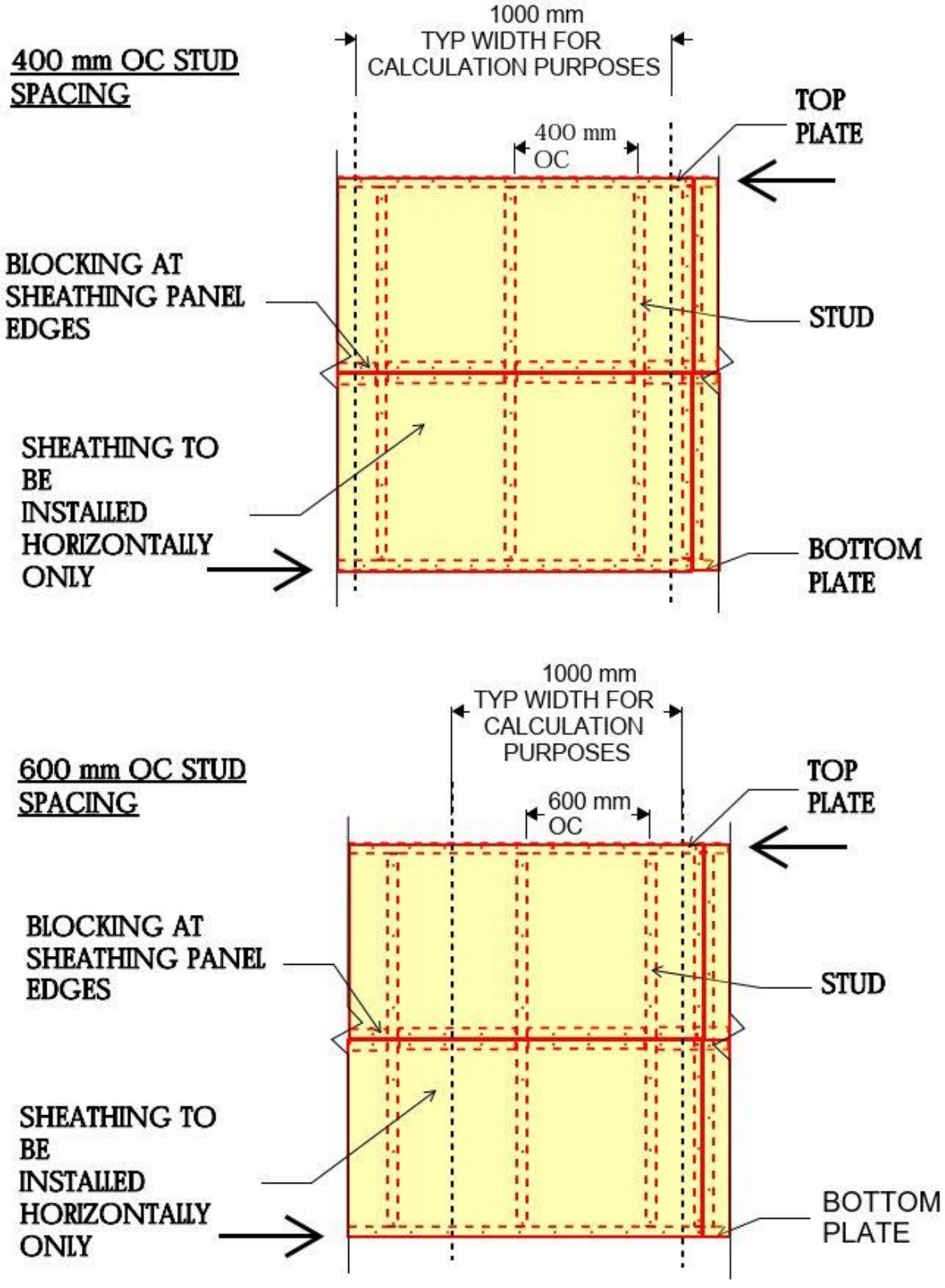
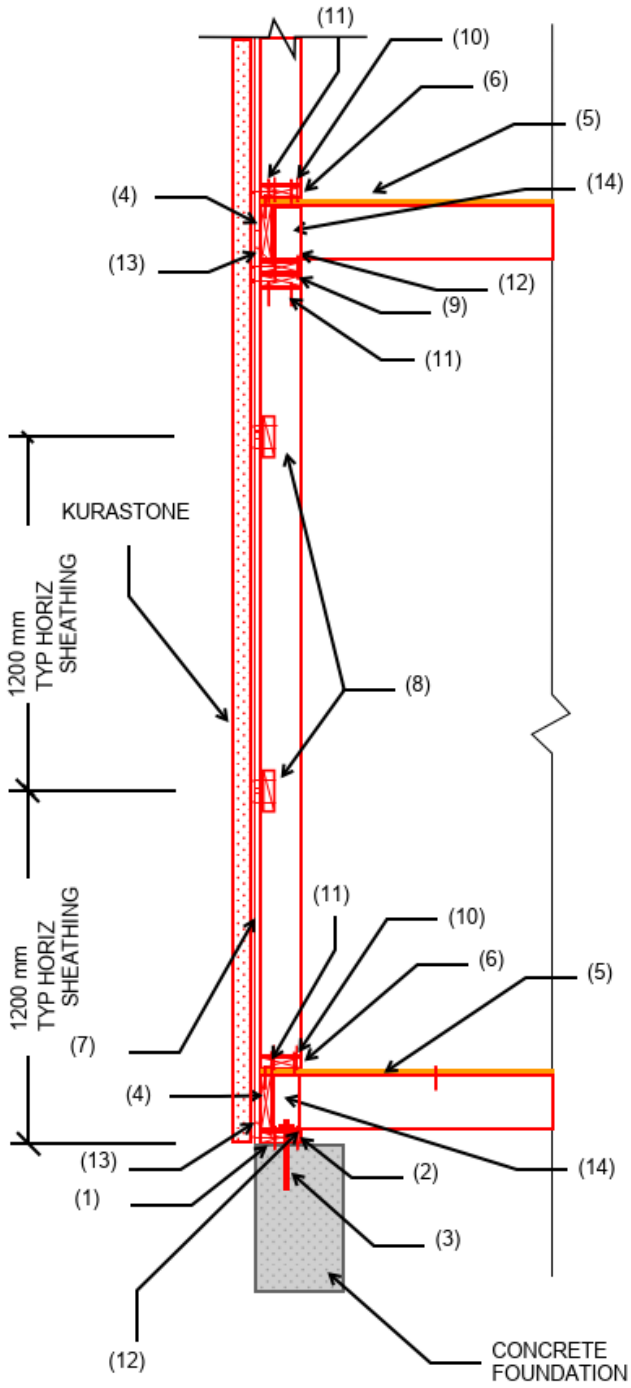


Figure A1. Exterior sheathing panel layout

A6. Details of Stud Wall Construction

The details of stud wall construction with sawn lumber joist are illustrated in Figure A2.



1. PROVIDE DAMP PROOF COURSE BETWEEN WOOD AND CONCRETE

2. MIN 38 mm x 140 mm (2x6) SILL PLATE

3. ANCHOR BOLT

4. RIM BOARD TO MATCH FLOOR JOISTS, NAIL FLOOR PLY TO RIM BOARD*

5. FLOOR PLY

6. MIN 38 mm x 140 mm (2x6) BOTTOM PLATE

7. MIN 12 mm CSP 4-ply, or 12 mm OSB INSTALLED HORIZONTALLY AND NAILED WITH MIN 63mm LONG COMMON NAILS @150 mm OC ALL EDGES PER TABLE 9.23.3.5 B or C.

8. 38 mm x 140 mm (2x6) BLOCKING AT SHEATHING EDGES, NAIL EACH PANEL EDGE AS NOTED ABOVE

9. MIN 2 - 38 mm x 140 mm (2x6) TOP PLATE

10. 2 - 82 mm LONG NAILS (WALL PLATE TO JOIST) PER TABLE 9.23.3.4

11. 2 - 82 mm LONG END NAILS (STUD TO PLATE) PER TABLE 9.23.3.4

12. 2 - 82 mm LONG TOE NAILS (FLOOR JOIST TO SILL) PER TABLE 9.23.3.4

13. 82 mm LONG NAILS (RIM TO SILL) PER TABLE 9.23.3.4

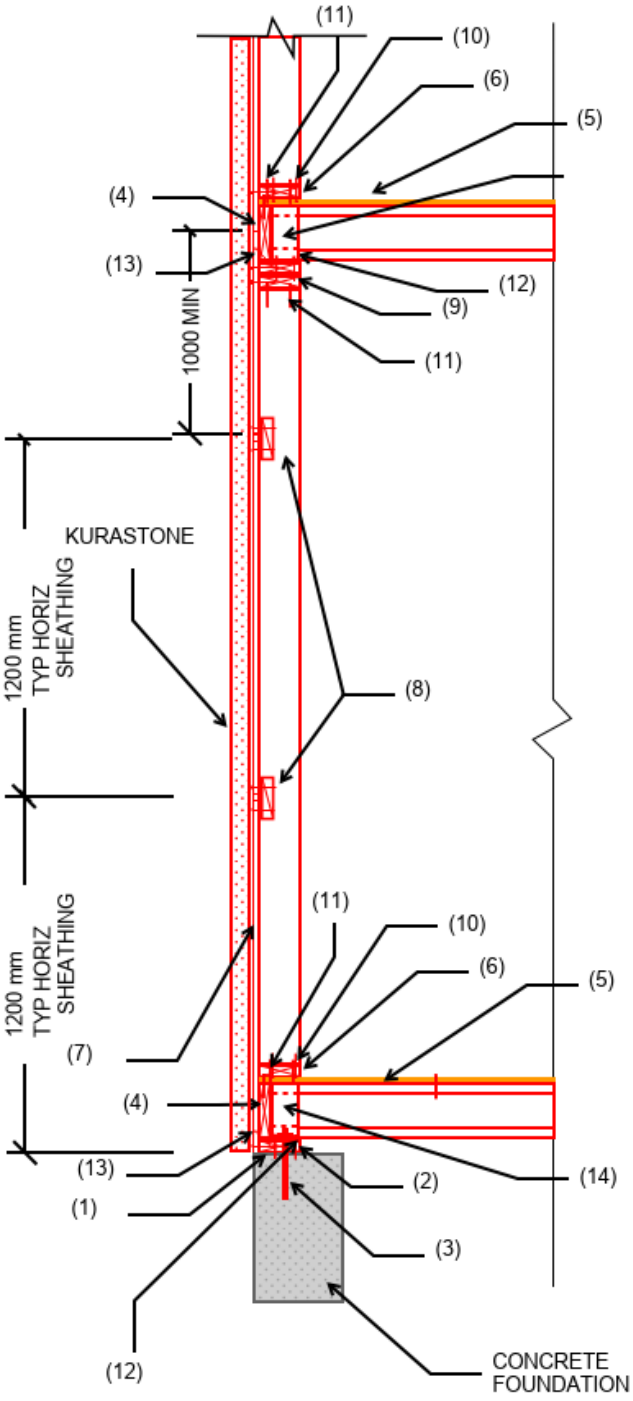
14. 38 mm x 89 mm (2x4) SQUASH BLOCKING AT SAME SPACING AS STUD WALL ABOVE

*NOTE: IF RIMBOARD THICKNESS IS LESS THAN 44mm, PROVIDE DOUBLE SILL PLATE AT EACH FLOOR. MINIMUM RIMBOARD THICKNESS IS 28mm

Figure A2. Details of stud wall construction with sawn lumber joists

A7. Details of Stud Wall Construction with I-joists

The details of stud wall construction with I-joists are illustrated in Figure A3.



1. PROVIDE DAMP PROOF COURSE BETWEEN WOOD AND CONCRETE

2. MIN 38 mm x 140 mm (2x6) SILL PLATE

3. ANCHOR BOLT

4. RIM BOARD TO MATCH FLOOR JOISTS, NAIL FLOOR PLY TO RIM BOARD*

5. FLOOR PLY

6. MIN 38 mm x 140 mm (2x6) BOTTOM PLATE

7. MIN 12 mm CSP 4-ply, or 12 mm OSB INSTALLED HORIZONTALLY AND NAILED WITH MIN 63mm LONG COMMON NAILS @150 mm OC ALL EDGES PER TABLE 9.23.3.5 B or C.

8. 38 mm x 140 mm (2x6) BLOCKING AT SHEATHING EDGES, NAIL EACH PANEL EDGE AS NOTED ABOVE

9. MIN 2 - 38 mm x 140 mm (2x6) TOP PLATE

10. 2 - 82 mm LONG NAILS (WALL PLATE TO JOIST) PER TABLE 9.23.3.4

11. 2 - 82 mm LONG END NAILS (STUD TO PLATE) PER TABLE 9.23.3.4

12. 2 - 82 mm LONG TOE NAILS (FLOOR JOIST TO SILL) PER TABLE 9.23.3.4

13. 82 mm LONG NAILS (RIM TO SILL) PER TABLE 9.23.3.4

14. 38 mm x 89 mm (2x4) SQUASH BLOCKING AT SAME SPACING AS STUD WALL ABOVE

*NOTE: IF RIMBOARD THICKNESS IS LESS THAN 44mm, PROVIDE DOUBLE SILL PLATE AT EACH FLOOR. MINIMUM RIMBOARD THICKNESS IS 28mm

Figure A3. Details of stud wall construction with I-joists

A8. Maximum Lintel Span

The maximum lintel spans for S – P – F No. 1/No. 2 Lumber and for Douglas Fir – Larch (D Fir – L) No. 1/No. 2 Lumber are shown in Tables A8.1 and A8.2, respectively.

Table A8.1 Maximum Lintel Span for S – P – F No. 1/No. 2 Lumber (mm)

Supporting	2 – 2 × 6	2 – 2 × 8	2 – 2 × 10	2 – 2 × 12
Roof only	800	910	1 060	1 180
Roof + one storey	510	570	670	740
Roof + two storeys	370	420	490	540

Table A8.2 Maximum Lintel Span for D Fir – L No. 1/No. 2 Lumber (mm)

Supporting	2 – 2 × 6	2 – 2 × 8	2 – 2 × 10	2 – 2 × 12
Roof only	870	1 060	1 290	1 490
Roof + one storey	640	720	850	940
Roof + two storeys	470	530	620	690

Notes to Tables A8.1 and A8.2:

- The exterior studs can be up to 3.05-m long
- The table is calculated using a roof dead load of 0.63 kPa, a floor dead load of 0.71 kPa, and a partition load of 1.00 kPa
- The table is not to be used for walls that support floors with concrete topping.
- The table is calculated for a residential live load of 1.9 kPa.
- The table is calculated for an exterior wall dead load of 0.31 kPa for the height of the exterior wall.
- The table assumes 0.66 kPa self weight for "KuraStone™" panels on the full height of all exterior walls.
- The table is calculated using K_D = 0.93, KT = 1.0, and K_S = 1.0, in accordance with CSA O86.
- The maximum allowable snow load is 3 kPa.
- Deflection is based on a limit of L/360.
- A minimum of 2 – 2 × 6 built up studs must be provided on each side of the lintel. Refer to Article 9.23.10.6, Studs at Sides of Openings, of Division B of the NBC 2015.