NRC·CNRC
Institute for Research in Construction

Evaluation Report CCMC 13107-R

MASTERFORMAT:	03 11 19.01
Issued:	2003-04-16
Re-evaluated:	2011-04-28
Re-evaluation due:	2012-04-16

Reward iForm™

1. Opinion

It is the opinion of the Canadian Construction Materials Centre (CCMC) that "Reward iForm™" when used as an insulated concrete form in accordance with the conditions and limitations stated in Section 3 of this Report, complies with the National Building Code 2005:

- Clause 1.2.1.1.(1)(a), Division A, using the following acceptable solutions from Division B:
  - Article 4.1.1.3. Design Requirements (structural loads and procedures)
  - Article 4.3.3.1. Design Basis for Plain, Reinforced and Pre-stressed Concrete
  - Subsection 9.3.1. Concrete
  - Section 9.4. Structural Requirements
  - Clause 9.15.1.1.(1)(c) General (footings and foundations)
  - Article 9.15.3.3. Application of Footing Width and Area Requirements
  - Clause 9.15.3.5.(1)(c) Adjustments to Footing Widths for Exterior Walls
  - Clause 9.20.1.1.(1)(b) General (masonry and insulating concrete form walls not in contact with the ground)
  - Sentence 9.20.1.1.(2) General (masonry and insulating concrete form walls not in contact with the ground)
  - Subsection 9.20.17. Above-Ground Flat Insulating Concrete Form Walls
- Clause 1.2.1.1.(1)(b), 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:
  - Subsection 9.15.4. Foundation Walls
  - Article 9.20.1.2. Earthquake Reinforcement

This opinion is based on CCMC's evaluation of the technical evidence in Section 4.1 provided by the Report Holder.

2. Description

The product is a modular, interlocking, concrete form system in which each unit consists of two expanded polystyrene panels. Embedded in the polystyrene panels are eight polypropylene connectors that are equally spaced 150 mm apart horizontally.

The forms are dry-laid and stacked in a running bond (staggered) configuration. The stacked units form a rectangular space that, after being filled with concrete, forms an insulated, monolithic concrete wall of uniform thickness.

The polystyrene face panels have a preformed interlocking design along their top and bottom edges which facilitates stacking and alignment and prevents leakage of freshly placed concrete.

Reinforcement may be placed where required to satisfy strength requirements for above- or below-grade loadbearing walls, beams, lintels and shear walls.

The units have external dimensions of 1219 mm in length and 406 mm in height. The polystyrene panels are each 64 mm thick, resulting in an overall wall thickness of 228 mm, 278 mm, 328 mm, and 378 mm for the 100 mm, 150 mm, 200 mm, and 250 mm concrete form wall.

The units are available in straight, 90-degree or 45-degree corner forms, Taper Top forms and Brick Ledge forms.

A standard unit is illustrated in Figure 1.

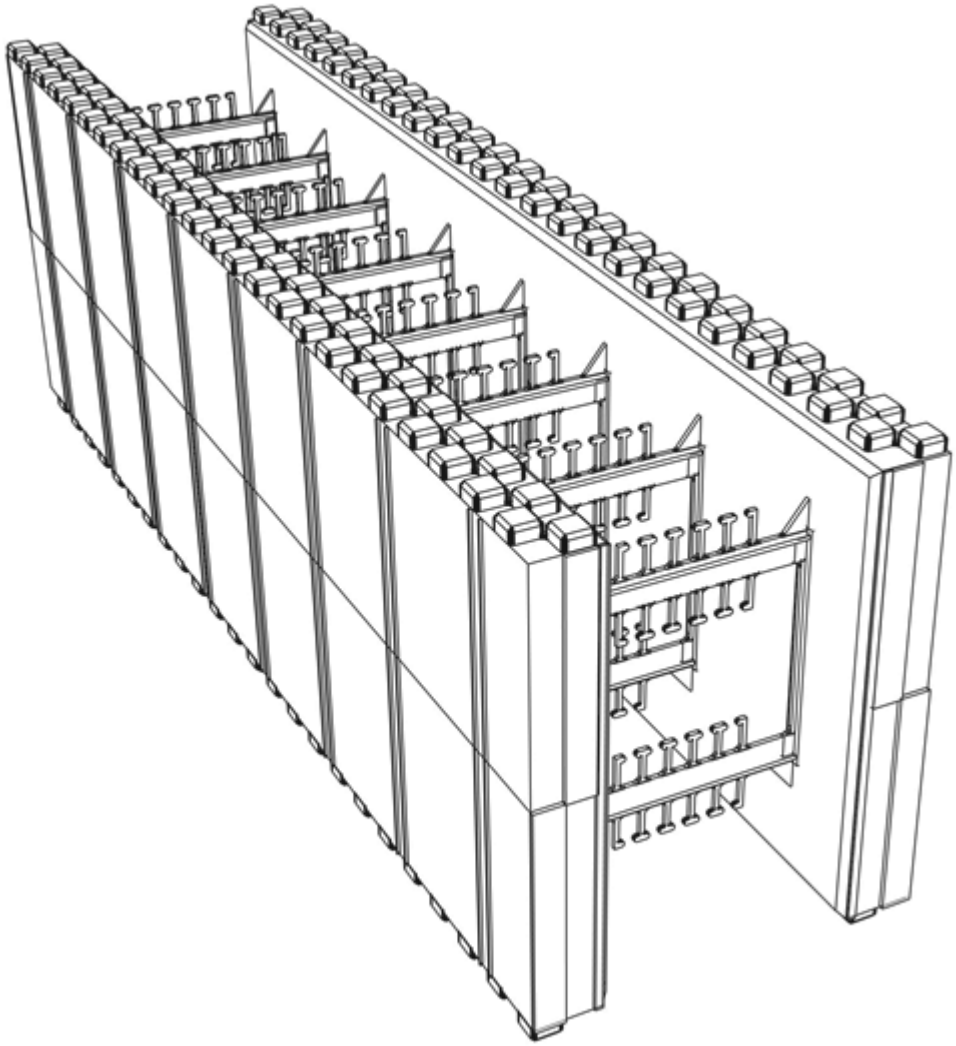

Figure 1. "Reward iForm™" standard unit

3. Conditions and Limitations

CCMC's compliance opinion in Section 1 is bound by the "Reward iForm™" being used in accordance with the conditions and limitations set out below.

- Use of the product is permitted in the construction of houses and small buildings up to two storeys above grade and one storey below grade, which does not include residences with walkout basements, that fall under the provisions of Part 9 of Division B of the NBC 2005, subject to all of the conditions listed below.
- The structural applications of this product must be in strict accordance with the design analysis as prepared by TACOMA Engineers, Report No. 2284, dated October 11, 2010 from which Tables 4.1.2.1.1(a) to 4.1.2.3.1(o) have been reproduced. When the product is used in structural applications outside the scope of the referenced design analysis, the engineering design analysis, related documents and drawings must bear the authorized seal of a registered professional engineer skilled in concrete design and licensed to practice under the appropriate provincial or territorial legislation. The engineer must certify that the construction provides a level of performance equivalent to that required by Part 4 and/or Part 9 of the NBC 2005.
- The structural applications of the product are limited to constructions with a floor-to-floor height of 3.66 m, and erected in locations where the spectral response acceleration, Sa(0.2), does not exceed the values indicated in the tables in this report. (See Appendix A, A-9.20.1.2. and Appendix C of the NBC 2005 for the applicable locations.) The specific steel reinforcement used shall be in accordance with Tables 4.1.2.1.1(a) to 4.1.2.2.1(i).
- The maximum permitted building length is 24.0 m and the maximum permitted building width is 12.0 m. For buildings with a dimension that exceeds any of the above dimensions engineering is required on a case-by-case basis.
- Concrete used with this system must comply with Subsection 9.3.1. of Division B of the NBC 2005. It must be Type 10 or Type 30 with a minimum compressive strength of 20 MPa and a maximum slump of 150 ± 20 mm.
- The maximum aggregate size to be used in conjunction with this product must be no greater than 13 mm for the 150-mm-thick concrete walls, and 19 mm for the 200-mm- and 250-mm-thick concrete walls.
- For the wall heights indicated in Tables 4.1.2.1.1(a) to 4.1.2.2.1(i), the pouring of concrete must be made at a rate of 1.3 m per hour in consecutive lifts; each lift is limited to a maximum height of 1.3 m.
- All point loads, such as concentrated loads created by girder trusses, columns and beams, must bear directly on top of the concrete wall, and must not be supported in any manner to create an eccentric loading on the concrete wall.
- Floor and roof connections to ICF walls must be designed to accommodate diaphragm action in seismic zones and zones of high wind pressure.
- The concrete must be cured a minimum of seven days before backfilling. The wall must be laterally supported at the top and bottom prior to backfilling.
- The EPS insulation used in this system must comply with CAN/ULC-S701-05, "Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering," Type 2 as a minimum.
- The product's EPS insulation panels must be aged for at least three weeks from their date of manufacturing.
- The concrete wall must be constructed on a footing designed as per Article 9.15.3.4., Basic Footing Widths and Areas, of Division B of the NBC 2005.
- The attachment of exterior cladding and interior finishing materials has not been assessed by the present evaluation. The exterior cladding attachment must be as per Part 5 of Division B of the NBC 2005 as stated in Sentence 9.27.1.1.(5), General (cladding), of Division B of the NBC 2005.
- The interior face of the product panels must be protected from the inside of the building in accordance with Sentence 9.10.17.10.(1), Foamed Plastics, of Division B of the NBC 2005.
- For above-grade installations, the exterior face of the product must be protected with materials conforming to Article 9.20.6.4., Masonry Veneer, and Sections 9.27., Cladding, and/or 9.28., Stucco, of Division B of the NBC 2005.
- For below-grade installations, dampproofing must be provided in accordance with Subsection 9.13.2., Dampproofing, of Division B of the NBC 2005.

- Where hydrostatic pressure exists, waterproofing must be provided in accordance with Subsection 9.13.3., Waterproofing, of Division B of the NBC 2005.
- For foundation-wall installations, the backfill must be placed in such a way as to avoid damaging the wall, the exterior insulation panel and the waterproofing and dampproofing protection. The backfill material must be well-drained and a drainage system must be installed around the footing in accordance with the requirements of the NBC 2005.
- The installation of the product must be in strict compliance with Reward Wall Systems Installation Manual dated January 6th 2011, without conflicting with the requirements stated in the NBC 2005 or in this report. Only installers trained and authorized by Reward Wall Systems shall be contracted to set up the wall system.

4. Technical Evidence

CCMC's Technical Guide for "Reward iForm™" sets out the nature of the technical evidence required by CCMC to enable it to evaluate a product as an acceptable or alternative solution in compliance with the NBC 2005. The Report Holder has submitted test results and documentation for CCMC's evaluation. Testing was conducted at independent laboratories recognized by CCMC. The corresponding test results for "Reward iForm™" are summarized below.

4.1 NBC 2005 Compliance Data for "Reward iForm™" on which CCMC Based its Opinion in Section 1

4.1.1 Material Requirements

4.1.1.1 Conformance of the EPS

Compliance of the expanded polystyrene thermal insulation with the requirements of CAN/ULC-S701 is covered under the Quality Auditing Institute (QAI).

4.1.2 Design Requirements

Conformance of Structural Capacity (Steel Reinforcement Designs)

The design analysis in the Engineering Analysis Report provided to CCMC of walls using the product provides a level of performance equivalent to that required by applicable provisions in Part 4 and/or Part 9 of Division B of the NBC 2005. The corresponding design analysis is summarized in Tables 4.1.2.1.1(a) to 4.1.2.3.1(o). The tables provide the steel reinforcement specifications for a number of different wall and lintel applications based on specific structural loads. The design assumption is indicated below each table.

4.1.2.1 Vertical and horizontal steel reinforcement for below-grade walls

Table 4.1.2.1.1(a) Vertical and horizontal steel reinforcement for below-grade walls[(1)]

Wall Height (m)	Backfill Height (m)	Seismic Zone Classification Sa(0.2) < 0.12					
		Max. Spacing for Vertical Reinforcement (mm)			Max. Spacing for Horizontal Reinforcement (mm)		
		150-mm Wall	200-mm Wall	250-mm Wall	150-mm Wall	200-mm Wall	250-mm Wall
2.44	1.22	15M @ 300	15M @ 450	15M @ 450	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	1.53	15M @ 150	15M @ 300	15M @ 450	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	1.83		20M @ 300	15M @ 300	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	2.13			20M @ 300	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
3.05	1.22	15M @ 300	15M @ 450	15M @ 450	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	1.53		20M @ 300	15M @ 300	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	1.83		20M @ 150	20M @300	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	2.13			20M @ 150	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	2.44				15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	2.74				15M @ 406	15M @ 406	1-15M & 1-10M @ 406
3.66	1.22	15M @ 300	15M @ 300	15M @ 450	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	1.53		20M @ 300	15M @ 300	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	1.83			20M @ 300	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	2.13			20M @ 150	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	2.44				15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	2.74				15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	3.05				15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	3.35				15M @ 406	15M @ 406	1-15M & 1-10M @ 406

Table 4.1.2.1.1(b) Vertical and horizontal steel reinforcement for below-grade walls[(1)]

Wall Height (m)	Backfill Height (m)	Seismic Zone Classification $0.12 \leq Sa(0.2) \leq 0.67$					
		Max. Spacing for Vertical Reinforcement (mm)			Max. Spacing for Horizontal Reinforcement (mm)		
		150-mm Wall	200-mm Wall	250-mm Wall	150-mm Walls	200-mm Wall	250-mm Wall
2.44	1.22	10M @ 150	15M @ 450	15M @ 450	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	1.53	15M @ 450	15M @ 450	15M @ 450	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	1.83		15M @ 450	15M @ 450	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	2.13		15M @ 300	15M @ 450	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
3.05	1.22	10M @ 300	15M @ 450	15M @ 450	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	1.53	15M @ 300	15M @ 450	15M @ 450	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	1.83		15M @ 300	15M @ 450	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	2.13		20M @ 300	15M @ 300	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	2.44			15M @ 300	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	2.74			20M @ 300	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
3.66	1.22	10M @ 300	15M @ 450	15M @ 450	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	1.53	15M @ 150	15M @ 450	15M @ 450	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	1.83		15M @ 300	15M @ 450	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	2.13			15M @ 300	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	2.44			20M @ 300	15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	2.74				15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	3.05				15M @ 406	15M @ 406	1-15M & 1-10M @ 406
	3.35				15M @ 406	15M @ 406	1-15M & 1-10M @ 406

Note to Tables 4.1.2.1.1(a) and (b): Shaded table cells indicate that the spacing is not feasible with respect to the proposed backfill height.

(1) Table 4.1.2.1.1(a) and (b) are based on the following assumptions:

a. The design is applicable for the seismic zones indicated in the tables.
b. The design is applicable to structures that are constructed on soil Types A, B, C and D.
c. Maximum building dimension is 24.0 m.
d. Maximum building width is 12.0 m.
e. Maximum floor clear span is 6.0 m.
f. Maximum roof clear span is 12.0 m with a maximum overhang of 2 m.
g. Maximum number of stories above grade is two (2).
h. Maximum number of stories below grade is one (1).
i. Maximum height of foundation walls and first floor walls is 3.66 m.
j. Maximum height of above grade second floor wall is 3.05 m.
k. The concrete walls are evenly distributed on each side and in each direction.
l. $K_0 = 0.50$; density of soil = $18 kN/m^3$.
m. Roof dead load is 0.70 kPa.
n. Floor dead load is 0.70 kPa.
o. Snow load is 4.0 kPa.
p. Floor live load is 1.90 kPa.
q. Factored surcharge lateral pressure = 2.4 kPa.
r. Loads include earth pressure and surcharge loads, plus gravity load. Gravity load assumes 2 ICF storeys and wood roof frame.

s. All walls shall be proportionally and evenly distributed in both the transverse and longitudinal direction of the building.
t. Below grade walls are considered to be supported by the floor system at the top.
u. Slenderness of the wall shall not exceed 25.
v. A minimum of 2 lengths of solid concrete in all below-grade and above-grade shear walls without openings is required in each exterior wall in each building direction on all levels of the building. (For more information, please refer to the shear wall limits as indicated in the TACOMA Engineers, Report No. 2284.)
w. Reinforcing bars shall be hard grade deformed bars conforming to CSA G30.12-M, "Billet-Steel Bars for Concrete Reinforcement," Grade 400. Specified yield strength of reinforcement, f_y, is 400 MPa.
x. Wall design detailing bends, placement, spacing, splicing and protection of reinforcement shall be in accordance with CAN/CSA-A23.3-04(R2000), "Design of Concrete Structures."
y. For below grade walls, the placement of vertical reinforcement shall be located on the inside face of the wall, between horizontal bars. For 150-mm-thick walls, the concrete cover to the vertical reinforcement (measured from the edge of concrete to centre of reinforcement bars) shall be 55 mm. For 200-mm- and 250-mm-thick walls, the concrete cover shall be 80 mm and 84 mm.
z. Horizontal reinforcing shall be as per the tables, plus 1-10M continuous bar shall be placed 150 mm from the top of the wall and at floor level.
aa. Two full height vertical bars equal to the vertical reinforcing within the wall system are to be installed at all corners and on each side of the wall openings.
ab. Two 15M bars shall be placed around all openings and shall extend 600 mm (24") beyond each side of the openings.
ac. Minimum 28 day concrete compressive strength of 20 MPa. Maximum aggregate size is 13 mm for the 150-mm-thick concrete walls and 19 mm for 200-mm and 250-mm concrete walls.
ad. Concrete pours shall only be terminated at locations of lateral support.
ae. Concrete shall be allowed to cure for a minimum of seven days prior to backfilling.
af. All materials and workmanship shall conform to the requirements of the NBC 2005 and its Revisions and Errata that have been released as of the issue date of these tables.

4.1.2.2 Vertical and Horizontal Steel Reinforcement for Above-grade Walls

Table 4.1.2.2.1(a) Vertical and horizontal steel reinforcement for above-grade walls[(1)]

Wall Height (m)	Max. Spacing for Vertical Reinforcement (mm)		Max. Spacing for Horizontal Reinforcement (mm)	
	150-mm Wall	**200-mm Wall**	**150-mm Wall**	**200-mm Wall**
	Hourly Wind Pressure, $Q_{50} \leq 0.59$ kPa			
	Sa(0.2) ≤ 0.32			
Single-storey concrete construction supporting a wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 750	10M @ 300	15M @ 406	15M @ 406
Ground floor concrete construction supporting a second storey wood frame and wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 750	10M @ 300	15M @ 406	15M @ 406
Ground floor concrete construction supporting a second storey concrete construction and a wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 750	10M @ 300	15M @ 406	15M @ 406

Table 4.1.2.2.1(b) Vertical and horizontal steel reinforcement for above-grade walls[(1)]

Wall Height (m)	Max. Spacing for Vertical Reinforcement (mm)		Max. Spacing for Horizontal Reinforcement (mm)	
	150-mm Wall	200-mm Wall	150-mm Wall	200-mm Wall
	Hourly Wind Pressure, $Q_{50} \leq 0.59$ kPa			
	$0.32 \leq Sa(0.2) \leq 0.67$			
Single-storey concrete construction supporting a wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 750	10M @ 300	15M @ 406	15M @ 406
Ground floor concrete construction supporting a second storey wood frame and wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 750	10M @ 300	15M @ 406	15M @ 406
Ground floor concrete construction supporting a second storey concrete construction and a wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 750	10M @ 300	15M @ 406	15M @ 406

Table 4.1.2.2.1(c) Vertical and horizontal steel reinforcement for above-grade walls[(1)]

Wall Height (m)	Max. Spacing for Vertical Reinforcement (mm)		Max. Spacing for Horizontal Reinforcement (mm)	
	150-mm Wall	200-mm Wall	150-mm Wall	200-mm Wall
	Hourly Wind Pressure, $Q_{50} \leq 0.59$ kPa			
	$0.67 \leq Sa(0.2) \leq 2.3$			
Single-storey concrete construction supporting a wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 600	15M @ 600	15M @ 406	15M @ 406
Ground floor concrete construction supporting a second storey wood frame and wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 600	15M @ 600	15M @ 406	15M @ 406
Ground floor concrete construction supporting a second storey concrete construction and a wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 450	15M @ 300	15M @ 406	15M @ 406
3.66		15M @ 300	15M @ 406	15M @ 406

Table 4.1.2.2.1(d) Vertical and horizontal steel reinforcement for above-grade walls[(1)]

Wall Height (m)	Max. Spacing for Vertical Reinforcement (mm)		Max. Spacing for Horizontal Reinforcement (mm)	
	150-mm Wall	200-mm Wall	150-mm Wall	200-mm Wall
	Hourly Wind Pressure, $0.59 \leq Q_{50} \leq 0.91$ kPa			
	$Sa(0.2) \leq 0.32$			
Single-storey concrete construction supporting a wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 750	10M @ 300	15M @ 406	15M @ 406
Ground floor concrete construction supporting a second storey wood frame and wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 750	10M @ 300	15M @ 406	15M @ 406
Ground floor concrete construction supporting a second storey concrete construction and a wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 600	15M @ 450	15M @ 406	15M @ 406

Table 4.1.2.2.1(e) Vertical and horizontal steel reinforcement for above-grade walls[(1)]

Wall Height (m)	Max. Spacing for Vertical Reinforcement (mm)		Max. Spacing for Horizontal Reinforcement (mm)	
	150-mm Wall	200-mm Wall	150-mm Wall	200-mm Wall
	Hourly Wind Pressure, $0.59 \leq Q_{50} \leq 0.91$ kPa			
	$0.32 \leq Sa(0.2) \leq 0.67$			
Single-storey concrete construction supporting a wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 750	10M @ 300	15M @ 406	15M @ 406
Ground floor concrete construction supporting a second storey wood frame and wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 750	10M @ 300	15M @ 406	15M @ 406
Ground floor concrete construction supporting a second storey concrete construction and a wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 600	15M @ 450	15M @ 406	15M @ 406

Table 4.1.2.2.1(f) Vertical and horizontal steel reinforcement for above-grade walls[(1)]

Wall Height (m)	Max. Spacing for Vertical Reinforcement (mm)		Max. Spacing for Horizontal Reinforcement (mm)	
	150-mm Wall	200-mm Wall	150-mm Wall	200-mm Wall
	Hourly Wind Pressure, $0.59 \leq Q_{50} \leq 0.91$ kPa			
	$0.67 \leq Sa(0.2) \leq 2.3$			
Single-storey concrete construction supporting a wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 600	15M @ 450	15M @ 406	15M @ 406
Ground floor concrete construction supporting a second storey wood frame and wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 600	15M @ 450	15M @ 406	15M @ 406
Ground floor concrete construction supporting a second storey concrete construction and a wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 450	15M @ 300	15M @ 406	15M @ 406
3.66		15M @ 300	15M @ 406	15M @ 406

Table 4.1.2.2.1(g) Vertical and horizontal steel reinforcement for above-grade walls[(1)]

Wall Height (m)	Max. Spacing for Vertical Reinforcement (mm)		Max. Spacing for Horizontal Reinforcement (mm)	
	150-mm Wall	200-mm Wall	150-mm Wall	200-mm Wall
	Hourly Wind Pressure, $0.91 \leq Q_{50} \leq 1.23$ kPa			
	$Sa(0.2) \leq 0.32$			
Single-storey concrete construction supporting a wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 600	10M @ 300	15M @ 406	15M @ 406
Ground floor concrete construction supporting a second storey wood frame and wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 600	10M @ 300	15M @ 406	15M @ 406
Ground floor concrete construction supporting a second storey concrete construction and a wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 450	15M @ 450	15M @ 406	15M @ 406

Table 4.1.2.2.1(h) Vertical and horizontal steel reinforcement for above-grade walls[(1)]

Wall Height (m)	Max. Spacing for Vertical Reinforcement (mm)		Max. Spacing for Horizontal Reinforcement (mm)	
	150-mm Wall	200-mm Wall	150-mm Wall	200-mm Wall
	Hourly Wind Pressure, $0.91 \leq Q_{50} \leq 1.23$ kPa			
	$0.32 \leq Sa(0.2) \leq 0.67$			
Single-storey concrete construction supporting a wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 600	10M @ 300	15M @ 406	15M @ 406
Ground floor concrete construction supporting a second storey wood frame and wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 600	10M @ 300	15M @ 406	15M @ 406
Ground floor concrete construction supporting a second storey concrete construction and a wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 450	15M @ 450	15M @ 406	15M @ 406

Table 4.1.2.2.1(i) Vertical and horizontal steel reinforcement for above-grade walls[(1)]

Wall Height (m)	Max. Spacing for Vertical Reinforcement (mm)		Max. Spacing for Horizontal Reinforcement (mm)	
	150-mm Wall	200-mm Wall	150-mm Wall	200-mm Wall
	Hourly Wind Pressure, $0.91 \leq Q_{50} \leq 1.23$ kPa			
	$0.67 \leq Sa(0.2) \leq 2.3$			
Single-storey concrete construction supporting a wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 600	15M @ 450	15M @ 406	15M @ 406
Ground floor concrete construction supporting a second storey wood frame and wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.66	15M @ 600	15M @ 450	15M @ 406	15M @ 406
Ground floor concrete construction supporting a second storey concrete construction and a wood frame roof structure				
2.44	15M @ 750	10M @ 300	15M @ 406	15M @ 406
3.05	15M @ 450	15M @ 300	15M @ 406	15M @ 406
3.66		15M @ 300	15M @ 406	15M @ 406

Note to Tables 4.1.2.2.1(a) to (i): Shaded table cells indicate that the spacing is not feasible with respect to the proposed wall height.

(1) Table 4.1.2.2.1(a) to (i) are based on the following assumptions:

a. The design is applicable for the seismic zones and the maximum factored wind pressure indicated in the tables.
b. Loads include all applicable gravity loads, seismic and wind loads.

c. The exterior walls have been designed to include the option of cladding with clay bricks.
d. For allowable building dimensions, see Note (1) to Tables 4.1.2.1.1(a) and (b).
e. For assumed loads, see Note (1) to Tables 4.1.2.1.1(a) and (b).
f. Vertical reinforcement is to be placed in the centre of the wall.
g. For concrete and steel material properties, see Note (1) to Tables 4.1.2.1.1(a) and (b).
h. Horizontal reinforcing shall be as per the tables, plus 1-10M continuous bar shall be placed 150-mm from the top of wall and at floor level .
i. Two full height vertical bars equal to the vertical reinforcing within the wall system are to be installed at all corners and on each side of the wall openings.
j. Two 15M bars shall be placed around all openings and extend 600-mm (24") beyond each side of the openings.
k. All materials and workmanship shall conform to the requirements of the NBC 2005 and its Revisions and Errata that have been released as of the issue date of these tables.

4.1.2.3 Minimum Steel Reinforcement of Lintels

Table 4.1.2.3.1(a) Minimum steel reinforcement of lintels with 150-mm core and 200 mm deep[(1)]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)									
	7.3		10.9		14.5		18.2		21.8	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-10M	152	1-15M	228
1200	1-10M	0	1-15M	152	1-15M	304	1-15M	304		
1500	1-15M	152	1-15M	304						
1800	1-15M	304								
2400										
3000										
3600										
4200										
4800										
5400										
6000										

Table 4.1.2.3.1(a) cont'd. Minimum steel reinforcement of lintels with 150-mm core and 200 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)							
	25.5		29.1		32.8		36.4	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-15M	228	1-15M	304	1-15M	304	1-15M	304
1200								
1500								
1800								
2400								
3000								
3600								
4200								
4800								
5400								
6000								

Table 4.1.2.3.1(b) Minimum steel reinforcement of lintels with 150 mm core and 300 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)									
	7.3		10.9		14.5		18.2		21.8	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	254
1200	1-10M	0	1-10M	0	1-10M	381	1-15M	381	1-15M	381
1500	1-10M	0	1-15M	381	1-15M	508	1-15M	508	1-15M	635
1800	1-15M	381	1-15M	508	1-15M	635	1-15M	635	1-20M	762
2400	1-15M	635	1-20M	889	2-15M	889	2-15M	1016	1-15M 1-20M	1016
3000	1-20M	1016	2-15M	1143						
3600	1-15M 1-20M	1270								
4200										
4800										
5400										
6000										

Table 4.1.2.3.1(b) cont'd. Minimum steel reinforcement of lintels with 150-mm core and 300 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)							
	25.5		29.1		32.8		36.4	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	254	1-10M	381	1-15M	381	1-15M	381
1200	1-15M	508	1-15M	508	1-15M	508	1-15M	508
1500	1-15M	635	1-20M	635	1-20M	635	1-20M	635
1800	1-20M	762	2-15M	762	2-15M	762	1-15M 1-20M	762
2400								
3000								
3600								
4200								
4800								
5400								
6000								

Table 4.1.2.3.1(c) Minimum steel reinforcement of lintels with 150-mm core and 400 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)									
	7.3		10.9		14.5		18.2		21.8	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1200	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1500	1-10M	0	1-10M	0	1-10M	0	1-15M	406	1-15M	406
1800	1-10M	0	1-15M	0	1-15M	610	1-15M	610	1-15M	610
2400	1-15M	406	1-15M	610	1-15M	813	1-20M	813	1-20M	1016
3000	1-15M	813	1-20M	1016	2-15M	1219	2-15M	1219	1-15M 1-20M	1219
3600	1-20M	1016	2-15M	1219	1-15M 1-20M	1422	1-10M 2-20M	1422	1-15M 2-20M	1625
4200	2-15M	1422	2-20M	1625	1-15M 2-20M	1828				
4800	2-20M	1625	1-15M 2-20M	1828						
5400	1-15M 2-20M	2032								
6000										

Table 4.1.2.3.1(c) cont'd. Minimum steel reinforcement of lintels with 150-mm core and 400 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)							
	25.5		29.1		36.4		43.7	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1200	1-10M	0	1-15M	406	1-15M	406	1-15M	610
1500	1-15M	610	1-15M	610	1-15M	610	1-15M	610
1800	1-15M	610	1-15M	813	1-20M	813	1-20M	813
2400	2-15M	1016	2-15M	1016	1-15M 2-20M	1016	2-20M	1219
3000	2-20M	1219	1-10M 2-20M	1422				
3600								
4200								
4800								
5400								
6000								

Table 4.1.2.3.1(d) Minimum steel reinforcement of lintels with 150-mm core and 600 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)									
	7.3		10.9		14.5		18.2		21.8	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1200	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1500	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1800	1-10M	0	1-10M	0	1-10M	0	1-15M	0	1-15M	0
2400	1-10M	0	1-15M	0	1-15M	610	1-15M	914	1-15M	914
3000	1-15M	0	1-15M	914	1-15M	914	1-20M	1219	1-20M	1219
3600	1-15M	914	1-20M	1219	1-20M	1219	2-15M	1524	2-15M	1524
4200	1-20M	1219	1-20M	1524	2-15M	1524	1-15M 1-20M	1829	2-20M	1829
4800	1-20M	1524	2-15M	1829	1-15M 1-20M	1829	1-10M 2-20M	2133	1-15M 3-20M	2133
5400	2-15M	1829	2-20M	2133	1-10M 2-20M	2133	3-20M	2438	1-15M 3-20M	2438
6000	1-15M 1-20M	2133	1-10M 2-20M	2438	3-20M	2438	1-15M 3-20M	2743		

Table 4.1.2.3.1(d) cont'd. Minimum steel reinforcement of lintels with 150-mm core and 600 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)							
	29.1		36.4		43.7		51.0	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1200	1-10M	0	1-10M	0	1-10M	0	1-15M	0
1500	1-15M	0	1-15M	0	1-15M	0	1-15M	0
1800	1-15M	610	1-15M	610	1-15M	914	1-15M	914
2400	1-20M	914	1-20M	914	2-15M	1219	2-15M	1219
3000	2-15M	1219	1-15M 1-20M	1219	2-20M	1524	2-20M	1524
3600	2-20M	1524	1-15M 2-20M	1524	1-15M 2-20M	1829	1-10M 3-20M	1829
4200	1-15M 1-20M	1829	1-10M 3-20M	1829	4-20M	2134		
4800	1-15M 3-20M	2133						
5400								
6000								

Table 4.1.2.3.1(e) Minimum steel reinforcement of lintels with 150-mm core and 750 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)									
	7.3		10.9		14.5		18.2		21.8	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1200	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1500	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1800	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
2400	1-10M	0	1-10M	0	1-15M	0	1-15M	700	1-15M	700
3000	1-15M	0	1-15M	0	1-15M	700	1-20M	700	1-20M	1050
3600	1-15M	0	1-20M	700	1-20M	1050	1-20M	1050	1-20M	1400
4200	1-20M	0	1-20M	1050	1-20M	1400	2-15M	1400	1-15M 1-20M	1400
4800	1-20M	1050	2-15M	1400	2-15M	1750	1-15M 1-20M	1750	2-20M	1750
5400	1-20M	1400	2-15M	1750	1-15M 1-20M	1750	2-20M	2100	3-20M	2100
6000	2-15M	1400	1-15M 1-20M	2100	1-10M 2-20M	2100				

Table 4.1.2.3.1(e) cont'd. Minimum steel reinforcement of lintels with 150-mm core and 750 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)							
	29.1		36.4		43.7		51.0	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1200	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1500	1-10M	0	1-15M	0	1-15M	700	1-15M	700
1800	1-15M	0	1-15M	700	1-15M	700	1-15M	700
2400	1-20M	700	1-20M	1050	1-20M	1050	1-20M	1050
3000	1-20M	1050	2-15M	1050	2-15M	1400	1-15M 1-20M	1400
3600	2-15M	1400	1-15M 1-20M	1400	2-20M	1750	1-15M 2-20M	1750
4200	2-20M	1750	1-15M 2-20M	1750	3-20M	1750		
4800	3-20M	2100						
5400								
6000								

Table 4.1.2.3.1(f) Minimum steel reinforcement of lintels with 200-mm core and 200 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)									
	7.3		10.9		14.5		18.2		21.8	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-15M	0	1-15M	152
1200	1-15M	0	1-15M	0	1-15M	228	1-15M	228	1-15M	304
1500	1-15M	0	1-15M	152	1-20M	380	1-20M	380		
1800	1-15M	0	1-20M	304						
2400										
3000										
3600										
4200										
4800										
5400										
6000										

Table 4.1.2.3.1(f) cont'd. Minimum steel reinforcement of lintels with 200-mm core and 200 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)							
	25.5		29.1		32.8		36.4	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-15M	152	1-15M	228	1-15M	228	1-15M	304
1200	1-20M	304	1-20M	380				
1500								
1800								
2400								
3000								
3600								
4200								
4800								
5400								
6000								

Table 4.1.2.3.1(g) Minimum steel reinforcement of lintels with 200-mm core and 300 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)									
	7.3		10.9		14.5		18.2		21.8	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1200	1-10M	0	1-10M	0	1-10M	0	1-15M	254	1-15M	381
1500	1-10M	0	1-15M	0	1-15M	381	1-15M	381	1-15M	508
1800	1-15M	0	1-15M	381	1-15M	508	1-15M	635	1-20M	635
2400	1-15M	508	1-20M	762	1-20M	762	2-15M	889	1-15M 1-20M	1016
3000	1-20M	762	2-15M	1016	2-20M	1143	1-10M 2-20M	1143		
3600	1-15M 1-20M	1143	1-10M 2-20M	1270						
4200	1-15M 2-20M	1397								
4800										
5400										
6000										

Table 4.1.2.3.1(g) cont'd. Minimum steel reinforcement of lintels with 200-mm core and 300 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)							
	25.5		29.1		32.8		36.4	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-15M	254	1-15M	254
1200	1-15M	381	1-15M	381	1-15M	508	1-15M	508
1500	1-15M	508	1-15M	635	1-20M	635	1-20M	635
1800	1-20M	635	1-20M	762	2-15M	762	2-15M	762
2400	2-20M	1016	1-10M 2-20M	1016				
3000								
3600								
4200								
4800								
5400								
6000								

Table 4.1.2.3.1(h) Minimum steel reinforcement of lintels with 200-mm core and 400 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)									
	7.3		10.9		14.5		18.2		21.8	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1200	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1500	1-10M	0	1-10M	0	1-10M	0	1-15M	0	1-15M	0
1800	1-10M	0	1-15M	0	1-15M	0	1-15M	406	1-15M	609
2400	1-15M	0	1-15M	406	1-15M	609	1-20M	812	1-20M	812
3000	1-15M	609	1-20M	812	2-15M	1015	2-15M	1015	1-15M 1-20M	1218
3600	1-20M	812	2-15M	1015	1-15M 1-20M	1218	2-20M	1421	1-10M 2-20M	1421
4200	2-15M	1218	2-20M	1421	1-10M 2-20M	1624	3-20M	1624		
4800	2-20M	1421	1-15M 2-20M	1624	1-10M 3-20M	1827				
5400	1-10M 2-20M	1827	1-10M 3-20M	2030		.				
6000	3-20M	2030								

Table 4.1.2.3.1(h) cont'd. Minimum steel reinforcement of lintels with 200-mm core and 400 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)							
	25.5		29.1		36.4		43.7	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1200	1-10M	0	1-15M	0	1-15M	406	1-15M	406
1500	1-15M	403	1-15M	406	1-15M	609	1-15M	609
1800	1-15M	609	1-15M	609	1-20M	812	1-20M	812
2400	2-15M	812	2-15M	1015	1-15M 1-20M	1015	2-20M	1015
3000	2-20M	1218	1-15M 2-20M	1218	1-15M 2-20M	1421	1-10M 3-20M	1421
3600	3-20M	1421	1-10M 3-20M	1624				
4200								
4800								
5400								
6000								

Table 4.1.2.3.1(i) Minimum steel reinforcement of lintels with 200-mm core and 600 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)									
	7.3		10.9		14.5		18.2		21.8	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1200	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1500	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1800	1-10M	0	1-10M	0	1-10M	0	1-15M	0	1-15M	0
2400	1-10M	0	1-15M	0	1-15M	0	1-15M	0	1-20M	914
3000	1-15M	0	1-20M	0	1-20M	914	1-20M	914	1-20M	914
3600	1-20M	0	1-20M	914	1-20M	1219	2-15M	1219	2-15M	1219
4200	1-20M	914	1-20M	1219	2-15M	1524	1-15M 1-20M	1524	2-20M	1524
4800	1-20M	1219	2-15M	1524	2-20M	1829	1-10M 2-20M	1829	1-15M 2-20M	1829
5400	2-15M	1524	2-20M	1829	1-10M 2-20M	2133	1-15M 2-20M	2133	1-10M 3-20M	2133
6000	1-15M 1-20M	1824	1-10M 2-20M	2133	3-20M	2438	1-15M 3-20M	2438		

Table 4.1.2.3.1(i) cont'd. Minimum steel reinforcement of lintels with 200-mm core and 600 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)							
	29.1		36.4		43.7		51.0	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1200	1-10M	0	1-10M	0	1-10M	0	1-15M	0
1500	1-15M	0	1-15M	0	1-15M	0	1-15M	0
1800	1-15M	0	1-15M	0	1-20M	914	1-20M	610
2400	1-20M	914	1-20M	914	2-15M	914	2-15M	914
3000	2-15M	1219	1-15M 1-20M	1219	1-15M 1-20M	1219	2-20M	1219
3600	1-15M 1-20M	1524	1-10M 2-20M	1524	1-15M 2-20M	1524	3-20M	1524
4200	1-15M 2-20M	1829	3-20M	1829	1-15M 3-20M	1829		
4800	1-10M 3-20M	2133						
5400								
6000								

Table 4.1.2.3.1(j) Minimum steel reinforcement of lintels with 200-mm core and 750 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)									
	7.3		10.9		14.5		18.2		21.8	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1200	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1500	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1800	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
2400	1-10M	0	1-15M	0	1-15M	0	1-15M	0	1-15M	0
3000	1-15M	0	1-15M	0	1-15M	0	1-20M	700	1-20M	700
3600	1-15M	0	1-20M	0	1-20M	700	2-15M	1050	2-15M	1050
4200	1-20M	0	1-20M	700	2-15M	1050	2-15M	1050	1-15M 1-20M	1400
4800	2-15M	700	2-15M	1050	2-15M	1400	1-15M 1-20M	1400	2-20M	1750
5400	2-15M	700	2-15M	1400	1-15M 1-20M	1750	2-20M	1750	1-10M 2-20M	2100
6000	2-15M	1050	1-15M 2-20M	1750	1-15M 2-20M	1750	3-20M	2100		

Table 4.1.2.3.1(j) cont'd. Minimum steel reinforcement of lintels with 200-mm core and 750 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)							
	29.1		36.4		43.7		51.0	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1200	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1500	1-10M	0	1-15M	0	1-15M	0	1-15M	0
1800	1-15M	0	1-15M	0	1-15M	700	1-20M	700
2400	1-20M	700	1-20M	700	1-20M	700	2-15M	1050
3000	2-15M	1050	2-15M	1050	2-15M	1050	1-15M 1-20M	1400
3600	2-15M	1400	1-15M 1-20M	1400	2-20M	1400	1-15M 2-20M	1400
4200	2-20M	1400	3-20M	1750	3-20M	1750		
4800	3-20M	1750						
5400								
6000								

Table 4.1.2.3.1(k) Minimum steel reinforcement of lintels with 250-mm core and 200 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)									
	7.3		10.9		14.5		18.2		21.8	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-15M	0	1-15M	0
1200	1-15M	0	1-15M	0	1-15M	0	1-15M	0	1-15M	228
1500	1-15M	0	1-15M	0	1-20M	152	1-20M	304	2-15M	380
1800	1-15M	0	1-20M	152	2-15M	304				
2400	2-15M	228								
3000										
3600										
4200										
4800										
5400										
6000										

Table 4.1.2.3.1(k) cont'd. Minimum steel reinforcement of lintels with 250-mm core and 200 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)							
	25.5		29.1		32.8		36.4	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-15M	0	1-15M	152	1-15M	228	1-15M	228
1200	1-20M	304	1-20M	304	1-20M	380	2-15M	380
1500								
1800								
2400								
3000								
3600								
4200								
4800								
5400								
6000								

Table 4.1.2.3.1(l) Minimum steel reinforcement of lintels with 250-mm core and 300 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)									
	7.3		10.9		14.5		18.2		21.8	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1200	1-10M	0	1-10M	0	1-10M	0	1-15M	0	1-15M	254
1500	1-10M	0	1-15M	0	1-15M	0	1-15M	381	1-15M	381
1800	1-15M	0	1-15M	254	1-15M	381	1-15M	508	1-20M	635
2400	1-15M	381	1-20M	635	1-20M	762	2-15M	762	1-15M 1-20M	889
3000	1-20M	635	2-15M	889	1-15M 1-20M	1016	1-10M 2-20M	1143	1-15M 2-20M	1143
3600	1-15M 1-20M	889	2-20M	1143	1-15M 2-20M	1270				
4200	2-20M	1270								
4800										
5400										
6000										

Table 4.1.2.3.1(l) cont'd. Minimum steel reinforcement of lintels with 250-mm core and 300 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)							
	25.5		29.1		32.8		36.4	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-15M	0	1-15M	0
1200	1-15M	381	1-15M	381	1-15M	381	1-15M	381
1500	1-15M	508	1-15M	508	1-20M	508	1-20M	508
1800	1-20M	635	1-20M	635	2-15M	635	2-15M	762
2400	2-20M	889	2-20M	1016	1-10M 2-20M	1016	1-15M 2-20M	1016
3000								
3600								
4200								
4800								
5400								
6000								

Table 4.1.2.3.1(m) Minimum steel reinforcement of lintels with 250-mm core and 400 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)									
	7.3		10.9		14.5		18.2		21.8	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1200	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1500	1-10M	0	1-10M	0	1-10M	0	1-15M	0	1-15M	0
1800	1-10M	0	1-15M	0	1-15M	0	1-15M	0	1-20M	406
2400	1-15M	0	1-20M	0	1-20M	609	1-20M	609	1-20M	812
3000	1-20M	0	1-20M	609	2-15M	812	2-15M	1015	1-15M 1-20M	1015
3600	1-20M	609	2-15M	1015	1-15M 1-20M	1218	2-20M	1218	1-10M 2-20M	1421
4200	2-15M	1015	2-20M	1218	1-10M 2-20M	1421	3-20M	1624	1-10M 3-20M	1624
4800	2-20M	1218	1-10M 2-20M	1624	1-10M 3-20M	1827	4-20M	1827		
5400	1-10M 2-20M	1624	1-10M 3-20M	1827						
6000	3-20M	1827								

Table 4.1.2.3.1(m) cont'd. Minimum steel reinforcement of lintels with 250-mm core and 400 mm deep[(1)]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)							
	25.5		29.1		36.4		43.7	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1200	1-10M	0	1-15M	0	1-15M	0	1-15M	0
1500	1-15M	0	1-15M	406	1-20M	406	1-20M	609
1800	1-20M	609	1-20M	609	1-20M	609	1-20M	609
2400	2-15M	812	2-15M	812	1-15M 1-20M	1015	2-20M	1015
3000	2-20M	1218	2-20M	1218	1-15M 2-20M	1218	1-10M 3-20M	1218
3600	1-15M 3-20M	1421	1-10M 3-20M	1421				
4200								
4800								
5400								
6000								

Table 4.1.2.3.1(n) Minimum steel reinforcement of lintels with 250-mm core and 600 mm deep[(1)]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)									
	7.3		10.9		14.5		18.2		21.8	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1200	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1500	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1800	1-10M	0	1-10M	0	1-10M	0	1-15M	0	1-15M	0
2400	1-15M	0	1-15M	0	1-15M	0	1-15M	0	1-20M	0
3000	1-15M	0	1-20M	0	1-20M	0	1-20M	914	1-20M	914
3600	1-20M	0	1-20M	0	1-20M	914	2-15M	1219	2-15M	1219
4200	1-20M	0	2-15M	914	2-15M	1219	1-15M 1-20M	1524	2-20M	1524
4800	2-15M	914	1-15M 1-20M	1219	2-20M	1524	1-10M 2-20M	1829	1-15M 2-20M	1829
5400	1-15M 1-20M	1219	2-20M	1524	1-10M 2-20M	1829	1-15M 2-20M	2134	1-10M 3-20M	2134
6000	2-20M	1524	1-10M 2-20M	1829	3-20M	2134	1-15M 3-20M	2438		

Table 4.1.2.3.1(n) cont'd. Minimum steel reinforcement of lintels with 250-mm core and 600 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)							
	29.1		36.4		43.7		51.0	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1200	1-10M	0	1-10M	0	1-10M	0	1-15M	0
1500	1-15M	0	1-15M	0	1-15M	0	1-15M	0
1800	1-15M	0	1-15M	0	1-20M	0	1-20M	914
2400	1-20M	914	1-20M	914	2-15M	914	2-15M	914
3000	2-15M	914	1-15M 1-20M	1219	1-15M 1-20M	1219	2-20M	1219
3600	1-15M 2-20M	1219	1-10M 2-20M	1524	1-15M 2-20M	1524	3-20M	1524
4200	1-10M 2-20M	1524	3-20M	1829	1-15M 3-20M	1829		
4800	1-10M 3-20M	1829	4-20M	2134				
5400								
6000								

Table 4.1.2.3.1(o) Minimum steel reinforcement of lintels with 250-mm core and 750 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)									
	7.3		10.9		14.5		18.2		21.8	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1200	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1500	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1800	1-10M	0	1-10M	0	1-10M	0	1-10M	0	1-10M	0
2400	1-10M	0	1-15M	0	1-15M	0	1-15M	0	1-15M	0
3000	1-15M	0	1-15M	0	1-15M	0	1-20M	0	1-20M	700
3600	1-15M	0	1-20M	0	1-20M	0	2-15M	700	2-15M	700
4200	1-20M	0	2-15M	0	2-15M	700	2-15M	1050	1-15M 1-20M	1050
4800	2-15M	0	2-15M	700	2-15M	1050	1-15M 1-20M	1400	2-20M	1400
5400	2-15M	0	1-20M	1050	2-20M	1400	1-15M 2-20M	1400	3-20M	1750
6000	2-15M	700	2-20M	1400	1-15M 2-20M	1750	3-20M	1750		

Table 4.1.2.3.1(o) cont'd. Minimum steel reinforcement of lintels with 250-mm core and 750 mm deep[1]

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)							
	29.1		36.4		43.7		51.0	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
900	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1200	1-10M	0	1-10M	0	1-10M	0	1-10M	0
1500	1-10M	0	1-10M	0	1-15M	0	1-15M	0
1800	1-15M	0	1-15M	0	1-15M	0	1-20M	0
2400	1-20M	0	1-20M	700	2-15M	700	2-15M	700
3000	2-15M	700	2-15M	1050	2-15M	1050	1-15M 1-20M	1050
3600	2-15M	1050	1-15M 1-20M	1400	2-20M	1400	3-20M	1400
4200	2-20M	1400	1-15M 2-20M	1400	3-20M	1750		
4800	3-20M	1750	3-20M	1750				
5400								
6000								

Note to Tables 4.1.2.3.1(a) to (o): Shaded table cells indicate that the spacing is not feasible with respect to the proposed core thickness.

[1] Tables 4.1.2.3.1(a) to (o) are based on the following assumptions:

a. The design of the lintels falling under the scope of the referenced tables is limited to factored, uniformly distributed gravity loads and does not include lateral loads, or point loads such as concentrated loads created by girder, trusses, columns, and beams.
b. The minimum height of the lintel is 200 mm.
c. The top of all lintels shall be laterally supported by the building roof and floor system.
d. Stirrups are single leg fabricated from #10 bars spaced at 76 mm on centre for 200-mm-deep lintels, 127 mm for 300-mm-deep lintels, 203 mm for 400-mm-deep lintels, 304 mm for 600-mm-deep lintels and 350 mm for 750- mm- deep lintels.
e. Lintel reinforcing is located 89 mm from the bottom of lintel and projects 600 mm into lintel support on each side.
f. Specified compressive strength of concrete, @ 28 days f'_c, is 20 MPa.
g. Specified yield strength of reinforcement, f_y, is 400 MPa.
h. Two #15 bars should be placed around all openings and shall extend at least 600 mm beyond each corner of the opening.

Report Holder: Reward Wall Systems Inc.
9931 South 136th Street, Suite 100
Omaha, NE 68138-3936
U.S.A.
Tel: 402-592-7077
Fax: 402-592-7969

Plant(s): Dartmouth, NS
New Brighton, PA, U.S.A.
Becker, MN, U.S.A.
Post Falls, ID, U.S.A.

This Report is issued by the Canadian Construction Materials Centre, a program of the Institute for Research in Construction at the National Research Council of Canada. The Report must be read in the context of the entire CCMC Registry of Product Evaluations, including, without limitation, the introduction therein which sets out important information concerning the interpretation and use of CCMC Evaluation Reports.

Readers must confirm that the Report is current and has not been withdrawn or superseded by a later issue. Please refer to http://www.nrc-cnrc.gc.ca/eng/services/irc/ccmc.html, or contact the Canadian Construction Materials Centre, Institute for Research in Construction, National Research Council of Canada, 1200 Montreal Road, Ottawa, Ontario, K1A 0R6. Telephone (613) 993-6189. Fax (613) 952-0268.