



**National Research
Council Canada**

**Conseil national
de recherches Canada**

Institute for
Research in
Construction

Institut de
recherche en
construction

CCMC 13283-R



*EVALUATION
REPORT*

DIVISION 03131

Issued 2007-08-03

Re-evaluation due 2010-08-03

BuildBlock Insulating Concrete Forms

BuildBlock Building Systems, LLC
109 Lynch Street
Pardeeville, Wisconsin
53954 USA

Tel.: (405) 840-3386
Fax: (405) 840-0625

Plants: SCA Packaging North America
Colorado Springs, Colorado
80907 USA

SCA Packaging North America
Pardeeville, Wisconsin
53954 USA

Plants: CBIS/Korfill Inc.
(cont'd) West Brookfield, Massachusetts
01585 USA

Foam Molders Inc.
Post Falls, Idaho
83854 USA

EFP Corporation
Elkhart, Indiana
45615 USA

Speedling Inc.
Sun City, Florida
33586 USA

*This Report is provided without representation, warranty, or guarantee of any kind, expressed or implied, and the National Research Council of Canada (NRC) provides no endorsement for any evaluated material, product, system or service described herein.
NRC has evaluated the material, product, system or service described herein only for those characteristics stated herein. The information and opinions in this Report are directed to those who have the appropriate degree of experience to use and apply its contents.
NRC accepts no responsibility whatsoever arising in any way from any and all use or reliance on the information contained in this Report. NRC is not undertaking to render professional or other services for or on behalf of any person or entity nor to perform any duty owed by any person or entity to another person or entity.*

1. Purpose of Evaluation

The proponent sought confirmation from the Canadian Construction Materials Centre (CCMC) that "BuildBlock Insulating Concrete Forms" can serve as a wall forming system, resulting in a monolithic concrete wall in compliance with the intent of the National Building Code of Canada (NBC) 1995.

2. Opinion

Subject to the limitations and conditions stated in this report, test results and assessments provided by the proponent show that “BuildBlock Insulating Concrete Forms” comply with CCMC’s Technical Guide for Modular, Expanded-Polystyrene Concrete Forms, MasterFormat number 03131, dated 00-09-16, and provide a level of performance equivalent to that required in:

- NBC 1995, Article 4.3.3.1., Subsection 9.3.1., Section 9.4. and Subsection 9.15.4. with respect to wall construction.

Canada Mortgage and Housing Corporation permits the use of this product in construction financed or insured under the *National Housing Act*.

Note: The attachment of exterior cladding and interior finishing materials has not been assessed by the present evaluation.

3. Description

“BuildBlock Insulating Concrete Forms” are modular, interlocking, concrete form systems consisting of two expanded-polystyrene panels with polypropylene connectors molded into the polystyrene panels and equally spaced at 150 mm horizontally and 200 mm vertically. The extremities of the polypropylene connectors are embedded close to the exterior surface of the polystyrene panels.

The units have a preformed symmetrical interlocking design along their top, bottom and side edges that make the forms reversible (top and bottom), facilitates stacking and alignment, and prevents leakage of freshly placed concrete. The units are dry-laid and stacked in a running (staggered) configuration. The stacked units form a rectangular space that, after being filled with concrete, results in an insulated, monolithic concrete wall of uniform thickness.

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 1 219 mm in length and 406 mm in height. The polystyrene panels are 64 mm thick, resulting in an overall wall thickness of 277 mm and 327 mm that in turn encloses a 150-mm and 200-mm concrete wall.

“BuildBlock Insulating Concrete Forms” are available as straight, 90-degree or 45-degree corner forms and as brick ledge forms.

A standard unit of “BuildBlock Insulating Concrete Forms” is illustrated in Figure 1.

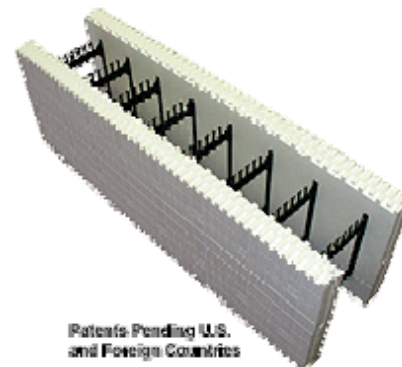


Figure 1. “BuildBlock Insulating Concrete Forms” standard unit.

4. Usage and Limitations

The use of “BuildBlock Insulating Concrete Forms” is permitted in the construction of houses and small buildings up to two storeys high that fall under the provisions of Part 9 of the NBC 1995, subject to the following conditions:

- The structural applications of “BuildBlock Insulating Concrete Forms” must be in strict accordance with the design analysis as prepared for BuildBlock Building Systems, LLC by Novatech Engineering Consultants Ltd., Report No. 106129, dated 22 June 2007, from which Tables 1a, 1b, 1c, 2a and 2b have been reproduced.
- The concrete used in “BuildBlock Insulating Concrete Forms” must be Type 10 or Type 30 having a minimum compressive strength of 20 MPa and a maximum slump of 150 mm.

The maximum aggregate size shall be 10 mm for the 150-mm wall and 20 mm for the 200-mm wall.

- For the wall heights indicated in Tables 2a and 2b, 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.
- The expanded polystyrene (EPS) insulation used in this system must comply with CAN/ULC-S701-97, "Standard For Thermal Insulation, Polystyrene, Boards and Pipe Covering," Type 2.
- The aging of the "BuildBlock Insulating Concrete Forms" EPS insulation panels must be not less than four weeks from the date of manufacturing.
- The interior face of the "BuildBlock Insulating Concrete Forms" panels shall be protected from the inside of the building in accordance with Sentence 9.10.16.10.(1) of the NBC 1995.
- For above-grade installations, the exterior face of "BuildBlock Insulating Concrete Forms" shall be protected with materials conforming to the NBC 1995, Sections 9.20., 9.27. and/or 9.28.
- For foundation wall installations, the backfill shall be placed in such a way as to avoid damaging the wall, the exterior insulation panel, and the waterproofing and dampproofing protection.
- The concrete must be cured a minimum of seven days before backfilling. The top of the foundation wall must be supported by the first floor prior to backfilling.
- For below-grade installations, dampproofing material compatible with the EPS insulation must be provided in accordance with the NBC 1995, Article 9.13.1.1.

- Where hydrostatic pressure exists, waterproofing compatible with the EPS insulation must be provided in accordance with the NBC 1995, Article 9.13.1.2.
- The backfill material must be well-drained and a drainage system must be installed around the footing as per NBC 1995 requirements.
- Installation of the "BuildBlock Insulating Concrete Forms" shall be in strict compliance with the "BuildBlock Installation Manual" dated 25 March 2006. Only installers who have been trained and authorized by BuildBlock Building Systems, LLC shall be contracted to install the wall system.

5. Performance

Compliance of the EPS thermal insulation with the requirements of CAN/ULC-S701-97 is covered under Intertek Testing Services NA Ltd. certification program.

The design analysis of walls using "BuildBlock Insulating Concrete Forms" as prepared for "BuildBlock Building Systems, LLC" is summarized in Tables 1a, 1b 1c, 2a and 2b.

The tables provide steel reinforcement designs for a number of different wall and lintel applications based on the structural loads, and the design assumptions are indicated below each table. When "BuildBlock Insulating Concrete Forms" are used in structural applications outside the scope of the referenced design analysis, a registered professional engineer skilled in concrete design must certify the design analysis and the design drawings for such applications. The engineer shall certify that the construction provides a level of performance equivalent to that required by Part 4 and/or Part 9 of the NBC 1995.

Table 1a. Vertical and Horizontal Steel Reinforcement for “BuildBlock Insulating Concrete Forms” in Below-Grade Walls in all Seismic Zones⁽¹⁾⁽²⁾

Wall Height (m)	Backfill Height (m)	Seismic Zones 0, 1 and 2							
		Max. Spacing for Vertical Reinforcement				Max. Spacing for Horizontal Reinforcement			
		Without Brick Ledge		With Brick Ledge		Without Brick Ledge		With Brick Ledge	
		150-mm Wall	200-mm Wall	150-mm Wall	200-mm Wall	150-mm Wall	200-mm Wall	150-mm Wall	200-mm Wall
2.44	1.22	10M@300	10M @ 300	10M @ 300	10M @ 300	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	1.53	10M @ 300	10M @ 300	15M @ 450	15M @ 450	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	1.83	10M @ 300	10M @ 450	15M @ 450	15M @ 450	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	2.14	15M @ 450	15M @ 300	15M @ 300	15M @ 450	15M @ 405	15M @ 405	15M @ 405	15M @ 405
3.05	1.22	10M @ 300	10M @ 300	10M @ 300	10M @ 300	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	1.53	10M @ 300	10M @ 300	15M @ 450	15M @ 450	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	1.83	10M @ 300	10M @ 300	15M @ 300	15M @ 450	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	2.14	15M @ 450	15M @ 450	15M @ 300	15M @ 300	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	2.44	15M @ 300	15M @ 450	15M @ 150	15M @ 300	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	2.75	15M @ 150	15M @ 300	15M @ 150	15M @ 150	15M @ 405	15M @ 405	15M @ 405	15M @ 405
3.66	1.22	10M @ 300	10M @ 300	10M @ 300	10M @ 300	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	1.53	10M @ 300	10M @ 300	15M @ 450	15M @ 450	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	1.83	15M @ 450	10M @ 450	15M @ 300	15M @ 450	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	2.14	15M @ 300	15M @ 450	15M @ 150	15M @ 300	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	2.44	15M @ 150	15M @ 300	15M @ 150	15M @ 300	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	2.75	15M @ 150	15M @ 300		15M @ 150	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	3.05		15M @ 150		15M @ 150	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	3.36		15M @ 150		15M @ 150	15M @ 405	15M @ 405	15M @ 405	15M @ 405

Notes to Table 1a:

(1) Table 1a is based on the following assumptions:

- Loads include earth pressure, surcharge, seismic and gravity load. Gravity load assumes two storeys, concrete construction and wood-frame roof structure.
- Snow load is equal to 1.9 kPa, and the floor load equal to 1.9 kPa.
- Specified compressive strength of concrete, f_c at 28 days is 20 MPa.
- Specified yield strength of reinforcement, f_y , is 400 MPa.
- Two #15 bars should be placed around all openings and shall extend at least 600 mm beyond each corner of the opening.

(2) The shaded area means not feasible with respect to the proposed backfill height.

Table 1b. Vertical and Horizontal Steel Reinforcement for “BuildBlock Insulating Concrete Forms” Below-Grade Walls in all Seismic Zones⁽¹⁾⁽²⁾

Wall Height (m)	Backfill Height (m)	Seismic Zones 3 and 4							
		Max. Spacing for Vertical Reinforcement				Max. Spacing for Horizontal Reinforcement			
		Without Brick Ledge		With Brick Ledge		Without Brick Ledge		With Brick Ledge	
		150-mm Wall	200-mm Wall	150-mm Wall	200-mm Wall	150-mm Wall	200-mm Wall	150-mm Wall	200-mm Wall
2.44	1.22	10M @ 300	10M @ 300	10M @ 300	10M @ 300	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	1.53	10M @ 300	10M @ 300	15M @ 450	15M @ 450	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	1.83	10M @ 300	10M @ 300	15M @ 450	15M @ 450	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	2.14	15M @ 450	15M @ 450	15M @ 300	15M @ 450	15M @ 405	15M @ 405	15M @ 405	15M @ 405
3.05	1.22	10M @ 300	10M @ 300	10M @ 300	10M @ 300	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	1.53	10M @ 300	10M @ 300	15M @ 450	15M @ 450	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	1.83	15M @ 450	15M @ 450	15M @ 300	15M @ 450	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	2.14	15M @ 300	15M @ 450	15M @ 150	15M @ 300	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	2.44	15M @ 150	15M @ 300	15M @ 150	15M @ 300	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	2.75	15M @ 150	15M @ 300	15M @ 150	15M @ 150	15M @ 405	15M @ 405	15M @ 405	15M @ 405
3.66	1.22	10M @ 300	10M @ 300	10M @ 300	10M @ 300	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	1.53	10M @ 300	10M @ 300	15M @ 450	15M @ 450	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	1.83	15M @ 450	15M @ 450	15M @ 300	15M @ 450	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	2.14	15M @ 300	15M @ 450	15M @ 150	15M @ 300	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	2.44	15M @ 150	15M @ 300	15M @ 150	15M @ 150	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	2.75	15M @ 150	15M @ 150		15M @ 150	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	3.05		15M @ 150		15M @ 150	15M @ 405	15M @ 405	15M @ 405	15M @ 405
	3.36		15M @ 150		15M @ 150	15M @ 405	15M @ 405	15M @ 405	15M @ 405

Notes to Table 1b:

(1) Table 1b is based on the following assumptions:

- Loads include earth pressure, surcharge, seismic and gravity load. Gravity load assumes 2 storeys, concrete construction and wood frame roof structure.
- Snow load is equal to 1.9 kPa, and floor load equal to 1.9 kPa.
- Specified compressive strength of concrete, f'_c at 28 days is 20 MPa.
- Specified yield strength of reinforcement, f_y , is 400 MPa.
- Two #15 bars should be placed around all openings and shall extend at least 600 mm beyond each corner of the opening.

(2) The shaded area means not feasible with respect to the proposed backfill height.

Table 1c. Vertical and Horizontal Steel Reinforcement for “BuildBlock Insulating Concrete Forms” Above-Grade Walls in all Seismic Zones⁽¹⁾

Wall Height (m)	Max. Spacing of Vertical Reinforcement (mm)		Max. Spacing for Horizontal Reinforcement (mm)	
	150-mm Wall	200-mm Wall	150-mm Wall	200-mm Wall
Single-Storey Concrete Construction Supporting a Wood-Frame Roof Structure				
2.44	10M @ 300	10M @ 300	15M @ 405	15M @ 405
3.05	10M @ 300	10M @ 300	15M @ 405	15M @ 405
3.66	10M @ 300	10M @ 300	15M @ 405	15M @ 405
Ground Floor Concrete Construction Supporting a Second Storey Wood-Frame and wood-Frame Roof Structures				
2.44	10M @ 300	10M @ 300	15M @ 405	15M @ 405
3.05	10M @ 300	10M @ 300	15M @ 405	15M @ 405
3.66	10M @ 300	10M @ 300	15M @ 405	15M @ 405
Ground Floor Construction Supporting a Second Storey Concrete Construction and a Wood-Frame Roof Structure				
2.44	10M @ 300	10M @ 300	15M @ 405	15M @ 405
3.05	10M @ 300	10M @ 300	15M @ 405	15M @ 405
3.66	10M @ 300	10M @ 300	15M @ 405	15M @ 405

Notes to Table 1c:

- (1) Table 1c is based on the following assumptions:
- Loads include all applicable gravity and wind loads.
 - Applicable to all seismic zones and to a wind pressure, $q^{1/30}$ of 2.0 kPa.
 - Specified compressive strength of concrete, f'_c at 28 days is 20 MPa.
 - Specified yield strength of reinforcement, f_y , is 400 MPa.
 - Two #15 bars should be placed around all openings and shall extend at least 600 mm beyond each corner of the opening.

Table 2a. Minimum Steel Reinforcement of Lintels for 150-mm Core “BuildBlock Insulating Concrete Forms”⁽¹⁾

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)											
	5.0		10.0		15.0		20.0		25.0		30.0	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
1 000	1-15M	0	1-15M	0	1-15M	0	1-15M	0	1-15M	0	1-15M	0
1 500	1-15M	0	1-15M	0	1-15M	0	1-15M	0	1-15M	110	1-15M	210
2 000	1-15M	0	1-15M	0	1-15M	0	1-15M	200	1-15M	360	1-15M	460
2 500	1-15M	0	1-15M	0	1-15M	180	1-15M	450	1-15M	610	1-15M	710
3 000	1-15M	0	1-15M	0	1-15M	430	1-15M	700	1-20M	860	1-20M	960
3 500	1-15M	0	1-15M	140	1-15M	680	1-20M	950	1-25M	1 110	1-25M	1 210
4 000	1-15M	0	1-15M	390	1-20M	930	1-25M	1 200	2-20M	1 360	1-20M	1 460
4 500	1-15M	0	1-15M	640	1-25M	1 180	2-20M	1 450	2-20M	1 610	2-25M	1 710
5 000	1-15M	0	1-20M	890	1-25M	1 430	2-20M	1 700	2-25M	1 860	2-25M	1 960

Notes to Table 2a:

(1) Table 2a is based on the following assumptions:

- The factored uniformly distributed load includes live and dead loads.
- The minimum height of the lintel is 406 mm.
- Stirrups are single leg fabricated from # 10 bars spaced at 170 mm on centre.
- Lintel reinforcing is located in the bottom of the lintel and projects 300 mm into the lintel support on each side.
- Specified compressive strength of concrete, @ 28 days f'_c is 20 MPa.

Table 2b. Minimum Steel Reinforcement of Lintels for 150-mm Core “BuildBlock Insulating Concrete Forms” ⁽¹⁾

Opening Width (mm)	Factored Uniformly Distributed Load (kN/m)											
	5.0		10.0		15.0		20.0		25.0		30.0	
	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)	Bottom Steel	Stirrup End Dist. (mm)
1 000	1-15M	0	1-15M	0	1-15M	0	1-15M	0	1-15M	0	1-15M	0
1 500	1-15M	0	1-15M	0	1-15M	0	1-15M	0	1-15M	0	1-15M	30
2 000	1-15M	0	1-15M	0	1-15M	0	1-15M	0	1-15M	140	1-15M	280
2 500	1-15M	0	1-15M	0	1-15M	0	1-15M	180	1-15M	390	1-15M	530
3 000	1-15M	0	1-15M	0	1-15M	70	1-15M	430	1-20M	640	1-20M	780
3 500	1-15M	0	1-15M	0	1-15M	320	1-20M	680	2-15M	890	2-15M	1 030
4 000	1-15M	0	1-15M	0	1-20M	570	2-15M	930	1-25M	1 140	1-25M	1 280
4 500	1-15M	0	1-15M	100	1-20M	8 20	1-25M	1 180	2-20M	1 390	2-25M	1 530
5 000	1-15M	0	1-20M	350	1-15M	1 070	2-20M	1 430	2-25M	1 640	2-25M	1 780

Notes to Table 2b:

(1) Table 2b is based on the following assumptions:

- The factored uniformly distributed load includes live and dead loads.
- The minimum height of the lintel is 406 mm.
- Stirrups are single leg fabricated from # 10 bars spaced at 170 mm on centre.
- Lintel reinforcing is located in the bottom of the lintel and projects 300 mm into the lintel support on each side.
- Specified compressive strength of concrete, @ 28 days f'_c is 20 MPa.

For more information contact:

Fadi Nabhan
(613) 993-7702

Note: Readers are asked to refer to limitations imposed by NRC on the interpretation and use of this report. These limitations are included in the introduction to CCMC’s Registry of Product Evaluations, of which this report is part.

Readers are advised to confirm that this report has not been withdrawn or superseded by a later issue by referring to <http://irc.nrc.gc.ca/ccmc>, or contacting the Canadian Construction Materials Centre, Institute for Research in Construction, National Research Council of Canada, Montreal Road, Ottawa, Ontario, K1A 0R6; Telephone (613) 993-6189, Fax (613) 952-0268.

Issued by the Institute for Research in Construction under the authority of the National Research Council

John Flack, Ph.D.
Manager, CCMC