B-3.1. BASEMENT WALLS

There are three options for using Armopanel system in low-rise residential buildings. The summaries of these three options are presented in basement wall tables below.

1) **Armopanel ™** basement wall supporting one-storey wood framing,
2) **Armopanel ™** basement wall supporting two-storey:
    a. The first storey – concrete floor, and
    b. The second storey – wood framing.
3) **Armopanel ™** basement wall supporting two-storey:
    a. The first storey – concrete floor,
    b. The second storey – concrete floor, concrete wall and roof.

The tables below are based on *Prescriptive Method for insulating concrete forms in residential construction. Second Edition , January 2002. [1]*
This tables are to be used for low-rise residential buildings only.
Placement of reinforcement shall be in accordance with the local standards, regulations, or code having jurisdiction.
In Canada, the placement of reinforcing steel shall conform to CSA A23.1; design requirements must be in accordance with CSA A23.3, the latest addition.
In the US, the placement and design of reinforcing steel must be in conformance with ACI 318, or ACI 332, or the 2000 International Residential Code. Alternatively, some areas have adopted the 1999 Standard Building Code, or Prescriptive Method for Insulating Concrete Forms in Residential Construction.
Distances between rebars and rebar sizes have been modified in accordance with Armopanel™ Wall System and Canadian rebars designation and are to be used only within the assumptions and restrictions laid out in that document. These tables are to be superseded by the local building code or original engineering performed for the specific construction project.
Each table of the below grade walls includes reinforcement for all the above conditions.
The design criteria assumed for each of these three construction conditions are shown in this section. The basement wall tables reflect the reinforcement required for the specified conditions, only.

Any other conditions are not covered by the tables below and require special attention from the structural engineer of the specific project.

Specific project information and design criteria should be used to properly design the wall. Deflection criteria is L/240, where L is the height of the wall storey.
The tables have data intended to help the Engineer/Contractor quickly determine the required basement wall thickness and appropriate reinforcement for basement walls with thickness of 150mm to 250mm (5.5”-9.5”) based on horizontal soil pressure and the wall height.
The horizontal load from the soil pressure from the backfill has been changed to the equivalent load from the water pressure.
The section “Detailed Drawing” describes the details of the basement walls and intends to help the Designer in developing the specific project with **Armopanel ™.**

Table B.3.1.1

Equivalent Fluid* Density Soil Classification**

Maximum Equivalent Fluid Density kg/m³ (pcf)	UCS	Soil Description
481 (30)	GW, GP, SW, SP, GM	Well-drained, cohesionless soil such as clean (few or no fines) sand and gravels
721 (45)	GC, SM	Well-drained, cohesionless soil such as sand and gravels containing silt or clay
961 (60)	SC, MN, CL, CH, ML-CL	Well-drained, inorganic silts and clays that are broken up into small pieces

UCS – Uniform Soil Classification

* Equivalent Fluid Density - The mass of a soil per unit volume treated as a fluid mass for the purpose of determining lateral design loads produced by the soil on an adjacent structure such as a basement wall.
** Taken from Table C3.2 [1]

Table B-3.1.2*

Minimum Horizontal Reinforcement for Flat ICF Above-Grade Walls

Maximum Height of Basement Wall (feet.)	Location of Horizontal Reinforcement
8	One No 4 bar within 12 inches of top of the wall story, and one No 4 bar near mid-height of wall story
9	One No 4 bar within 12 inches of top of the wall story, and one No 4 bar near third points in the wall story
10	One No 4 bar within 12 inches of top of the wall story, and one No 4 bar near third points in the wall story

Horizontal reinforcement requirements minimum yield strength of 40,000 psi
Concrete compressive strength 2,500 psi
* Taken from Table 3.3 [1]

Table B-3.1.3*

Minimum Horizontal Reinforcement for Flat ICF Above-Grade Walls

Maximum Height of Wall Storey (metre)	Location of Horizontal Reinforcement
2.44	One 15M bar within 400 mm of top of the wall story, and one 15M bar near mid-height of wall story
2.74	One 15M bar within 400 mm of top of the wall story, and one 15M bar near third points in the wall story
3.05	One 15M bar within 400 mm inches of top of the wall story, and one 15M bar near third points in the wall story

Horizontal reinforcement requirements minimum yield strength of 400 MPa
Concrete compressive strength 20 MPa
* Table is based on Table 3.3 [1]

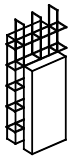

Table B-3.1.4.*

MINIMUM VERTICAL WALL REINFORCEMENT FOR
150-mm- THICK FLAT ICF BASEMENT WALLS [1,2,3,4,5,6,7]

MAX. WALL HEIGHT (metre)	MAXIMUM UNBALANCED BACKFILL HEIGHT (metre)	MINIMUM VERTICAL REINFORCEMENT		
		MAXIMUM EQUIVALENT FLUID DENSITY 4.81 kN/m³	MAXIMUM EQUIVALENT FLUID DENSITY 7.21 kN/m³	MAXIMUM EQUIVALENT FLUID DENSITY 9.61 kN/m³
2.44	1.22	10M@1200	10M@1200	10M@1200
	1.53	10M@1200	10M@600; 15M@1000	10M@400; 15M@800
	1.83	10M@600; 15M@1000	10M@400 ; 15M@800	10M@200 ; 15M@600
	2.14	10M@400 ; 15M@800	10M@200 ; 15M@600	10M@200 ; 15M@400
2.75	1.22	10M@1200	10M@1200	10M@1200
	1.53	10M@1000	10M@600; 15M@1000	10M@400; 15M@800
	1.83	10M@600; 15M@1000	10M@400; 15M@600	10M@200; 15M@400
	2.14	10M@400; 15M@800	10M@200; 15M@400	15M@400; 20M@600
	2.44	10M@200; 15M@600	15M@400; 20M@600;	15M@200 20M@400;
3.05	1.22	10M@1200	10M@1200	10M@1200
	1.53	10M@1000	10M@600; 15M@1000	10M@400; 15M@800
	1.83	10M@400; 15M@600	10M@400; 15M@600	10M@200; 15M@400
	2.14	10M@200; 15M@600	10M@200; 15M@400	15M@200 20M@400
	2.44	10M@200; 15M@400	20M@400	20M@200
	2.75	15M@400 20M@600	15M@200 20M@400	20M@200

[1] Table values are based on reinforcing bars with a minimum yield strength of 400 MPa and concrete with a minimum specified compressive strength of 20 MPa
[2] Reinforcement shall not be less than one 10M bar at 1200 mm on center.
[3] Deflection criterion is L/240, where L is the height of the basement wall in inches.
[4] Interpolation shall not be permitted.
[5] Walls shall be laterally supported at the top before backfilling.
[6] Unbalanced Backfill Height : The maximum clear vertical distance between the ground level or finished floor and the finished ceiling or sill plate.
[7] Vertical reinforcement should be placed within middle third of the concrete wall

* Table is based on Table 3.4 [1]

Table B-3.1.5.*

MINIMUM VERTICAL WALL REINFORCEMENT FOR
5.5-inch- THICK FLAT ICF BASEMENT WALLS [1,2,3,4,5,7]

MAX. WALL HEIGHT (meter)	MAXIMUM UNBALANCED BACKFILL HEIGHT [6] (meter)	MINIMUM VERTICAL REINFORCEMENT		
		MAXIMUM EQUIVALENT FLUID DENSITY 30 pcf	MAXIMUM EQUIVALENT FLUID DENSITY 45 pcf	MAXIMUM EQUIVALENT FLUID DENSITY 60 pcf
8	4	#4@48″	#4@48″	#4@48″
	5	#4@48″	#3@8″; #4@16″; #5@32″; #6@40″	#4@8″; #5@16″; #6@24″
	6	#3@8″; #4@16″; #5@24″; #6@40″	#4@8″; #5@16″; #6@24″	#4@8″; #5@16″; #6@24″
	7	#4@8″; #5@16″; #6@24″	#4@8″; #5@16″; #6@16″	#5@8″; #6@16″
9	4	#4@48″	#4@48″	#4@48″
	5	#4@48″	#3@8″; #4@16″; #5@24″; #6@32″	#4@8″; #5@16″ #6@24″
	6	#3@8″; #4@16″; #5@24″; #6@32″	#4@8″; #5@16″	#4@8″ #6@16″
	7	#4@8″; #5@16″; #6@24″	#4@8″; #5@8″; #6@16″	#6@8″
	8	#4@8″; #6@16″	#5@8″	#6@8″
10	4	#4@48″	#4@48″	#4@48″
	5	#4@8″;	#3@8″; #4@16″; #5@24″; #6@32″	#4@8″; #5@16″
	6	#3@8″; #4@16″; #5@24″; #6@32″	#4@16″; #5@24″; #6@32″	#5@8″; #6@16″
	7	#4@8″; #5@16″; #6@16″	#5@8″ #6@16″	#6@8″
	8	#5@8″ #6@16″	#5@8″	#6@8″
	9	#5@8″	#6@8″	

[1] Table values are based on reinforcing bars with a minimum yield strength of 40,000 psi (276 MPa) and concrete with a minimum specified compressive strength of 2,850 psi (20 MPa).
[2] Spacing of rebar shall be permitted to be multiplied by 1.5 when reinforcing steel with a minimum yield strength of 60,000 psi (414 MPa) is used. Reinforcement shall not be less than one #4 bar at 48 inches (1.2 m) on center.
[3] Deflection criterion is L/240, where L is the height of the basement wall in inches.
[4] Interpolation shall not be permitted.
[5] Walls shall be laterally supported at the top before backfilling.
[6] Unbalanced Backfill Height : The maximum clear vertical distance between the ground level or finished floor and the finished ceiling or sill plate.
[7] Vertical reinforcement should be placed within middle third of the concrete wall.

* Table is based on Table 3.4 [1]

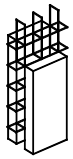

Table B-3.1.6.*

MINIMUM VERTICAL WALL REINFORCEMENT FOR
200-mm- THICK FLAT ICF BASEMENT WALLS [1,2,3,4,5,7]

MAX. WALL HEIGHT (meter)	MAXIMUM UNBALANCED BACKFILL HEIGHT [6] (meter)	MINIMUM VERTICAL REINFORCEMENT		
		MAXIMUM EQUIVALENT FLUID DENSITY 4.81 kN/m³	MAXIMUM EQUIVALENT FLUID DENSITY 7.21 kN/m³	MAXIMUM EQUIVALENT FLUID DENSITY 9.61 kN/m³
2.44	1.22	N/R	N/R	N/R
	1.53	N/R	N/R	N/R
	1.83	N/R	N/R	N/R
	2.14	N/R	10M@400; 15M@800	10M@200; 15M@600
2.75	1.22	N/R	N/R	N/R
	1.53	N/R	N/R	N/R
	1.83	N/R	N/R	10M@400; 15M@800
	2.14	N/R	10M@200; 15M@800	10M@200; 15M@600
	2.44	10M@400; 15M@800	10M@200; 15M@600;	10M@200 15M@400;
3.05	1.22	N/R	N/R	N/R
	1.53	N/R	N/R	N/R
	1.83	N/R	N/R	10M@400; 15M@800
	2.14	N/R	10M@200; 15M@800	10M@200; 15M@400
	2.44	10M@400; 15M@800	10M@200; 15M@400	15M@400; 20M@600
	2.75	10M@200; 15M@600	15M@400 20M@600	15M@200 20M@400

[1] Table values are based on reinforcing bars with a minimum yield strength of 400 MPa and concrete with a minimum specified compressive strength of 20 MPa
[2] Reinforcement shall not be less than one 10M bar at 1200 mm on center.
[3] Deflection criterion is L/240, where L is the height of the basement wall in inches.
[4] Interpolation shall not be permitted.
[5] Walls shall be laterally supported at the top before backfilling.
[6] Unbalanced Backfill Height : The maximum clear vertical distance between the ground level or finished floor and the finished ceiling or sill plate.
[7] Vertical reinforcement should be placed on the tension side of the wall and shall be covered by 40 mm thick concrete. If wall is bearing pure axial load the reinforcement must be placed in the middle third of the wall.

* Table is based on Table 3.5 [1]

Table B-3.1.7.*

MINIMUM VERTICAL WALL REINFORCEMENT FOR
7.5-inch- THICK FLAT ICF BASEMENT WALLS [1,2.3.4.5,7]

MAX. WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT [6] (feet)	MINIMUM VERTICAL REINFORCEMENT		
		MAXIMUM EQUIVALENT FLUID DENSITY 30 pcf	MAXIMUM EQUIVALENT FLUID DENSITY 45 pcf	MAXIMUM EQUIVALENT FLUID DENSITY 60 pcf
8	4	N/R	N/R	N/R
	5	N/R	N/R	N/R
	6	N/R	N/R	N/R
	7	N/R	#3@8"; #4@8"; #5@16"; #6@24"	#4@8"; #5@16"; #6@24"
9	4	N/R	N/R	N/R
	5	N/R	N/R	N/R
	6	N/R	N/R	#3@8"; #4@8"; #5@16"; #6@24"
	7	N/R	#4@8"; #5@16"; #6@24"	#4@8"; #5@8"; #6@16"
	8	#3@8"; #4@8"; #5@16"; #6@24"	#4@8"; #5@8"; #6@16"	#5@8"; #6@16"
10	4	N/R	N/R	N/R
	5	N/R	N/R	N/R
	6	N/R	N/R	#4@8"; #5@16"; #6@24"
	7	N/R	#4@8"; #5@16"; #6@24"	#4@8"; #5@8"; #6@16"
	8	#4@8"; #5@16"; #6@24"	#4@8"; #5@8"; #6@16"	#5@8"; #6@8"
	9	#4@8"; #5@16"; #6@16"	#5@8"; #6@8"	#6@8"

[1] Table values are based on reinforcing bars with a minimum yield strength of 40,000 psi (276 MPa) and concrete with a minimum specified compressive strength of 2,850 psi (20 MPa).
[2] Spacing of rebar shall be permitted to be multiplied by 1.5 when reinforcing steel with a minimum yield strength of 60,000 psi (414 MPa) is used. Reinforcement shall not be less than one #4 bar at 48 inches (1.2 m) on center.
[3] Deflection criterion is L/240, where L is the height of the basement wall in inches.
[4] Interpolation shall not be permitted.
[5] Walls shall be laterally supported at the top before backfilling.
[6] Unbalanced Backfill Height : The maximum clear vertical distance between the ground level or finished floor and the finished ceiling or sill plate.
[7] Vertical reinforcement should be placed on the tension side of the wall and shall be covered by 1 ½" thick concrete. If wall is bearing pure axial load the reinforcement must be placed in the middle third of the wall.

* Table is based on Table 3.5 [1]

Table B-3.1.8.*

MINIMUM VERTICAL WALL REINFORCEMENT FOR
250-mm- THICK FLAT ICF BASEMENT WALLS [1,2,3,4,5,7]

MAX. WALL HEIGHT (meter)	MAXIMUM UNBALANCED BACKFILL HEIGHT [6] (meter)	MINIMUM VERTICAL REINFORCEMENT		
		MAXIMUM EQUIVALENT FLUID DENSITY 4.81 kN/m³	MAXIMUM EQUIVALENT FLUID DENSITY 7.21 kN/m³	MAXIMUM EQUIVALENT FLUID DENSITY 9.61 kN/m³
2.44	1.22	N/R	N/R	N/R
	1.53	N/R	N/R	N/R
	1.83	N/R	N/R	N/R
	2.14	N/R	N/R	N/R
2.75	1.22	N/R	N/R	N/R
	1.53	N/R	N/R	N/R
	1.83	N/R	N/R	N/R
	2.14	N/R	N/R	10M@400; 15M@800
	2.44	N/R	10M@400; 15M@800	10M@200; 15M@600
3.05	1.22	N/R	N/R	N/R
	1.53	N/R	N/R	N/R
	1.83	N/R	N/R	10M@600; 15M@800
	2.14	N/R	N/R	10M@200; 15M@800
	2.44	N/R	10M@400; 15M@600	10M@200; 15M@400
	2.75	N/R	10M@200; 15M@400	15M@400 20M@600

[1] Table values are based on reinforcing bars with a minimum yield strength of 400 MPa and concrete with a minimum specified compressive strength of 20 MPa.
[2] Reinforcement shall not be less than one 10M bar at 1200 mm on center.
[3] Deflection criterion is L/240, where L is the height of the basement wall in inches.
[4] Interpolation shall not be permitted.
[5] Walls shall be laterally supported at the top before backfilling.
[6] Unbalanced Backfill Height : The maximum clear vertical distance between the ground level or finished floor and the finished ceiling or sill plate.
[7] Vertical reinforcement should be placed on the tension side of the wall and shall be covered by 40 mm thick concrete. If wall is bearing pure axial load the reinforcement must be placed in the middle third of the wall.

* Table is based on Table 3.6 [1]

Table B-3.1.9.*

MINIMUM VERTICAL WALL REINFORCEMENT FOR
9.5-inch- THICK FLAT ICF BASEMENT WALLS [1,2.3.4.5,7]

MAX. WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT [6] (feet)	MINIMUM VERTICAL REINFORCEMENT		
		MAXIMUM EQUIVALENT FLUID DENSITY 30 pcf	MAXIMUM EQUIVALENT FLUID DENSITY 45 pcf	MAXIMUM EQUIVALENT FLUID DENSITY 60 pcf
8	4	N/R	N/R	N/R
	5	N/R	N/R	N/R
	6	N/R	N/R	N/R
	7	N/R	N/R	N/R
9	4	N/R	N/R	N/R
	5	N/R	N/R	N/R
	6	N/R	N/R	N/R
	7	N/R	N/R	#4@8"; #5@16"; #6@24"
	8	N/R	#4@8"; #5@16"; #6@24"	#5@8"; #6@16"
10	4	N/R	N/R	N/R
	5	N/R	N/R	N/R
	6	N/R	N/R	#4@16"; #5@24"; #6@32"
	7	N/R	N/R	#4@8"; #5@16"; #6@24"
	8	N/R	#4@8"; #5@16"; #6@24"	#5@8"; #6@16"
	9	N/R	#5@8"; #6@16"	#6@8"

[1] Table values are based on reinforcing bars with a minimum yield strength of 40,000 psi (276 MPa) and concrete with a minimum specified compressive strength of 2,850 psi (20 MPa).
[2] Spacing of rebar shall be permitted to be multiplied by 1.5 when reinforcing steel with a minimum yield strength of 60,000 psi (414 MPa) is used. Reinforcement shall not be less than one #4 bar at 48 inches (1.2 m) on center.
[3] Deflection criterion is L/240, where L is the height of the basement wall in inches.
[4] Interpolation shall not be permitted.
[5] Walls shall be laterally supported at the top before backfilling.
[6] Unbalanced Backfill Height : The maximum clear vertical distance between the ground level or finished floor and the finished ceiling or sill plate.
[7] Vertical reinforcement should be placed on the tension of the wall and shall be covered by 1 ½" thick concrete. If wall is bearing pure axial load the reinforcement must be placed in the middle third of the wall.

* Table is based on Table 3.6 [1]