B-6. Group-IV. CONSTRUCTION OF STRUCTURAL CONCRETE WALLS with Armopanel™ Concrete Wall System

This group include Interaction Diagrams and Tables for selection of reinforcement for above grade walls with height up to 20.0m (65'), basement walls up to 9.0m (30'), one-storey industrial buildings, and retaining walls with height up to 6.0 m (20').

B-6.1. BASIC DOCUMENTS AND LIMITATIONS

B-6.1.1. Codes and Standards considered during the design process.

The system of the cast in place reinforced concrete walls, **Armopanel™,** is designed in accordance with recommendations of National Building Code of Canada and American Codes and Standards - ICBO, SBCCI and BOCA.

This design guide considers provisions of the above codes regarding live and dead loads as well as safety factors.

Recommendations of NEHRP 2000 are considered for calculations and design of concrete structures built in seismic zones.

For each specific project, the Engineer should follow the local structural Codes, Standards and Regulations in order to calculate the factored loads and forces applied on the structure.

B-6.1.2. Calculation of the cast in place reinforced concrete walls is performed in accordance with CSA STANDARD A23.3-94; US CODE ACI-318-99 and Commentary 318R-99. Also, recommendations from "Reinforced Concrete Fundamentals", Phil Ferguson, John E. Breen, James O. Jirsa, 5th Edition and "Guide to Formwork for Concrete".

B-6.1.3. The following Standards were used for references:

Welding of reinforcement: in accordance with CSA Standard W59-M1989, ANSI/AWD D 1.4 – 98 (USA).

Reinforcement:

Deformed bars: CSA Standard G30.14; ASTM A496, ASTM A497, ASTM A615/A615M A616/A616M, A706/A706M

Yield Strength 400MPa; (Grade 60) is no lower than 60 000 psi

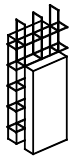
Plain wires are required for reinforcement ties, bracers and fasteners for polystyrene boards with strength of at least 280MPa, CSA Standard G30.3; 40 000 psi: ASTM B-82; ASTM A85.

B-6.1.4. Concrete: in accordance with the requirements: CAN/CSB-A23.1/A23.2-00; ASTM 150 and C 595; ASTM and C 172; ASTM and C 173 (or C 231)

B-6.1.5. Polystyrene: CAN/ULC-S701-97 EPS or XPS not less than Type 3

ASTM C 578-00 EPS or XPS Type IV, Type IX, Type X

B-6.1.6. The material of the polypropylene caps for securing of the polystyrene boards meets the requirements of CAN/CSA-C22.2 N0. 0.17-00; ASTM D1505, D638, D790 and D2240.



B-6.1.7 The U-guide material is zinced cold formed profile with thickness of approximately 1/16" (1.52 mm) and meets the requirements of CAN S136-M84; ASTM A-792M, AZ50.

B-6.1.8. Fire safety requirements for monolithic reinforced concrete walls built with elements of **Armopanel™ Concrete Wall System**.

Monolithic reinforced concrete walls designed with **Armopanel™ Concrete Wall System** are classified as noncombustible materials with 1-4 hour fire resistance according to NBC of Canada 1995 (Section D-2); BOCA (NBC999), ICBO (UBC997), SBCCI (SBC999.)**.**

B-6.1.9. Armopanel™ can be used according to codes in the following types of residential, industrial and commercial structures:

Group A - Assembly (UBC - Section 303; SBC-Section 304, NBC-Section 303), 2.2.1.2.; Group B - Business (UBC - Section 304; SBC-Section 305, NBC-Section 304), 2.2.1.3.; Group E - Educational(UBC - Section 305; SBC-Section 306, NBC-Section 305); Group F - Factory-Industrial (UBC - Section 306; SBC-Section 306, NBC Section 306), Group M-Mercantile (UBC - Section 309; SBC-Section 310, NBC-Section 309), 2.2.1.6. Group R-Residential (UBC - Section 310; SBC-Section 311, NBC-Section 310), 2.2.1.7. Group S-Storage (UBC - Section 311; SBC-Section 312, NBC-Section 311).

B-6.1.10. Minimal thickness of monolithic reinforced concrete walls accepted for Armopanel™ Concrete Wall System design is equal 100mm (4"). With dry plaster by thickness 5/8", fire resistance of walls with thickness 100mm (4") will correspond to the required 2 hour fire resistance rating. Accepted in **Armopanel™ Concrete Wall System** walls thickness of 150-350mm (from 6 " up to 14 "), it corresponds to 3 hour fire resistance rating and without plaster, and walls thickness 200 – 350mm (from 8 " up to 14 ") corresponds to 4 hour fire resistance rating (see NBC of Canada 1995, part 3.1.7.5.; ICBO 709; SBCCI-709.2.3A and BOCA-709.2.3.1).

B-6.1.11. The minimal storey height is not limited by the present "Manual"; the maximum height of a storey can be **3.8m (152")** for above grade and **underground walls.** The total height of the building cannot exceed **19.8m (65 ')** above grade. The total depth of the basement cannot exceed **9m (30 ').** The height of each **retaining wall** cannot exceed **6m (20').**

B-6.1.12. The thickness of the reinforced above and below grade walls of the **Armopanel™ Concrete Wall System** can be from 150 to 350mm (from 6 " up to 14 ").

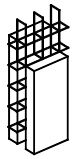
Selection of wall thickness and reinforcement for ***construction of structured concrete walls*** should be done in accordance with the ***Interaction Diagrams*** below.

B-6.1.13.

Interface between the walls and the foundation is provided by means of dowels, which are inserted into the foundation. For projection of the dowels inside the concrete wall see (CAN STANDARD A23.3-94; ACI 318-99, §12.2; §12.5.1). Thus providing continuity of vertical reinforcement.

B-6.1.14. Vertical interface of monolithic walls is similar to interface between walls and the foundations.

The continuity of vertical reinforcement between panels is achieved by sufficient splice of vertical reinforcement according to the local building code.



B-6.1.15. The interface between concrete walls and the last concrete slabs or roof can be fixed or hinged. In the first case, the moment connection will be achieved by using proper splicing of reinforcement in accordance with the local building code.

B-6.1.16. In the second case, hinge connection can be achieved by means of anchor bolts embedded in the wall. The size of the bolts and the distance between them shall be in accordance with local building codes.

B-6.1.17.
Armopanel™ polystyrene boards should be used in the system no earlier than 4 weeks after production.

B-6.1.18. Interior surface of the panels should be protected in accordance with NBC of Canada 1995 [9.10.16.(1)], BOCA (NBC999), ICBO (UBC997), SBCCI (SBC999).

B-6.1.19. The exterior surface of the panels should be protected with brick veneer, stucco or siding in accordance with NBC of Canada 1995 (9.20, 9.27, 9.28); BOCA (NBC – 1999), SBCCI (SBC –1999).

Application range of Armopanel system in low and average seismic zones is outlined in the Table B-6.1.

Table B-6.1

Code, Standard or Resource Document	Seismic Performance category (SPC); Seismic Design Category (SDC); Definition of Seismic Zones				
	Low		Moderate / Intermediate	High	
BOCA National Building Code (1999)	A	B	C	D	E
	+	+	+ (n)	-	
Standard Building Code (1997)	A	B	C	D	E
	+	+	+ (n)	-	
Uniform Building Code (1997)	0	1	2 & 3	4 & Higher	
	+	+	+ (n)	-	
NBC of Canada 1995	0	2	3 & 4	5 & 6	
	+	+	+	-	

Notes: + : Acceptable
- : Unacceptable
(n): Exclusive Intermediate Moment Frames
A or 0, B or 1, C or 2 &3, E or 4 & up Zones of seismic risk