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European Technical Assessment

ETA 23/0089 of 19/12/2023

English translation prepared by IETcc. Original version in Spanish language

General Part

Technical Assessment Body issuing the European Technical Assessment: Instituto de Ciencias de la Construcción Eduardo Torroja (IETcc)	
Trade name of the construction product	GREEN WALLS BUILDING SYSTEM
Product family to which the construction product belongs	Building kits, units, pre-fabricated elements
Manufacturer	GREEN WALLS SpA. Via Sant'Elia, sn – Zona Industriale 70033 Corato (BA), Italy https://greenwallspa.com/
Manufacturing plant(s)	Via Sant'Elia, sn – Zona Industriale 70033 Corato (BA), Italy
This European Technical Assessment contains	12 pages and 2 Annexes
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 340002-00-0204 Panels of steel wires with incorporated thermal insulation for a whole structure

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

Table of contents

Specific parts

1. Technical description of the product

GREEN WALLS BUILDING SYSTEM comprises a range of panels made of (see Figure 1):

- a 3-dimensional grid of two welded fabrics of steel wires, jointed with connectors of to the fabrics;
- thermal insulation material of expanded polystyrene, EPS, between the two welded fabrics, penetrated by the connectors.

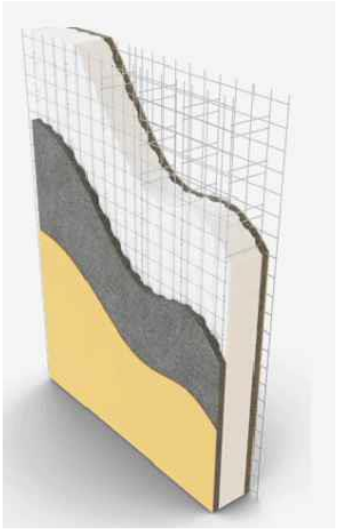


Figure 1. Panel – Factory made 3-dimensional grid of steel wires and a core of thermal insulation material of expanded polystyrene, EPS, plus concrete applied by shotcrete technique. (Example)

In case the panel geometry needs to adapt to that of a stair (see Figure 2), GREEN WALLS produces a specific panel with internal longitudinal cavities, to be completed on site with steel and concrete forming beams. Individual reinforced concrete beams may be calculated and verified in accordance with the Concrete Code. The behaviour of the panel in this arrangement has not been specifically assessed, but its factory production control has.

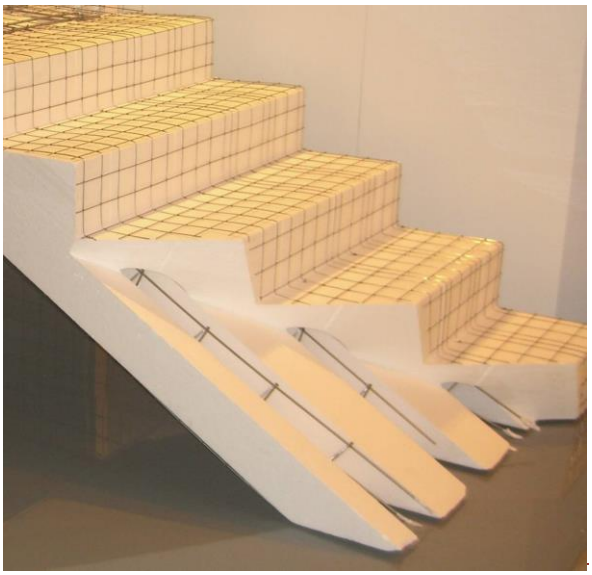


Figure 2. Stair panel – Factory made 3-dimensional grid of steel wires and a core of thermal insulation material of expanded polystyrene, EPS.

Strips and sheets of welded fabric of steel wires to be tied on the panels to reinforce joints, corners and the edges of openings (e.g. cut outs for windows, etc., see Annex A2) are also part of the System.

For a building, the walls are split up into panels taking into account all the particularities such as doors and windows, reinforcement, etc... The panels are manufactured in standardised width of 1125 or 1200 mm. The length of the panels is specific to the project.

On site, the panels are arranged next to each other, as shown in Annex A3, on a substructure flat and carefully levelled out before placing the panels. In the substructure, splice bars are installed for structural connection of the panels. Care should be taken to tightly close the joints between the cores of expanded polystyrene without remaining gap between them. In addition, the panels are aliened vertically with flush cores of expanded polystyrene. All that to ensure equal thickness of shotcrete over the whole wall and to avoid thermal bridges within the wall

Splice bars for structural connection to foundation and shotcrete provided on the construction site are not part of the kit.

The definition of the main components of the panels is specified in the following sections:

1.1 Steel mesh and connectors

The steel mesh and connectors are made of galvanised steel wires with diameter of 2.5 and 3.0 mm, according to EN ISO 16120-2:2017.

The minimum zinc coating is 45 g/m^2 for 2.5 mm diameter and 50 g/m^2 for 3.0 mm diameter wires, according to EN 10244-2:2023.

The steel mesh usually consists of 20 longitudinal welded fabric wires on each side and a steel wire every 75 mm in the secondary direction (see Annex A1 figure A1.4). The geometry of the resulting meshes is 1160 mm or 1240 wide (70 mm will protrude on each side of the panel, on opposite sides, for the connection of adjacent panels), respectively for 1125 and 1200 mm panels, with variable length according to the required panel length.

These meshes are joined together through galvanized steel connectors Ø3.0 mm every 150 mm.

1.2 Expanded polystyrene (EPS) in the core of the panel

Thermal insulation material of expanded polystyrene, EPS, thickness between 50 and 400 mm, remains between the two welded fabrics joined by the connectors.

This product must be CE marked according to EN 13163:2012+A1:2015.

Performances required for the material: see Tables 1 to 5.

1.3 Joining and reinforcing meshes

Connections, corners of windows and doors, etc. are reinforced with strips and sheets of welded fabric that are part of the kit.

All strips and sheets of welded fabric are tied to the panels with tie wire at a minimum of one tie wire every 25 cm.

1.3.1 Angular mesh

All the building corners, either vertical or horizontal, (see Annex A1 figures A1.2 and A1.3) are reinforced by means of the angular meshes. These may be RG1 (187.5 + 187.5 mm wide) or RG1A (262.5 + 262.5 mm wide) by 1.16 m or 1.20 length. They are manufactured with the same material as the meshes of the panels: galvanized steel Ø2.5 mm each 7.5 cm. (see Annex A2 figure A2.1).

1.3.2 Flat meshes

To ensure continuity on the sides of the panel without overlapping and to reinforce the corners of openings in the walls, flat meshes sheet at 45º are used. The window and door lintels, according to their length and the window parapets, whose span is longer than 1.2 m shall be additionally reinforced from both sides.

These flat sheets are made of the same steel as the mesh of the panels. The width is 225 mm and the length depends on the type of panel that they reinforce. See Figure A2.2 in Annex A2.

1.3.3 U-shaped meshes

This type of mesh is used along the edges of the walls, see Figure A2.3 in Annex A2. Sometimes it is used along the reveals of the door and window openings. As an alternative, double angular meshes shall be placed

1.4 Additional reinforcing steel

Additional reinforcing steel is tied to the welded fabric to enhance the structural performance of the structure.

These shall be installed according to the design. The detailing of the reinforcement shall be observed. This applies in particular to reinforcement of lintels, parapets, and ring anchors at the floor level, see examples in Figures A1.2 and A1.3.

The joint with the foundation is made by means of reinforcing steel bars, 6 mm minimum diameter, see example in Figures A3.1. This basic installation frame and the rest of the necessary anchors will be defined by calculation and installed according to the manufacturer's instructions.

These elements are not part of the kit.

1.5 Shotcrete

Shotcrete is provided on the construction site. The shotcrete conforms to EN 14487-1 and it is applied according to EN 14487-2. The shotcrete is not part of the kit.

Load bearing walls are completed by applying shotcrete on both sides of the panels with a thickness of at least 3.5 cm. Appropriate concrete cover shall be ensured. The structure thus obtained is a reinforced concrete member with a core of expanded polystyrene, EPS.

The shotcrete is according to the design of the structure and appropriate for the exposure class the structure is subject. The following specifications are met:

- Concrete strength class at least C25/30.
- Exposure class at least XC1.
- Maximum aggregate size should be 6 mm.

1.6 Design considerations

The walls are assembled on site and completed by floors, roof, and connecting reinforced concrete ring beams. Hence, the design of the structure is an arrangement of walls jointed together and joined with slab elements at each floor. Within the structure out-of-plane slenderness ratio together with proper connections between walls and floors allows to prevent out-of-plane failure modes. Therefore, the global seismic response is governed by the in-plane behaviour of walls.

Each floor has such stiffness to considered them as rigid, i.e. its horizontal displacements, when it is modelled with its actual in-plane flexibility, do not significantly differ from horizontal displacement resulting from a rigid diaphragm assumption.

The structures constructed with the product are thin-walled reinforced concrete sandwiches. These can mainly transfer, compression and shear forces in the plane of elements. Actions perpendicular to the reinforced concrete sandwich are only possible to a minor extent.

Structures are regular in plan and elevation following the recommendation given in Eurocode 8.

The effect of the seismic actions on the structure should be assessed by means of linear spectral dynamic analysis, nonlinear pushover analysis or nonlinear dynamic analysis. In the last two cases the modelling technique should be experimentally validated.

Shear failure and sliding shear failure are avoided as it leads to an important loss of strength and stiffness. Each element and section is verified for the relevant actions including seismic actions. This kind of structures can be analysed with linear and nonlinear finite element models (FEM). If a linear model is employed, the modulus of elasticity should be reduced to account for the cracking of sections, e.g. around 8 000 MPa for a C25/30 shotcrete.

The drifts at the damage limit state should be limited to 0.2 %.

2. Specification of the intended use in accordance with the applicable European Assessment Document (hereinafter EAD).

2.1 Intended use(s)

The intended use of the "Panels of steel wires with incorporated thermal insulation for a whole structure" is the construction of structures, typically for buildings, including internal and external walls, which may be above or below ground, roofs and their joints. The structure is completed on site with reinforcing steel, if required, and with shotcrete. Reinforcing steel and shotcrete have both a structural function within the structure but are not part of the kit.

The structure constructed with the panels is subjected to only static, quasi-static, and seismic actions. The kit is intended to be used as a structural part of dissipative structures in seismic areas.

Structures subject to fire regulation are included.

2.2 Relevant general conditions for the use of the kit

The provisions made in this European Technical Assessment are based on an assumed working life of 50 years from installation in the works, according to EAD 340002-00-0204, provided that the conditions lay down for the installation, packaging, transport and storage as well as appropriate use, maintenance and repair are met. In this respect, the design phase of the structural solution is key, having as a special condition the absence of interstitial condensation in the core of panels.

The indications given on the working life cannot be interpreted as a guarantee given neither by the product manufacturer nor by EOTA nor by the Technical Assessment Body issuing this ETA, but are regarded only as a means for choosing the right product in relation to the expected economically reasonable working life of the works.

Installation should be carried out according to the ETA holder’s specifications and using the specific application instructions of the product manufactured by the ETA holder or by suppliers recognized by the ETA holder. Installation should be carried out by appropriately qualified staff and under the supervision of the technical responsible of the site.

3. Performance of product and references to the methods used for its assessment

3.1. Essential characteristics of the product

The identification tests and the assessment for the intended use of “Panels of steel wires with incorporated thermal insulation for a whole structure GREEN WALLS BUILDING SYSTEM” according to the Basic Work Requirements (BWR) were carried out in compliance with the EAD 340002-00-0204. The characteristics of each system shall correspond to the respective values laid down in Tables 1, 2, 3, 4 and 5 of this ETA, checked by IETcc.

Methods of verification and of assessing and judging are listed afterwards.

3.1.1 *Mechanical resistance and stability (BWR 1)*

Table 1: Results for GREEN WALLS BUILDING SYSTEM **BWR 1**				
Basic requirement for construction works 1: Mechanical resistance and stability				
Essential characteristic		**Relevant clause in EAD**	**Performance**	
PANELS	Shape of panels	2.2.1	See Annex A1	
	Dimensions of panels	2.2.2	See Annex A1	
	Resistance to flexure	2.2.3	See Annex B4	
	Resistance to shear	2.2.4	See Annex B1	
	Resistance to compression	2.2.5	See Annex B1	
	Resistance to concentrated loads	2.2.6	Pass, acc. to EAD	
	Long term loading	2.2.7	NPA	
	Resistance to seismic actions	2.2.8	See Annex B	
	Resistance to corrosion	2.2.9	Pass, acc. to EAD	
WIRES	Mechanical characteristics of welded fabric and connectors: - yield strength (MPa) - tensile strength (MPa) - elongation at maximum load	2.2.18 2.2.25	Ø2.5 ≥ 650 ≥ 700 > 2.5 %	Ø3.0 ≥ 650 ≥ 700 > 2.5 %
	Weld shear force of welded fabric and connectors (N)	2.2.19 2.2.26	≥ 853	≥ 1 370
	Bending of welded fabric	2.2.20	NPA	
	Dimensions of welded fabric and connectors: - Nominal diameters - Dimension of welded fabric	2.2.21 2.2.27	Ø2.5; Ø3.0 mm 1200 mm x L (acc. to project)	
	Mass of welded fabric and connectors (kg/m, ± 6 %)	2.2.21 2.2.27	0.0358	0.0555
	Resistance to corrosion of welded fabric and connectors	2.2.22 2.2.28	Zinc coating Class D	
EPS	Dimensional stability of EPS	2.2.32	NPA	
	Compressive creep of EPS	2.2.33	NPA	
	Compressive stress at 10 % deformation of EPS	2.2.34	CS(10)80 (for 15 kg/m^3) CS(10)150 (for 25 kg/m^3)	
	Shear behaviour of EPS	2.2.35	NPA	

3.1.2 *Safety in case of fire (BWR 2)*

Table 2: Results for GREEN WALLS BUILDING SYSTEM **BWR 2**			
Basic requirement for construction works 2: Safety in case of fire			
Essential characteristic		**Relevant clause in EAD**	**Performance**
PANELS	Reaction to fire of panels	2.2.10	NPA
	Resistance to fire of panels	2.2.11	REI90 / RE120 (wall)* NPA (floor panels)
WIRES	Reaction to fire of welded fabric and connectors	2.2.23 2.2.29	Class A1
EPS	Reaction to fire of EPS	2.2.36	Class E

** Steel wires Ø2.5 mm every 70 mm in both longitudinal and secondary direction. Panel thickness (mm): 40 (shotcrete average) + 80 (EPS) + 40 (shotcrete average). Distributed vertical load of 212 kN. Panel installed with reinforcement bars, according to calculation, for the fire resistance test.*

3.1.3 Hygiene, health and environment (BWR 3)

Table 3: Results for GREEN WALLS BUILDING SYSTEM **BWR 3**		
Basic requirement for construction works 3: Hygiene, health, and the environment		
Essential characteristic	**Relevant clause in EAD**	**Performance**
Vapour permeability	2.2.12	Acc. to panel configuration. $\mu_{concrete}$= 120 ~ 130
Water vapour transmission of EPS	2.2.37	NPA

3.1.4 *Safety and accessibility in use: (BWR 4)*

Same as basic requirement 1 (except resistance to seismic actions).

3.1.5 *Protection against noise (BWR 5)*

Table 4: Results for GREEN WALLS BUILDING SYSTEM **BWR 5**		
Basic requirement for construction works 5: Protection against noise		
Essential characteristic	**Relevant clause in EAD**	**Performance**
Airborne sound insulation	2.2.13	R_w = 41 (-1; -3) dB.

3.1.6 *Energy economy and heat retention (BWR 6)*

Table 5: Results for GREEN WALLS BUILDING SYSTEM **BWR 6**			
Basic requirement for construction works 6: Energy economy and heat retention			
Essential characteristic		**Relevant clause in EAD**	**Performance**
PANELS	Thermal resistance	2.2.14	Acc. to panel configuration. $\lambda_{concrete}$= 2.3 W/(m·K)
	Thermal inertia	2.2.15	Acc. to panel configuration. $\rho_{concrete}$= 2 300 kg/m^3 $c_{p\text{- }concrete}$= 1 000 J/(kg·K)
	Air tightness	2.2.16	Satisfactory impermeable to air panels

Table 5: Results for GREEN WALLS BUILDING SYSTEM **BWR 6**				
Basic requirement for construction works 6: Energy economy and heat retention				
Essential characteristic		**Relevant clause in EAD**	**Performance**	
WIRES	Thermal conductivity of connectors	2.2.30	λ= 50 W/(m·K)	
	Thermal inertia of connectors	2.2.31	ρ= 7 800 kg/m^3 cp= 450 J/(kg·K)	
EPS	Apparent density of EPS	2.2.38	15 kg/m^3	25 kg/m^3
	Bending strength of EPS	2.2.39	BS 120	BS 250
	Shape of EPS	2.2.40	See Annex A1, Fig A1.4	
	Dimensions of EPS	2.2.41	Raw material: T(1)-L(2)-W(2)-P(10). Panel: see Annex A1, Fig A1.4; tolerance ± 2 mm	
	Squareness of EPS	2.2.42	Raw material: S(2) Panel: see Annex A1, Fig A1.4; tolerance ± 1 mm/m	
	Thermal conductivity of EPS	2.2.43	λ= 0.038 W/m·K	λ= 0.033 W/m·K

3.2. Methods of verification

The assessment for the intended use was carried out according to the Basic Work Requirements (BWR). The characteristics of the components shall correspond to the respective values laid down in Tables 1, 2, 3, 4 and 5 of this ETA, checked by IETcc.

Panels of steel wires with incorporated thermal insulation

3.2.1 **Shape of panels:** visual inspection, by reference to workshop drawings.

3.2.2 **Dimensions of panels:** measuring, by reference to panel specification.

3.2.3 **Resistance to flexure:** testing according to EAD clause 2.2.8, procedure 3.

3.2.4 **Resistance to shear:** testing according to EAD clause 2.2.8, procedure 3.

3.2.5 **Resistance to compression:** testing according to EAD clause 2.2.8, procedures 1 and 3.

3.2.6 **Resistance to concentrated loads:** concentrated loads can be applied to the shotcrete only. Anchors are installed in the shotcrete for fixing objects. For heavy objects, the panels with shotcrete are unsuitable and solutions that are not subject of this ETA shall be implemented.

3.2.7 **Long term loading:** No Performance Assessed.

3.2.8 **Resistance to seismic actions:** testing according to EAD clause 2.2.8, procedures 1, 3, 4 and 5.

3.2.9 **Resistance to corrosion:** corrosion protection is ensured by sufficient concrete cover and by the use of zinc-coated steel (see 3.2.22). The prescriptive specifications of EN

1992-1-1 and EN 206 regarding exposure classes and concrete cover shall apply. The absence of interstitial condensation in the core of panels is a design condition for the wall.

3.2.10 **Reaction to fire:** No Performance Assessed for the whole kit. Nevertheless, the reaction to fire performance requirement of each component is provided: A1 for shotcrete; A1 for steel wires; E for EPS.

3.2.11 **Resistance to fire:** testing according to EN 1365 Part 1 (wall) and classified according to the appropriate part of EN 13501-2. No Performance Assessed for floor panels.

3.2.12 **Vapour permeability:** design values of the layers according to EN ISO 10456.

3.2.13 **Airborne sound insulation:** testing according to ISO 140-3 and classified according to the appropriate part of ISO 717-1.

3.2.14 **Thermal resistance:** design values of the layers according to EN ISO 10456.

3.2.15 **Thermal inertia:** calculation based on panel configuration and thermal properties (design values) of the layers, according to EN ISO 10456.

3.2.16 **Air tightness:** considered as satisfactory impermeable to air without being tested.

Welded fabric and connectors

3.2.17 **Mechanical characteristics:** according to the applicable part of EN 15630-2.

3.2.18 **Weld shear force:** according to the applicable part of EN 15630-2.

3.2.19 **Bending:** No Performance Assessed.

3.2.20 **Dimensions:** according to the applicable part of EN 10080.

3.2.21 **Mass:** according to the applicable part of EN 10080.

3.2.22 **Resistance to corrosion:** mass of zinc per area, according to the applicable part of EN 10244-2 (supplier declared value). The absence of interstitial condensation in the core of panels is a design condition for the wall.

3.2.23 **Reaction to fire:** steel wires are considered to satisfy the requirements for performance class A1 of the characteristic reaction to fire in accordance with the Commission Decision 96/603/EC.

3.2.24 **Thermal conductivity:** design value from EN ISO 10456.

3.2.25 **Specific heat capacity:** design value from EN ISO 10456.

Thermal insulation material (EPS)

3.2.26 **Dimensional stability:** No Performance Assessed.

3.2.27 **Compressive creep:** No Performance Assessed.

3.2.28 **Compressive stress at 10 % deformation:** according to the applicable part of EN 13163 (supplier declared value in DoP).

3.2.29 **Shear behaviour:** No Performance Assessed.

3.2.30 **Reaction to fire:** according to the applicable part of EN 13163 (supplier declared value in DoP).

3.2.31 **Water vapour transmission:** No Performance Assessed.

3.2.32 **Apparent density:** according to the applicable part of EN 13163 (type test / declared value).

3.2.33 **Bending strength:** according to the applicable part of EN 13163 (type test / declared value).

3.2.34 **Shape:** visual inspection.

3.2.35 **Dimensions:** according to the applicable part of EN 13163 (type test / declared value).

3.2.36 **Squareness:** according to the applicable part of EN 13163 (type test / declared value).

3.2.37 **Thermal conductivity:** according to the applicable part of EN 13163 (type test / declared value).

4. Assessment and verification of constancy of performance (hereinafter AVCP)

4.1 System of assessment and verification of constancy of performance

According to the decision 2003/728/EC of the European Commission[1], System 1 of assessment and verification of constancy of performance (see EC delegated regulation (EU) No 568/2014 amending Annex V to Regulation (EU) N.º 305/2011) applies.

[1] Published in the Official Journal of the European Union (OJEU) L 262 , 14/10/2003 P. 0034 - 0036.

See www.new.eur-lex.europa.eu/oj/direct-access.html

5. Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan, which is deposited at IETcc[2].

For type testing, the results of the tests performed as part of the assessment for the European Technical Assessment shall be used unless there are changes in the production line or plant. In such cases, the necessary type testing has to be agreed between IETcc and the notified body.

Issued in Madrid on 2023 December 19

By

Ángel Castillo Talavera

Director

on behalf of Instituto de Ciencias de la Construcción Eduardo Torroja (IETcc – CSIC)

[2] The Control Plan is a confidential part of the ETA and only handed over to the notified certification body involved in the assessment and verification of constancy of performance.

ANNEX A. IMAGES AND DESCRIPTIVE DOCUMENTATION OF GREEN WALLS BUILDING SYSTEM

Annex A1. Images of GREEN WALLS BUILDING SYSTEM panels

Figure A1.1. General infographic of GREEN WALLS BUILDING SYSTEM

Figure A1.2. Schematic example of GREEN WALLS BUILDING SYSTEM external wall-floor joining

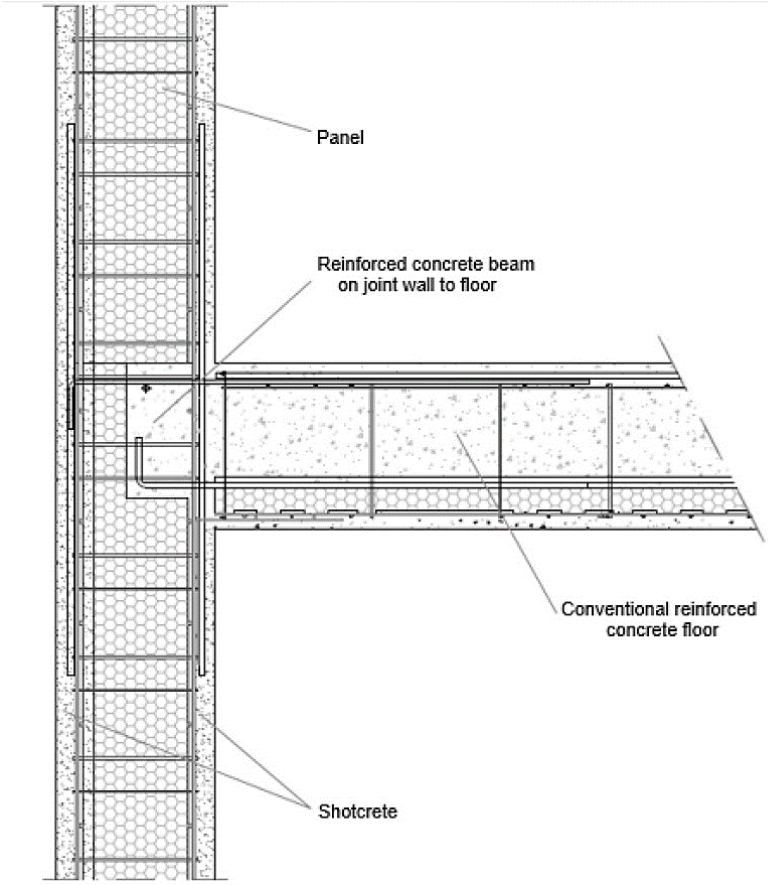


Figure A1.3. Schematic example of GREEN WALLS BUILDING SYSTEM internal wall-floor joining.

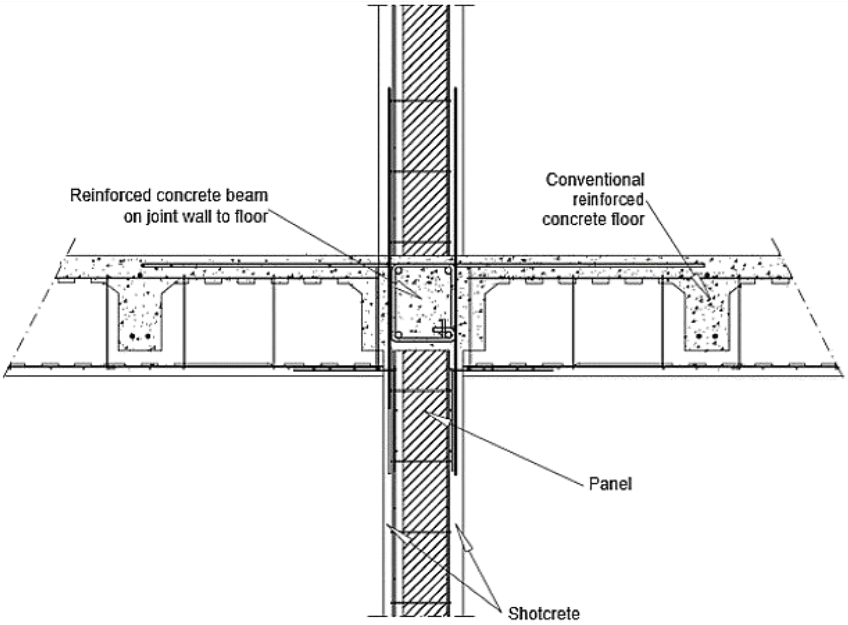
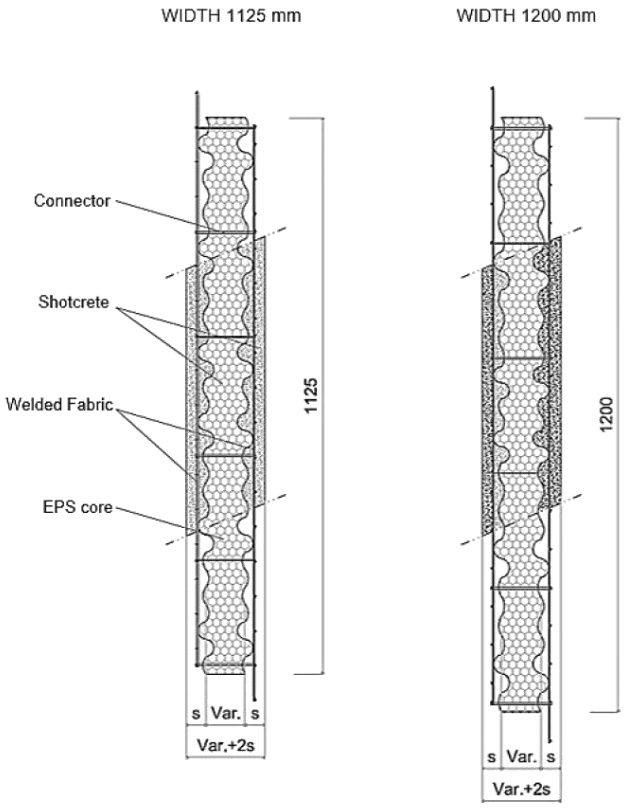


Figure A1.4. Cross section of the installed panel, dimensions in mm.



Annex A2. Images and descriptive documentation of joining and reinforcing meshes

Figure A2.1. Detail of wall joining by means of angular and reinforcing meshes (horizontal section).

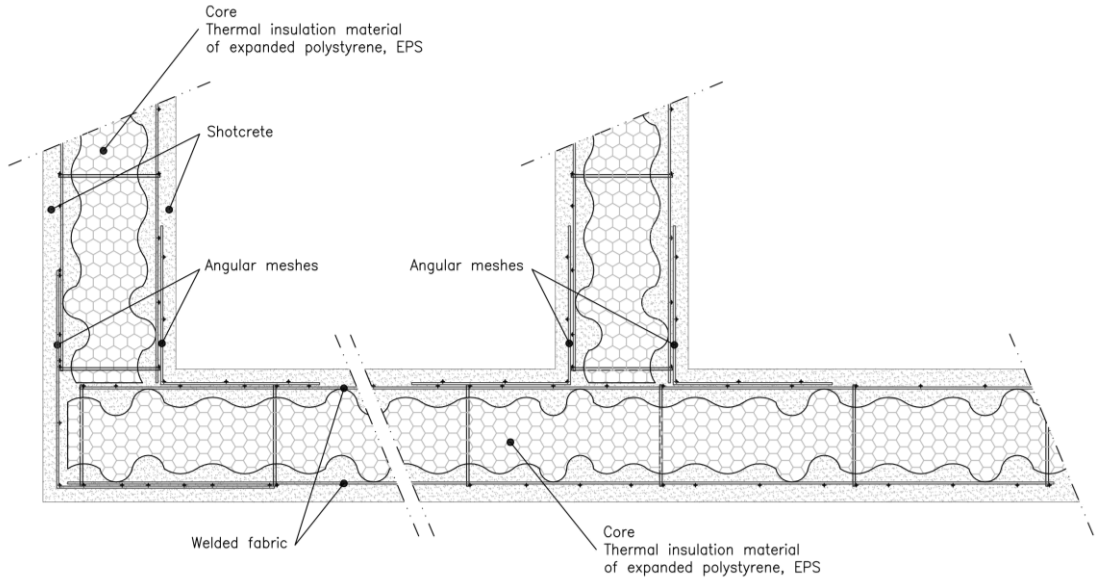


Figure A2.2. Use of flat reinforcing meshes (vertical and horizontal sections). Example.

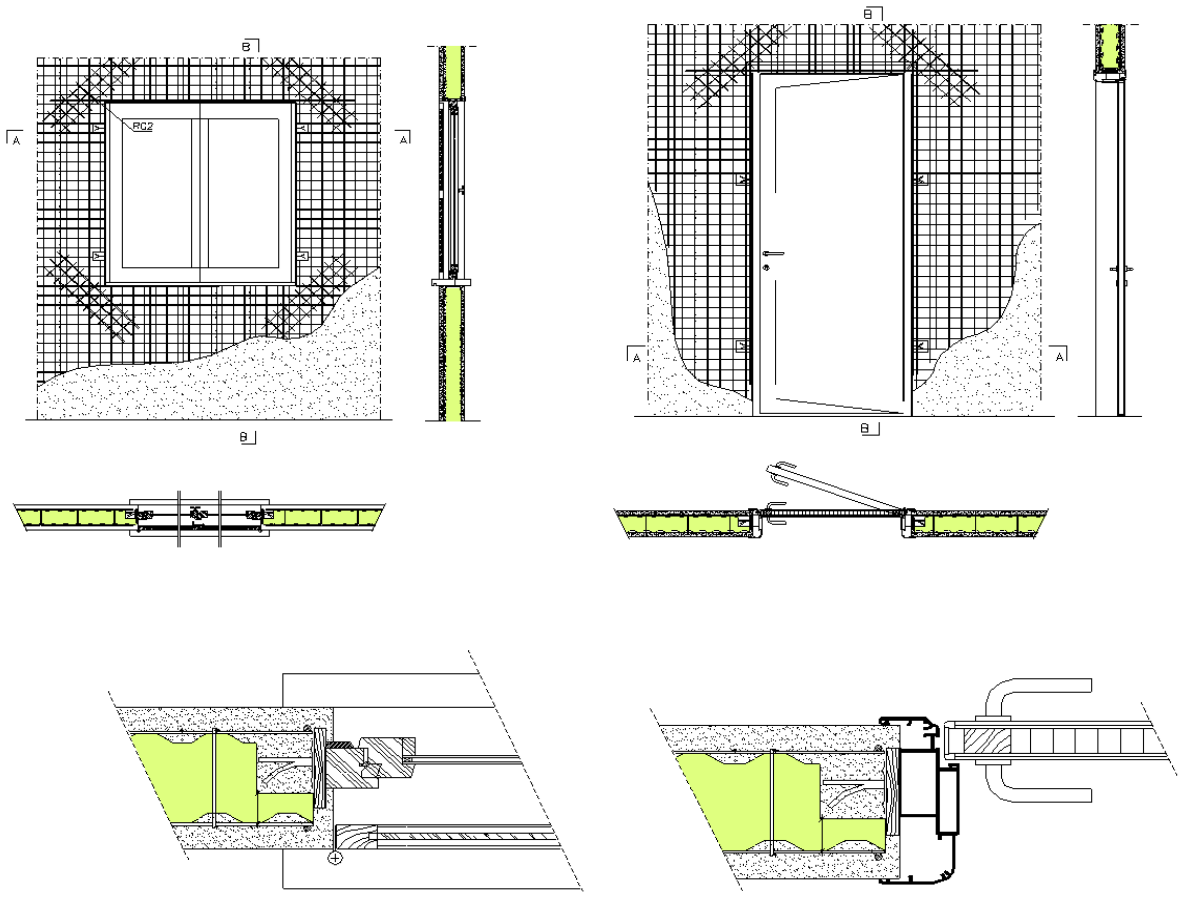
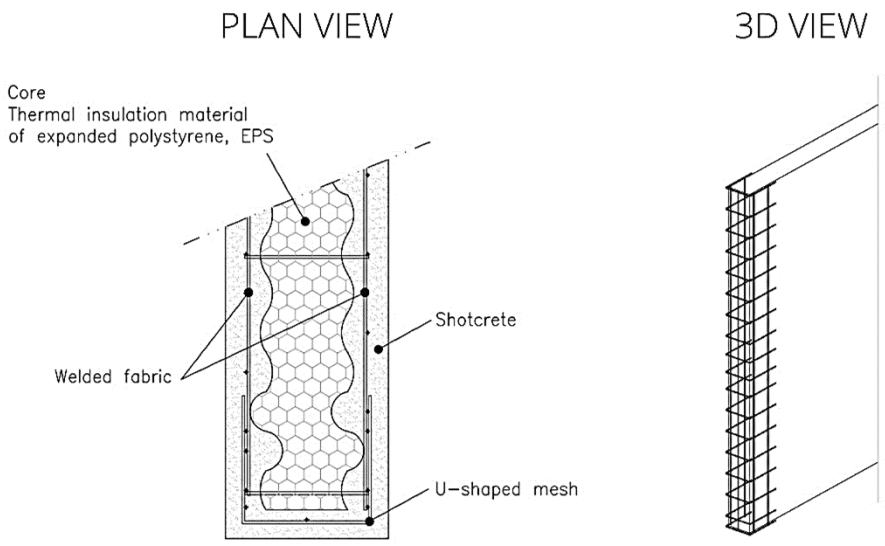


Figure A2.3. Use of *U-shaped* meshes. Example.



Annex A3. Installation

Figure A3.1. Joint wall to sub-structure – vertical section – example

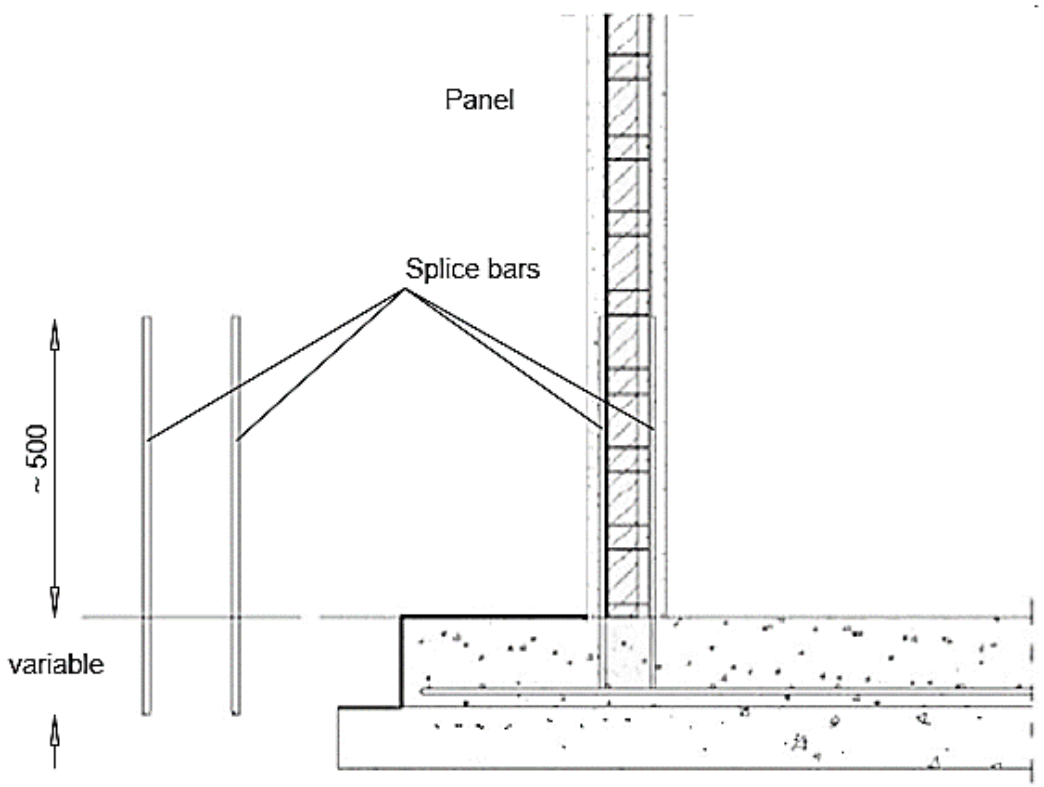


Figure A3.2. Tying panels with corrugated steel installation/foundation by means of wire. Example.

Figure A3. 3. Tying continuous panels with staplers / clamps. Example.

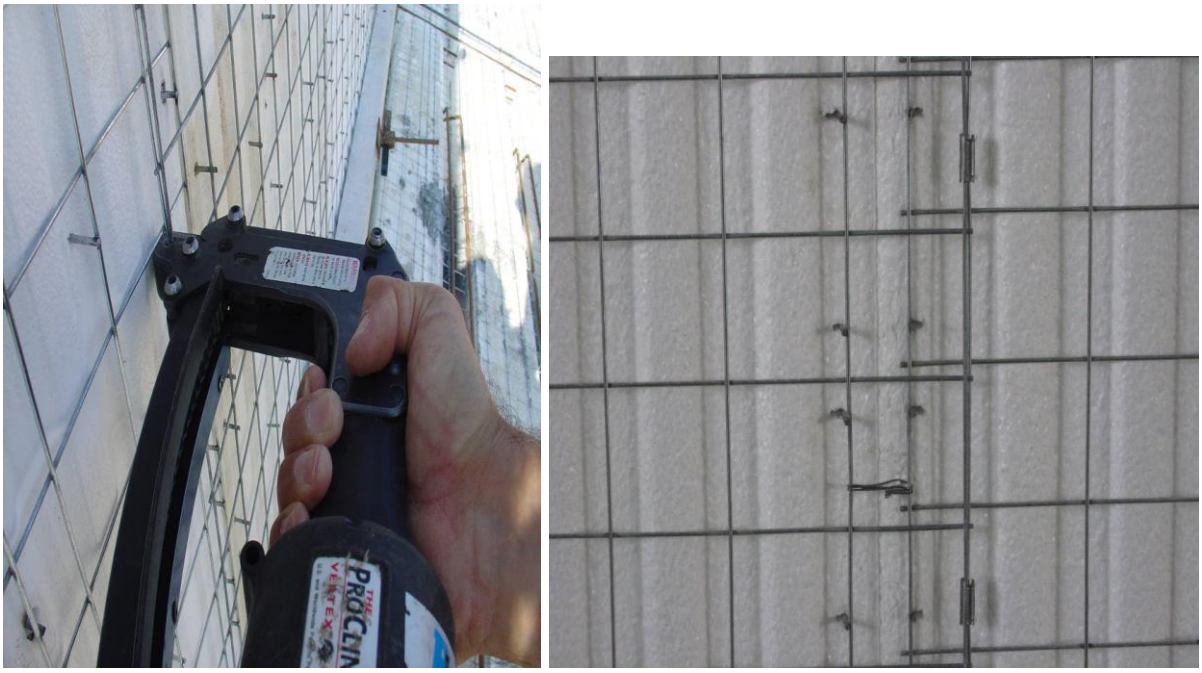
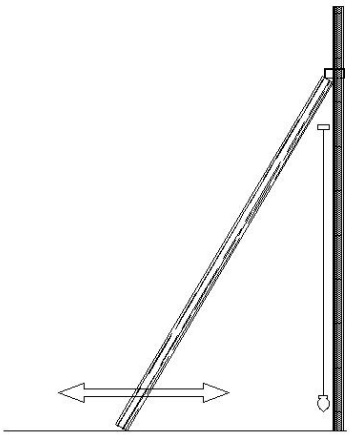
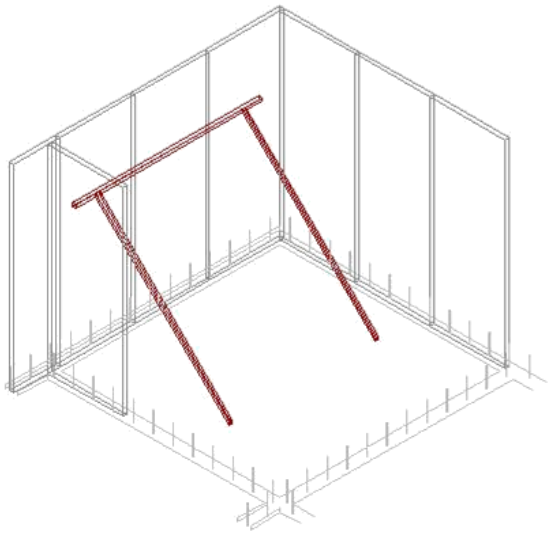
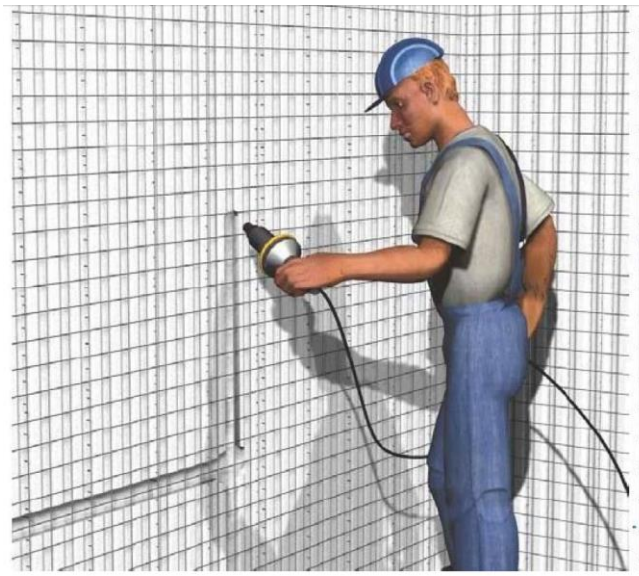


Figure A3.4. Plumbing and bracing of panels during construction – Example



PLUMBING AND FIXING





Annex B. Resistance to seismic actions

B1. Verification method according to Clause 2.2.8, Procedure 1 in EAD

Quasi-static monotonic tests performed on small sized specimens for the assessment of resistance to centred compression, eccentric axial compression, diagonal compression and laminar shear.

Table B1.1 Performance of small panels: ***Centred compression***					
Specimens definition	Dimensions [m]	1.13 x 1.13	0.60 x 1.13	1.13 x 1.13	0.60 x 1.13
	Thickness [mm]	35 + 80 + 35	35 + 140 + 35	35 + 80 + 35	35 + 80 + 35
	Polystyrene density [kg/m^3]	15	15	25	25
Initial in-plane stiffness, K_{iNe} (kN/m)		134 224	44 294	184 722	76 159
Ultimate load, N_{iu} (kN)		186.31	95.71	181.07	118.55

Table B1.2 Other performances of small panels			
Specimens dimensions: 1.13 x 1.13 m, thickness 35 + 80 + 35 mm	***Eccentric axial compression***	***Diagonal compression***	***Laminar shear***
Initial in-plane stiffness (kN/m)	---	---	K_{iDe} = 4 730
Ultimate load (kN)	N_{iu} = 85.77	T_{iu}= 299	10.6

B2 Verification method according to Clause 2.2.8, Procedure 3 in EAD

Type of wall specimens:

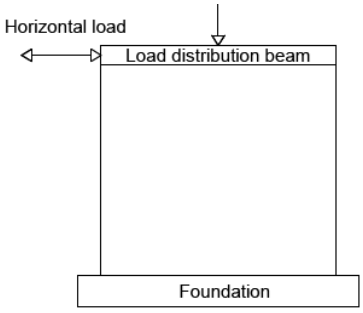


Figure B2.1. **Type 1:** dimensions 300 x 300 x 15 cm (aspect ratio 1:1), without opening

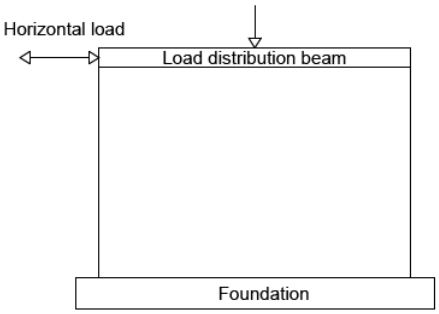


Figure B2.2. **Type 2:** dimensions 400 x 300 x 15 cm (aspect ratio 4:3), without opening

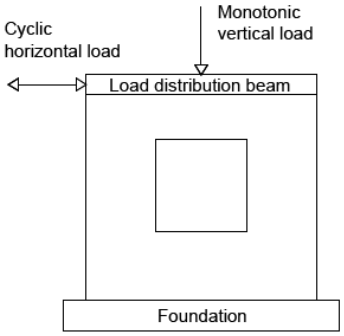


Figure B2.3. **Type 3:** dimensions 300 x 300 x 15 cm (aspect ratio 1:1), window opening (1.0 x 1.0 m) in the centre of the panel.

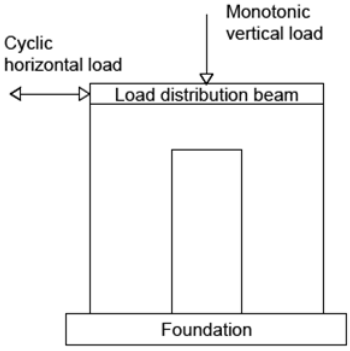


Figure B2.4. **Type 4:** dimensions 300 x 300 x 15 cm (aspect ratio 1:1), door opening (0.85 x 2 m) in the centre of the panel**.**

Common aspects to all specimens:

- Thermal insulation material: 80 mm thickness; 15 kg/m^3 density.
- Wire disposition in meshes, as indicated in section 1.1 of the ETA.
- Connectors: meshes are joined together through galvanized steel Ø3.0 mm every 150 mm.
- Average compressive strength of shotcrete: 25 MPa
- Average thickness of shotcrete in each side: 35 mm
- Total panel thickness: 150 mm

Table B2.1 Performance of full-scale wall panels in cyclic shear tests

Type / id of specimens	***1(a)***	***1(b)***	***2(a)***	***2(b)***	***3(a)***	***3(b)***	***4(a)***	***4(b)***
Total vertical load on panel (kN)	100	300	100	300	100	300	100	300
Initial stiffness, K_{iVe} (kN/mm)	57.5	64.7	85.5	89.9	41.8	49.1	34.9	38.5
Maximum shear force, V_{iu} (kN)	209	257	287	396	161	199	149	161
Shear force of plastic branch, V_{ie} (kN)	147	156	187	279	103	144	109	119
Displacement at begin of plastic branch, d_{ie} (mm)	3.64	3.98	3.35	4.41	3.86	4.05	4.27	4.18
Ductility, $d_{ie,end}$/ $d_{ie,ini}$	3.3	3.4	2.8	3.3	6.4	6.6	5.9	3.8
Equivalent damping ξ_{eq} [%]	7.8	9.0	7.3	7.9	7.3	7.1	6.7	6.1

B3 Verification method according to Clause 2.2.8, Procedure 4 in EAD.

Type of wall specimens:

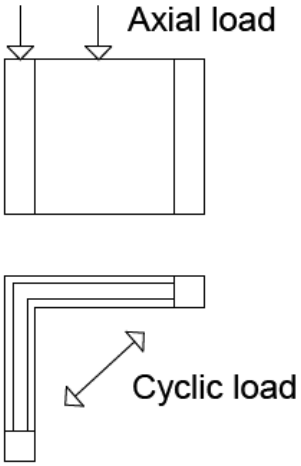


Figure B3.1. Type L

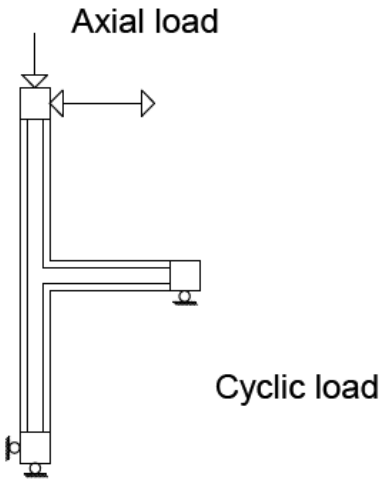


Figure B3.2. Type T

- GREEN WALLS panels: thermal insulation material 80 mm thickness.

- Lateral panel: thermal insulation material 80 mm thickness.
- Horizontal panel: thermal insulation material 120 mm thickness.

- Wire disposition in meshes, as indicated in section 1.1 of the ETA: 20 longitudinal welded fabric wires Ø2.5 mm on each side.
- Connectors: meshes are joined together through galvanized steel Ø3.0 mm every 150 mm.
- Reinforcing angular meshes as described in section 1.3.1 of the ETA, in the corners.
- Average compressive strength of shotcrete: 25 MPa
- Average thickness of shotcrete in each side: 35 mm

Table B3.1 Performance of panels connections in cyclic tests

Type / id of specimens	***L***	***T***
Initial stiffness, K_{ime} (m·kN/rad)	396	717
Bending moment at cracking (1st deviation of pure linear response), M_{icr} (m·kN)	1.95	2.76
Bending moment (yielding of longitudinal steel), M_{ie} (m·kN)	2.6	4.23
Bending moment at maximum resistance of the panel, M_{iu} (m·kN)	3.77	5.66
Rotation at cracking, θ_{cr} (rad)	0.005	0.004
Rotation at yielding, θ_e (rad)	0.010	0.011
Rotation at collapse, θ_u (rad)	0.129	0.066

B4 Verification method according to Clause 2.2.8, Procedure 5 in EAD.

The following floor panels have been tested for the assessment of bending resistance.

Table B4.1. Specimen properties and dimensions for bending test

#Specimen	Horizontal panel dimensions	Polystyrene thickness	Polystyrene density
F1	2.25 m x 4 m	8 cm	15 kg/m^3
F2	2.25 m x 4 m	8 cm	15 kg/m^3
F3	2.25 m x 4 m	8 cm	25 kg/m^3
F4	2.25 m x 4 m	8 cm	25 kg/m^3
F5	2.25 m x 5 m	16 cm	15 kg/m^3
F6	2.25 m x 5 m	16 cm	15 kg/m^3
F7	2.25 m x 5 m	16 cm	25 kg/m^3
F8	2.25 m x 5 m	16 cm	25 kg/m^3

Test layout:
- Horizontal panels on two horizontal supports.
- 2 linear loads in the thirds of the span.
- Cyclical loads of increasing amplitudes in displacement control.

Table B4.2. Results for bending test

#Specimen	Displ. at cracking δ_{cr} [mm]	Force at cracking F_{cr} [kN]	Initial Stiffness K_{ini} [kN/m]	Displ. at yielding δ_y [mm]	Force at yielding F_y [kN]	Cracked Stiffness K_{cr} [kN/m]	Ultimate displacement δ_u [mm]	Maximum force F_u [kN]
F1	3.13	7.47	2387	38.40	33.38	869	41.38	34.59
F2	4.89	7.71	1577	40.00	32.95	824	56.91	35.03
F3	4.57	12.75	2790	37.14	46.62	1255	51.32	54.6
F4	5.72	15.94	2787	41.32	49.33	1194	74.64	56.92
F5	4.96	13.04	2629	50.09	49.26	983	81.06	46.74
F6	4.99	11.82	2369	44.65	47.07	1054	70.97	57.46
F7	4.21	12.30	2921	52.65	54.16	1029	88.57	61.16
F8	2.41	11.21	4651	44.41	49.98	1025	79.26	60.28