Unit 1: Foundations

Main objectives of the unit

Every building built using Emmedue panels **starts from the foundations**. This unit provides information on the types of foundations and how to build them, also based on which Emmedue panels are used.

Contents of the unit

1. General information
2. Types of foundation:
   a) Strip foundation
   b) Raft foundation

1. General information

Foundation size and reinforcement are based on the results of structural analyses, which take into consideration the type of building, the **loads and the geological characteristics of the ground**. Generally, **the evenness of the extrados** of the foundation is crucial for correct panel positioning.

2. Types of foundations

Normally the most common solutions used in panel construction are **strip foundations (Fig. 1) and raft foundations (Fig. 2)**.

Fig. 1

Fig. 2

a) Strip foundations: main characteristics

The main characteristics of strip foundations **(Fig. 3, 4)** are:

- Reduced digging volumes
- Less use of materials (steel and concrete)
- The possibility of differentiating the depth/width of elements

This type of solution is used with:

- Ground featuring good lift
- The need to investigate the load transfer value
- Raised structures, with walls

On the other hand, it requires:

- Digging with obligatory section
- Filling following core casting
- Setting up holes for systems/draining ducts

Fig. 3

Fig. 4

These are the main construction phases

PHASE 1. Wide section digging (topsoil)

PHASE 2. Digging with obligatory section

PHASE 3. Lean concrete formation

PHASE 4. Reinforcement implementation and concrete casting on the foundation base

PHASE 5. Reinforcement implementation, formwork, concrete casting and removal of vertical beams (hole arrangement)

b) Raft foundation: main characteristics

The main characteristics of raft foundations **(Fig. 5, 6)** are:

- Only wide section digging
- The possibility of using mesh as reinforcement
- Fast execution

This type of solution is used with:

- Ground featuring good lift
- No need to investigate the load transfer value
- Raised structures, with walls

On the other hand, it requires:

- Greater amounts of materials

Fig. 5

Fig. 6

These are the main construction phases

PHASE 1. Wide section digging

PHASE 2. Lean concrete formation

PHASE 3. Reinforcement and drain ducts implementation

PHASE 4. Formwork

PHASE 5. Concrete casting and prop removal

PHASE 6. Any side filling

Unit 2: Anchoring
Main objectives of the unit

Optimise the implementation of the **structure panel connections** in order to ensure that the panels are kept well aligned and vertical, as well as securely fastened to the foundations.
This unit explains how to build anchors properly.

Contents of the unit

1. Introduction
2. Main operational phases

1. Introduction

The panels are anchored to the foundation by means of **anchoring bars** (or rebars) that **must be placed before the concrete casting (Fig. 1).**

Fig. 1

2. Main operational phases

Phase 1: Identify the anchoring bars features

Identify the anchoring bars **according to the design**.

Anchoring bars main features:

- **filleted U type** to better enable the panel insertion
- **diameter** from structural calculations
- **height** from structural calculations
- **intervals** from structural calculations
- **width** (external-external) equal to concrete wall width minus 5 cm (2 in)

Phase 2: Verify the anchoring bars distance

Properly calculate the external distance of the bars to ensure compliance with the design dimensions **(Fig. 2).**

Fig. 2

- **The width measured externally** must not be greater than the concrete wall width minus 5 cm (2 in).

Phase 3: Aligning

When aligning the anchoring bars ensure a **tolerance of max +/- 1cm**. Any errors of alignment could cause difficulty in placing the panels.

Fig. 3

Phase 4: Concrete casting in the foundation

Phase 5: Adjusting tables positioning

Place the adjusting tables at the base of the panels, firmly secured to the ground **(Fig. 4)**.

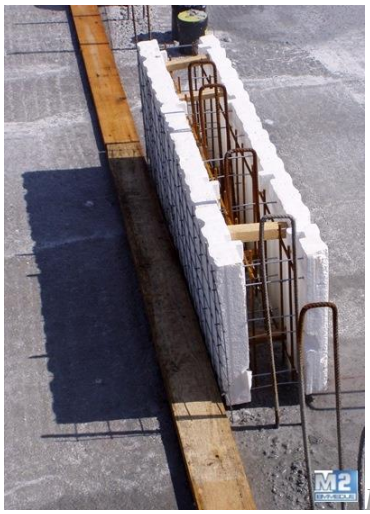


Fig. 4

- **The adjusting tables ensure the alignment**, they are useful to block the panels and position any reinforcing elements.

Phase 6: Screed boards positioning

Set out an outer line and **position screed boards (Fig. 5)** to ensure proper alignment.

Fig. 5

Unit 3: Panel cut

Main objectives of the unit

This unit explains **how to cut the panels and minimise material waste**.

Contents of the unit

1. Panel cut: main steps
2. Building a corner
3. Building an intersection
4. Final recommendations

1. Panel cut: main steps

a) Identify the equipment

Before cutting the panels **be sure to have the following equipment**:

Marking wire

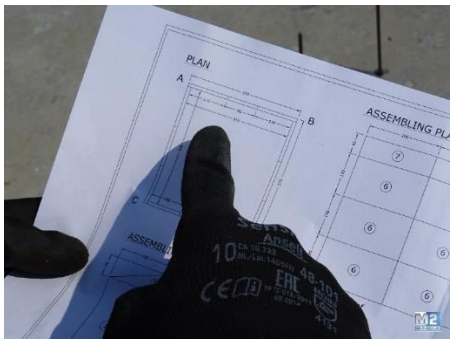
Cutting nipper

Tape measure

Hand saw

Trimmer

b) Study of layout



During cutting, follow the instructions provided **by the assembling plan** (supplied with the panels) that states **(Fig. 1, 2)**:

- **the alignments of the structure**
- **the layout, in the plans, of the floor panels**
- **instructions on cutting** to create non-standard elements

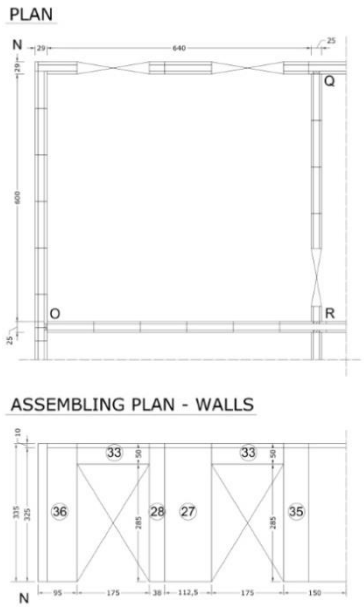


Fig. 1

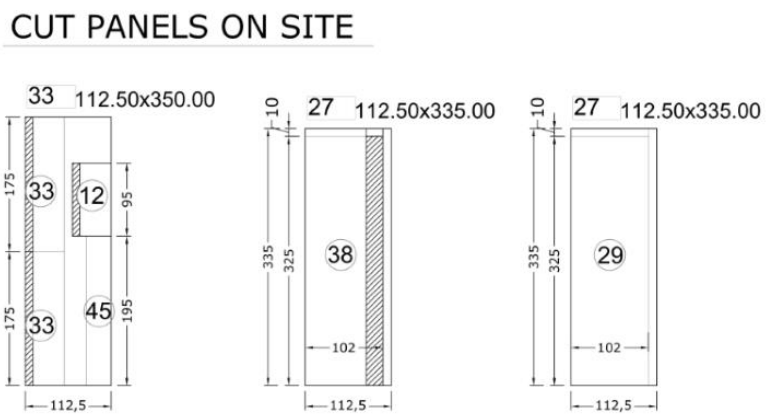


Fig. 2

c) Panel marking

- During marking follow the instructions provided **by the assembling plan.**

d) Panel cut with trimmer (Fig. 3), as a substitute use you can use cutting nipper and hand saw. The use of a trimmer considerably speeds up the cutting operation.

Fig. 3

2. Building a corner

Phase 1

- **L junction** highlighted the plate of the PDM double panels to be cut **(Fig. 4)**

Phase 2

- **Cut** the internal plate (including the internal mesh)
- **Cut width = wall width + plate thickness (Fig. 5)**

Phase 3

- **Assemble** the panels and join them by means of angular meshes **(Fig. 6)**

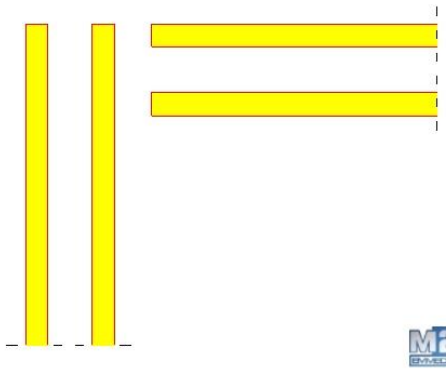


Fig. 4

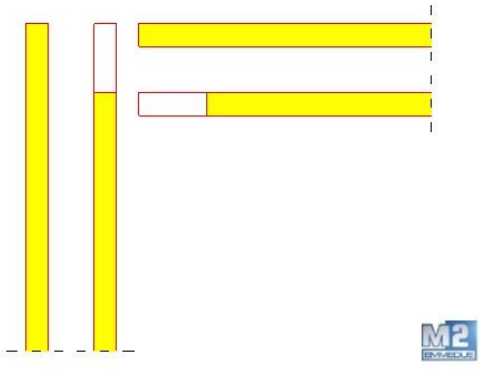


Fig. 5

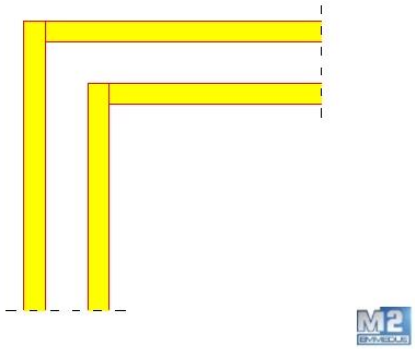


Fig. 6

3. Building an intersection

Phase 1

- **T junction** highlighted the plate of the PDM double panels to be cut **(Fig. 7)**

Phase 2

- **Cut** the polystyrene plates
- **Cut width = width of orthogonal wall (Fig. 8)**

Phase 3

- **Assemble** the panels and join them by means of angular meshes **(Fig. 9)**

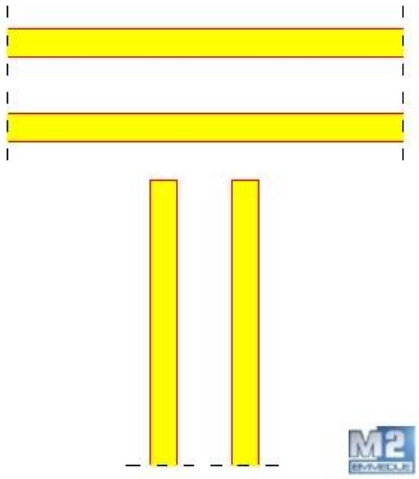


Fig. 7

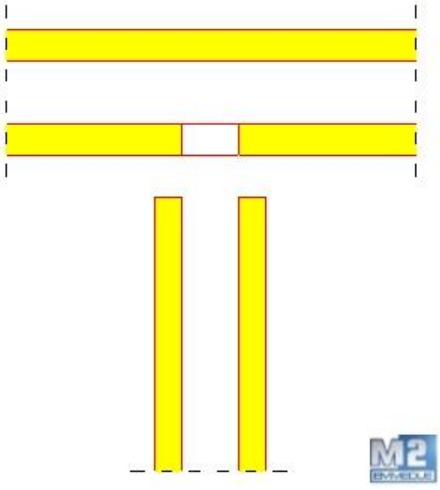


Fig. 8

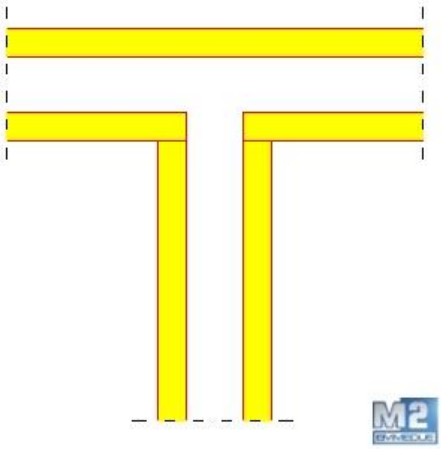


Fig. 9

4. Final recommendations

- **Any openings that are not included in the layout** can easily be implemented by cutting the panels when assembly is complete
- **N.B.** It will be necessary to check feasibility and implications for any changes to openings or the need to implement other ones

Unit 4: Panel assembly

Main objectives of the unit

This unit explains how to put up the panels that will form the walls. The double panel consists of two shaped EPS slabs, which can have a variable thickness.

Contents of the unit

1. Panel storage
2. Element identification
3. Setting out
4. Panel assembly: main phases
5. Tips

1. Panel storage

The construction site must include an area for storage **(Fig. 1)**.

Instructions for storage:

- **Place the panels on a flat surface** which is not pliable, so they can be vertically stacked.
- **Do not place the panels directly on the ground**, to avoid them from getting soiled and subsequently preventing the plaster from adhering.
- **Tie the panels** to prevent them from being thrown by the wind.

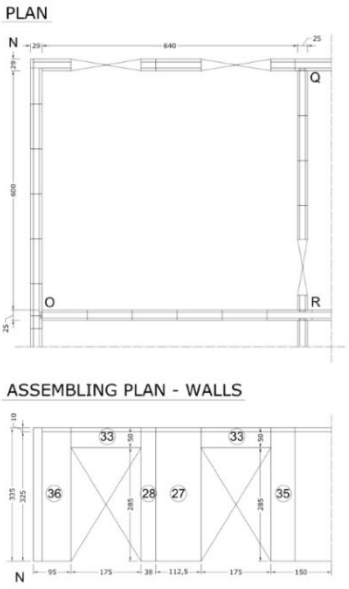
Fig. 1

Check the integrity of panels and mesh and verify that **the supplied elements** match the project design and panel layout.

2. Element identification

For correct positioning, refer to the assembling plan which indicates **(Fig. 2, 3)**:

- the various alignments of the structure
- the layout, in the plans, of the floor panels
- the instructions on cutting to create non-standard elements



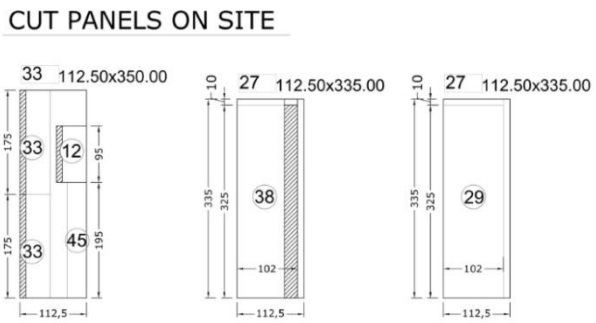


Fig. 2 *Fig. 3*

3. Setting out

Prior to assembly it is necessary to **set out at least one of the outer lines of the panel on the foundation** (we then recommend setting up screed boards) **(Fig. 4, 5)**.

Fig. 4

Fig. 5

4. Panel assembly: main phases

Phase 1: Assembly of the first corner panels

Put up the first two panels **to create a corner (Fig. 6).**

Fig. 6

Phase 2: Panel positioning

The panels must be **set in place lowering them from above**, once pulled together, so that the rebars do not get in the way of operations **(Fig. 7)**.

Fig. 7

Phase 3: Assembly the adjacent panels

Then, set up the adjacent panels according to the project **(Fig. 8).**

Fig. 8

Place scaffolds on the walls to counter the action of the wind **(Fig. 9)**

Fig. 9

Phase 4: Connect the adjacent panels

Put in additional brackets to connect the adjacent panels:

- Between consecutive panels with SPD brackets between panels or with straight bars on completed walls **(Fig. 10);**
- At intersections newly set-up **(Fig. 11).**

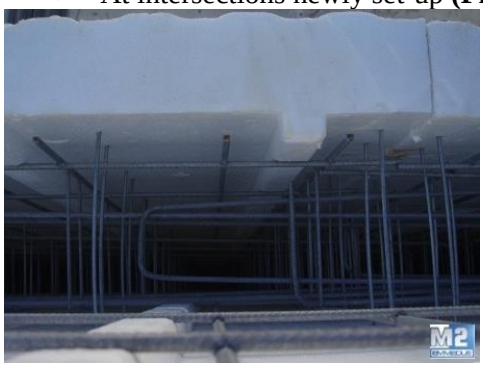


Fig. 10

Fig. 11

Phase 5: Alignment and verticality

Always check panel alignment (Fig. 12) and the **perfect fit** of the consecutive polystyrene plates **(Fig. 13)**.

Any **gap** between the joints could **cause thermal bridges**.

Always check panel verticality (Fig. 14).

Fig. 12

Fig. 13

Fig. 14

If any element is **out of plumb** this could **lead to structural weakness**.

Phase 6: Set out the additional reinforcements

Put in additional reinforcements at intersections and, if necessary, at the edges of any openings.

Horizontal connecting brackets are set up inside the corners as the element is created **(Fig. 15)**.

Fig. 15

Assembly methods

It is possible to build in two different ways:

a) Building by single rooms

The first method involves **building room by room**, starting with a corner and proceeding from both sides (being careful to maintain perpendicularity) until the room is finished.

b) Building by alignments

This method is usually **used when the walls are very long**. You start with one side, with the panels assembly of the long walls, by setting up the perpendicular walls, **proceeding to build frontwards**.
When getting to the intersection of a perpendicular wall, the first panel of that wall must be set up.
Then proceed by assembling the panels of the long wall.

Panel connection

When the panels are set up and verticality has been checked, **connect them by the overlapping mesh,** which is on both sides of the panels **(Fig. 16)**.

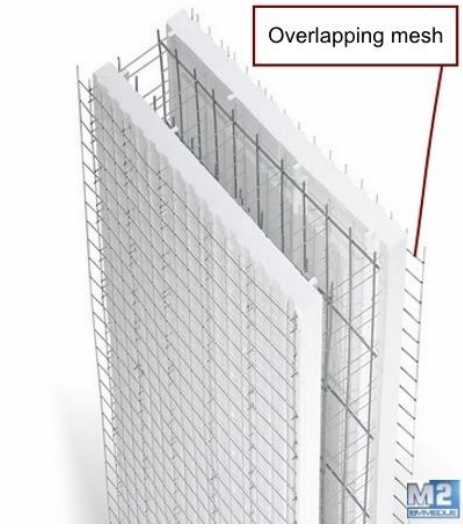


Fig. 16

The panels are connected by **joining the overlapping mesh of one panel to the next:**

- **Initially join** the panels with **binding wire;**
- Then connect **with fastenings** (use one link every four or one link approx. every 25 cm) **(Fig. 17)**.

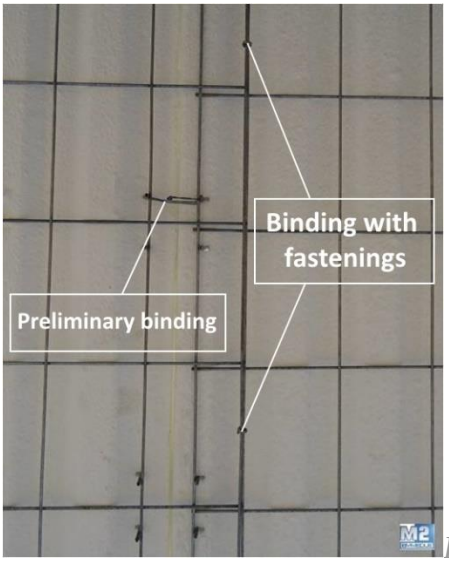


Fig. 17

To connect the panels, it is possible to use the following equipment:

Pincers and binding wire

Manual clamp pincer and staples

Pneumatic clamp pincer and staples

5. Tips

The panels are produced with appropriate steel reinforcement; if additional reinforcement is required, in accordance with the structural designs, we recommend placing it on site and fixing it at the base and at the head of the panel **The additional bars** should be placed inside the mesh in order to ensure adequate cover.

During assembly, it is important to consider the project openings, according to the layout. **Any changes to openings or the implementation of new ones must be planned by the designer** who will take the structural implications of each change into account.

Unit 5: Scaffolding

Main objectives of the unit

The distinguishing feature of PDM panels is that they are used to create a system of **permanent formwork for** – after **anchoring, alignment and vertical installation – concrete casting. The unit reinforces scaffolding.**

Contents of the unit

- Scaffolding: main phases

Phase 1: Preliminary checks

Before proceeding with propping **check the alignment and planarity** of the panels, using a level or common plumb line **(Fig. 1).**

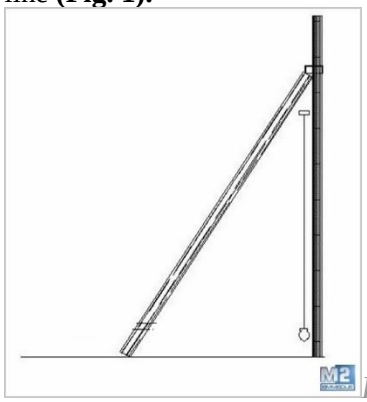


Fig. 1

- Perfect planarity **prevents dangerous eccentricity** of the completed walls.
- Moreover, **in order to correct the verticality of finished walls**, one would require an excessive quantity of finishing materials, **creating a waste of time and product**.

2. Wall propping

Scaffolding is set up on both sides and along the full length of the panels (Fig. 2) to ensure complete verticality during concrete casting.

Fig. 2

For propping, use **(Fig. 3):**

- aluminium **box profiles** and wooden beams **(Fig. 4)**
- boards connected with metal butterfly clamps or **ties**
- **iron wires or round bars with clamps**

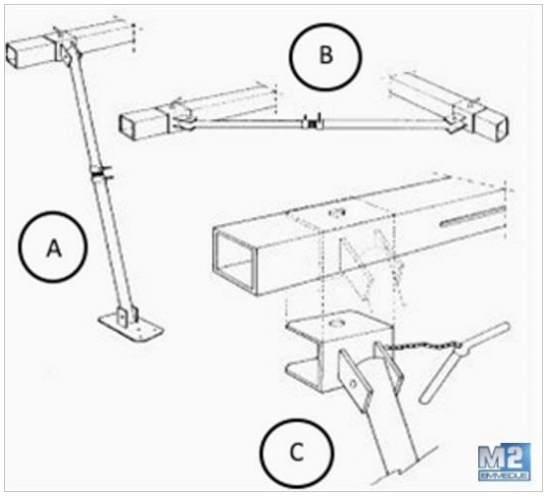


Fig. 3

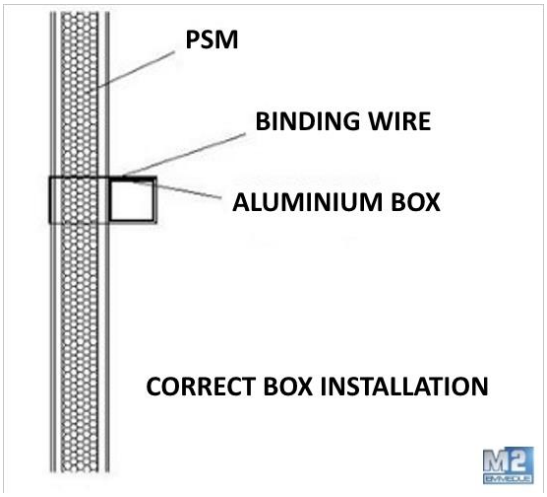


Fig. 4

Position the anchoring at the base (with wood boards and ties) of the panels where the casting thrust is the greatest. **Position a scaffold** at approximately 250 cm from the ground **(Fig. 5)**.


Fig. 5

- **For ordinary panel height** (3-3.5 m) use **1 horizontal row** of reinforcements.
- The panel is able to sustain the thrust during casting thanks to **the polystyrene density of 30kg/m^3 (Compression resistance > 250 kPa)** and controlled filling speed. Scaffolding ensures **complete panel stability**.


Fig. 6

Phase 3: Scaffolding the openings

Also position boards and reinforcements at the **openings**. Doors and windows must have **a crest of boards** held up by scaffolding approximately every 100 cm **(Fig. 7)**.


Fig. 7

- **N.B.: Clad** the perimeter of any openings with polystyrene slabs of the required thickness (when necessary). **Cover with mesh** and before casting, always set up frames for conventional sealing **(Fig. 8)**.

Fig. 8

Phase 4: Scaffolding the corners

Suitable scaffolding must be installed **on the corners (Fig. 9).**

The angular meshes RG1 allow to withstand the thrust of concrete on the corners.

Fig. 9

Correctly apply the reinforcements at panel intersections and ends **(Fig. 10, 11).**

Fig. 10

Fig. 11

Unit 6: Windows and doors

Main objectives of the unit

This unit explains **how to build windows and doors** using the Emmedue construction system.

Contents of the unit

1. Preliminary instructions
2. Placing door and window counter frames
3. Reinforcement meshes

1. Preliminary instructions

To build openings (doors and windows), **follow the specifications provided in the assembling plan**:

- **any openings that are not included in the layout** can be easily implemented by cutting the panels when assembly is complete.
- it will be necessary to **check feasibility** and implications for any changes to openings or the need to implement other ones.

2. Placing door and window counterframes

Locally remove polystyrene to **anchor counterframe (Fig. 1)**.

Fig. 1

3. Reinforcement meshes

Placing RG2 flat meshes

Place flat meshes at 45°, at a distance of less than 1 cm (0.4 in.) from the opening's edge **(Fig. 2).**

Fig. 2

Placing RG1 angular meshes

In order to reduce thermal bridges, **one may cover all opening's perimeter with polystyrene plates** of 2-3 cm (0.8-1.2 in) thickness. Such plates, if rendered, should be covered by meshes. In any case, before the casting, always prepare frames for conventional sealing **(Fig. 3)**.

Fig. 3

Unit 7: Filling wall panel with concrete

Main objectives of the unit

The **distinguishing feature** of PDM panels is that they are used to create a **system of permanent formwork for** – after anchoring, alignment and vertical installation – **concrete casting**. The unit reinforces the **concrete filling operations**.

Contents of the unit

1. Mixing project
2. Filling with concrete

1. Mixing project

When scaffolding is set up on the panels, proceed with the filling phase. The recommended characteristics of the concrete are the following (**mix design**):

- Maximum aggregate diameter: 12 mm
- Workability at unloading Slump=S5
- Mechanical resistance: Rck ≥ 25 Mpa

The characteristics of the mixture must be provided in the manufacturer's transport document and, as far as possible, checked on the construction site.

2. Filling with concrete

Use buckets (if you have a crane) or an auto-pump for filling. In the latter case, **preventively build a suitable fitting** in order to direct the concrete into the walls and avoid any waste **(Fig. 2)**.

Proceed gradually, filling the panels at a rate of less than 4 m/h and proceeding with casting along all of the walls **(Fig. 1, 2, 3, 4)**.

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Core drill to check filling **(Fig. 5)**.

Fig. 5

- **The casting level should not reach the top of the panels,** but should stop approximately 30 cm lower, to set up the reinforcement rebars for the panels of the next level.
- This gap will be filled when the floor is cast.

With casting-blocks (Fig. 6), it will be necessary to fasten the emerging part of the panel to the mesh and/or top floor rebars, with a centre distance of approximately 50 cm **(Fig. 7).**

Fig. 6

Fig.

The PDM double panel filling operation is now complete, it is possible to proceed to the next phases (system chasing, additional mesh, plastering).

Unit 8: Additional meshes

Main objectives of the unit

Emmedue panels require **angular and flat reinforcing meshes** (RG1, RG2). This unit explains all of the types of additional reinforcing meshes and how to apply them.

Contents of the unit

1.
    1. Required equipment
    2. Mesh types:
        a) RG1 angular mesh
        b) RG2 flat mesh

1. Required equipment

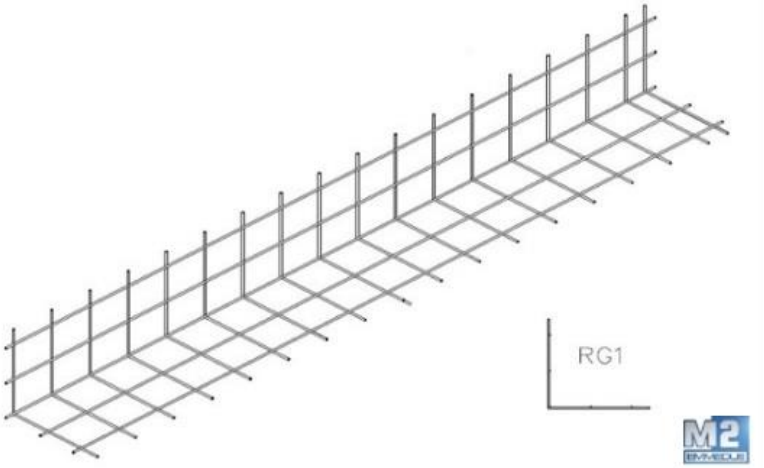
Two types of tools are used to fasten additional mesh **(Fig. 1):**

- Manual stapler
- Pneumatic stapler

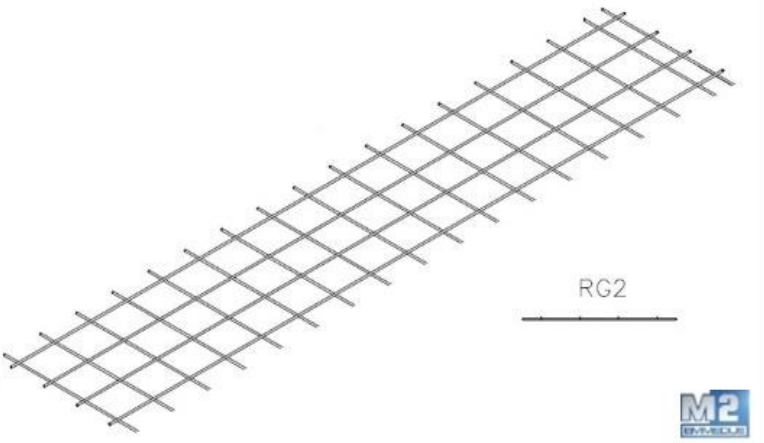
Fig. 1

2. Mesh types

The Emmedue construction system offers two types of additional mesh:



RG1 angular mesh



RG2 flat mesh

Additional mesh must be connected to panels using manual stapler for mesh **(Fig. 2).**

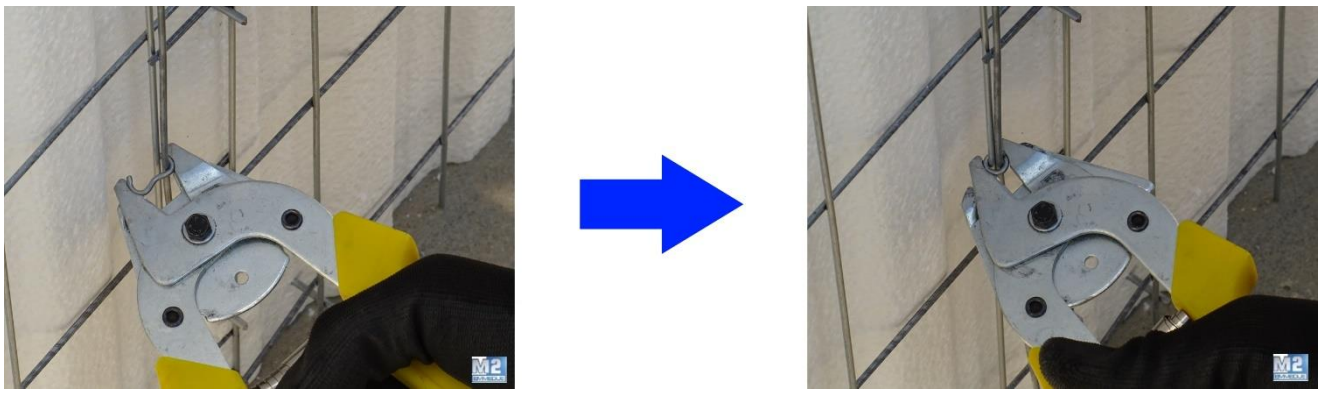


Fig. 2

a) RG1 angular mesh

RG1 angular mesh **(Fig. 3)** is applied **in every corner – internal and external to the building – vertical and horizontal**.

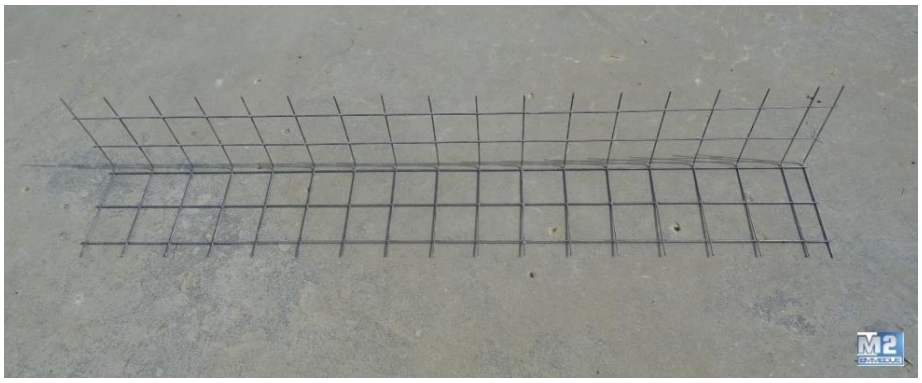


Fig. 3

RG1 angular mesh is also used at **all intersections between load bearing walls, and walls and floor slabs.**

- Intersection between load bearing walls – external corner **(Fig. 4)**
- Intersection between load bearing walls – internal corner **(Fig. 5)**
- Intersection between wall and floor slab -internal corner **(Fig. 6)**

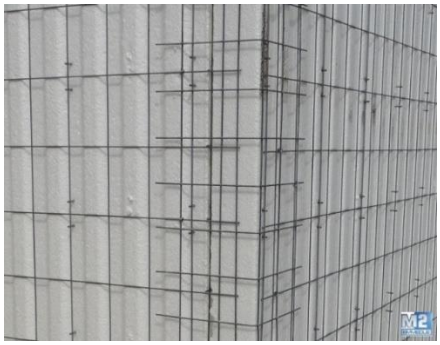


Fig. 4

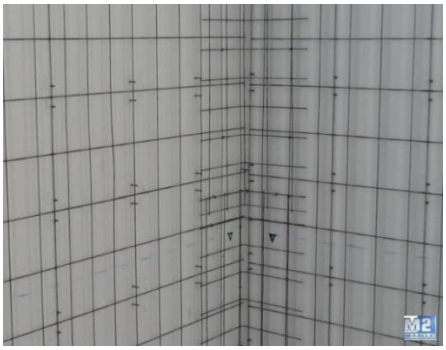


Fig. 5


Fig. 6

With PDM panels the best practice is to surround the entire perimeter of the openings with polystyrene plates with a thickness of 2-3 cm **(Fig. 7)**. Such plates, if rendered, should be covered by mesh. In any case, before casting, always prepare frames for conventional sealing.


Fig. 7

RG2 flat mesh

The RG2 flat mesh **(Fig. 8)** is applied to line up with **all the vertices of the openings** (on the external side and the internal side).

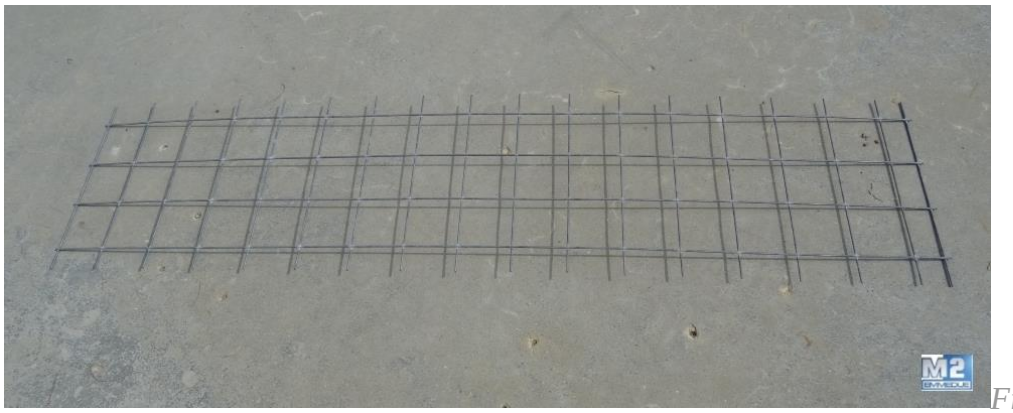


Fig. 8

RG2 application to the top of openings

The flat mesh **must be set at 45°**, at a distance of no more than 1 cm from the edge of the openings.

Fig. 9

Fig. 10

RG2 application to restore the panel mesh

In portion where some cuts have been realized and so the structural continuity of the mesh has been interrupted **(Fig. 11),** RG2 flat mesh is applied to restore the panel mesh **(Fig. 12).**

Fig. 11

Fig. 12

Address: Kingswick Annex, Kingswick Drive, Sunninghill, Ascot, Berkshire, SL5 7BH
Tel: 01344 949 226 – www.primabuildingsolutions.co.uk

Unit 10: Floor panel application

Main objectives of the unit

This unit explains how to build floors using the Emmedue construction system.

Contents of the unit

- Joist slabs with PSG panel

Joist slabs with PSG panel

PSG panel (Fig. 1) is usually used for buildings built with Emmedue double panels and for spans of approximately 8 m. The panels function as lightweight formwork and create resistant components of unidirectional behaviour that are finished on site. The concrete fills in the joists and forms an upper slab of variable thickness of 4 to 6 cm.(1.6 to 2.4 in.) depending on the specific conditions (loads, spans, ect.).

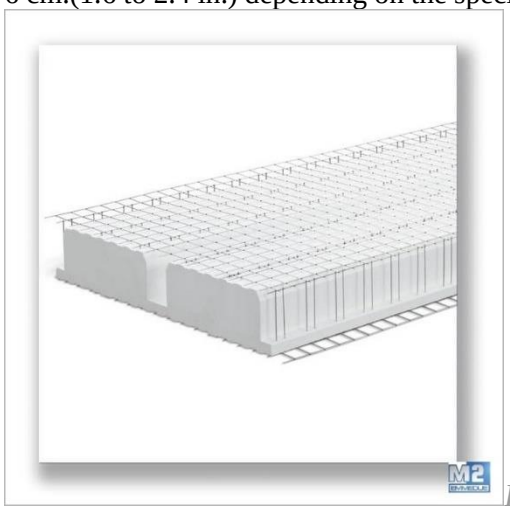


Fig. 1

Characteristics of the concrete:

- mechanical resistance > 30 Mpa
- maximum diameter of the aggregate < 12 mm

For slabs realization with PSG panel, carry out the following phases:

Phase 1: PSG floor panels propping

Panels must be supported by scaffolding boards or beams, sitting on metal props, at intervals of approximately 60 cm **(Fig. 2). A camber of 0.25 cm** should be applied to the panel **for every m of slab length**.

Fig. 2

Phase 2: PSG floor panels assembly

a. **Install the rebars** inside the joists. This operation **can be carried out with the slab panel lying on the ground**. The bars may reach the site already bent and of the right length in order to be anchored to the walls.

It is advisable to use omega shaped bars to ensure the necessary coverage for the reinforcements and prevent spot polystyrene crushing **(Fig. 3).**

Fig. 3

b. Firstly, **position and join the single elements** together and then attach them to the walls with steel bars and/or reinforcement meshes.

For the correct placement of the panels, refer to the assembling plan.

Phase 3: PSG floor panels completion

a. **Check the beam reinforcements** that need to be set up prior to casting (loads, overloads in addition to stresses from cantilevers and slabs).

b. **Set up the RG1 reinforcement meshes** on the supports on the walls before applying plaster.

c. **Cast the concrete and remove** the **supporting props** in steps (removal times provided by the project supervisor).

d. Proceed with **plastering** the intrados **(Fig. 4).**

Fig. 4

Tips:

- In case of inter-storey slab, check to have install the rebars for the upper level walls before casting **(Fig. 5)**.

Fig. 5

- During casting, **only walk on the scaffolding boards** supported by the underlying beams.
- Use **concrete with Rck ≥ 30 MPa, maximum diameter of the aggregate < than 12 mm**, slump S4 (160-210 mm).
- **The polystyrene strip** ensures even **thermal insulation (Fig. 6).**

Fig. 6

Unit 11: Shotcrete application

Main objectives of the unit

After assembly, ducting and application of reinforcing mesh, **plaster is applied** to the walls.

Contents of the unit

1. Type of plaster
2. Shotcrete application
3. Shotcrete curing
4. Finishes

1. Type of plaster

- Generally, the Emmedue double panel (PDM) can be completed with **any type of** cement based **plaster**, **without any lime content**. Nonetheless, the plaster must have a standard resistance of at least **8 MPA** in order to provide the resistance required to sustain normal loads with common anchoring.
- We recommend checking the product technical data sheets to ensure it can be used with the substrate (polystyrene).
- For all work phases and specifications, i.e. refer to the **operational modes** relative to the specific phase (plastering); additional information, on top of the standard instructions, are provided below.

2. Shotcrete application

Phase 1: Setting up rails

Set up the rails, with a centre distance of approximately 1,5 m (**Fig. 1**). The rails can be **set up on-site** (**Fig. 2**) **or using metal profiles** (**Fig. 3**), which will be removed after use.

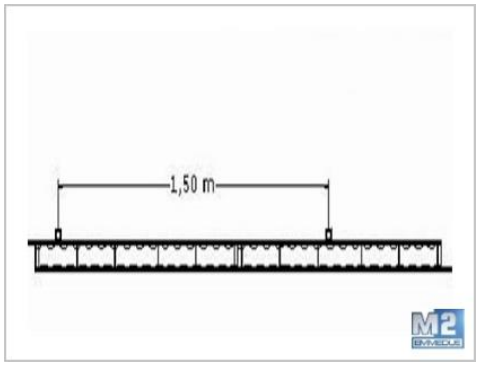


Fig. 1

Fig. 2

Fig. 3

- **Do not forget to install all of the reinforcement mesh** before setting up the rails.

Phase 2: Plaster application

Proceed with plaster application using the **Emmedue plaster sprayer** (**Fig. 4**) or a **continuous plaster sprayer** (**Fig. 5**).

Fig.4

Fig. 5

Using a plaster sprayer applies the plaster more compactly and evenly, reducing shrinkage and improving its performance.

Carry out plastering by following the instructions provided below:

- Always **apply the plaster** from the **bottom working upwards** (**Fig. 6**).
- **Spray the first layer of plaster** on one side first, then the other, **until the steel mesh is covered** (approximately 2 cm).
- **Apply the second layer** when the first layer has started hardening.

Fig. 6

- **If there is no overlapping mesh**, due to panel cutting, **integrate it with RG2 flat mesh**.
- **Plaster both sides equally** to avoid loading the wall eccentrically.

- **Avoid excessively extensive applications**.

The slump of the fresh mixture and **spray pressure**, for application, **are crucial** in **achieving** the required **compactness** (**Fig. 7**).

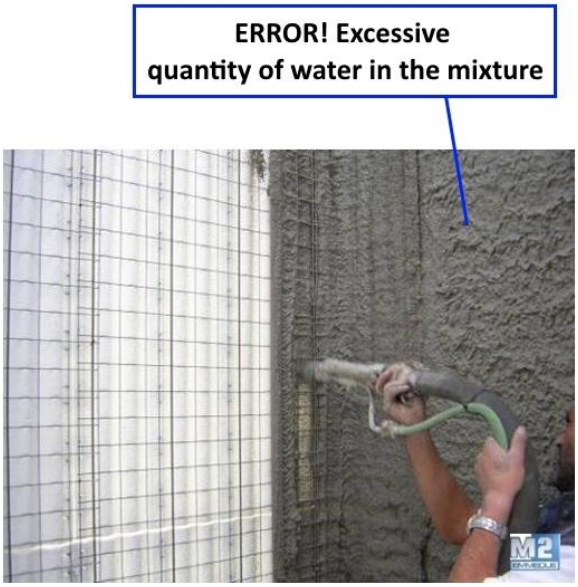


Fig. 7

- **Always leave a gap between screed rail and plaster** (**Fig. 8, 9**).

Fig. 8

Fig. 9

Phase 3: Taking down the screed rails

- **Check wall planarity.**
- **The screed rails are taken down** shortly after plastering.

3. Shotcrete curing

Instructions:

- **At temperatures below 4°C, avoid applying** plaster.
- **In case of rain**, it is advisable **to interrupt work** and cover whatever has been completed.
- **Wait at least 28 days** before **applying a finishing** coat/coat of paint.
- **Adopt all possible precautions for optimal curing.**

4. Finishes

It is only possible to apply the **finishing layer** (**Fig. 10**) after the plaster is completely cured, to prevent any micro-cracking.

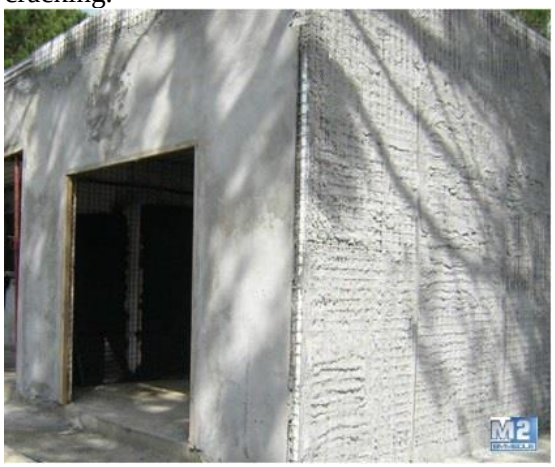


Fig. 10

Note that:

- The finish coating must ensure that wall and roof are water-resistant.
- The high-elasticity paint or coatings prevent hair cracks from forming on the plaster.

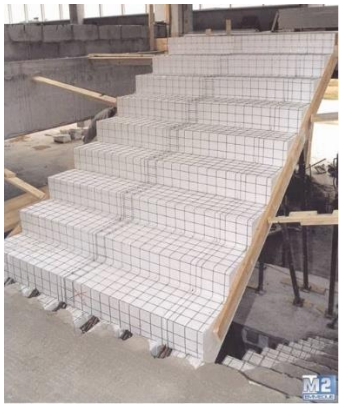
Unit 12: Stairs, landings and balconies

Main objectives of the unit

This unit explains how to build stairs, landings and balconies using the Emmedue construction system.

Contents of the unit

1. Staircase panel and landing panel: **description**
2. Staircase panel and landing panel: **building**



1. Staircase panel and landing panel: description

The Emmedue staircase panel (Fig. 1) is made from a block of **expanded polystyrene, shaped** depending on the design requirements, **coated with two wire meshes**.

The Emmedue landing panel (Fig. 2) is used for the realization of landings, floors and bi-directional reinforcing slabs. **It grants a continuous insulation** to the panel intrados.

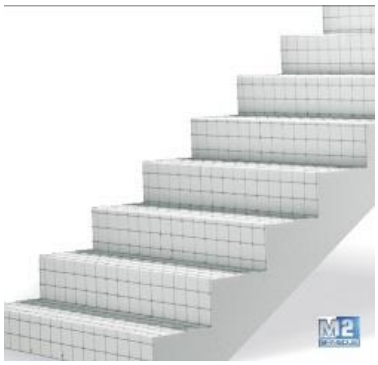


Fig. 1

Fig. 2

2. Staircase panel and landing panel: building

For building the staircase panel and the landing panel, proceed with the following phases:

- Setting up of the reinforcements
- Panel assembly

The **staircase panel and landing panel** stand out for being extremely **easy to install and** their **lightweight** structure.

Setting up of the reinforcements

Before putting in stair panels, **due reinforcement needs to be set up** inside each beam **(Fig. 3, 4).**

Fig. 3

Fig. 4

Reinforcement diameter and quantity are based on structural calculations.

It is possible to use the panel mesh to space out the reinforcements **(Fig. 5, 6).**

Fig. 5

Fig. 6

After having set up the reinforcements inside each beam, it is necessary to connect them to the upper mesh of the staircase panel.

- **Create an hole** for beam lifting **(Fig. 7).**
- **Lift the beam** to provide the reinforcement with the required coverage **(Fig. 8).**

Fig. 7

Fig. 8

P**anel assembly**

Phase 1: Setting up the rebars in the foundation

The first step for staircase panel assembly concerns in **setting up the rebars properly in the foundation (Fig. 9)**, in order to anchor the beam reinforcements.

Fig. 9

Check to have set up the **rebars** properly.

The first step with concrete (which casting will be realized in casting operation after the installation) should be built **to make the staircase panel installation easier**.

Phase 2: Staircase panel assembly

- **Install the staircase panel** while ensuring to check the **perfect horizontality** in both directions (perpendicular and parallel direction to the tread axis).
- Leave a **space of 3 cm** approximately **between the wall and the staircase panel** side. This will allow the passage of plaster, so the **structural continuity** of the wall will **be allowed**.
- **Connect** the staircase panel to the wall **using RG1 angular meshes**.

If the **staircase** is **along a wall**, mark the finished height on the wall **(Fig. 10).**

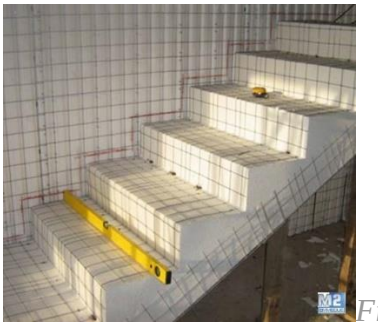


Fig. 10

Useful indications for assembly

For assembly, you must **consider the initial and final levels** of the stairs **(Fig. 11).**

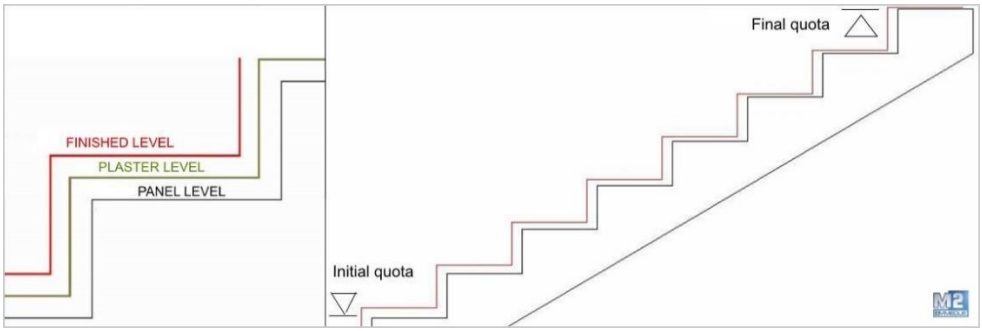


Fig. 11

If there is a difference between the finished stair starting level and the effective level in the construction site, it is possible to do the following:

- **Turn the stair panel** using the starting point as the reference **(Fig. 12).**
- **Match the two points up** with the design values **(Fig. 13**).

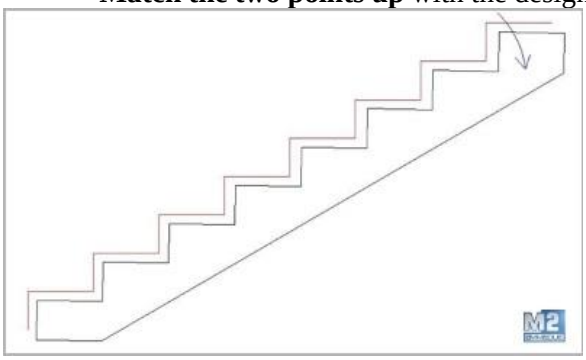


Fig. 12

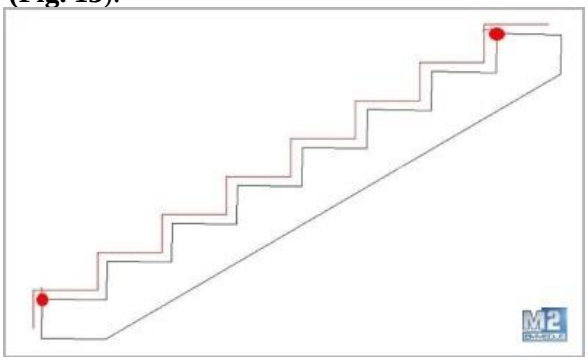


Fig. 13

- So as to compensate each increment uniformly **(Fig. 14).**
- And subsequently, each tread that will be levelled then with a mortar bed **(Fig. 15).**

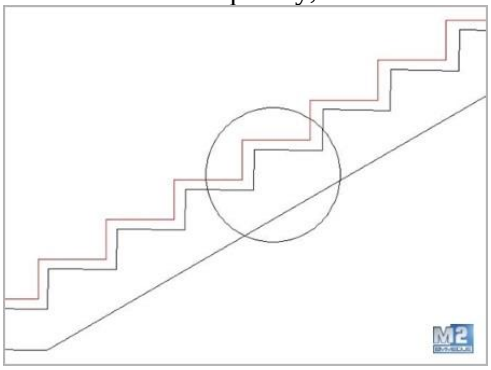


Fig. 14

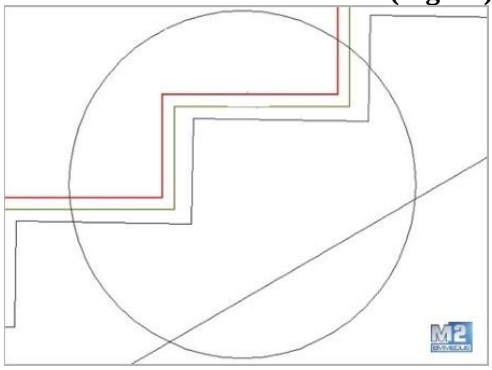


Fig. 15

Phase 3: Staircase panel propping



Fig. 16

Place props approximately at every meter **(Fig. 16).**

Phase 4: Landing panel assembly

- Remove the polystyrene locally using a jet of heat **(Fig. 17).**
- Place and anchor the landing to the load-bearing wall **(Fig. 18).**

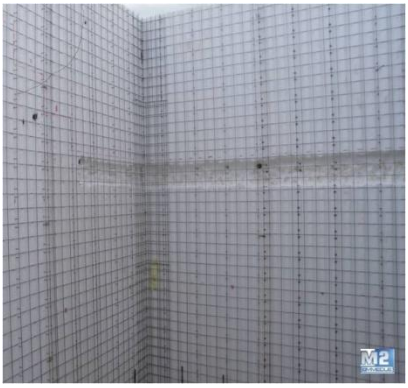


Fig. 17

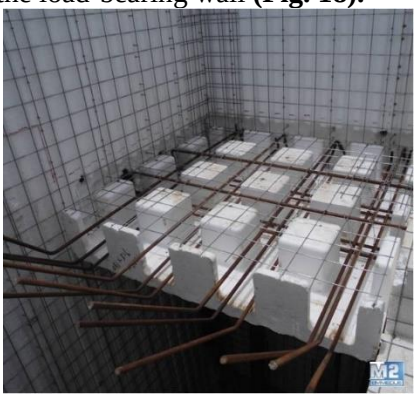


Fig. 18

Phase 5: Tips before casting operation

It is advisable to **cut out portions of polystyrene at the meeting point of tread and rise (Fig. 19).** The hole just created will allow to:

- connect the upper bar of beam to the stair panel mesh **(Fig. 20);** this will ensure the required **coverage** to the beams reinforcements;
- during the casting operation, visually check the **complete filling** of beams;
- **create points of continuity** between the beam and the mortar that lies above.

Fig. 19

Fig. 20

Phase 6: Concrete casting

When the steel trestles are set up inside the beams, the stair panel is set up, the necessary fastenings put in and the reinforcements are anchored, **the hollows are filled with concrete (Fig. 21)** with a maximum aggregate dimension of < 12 mm and a minimum mechanical resistance of Rck ≥ 30 MPa, and nevertheless determined by the designer.

Fig. 21

The **concrete casting in the joists** must take place **only after** the appropriate **props are placed** beneath the stair slab. The supports are formed by boards or wooden beams at intervals of 80-100 cm.

Next, one may proceed by **applying the plaster on the lower surface** of the stair slab **(Fig. 22)** and **on the upper surface (Fig. 23)** by casting the mortar with a medium thickness of **2.5 cm** (1 in.), creating so, the base for the coating (marble, tiles, ecc).

Fig. 22

Fig. 23

Any **railing** can be attached to the tread or to the side, by **first** of all **anchoring it to the internal beams** through connecting holes.

Examples of realization

Building balconies

- **Balconies** may be built by **using slab panels** that are completed with additional **reinforcement bars, anchored on the slab panel itself**.
- **The number and diameter of such reinforcements** and the **thickness of the concrete slab**, depend on the length of the cantilever and the quantity of dead and live load that **are considered in the calculation assumptions**.
- **Only after the curing is completed**, one may advance with the **removal of the props** and the **application of the plaster** on the ceiling.

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