GARCIA-BBM, S.L.

Consultants in Acoustics, Noise and Vibration Control

P-7545/2-v01

SEPTEMBER 2009

THE ACOUSTIC ASSESSMENT OF THE AUDITORIUM OF TROYES (FRANCE)

SOUND INSULATION SOLUTIONS

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TABLE OF CONTENTS PAGE

TABLE OF CONTENTS PAGE

1. INTRODUCTION

GARCIA-BBM S.L. was requested by the Architect D. José Ignacio Linazasoro Rodríguez to provide the Acoustic Assessment of the Auditorium of Troyes. This report presents the general sound insulation solutions which meet the sound insulation criteria set out in Points 5.2.2, 5.2.3, 6.1 and 6.2 of our report P-7545/1 (see Appendix A).

It is important to point out that the sound insulation solutions defined are generic: they offer alternative ways of achieving the required acoustic insulation and, as a result, this report does not detail the joins between the different building elements as it is unknown what solutions will be adopted.

However, given the geometric shape of the Auditorium Building certain specific indications have been given regarding mixed solutions with prefabricated plaster board and brick construction.

Where necessary and especially in Rehearsal Rooms and Installation Areas an outline of the joint building solution (vertical and horizontal building elements) will be shown and recommendations given for their integration in the Project.

2. GENERAL SOUND INSULATION SOLUTIONS

The sound insulation solutions set out in this point are not applicable to Music Rehearsal Rooms, unless specifically mentioned.

Similarly, these solutions do not apply to Installation or Technical Areas unless otherwise stated.

2.1 Interior Vertical Walls

Vertical walls include: partitions, party walls, walls, etc. which are not external. Plans 1 to 22 show layouts of building elements.

2.1.1 Acoustic Insulation R_A=35 dB(A)

T35-A (Plan 1)

– Double hollow brick wall (115 mm), rendered or plastered on both sides (15 mm). The minimum weight for the building solution is 127 kg/m^2.

T35-B (Plan 1)

– A prefabricated system of plaster boards (26 kg/m^2) made of:

  - Plaster board 15 mm thick, screwed to fastener on one side. Sealed joints
  - Fastener 48mm thick. Between fasteners place a glass or rockwool absorber blanket 40 mm thick with a density of ≥40 kg/m^3.
  - Plaster board 15 mm thick, screwed to fastener on one side. Sealed joints

2.1.2 Acoustic Insulation R_A=40 dB(A)

T40-A (Plan 1)

– Perforated brick wall (115 mm) rendered or plastered on both sides (15 mm). The minimum weight for the building element is 149 kg/m^2.

T40-B (Plan 1)

– Concrete block construction (150 mm), rendered or plastered on both sides (15 mm). The minimum weight for the building element is 186 kg/m^2.

T40-C (Plan 1)

– System of two double hollow brick wall construction (120 kg/m^2), made up of:

  - Double hollow brick wall (70 mm), rendered or plastered on both sides (15 mm).

- Air cavity 40 mm thick, filled with glass or rockwool absorber blanket 40 mm thick with a density of $\geq$40 kg/m^3.
- Double hollow brick wall (70 mm), rendered or plastered on both sides (15 mm).

T40-D (Plan 1)

– Prefabricated system of plaster boards (42 kg/m^2) made up of:

- 2 plaster boards 15 mm thick each, secured with taped and sealed joints, screwed to fastener on one side.
- Fastener 48 mm thick. Between fasteners place a glass or rockwool absorber blanket 40 mm thick with a density of $\geq$40 kg/m^3.
- 2 plates of plaster board 15 mm thick each, secured with taped and sealed joints on one side, screwed to fastener on one side.

2.1.3 Acoustic Insulation R_A=45 dB(A)

T45-A (Plan 2)

– Perforated brick wall (240 mm), rendered or plastered on both sides (15 mm). The minimum weight for this building solution is 280 kg/m^2.

T45-B (Plan 2)

– Concrete block construction (250 mm), rendered or plastered on both sides (15 mm). The minimum weight for this building element is 290 kg/m^2.

T45-C (Plan 2)

– System of two brick constructions (300 kg/m^2), made up of:

- Perforated brick wall (115 mm), rendered or plastered on one side.
- Air cavity 40 mm thick, filled with glass or rockwool absorber blanket 40 mm thick with a density of $\geq$40 kg/m^3.
- Perforated brick wall (115 mm), rendered or plastered on one side. (15 mm).

T45-D (Plan 2)

– System of two concrete block construction (230 kg/m^2) made up of:

  - Concrete block (80 mm), rendered or plastered on both sides (15 mm).
  - Air cavity 40 mm thick, filled with glass or rockwool absorber blanket 40 mm thick with a density of ≥40 kg/m^3.
  - Concrete block (80 mm), rendered or plastered on both sides. (15 mm).

T45-E (Plan 2)

– A mixed system composed of brick wall and prefabricated plasterboard panels (175 kg/m^2), made up of:

  - Perforated brick wall (115 mm), rendered or plastered on one side
  - Air cavity 20 mm thick.
  - Fastener 48 mm thick, not touching the brick wall. Between fasteners place a glass or rockwool absorber blanket 40 mm thick with a density of ≥40 kg/m^3.
  - Plaster board 15 mm thick, screwed to fastener. Sealed joints.

T45-F (Plan 2)

– Prefabricated system of plaster board (50 kg/m^2), made up of:

  - 2 plaster boards 15 mm thick each, secured with taped and sealed joints and screwed to fastener on one side.
  - Fastener 48 mm thick. Between fasteners place a glass or rockwool absorber blanket 40 mm thick with a density of ≥40 kg/m^3.
  - Air cavity 20 mm thick.
  - Fastener 48 mm thick. Between fasteners place a glass or rockwool absorber blanket 40 mm thick with a density of ≥40 kg/m^3
  - 2 plaster boards 15 mm thick each, secured with taped and sealed joints and screwed to fastener on one side.

2.1.4 Acoustic Insulation R_A=50 dB(A)

T50-A (Plan 3)

– Reinforced concrete wall 180 mm thick (450 kg/m^2).

T50-B (Plan 3)

– System of two panels of brick wall construction (400 kg/m^2), made up of:

  - Perforated brick wall (240 mm), rendered or plastered on one side (15 mm).
  - Air cavity 40 mm thick, filled with glass or rockwool absorber blanket 40 mm thick with a density of ≥40 kg/m^3.
  - Perforated brick wall (115 mm), rendered or plastered on one side (15 mm).

  For this system rigid fixings between panels are allowed. However, antivibration rubber elements are preferred in case they are needed.

T50-C (Plan 3)

– Mixed system composed of brick wall and prefabricated plasterboard panels (300 kg/m^2), made up of:

  - Perforated brick wall (240 mm), rendered or plastered on one side (15 mm).
  - Air cavity 30 mm thick.
  - Fastener 48 mm thick, not in rigid contact with the brick wall (should fixings be necessary, rubber antivibrators will be used). Between the fasteners place a glass or rockwool absorber blanket panel 40 mm thick with a density of ≥40 kg/m^3.
  - Plaster board panel 15 mm thick, screwed to fastener. Sealed joints.

  The unions between panels can be joined by wall antivibrators made of rubber.

T50-D (Plan 3)

– A mixed system composed of brick wall and prefabricated plasterboard panels (195 kg/m^2), comprising of:

  - Plasterboard panel 15 mm thick, screwed to fastener. Sealed joints.
  - Fastener 48 mm thick. Between fasteners place a glass or rockwool absorber blanket panel 40 mm thick with a density of ≥40 kg/m^3.
  - Air cavity 15 mm thick.
  - Perforated brick wall (115 mm), rendered or plastered on both sides (15 mm).
  - Air cavity 15 mm thick.
  - Fastener 48 mm thick. Between fasteners place a glass or rockwool absorber blanket 40 mm thick with a density of ≥40 kg/m^3.
  - Plasterboard panel 15 mm thick, screwed to fastener. Sealed joints.

  The unions between the panels can be joined by wall antivibrators made of rubber.

T50-E (Plan 3)

– Prefabricated system of plasterboard panels (65 kg/m^2), made up of:

  - 2 plasterboard panels 15 mm thick each, secured with taped and sealed joints, screwed to fastener on one side.
  - Fastener 48 mm thick. Between fasteners place a glass or rockwool absorber blanket 40 mm thick with a density of ≥40 kg/m^3.
  - Plasterboard panel 15 mm thick, screwed to fastener. Sealed joints.
  - Air cavity 30 mm thick.
  - Fastener 48 mm thick. Between fasteners place a glass or rockwool absorber blanket 40 mm thick with a density of ≥40 kg/m^3.
  - 2 plasterboard panels 15 mm thick each, secured with taped and sealed joints, screwed to fastener on one side.

  The unions between panels can be joined by wall antivibrators made of rubber.

2.1.5 Acoustic Insulation R_A=55 dB(A)

T55-A (Plan 4)

– Reinforced concrete wall 240 mm thick (600 kg/m^2).

T55-B (Plan 4)

– System of two panels of brick wall construction (550 kg/m^2), made up of:

- Perforated brick wall (240 mm), rendered or plastered on one side (15 mm).
- Air cavity 80 mm thick, filled with glass or rockwool absorber blanket 40 mm thick with a density of ≥40 kg/m^3 (2 x 40 mm).
- Perforated brick wall (240 mm), rendered or plastered on one side (15 mm).

For this system rigid fixings between panels are allowed. However, antivibration rubber elements are preferred in case they are needed.

T55-C (Plan 4)

– Mixed system composed of brick wall construction and prefabricated plasterboard panels (310 kg/m^2), made up of:

- Plasterboard panel 15 mm thick, screwed to fastener. Sealed joints.
- Fastener 48 mm thick. Between fasteners place a glass or rockwool absorber blanket 40 mm thick with a density of ≥40 kg/m^3.
- Air cavity 15 mm thick.
- Perforated brick wall (240 mm), rendered or plastered on both sides (15 mm).
- Air cavity 15 mm thick.
- Fastener 48 mm thick. Between fasteners place a glass or rockwool absorber blanket 40 mm thick with a density of ≥40 kg/m^3.
- Plasterboard panel 15 mm thick, screwed to fastener. Sealed joints.

The unions between panels can be joined by wall antivibrators made of rubber.

T55-D (Plan 4)

– Mixed system composed of brick wall and prefabricated plasterboard panels (205 kg/m^2), made up of:

  - 2 plasterboard panels 15 mm thick each, secured with taped and sealed joints, screwed to fastener.
  - Fastener 48 mm thick. Between fasteners place a glass or rockwool absorber blanket 40 mm thick with a density of ≥70 kg/m^3.
  - Air cavity 15 mm thick.
  - Perforated brick wall (115 mm), rendered or plastered on both sides (15 mm).
  - Air cavity 15 mm thick.
  - Fastener 48 mm thick. Between fasteners place a glass or rockwool absorber blanket 40 mm thick with a density of ≥70 kg/m^3.
  - 2 plasterboard panels 15 mm thick each, secured with taped and sealed joints and screwed to fastener.

  The unions between panels can be joined wall antivibrators made of rubber.

T55-E (Plan 4)

– System of prefabricated plasterboard elements (80 kg/m^2), made up of:

  - 2 plasterboard panels 15 mm thick each, secured with taped and sealed joints, screwed to fastener.
  - Fastener 48 mm thick. Between fasteners place a glass or rockwool absorber blanket 40 mm thick with a density of ≥70 kg/m^3.
  - 2 plasterboard panels 15 mm thick each, secured with taped and sealed joints and screwed to fastener.
  - Air cavity 50 mm thick.
  - Fastener 48 mm thick. Between fasteners place a glass or rockwool absorber blanket 40 mm thick with a density of ≥70 kg/m^3.
  - 2 plasterboard panels 15 mm thick each, secured with taped and sealed joints screwed to fastener.

  The unions between panels can be joined by wall antivibrators made of rubber.

2.1.6 Acoustic Insulation R_A=60 dB(A)

T60-A (Plan 5)

– Reinforced concrete wall 350 mm thick (875 kg/m^2).

T60-B (Plan 5)

– System of two panels of brick wall (550 kg/m^2) made up of:

- Perforated brick wall (240 mm), rendered or plastered on one side (15 mm).
- Air cavity at least 150 mm thick. Place two panels of rockwool or glass absorber blanket 60 mm thick with a density of ≥70 kg/m^3 (2 x 60 mm).
- Perforated brick wall (240 mm), rendered or plastered on one side (15 mm).

For this system rigid fixings between between the panels are allowed. However, antivibration rubber elements are preferred in case they are needed.

T60-C (Plan 5)

Mixed system composed of brick wall and plasterboard panels (330 kg/m^2) made up of:

- 2 plasterboard panels 15 mm thick each, secured with taped and sealed joints and screwed to fastener.
- Fastener 48 mm thick. Between fasteners place a glass or rockwool absorber blanket 40 mm thick with a density of ≥70 kg/m^3.
- Air cavity 30 mm thick.
- Perforated brick wall (240 mm), rendered or plastered on one side (15 mm).
- Air cavity 30 mm thick.
- Fastener de 48 mm thick. Between fasteners place a glass or rockwool absorber blanket 40 mm thick with a density of ≥70 kg/m^3
- 2 plasterboard panels 15 mm thick each, with taped and sealed joints and screwed to fastener.

The unions between panels can be joined by wall antivibrators made of rubber.

T60-D (Plan 5)

– System of prefabricated plasterboard elements (90 kg/m^2) made up of:

- 2 plasterboard panels 15 mm thick each, secured with taped and sealed joints and screwed to fastener.
- Fastener 48 mm thick. Between fasteners place a glass or rockwool absorber blanket 40 mm thick with a density of ≥70 kg/m^3
- Air cavity 30 mm thick.
- Plasterboard panel 15 mm thick, screwed to fastener. Sealed joints.
- Fastener de 48 mm thick. 15 mm thick, screwed to fastener. Sealed joints.
- Plasterboard panel 15 mm thick, screwed to fastener. Sealed joints.
- Air cavity 30 mm thick.
- Fastener 48 mm thick. Between fasteners place a glass or rockwool absorber blanket 40 mm thick with a density of ≥70 kg/m^3.
- 2 plasterboard panels 15 mm thick each, secured with taped and sealed joints and screwed to fastener.

The unions between the panels can be joined by wall antivibrators made of rubber.

2.1.7 Acoustic Insulation R_A=65 dB(A)

T65-A (Plan 6)

– Reinforced concrete wall 700 mm thick (1.750 kg/m^2).

T65-B (Plan 6)

– Mixed system of brick wall and plasterboard panels (360 kg/m^2)made up of:

- 3 plasterboard panels 15 mm thick each, with taped and sealed joints, screwed to fastener of 70 mm.
- Fastener 70 mm. Between fasteners place a glass or rockwool absorber blanket 60 mm thick with a density of ≥70 kg/m^3.
- Air cavity 30 mm thick.
- Perforated brick wall (240 mm), rendered or plastered, on both sides (15 mm).
- Air cavity 30 mm thick.

- Fastener 70 mm. Between fasteners place a glass or rockwool absorber blanket 60 mm thick with a density of ≥70 kg/m^3.
- 3 plasterboard panels 15 mm thick each, with taped and sealed joints, screwed to fastener of 70 mm.

The unions between the panels can be joined by wall antivibrators made of rubber.

T65-C (Plan 6)

– System of prefabricated plasterboard elements (105 kg/m^2), made up of:

- 3 plasterboard panels 15 mm thick each with taped and sealed joints screwed to fastener de 70 mm.
- Fastener 70 mm. Between fasteners place a glass or rockwool absorber blanket 60 mm thick with a density of ≥70 kg/m^3.
- Air cavity 30 mm thick.
- Plasterboard panel 15 mm thick, screwed to fastener. Sealed joints.
- Fastener 48 mm thick. Between fasteners place a glass or rockwool absorber blanket 40 mm thick with a density of ≥40 kg/m^3.
- Plasterboard panel 15 mm thick, screwed to fastener. Sealed joints.
- Air cavity 30 mm thick.
- Fastener 70 mm. Between fasteners place a glass or rockwool absorber blanket 60 mm thick with a density of ≥70 kg/m^3.
- 3 plasterboard panels 15 mm thick each, with taped and sealed joints , screwed to fastener of 70 mm.

The unions between panels can be joined by wall antivibrators made of rubber.

2.2 Vertical façade building elements

The following are double-panelled sound insulation solutions for the solid façade walls. Panels of polystyrene with a density of ≥40 kg/m^3 are included in the air cavity between the double panels.

2.2.1 Acoustic Insulation R_A=45 dB(A)

T45-A (Plan 7)

– System of double brick wall construction (210 kg/m^2), made up of:

- Perforated brick wall (115 mm), rendered or plastered on one side: either interior or exterior (15 mm).
- Polystyrene panel 40 mm. thick.
- Air cavity 20 mm.
- Double hollow brick wall (70 mm), Rendered or plastered on one side (15 mm).

T45-B (Plan 7)

System of double panel brick and prefabricated plasterboard wall (160 kg/m^2), made up of:

- Perforated brick wall (115 mm), rendered or plastered on one side: interior or exterior (15 mm).
- Air cavity 20 mm.
- Fastener 48 mm. Between fasteners place extruded polystyrene or rockwoll absorber blankets of 40mm with a density of $\geq$40 kg/m^3.
- 2 Plasterboard panels 20 mm thick each, secured with taped and sealed joints, screwed to fastener.

2.2.2 Acoustic Insulation R_A=50 dB(A)

T50-A (Plan 7)

– System of double panel brick wall (270 kg/m^2), made up of:

- Perforated brick wall (115 mm), rendered or plastered on one side: interior or exterior (15 mm).
- Polystyrene panel 40 mm thick.
- Air cavity 20 mm.
- Double hollow brick wall (115 mm), rendered or plastered on one side (15 mm).

T50-B (Plan 7)

– System of double panel brick and prefabricated plasterboard wall (170 Kg/m^2), made up of:

  - Perforated brick wall (115 mm), rendered or plastered on one side: interior or exterior (15 mm).
  - Air cavity 30 mm.
  - Fastener 48 mm. Between fasteners place extruded polystyrene panels or rockwool absorber blanket 40 mm with a density of $\geq$40 kg/m^3.
  - 2 plasterboard panels 15 mm thick each, secured with taped and sealed joints, screwed to fastener.

2.2.3 Acoustic Insulation R_A=55 dB(A)

T55-A (Plan 7)

– System of double panel brick wall (290 kg/m^2), made up of:

  - Perforated brick wall (115 mm), rendered or plastered on one side: interior or exterior (15 mm).
  - Polystyrene panel 40 mm thick.
  - Air cavity 30 mm.
  - Perforated brick wall (115 mm), rendered or plastered on one side (15 mm).

T50-B (Plan 7)

– System of double brick and prefabricated plasterboard wall construction (310 kg/m^2), made up of:

  - Perforated brick wall (240 mm), rendered or plastered on one side: interior or exterior (15 mm).
  - Air cavity 30 mm.
  - Fastener 48 mm. Between fasteners place extruded polystyrene or rockwool absorber blankets 40 mm with a density of $\geq$40 kg/m^3.
  - 2 plasterboard panels 15 mm thick each, with taped and sealed joints screwed to fastener.

2.3 Horizontal interior building elements

The sound insulation solutions defined in this point do not include floor finishes or false ceilings to reduce impact levels. The sound insulation solutions indicated here offer an impact level($L_n \geq 80$ dB(A)).

2.3.1 Acoustic Insulation $R_A = 45$ dB(A)

FOR45-A (Plan 8)

– Reinforced concrete slab 120 mm thick (300 kg/m^2) on metal deck sheet

FOR45-B (Plan 8)

– Hollow tiled or concrete floor slab 250 mm thick and levelling layer 50 mm (300 – 330 kg/m^2). Rendered or plastered on the lower side(15 mm). Floor of terrazzo or similar finish (25 mm).

2.3.2 Acoustic Insulation $R_A = 50$ dB(A)

FOR50-A (Plan 9)

– Reinforced concrete slab 180 mm thick (450 kg/m^2) on corrugated metal deck

FOR50-B (Plan 9)

– Hollow-tiled or concrete floor slab 300 mm thick and levelling layer 50 mm thick (340 – 370 kg/m^2). Rendered or plastered on lower side (15 mm). Floor in terrazzo or similar finish (25 mm).

2.3.3 Acoustic Insulation R_A=55 dB(A)

FOR55-A (Plan 10)

– Reinforced concrete slab 240 mm thick (600 kg/m^2) on metal deck sheet.

FOR55-B (Plan 10)

– Hollow-tiled or concrete floor 350 mm thick with levelling layer 50 mm thick (360 – 410 kg/m^2), rendered and plastered on lower side (15 mm). Floor in terrazzo or similar finish (25 mm).

FOR55-C (Plan 10)

– Hollow core slab 350 mm thick (420 kg/m^2), rendered or plastered on lower side (15 mm).

2.3.4 Acoustic Insulation R_A=60 dB(A)

FOR60-A (Plan 11)

– Reinforced concrete slab 350 mm thick (875 kg/m^2).

FOR60-B (Plan 11)

– Hollow core slab 500 mm thick (600 kg/m^2), rendered or plastered on lower side (15 mm).

2.3.5 Acoustic Insulation R_A=65 dB(A)

FOR65-A (Plan 11)

– Reinforced concrete slab 700 mm thick (1.750 kg/m^2).

2.4 Improved sound insulation horizontal building elements

This section details systems to improve airborne and impact noise insulation

2.4.1 Floating Floor

For the same base slab, the following building details are recommended for floating floors.

2.4.1.1 Acoustic Insulation $R_A \geq 50$ dB(A)

SF-Aly A2-A (Plan 12)

- Base slab (Point 2.3), $R_A = 45$ dB(A)
- Elastic (rockwool absorber blanket or polyethylene panels or bitumen complexes) 10 mm thick with waterproof membrane
- Levelling mortar 40 mm thick or three layers of prefabricated plasterboard13+13 mm thick.
- Floor finish.

The improvement in the impact noise level (ΔL_n) varies between 15 dB(A) y 20 dB(A), and is also a function of the type of floor finish..

2.4.1.2 Acoustic Insulation $R_A \geq 55$ dB(A)

SF-B1 y B2 (Plan 12)

- Base slab (Point 2.3), $R_A = 50$ dB(A)
- Elastic (rockwool absorber blanket or polyethylene panels or bitumen complexes) 30 mm thick with waterproof membrane.

– Levelling mortar 60 mm thick or three layers of prefabricated plasterboard 13+13+13 mm thick.

– Floor Finish.

The improvement in the impact noise level (ΔL_n) varies between 22 dB(A) y 27 dB(A),and is also a function of the type of floor finish..

2.4.1.3 Acoustic Insulation $R_A \geq 60$ dB(A)

SF-C1 y C2 (Plan 12)

– Base slab (Point 2.3), $R_A = 50$ dB(A)

– Elastic (rockwool absorber blanket or polyethylene panel or bitumen complexes) 60 mm thick (2 x 30 mm), with waterproof membrane.

– Reinforced concrete slab 100 mm thick or three layers of prefabricated plasterboard 13+13+13+13 mm thick.

– Floor finish.

The improvement in the impact noise level (ΔL_n) varies between 30 dB(A) y 35 dB(A) and is also a function of the type of floor finish.

2.4.1.4 Acoustic Insulation $R_A \geq 65$ dB(A)

Designs for specific sound insulation solutions are required, especially in the Installation Areas, as are specific solutions for other walls.

2.4.2 Suspended ceilings or acoustic barriers

For a reference slab the following sound insulation solutions are recommended for acoustic barriers.

2.4.2.1 Acoustic Insulation R_A=50 dB(A)

BA-1 (Plan 13)

- Base slab (Point 2.3), R_A=45 dB(A)
- Air cavity 100 – 150 mm thick.
- Panels of absorbent material or plaster or plasterboard 15 mm thick.

2.4.2.2 Acoustic Insulation $R_A \geq 55$ dB(A)

BA-2 (Plan 13)

- Base slab (Point 2.3), R_A=45 dB(A)
- Air cavity 100 – 150 mm thick.
- Plasterboard panels 15 mm thick. Sealed joints. Suspension with wall antivibrators of rubber or similar material. Place a glass or rockwool absorber blanket 40 mm thick with a density of $\geq$40 kg/m^3 in air cavity.

2.4.2.3 Acoustic Insulation $R_A \geq 60$ dB(A)

BA-3 (Plan 13)

- Base slab (Point 2.3), R_A=50 dB(A)

– Air cavity 100 – 150 mm thick.

– 2 panels of plasterboard 15 mm thick each, secured with taped and sealed joints. Suspension con antivibrators. Place a glass or rockwool absorber blanket 60 mm thick with a density of $\geq$70 kg/m^3 in air cavity.

2.4.2.4 Acoustic Insulation $R_A \geq 65$ dB(A)

BA-4 (Plan 13)

– Base slab (Point 2.3), $R_A = 50$ dB(A)

– Air cavity 150 – 200 mm thick.

– 2 panels of plasterboard 15 mm thick each, secured with taped and sealed joints. Suspension con antivibrators. Place a glass or rockwool absorber blanket 80 mm thick with a density of $\geq$70 kg/m^3 (2 x 40 mm) in air cavity.

This building solution must include specific solutions for other walls.

2.5 Roof covers

2.5.1 Heavy roof covers

The sound insulation solutions set out in Point 2.4 apply to this type of roof cover and include the corresponding water proofing systems. The improvement in airborne noise insulation (ΔR_A) is no greater than 5 dB(A), while the improvement in impact noise level insulation is very variable and is a function of the finish and damp proofing system used.

2.5.2 Light roof covers

In light roof constructions the level of impact noise y its insulation depends on the exterior finish of the systems. In exterior metal finishes the impact noise level (L_n) does not fall below 45 dB(A).

2.5.2.1 Acoustic Insulation R_A=40 dB(A)

CR40 A y B (Plan 14)

– Systems of prefabricated elements composed of:

- Metal sheet exterior finish 1 mm thick.
- Asphalt waterproof membrane.
- Dampproof board 20 mm thick, with sealed joints.
- Rockwool absorber blanket 80 mm thick with a density of ≥80 kg/m^3.
- Wood board 20 mm thick with sealed joints or corrugated metal deck 1 mm thick.

The construction joints must not coincide in the floor plan; they must be staggered.

2.5.2.2 Acoustic Insulation R_A=45 dB(A)

CR45 A y B (Plan 15)

– System of prefabricated elements made up :

- Metal sheet exterior finish1 mm thick.
- Asphalt waterproof membrane.
- Dampproof board 20 mm thick with sealed joints.
- Rockwool absorber blanket 80 mm thick with a density of ≥80 kg/m^3.
- Wood board 20 mm thick, con sealed joints.
- Extruded polystyrene 50 mm thick with a density of ≥40 kg/m^3.
- Corrugated metal deck 1 mm thick or wood board 20 mm thick with sealed joints.

The construction joints must not coincide in the floor plan; they must be staggered.

3. SPECIFIC SOUND INSULATION SOLUTIONS

Certain rooms require high levels of sound Insulation. This may be because of the type of activity which takes place in the room or because the rooms generate high noise levels. This is the case in the Music Rehearsal Rooms and the Installation Areas where composite building systems with floating floors and independent ceilings and walls are essential.

In Installation Areas with rotary equipment floating floors are necessary to reduce significant vibration levels which may in turn generate unwanted noise levels.

3.1 Music Rehearsal Rooms

Plans 16 to 21 present the recommended composite sound insulation solutions (floor, walls and ceilings) for Music Rehearsal Rooms. As can be seen, the way to achieve high levels of acoustic insulation is to build one room within another.

Three alternatives are considered, taking into account the type of floating floor and the vertical building elements with prefabricated plasterboard and brick walls.

Although in the plans the elastic material named is Panel PF manufactured by ISOVER, Rocksol 501 Panel manufactured by ROCKWOOL is equally valid.

For façades containing windows, double windows are recommended. Under no circumstances are sliding or common windows or partitions allowed between Rehearsal Rooms.

3.2 Installation Area

Plan 22 shows a joint building detail of the Installation Area next to or near the Auditorium.

This detail can be adjusted according to the type of equipment installed in the designated installation area. The floating slab can be thicker, its surface area limited or the wall and ceiling panels reduced. The same applies to the absorbent materials used.

4. DOORS AND WINDOWS

Generally windows and doors are building elements which offer less airborne acoustic insulation than the partitions of which they form part. This means that the whole behaves as a mixed system offering less insulation than the partition.

The acoustic insulation of a composite wall is the result of the individual insulation and surface area of each of its components. The resulting insulation is conditioned by the element which offers the least insulation.

The insulation offered by standard doors and windows is, moreover, conditioned by the joints of the locking system, openings, type of carpentry, frame etc.

Although many laboratory experiments have been carried out on the airborne insulation offered by doors and windows, this points puts forward a series of recommendations concerning these building elements.

4.1 Doors

4.1.1 Acoustic Insulation R_A=20 dB(A)

- Wood door 25 mm thick (solid or laminated), with single overlap (≥10 mm), preferably with an elastic joint.

- Metal fire-resistant door RF-30.

4.1.2 Acoustic Insulation R_A=25 dB(A)

– Laminated wood door 35 mm thick, single overlap at door/frame position (≥10 mm), with elastic joints around perimeter.

– Metal fire resistant door type RF-90, with elastic joints around the perimeter.

4.1.3 Acoustic Insulation R_A=30 dB(A)

– Laminated wood door 60 mm thick, with double overlap at door/frame position (≥10 mm), with elastic perimeter join and a guillotine-type threshold lock.

– RF type fire resistant metal door with double overlap at door/ frame position (≥10 mm), with elastic joints around perimeter and a guillotine-type threshold lock.

4.1.4 Acoustic Insulation R_A=35 dB(A)

– Wood door made up of:

  - Veneered TDM type board 19 mm thick.
  - Rockwool absorber blanket 20 mm thick with a density of ≥40 kg/m^3.
  - Veneered DM type board 19 mm thick.
  - Rockwool absorber blanket 20 mm thick with a density of ≥40 kg/m^3.
  - Veneered DM type board 19 mm thick.

  This door requires an airtight closure with double overlap (≥10 mm) and elastic joints in the door/frame position, as well as a guillotine type threshold lock.

– Type RF-120 Metal door. This door requires an airtight closure with double overlap (≥10 mm) with elastic joints in the door/frame position, as well as a guillotine type threshold lock.

4.1.5 Acoustic Insulation $R_A \geq 40$ dB(A)

Doors, usually metal doors, offer this insulation with thicknesses of around 150 mm. These doors require airtight perimetral closure. However, these doors are not practical in many buildings for a number of reasons (weight, safety etc.).

From an acoustic standpoint a system of double doors with a sound lock is preferable (foyer). In this system doors with lower levels of insulation can increase their total acoustic insulation.

The advantage of this system of double doors with a sound lock is that there hardly ever exists a direct sound transmission between the two rooms: there is always sound insulation from one of the doors.

If concealed absorbent material is placed in the sound lock (a 10 mm thick fitted carpet or rockwool absorber blanket 20 mm thick), it is even possible to increase the sound insulation offered by this system by a few decibels.

4.1.6 Observations

Type RF metal doors can have a wood veneer. Should a bullseye view hole be incorporated it is important to choose one which offers the same acoustic insulation as the door in to which it has been fitted.

Doors whose surface are of glass must be mounted on carpentry which permits overlapping or guillotine type closures, as explained in previous points.

4.2 Windows

The following recommendations are made concerning glass panels for windows, airtight carpentry or airtight lock (not sliding windows), aluminium or PVC or wood, with thermal bridging break.

4.2.1 Acoustic Insulation R_A=25 dB(A)

– Simple glass 10mm thick.

– Laminated glass 4/4mm thick.

– Insulating glass 4 + 6 + 6 thick.

4.2.2 Acoustic Insulation R_A=30 dB(A)

– Laminated glass 6/6 mm thick.

– Insulating glass 4 + 6 +8 mm thick.

4.2.3 Acoustic Insulation R_A=35 dB(A)

– Laminated glass 6/6/6 mm thick.

– Insulating glass 8 + 12 +6/6 mm thick.

4.2.4 Acoustic Insulation R_A=40 dB(A)

– Laminated glass 8/8/8/8 mm thick.

– Insulating glass 6/6+16+10/10.

The frames of the windows with airtight closures must offer double overlapping with elastic joints around the whole perimeter.

4.2.5 Acoustic Insulation R_A=45 dB(A)

Double windows composed of:

– Laminated glass 6/6 thick.

– Air cavity at least 50 mm thick.

– Insulating glass 4 + 6 + 4 thick.

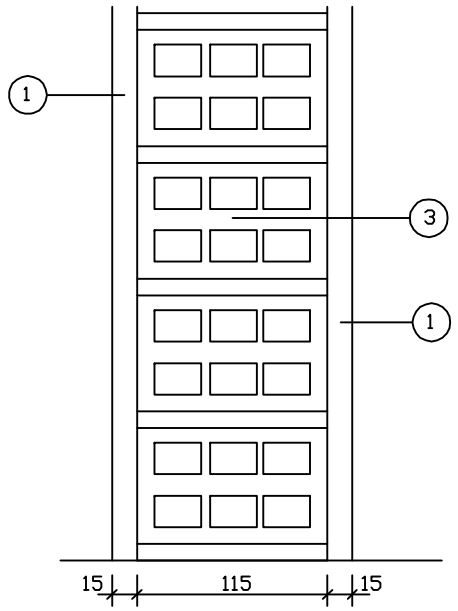
The frames of the windows with airtight closures must offer double overlapping with elastic joints around the whole perimeter in at least one window.

4.2.6 Acoustic Insulation R_A=50 dB(A)

When either windows or doors need to provide high levels of acoustic insulation then systems of double windows or doors must be installed. These must have airtight closures and in some cases maximum airtightness (fixed windows).

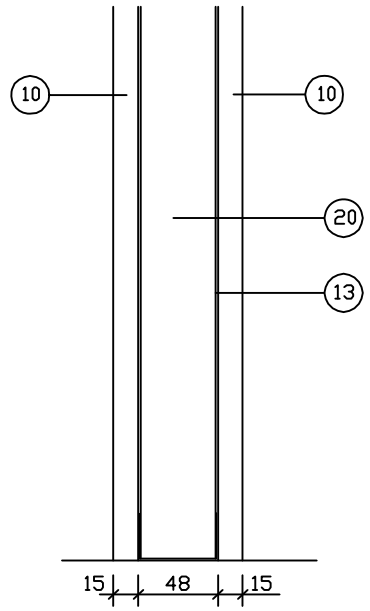
The greater the distance between the windows the greater the insulation offered by the system. In addition sound absorption is incorporated into the surface around the windows.

127Kg/m2



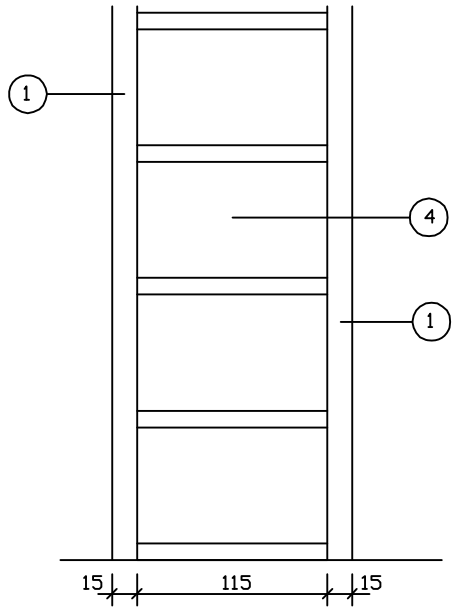
T35–A

26Kg/m2



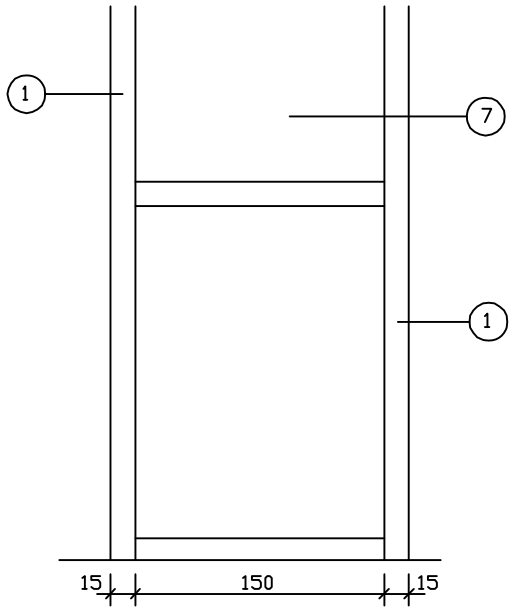
T35–B

149Kg/m2



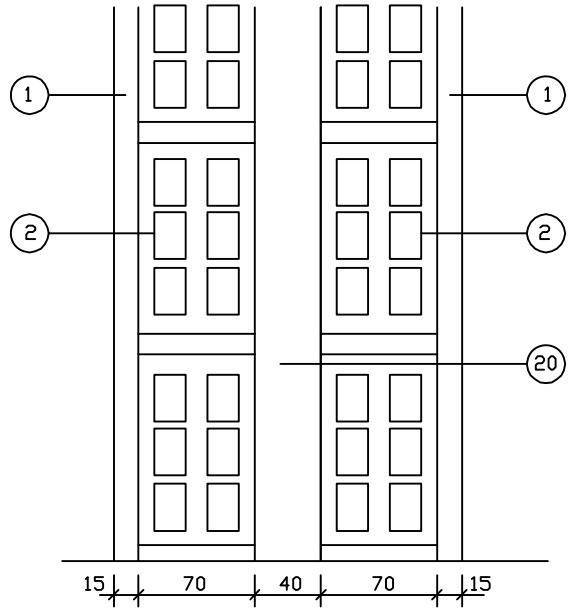
T40–A

186Kg/m2



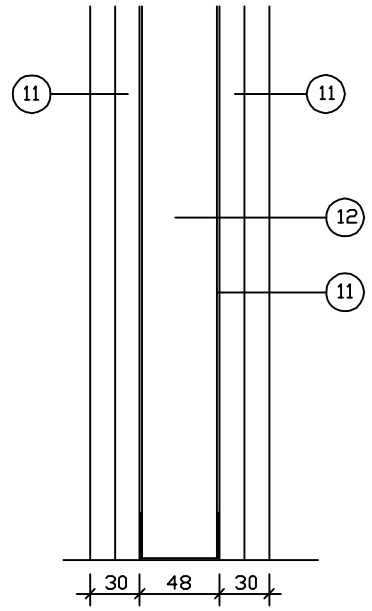
T40–B

120Kg/m2



T40–C

42Kg/m2



T40–D

NOMENCLATURE

1.– RENDERED OR PLASTERED
2.– DOUBLE HOLLOW BRICK WALL
3.– DOUBLE HOLLOW BRICK WALL(115mm)
4.– PERFORATED BRICK(115mm)
5.– PERFORATED BRICK(240mm)
6.– 8 cm CONCRETE BLOCK
7.– 15 cm CONCRETE BLOCK
8.– 25 cm CONCRETE BLOCK
9.– REINFORCED CONCRETE WALL

10.– PLASTER BOARD t=15mm
11.– PLASTER BOARD t=15+15mm
12.– PLASTER BOARD t=15+15+15mm
13.– FASTENER t=48mm
14.– FASTENER t=70mm
15.– PLASTER BOARD e=20mm

20.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=40 Kg/m3
21.– 20.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=70 Kg/m3
22.– 20.– GLASS OR ROCKWOOL BLANKET
t=60mm DENSIDAD >=70 Kg/m3
23.– EXTRUDED POLUSTURENNE
t=40mm DENSITY >=40 Kg/m3

DIMENSIONS IN MILIMMETERS

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TROYES AUDITORIUM (FRANCE)

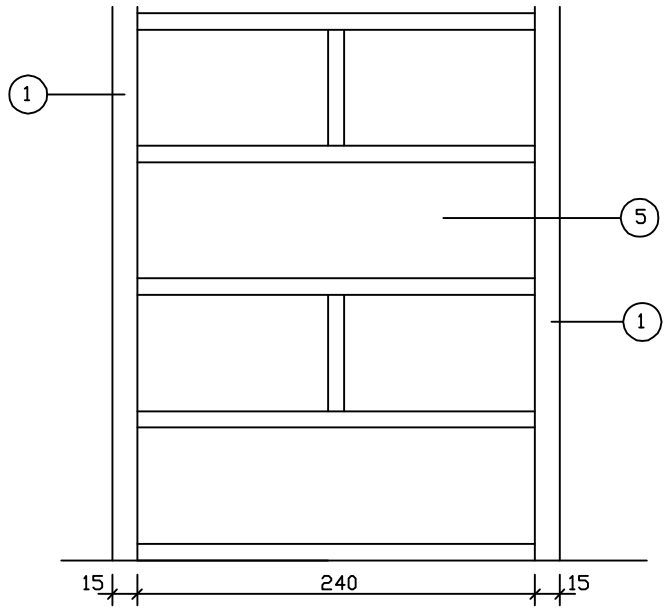
GENERAL SOLUTIONS

Building solutions for partitions, non-load bearing and load bearing walls

DATE ____ SEPTEMBER / 2009
SCALE ____ N/A

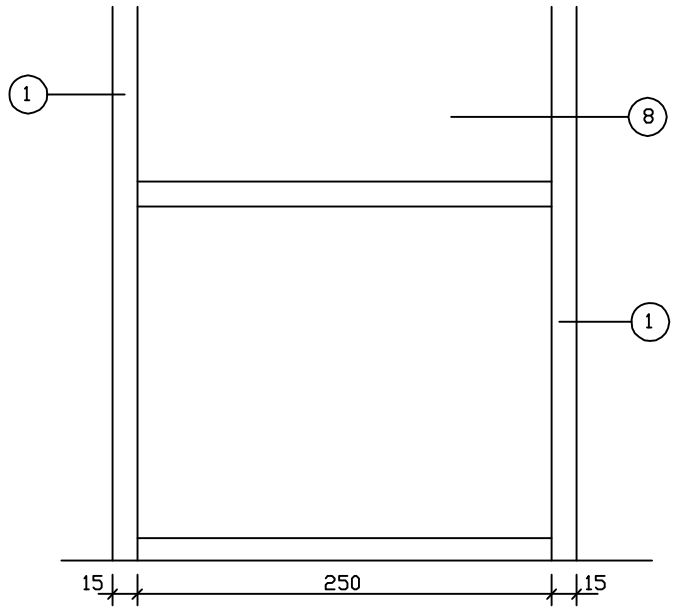
PLAN NUM. 01

280Kg/m2



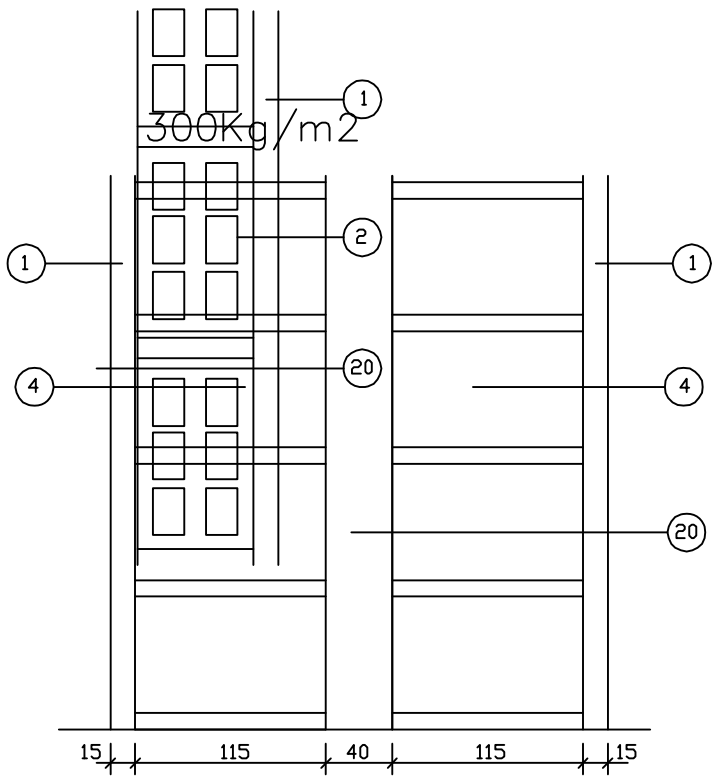
T45–A

290Kg/m2



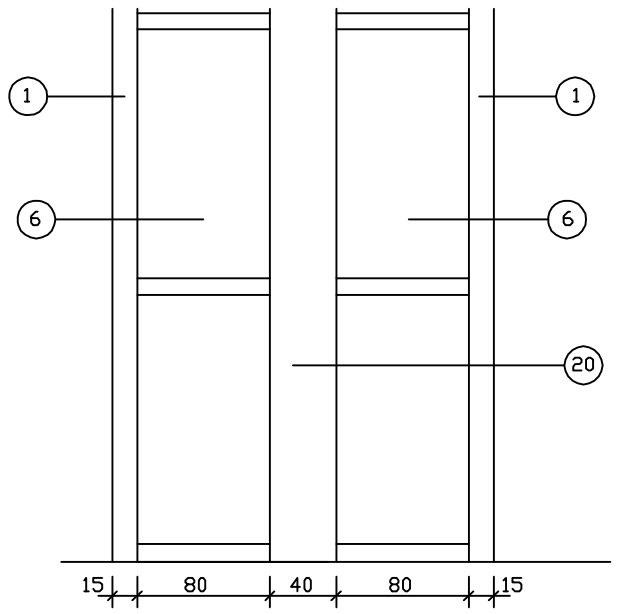
T45–B

300Kg/m2



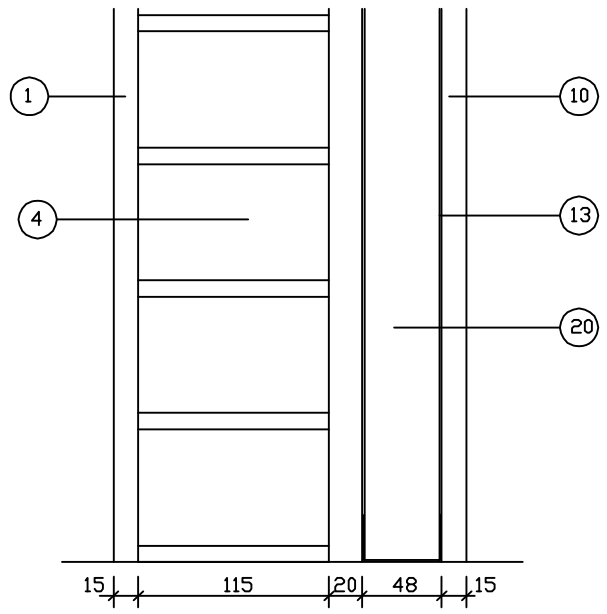
T45–C

230Kg/m2



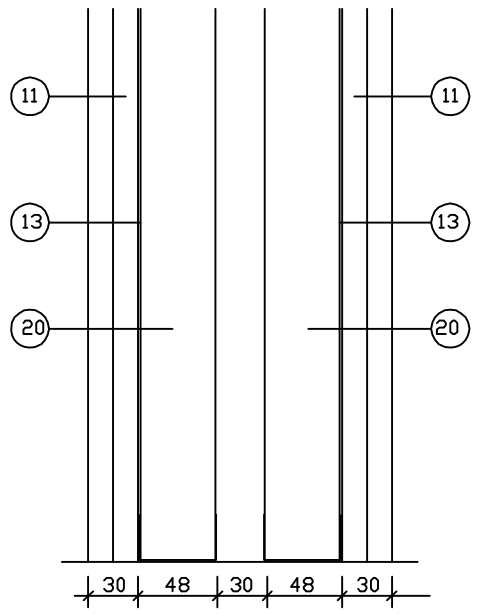
T45–D

175Kg/m2



T45–E

50Kg/m2



T45–F

NOMENCLATURE

1.– RENDERED OR PLASTERED
2.– DOUBLE HOLLOW BRICK WALL
3.– DOUBLE HOLLOW BRICK WALL(115mm)
4.– PERFORATED BRICK(115mm)
5.– PERFORATED BRICK(240mm)
6.– 8 cm CONCRETE BLOCK
7.– 15 cm CONCRETE BLOCK
8.– 25 cm CONCRETE BLOCK
9.– REINFORCED CONCRETE WALL

10.– PLASTER BOARD t=15mm
11.– PLASTER BOARD t=15+15mm
12.– PLASTER BOARD t=15+15+15mm
13.– FASTENER t=48mm
14.– FASTENER t=70mm
15.– PLASTER BOARD e=20mm

20.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=40 Kg/m3
21.– 20.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=70 Kg/m3
22.– 20.– GLASS OR ROCKWOOL BLANKET
t=60mm DENSIDAD >=70 Kg/m3
23.– EXTRUDED POLUSTURENNE
t=40mm DENSITY >=40 Kg/m3

DIMENSIONS IN MILIMMETERS

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TROYES AUDITORIUM (FRANCE)

GENERAL SOLUTIONS

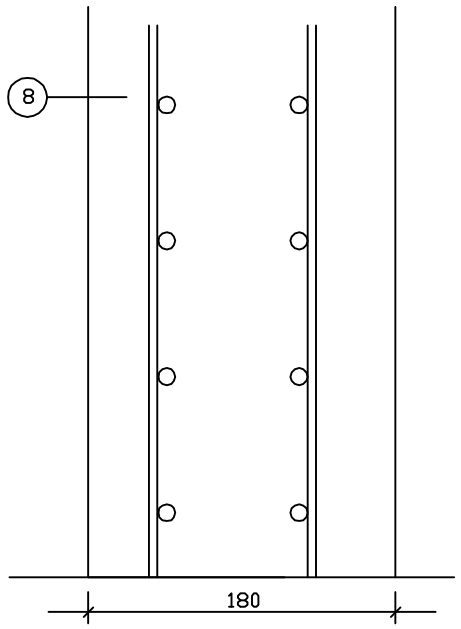
Building solutions for partitions, non-load bearing and load bearing walls

DATE ____ SEPTEMBER / 2009

SCALE ____ N/A

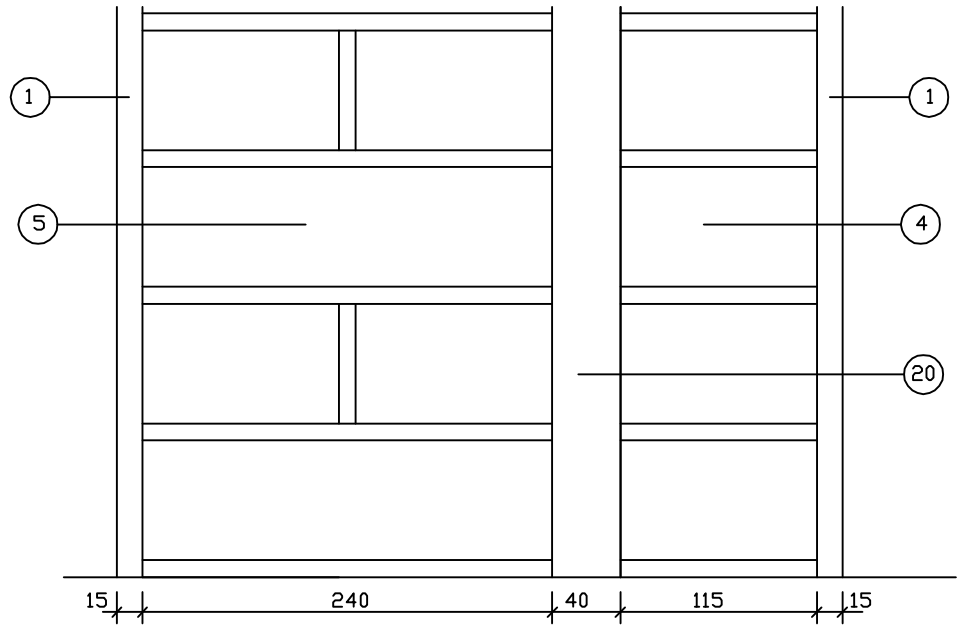
PLAN NUM. 02

450Kg/m2



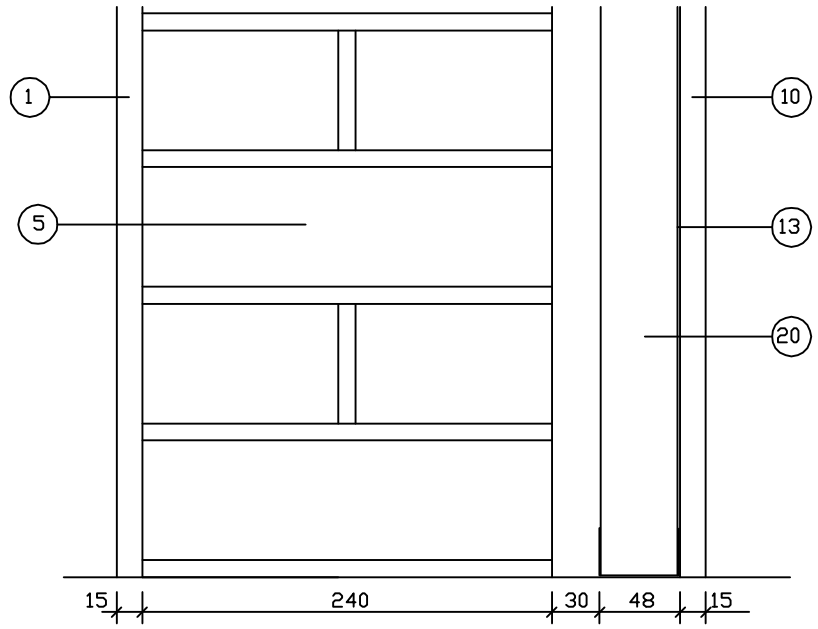
T50–A

400Kg/m2



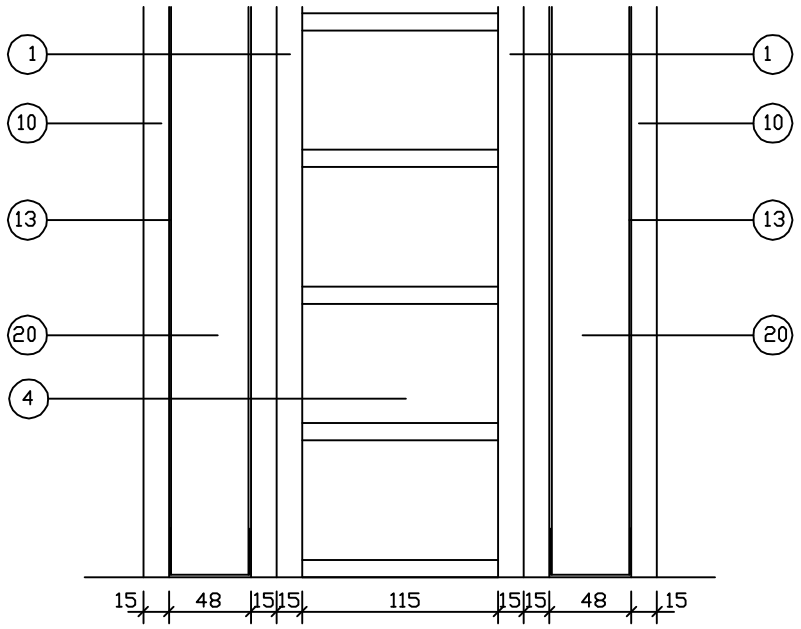
T50–B

300Kg/m2



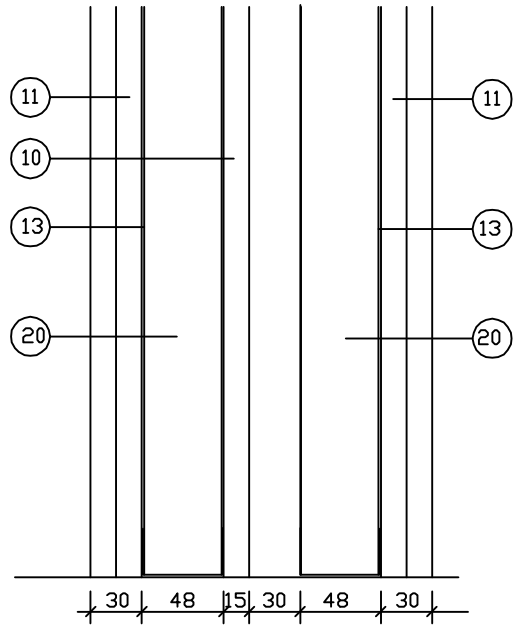
T50–C

195Kg/m2



T50–D

65Kg/m2



T50–E

NOMENCLATURE

1.– RENDERED OR PLASTERED
2.– DOUBLE HOLLOW BRICK WALL
3.– DOUBLE HOLLOW BRICK WALL(115mm)
4.– PERFORATED BRICK(115mm)
5.– PERFORATED BRICK(240mm)
6.– 8 cm CONCRETE BLOCK
7.– 15 cm CONCRETE BLOCK
8.– 25 cm CONCRETE BLOCK
9.– REINFORCED CONCRETE WALL

10.– PLASTER BOARD t=15mm
11.– PLASTER BOARD t=15+15mm
12.– PLASTER BOARD t=15+15+15mm
13.– FASTENER t=48mm
14.– FASTENER t=70mm
15.– PLASTER BOARD e=20mm

20.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=40 Kg/m3
21.– 20.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=70 Kg/m3
22.– 20.– GLASS OR ROCKWOOL BLANKET
t=60mm DENSIDAD >=70 Kg/m3
23.– EXTRUDED POLUSTURENNE
t=40mm DENSITY >=40 Kg/m3

DIMENSIONS IN MILIMMETERS

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TROYES AUDITORIUM (FRANCE)

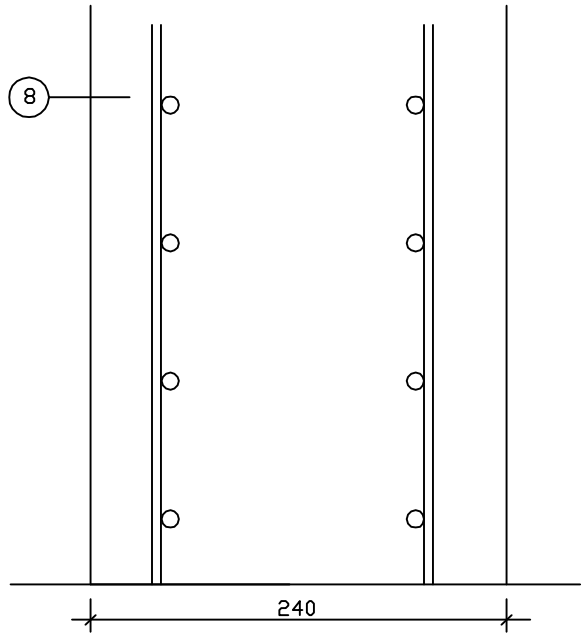
GENERAL SOLUTIONS

Building solutions for partitions, non-load bearing and load bearing walls

DATE ____ SEPTEMBER / 2009
SCALE ___ N/A

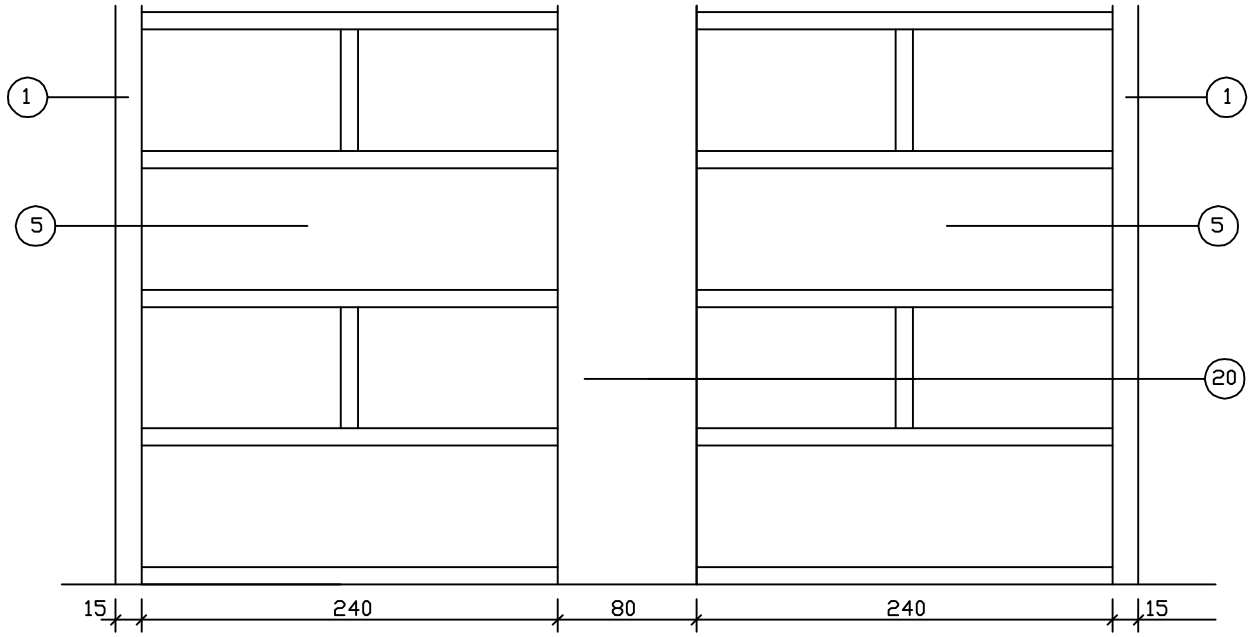
PLAN NUM. 03

600Kg/m2



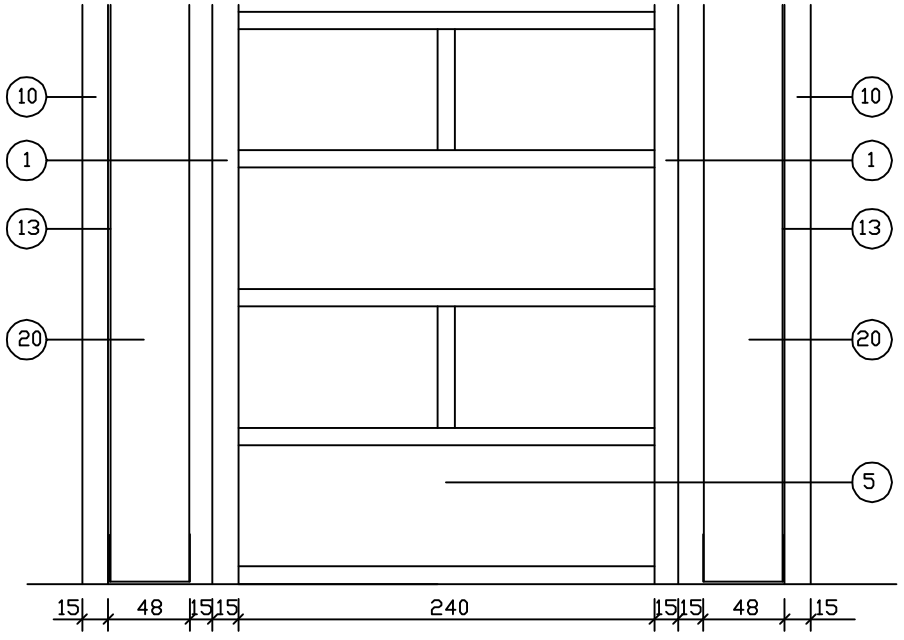
T55–A

550Kg/m2



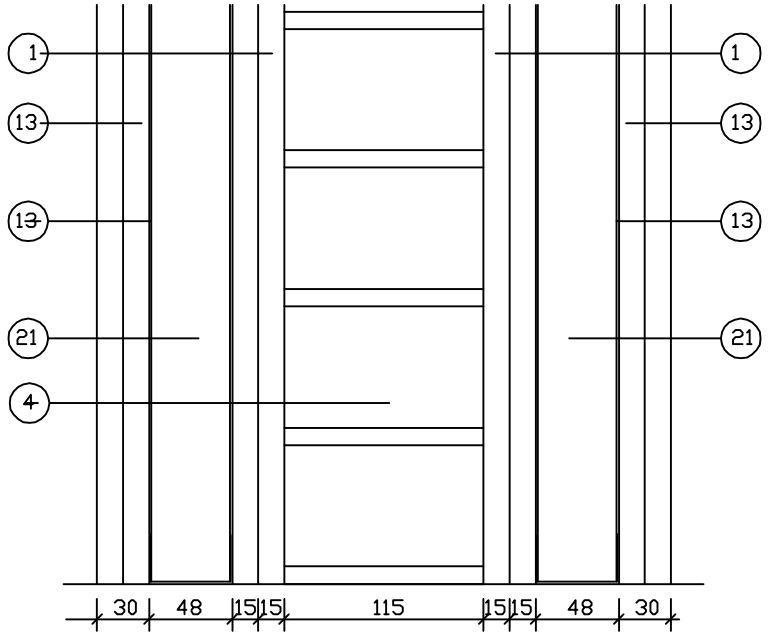
T55–B

310Kg/m2



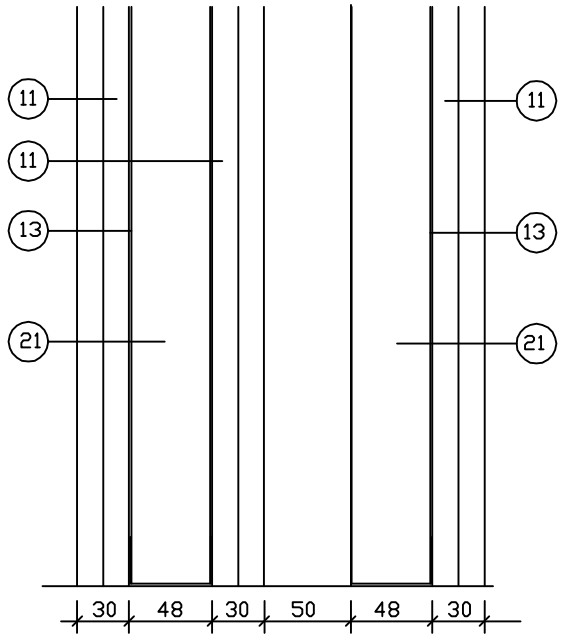
T55–C

205Kg/m2



T55–D

80Kg/m2



T55–E

NOMENCLATURE

1.– RENDERED OR PLASTERED
2.– DOUBLE HOLLOW BRICK WALL
3.– DOUBLE HOLLOW BRICK WALL(115mm)
4.– PERFORATED BRICK(115mm)
5.– PERFORATED BRICK(240mm)
6.– 8 cm CONCRETE BLOCK
7.– 15 cm CONCRETE BLOCK
8.– 25 cm CONCRETE BLOCK
9.– REINFORCED CONCRETE WALL

10.– PLASTER BOARD t=15mm
11.– PLASTER BOARD t=15+15mm
12.– PLASTER BOARD t=15+15+15mm
13.– FASTENER t=48mm
14.– FASTENER t=70mm
15.– PLASTER BOARD e=20mm

20.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=40 Kg/m3
21.– 20.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=70 Kg/m3
22.– 20.– GLASS OR ROCKWOOL BLANKET
t=60mm DENSIDAD >=70 Kg/m3
23.– EXTRUDED POLUSTURENNE
t=40mm DENSITY >=40 Kg/m3

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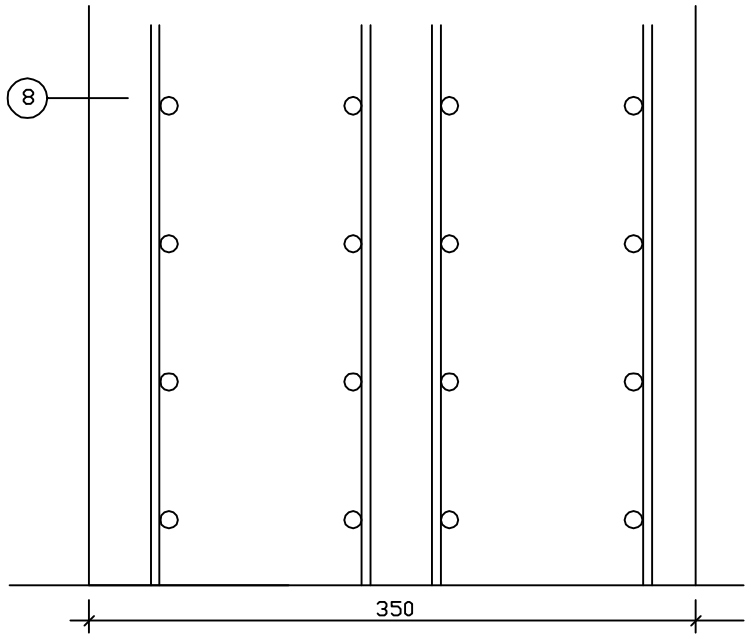
GENERAL SOLUTIONS

Building solutions for partitions, non-load bearing and load bearing walls

DATE ____ SEPTEMBER / 2009
SCALE ____ N/A

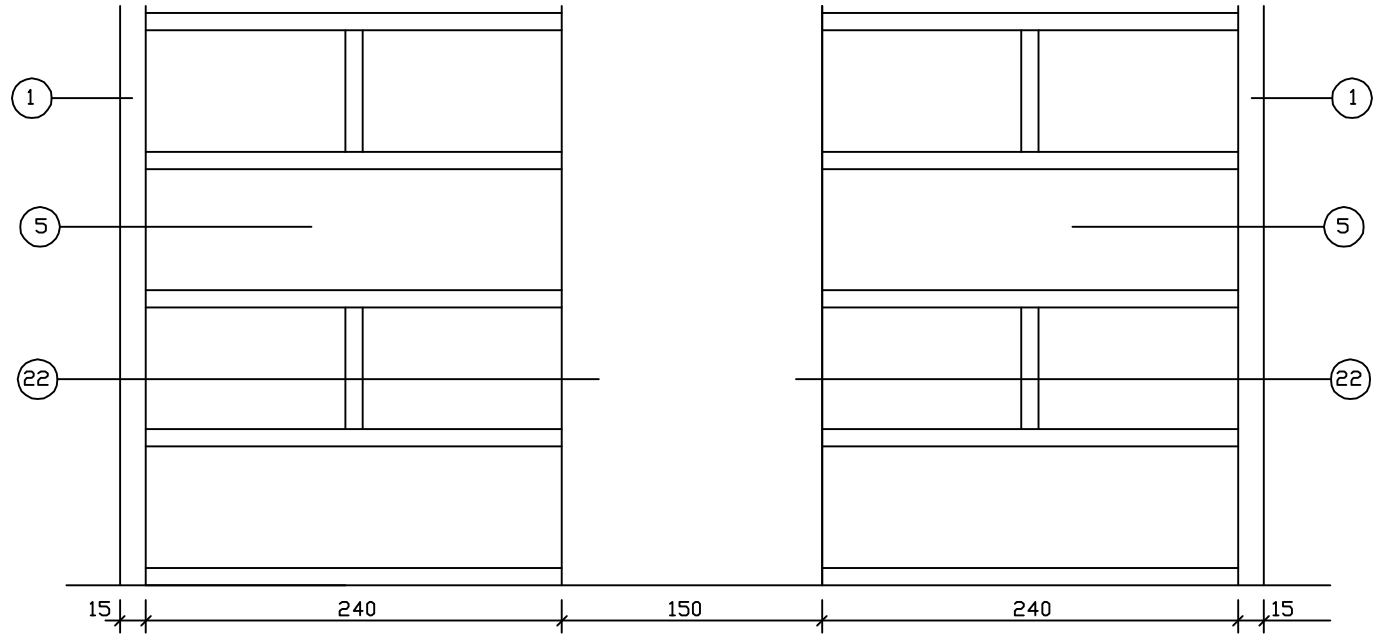
PLAN NUM. 04

875Kg/m2



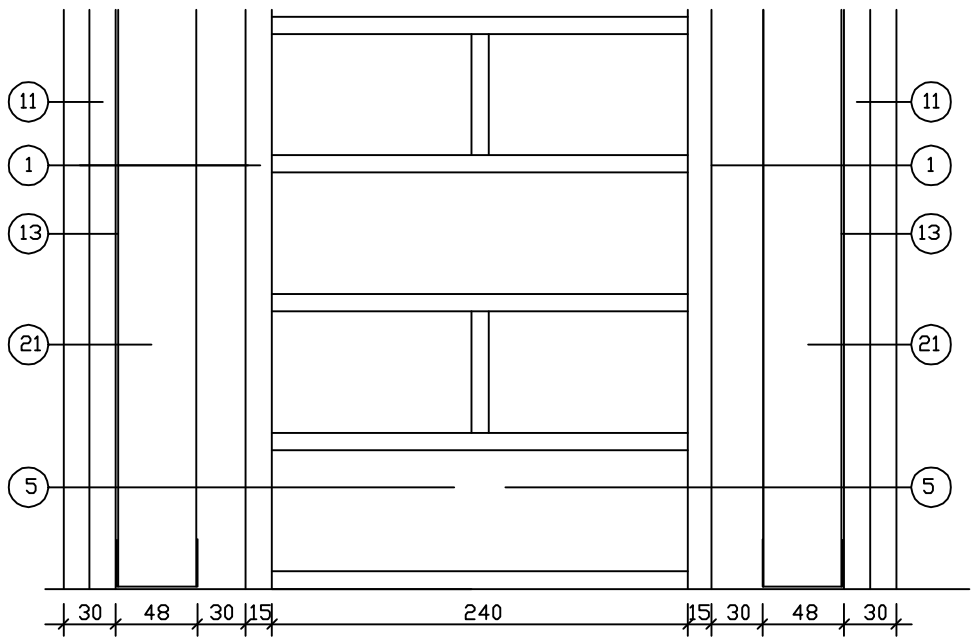
T60–A

550Kg/m2



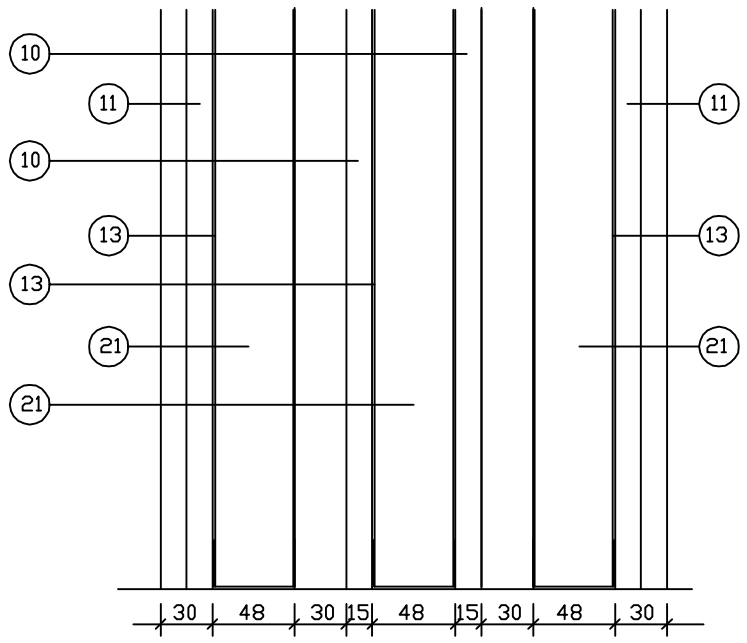
T60–B

330Kg/m2



T60–C

90Kg/m2



T60–D

NOMENCLATURE

1.– RENDERED OR PLASTERED
2.– DOUBLE HOLLOW BRICK WALL
3.– DOUBLE HOLLOW BRICK WALL(115mm)
4.– PERFORATED BRICK(115mm)
5.– PERFORATED BRICK(240mm)
6.– 8 cm CONCRETE BLOCK
7.– 15 cm CONCRETE BLOCK
8.– 25 cm CONCRETE BLOCK
9.– REINFORCED CONCRETE WALL

10.– PLASTER BOARD t=15mm
11.– PLASTER BOARD t=15+15mm
12.– PLASTER BOARD t=15+15+15mm
13.– FASTENER t=48mm
14.– FASTENER t=70mm
15.– PLASTER BOARD e=20mm

20.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=40 Kg/m3
21.– 20.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=70 Kg/m3
22.– 20.– GLASS OR ROCKWOOL BLANKET
t=60mm DENSIDAD >=70 Kg/m3
23.– EXTRUDED POLUSTURENNE
t=40mm DENSITY >=40 Kg/m3

DIMENSIONS IN MILIMMETERS

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TROYES AUDITORIUM (FRANCE)

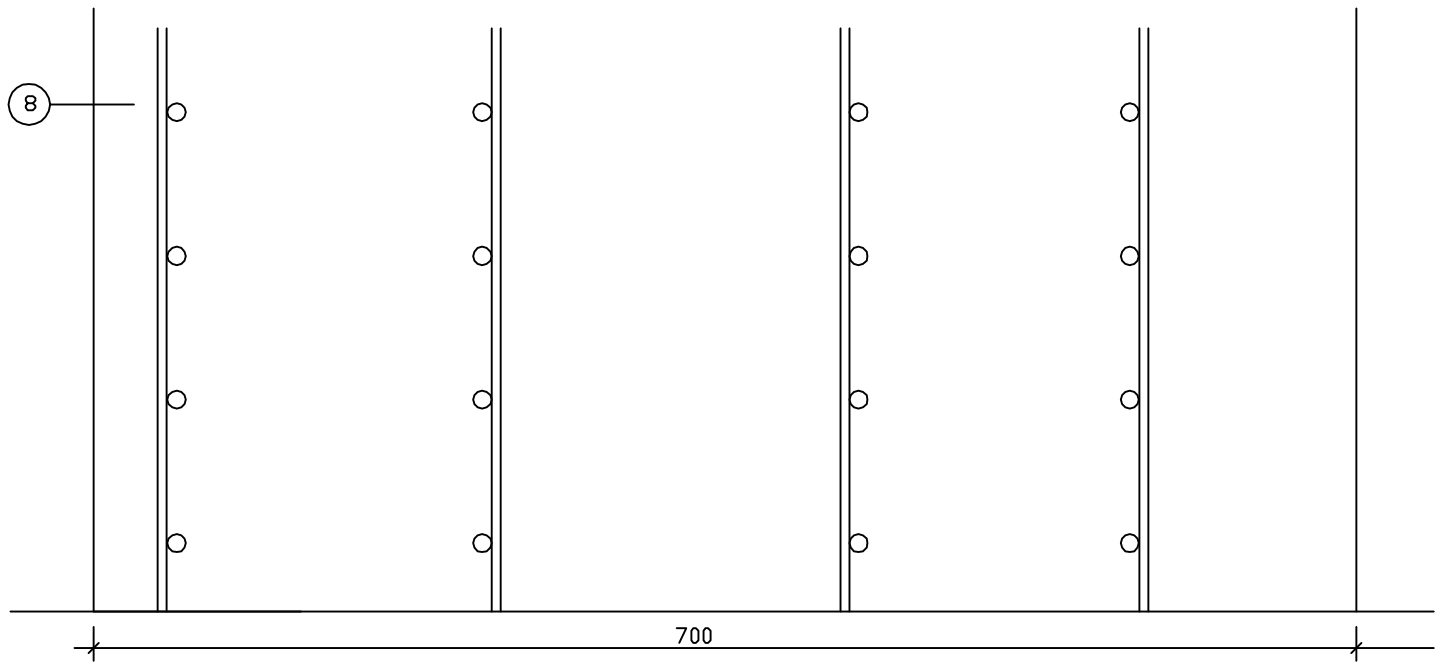
GENERAL SOLUTIONS

Building solutions for partitions, non-load bearing and load bearing walls

DATE ____ SEPTEMBER / 2009
SCALE ___ N/A

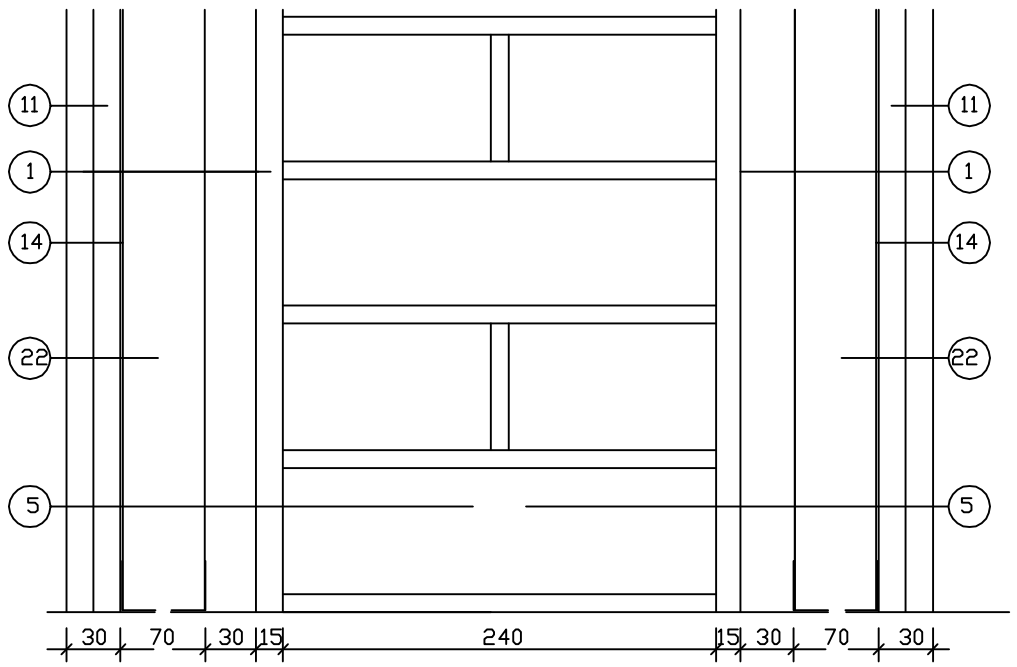
PLAN NUM. 05

1750Kg/m2



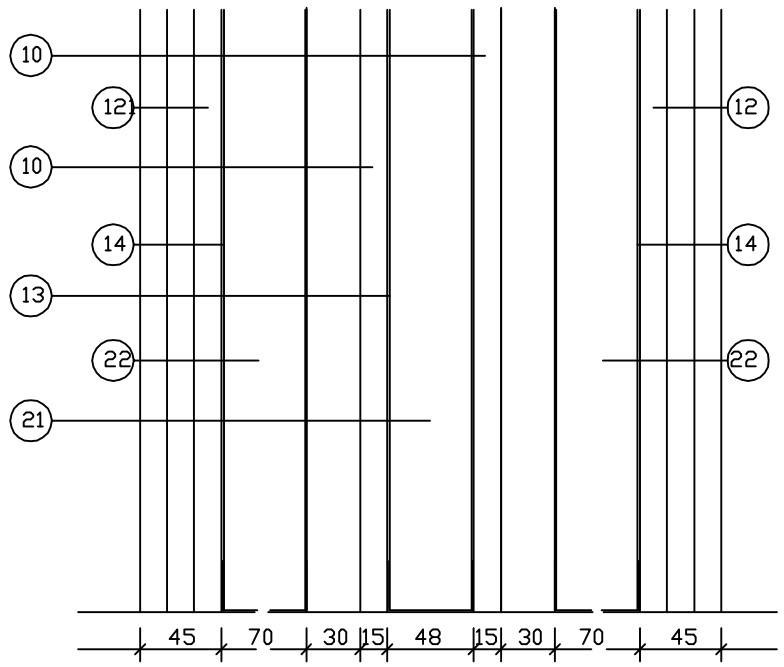
T65–A

360Kg/m2



T65–B

105Kg/m2



T65–C

NOMENCLATURE

1.– RENDERED OR PLASTERED
2.– DOUBLE HOLLOW BRICK WALL
3.– DOUBLE HOLLOW BRICK WALL(115mm)
4.– PERFORATED BRICK(115mm)
5.– PERFORATED BRICK(240mm)
6.– 8 cm CONCRETE BLOCK
7.– 15 cm CONCRETE BLOCK
8.– 25 cm CONCRETE BLOCK
9.– REINFORCED CONCRETE WALL

10.– PLASTER BOARD t=15mm
11.– PLASTER BOARD t=15+15mm
12.– PLASTER BOARD t=15+15+15mm
13.– FASTENER t=48mm
14.– FASTENER t=70mm
15.– PLASTER BOARD e=20mm

20.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=40 Kg/m3
21.– 20.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=70 Kg/m3
22.– 20.– GLASS OR ROCKWOOL BLANKET
t=60mm DENSIDAD >=70 Kg/m3
23.– EXTRUDED POLUSTURENNE
t=40mm DENSITY >=40 Kg/m3

DIMENSIONS IN MILIMMETERS

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ACOUSTIC PROJECT garcia-bbm

TROYES AUDITORIUM (FRANCE)

GENERAL SOLUTIONS

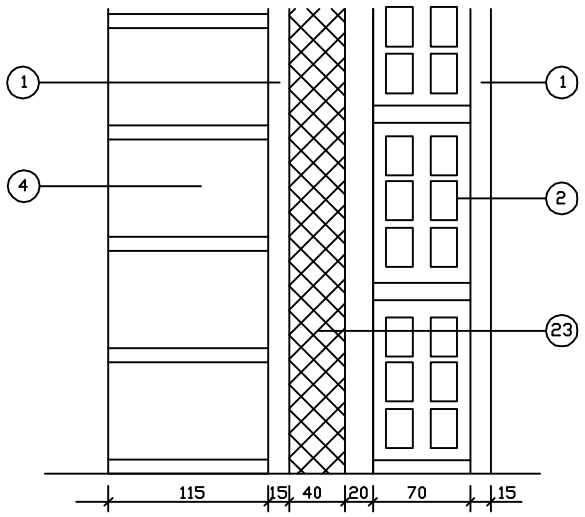
Building solutions for partitions, non-load bearing and load bearing walls

DATE ____ SEPTEMBER / 2009

SCALE ___ N/A

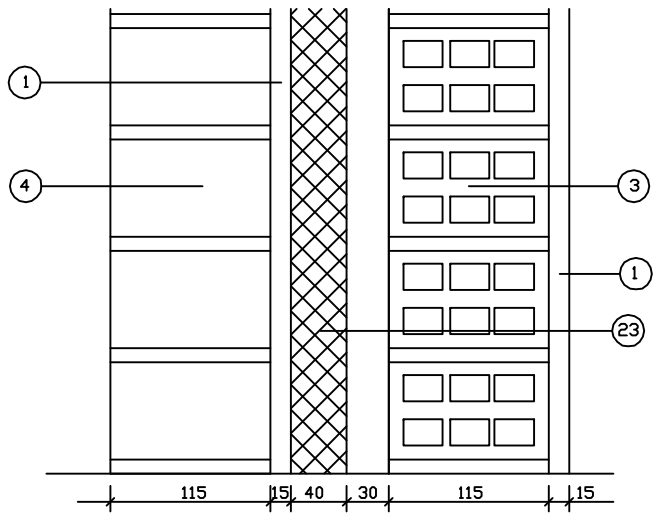
PLAN NUM. 06

210Kg/m2



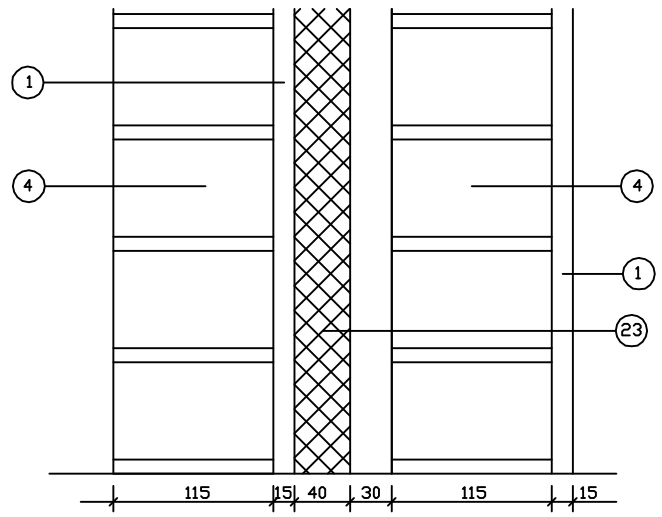
F45–A

270Kg/m2



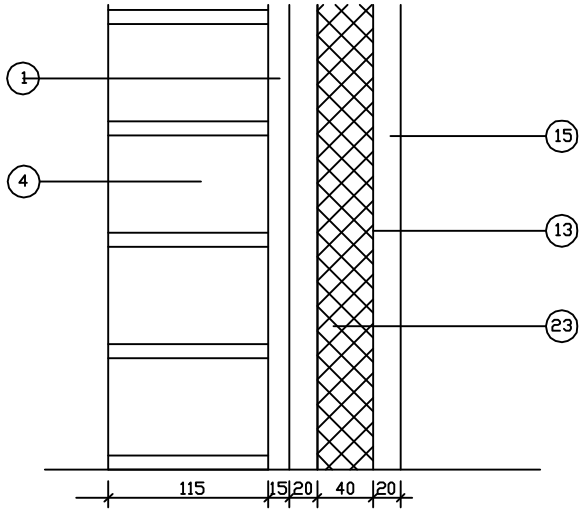
F50–A

290Kg/m2



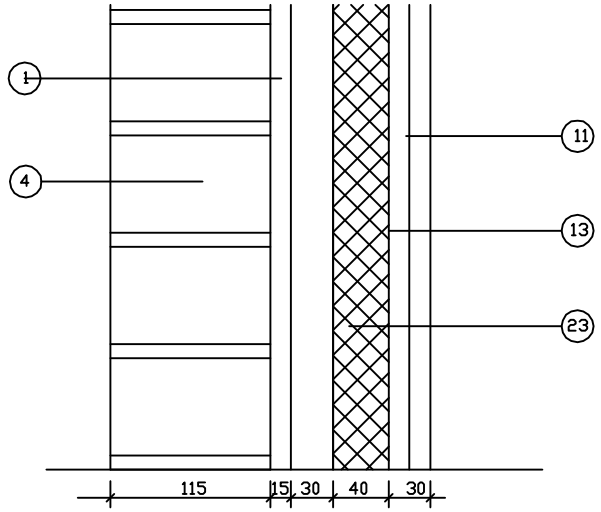
F55–A

160Kg/m2



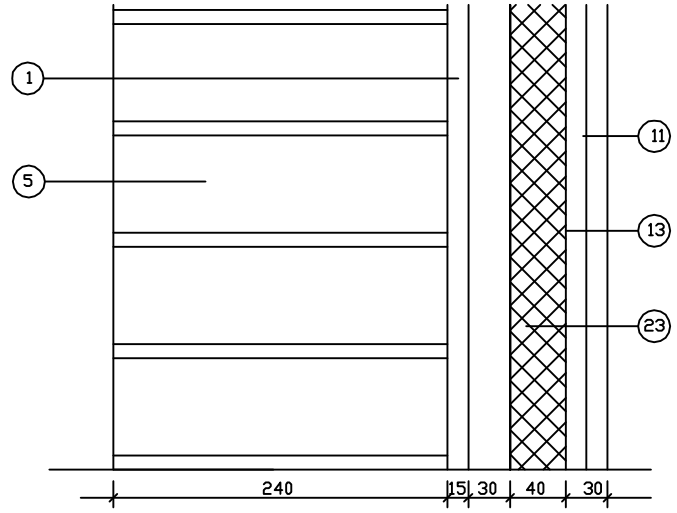
F45–B

170Kg/m2



F50–B

310Kg/m2



F55–B

NOMENCLATURE

1.– RENDERED OR PLASTERED
2.– DOUBLE HOLLOW BRICK WALL
3.– DOUBLE HOLLOW BRICK WALL(115mm)
4.– PERFORATED BRICK(115mm)
5.– PERFORATED BRICK(240mm)
6.– 8 cm CONCRETE BLOCK
7.– 15 cm CONCRETE BLOCK
8.– 25 cm CONCRETE BLOCK
9.– REINFORCED CONCRETE WALL

10.– PLASTER BOARD t=15mm
11.– PLASTER BOARD t=15+15mm
12.– PLASTER BOARD t=15+15+15mm
13.– FASTENER t=48mm
14.– FASTENER t=70mm
15.– PLASTER BOARD e=20mm

20.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=40 Kg/m3
21.– 20.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=70 Kg/m3
22.– 20.– GLASS OR ROCKWOOL BLANKET
t=60mm DENSIDAD >=70 Kg/m3
23.– EXTRUDED POLUSTURENNE
t=40mm DENSITY >=40 Kg/m3

DIMENSIONS IN MILIMMETERS

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TROYES AUDITORIUM (FRANCE)

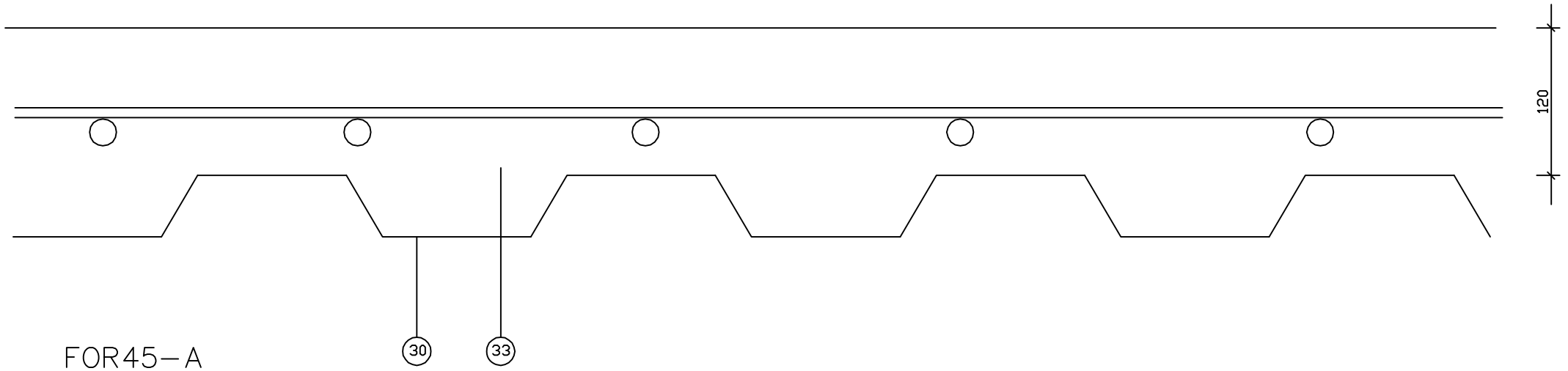
GENERAL SOLUTIONS

Building solutions for solid façades

DATE ____ SEPTEMBER / 2009
SCALE ____ N/A

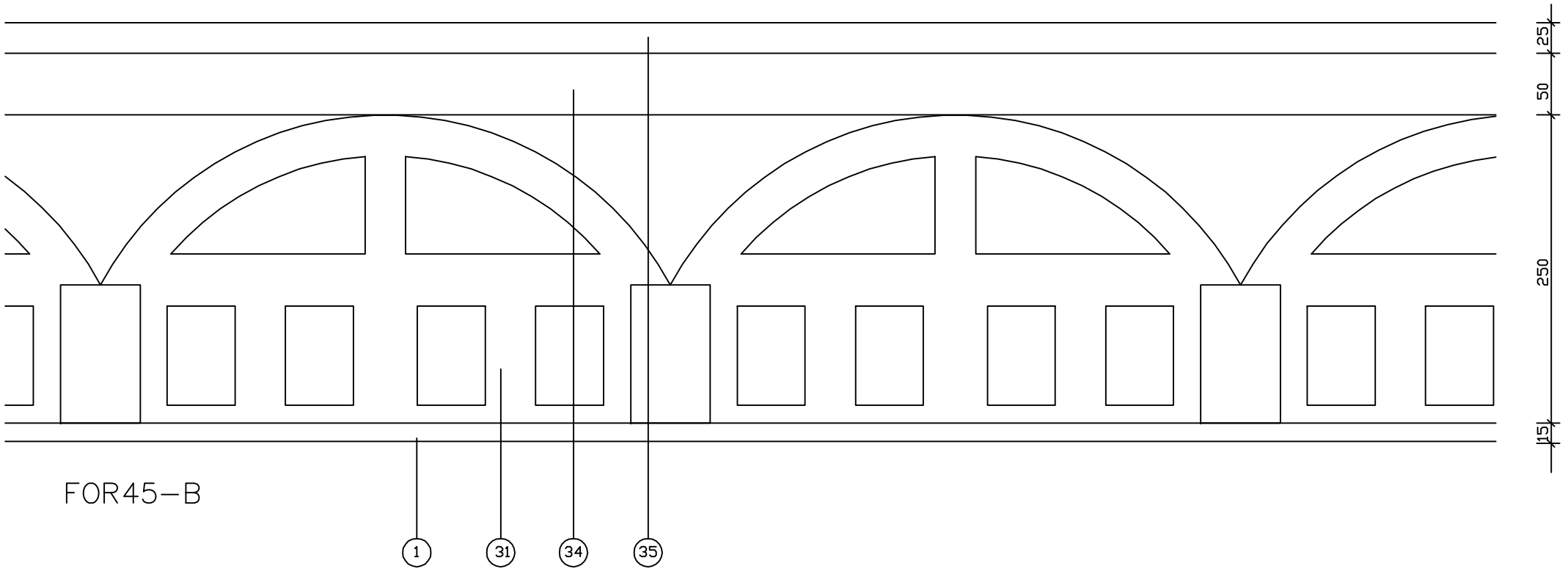
PLAN NUM. 07

300Kg/m2



FOR45–A

300–330Kg/m2



FOR45–B

NOMENCLATURE

1.– RENDERED OR PLASTERED
2.– DOUBLE HOLLOW BRICK WALL
3.– DOUBLE HOLLOW BRICK WALL(115mm)
4.– PERFORATED BRICK(115mm)
5.– PERFORATED BRICK(240mm)
6.– 8 cm CONCRETE BLOCK
7.– 15 cm CONCRETE BLOCK
8.– 25 cm CONCRETE BLOCK
9.– REINFORCED CONCRETE WALL

10.– PLASTER BOARD t=15mm
11.– PLASTER BOARD t=15+15mm
12.– PLASTER BOARD t=15+15+15mm
13.– FASTENER t=48mm
14.– FASTENER t=70mm
15.– PLASTER BOARD e=20mm

20.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=40 Kg/m3
21.– 20.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=70 Kg/m3
22.– 20.– GLASS OR ROCKWOOL BLANKET
t=60mm DENSIDAD >=70 Kg/m3
23.– EXTRUDED POLUSTURENNE
t=40mm DENSITY >=40 Kg/m3

30.– METAL DECK SHEET
31.– HOLLOWTILED FLOOR
32.– PREFABRICATED HOLLOW CORE SLAB
33.– RE–INFORCED CONCRETE
34.– SCREED
35.– FLOOR FINISH

DIMMENSIONS IN MILIMETERS

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TROYES AUDITORIUM (FRANCE)

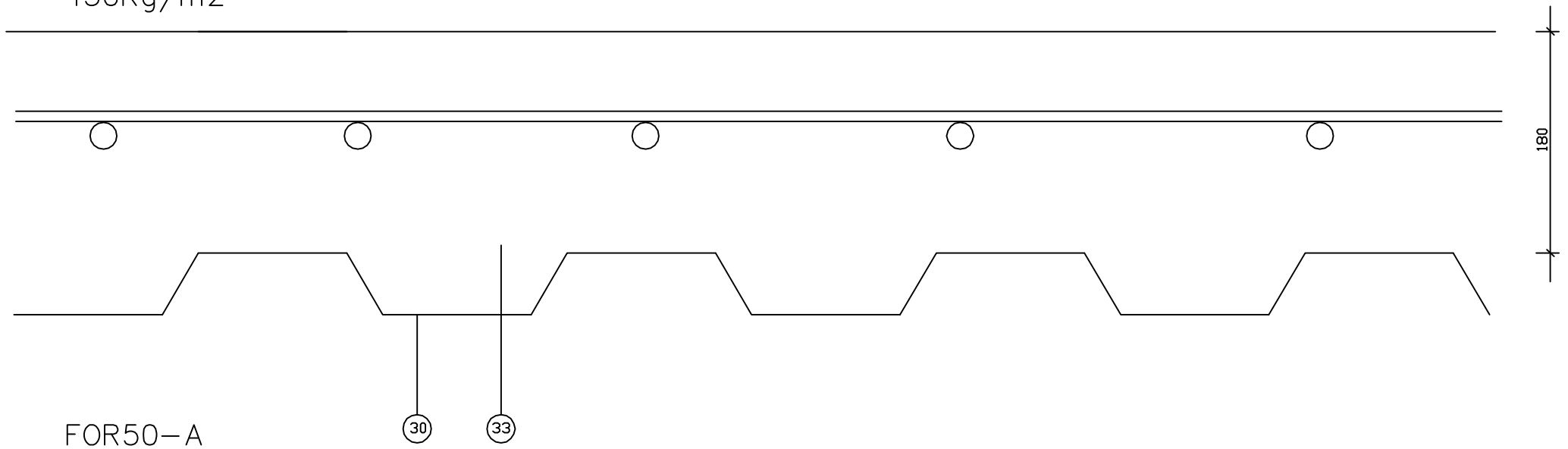
GENERAL SOLUTIONS

Building solutions for slabs

DATE ____ SEPTEMBER / 2009
SCALE ____ N/A

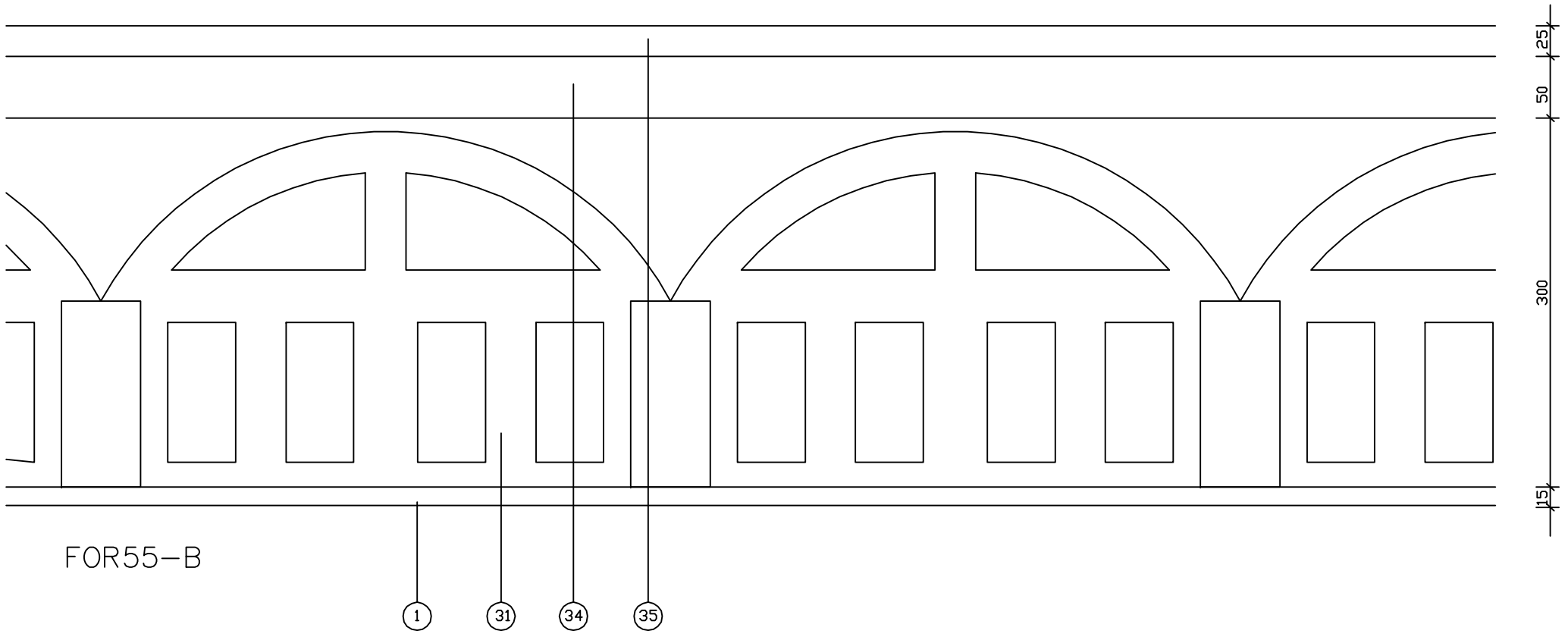
PLAN NUM. 08

450Kg/m2



FOR50–A

330–370Kg/m2



FOR55–B

NOMENCLATURE

1.– RENDERED OR PLASTERED
2.– DOUBLE HOLLOW BRICK WALL
3.– DOUBLE HOLLOW BRICK WALL(115mm)
4.– PERFORATED BRICK(115mm)
5.– PERFORATED BRICK(240mm)
6.– 8 cm CONCRETE BLOCK
7.– 15 cm CONCRETE BLOCK
8.– 25 cm CONCRETE BLOCK
9.– REINFORCED CONCRETE WALL

10.– PLASTER BOARD t=15mm
11.– PLASTER BOARD t=15+15mm
12.– PLASTER BOARD t=15+15+15mm
13.– FASTENER t=48mm
14.– FASTENER t=70mm
15.– PLASTER BOARD e=20mm

20.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=40 Kg/m3
21.– 20.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=70 Kg/m3
22.– 20.– GLASS OR ROCKWOOL BLANKET
t=60mm DENSIDAD >=70 Kg/m3
23.– EXTRUDED POLUSTURENNE
t=40mm DENSITY >=40 Kg/m3

30.– METAL DECK SHEET
31.– HOLLOWTILED FLOOR
32.– PREFABRICATED HOLLOW CORE SLAB
33.– RE–INFORCED CONCRETE
34.– SCREED
35.– FLOOR FINISH

DIMMENSIONS IN MILIMETERS

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TROYES AUDITORIUM (FRANCE)

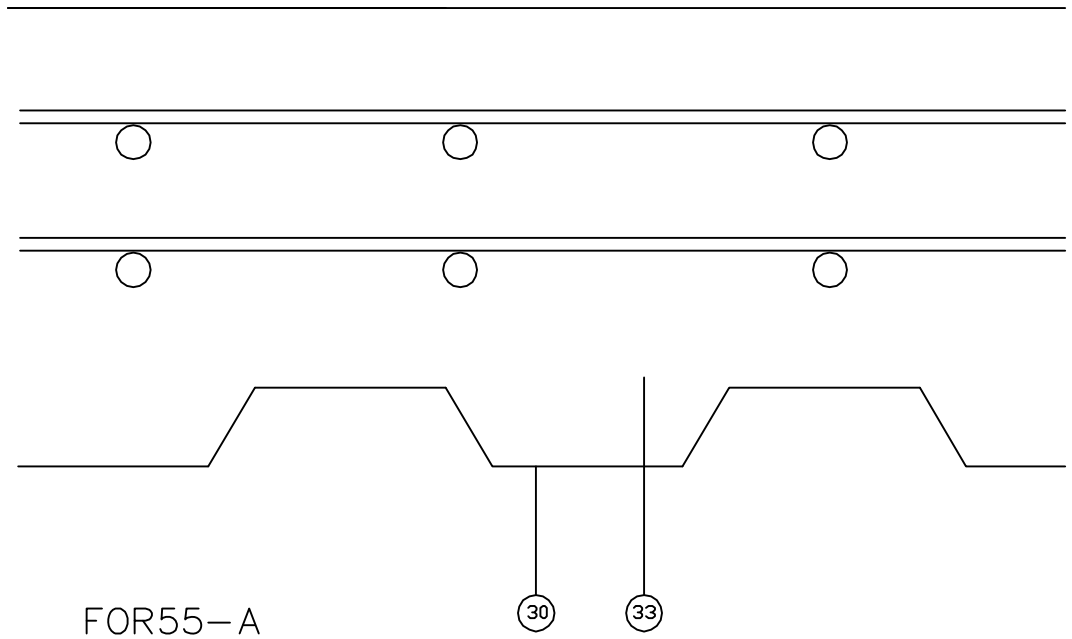
GENERAL SOLUTIONS

Building solutions for slabs

DATE ____ SEPTEMBER / 2009
SCALE ____ N/A

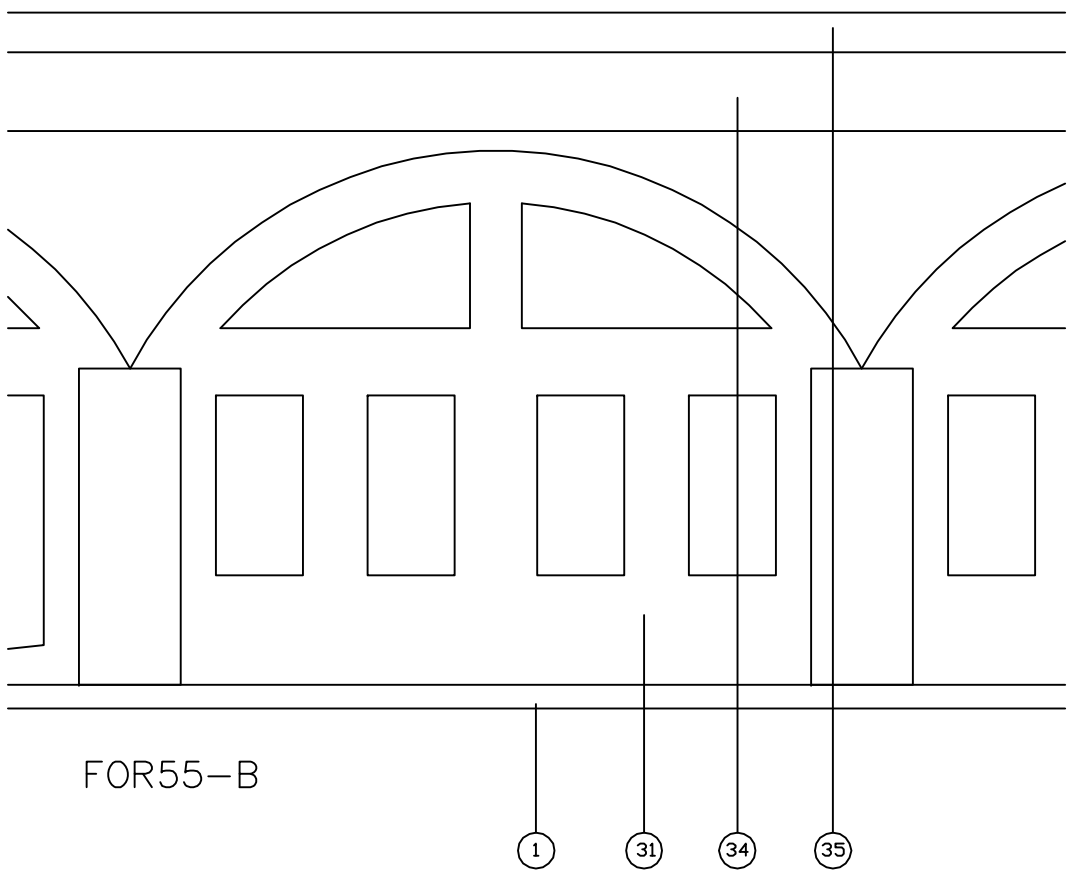
PLAN NUM. 09

600Kg/m2



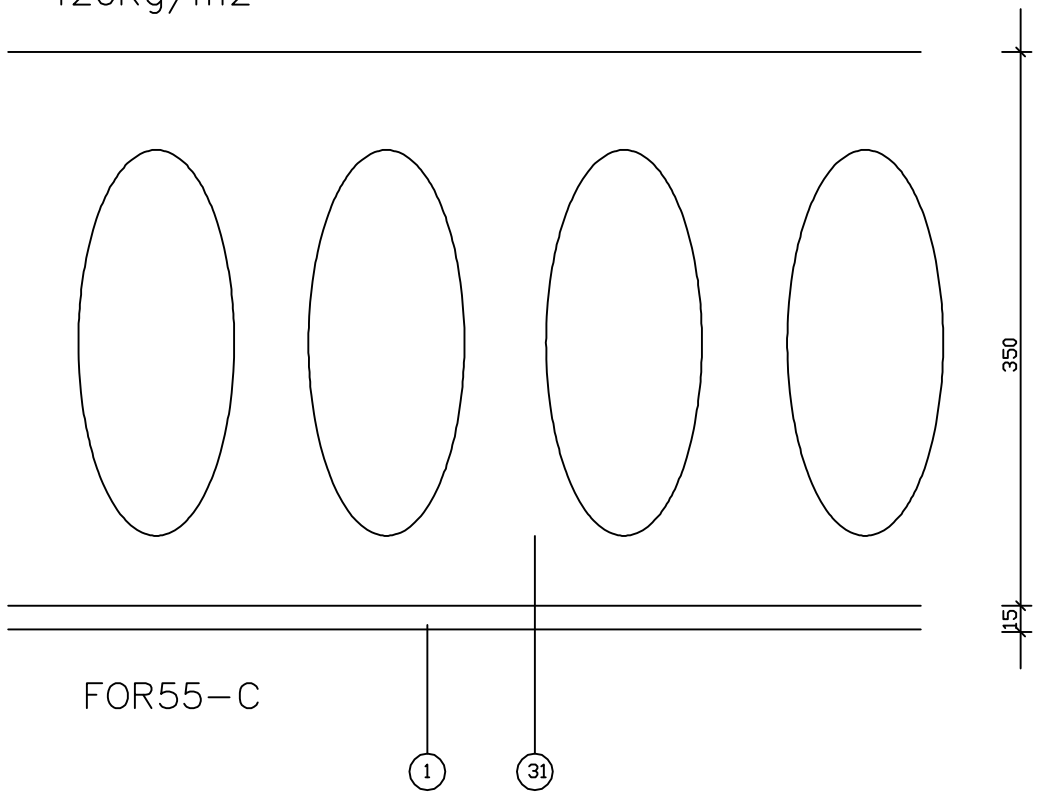
FOR55–A

370–410Kg/m2



FOR55–B

420Kg/m2



FOR55–C

NOMENCLATURE

1.– RENDERED OR PLASTERED
2.– DOUBLE HOLLOW BRICK WALL
3.– DOUBLE HOLLOW BRICK WALL(115mm)
4.– PERFORATED BRICK(115mm)
5.– PERFORATED BRICK(240mm)
6.– 8 cm CONCRETE BLOCK
7.– 15 cm CONCRETE BLOCK
8.– 25 cm CONCRETE BLOCK
9.– REINFORCED CONCRETE WALL

10.– PLASTER BOARD t=15mm
11.– PLASTER BOARD t=15+15mm
12.– PLASTER BOARD t=15+15+15mm
13.– FASTENER t=48mm
14.– FASTENER t=70mm
15.– PLASTER BOARD e=20mm

20.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=40 Kg/m3
21.– 20.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=70 Kg/m3
22.– 20.– GLASS OR ROCKWOOL BLANKET
t=60mm DENSIDAD >=70 Kg/m3
23.– EXTRUDED POLUSTURENNE
t=40mm DENSITY >=40 Kg/m3

30.– METAL DECK SHEET
31.– HOLLOWTILED FLOOR
32.– PREFABRICATED HOLLOW CORE SLAB
33.– RE–INFORCED CONCRETE
34.– SCREED
35.– FLOOR FINISH

DIMMENSIONS IN MILIMETERS

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TROYES AUDITORIUM (FRANCE)

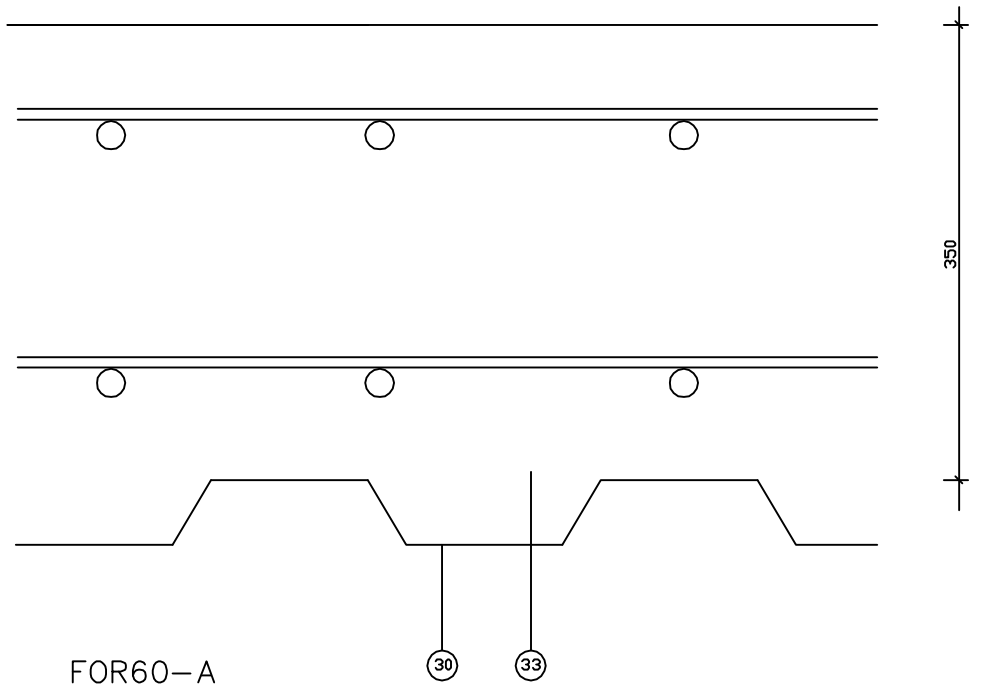
GENERAL SOLUTIONS

Building solutions for slabs

DATE ____ SEPTEMBER / 2009
SCALE ___ N/A

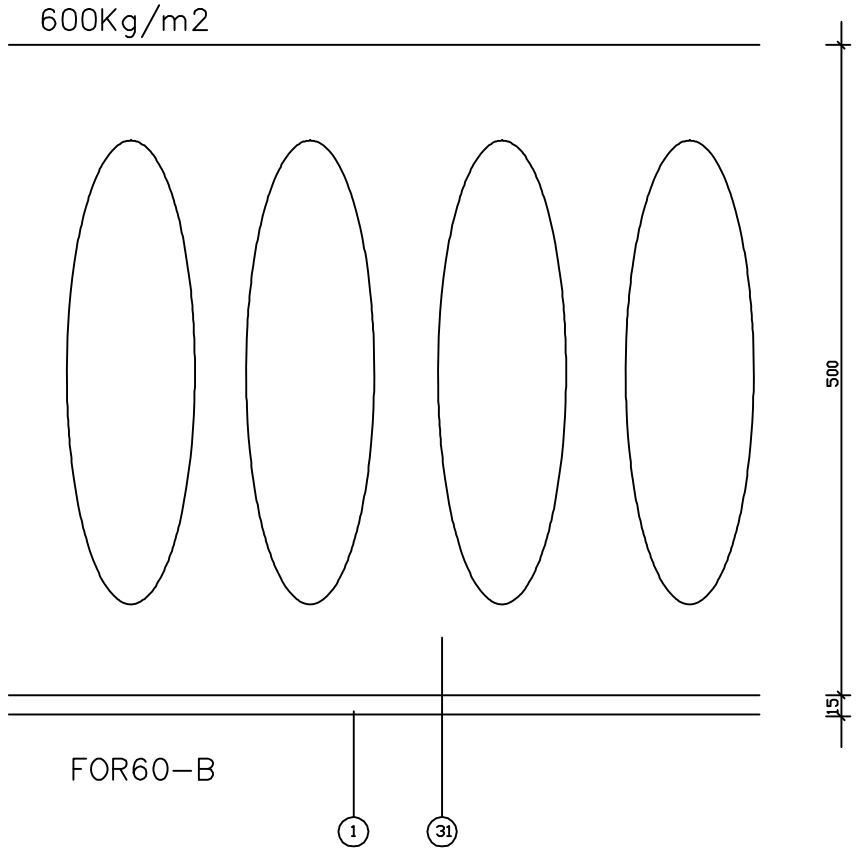
PLAN NUM. 10

875Kg/m2



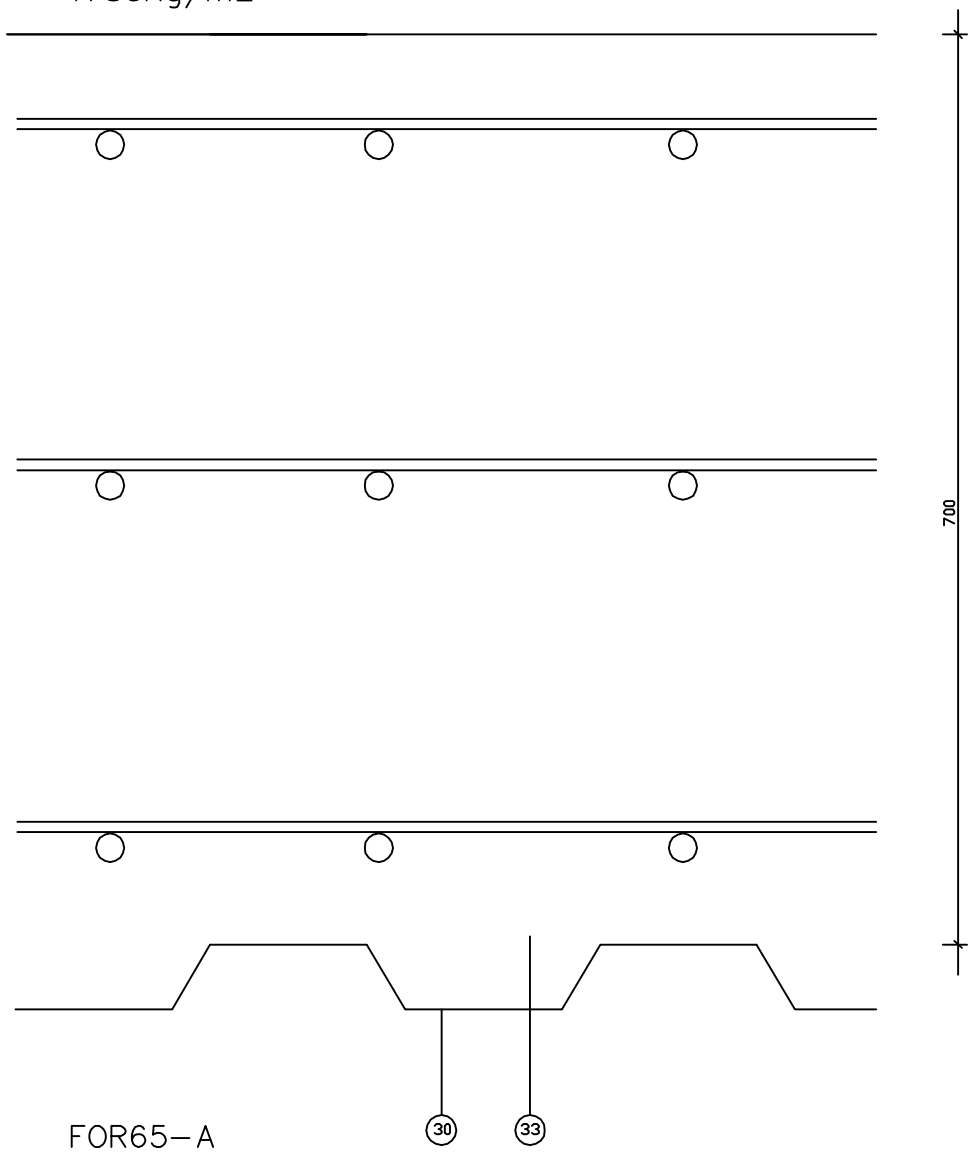
FOR60–A

600Kg/m2



FOR60–B

1750Kg/m2



FOR65–A

NOMENCLATURE

1.– RENDERED OR PLASTERED
2.– DOUBLE HOLLOW BRICK WALL
3.– DOUBLE HOLLOW BRICK WALL(115mm)
4.– PERFORATED BRICK(115mm)
5.– PERFORATED BRICK(240mm)
6.– 8 cm CONCRETE BLOCK
7.– 15 cm CONCRETE BLOCK
8.– 25 cm CONCRETE BLOCK
9.– REINFORCED CONCRETE WALL

10.– PLASTER BOARD t=15mm
11.– PLASTER BOARD t=15+15mm
12.– PLASTER BOARD t=15+15+15mm
13.– FASTENER t=48mm
14.– FASTENER t=70mm
15.– PLASTER BOARD e=20mm

20.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=40 Kg/m3
21.– 20.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=70 Kg/m3
22.– 20.– GLASS OR ROCKWOOL BLANKET
t=60mm DENSIDAD >=70 Kg/m3
23.– EXTRUDED POLUSTURENNE
t=40mm DENSITY >=40 Kg/m3

30.– METAL DECK SHEET
31.– HOLLOWTILED FLOOR
32.– PREFABRICATED HOLLOW CORE SLAB
33.– RE–INFORCED CONCRETE
34.– SCREED
35.– FLOOR FINISH

DIMMENSIONS IN MILIMETERS

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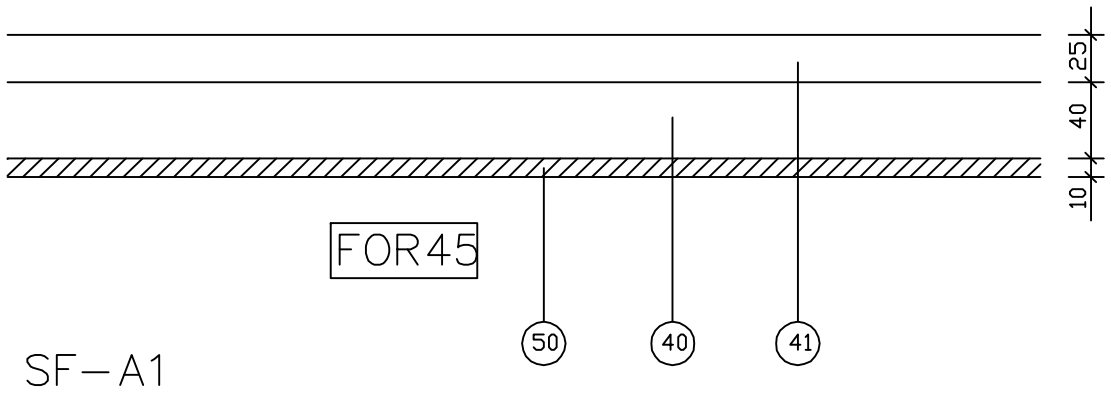
TROYES AUDITORIUM (FRANCE)

GENERAL SOLUTIONS

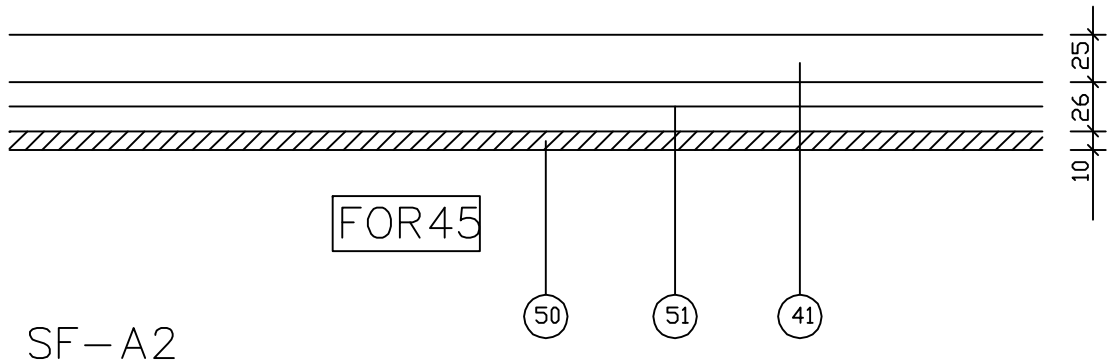
Building solutions for slabs

DATE SEPTEMBER / 2009
SCALE N/A

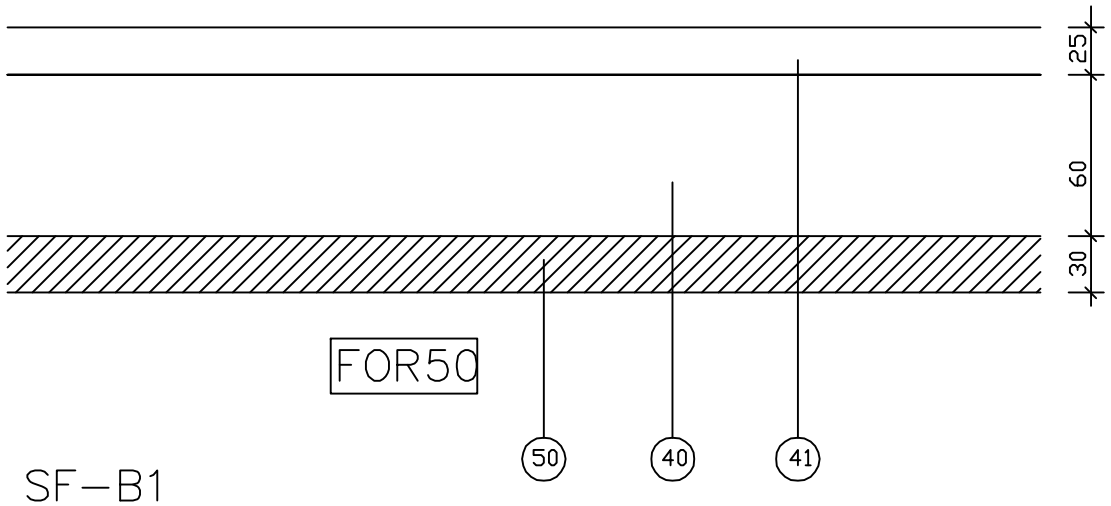
PLAN NUM. 11



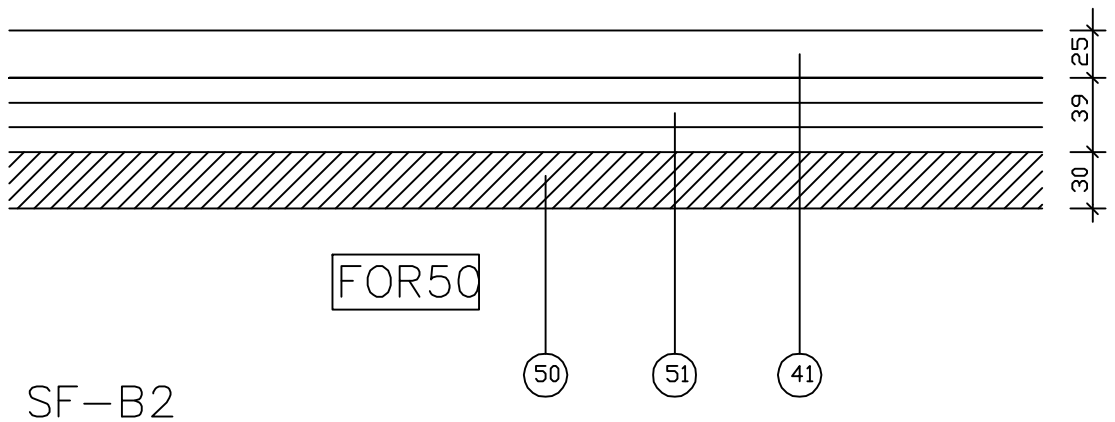
SF–A1



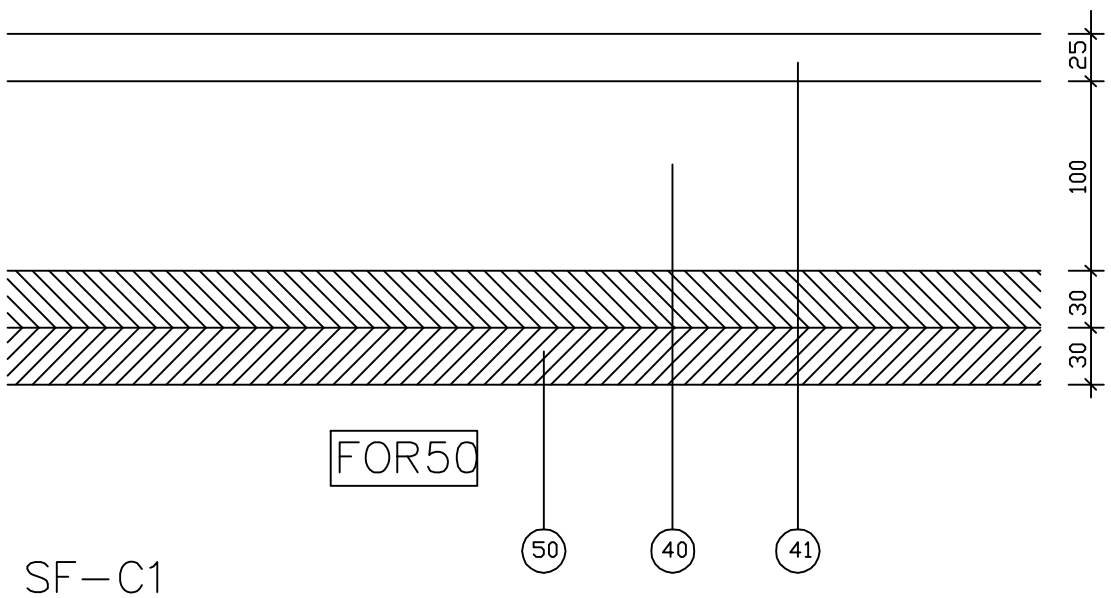
SF–A2



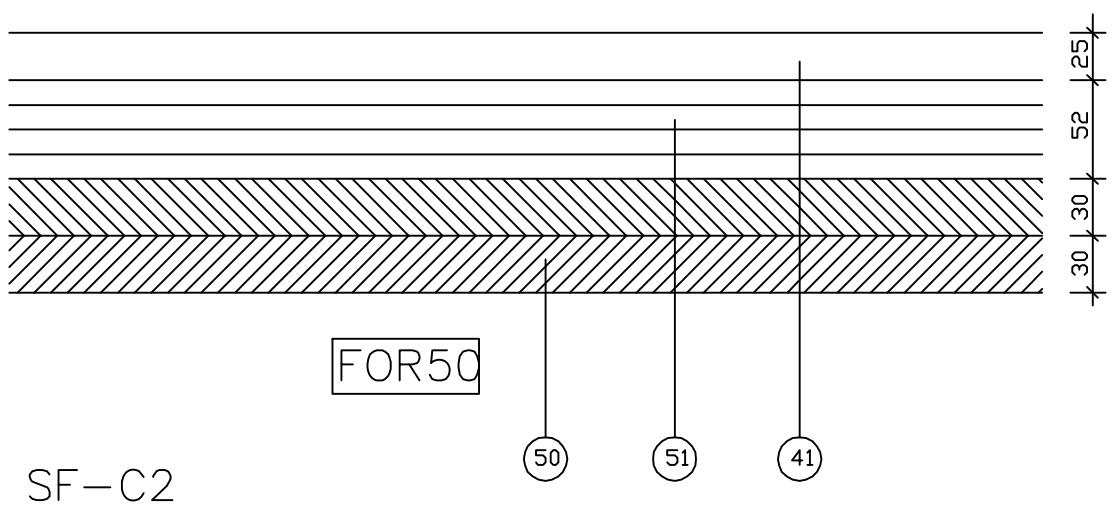
SF–B1



SF–B2



SF–C1



SF–C2

NOMENCLATURE

1.– RENDERED OR PLASTERED

10.– PLASTER BOARD t=15mm
11.– PLASTER BOARD t=15+15mm
13.– FASTENER t=48mm

20.– GLASS OR ROCKWOOL BLANKET t=40mm DENSITY >=40 Kg/m3
21.– GLASS OR ROCKWOOL BLANKET t=40mm DENSITY >=70 Kg/m3
22.– GLASS OR ROCKWOOK BLANKET t=60mm DENSITY >=70 Kg/m3

40.– SCREED
41.– FLOOR FINISHED

50.– ELASTIC MATERIAL
51.– THREE LAYERS OF PASTER BOARD e=13mm/placa
52.– ABSORBENT PLATES

60.– CEILING ANTIVIBRATOR

DIMENSIONS IN MILIMMETERS

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TROYES AUDITORIUM (FRANCE)

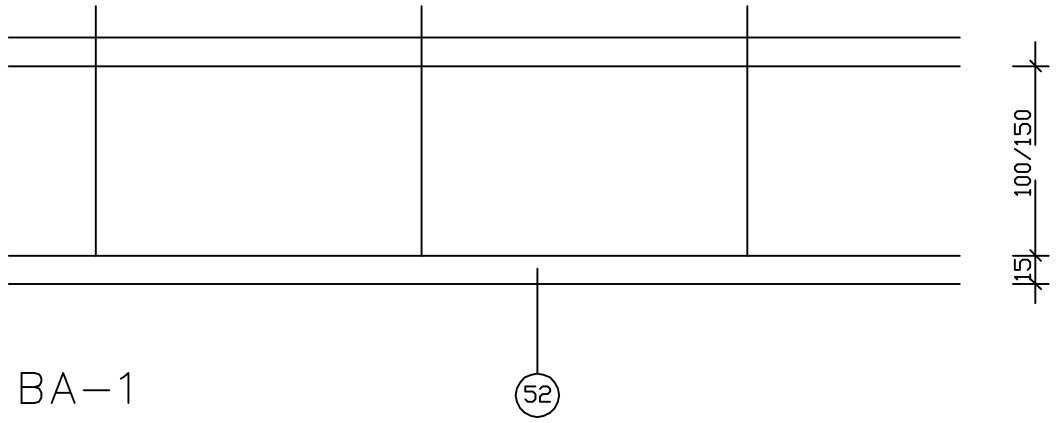
GENERAL SOLUTIONS

Building solutions for floating floors

DATE ____ SEPTEMBER / 2009
SCALE ____ N/A

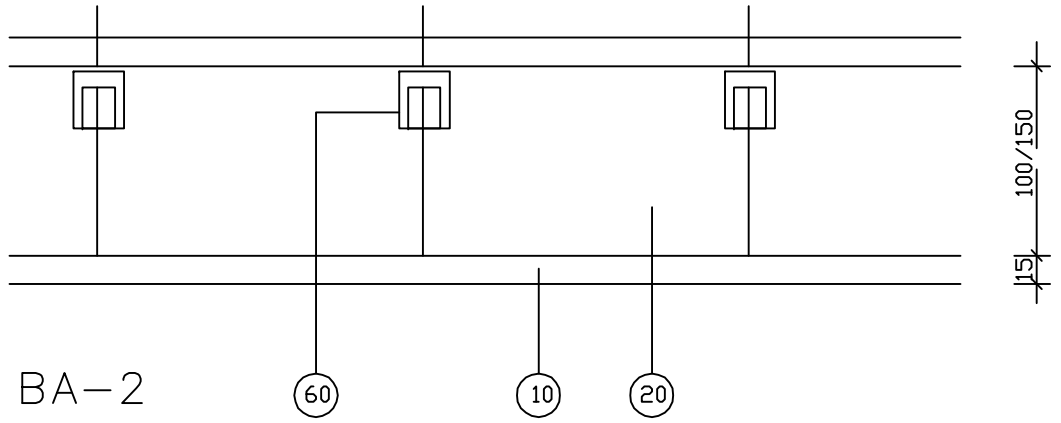
PLAN NUM. 12

FOR45



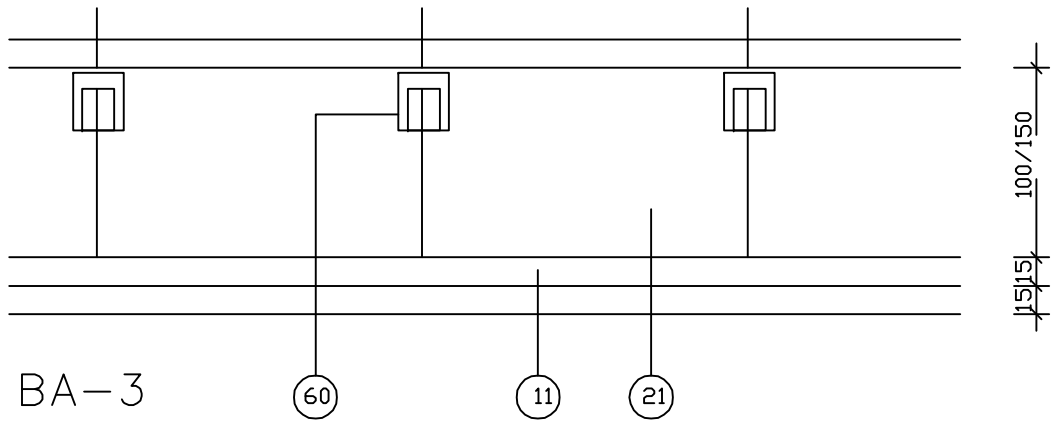
BA–1

FOR45



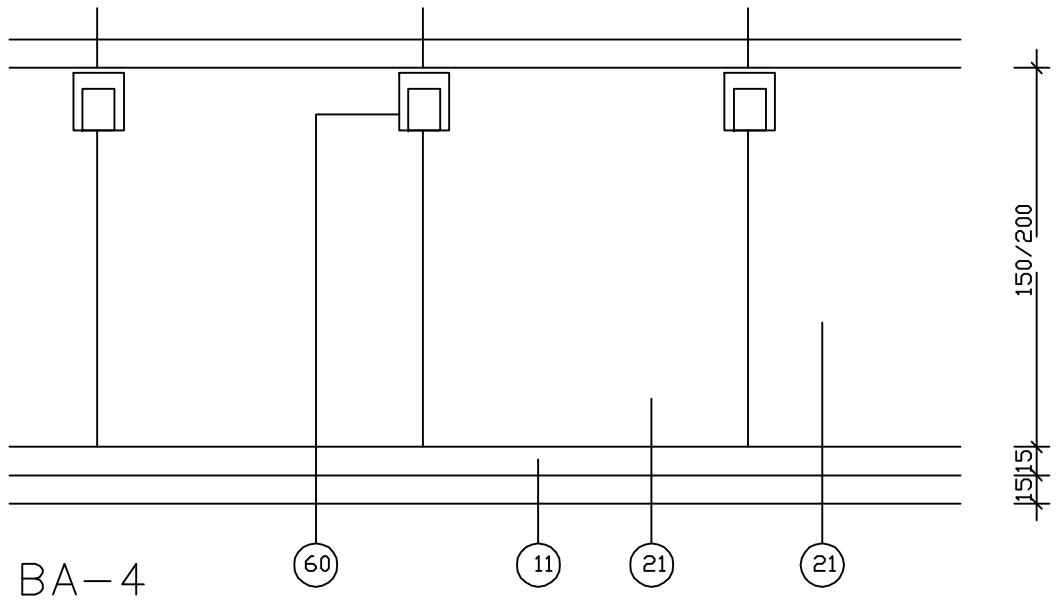
BA–2

FOR50



BA–3

FOR50



BA–4

NOMENCLATURE

1.– RENDERED OR PLASTERED

10.– PLASTER BOARD t=15mm
11.– PLASTER BOARD t=15+15mm
13.– FASTENER t=48mm

20.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=40 Kg/m3
21.– GLASS OR ROCKWOOL BLANKET
t=40mm DENSITY >=70 Kg/m3
22.– GLASS OR ROCKWOOK BLANKET
t=60mm DENSITY >=70 Kg/m3

40.– SCREED
41.– FLOOR FINISHED

50.– ELASTIC MATERIAL
51.– THREE LAYERS OF PASTER BOARD
e=13mm/placa
52.– ABSORBENT PLATES

60.– CEILING ANTIVIBRATOR

DIMENSIONS IN MILIMMETERS

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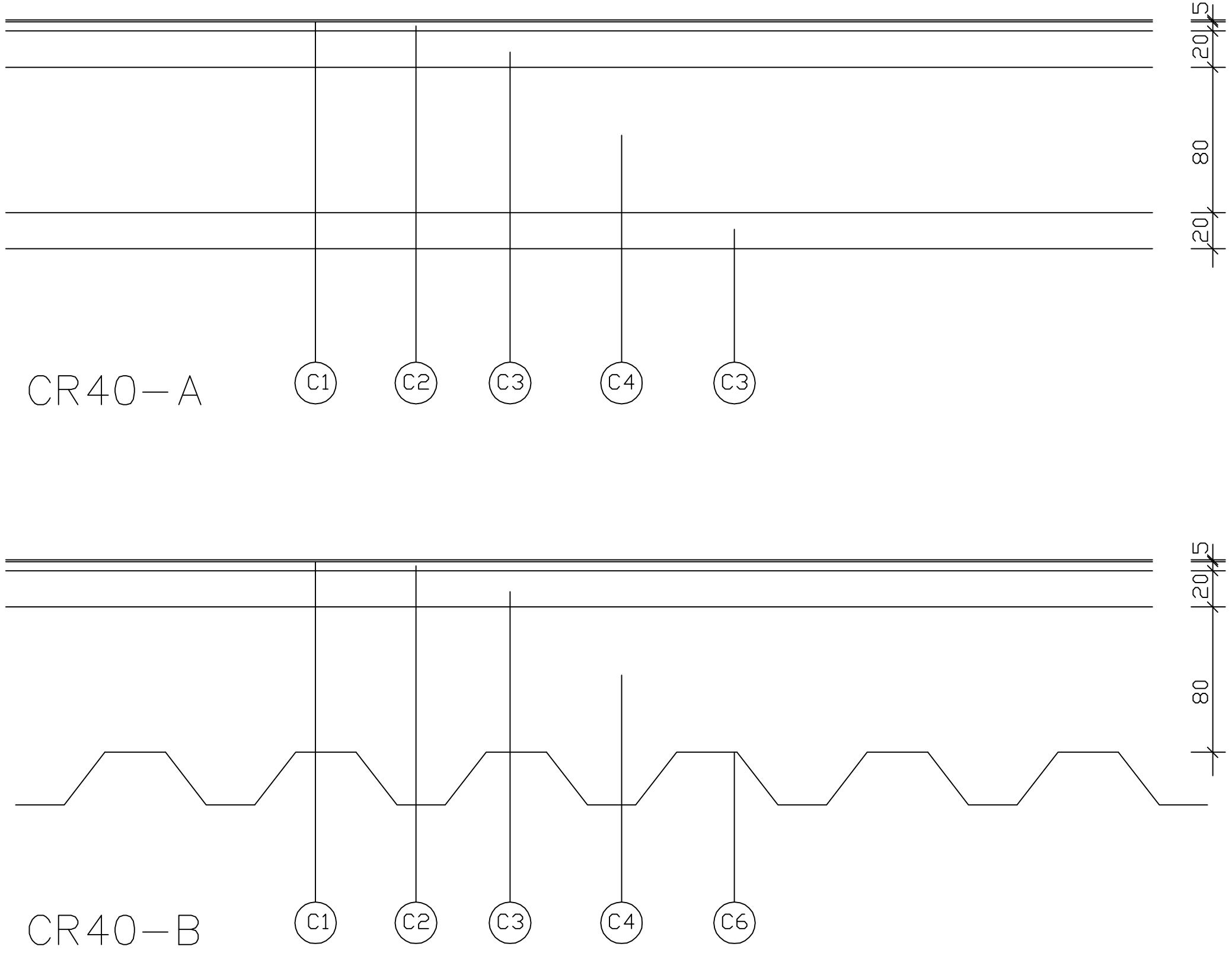
TROYES AUDITORIUM (FRANCE)

GENERAL SOLUTIONS

Building solutions for acoustic barriers

DATE ____ SEPTEMBER / 2009
SCALE ____ N/A

PLAN NUM. 13



NOMENCLATURE

C1.– METAL PLATE
C2.– WATER PROOF MEMBRANE
C3.– DAMP PROOF BOARD t=20mm
C4.– ROCKWOOL t=80mm
DENSITY >=80Kg/m3
C5.– POLYSTIRENE PANEL t=50mm
DENSITY >=40Kg/m3
C6.– CORRUGATED METAL PLATE

DIMMENSION IN MILIMMETERS

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TROYES AUDITORIUM (FRANCE)

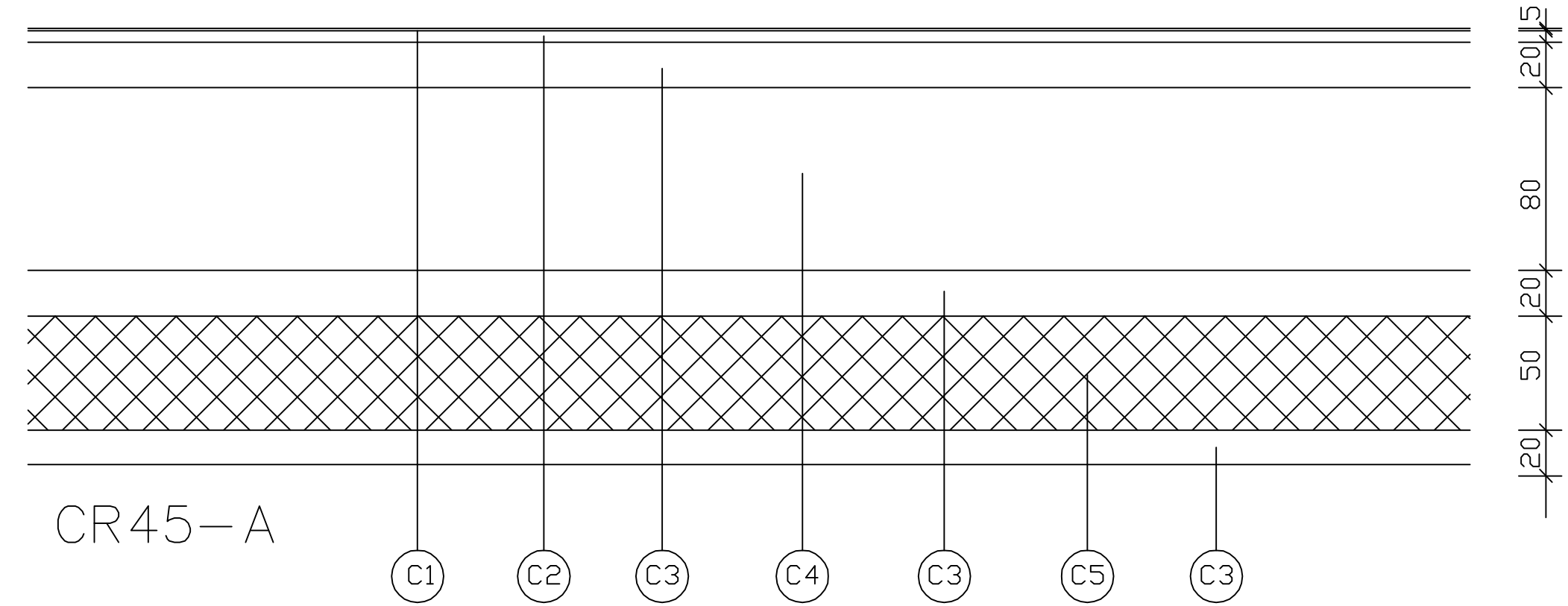
GENERAL SOLUTIONS

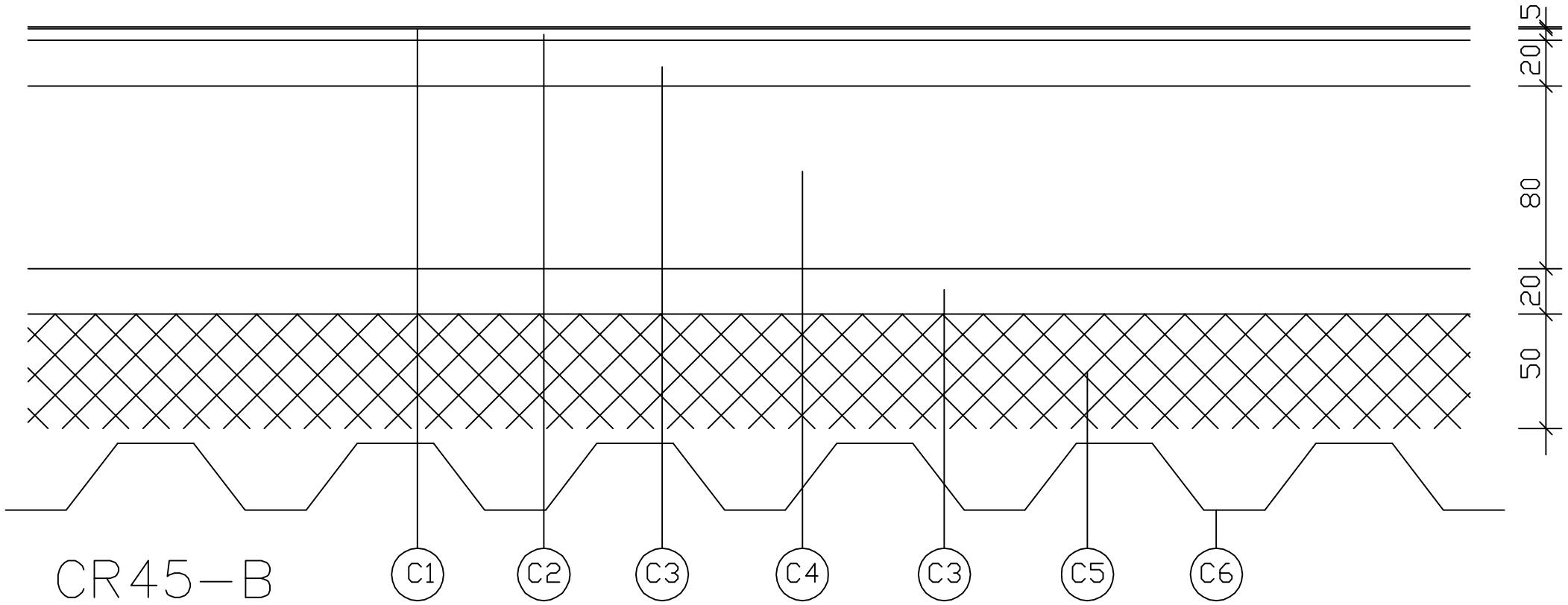
Building solutions for light roof covers

DATE SEPTEMBER / 2009

SCALE N/A

PLAN NUM. 14





NOMENCLATURE

C1.– METAL PLATE
C2.– WATER PROOF MEMBRANE
C3.– DAMP PROOF BOARD t=20mm
C4.– ROCKWOOL t=80mm
DENSITY >=80Kg/m3
C5.– POLYSTIRENE PANEL t=50mm
DENSITY >=40Kg/m3
C6.– CORRUGATED METAL PLATE

DIMMENSION IN MILIMMETERS

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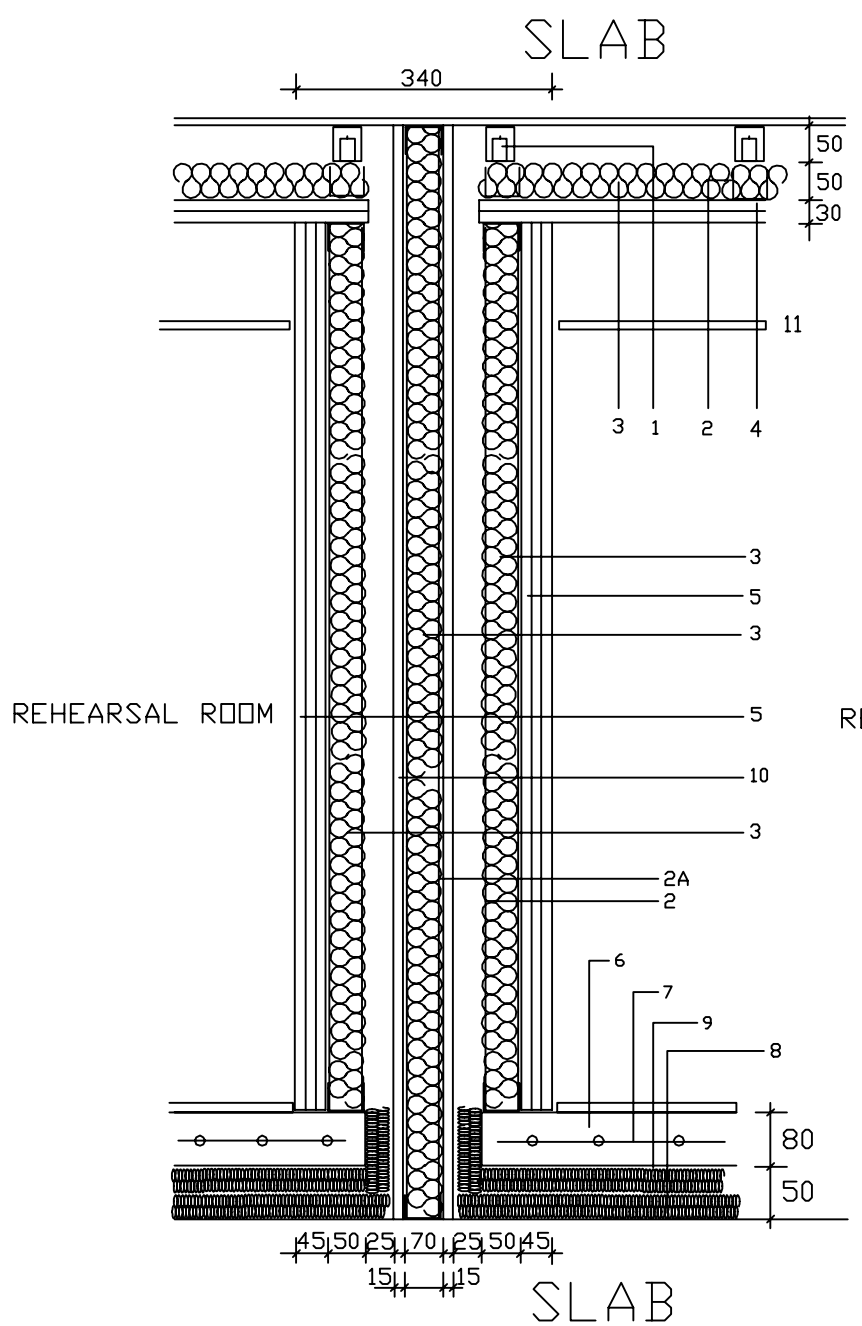
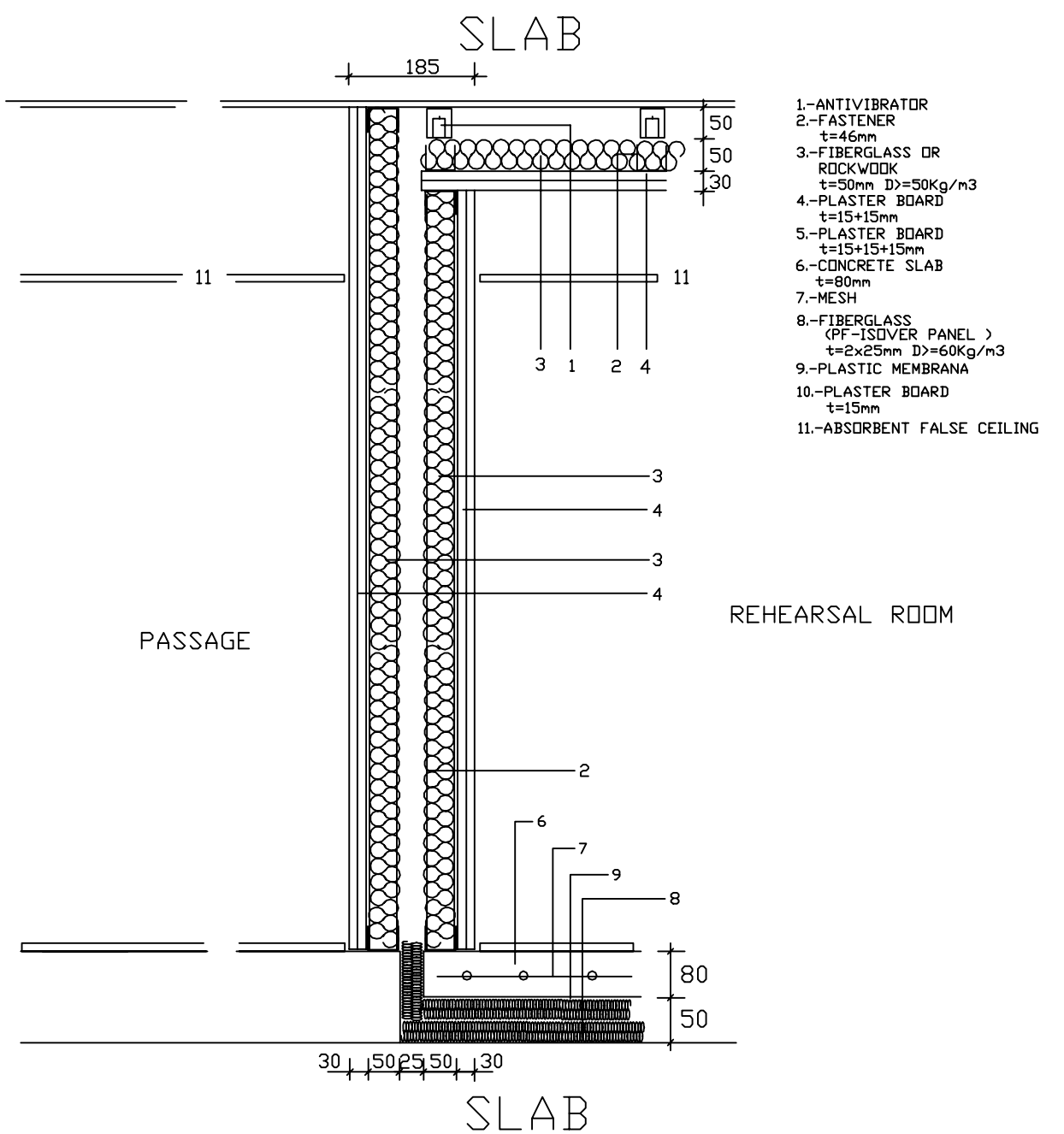
SCALE ____ N/A

PLAN NUM. 15



SLAB

DETAIL 1



SLAB

DETAIL 2

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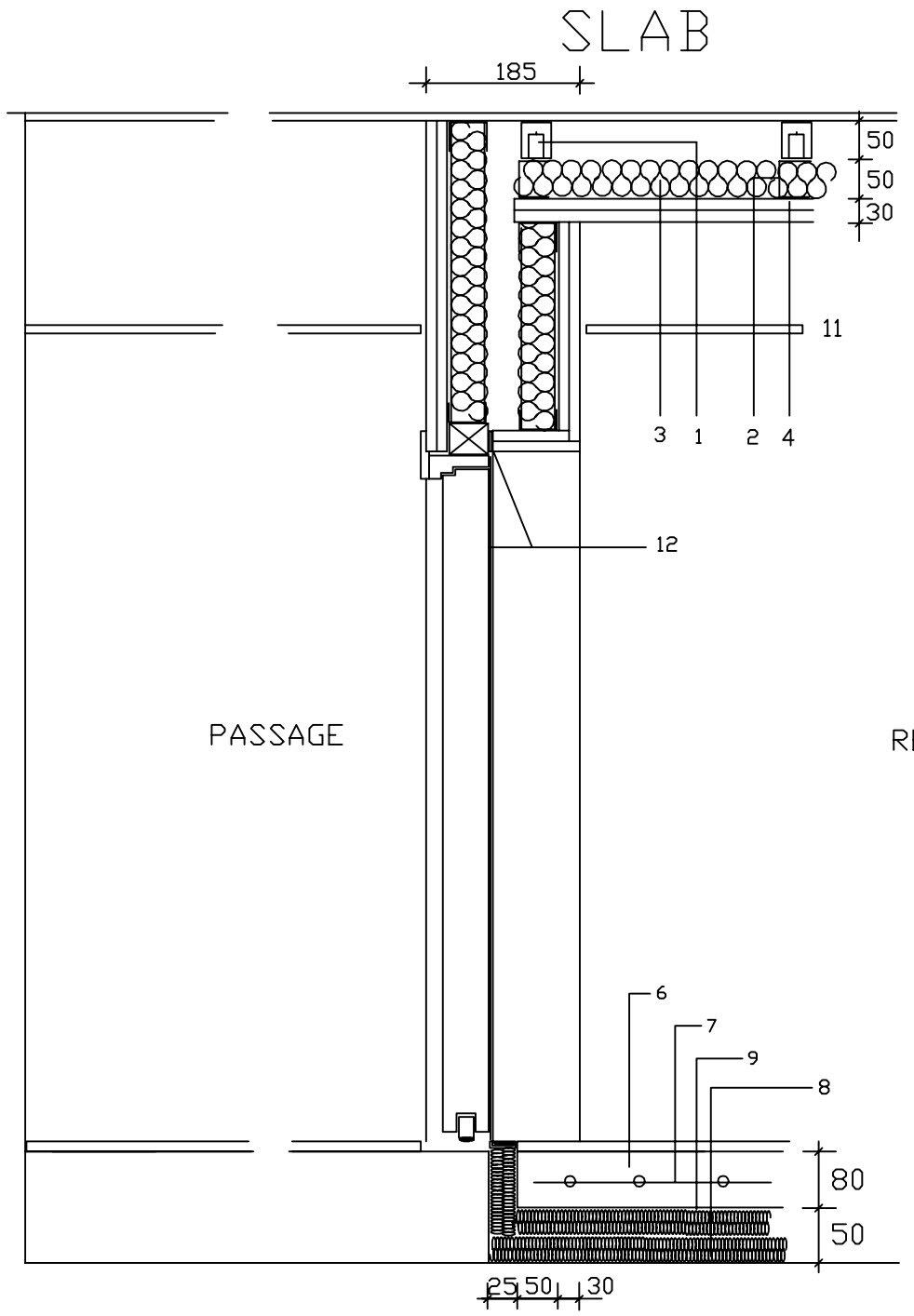
SCALE N/A

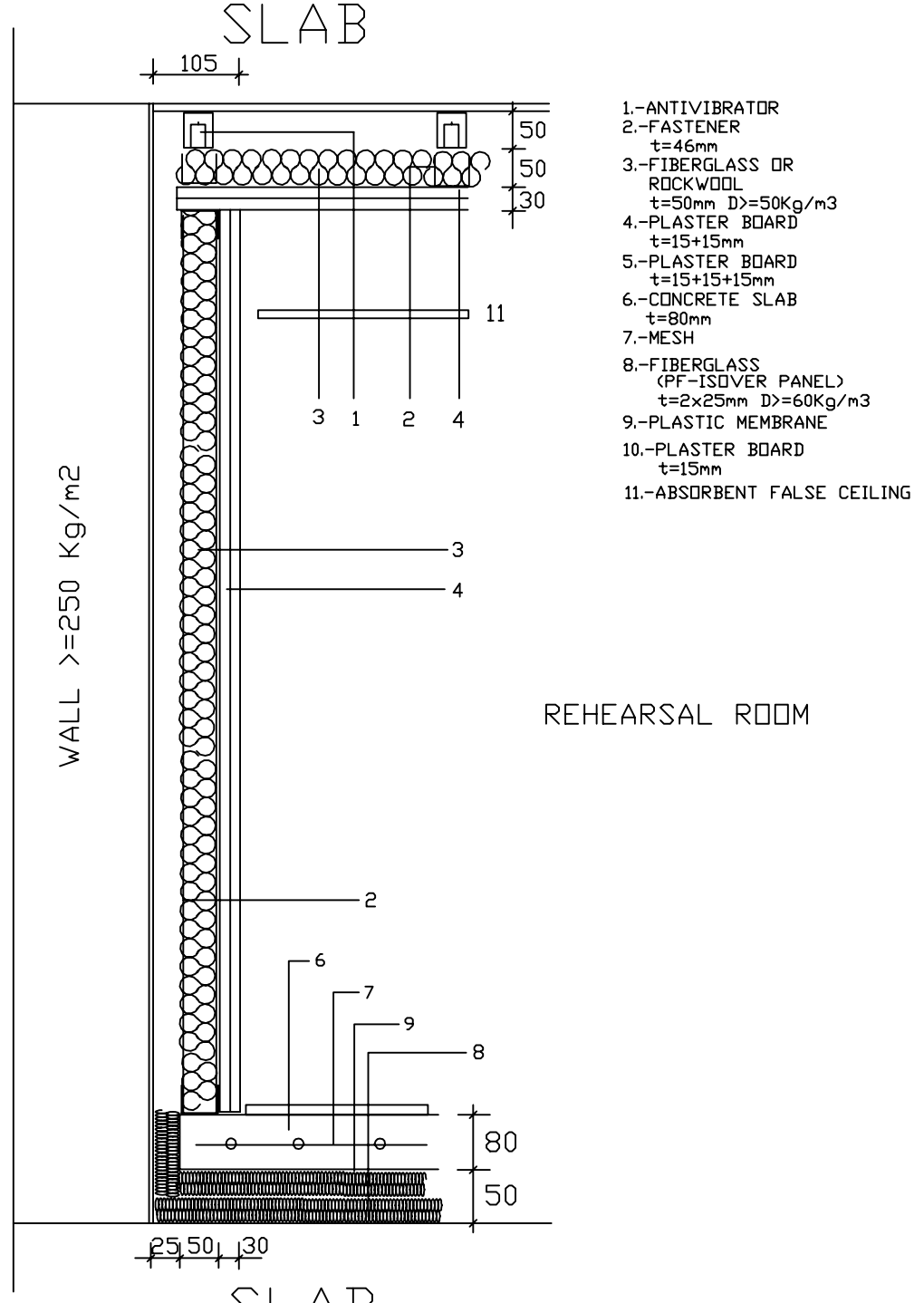
PLAN NUM. 16



1.-ANTIVIBRATOR
2.-FASTENER
t=46mm
3.-FIBERGLASS OR
ROCKWOOL
t=50mm D>=50Kg/m3
4.-PLASTER BOARD
t=15+15mm
5.-PLASTER BOARD
t=15+15+15mm
6.-CONCRETE SLAB
8=80mm
7.-MESH
8.-FIBERGLASS
(PF-ISOVER PANEL)
t=2x25mm D>=60Kg/m3
9.-PLASTIC MEMBRANA

11.-ABSORBENT FALSE CEILING
12..-ELASTIC JOINTS

SLAB
DETAIL 2-DOOR



1.-ANTIVIBRATOR
2.-FASTENER
t=46mm
3.-FIBERGLASS OR
ROCKWOOL
t=50mm D>=50Kg/m3
4.-PLASTER BOARD
t=15+15mm
5.-PLASTER BOARD
t=15+15+15mm
6.-CONCRETE SLAB
t=80mm
7.-MESH
8.-FIBERGLASS
(PF-ISOVER PANEL)
t=2x25mm D>=60Kg/m3
9.-PLASTIC MEMBRANE
10.-PLASTER BOARD
t=15mm
11.-ABSORBENT FALSE CEILING

SLAB
DETAIL 3

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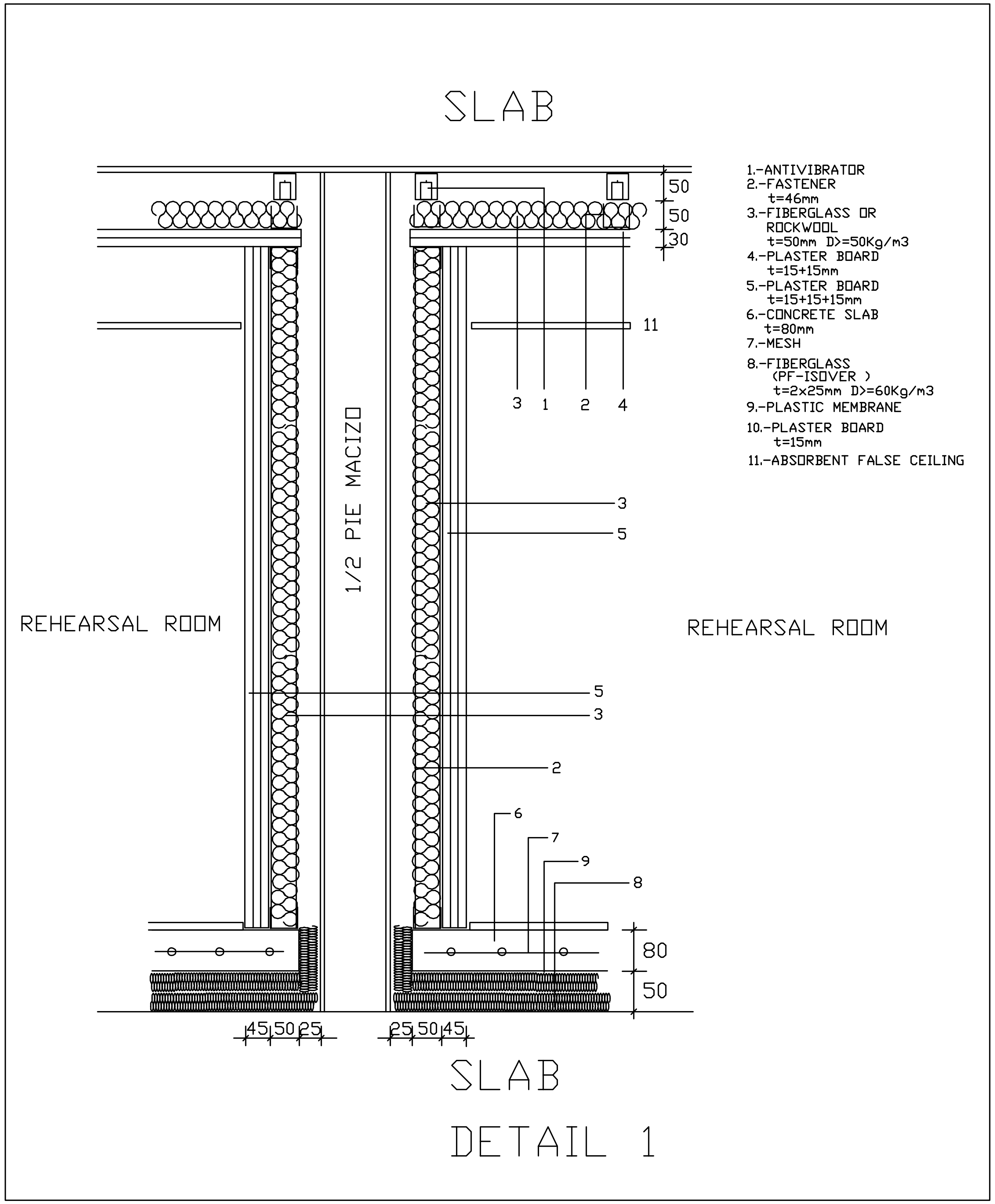
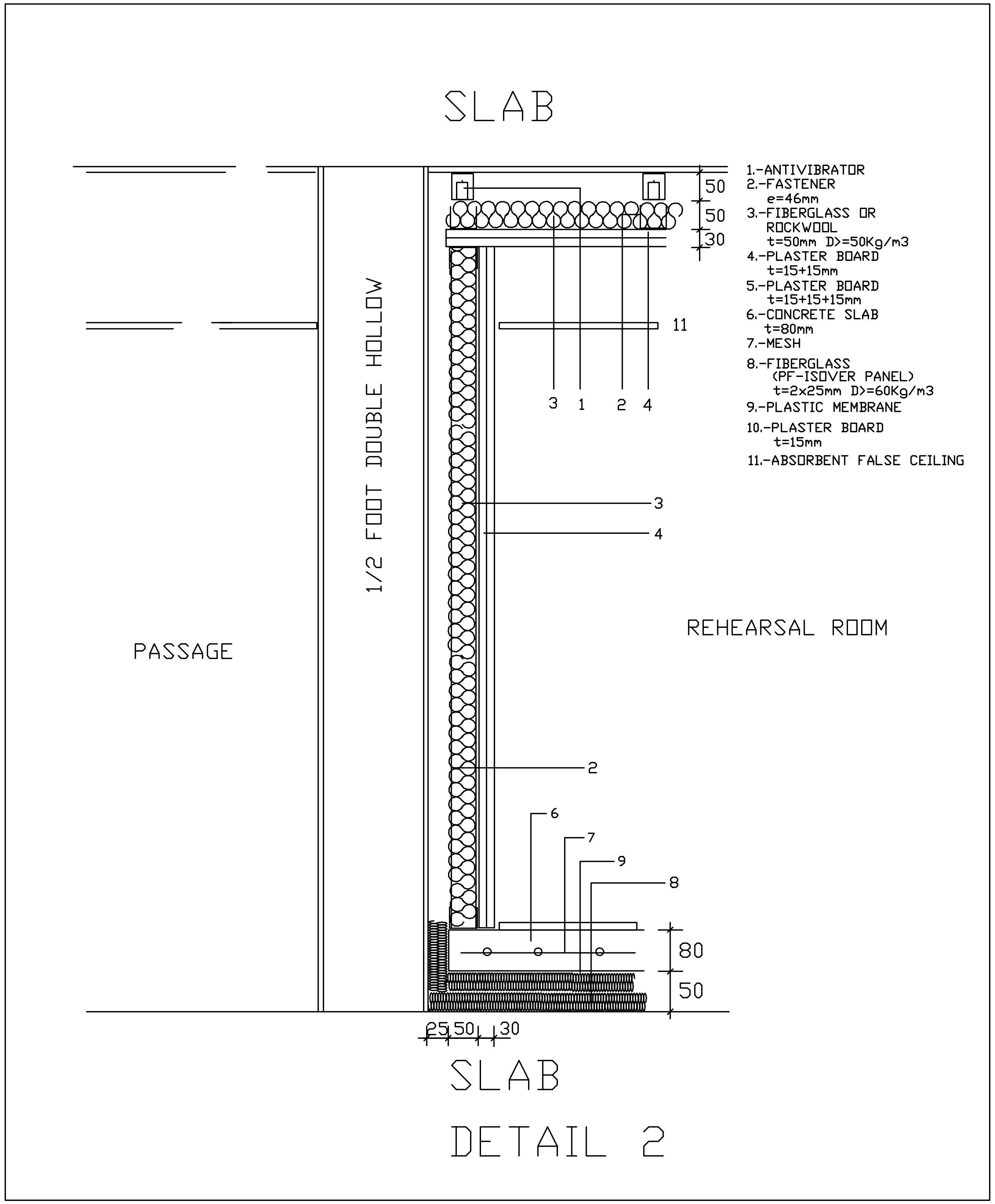
SCALE ___ N/A

PLAN NUM. 17





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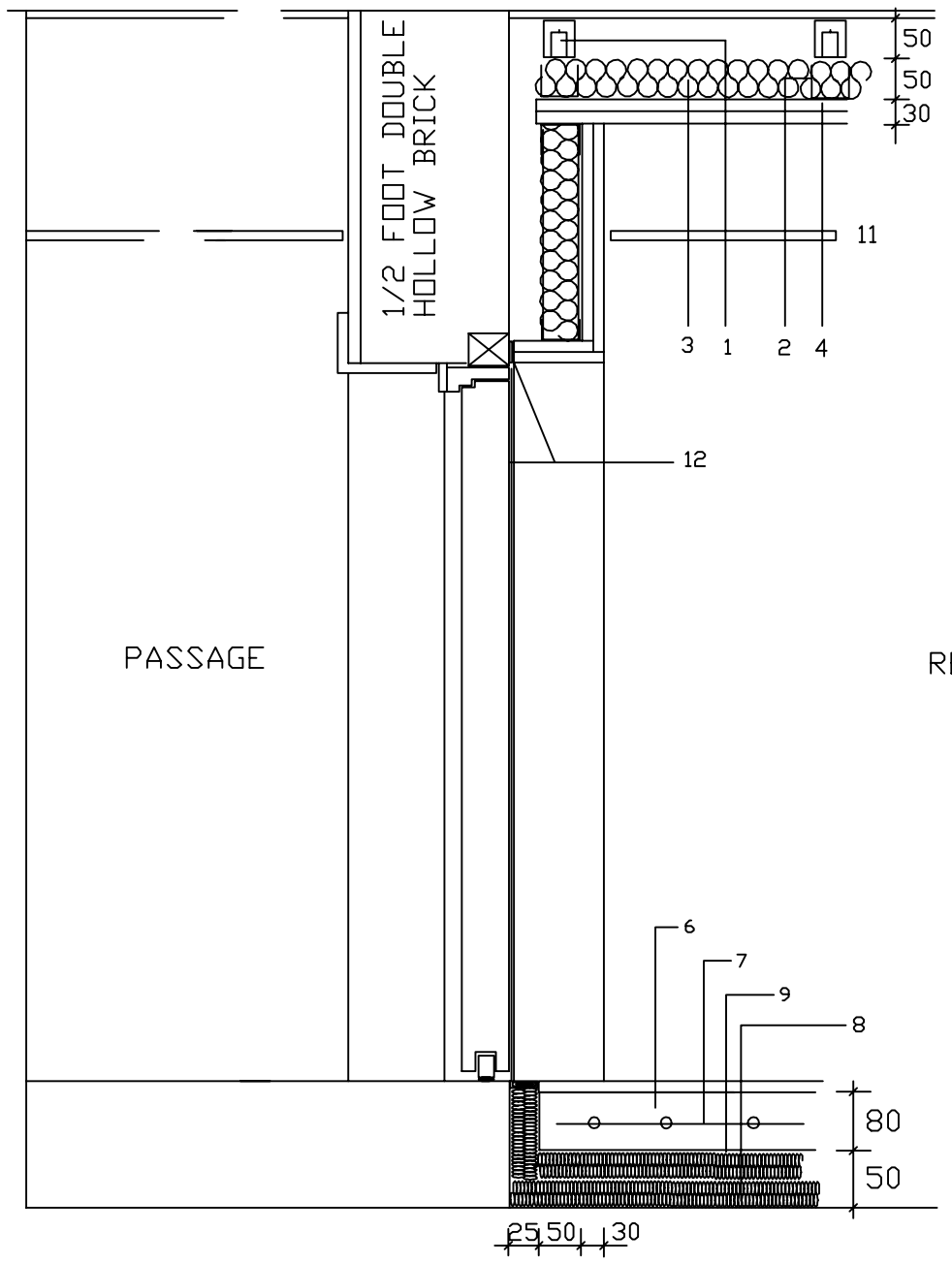
SCALE N/A

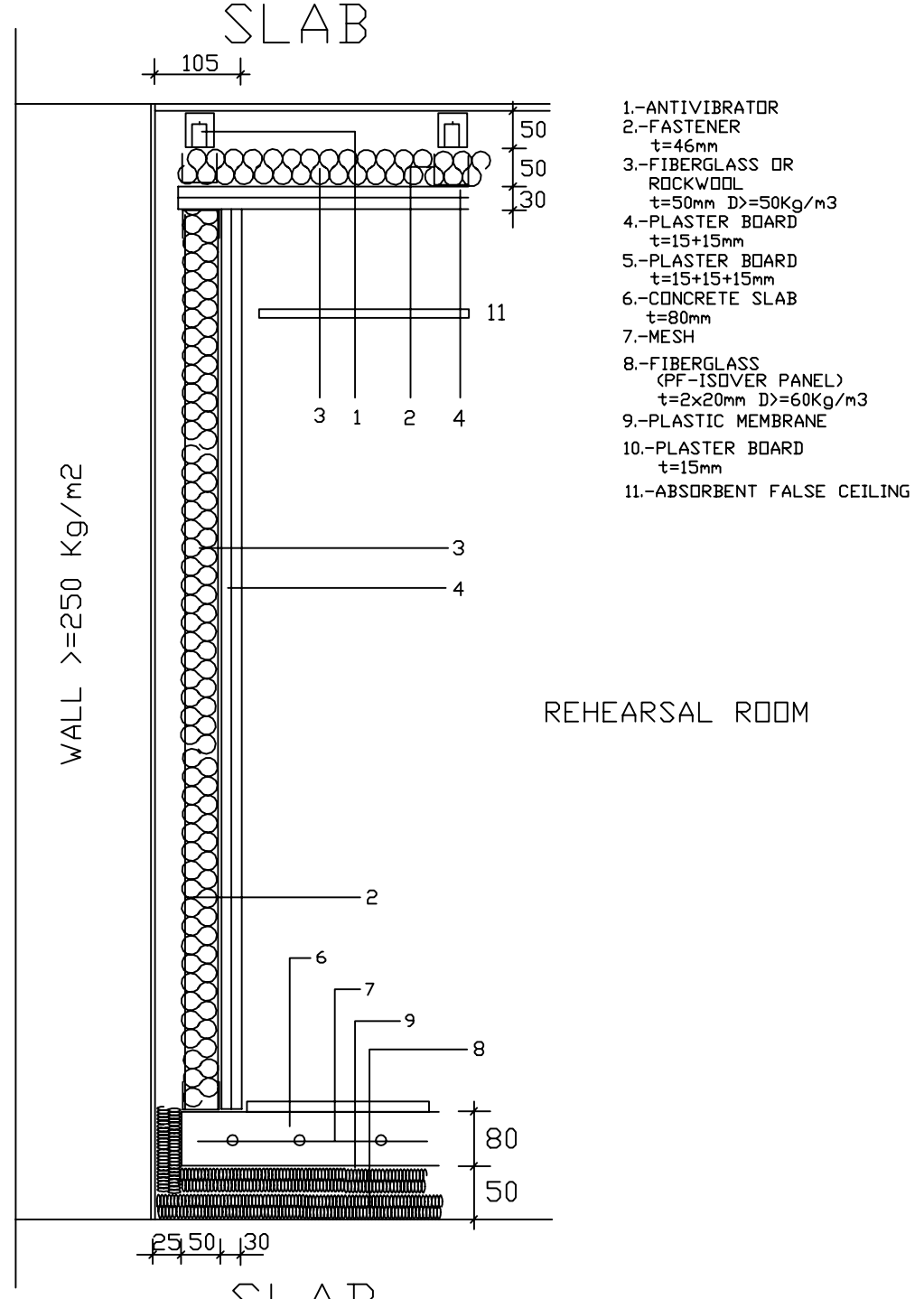
PLAN NUM. 18



1.-ANTIVIBRATOR
2.-FASTENER
t=46mm
3.-FIBERGLASS OR ROCKWOOL
t=50mm D>=50Kg/m3
4.-PLASTER BOARD
t=15+15mm
5.-PLASTER BOARD
t=15+15+15mm
6.-CONCRETE SLAB
t=60mm
7.-MESH
8.-FIBERGLASS (PF-ISOVER PANEL)
t=2x20mm D>=60Kg/m3
9.-PLASTIC MEMBRANE
10.-PLASTER BOARD
t=15mm
11.-ABSORBENT FALSE CEILING
12.-ELASTIC JOINTS

SLAB

DETAIL 2-DOOR



1.-ANTIVIBRATOR
2.-FASTENER
t=46mm
3.-FIBERGLASS OR ROCKWOOL
t=50mm D>=50Kg/m3
4.-PLASTER BOARD
t=15+15mm
5.-PLASTER BOARD
t=15+15+15mm
6.-CONCRETE SLAB
t=80mm
7.-MESH
8.-FIBERGLASS (PF-ISOVER PANEL)
t=2x20mm D>=60Kg/m3
9.-PLASTIC MEMBRANE
10.-PLASTER BOARD
t=15mm
11.-ABSORBENT FALSE CEILING

SLAB

DETAIL 3

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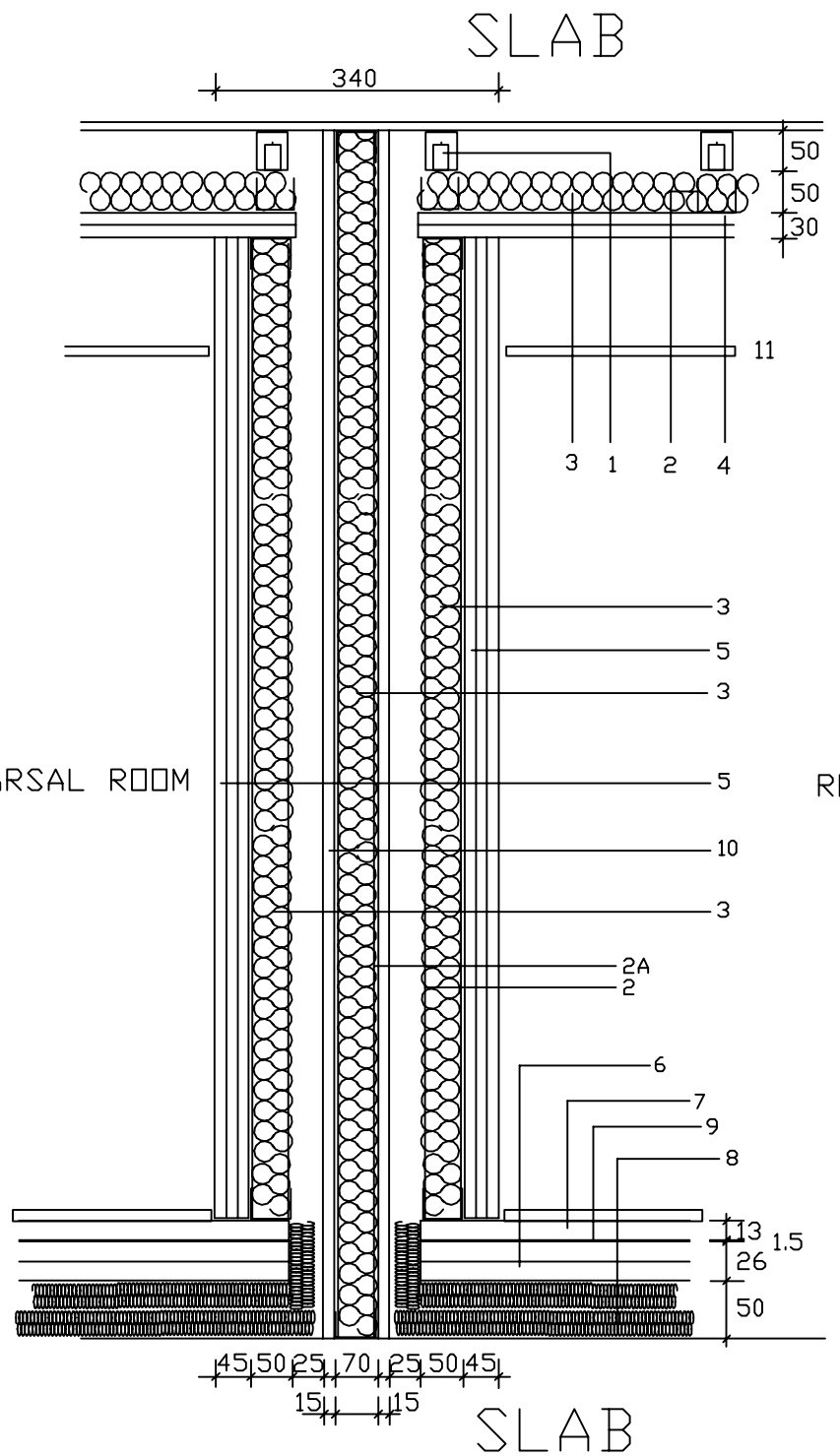
SCALE ___ N/A

PLAN NUM. 19



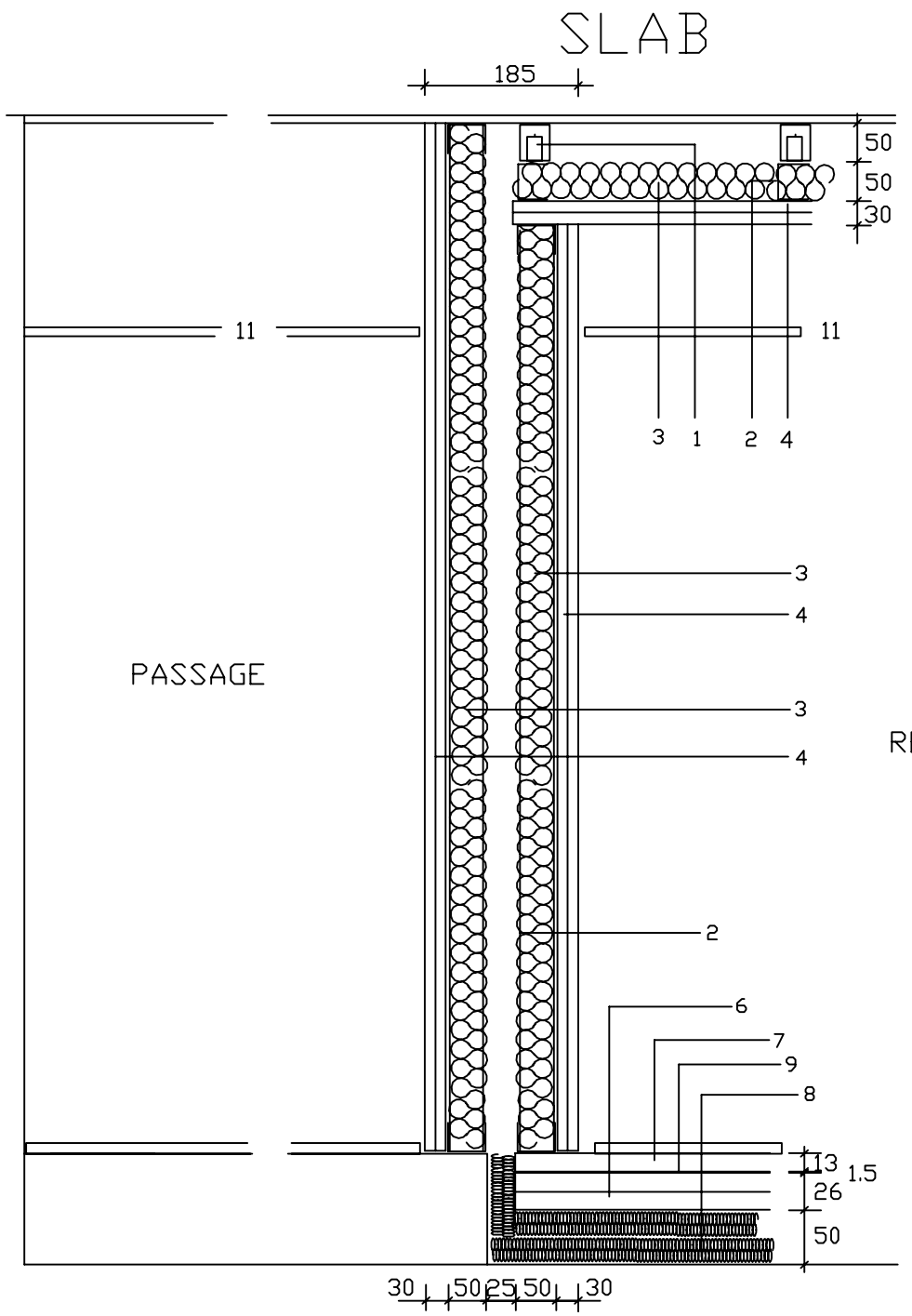
1.-ANTIVIBRATOR
2.-FASTENER
t=46mm
2A.-FASTENER
t=70mm
3.-FIBERGLASS OR
ROCKWOOL
t=50mm D>=50Kg/m3
4.-PLASTER BOARD
t=15+15mm
5.-PLASTER BOARD
t=15+15+15mm

6.-TWO LAYERS OF
PLASTER BOARD
t=13+13mm
7.-PLASTER BOARD
t=19mm
8.-FIBERGLASS
(PF-ISOVER PANEL)
t=2x25mm D>=60Kg/m3
9.-LEAD t=1.5mm
10.-PLASTER BOARD
t=15mm

11.-ABSORBENT FALSE CEILING

SLAB

DETAIL 1



1.-ANTIVIBRATOR
2.-FASTENER
t=46mm
2A.-FASTENER
t=70mm
3.-FIBERGLASS OR
ROCKWOOL
t=50mm D>=50Kg/m3
4.-PLASTER BOARD
t=15+15mm
5.-PLASTER BOARD
t=15+15+15mm

6.-TWO LAYERS OF
PLASTER BOARD
t=13+13mm
7.-PLASTER BOARD
t=19mm
8.-FIBERGLASS
(PF-ISOVER PANEL)
t=2x25mm D>=60Kg/m3
9.-LEAD e=1.5mm
10.-PLASTER BOARD
t=15mm

11.-ABSORBENT FALSE CEILING

SLAB

DETAIL 2

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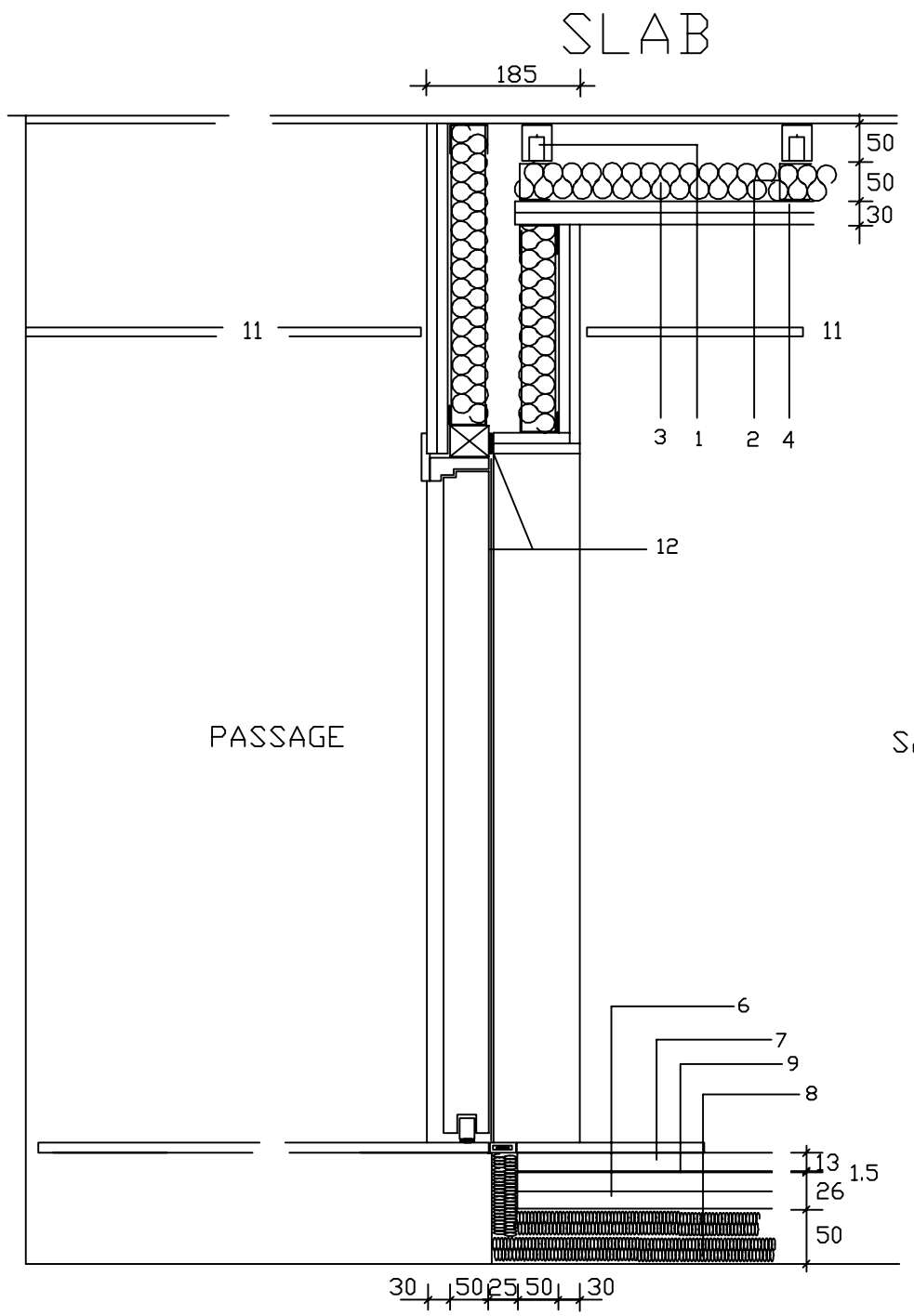
Specific building solutions for
Music Rehearsal Rooms. Alternative C

DATE _____ SEPTEMBER / 2009

SCALE ___ N/A

PLAN NUM. 20



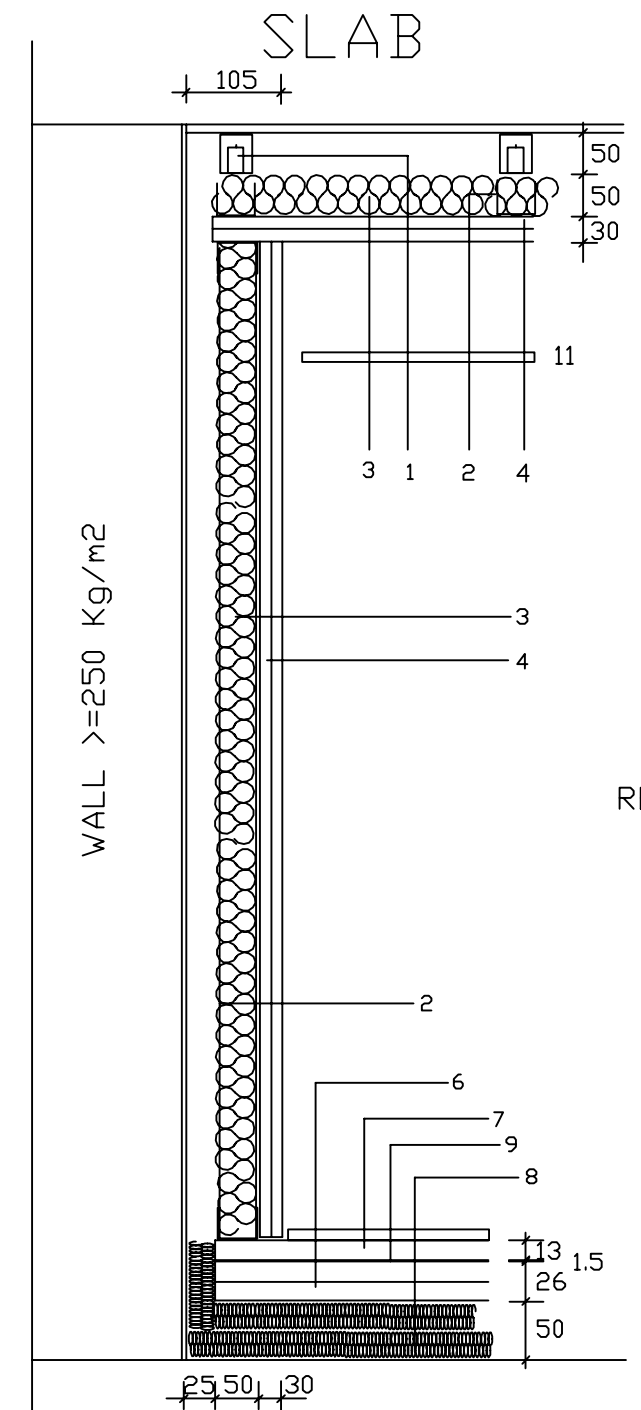
1.-ANTIVIBRATOR
2.-FASTENER
t=46mm
3.-FIBERGLASS OR ROCKWOOL
t=50mm D>=50Kg/m3
4.-PLASTER BOARD
t=15+15mm
5.-PLASTER BOARD
t=15+15+15mm

6.-TWO LAYERS OF PLASTER BOARD
t=13+13mm
7.-PLASTER BOARD
t=19mm
8.-FIBERGLASS
(PF-ISOVER PANEL)
t=2x25mm D>=60Kg/m3
9.-LEAD t=1.5mm
10.-PLASTER BOARD
t=15mm

11.-ABSORBENT FALSE CEILING
12.-ELASTIC JOINTS

SLAB

DETAIL 2-Door



SLAB

DETAIL 3

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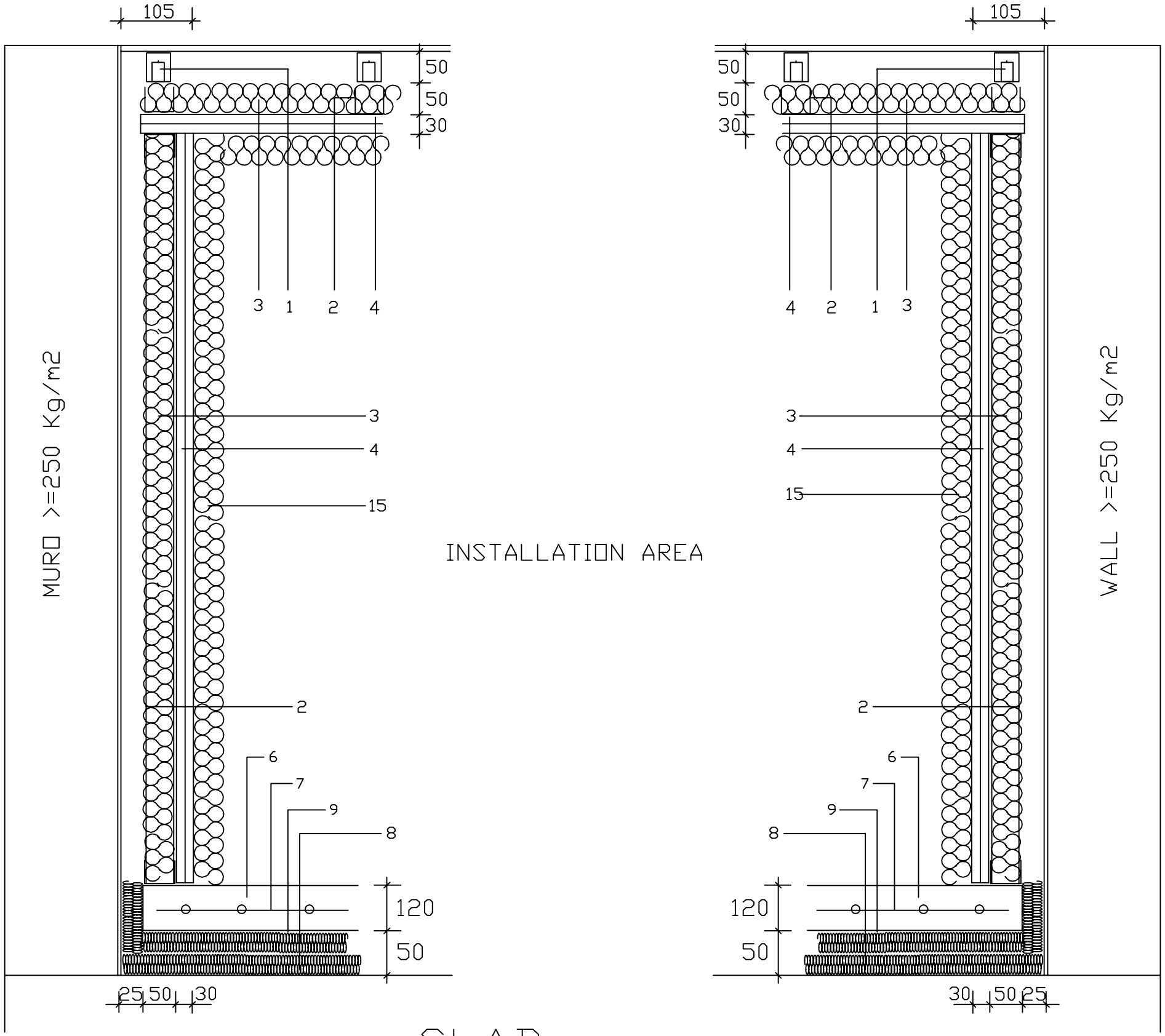
Specific building solutions for
Music Rehearsal Rooms. Alternative C

DATE SEPTEMBER / 2009

SCALE N/A

PLAN NUM. 21

SLAB



1.-ANTIVIBRATOR
2.-FASTENER
t=46mm
3.-FIBERGLASS OR ROCKWOOL
t=50mm D>=50Kg/m3
4.-PLASTER BOARD
t=15+15mm
5.-PLASTER BOARD
t=15+15+15mm
6.-CONCRETE SLAB
t=80mm
7.-MESH
8.-FIBERGLASS
(PF-ISOVER PANEL)
t=2x25mm D>=60Kg/m3
9.-PLASTIC MEMBRANE
10.-PLASTER BOARD
t=15mm

15.-FIBERGLASS OR ROCKWOOL
t=40mm D>=40Kg/m3
PROTECTED

SLAB

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Building solutions for Installation Areas

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SCALE ___ N/A

PLAN NUM. 22

APPENDIX A

CONTENTS

This Appendix contains the airborne acoustic insulation requirements for the different buildings elements.

A. AIRBORNE ACOUSTIC INSULATION REQUIREMENTS

A.1 Administration Building

The requirements for the airborne sound insulation between rooms separated by vertical internal partitions are:

LEVEL R-1 (-2.86)	$D_{nT,A}$	R_A
Between Technical Areas	≥35	≥40
Between Technical areas and the well of the stairs	≥40	≥45

LEVEL RDC (±0.00)	$D_{nT,A}$	R_A
Between Technical Area and Workshops	≥40	≥45
Between storage rooms	≥30	≥35
Between storage rooms and passages	≥30	≥35
Between storage rooms and multipurpose room	≥45	≥50
Between office and adjacent areas	≥40	≥45
Between Administration and adjacent areas	≥40	≥45
Between Multipurpose Room and Foyer	≥45	≥50

LEVEL R+1 (+4.10)	$D_{nT,A}$	R_A
Between Offices	≥40	≥45
Between Offices and Passages	≥35	≥40
Between Multipurpose Rooms and adjacent areas	≥45	≥50
Between Passages and Multipurpose Room	≥40	≥45

LEVEL R+2 (+7.40)	$D_{nT,A}$	R_A
Between Offices	≥40	≥45
Between Offices and Passages	≥35	≥40
Between Meeting rooms and adjacent areas	≥45	≥50

LEVEL R+3 (+10.70)	$D_{nT,A}$	R_A
Between Meeting rooms and adjacent areas	≥45	≥50
Between Meeting rooms and Board room	≥45	≥50
Between Board room and Technical Areas	≥50	≥55

The specifications for airborne sound insulation of solid façade walls in rooms are:

LEVEL RDC (±0.00)	$D_{2m,nT,A}$	R_A
Street Façades	≥38	≥45
Façades overlooking inner courtyards	≥35	≥40

LEVEL R+1 (+4.10)	$D_{2m,nT,A}$	R_A
Street Façades	≥40	≥45
Façades overlooking inner courtyards	≥35	≥40

LEVEL R+2 (+7.40)	$D_{2m,nT,A}$	R_A
Street Façades	≥40	≥45
Façades overlooking inner courtyards	≥35	≥40

LEVEL R+3 (+10.70)	$D_{2m,nT,A}$	R_A
Street Façades (Board Room)	≥50	≥55
Façades overlooking inner courtyards	≥35	≥40

The specifications for airborne sound insulation between rooms separated by horizontal building elements are:

LEVEL R-1 (-2.86) / LEVEL RDC (±0.00)	$D_{nT,A}$	R_A
Between Technical Areas	≥40	≥45
Between Technical Areas and Workshop	≥40	≥45

LEVEL RDC (±0.00) / LEVEL R+1 (+4.10)	$D_{nT,A}$	R_A
Between Technical Area and Offices	≥50	≥55
Between Storage rooms and Offices	≥45	≥50
Between Dining Room and Offices	≥50	≥55
Between Foyer and Offices	≥45	≥50

LEVEL R+1 (+4.10) / LEVEL R+2 (+7.40)	$D_{nT,A}$	R_A
Between Offices	≥45	≥50
Between Offices and Meeting Rooms	≥45	≥50
Between Meeting Rooms	≥45	≥50
Between Multipurpose Room and Offices	≥50	≥55

LEVEL R+2 (+7.40) / LEVEL R+3 (+10.70)	$D_{nT,A}$	R_A
Between Offices and Technical Areas	≥50	≥55
Between Meeting Rooms and Board Room	≥50	≥55
Between Meeting Room and Technical Areas	≥50	≥55

LEVEL R+3 (+10.70) / LEVEL RT ROOF	$D_{nT,A}$	R_A
Roof Top Technical Areas	≥35	≥40
Roof Top Meeting Room	≥55	≥60
Roof Top Board Room	≥40	≥45

The airborne sound insulation (R_A) which should be offered by the separating building elements between rooms is shown graphically in Plans 19 to 23.

A.2 Auditorium Building

The specifications for airborne sound insulation between rooms separated by vertical interior building elements are:

LEVEL RDC (±0.00)	$D_{nT,A}$	R_A
Between Auditorium and Toilets	≥55	≥60
Between Auditorium and Foyer	≥50	≥55
Between Auditorium and Rehearsal Rooms (simultaneous use without public)	≥60	≥65
Between Rehearsal Rooms	≥60	≥65
Between Rehearsal Rooms and Passages	≥50	≥55
Between Office and Personnel Room	≥40	≥45

LEVEL R+1 (+3.79)	$D_{nT,A}$	R_A
Between Auditorium and Foyer	≥50	≥55
Between Auditorium and Passages	≥50	≥55
Between Auditorium and Rehearsal Rooms (simultaneous use without public)	≥60	≥65
Between Auditorium and Elevator Well	≥55	≥60
Between Rehearsal Rooms	≥70	≥65
Between Rehearsal Rooms and Passages	≥50	≥55
Between Booths and Auditorium (solid walls)	≥45	≥50
Between Booths	≥35	≥40
Between Booths and Passages	≥35	≥40
Between Passages, Booths and Foyer	≥40	≥45

LEVEL R+2 (+6.17)	$D_{nT,A}$	R_A
Between Auditorium and Foyer	≥50	≥55
Between Auditorium and Passages	≥50	≥55
Between Auditorium and Rehearsal Rooms (simultaneous use without public)	≥60	≥65
Between Auditorium and Elevator Well	≥55	≥60

LEVEL R+2 (+6.17)	$D_{nT,A}$	R_A
Between Rehearsal Rooms	≥70	≥65
Between Rehearsal Rooms and Passages	≥50	≥55

LEVEL R+3 (+8.70)	$D_{nT,A}$	R_A
Between Technical Areas	≥40	≥45
Between Technical Areas and Passages	≥40	≥45
Between Technical Areas and Foyer	≥50	≥55
Between Technical Areas and beneath Roof	≥55	≥55

The specifications for the airborne sound insulation which should be provided by the solid façade walls of the Auditorium Building are:

	$D_{2m,nT,A}$	R_A
Auditorium Terrace Façades	≥45	≥50
Foyer Façades and others	≥40	≥45

The specifications for the airborne sound insulation between rooms separated by horizontal building elements are:

LEVEL RDC (±0.00) / LEVEL R+1 (+3.79)	$D_{nT,A}$	R_A
Between Foyer and Auditorium	≥50	≥55
Between Toilets and Auditorium	≥55	≥60
Between Auditorium and Rehearsal Rooms (simultaneous use without public)	≥65	≥70
Between Loading / Unloading Area and Rehearsal Rooms	≥50	≥55
Between Personnel Office and Rehearsal Rooms	≥55	≥60

LEVEL R+1 (+3.79) / LEVEL R+2 (+6.17)	$D_{nT,A}$	R_A
Between Booths and Auditorium	≥50	≥55
Between Rehearsal Rooms	≥65	≥70

LEVEL R+2 (+6.17) / LEVEL R+3 (+8.70)	$D_{nT,A}$	R_A
Between Auditorium and beneath the Roof	≥30	≥35
Between Auditorium and Technical Area	≥65	≥70
Between Rehearsal Rooms and Technical Area	≥65	≥70

LEVEL R+3 (+8.70) / LEVEL TERRACE (+12.50)	$D_{nT,A}$	R_A
Between Foyer and Terrace (Roof)	≥40	≥45
Between Technical Areas and Terrace (Roof)	≥40	≥45

LEVEL TERRACE (+12.50) / EXTERIOR (ROOF)	$D_{nT,A}$	R_A
Between beneath the Roof (Auditorium Area) and the Exterior	≥40	≥45