

Lecture 05 - Floors, Ceilings & Partitions

Advanced Technology Module Code: 5CTA1140

Semester A: Weeks 10 -24

Credits: 15

Course Leader: Ilona Hay

Module Co-ordinator: Brian Murphy

Lecturer: Sonia Tong

19th November 2019

Quote of the day

“Architecture is an expression of values”

Norman Foster, Architect



Semester A Programme

See Canvas Files and Announcements for latest Programme

Today's Lecture

Basic principles for;

- Floor Construction

- Ceiling Construction

- Partition Construction



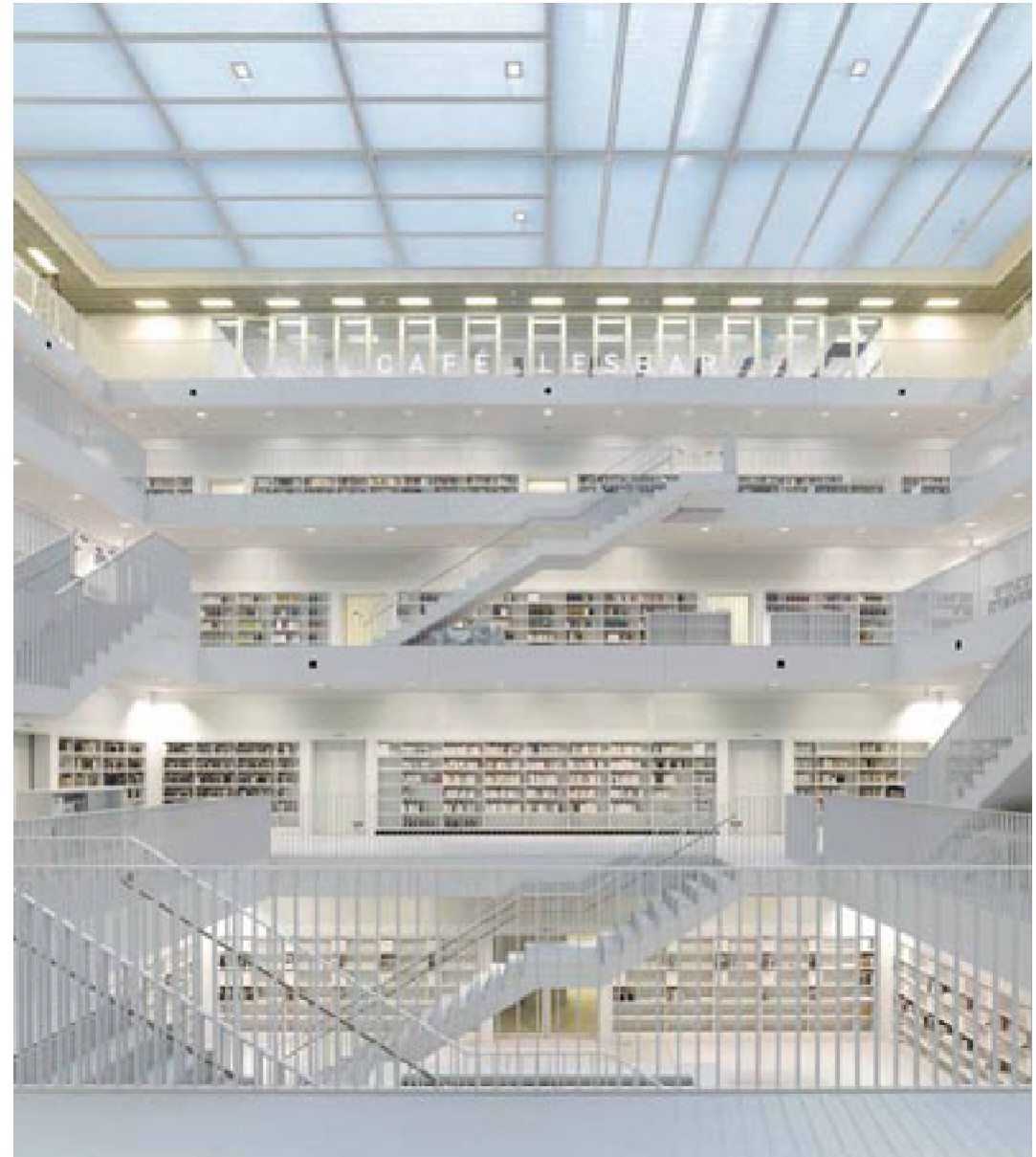
Floors



First Principles

Function of a floor:

- Provides structural support for the contents of a room, its occupants and the weight of the floor itself*
- Provides resistance to the passage of moisture, heat and sound*
- Contributes to the look and feel (and also acoustics, depending on finish) of a space*



Stadtbibliothek Library, Stuttgart, Yi Architects

Key Building Regulations

The Building Regulations 2010

Fire safety

APPROVED DOCUMENT

B

VOLUME 1 – DWELLINGHOUSES

- B1 Means of warning and escape
- B2 Internal fire spread (linings)
- B3 Internal fire spread (structure)

The Building Regulations 2010

Site preparation and resistance to contaminants and moisture

APPROVED DOCUMENT

C

- C1 Site preparation and resistance to contaminants
- C2 Resistance to moisture

The Building Regulations 2010
The Building (Approved Inspections etc) Regulations 2010

Resistance to the passage of sound

APPROVED DOCUMENT

E

- E1 Protection against sound from other parts of the building and adjoining buildings
- E2 Protection against sound within a dwelling-house etc

The Building Regulations 2010

Conservation of fuel and power

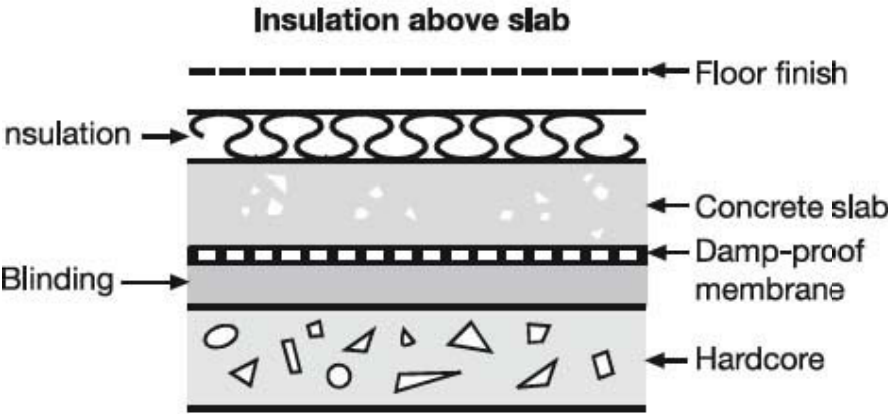
APPROVED DOCUMENT

L1A

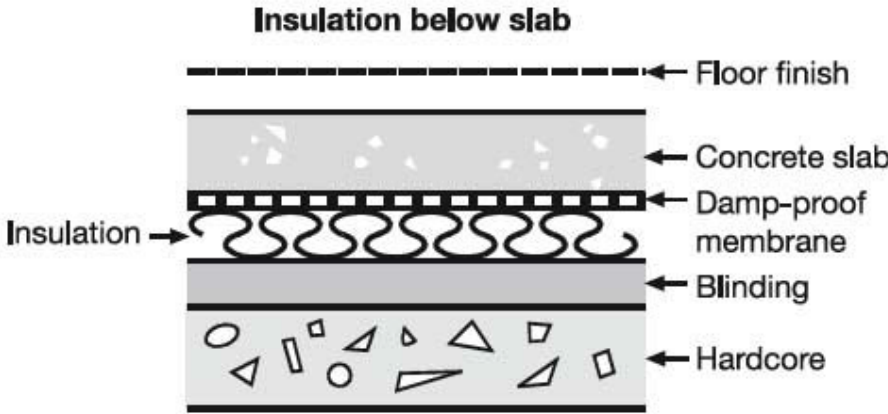
L1A Conservation of fuel and power

Ground Supported Floor

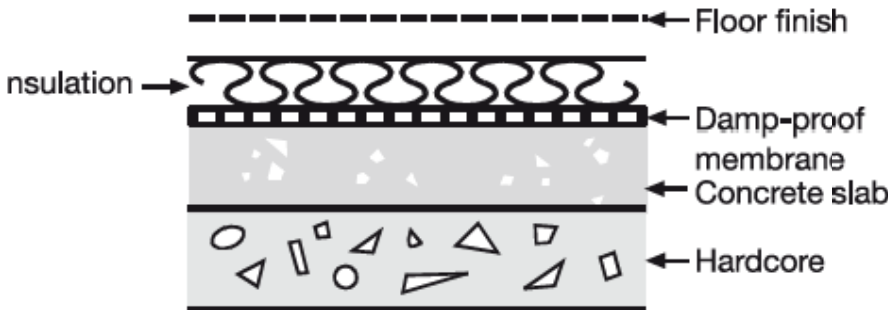
NB Insulation thicknesses are out of date with current Part L



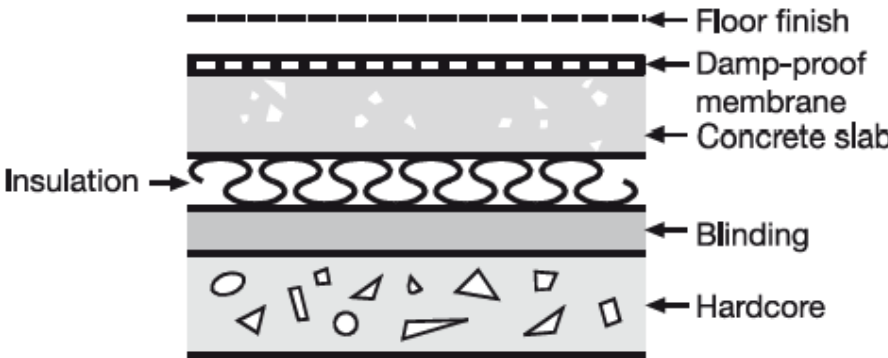
a) Damp-proof membrane below slab



(c) Damp-proof membrane below slab



b) Damp-proof membrane above slab



(d) Damp-proof membrane above slab

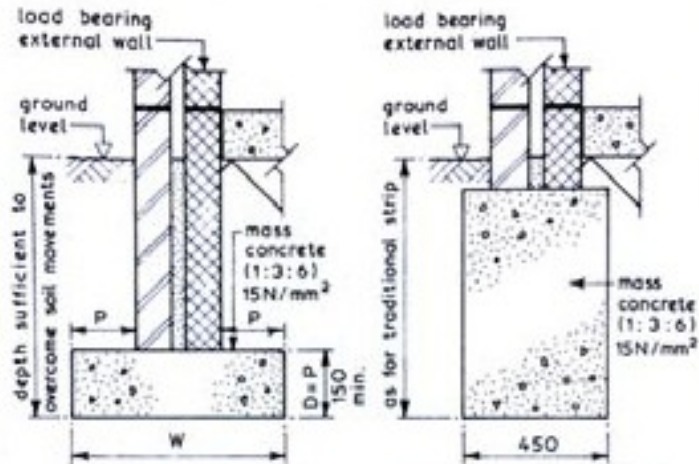
Ground Supported Floor



Ground Bearing Floor Site photo

Ground Supported Floor: (Some) Foundation Typologies

NB: insulation thicknesses and thermal bridges are out of date with Part L
Avoid notes including 'or similar' or 'or suitable' do use 'or equivalent' and police it



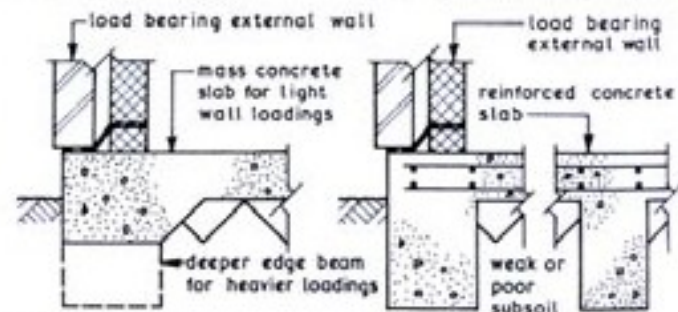
$$W = \frac{\text{load per metre}}{\text{bearing capacity of soil or}}$$

W = not less than that given in Table on page 198
NB. In all cases W must give adequate working space which is usually 450 to 600mm minimum depending on depth of excavation.

generally considered to be cheaper than traditional strip foundations since:-
1. fewer man hours required.
2. requires less skilled trades.
3. uses ready mix concrete therefore less material is stored on site making it clearer and easier to manage.

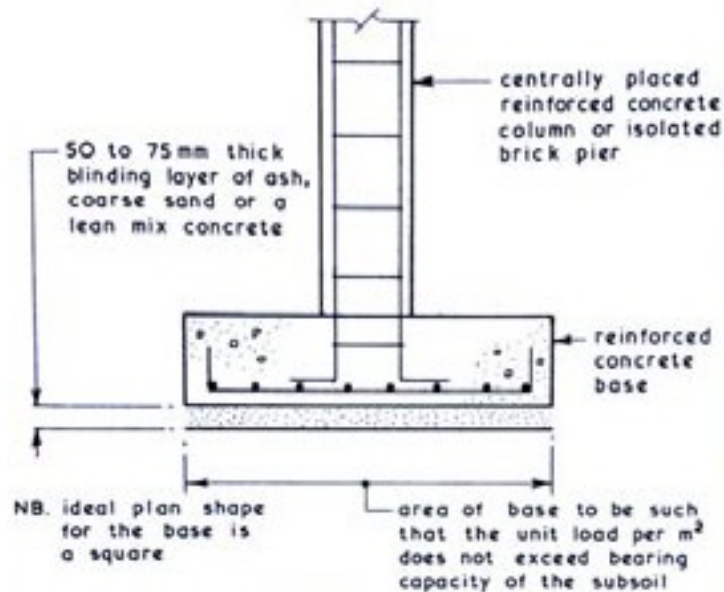
TRADITIONAL STRIP

DEEP STRIP OR TRENCH FILL

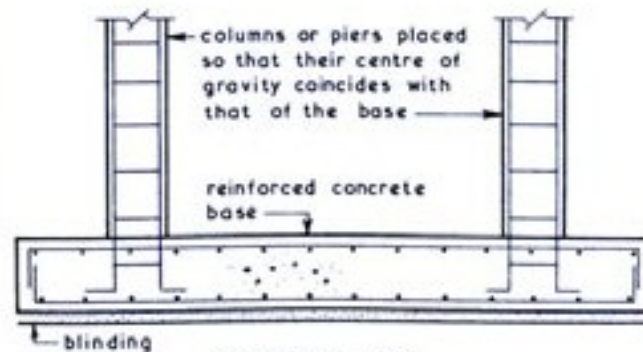


SOLID SLAB RAFT

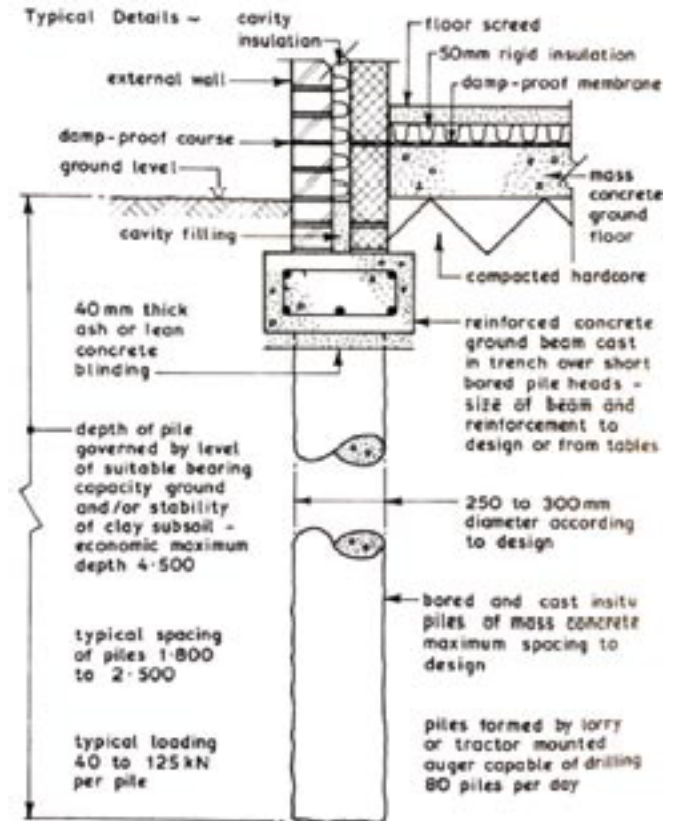
BEAM AND SLAB RAFT



ISOLATED PAD



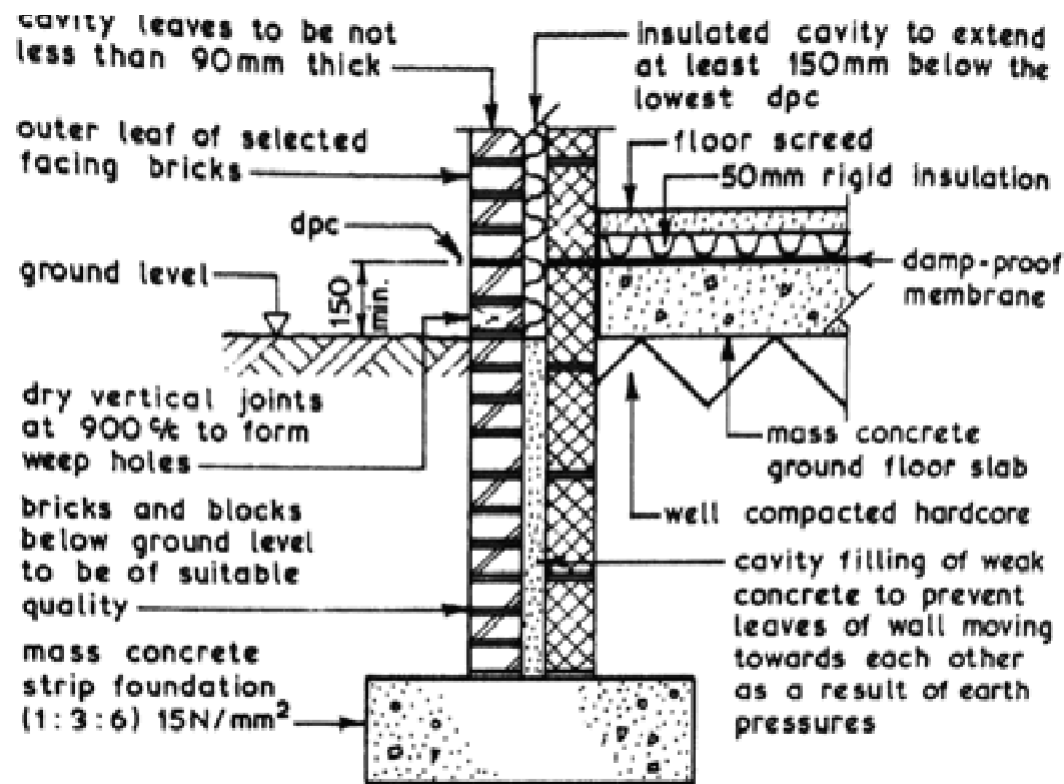
COMBINED PAD



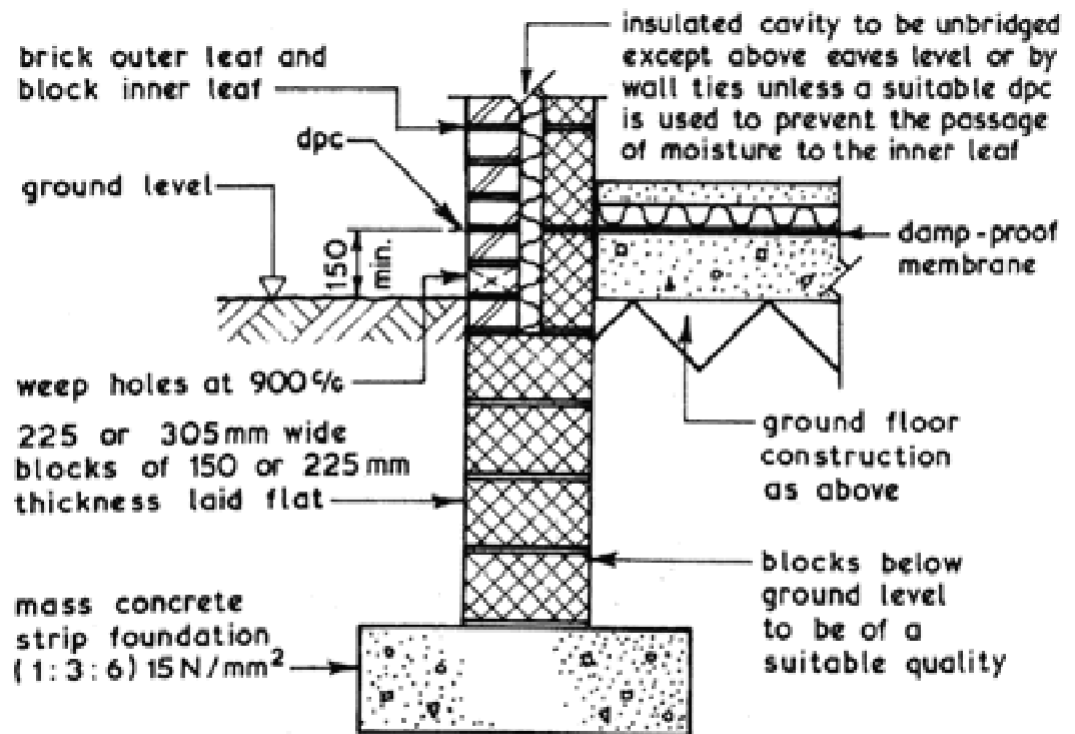
Ground Supported Floor: Traditional Strip Foundation

NB: insulation thicknesses and thermal bridges are out of date with Part L

Avoid notes including 'or similar' or 'or suitable' do use 'or equivalent' and police it



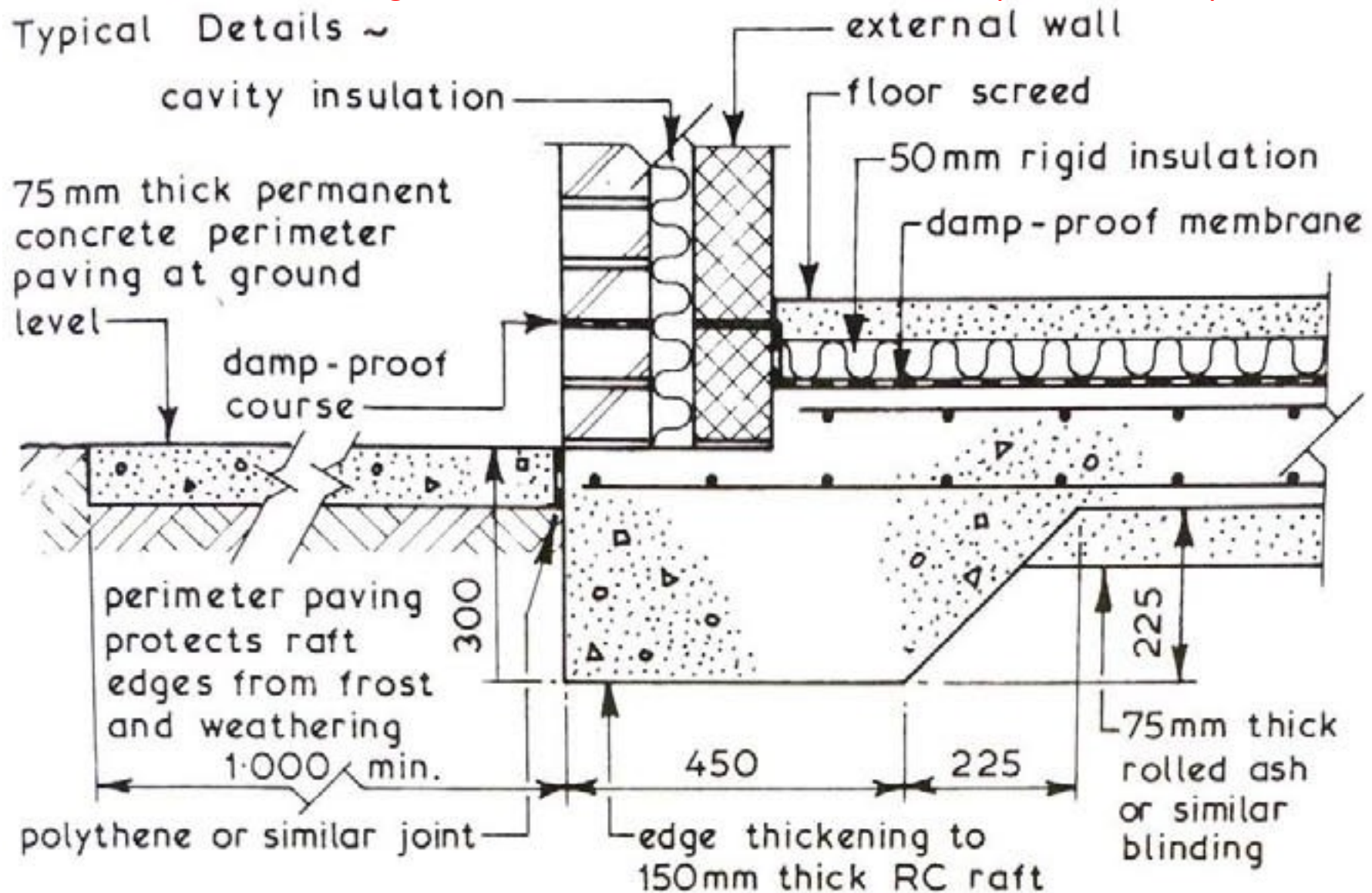
TRADITIONAL CONSTRUCTION



ALTERNATIVE CONSTRUCTION

Ground Supported Floor/Raft Foundation:

NB: insulation thicknesses and thermal bridges are out of date with Part L
Avoid notes including 'or similar' or 'or suitable' do use 'or equivalent' and police it



Suspended Timber Floor

NB: insulation thicknesses and thermal bridges are out of date with Part L

Diagram 5 Suspended timber floor – construction (see paragraph 4.14(a) (i))

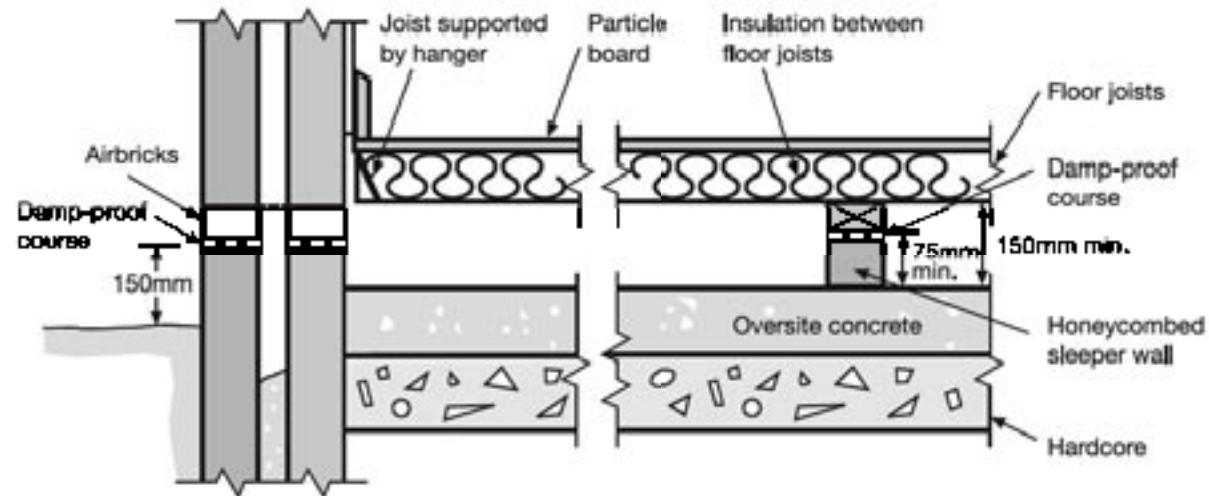
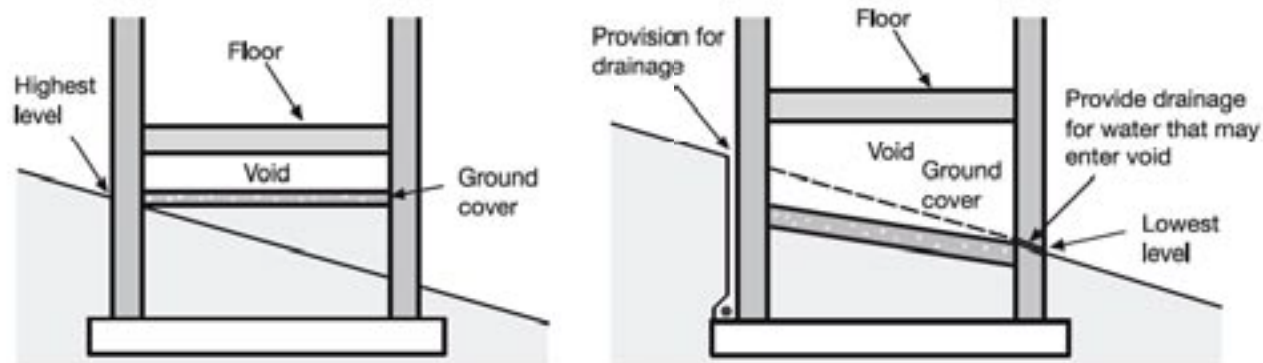


Diagram 6 Suspended floor – preventing water collection (see paragraph 4.14(a))



Note: Slope has been exaggerated for clarity

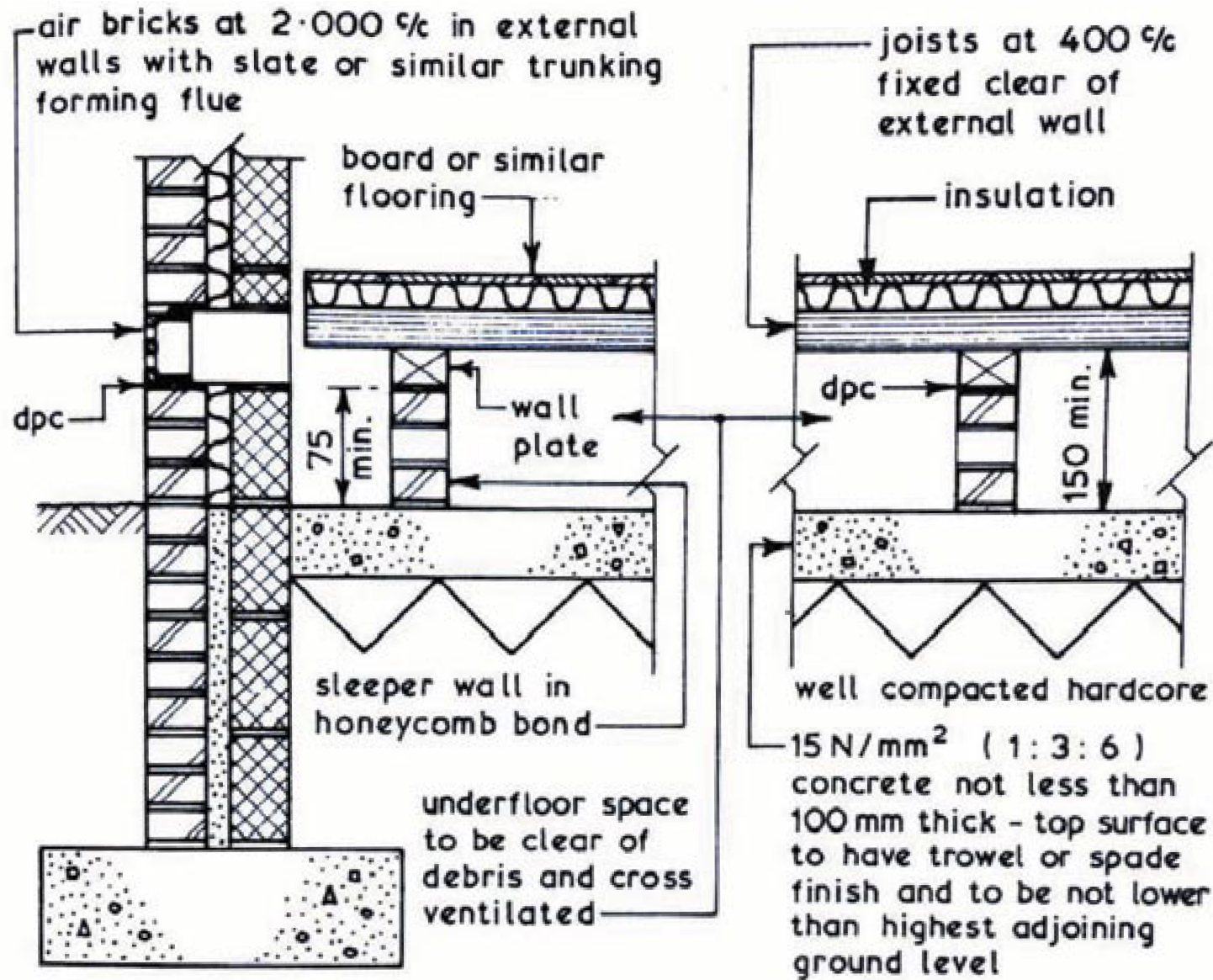
Suspended Timber Floor



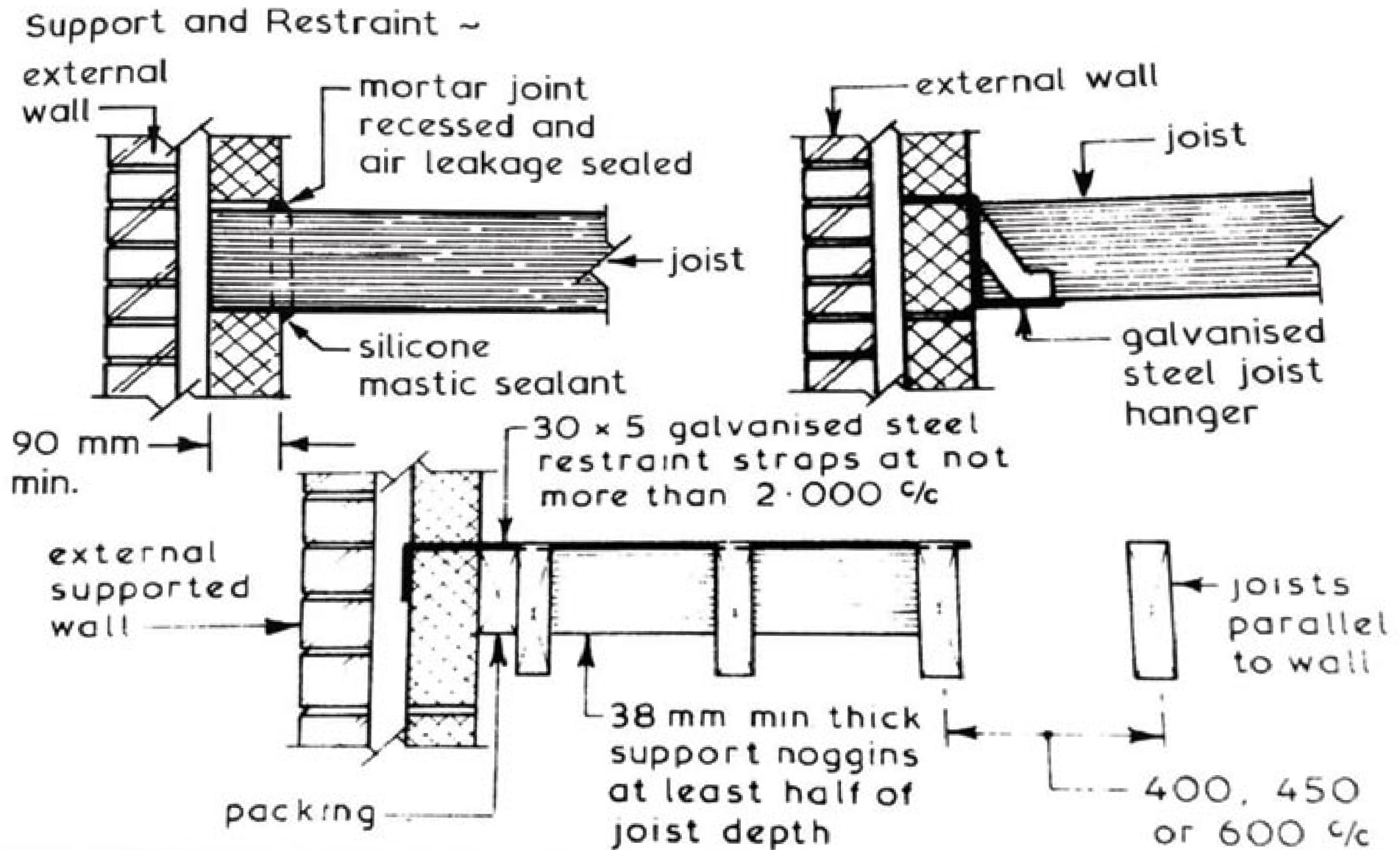
Example suspended timber floor

Suspended Timber Ground Floor: Typical Components

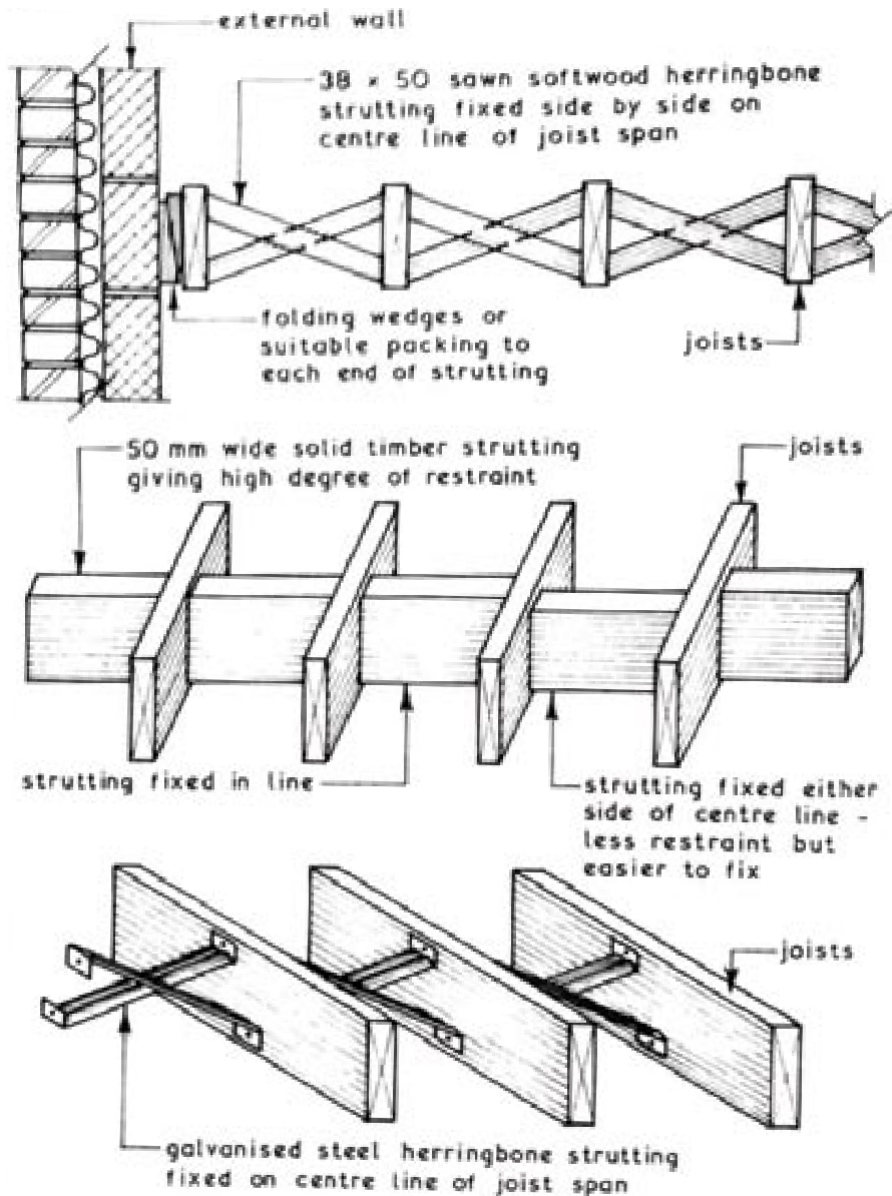
NB: Insulation thicknesses are out of date with Part L U values, thermal bridges, airtightness. Avoid notes including 'or similar' or 'or suitable' do use 'or equivalent' and police it



Suspended Timber Upper Floors:



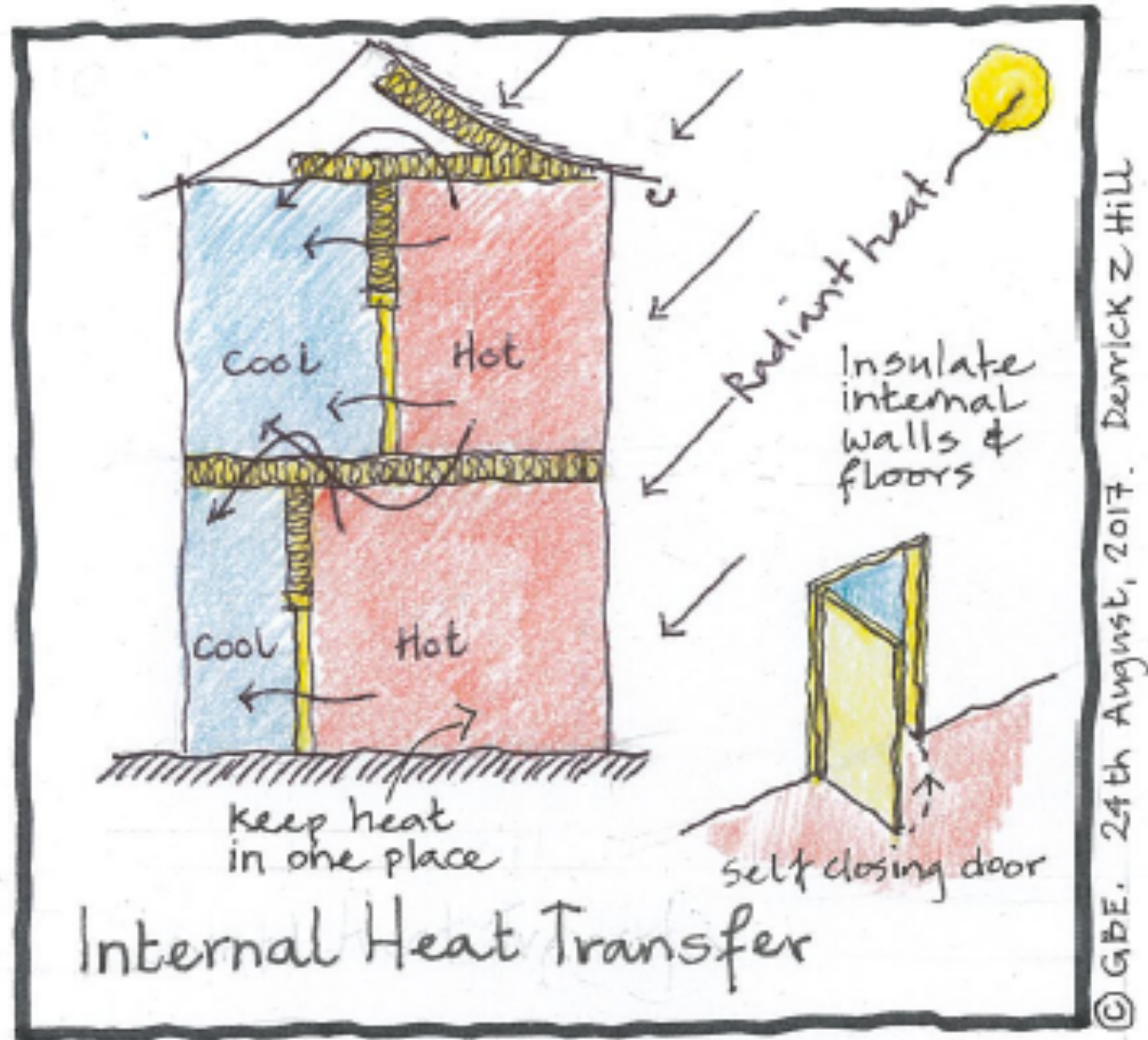
Suspended Timber Upper Floors



Excerpt from Building Construction Handbook

Internal Heat Transfer

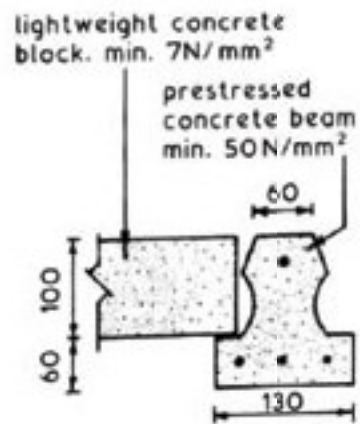
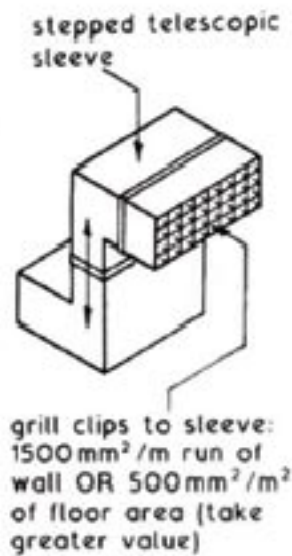
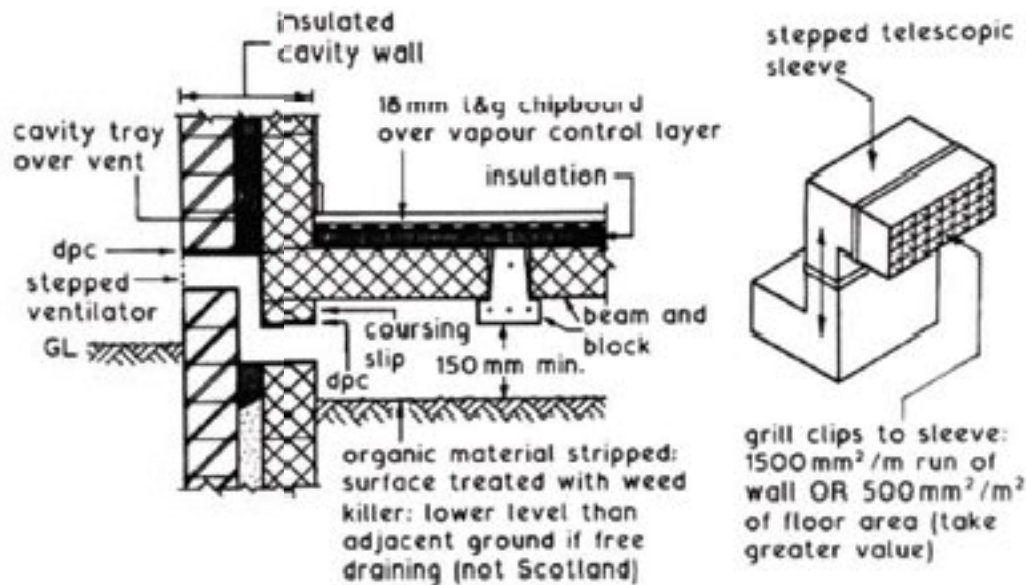
Keep heat in its
place of arrival
Maintain safe
refuge on the
cooler side
Insulate internal
floors and
partitions
Self-Closing doors
Promoted by
BedZED



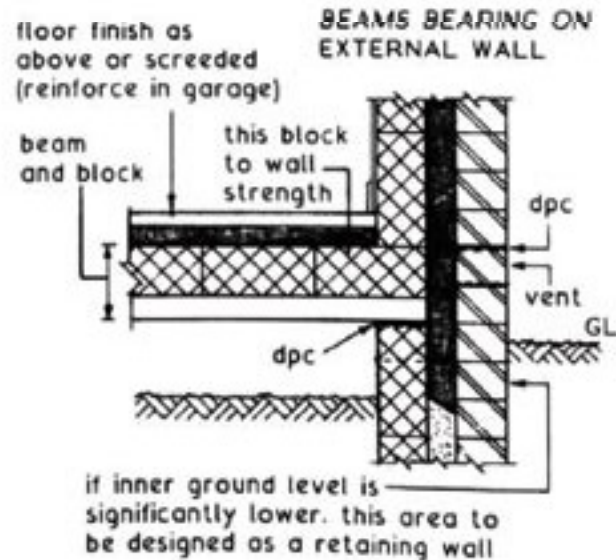
Suspended Concrete Ground Floor: Domestic/Light Commercial use

NB: insulation thicknesses and thermal bridges are out of date with Part L

Avoid notes including 'or similar' or 'or suitable' do use 'or equivalent' and police it



TYPICAL BEAM/RIB AND BLOCK DETAIL

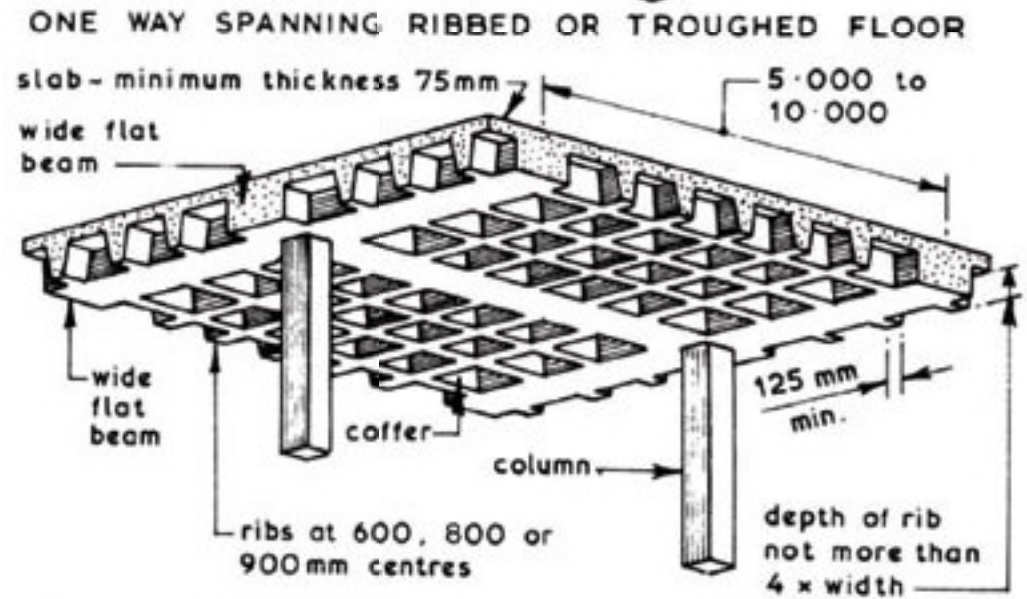
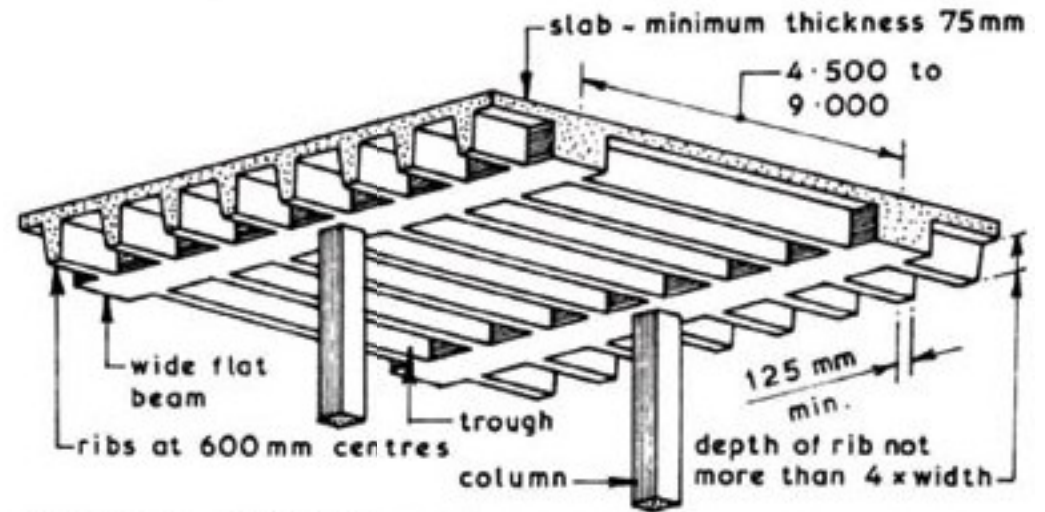
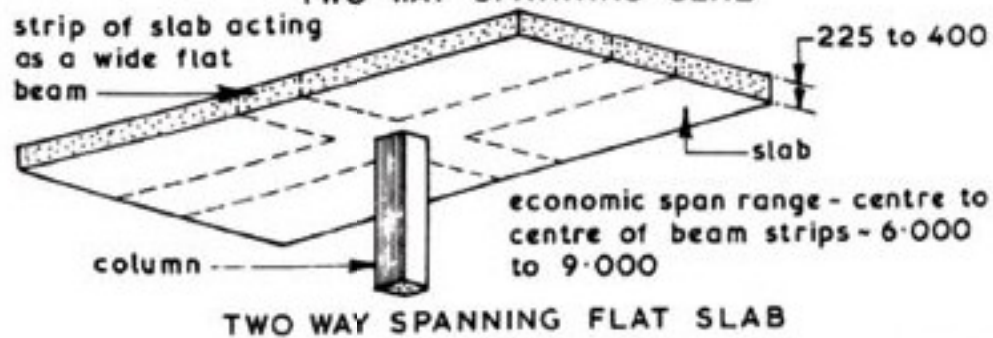
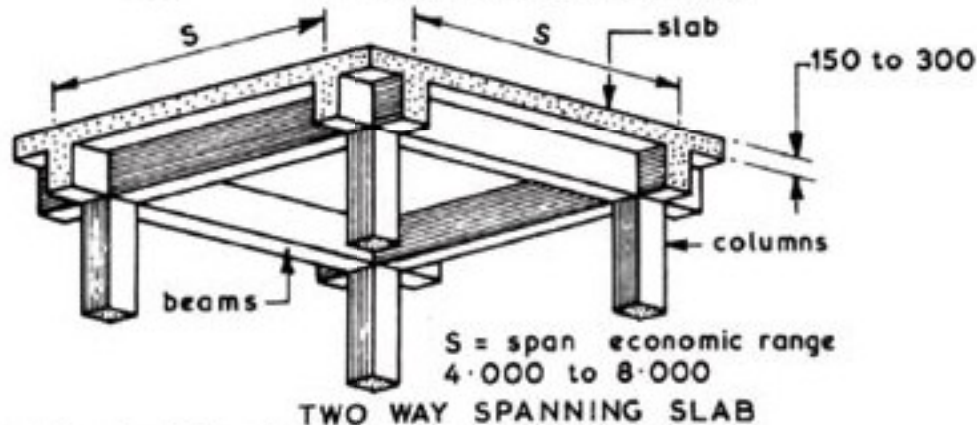
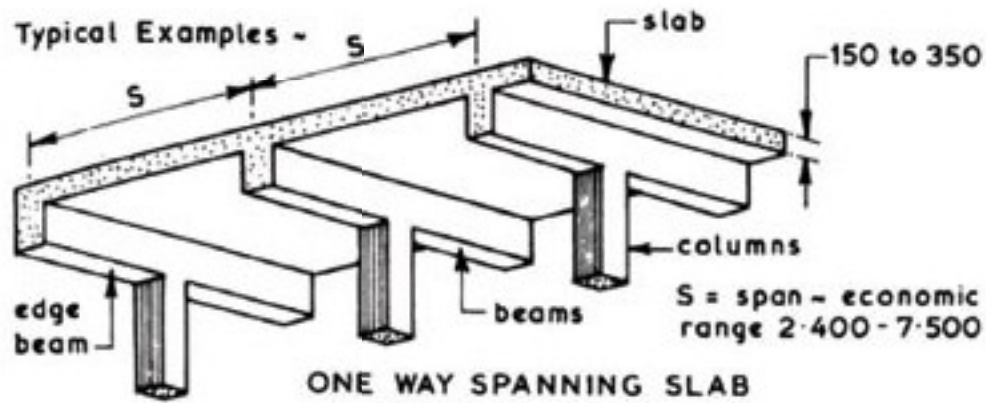


Suspended Concrete Floor: Beam and Block Floor

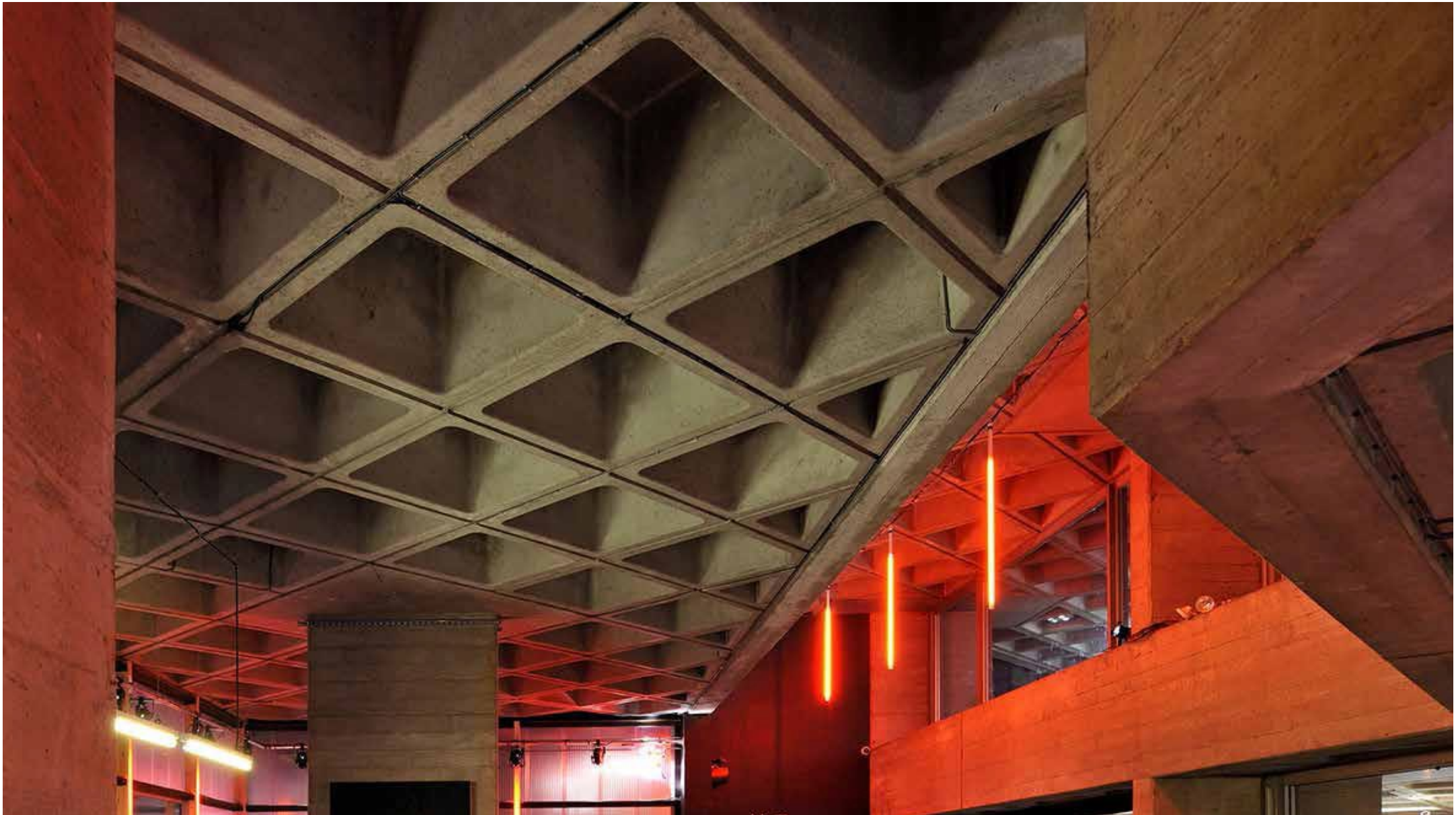


Example suspended concrete floor

Suspended Insitu Concrete Floor: Non-Domestic Commercial uses



Insitu Suspended Concrete 'Waffle' Slab: Non-domestic and Commercial use



Interior Royal National Theatre, London, Denys Lasdun

Suspended Light Steel Framed Floor: Domestic and Non-Domestic use



Example suspended steel floor

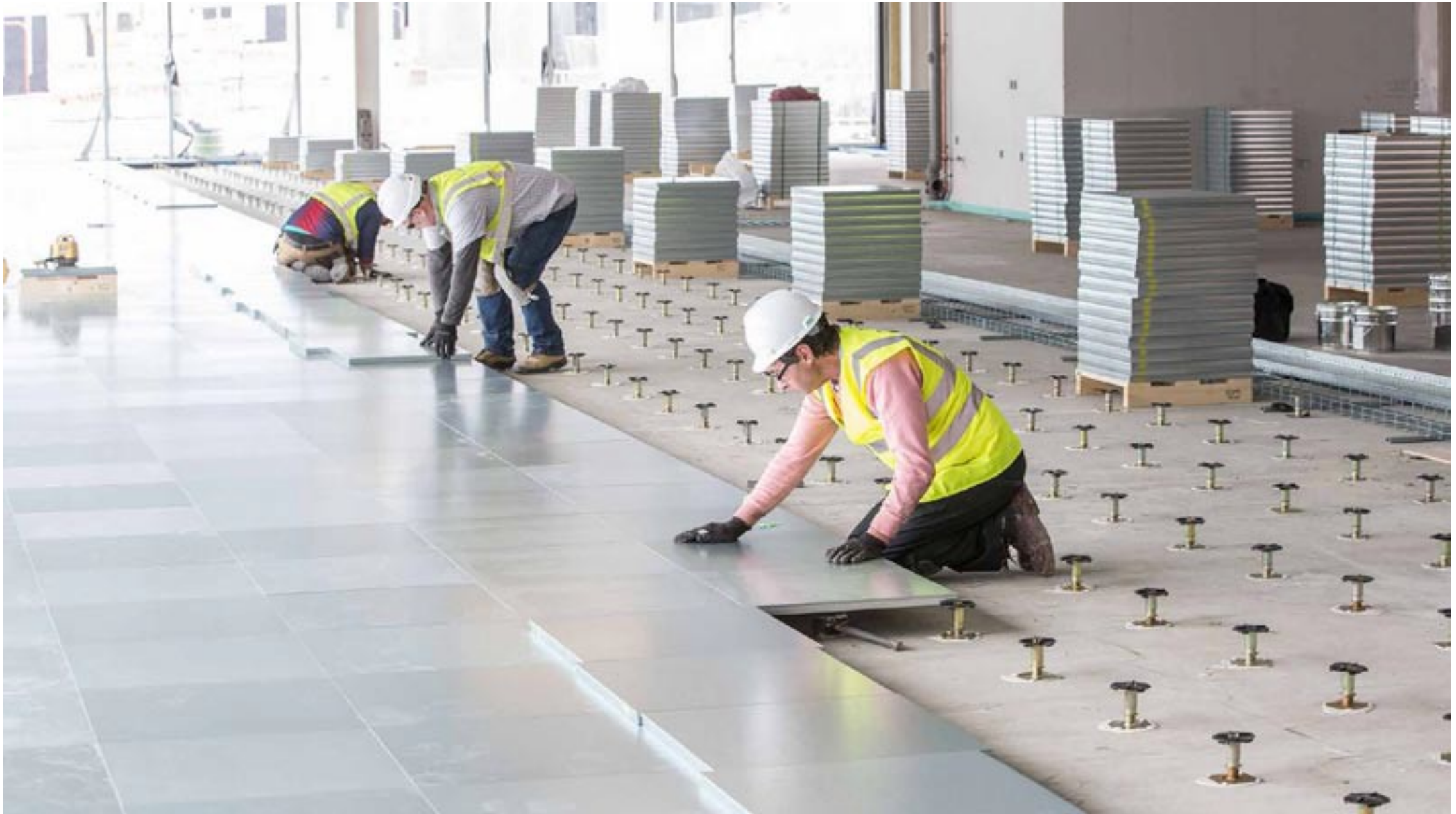
Hybrid Upper Floor: Non-domestic and Multiple Domestic

Fire protection of steel not installed yet



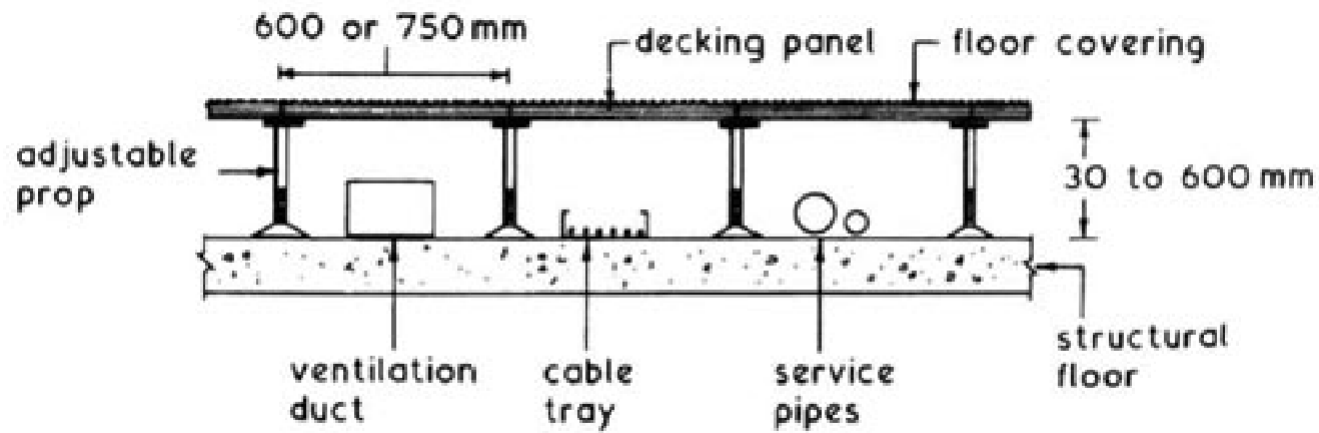
Example Steel Frame carrying Concrete Floor Deck

Raised Access Floor: Office and non-domestic

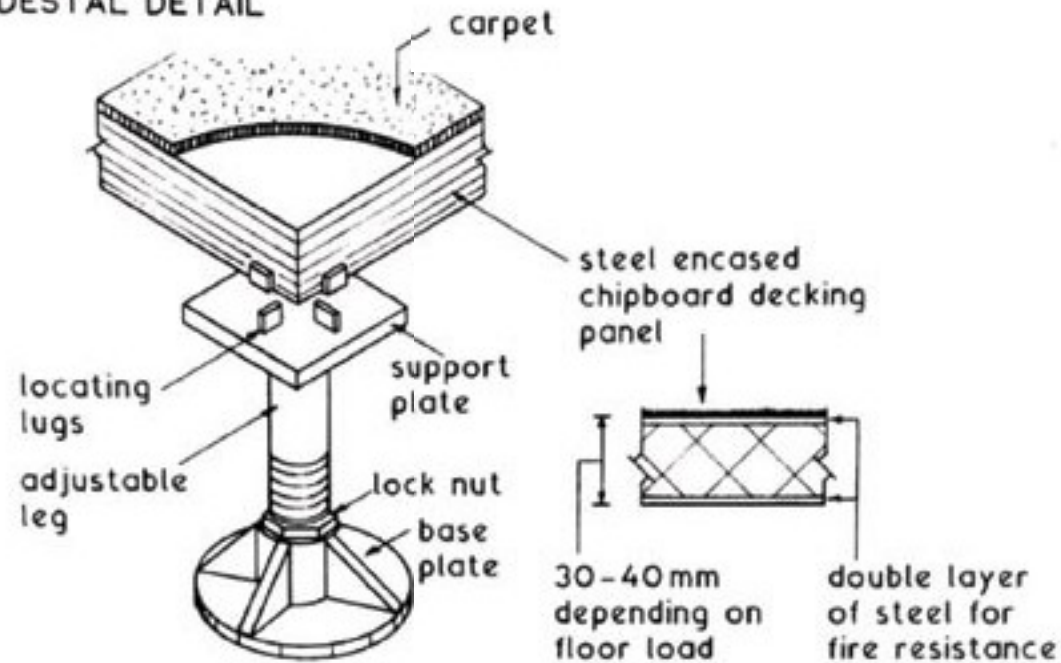


Raised Access Floor Site Photo

Raised Access Floor: Floor as Service Zone:



PEDESTAL DETAIL

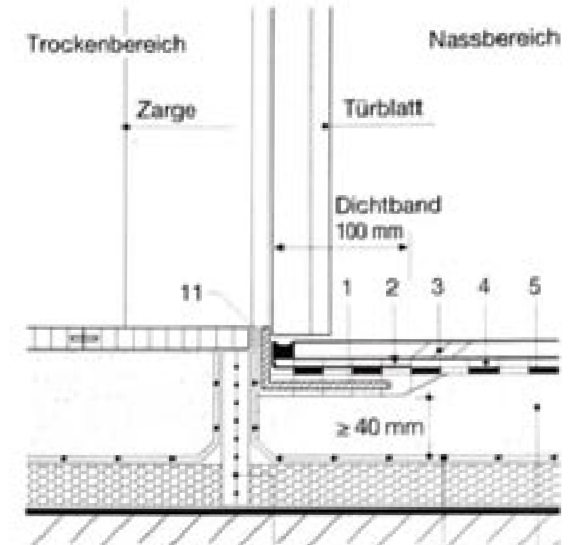
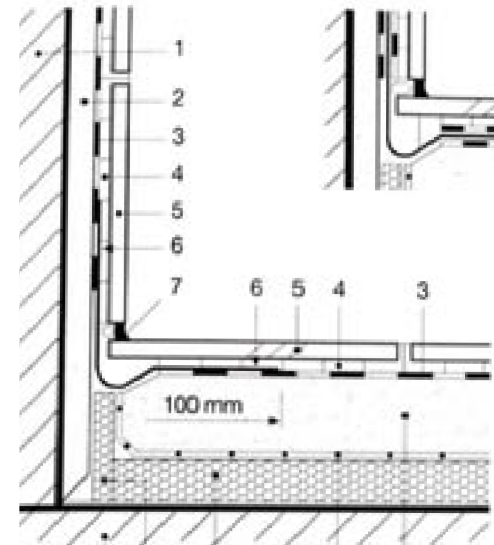
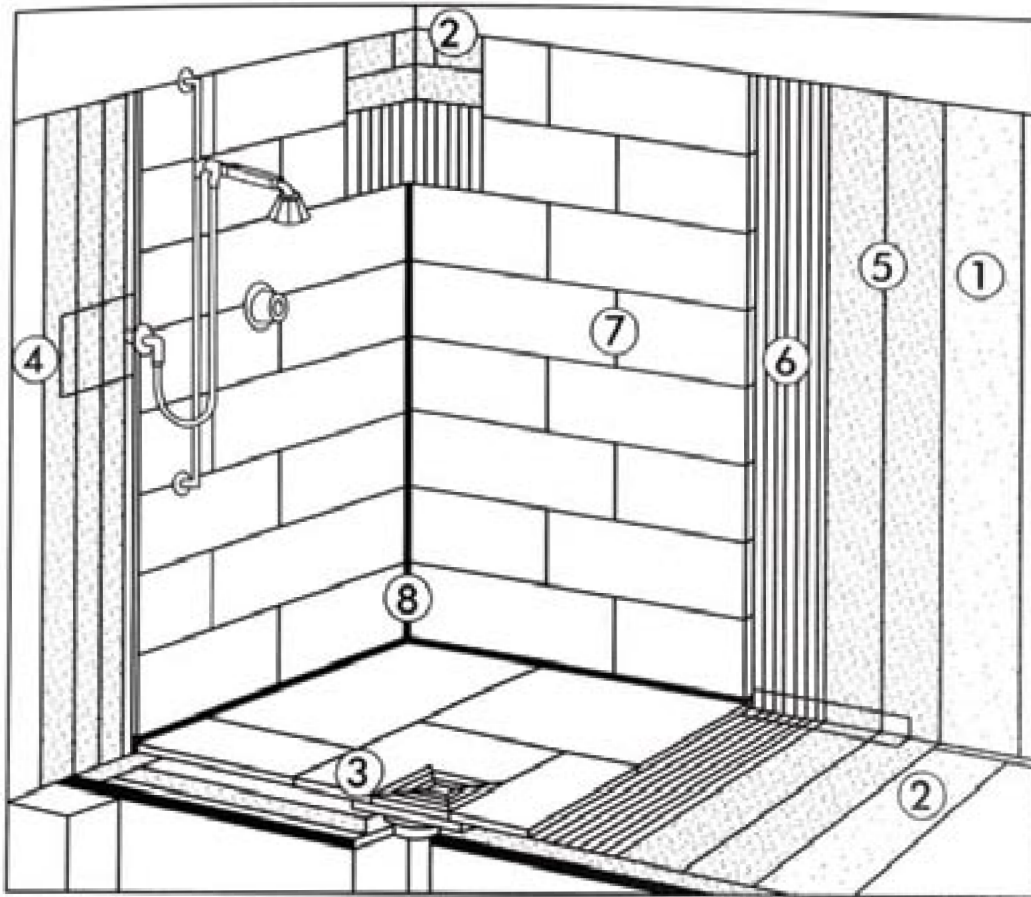


Floor as Service Zone: Under Floor Heating



Under Floor Heating Site Photo

Wet Room Floors



Floor: Rubber



Rubber Flooring, Staatsgalerie Stuttgart, Stirling Wilford

Floor: Polished Concrete



Tate Modern, London, Herzog de Meuron

Floor: Terrazzo



Neues Museum, Berlin, David Chipperfield

Floor: Timber



Refugee Camp, Mannheim, Students of the University of Kaiserslautern

Ceilings



First Principles

Functions and key considerations of ceilings:

- *As the underside of a floor or roof, ceilings contribute to the look feel (and acoustics, depending on finish) of a space*
- **Provision of service zones or plenums (depending on MEP strategy)**
- **Provision of a surface from which to hang or fix architectural, engineering and MEP components**



Ely Cathedral, Cambridgeshire

Key Building Regulations

The Building Regulations 2010

Fire safety

APPROVED DOCUMENT

B

VOLUME 1 – DWELLINGHOUSES

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- B3 Internal fire spread (structure)

The Building Regulations 2010
The Building (Approved Inspections etc) Regulations 2010

Resistance to the passage of sound

E

APPROVED DOCUMENT

- E1 Protection against sound from other parts of the building and adjoining buildings
- E2 Protection against sound within a dwelling-house etc

The Building Regulations 2010

Conservation of fuel and power

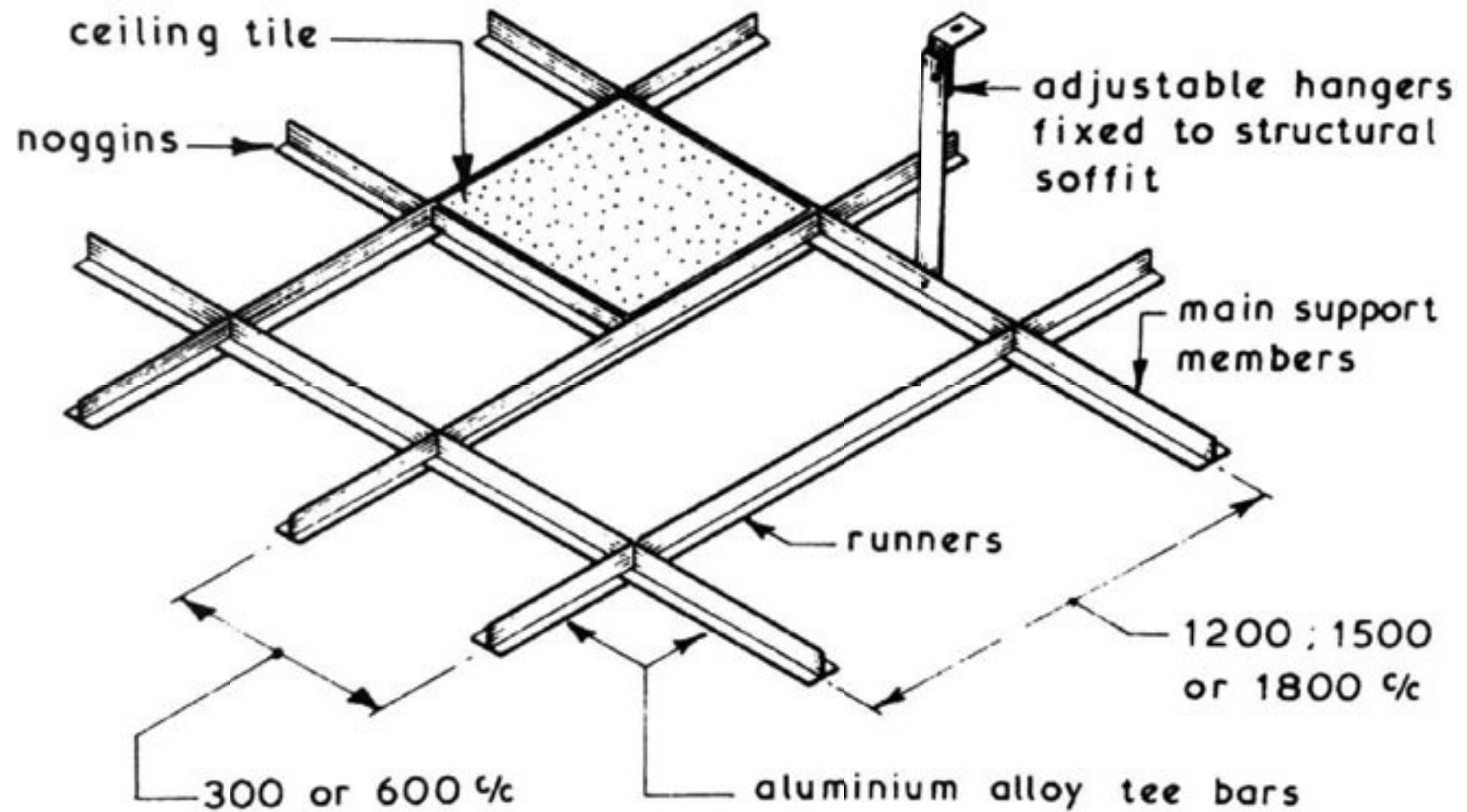
L1A

APPROVED DOCUMENT

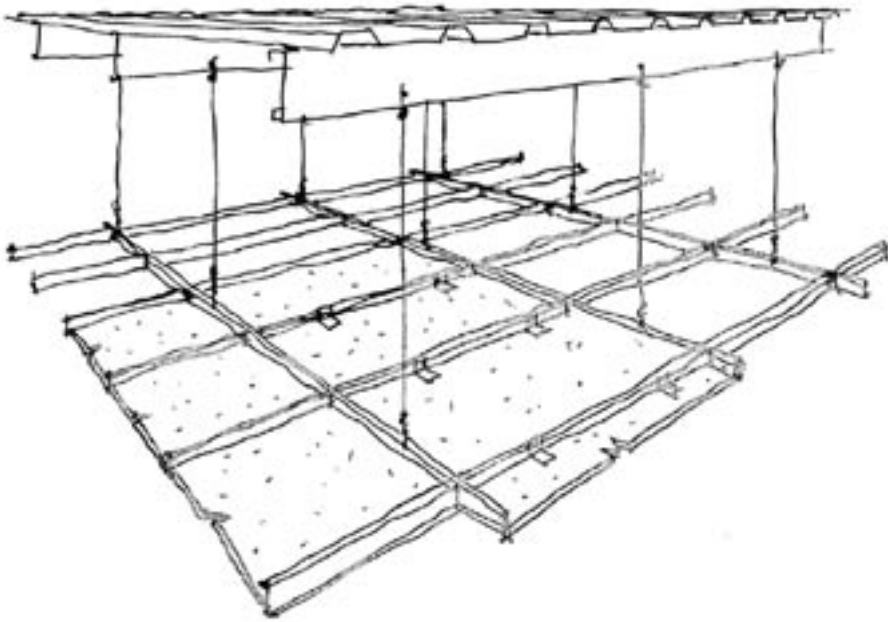
L1A Conservation of fuel and power

Suspended Ceiling

Typical Suspended Ceiling Grid Framework Layout ~



Suspended Ceiling

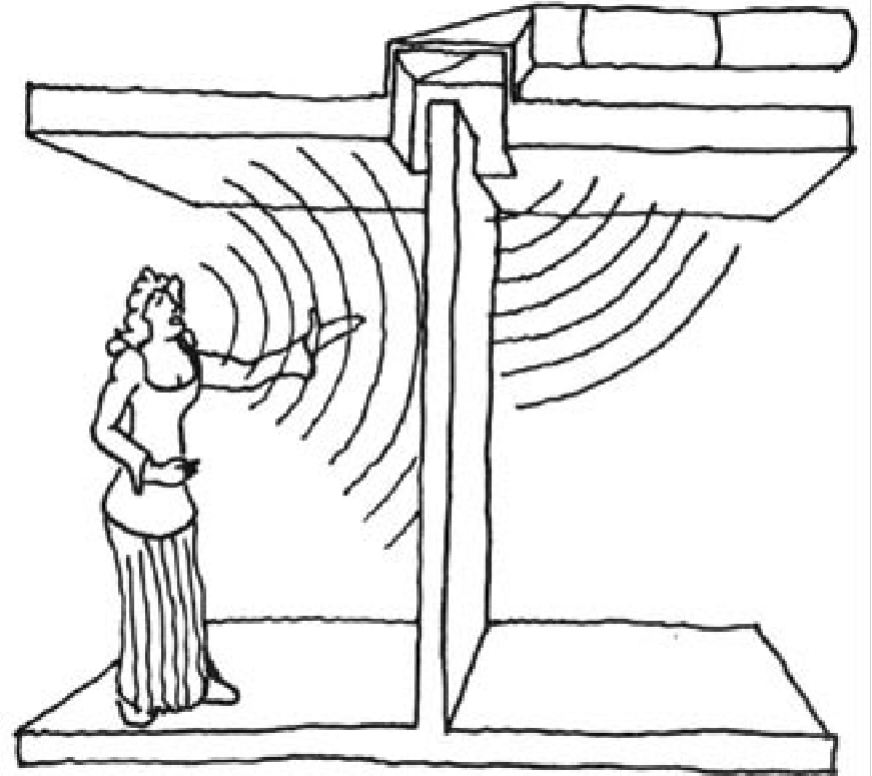


Example Sketch

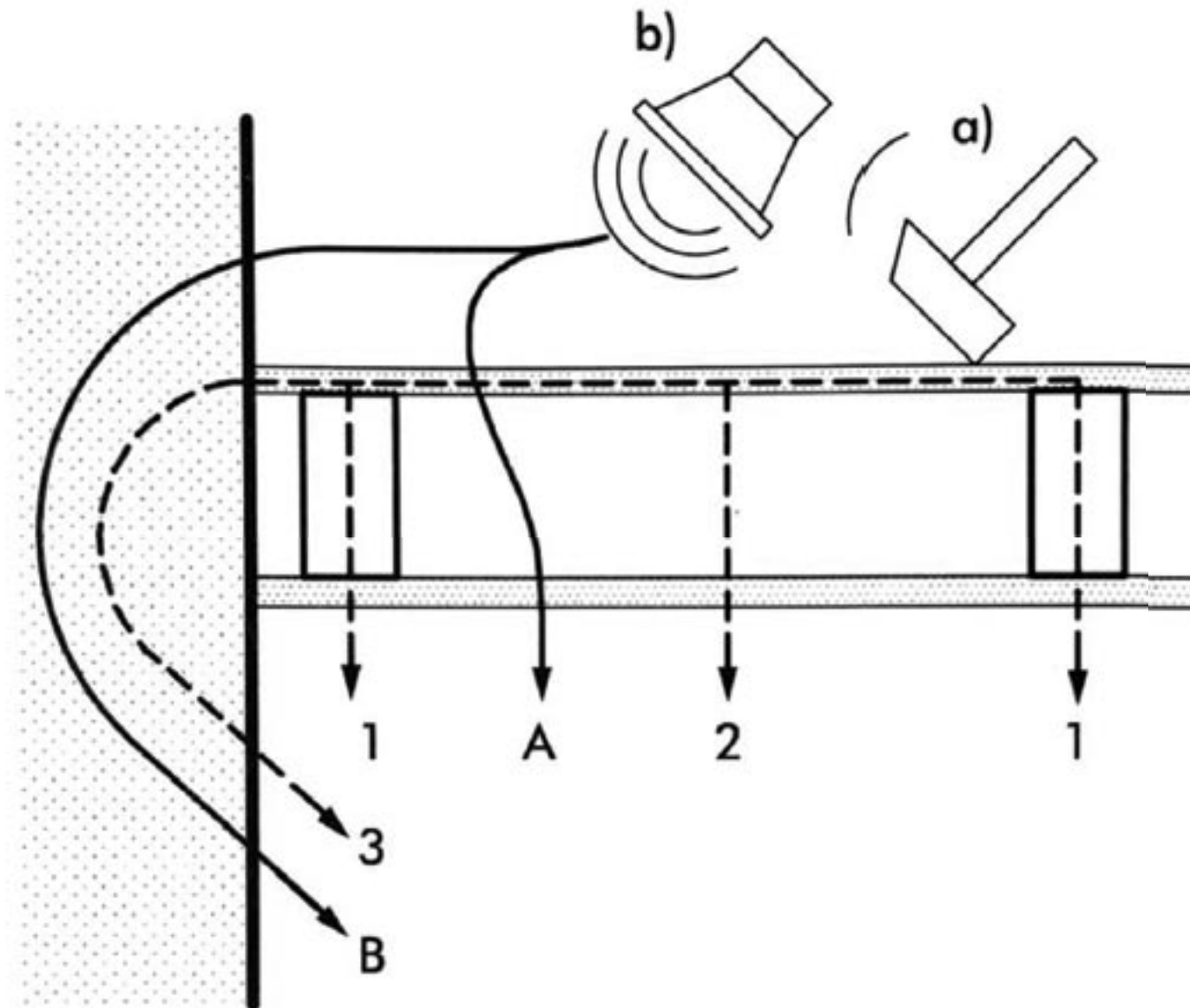


Site Image

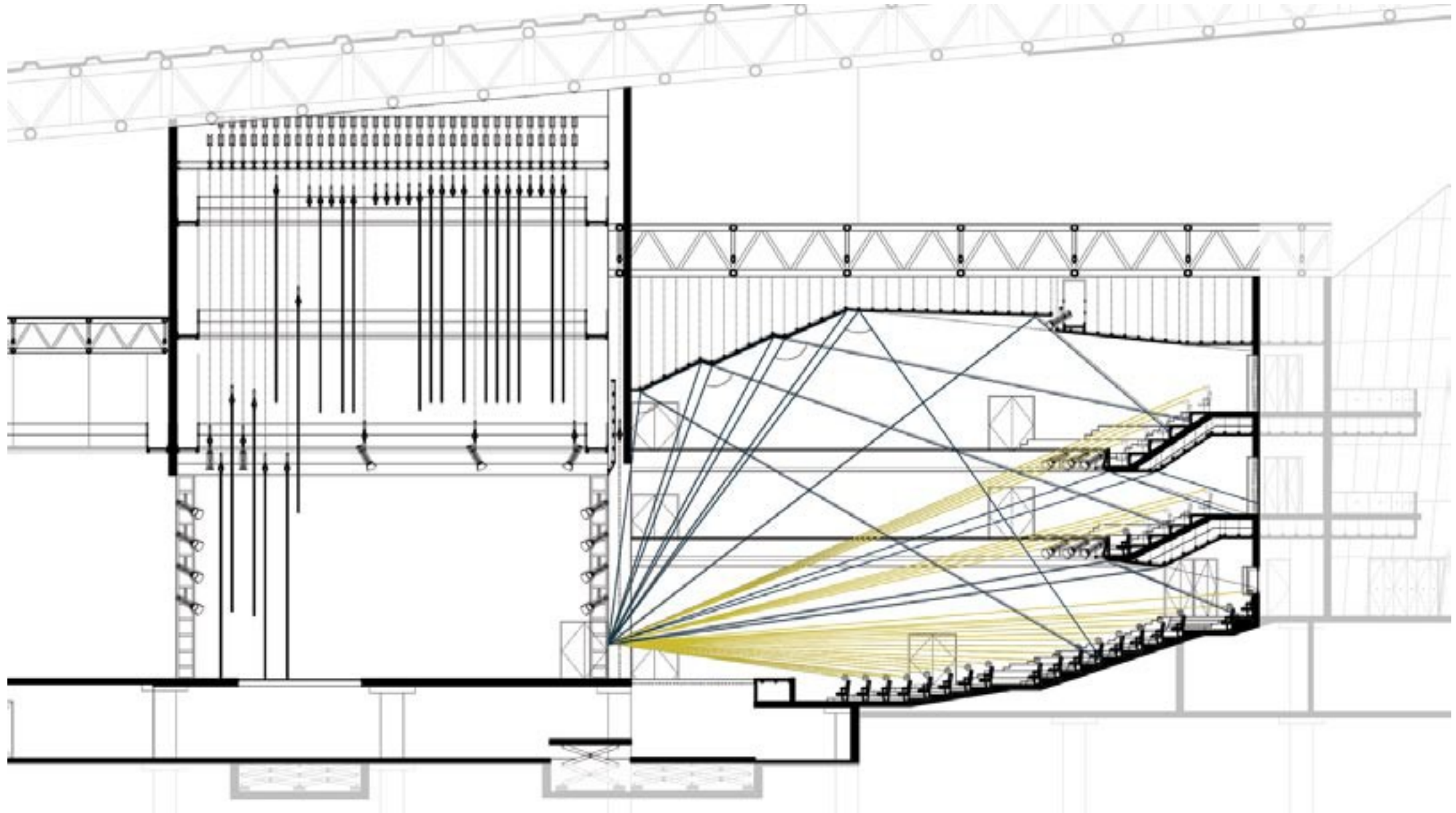
Acoustics: Reflection & Flanking/Bypass



Sound Acoustic Flanking

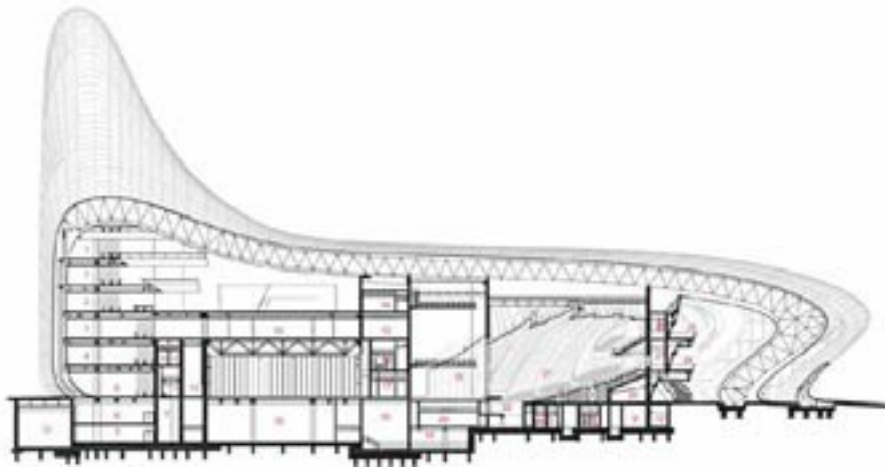
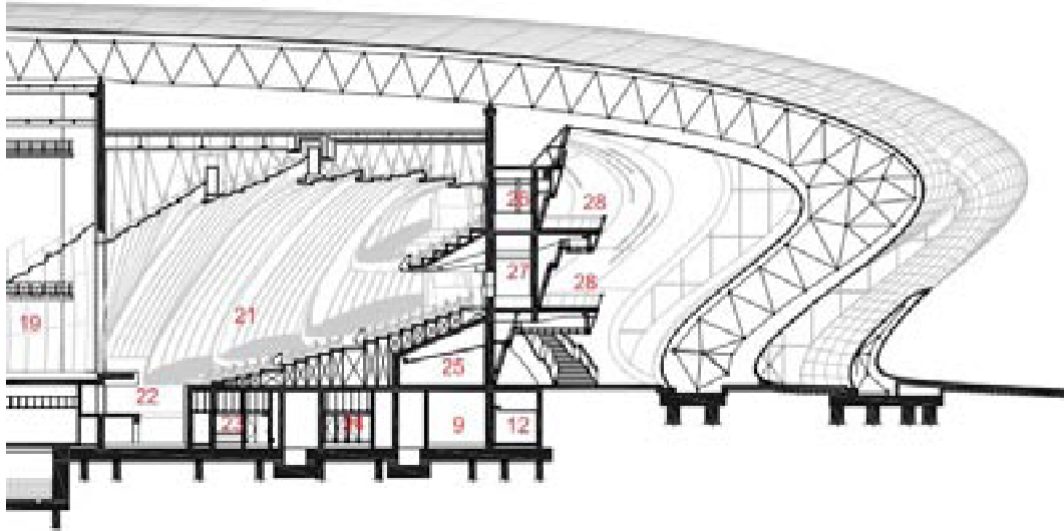


Acoustics: Reflection & Reverberation



The Phuket Opera, Acoustic Diagram

Suspended Ceilings



Heydar Aliyev Centre, Baku, Azerbaijan, Zaha Hadid Architects

Suspended Ceilings



Heydar Aliyev Centre, Baku, Azerbaijan, Zaha Hadid Architects

Ceiling/Roof



Shah Mosque, Isfahan, Iran

Ceiling/Roof



Kimbell Art Museum, Texas, Louis Kahn

Ceilings/ Roof



Tate St Ives, St Ives, Cornwall, Jamie Forbert Architects

Ceiling/Roof



Scottish Parliament, Edinburgh, Enric Miralles

(22) Internal Partitions

G14 Light Steel Frame,
G20 Light Timber Frame,
H13 Structural Glass Assemblies,
K10 Plasterboard linings and partitions and ceilings,
K30 Panel partitions
K32 Toilet Cubicles
K33 Terrazzo Toilet Cubicles

Partitions / Loadbearing Internal walls, Solid Wall Solutions

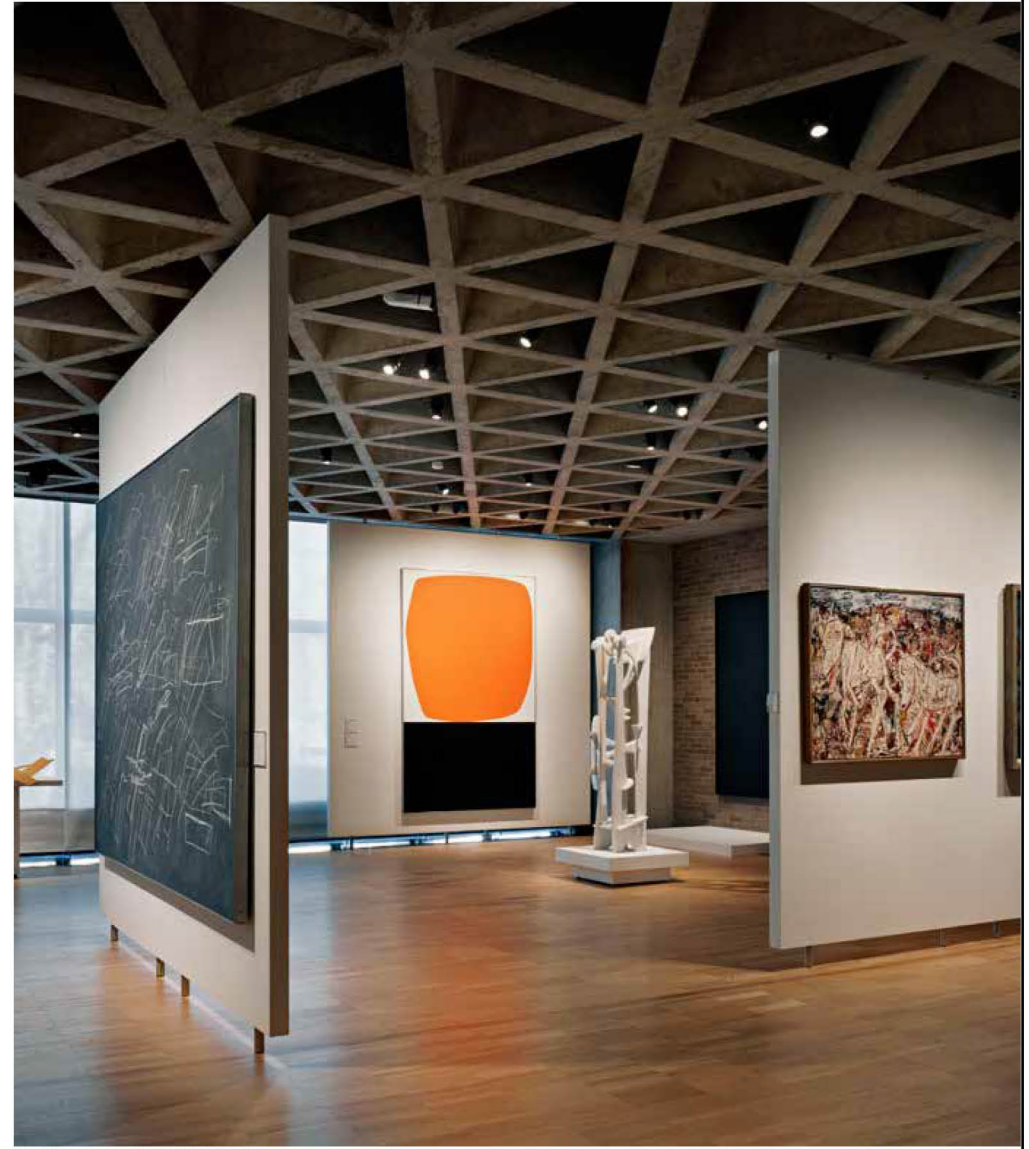


First Principles

Function of an internal wall:

- *Physical space separation*
- Isolation of certain activities
- Fire protection
- Thermal insulation
- Sound control
- Support internal fittings and fixtures
- Pleasing appearance colour and texture
- Structural (depending on structural strategy)

This only scratches the surface



MacMillan Centre, Yale, USA, Exhibition

THIRD EDITION

PRINCIPLES OF element design



Peter Rich &
Yvonne Dean



ARCHITECTURE/DESIGN

PRINCIPLES OF element design

THIRD EDITION

Peter Rich & Yvonne Dean



- Unique in its approach to detail design
- Invaluable for both students and practising architects, builders and surveyors
- Completely updated in a convenient reference sheet format

The construction of buildings is learnt through experience and the inheritance of a tradition in forming buildings over several thousand years. Successful construction learns from this experience which becomes embodied in principles of application. Though materials and techniques change, various elements have to perform the same function. **Principles of Element Design** identifies all the relevant elements and then breaks these elements down into all their basic constituents, making it possible for students to fully understand the given theory and principles behind each part. As all building projects are subject to guidance through the Building Regulations and British Standards, this book gives an immediate reference back to relevant information to help practitioners and contractors identify key documents needed.

Peter Rich BA (Hons) Architect, started his career with 14 years' experience as a qualified architectural technician. He then joined the AA School of Architecture, working with Bill Allen and John Bickerdike after his graduation, later becoming a partner of Bickerdike Allen Rich and Partners. He also taught building construction at the Bartlett School of Architecture, University College London, and architectural design at the Polytechnic of North London. He now acts as a Consultant.

Yvonne Dean BA (Hons) BA (Open) BA, is an architect, energy consultant and materials technologist. She also has 15 years' experience as a lecturer, travels widely and is a guest lecturer at many universities. She pioneered an access course for Women into Architecture and Building, which has been used as a template by others, and has been instrumental in helping to change the teaching of technology for architects and designers.



Architectural Press

An imprint of Butterworth-Heinemann
<http://www.bh.com>

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9 780750 631136

Gravity:

downward pull, self weight, Furniture and Lining loads

Dynamic forces:

Human impacts, wheeled furniture impacts

Internal Wind Pressure Buffeting:

Pressure, Rattling, Motive, Destructive, Penetrative

Moisture vapour:

permeation, condensation, moisture mass, moisture moderation, insulation impaired, hygroscopicity, material degradation

Sun:

Temp variation, thermal movement, heat gains, Chemical decomposition

Dirt and Dust: infiltration, deposition, surface pollution

Chemicals: corrosion, disintegration, decomposition

Sound: Noise nuisance, from within

Attack: Manual, Ballistics, Bomb Blast

Thermal: Solar heat gains/loss, thermal mass, phase change, stack effect,

Electromagnetic radiation: sickness for susceptible occupants

Gravity: Support & restraint

Wind pressure buffeting:

rigidity, resilience, sealing, air tightness layers and detailing

Moisture vapour:

resistance, hygroscopicity, permability, breathing, moisture mass

Sun:

movement joints, insulation, shielding, invulnerable materials

Dirt and Dust: repulsion, exclusion, sheilding, cleaning

Chemicals: invulnerable materials, exclusion,

Sound:

Insulation, absorption, acoustic mass, separation, isolation,

Attack:

toughness, lamination, edge restraint, edge protection

Insulating: thermal insulation, thermal mass,

Electromagnetic radiation: Absorbs, shields

Wall Categories

Partition, Party/Separating walls, Compartment walls

Systems

Brick/block units, Monolithic, frame and sheet, sandwich panels

Appearance

Structural strength and stability

Loadbearing, non-loadbearing

Wind pressure buffeting post, stability stiffening posts, head and abutment restraint, joint reinforcement

Fire Protection

Fire resistance, spread of flame

Stability, integrity, insulation

Durability and maintenance

Thermal performance

Insulation, thermal mass, cold bridge avoidance, air tightness

Acoustic performance:

Noise barrier, sound absorption, flanking sound,

Movement:

Thermal, structural, moisture

Security:

Prevent Entry, Resist Attack, Restrain occupants

Party walls:

Structural fire precautions, structural stability, Condensation and Insulation, sound control

Compartment Walls:

Fixed Partitions:

Relocate able Partitions, Demountable partitions

Mobile Partitions

Retractable, Sliding, Folding,
Cubicles

Key Building Regulations

Legal minimum > But 'the Performance Gap' suggests we don't meet this minimum very often

The Building Regulations 2010

Fire safety

APPROVED DOCUMENT

B

VOLUME 1 – DWELLINGHOUSES

- B1 Means of warning and escape
- B2 Internal fire spread (linings)
- B3 Internal fire spread (structure)

Part L

Internal partitions not normally regulated
Insulate to restrict overheating to sunny side

The Building Regulations 2010
The Building (Approved Inspections etc) Regulations 2010

Resistance to the passage of sound

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APPROVED DOCUMENT

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- E2 Protection against sound within a dwelling-house etc

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Conservation of
fuel and power

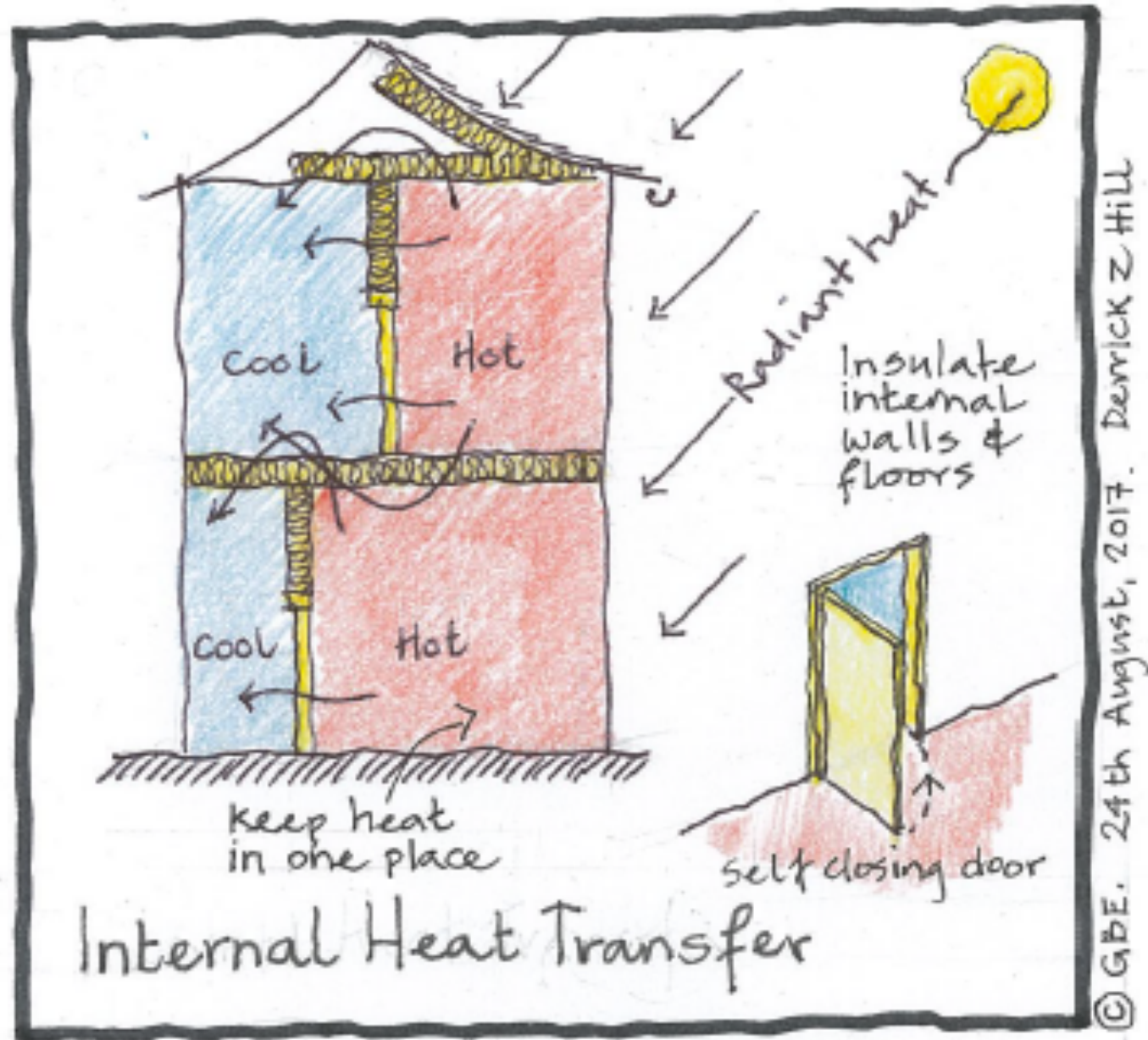
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L1A

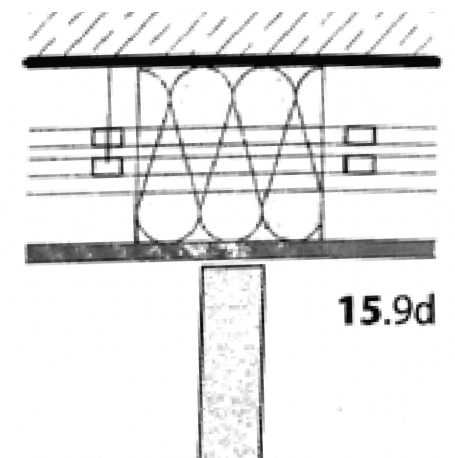
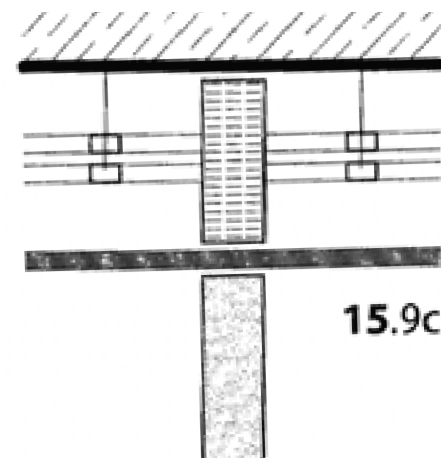
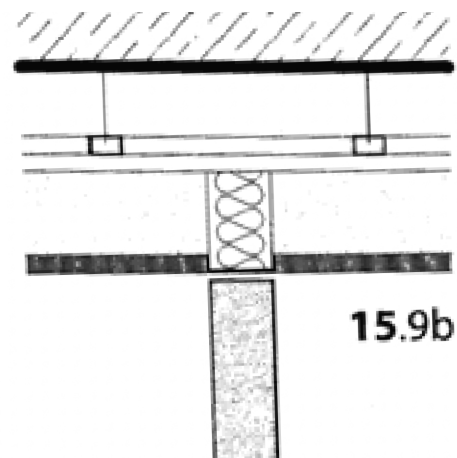
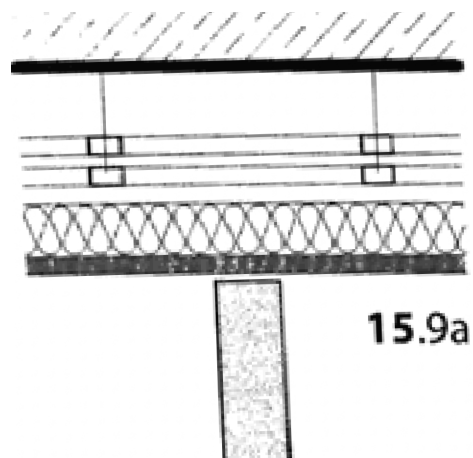
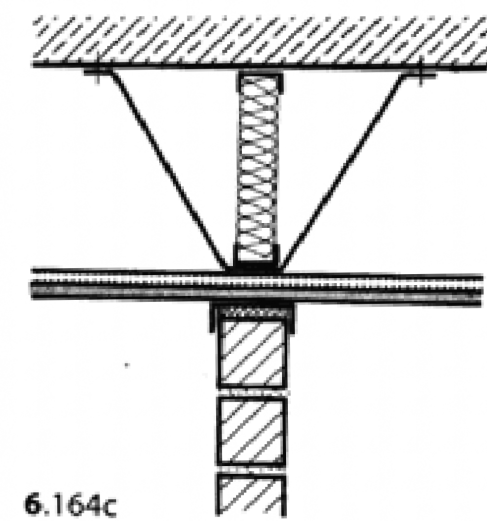
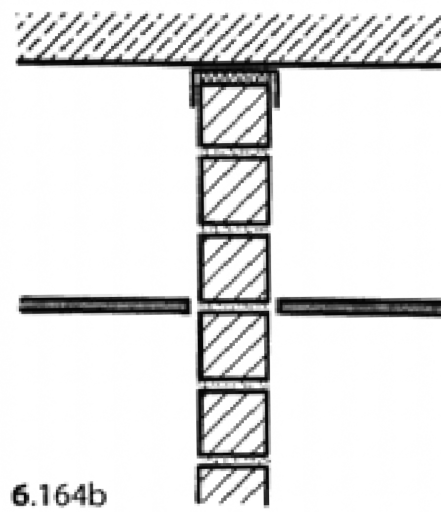
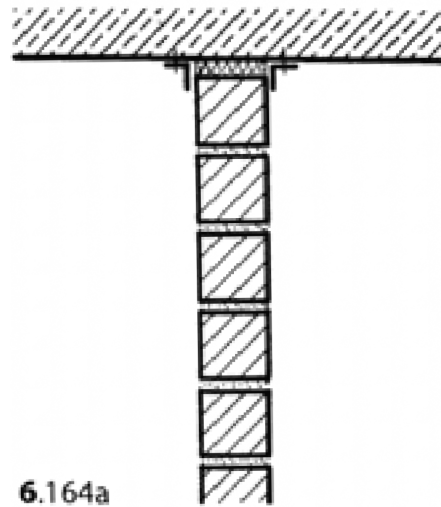
L1A Conservation of fuel and power

Internal Heat Transfer

Keep heat in its
place of arrival
Maintain safe
refuge on the
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Insulate internal
floors and
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Close doors
Promoted by
BedZED

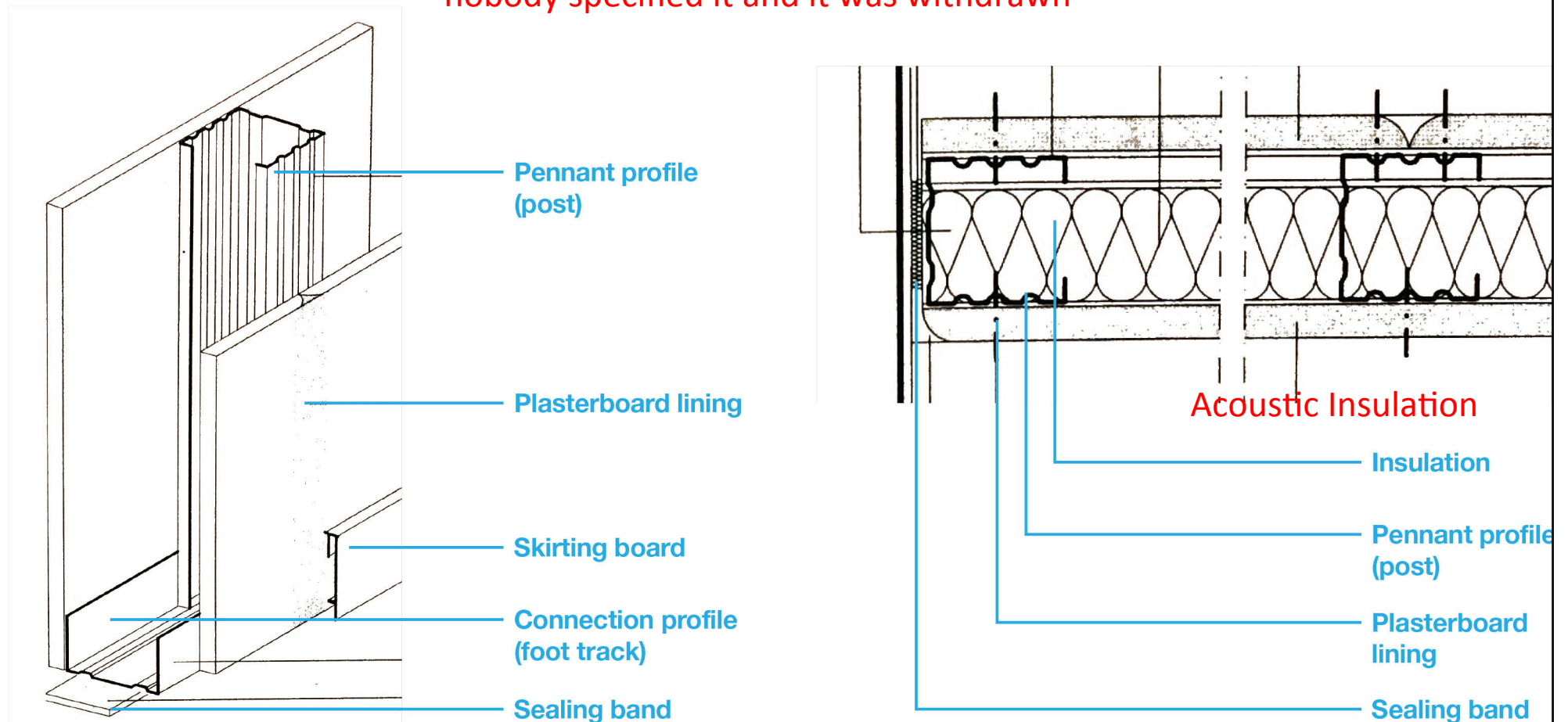


Partitions: Structural, Fire and Acoustic Configurations



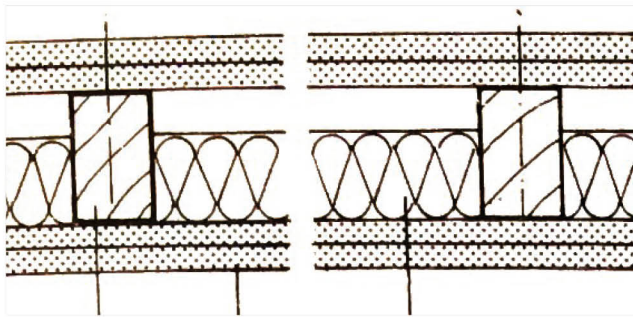
Typical ('demountable') Internal Partition Components

Demolish able: British Gypsum made Demountable,
nobody specified it and it was withdrawn

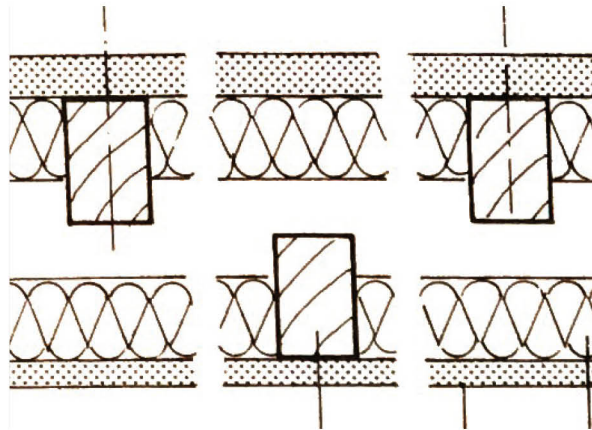


Example Horizontal Wall Sections /Partitions

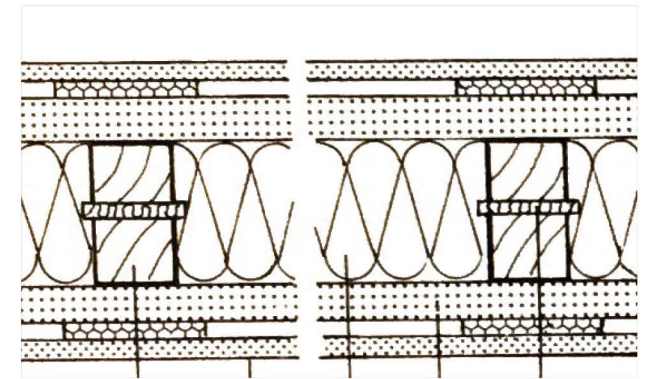
Single stud
Partial acoustic insulated
Double layers lining



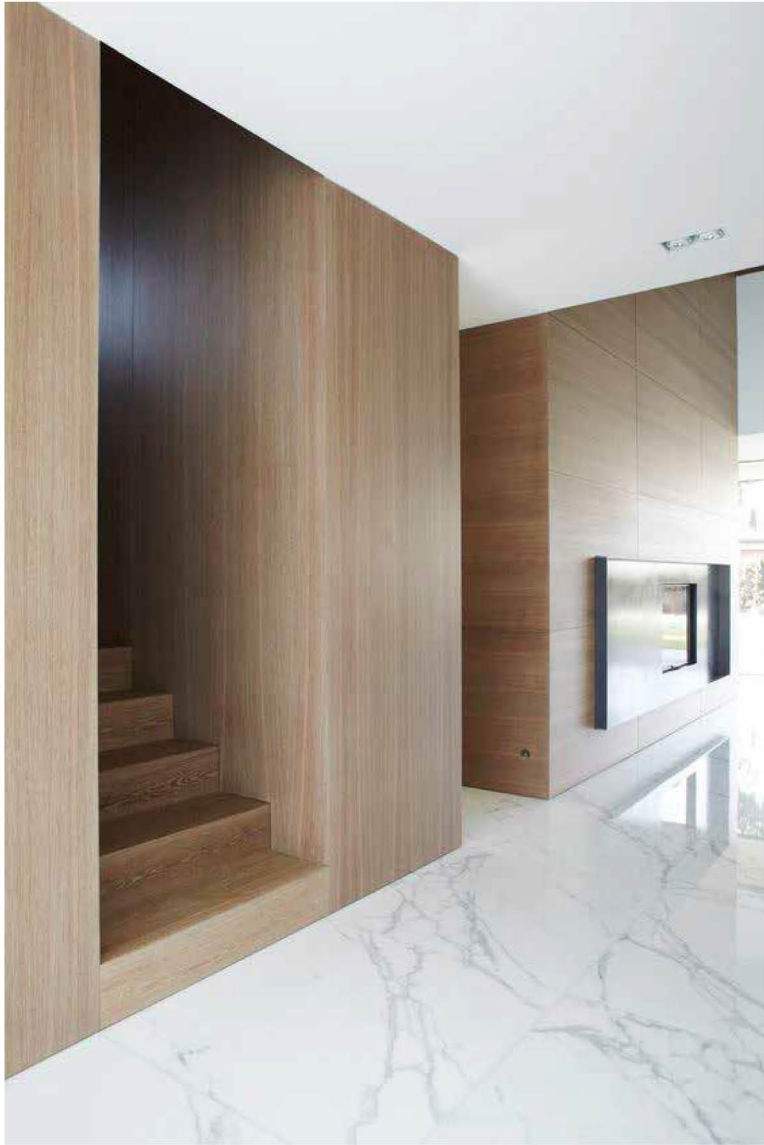
Timber Stud Partitions
Double staggered stud
Two layers acoustic insulation
Thicker linings



Acoustically broken stud
Thicker full insulated
Acoustically isolated linings



Partitions



Maison a Vessy, Antonio et Daniela Carnerio Architects



Fauland House, David Chinnerfield

END OF LECTURE - QUOTE

*“I prefer drawing to talking.
Drawing is faster, and leaves less room for lies”*

Le Corbusier, Architect

