1.1 Functions of external wall

Primary functions:

Secondary functions:
## 1.2 Functional requirements of external walls

<table>
<thead>
<tr>
<th>Required in all buildings *</th>
<th>Optional *</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Strong and stable</td>
<td></td>
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<tr>
<td>* Weather resistance</td>
<td></td>
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<tr>
<td>* Good fire resistance</td>
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<tr>
<td>* Good thermal insulation</td>
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<tr>
<td>* Good sound insulation</td>
<td></td>
</tr>
<tr>
<td>* Good aesthetics</td>
<td></td>
</tr>
<tr>
<td>* Easy to maintain</td>
<td></td>
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</tbody>
</table>

## 1.1 Strength and stability

- **Strength**: resistance to the stresses including its own weight and imposed loads

- **Stability**: resistance to buckling due to excessive slenderness (height/width) and overturning by lateral forces
1.2 Weather resistance

✓ Resistance to:
  ✓ wind
  ✓ rainfall

Resistance to rainfall penetration

A. Allow limited penetration by thickness
B. Block penetration by impermeable material
C. Non-capillary material e.g. no-fines concrete
D. Isolated outer surface from inner surface e.g. cavity wall

1.3 Fire resistance

✓ Purposes:
  ✓ To provide safe escape routes for occupants
  ✓ To prevent spread of fire between buildings
1.4 Thermal insulation

Methods:
☑ increase thickness of wall (in brick / concrete wall)

1.5 Sound insulation

Methods:
☑ increase the density of wall
1.6 Aesthetics & Ease of maintenance

- Depends on the structural materials and finishes used
- Has a direct impact to cost

Gondola used for cleaning external wall

2. Common materials for construction

- Bricks
- Stones
- Concrete
- Glass
2.1 Brick wall

2.2 Mortar

- in most situation: 1: 4.5 (c : fine agg)

- very exposed situations like chimneys: 1:3 (c : fine agg.)
2.3 Bonds

- Purpose: to provide better distribution of loading both horizontally and vertically

- Flemish bond
- English bond
- Stretcher bond

Adapted from Structure and Fabric, Part 1, 5th Edition, by J.S. Foster, p. 72
2.4 Jointing and Pointing

Two types:
✓ Jointing - carry out **during** the laying of bricks
✓ Pointing - carry out **after** the brickwork is completed

The finish of the face edge of the joints in between bricks

Pointing trowel

Flush
Recessed
Weathered
3. Wall in Natural Stone

✓ construction is similar to brick or block wall except for the bonding (variety will be more limited)

✓ careful selection of suitable size and shape of the stones will be required

4. Concrete wall

✓ most flexible in terms of thickness, layout and desirable strength

✓ monolithic in nature, hence better strength

✓ formwork (版模) will be required

✓ Can be precast or cast in-situ
Different components of Formwork to external wall

- Waling
- Stud
- Boarding
- Bolt tie
- Strut

Section through the wall formwork
Formwork for in-situ concrete external wall

Waling and bolt ties for keeping formwork in position

The space where concrete to be poured

Protruded bars left for laying concrete external wall of upper floor

Protruded bars left after laying of concrete to external wall
Summary of this topic

1. Functions & functional requirements
2. Materials for external wall
3. Methods of construction
1. Functions of internal walls

Primary functions:
- 

Secondary functions?
- 

Internal walls

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2. Functional Requirements

- Strong and durable
- Stable
- Good thermal insulation
- Good sound insulation
- Moisture resistant
- Good appearance
- Fire resistant
- Enable services accommodation
- Flexible in repartitioning

Applied to all situations *

Optional *

3. Internal wall types

- Small bonded unit type
- Framed type
- Reinforced concrete wall
- Demountable partition

- Brick wall
- Glass / acrylic block wall
- Timber framed / stud partition
- Glazed partition
3.1 Small bonded unit type

- labour intensive
- slow construction
- requires drying
- heavy and inflexible
- undemountable

3.1.1 Typical brick wall

- load-bearing
- Mortar mix: cement/lime/sand mortar (1:1:6)
- usually requires further finishing
- good fire resistance
- building services can only be fixed on surface or put inside pre-set conduits
Conduits positioned before laying of brick wall

3.1.2 Fixing brick wall to existing concrete structure

- 3 methods:
  - 1. steel rods at wall ends

Existing concrete wall

- PVC conduits laid
- Junction box for wires positioned
- Timber door frame set as well
2. Holdfast to provide a key between concrete wall and brick wall

S.S. holdfast as key to concrete wall and brick wall

Brick put on top of holdfast

F. Fixing to existing concrete structures:
F. 3. Use steel mesh (instead of holdfast) to provide the key

Steel mesh
3.1.3 Glass block wall

- approx. 100mm thick
- non-load bearing
- maximum height 6m
- maximum area 11m²
- difficult to fix fixtures
- basically self-finished

3.2.1 Timber framed/stud partition

- characteristics:
  - lightweight
  - non-load bearing
  - poor fire resistance
  - moderate durability: requires protection from moisture and surface impact
  - building services can be fixed on the surface or in the void of the partition
3.2.1 Timber stud partition details

1. Vertical studs, 400-600mm c/c

2. Horizontal noggins in between studs, at height of 1m apart

3. Surface covering e.g. plasterboard, plywood board to both sides (inner space in between surface coverings can be filled with insulation materials)

4. Thicker heads and jambs around openings

Adapted from Construction Technology, Vol. 1, by R. Chadley (1975)
Accommodation of services in timber stud partition

Conduits laid in between studs

3.2.2 Glazed partition

Frameless without vertical posts

Framed with vertical posts, head and base channels
3.3 In-situ R.C. internal wall

3.4 Demountable partition

- non-load bearing
- proprietary (special made) products
- Demountable \(\Rightarrow\) provide flexibility in spatial arrangement
- usually self-finished
- building services can be accommodated inside the void of the panel
3.4 Major forms of demountable partitions

3.4.1 Steel frame with panel partition

- Vertical post as frame
- Concealed conduits
3.4.2 Sliding/folding partition

- components:
  - sliding track: overhead track or bottom guide rail
  - wheel hangers
- can be constructed with a housing cabinet to store the partition if not use
- for heavy panels in order to achieve better acoustic insulation, motorised tracks have to be used
3.4.3 Cubicle partition

- commonly used in toilets
- modular design
- components:
  - panel: laminated timber panels
  - main support: pedestal (adjustable)
  - door with locks, hooks, etc.

Summary of this topic

1. Functions & functional requirements
2. Types of internal walls
3. Construction details