1. Building

A **building** is a structure with a roof and walls standing more or less permanently in one place, such as a house or factory. Buildings come in a variety of sizes, shapes and functions, and have been adapted throughout history for a wide number of factors, from building materials available, to weather conditions, to land prices, ground conditions, specific uses and aesthetic reasons. Buildings serve several needs of society – primarily as shelter from weather, security, living space, privacy, to store belongings, and to comfortably live and work. A building as a shelter represents a physical division of the human habitat (a place of comfort and safety) and the outside (a place that at times may be harsh and harmful).

1.1 Types of buildings

Buildings can be classified into different categories from different perspective. Many buildings fall into multiple categories simultaneously. In general, building can be of following types:

i. Residential Building
ii. Educational Building
iii. Institutional Building
iv. Assembly Building
v. Business Building
vi. Mercantile Building
vii. Industrial Building
viii. Storage Building
ix. Hazardous Building

i. Residential Building: This type includes the buildings for dwelling such as apartment houses, dormitories, hotels etc.

ii. Educational Building: The buildings those are used for school, college, day care purposes where group of people gathers fall into this category.

iii. Institutional Building: This type of buildings includes those where liberty of inmates is restricted. These buildings are for some specific purposes such as hospital, nursing homes, jails, orphanages etc.

iv. Assembly Building: The buildings or parts of building where groups of people gather for social, religious, civil, travel or amusement purposes can be classified as assembly building. Such buildings can be auditorium, exhibition halls, museum, gymnasium etc.

v. Business Building: These buildings are generally used for business transactions, keeping accounts, records etc. For instances, library, bank etc.

vi. Mercantile Buildings: This type of building is used for shop, malls, stationary where goods are stored and displayed for whole or retail sales purpose.

vii. Industrial Building: The buildings where fabrications, assembly, processing etc. of materials of all kinds take place are categorized as industrial building.

viii. Storage Building: These Building are used for storing goods or products such as ware house, cold storages, garages, grain elevators etc.

ix. Hazardous Building: The Buildings where highly combustible, explosive or toxic, corrosive or poisonous materials are stored are classified as hazardous building.



Fig. 1.1 Residential building



Fig. 1.2 Educational building



Fig. 1.3 Institutional building



Fig. 1.4 Assembly building

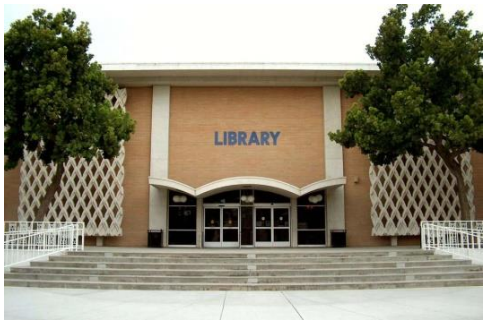


Fig. 1.5 Business building



Fig. 1.6 Mercantile building



Fig. 1.7 Industrial building



Fig. 1.8 Storage building



Fig. 1.9 Hazardous building

Why types of buildings is a concern:

1. To know the design load for the building
2. To know the best orientation of the building as per its purpose of use.

BNBC 2020 is followed in this regard in Bangladesh.

1.2 Load Transfer Path

Load transfer path depends on the type of structure of the building.
Broadly, building structures can be of 2 types:

i. Frame structure / Non-load bearing structure
ii. Load bearing structure

i. Frame structure: Frame structure consists of slab, beam, column, foundation which bear all the loads of building. Here the walls of the building are usually for partition purpose, these partition walls do not take part in the load bearing mechanism of the building.

1.2.1 Load transfer paths in frame structure

Loads passing path for typical frame structure:

Typically, in frame structures, load passes from slab to beam, beam to column and finally column to foundation.

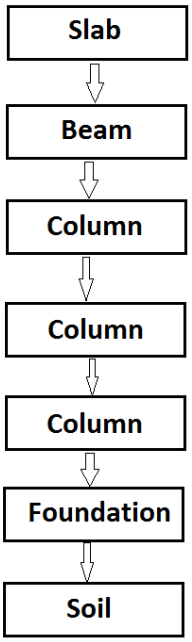


Fig. 1.10 Typical load transfer path in Frame structure

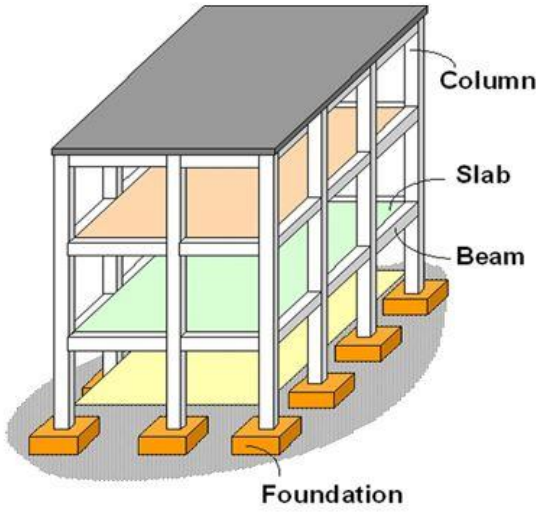


Fig. 1.11 Frame structure

Loads passing path for flat plate structure:

Load transfers directly from slab to column in case of flat plate or flat slab where no beams are constructed.

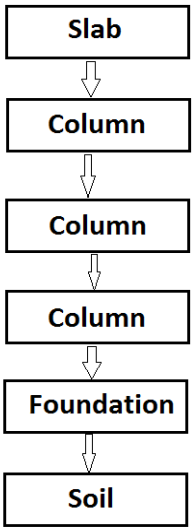


Fig. 1.12 Load transfer path in flat plate structure



Fig. 1.13 Flat plate structure

Loads passing path for structure with secondary beam:

This happens when a secondary beam is constructed between 2 primary beams. In this case, this secondary beam is not directly connected to any column.

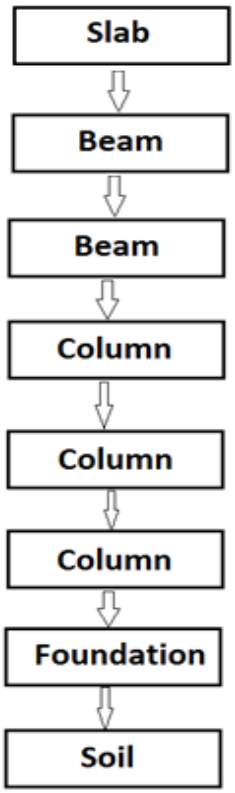


Fig. 1.14 Load transfer path in frame structure with secondary beam

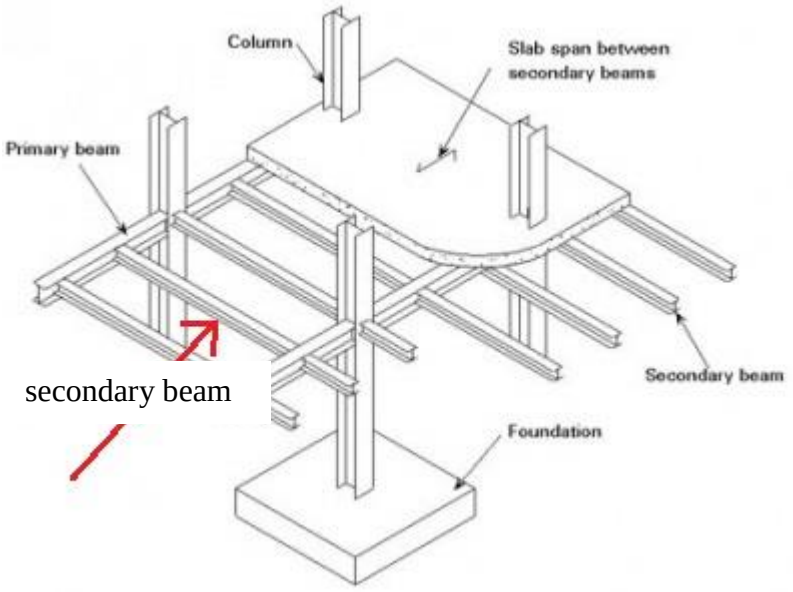


Fig. 1.15 Frame structure with secondary beam

Loads passing path for structure with deep beam:

This occurs when some columns at basement are required to remove in order to make more space for vehicles to park or other purposes. The deep beam constructed at that level carries the load from column and transfers it to the remaining columns at base level.

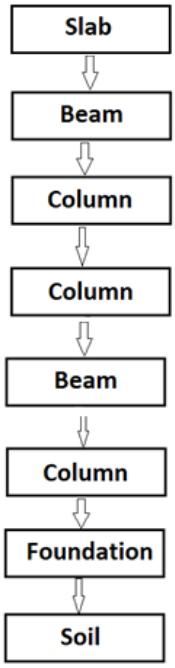


Fig. 1.16 Load transfer path in frame structure with deep beam

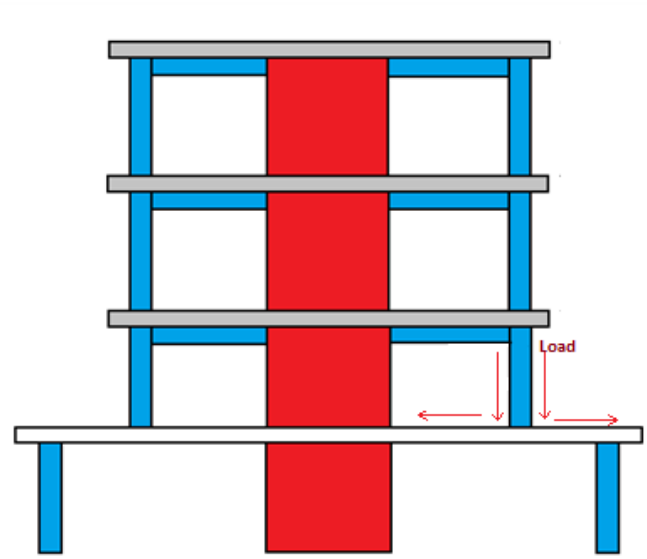


Fig. 1.17 Frame structure with deep beam

ii. Load Bearing Structure: In this structure, the walls of the building bear the load coming from the beam or directly from the slab and these walls subsequently transfer the load to the foundation.

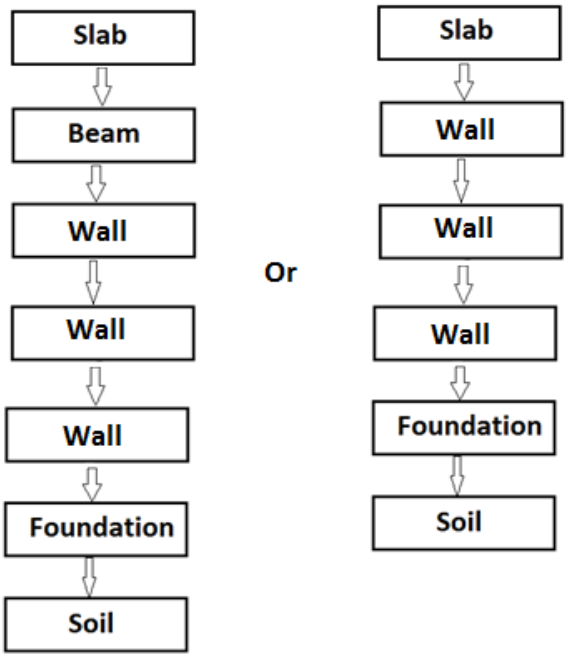


Fig. 1.18 Load transfer path in load bearing structure

1.3 Components of Building

Generally a building is divided in 2 major parts:

i. Super structure
ii. Sub structure

i. Super structure: This is the part of the building above the ground surface that is visible after the completion of the construction work. Example: Plinth, column, beam, slab etc.

ii. Sub structure: This is the part of the building below the ground surface that is not visible after the completion of the construction work. Example: Foundation, shore pile etc.

In a broader sense, the components of a building can be classified as follows:

- Foundation
- Plinth
- Walls
- Beams
- Columns
- Floors

- Doors, Windows
- Stairs
- Roof
- Building finishes
- Building service

Foundation: Foundation transfers all kind of load coming from the super structure to the soil in such a way that it doesn't exceed the bearing capacity of the soil of that place.
Plinth: This is the floor of the building immediately above the ground surface. Plinth restricts the rain water or other materials from entering directly to the ground floor.

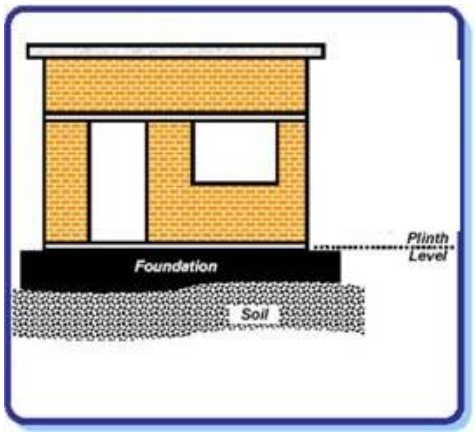


Fig. 1.19 Plinth

Walls: In frame structure, walls are constructed for partition purpose, walls provide separation of floor spacing and also protect the inside space from sun, rain and other direct weathering effect. In load bearing structure, walls participate in load transfer procedure of the building.
Beams: Beams are horizontal members which take load coming parallel to its cross section. It can also take axial loads. Beams are mainly designed to resist bending.
Columns: Columns are vertical members that mainly take axial load (predominantly compression).
Floors: Floors are plane firm surface of slab which provides accommodation on a given plot. People stand on floors. Furniture, goods or other materials are kept or placed on floors.
Doors, windows: Door is the passage path through walls. It provides access to building, rooms etc.
Windows are the open parts of walls with transparent cover for the purpose of ventilation, light and vision.
Stairs: Stairs are connectors between one floor to the next floor. It consists of steps (tread, rise).
Roof: It is the top surface of the building which usually protects the building from rain, sun, light, snow etc.
Building Finishes: Building finishes make the building complete to live in, such as plastering, placing tiles/ mosaic, painting, white washing etc.



Fig. 1.20 Building finishes

Building services: These are mainly the utility parts of a building such as water supply, electricity connection, gas connection, sanitation system etc.



Fig. 1.21 Building services

1.4 Technical Terms

Balcony: Balcony is one kind of cantilever. It provides passage through different rooms. It also provides sitting out places.
Basement: It is the lower floors of the building which are below or partially below ground level.
Sunshade: It is an outside cantilever projection from the lintel that is situated above windows.
Courtyard: It is a place fully/partially surrounded by building and permanently open to sky.
Damp Proof Course: It is a course that consists of water proof materials used in different parts of building to prevent water penetration or dampness.
Floor Area Ratio (FAR): IFAR Floor area ratio (FAR) is the measurement of a building's floor area in relation to the size of the lot/parcel that the building is located on. FAR is expressed as a decimal number, and is derived by dividing the total area of the building by the total area of the parcel (building area / plot area).

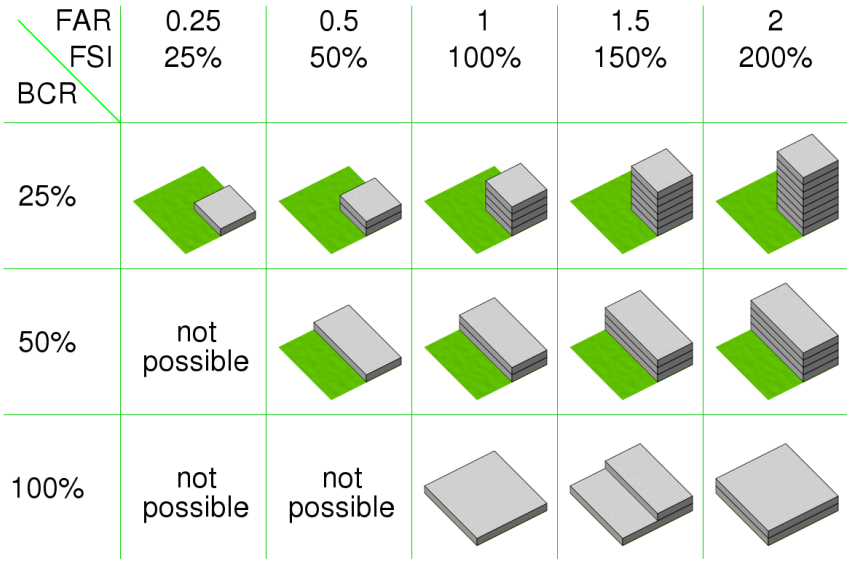


Fig. 1.22 Comparison of floor area ratio (FAR) or floor space index (FSI) and building coverage ratio (BCR)

Footing/ Foundation: It is the lower part of the structure directly connected to soil to transmit loads to the ground/ soil without stressing the soil beyond its bearing capacity.
Garage: It is a building or portion of a building used for shelter, storage or parking of vehicles.
Ground floor: It is the floor that is nearest to the ground surface around the building.
Parapet: It is a low wall or railing built along the edge of a roof of a building.
Partition wall: It is the non-load bearing wall of the building which is used for partitioning the spaces of the floors.
Porch: It is a covered surface supported on pillars or otherwise for the purpose of pedestrian or vehicle approach to a building.
Room height: It is the vertical distance measured from the finished floor surface to the finished ceiling surface.
Storey: The portion of a building included between the surface of any floor and the surface of the floor next above it, or if there is no floor above it, then the space between any floor and ceiling next above it is called a storey.
Structural wall: It is load bearing wall which carries the load of building along with its own weight.
Cornice: It is the slightly extra projected part of slab.
Storey height: It is the center to center distance between two consecutive slabs, or distance between floor of a slab to the next floor, or from one roof to the next roof.



Fig. 1.23 Balcony



Fig. 1.24 Basement

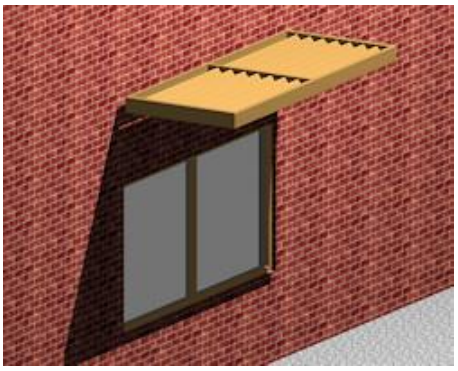


Fig. 1.25 Sunshade



Fig. 1.26 Courtyard



Fig. 1.27 DPC



Fig. 1.28 Parapet



Fig. 1.29 Porch

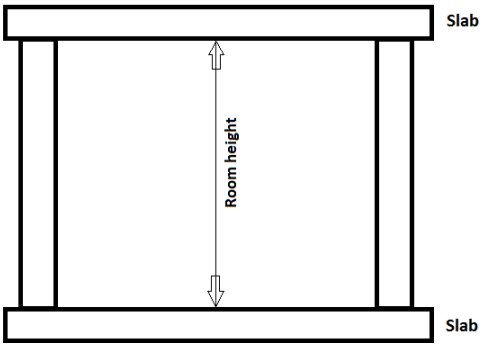


Fig. 1.3 Room height