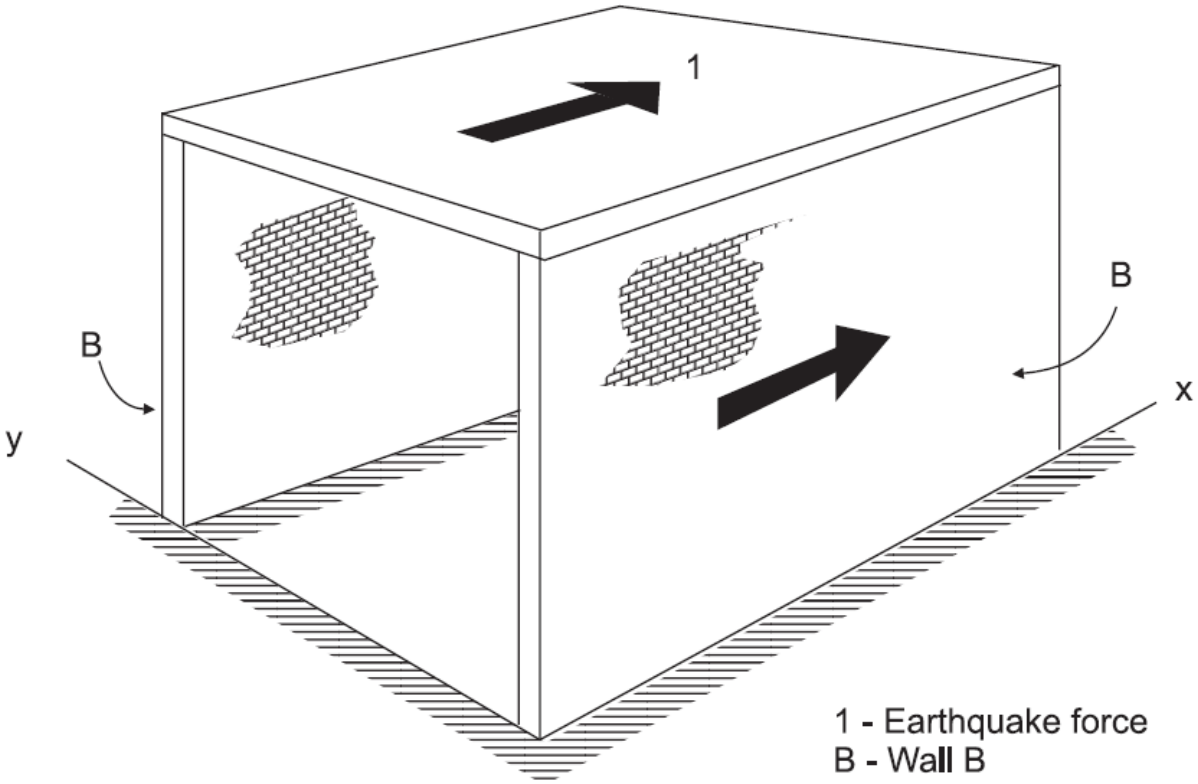
## Frequently Asked Questions

**Question 01:**

How does a roof on two walls behave during an earth quake?

**Answer:**



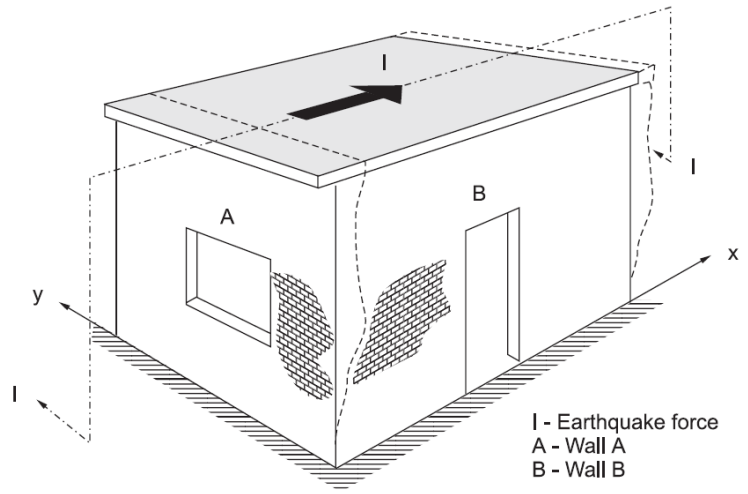

- In Figure, a roof slab is shown to be resting on two parallel walls B and the earthquake force is acting in the plane of the walls.
- Assuming that there is enough adhesion between the slab and the walls, the slab will transfer its inertia force at the top of walls B, causing shearing and overturning action in them.

- To be able to transfer its inertia force to the two end walls, the slab must have enough strength in bending in the horizontal plane.
- This action of slab is known as diaphragm action. Reinforced concrete or reinforced brick slabs have such strength inherently and act as rigid diaphragms.
- However, other types of roofs or floors such as timber or reinforced concrete joists with brick tile covering will be very flexible.
- The joists will have to be connected together and fixed to the walls suitably so that they are able to transfer their inertia force to the walls.
- At the same time, the walls B must have enough strength as shear wall to withstand the force from the roof and its own inertia force.

**Question 02:**

How does a roof on a wall enclosure behave during an earth quake? Elaborate.

**Answer:**

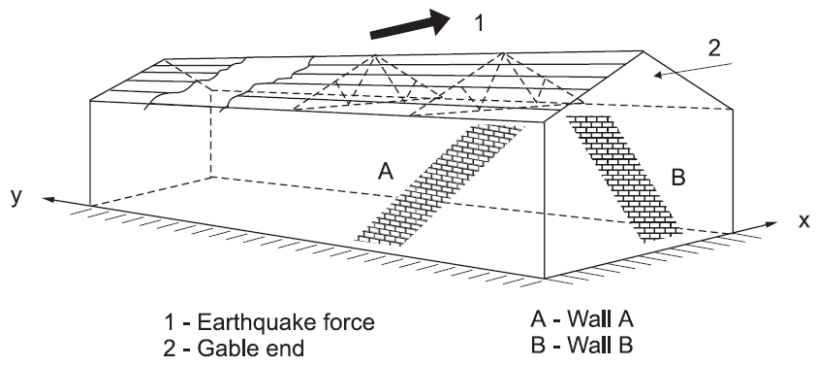


- Consider a complete wall enclosure with a roof on the top subjected to earthquake force acting along X-axis as shown.
- If the roof is rigid and acts as a horizontal diaphragm, its inertia will be distributed to the four walls in proportion to their stiffness.
- The inertia of roof will almost entirely go to walls B since the stiffness of the walls B is much greater than the walls A in X direction.
- In this case, the plate action of walls A will be restrained by the roof at the top and horizontal bending of wall A will be reduced.
- On the other hand, if the roof is flexible the roof inertia will go to the wall on which it is supported and the support provided to plate action of walls A will also be little or zero.
- Again the enclosure will act as a box for resisting the lateral loads, this action decreasing in value as the plan dimensions of the enclosures increase.

## Question 03:

How does roof and floor respond to earthquake? Elaborate.

## Answer:



- The earthquake-induced inertia force can be distributed to the vertical structural elements in proportion to their stiffness, provided the roofs and floors are rigid to act as horizontal diaphragms.
- Otherwise, the roof and floor inertia will only go to the vertical elements on which they are supported.
- Therefore, the stiffness and integrity of roofs and floors are important for earthquake resistance.
- The roofs and floors, which are rigid and flat and are bonded or tied to the masonry, have a positive effect on the wall, such as the slab or slab and beam construction be directly cast over the walls or jack arch floors or roofs provided with horizontal ties and laid over the masonry walls through good quality mortar.
- Others that simply rest on the masonry walls will offer resistance to relative motion only through friction, which may or may not be adequate depending on the earthquake intensity.

**Question 04:**

What are the considerations for seismic design as per the Indian Codes? Discuss in detail.

**Answer:**

- Experience in past earthquakes has demonstrated that many common buildings and typical methods of construction lack basic resistance to earthquake forces.
- In most cases this resistance can be achieved by following simple, inexpensive principles of good building construction practice.
- The following are the seismic zones:
    - Zone A: Risk of Widespread Collapse and Destruction
    - Zone B: Risk of Collapse and Heavy Damage
    - Zone C: Risk of Damage
    - Zone D: Risk of Minor Damage

Importance of Building:

- ✓ Important:

Hospitals, clinics, communication buildings, fire and police stations,

water supply facilities, cinemas, theatres and meeting halls, schools, dormitories, cultural treasures such as museums, monuments and temples, etc.

- ✓ Ordinary:

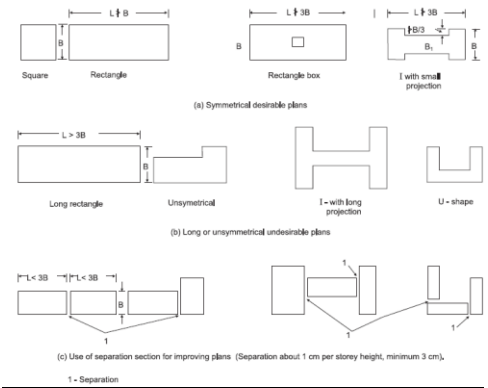
Housings, hostels, offices, warehouses, factories, etc

Bearing Capacity of Foundation Soil:

Three soil types are considered here:

- ➢ Firm: Those soils which have an allowable bearing capacity of more than 10 t/m2
- ➢ Soft: Those soils, which have allowable bearing capacity less than or equal to 10 t/m2.
- ➢ Weak: Those soils, which are liable to large differential settlement, or liquefaction during an earthquake.
- ➢ Buildings can be constructed on firm and soft soils but it will be dangerous to build them on weak soils.

Plan of the Building:



Fire Resistance

- It is not unusual during earthquakes that due to snapping of electrical fittings short circuiting takes place, or gas pipes may develop leaks and catch fire.
- Fire could also be started due to kerosene lamps and kitchen fires.
- The fire hazard sometimes could even be more serious than the earthquake damage.
- The buildings should therefore preferably be constructed of fire resistant materials.

Foundations:

- For the purpose of making a building truly earthquake resistant, it will be necessary to choose an appropriate foundation type for it.
- Since loads from typical low height buildings will be light, providing the required bearing area will not usually be a problem.
- For choosing the type of footing from the earthquake angle, the soils may be grouped as Firm and Soft avoiding the weak soil unless compacted and brought to Soft or Firm condition.
- Firm soil
    - In firm soil conditions, any type of footing (individual or strip type) can be used. It should of course have a firm base of lime or cement concrete with requisite width over which the construction of the footing may start.
    - It will be desirable to connect the individual reinforced concrete column footings in Zone A by means of RC beams just below plinth level intersecting at right angles.
- Soft soil
    - In soft soil, it will be desirable to use a plinth band in all walls and where necessary to connect the individual

column footings by means of plinth beams as suggested above.

- It may be mentioned that continuous reinforced concrete footings are considered to be most effective from earthquake considerations as well as to avoid differential settlements under normal vertical loads.