C6

Building Size and Configuration

No. of Slides: 17
Time: 45 min

National Disaster Management Authority

NCPDP
National Centre for Peoples'-Action in Disaster Preparedness
Technology for Vulnerability Reduction
Disaster Risk Reduction Platform in CEDAP

People in Centre

GUJARAT INSTITUTE OF DISASTER MANAGEMENT
BUILDING RESILIENCE

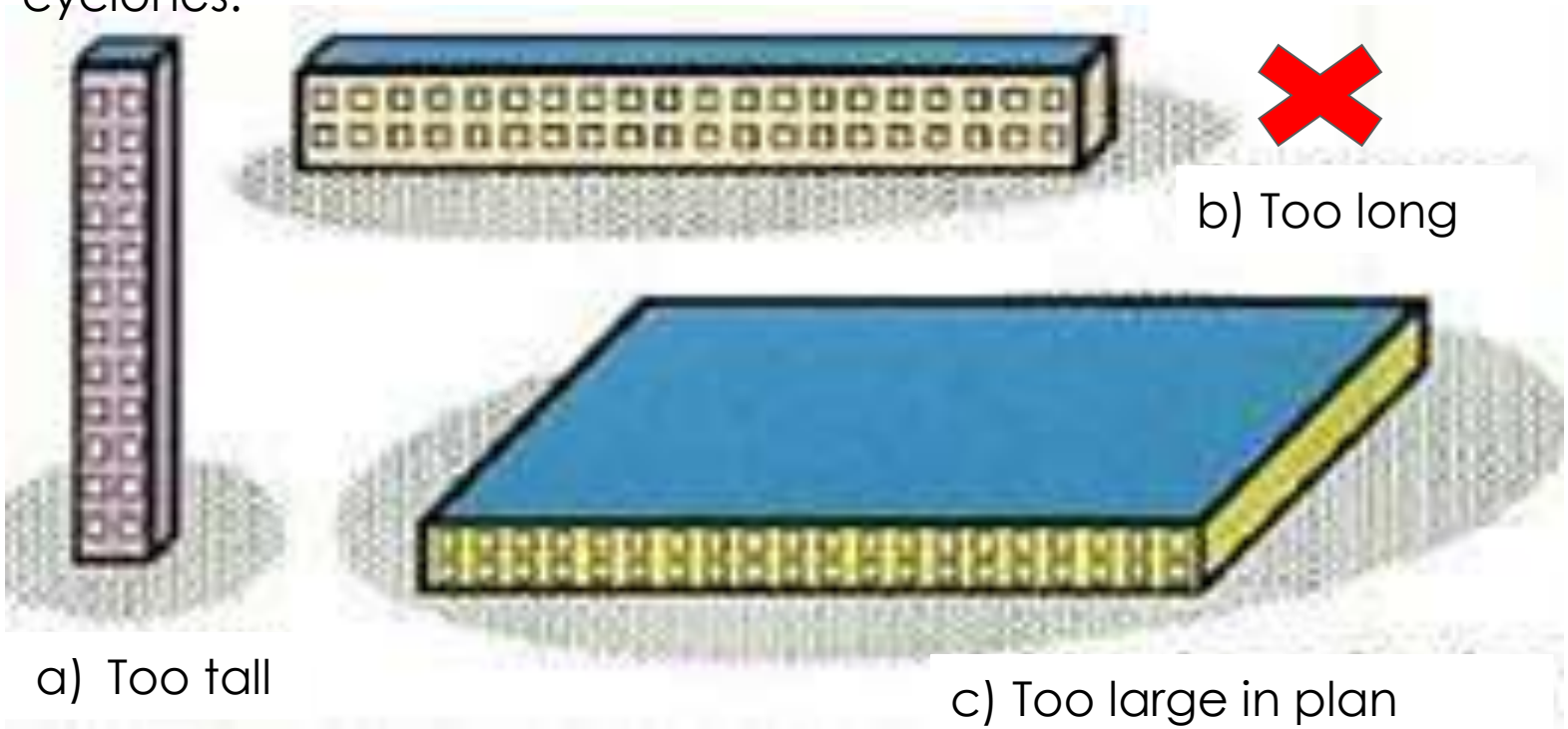
Gujarat Institute of Disaster Management

Expected Outcome

1. Masons develop an understanding of the optimal sizes, configurations, mass of the house, and performance during hazards.

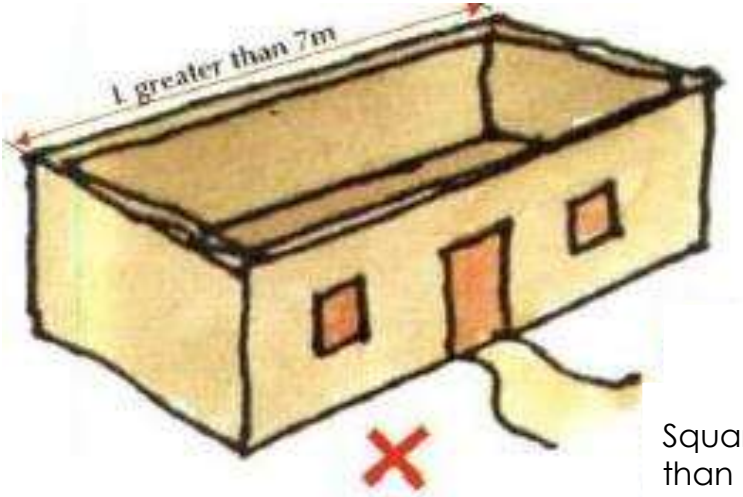
1. Size and Proportions of the House: Length, Height, Depth

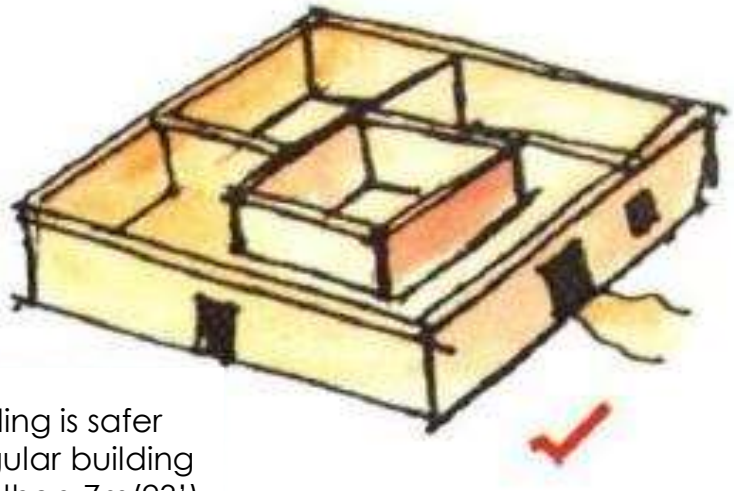
Buildings with one of their overall sizes much larger or smaller than the other do not perform well during earthquakes, floods or cyclones.



Earthquake Flood

Avoid houses that are too long and those which have its longer dimension greater than 7m.

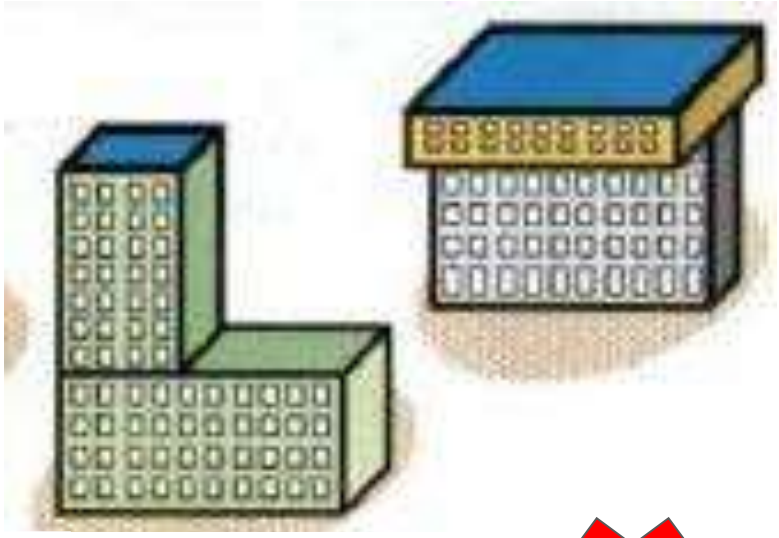




Square plan of a building is safer than the long rectangular building plan with walls longer than 7m(23').

2. Setbacks and Asymmetry

Distribution of mass and (horizontal) lateral load resisting elements across the house must be symmetrically placed. Otherwise, during an earthquake, they will behave differently at different points of the building as the load is not able to flow smoothly and uniformly to the ground.

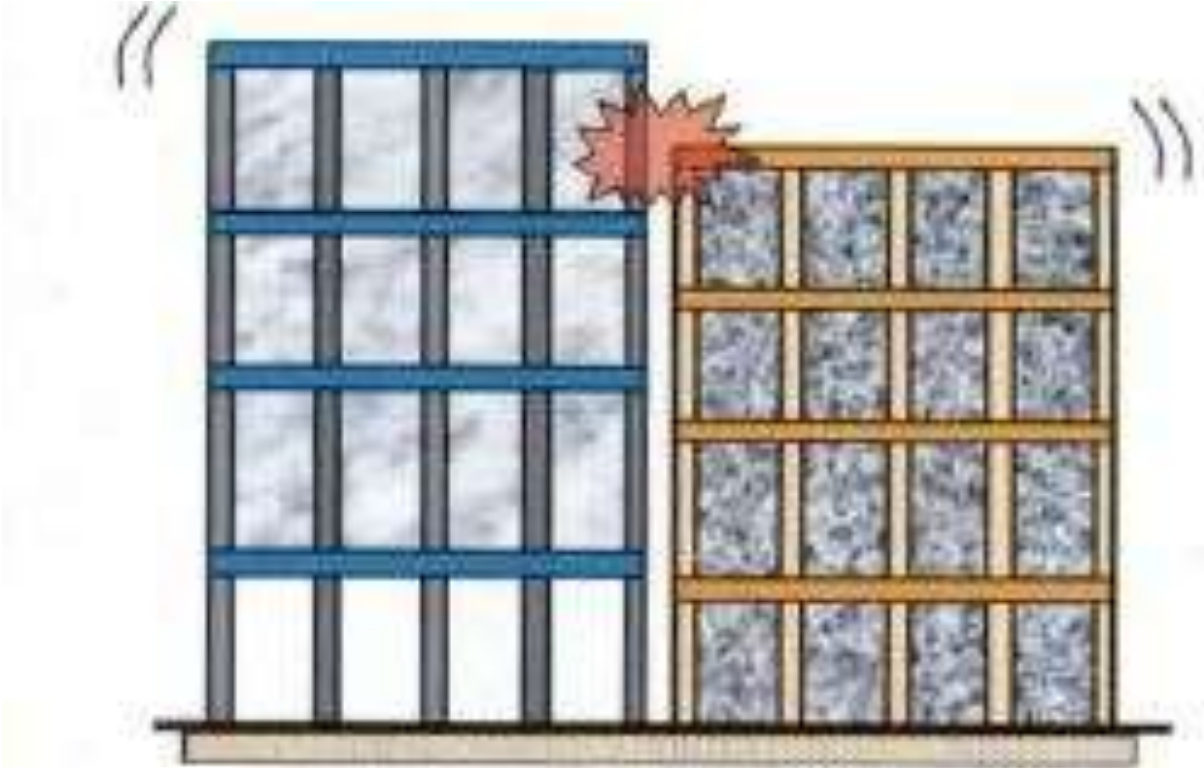


Setbacks

One-side open ground storey building twists during earthquake shaking.

2. Setbacks and Asymmetry

Two houses should not be built too close to each other.



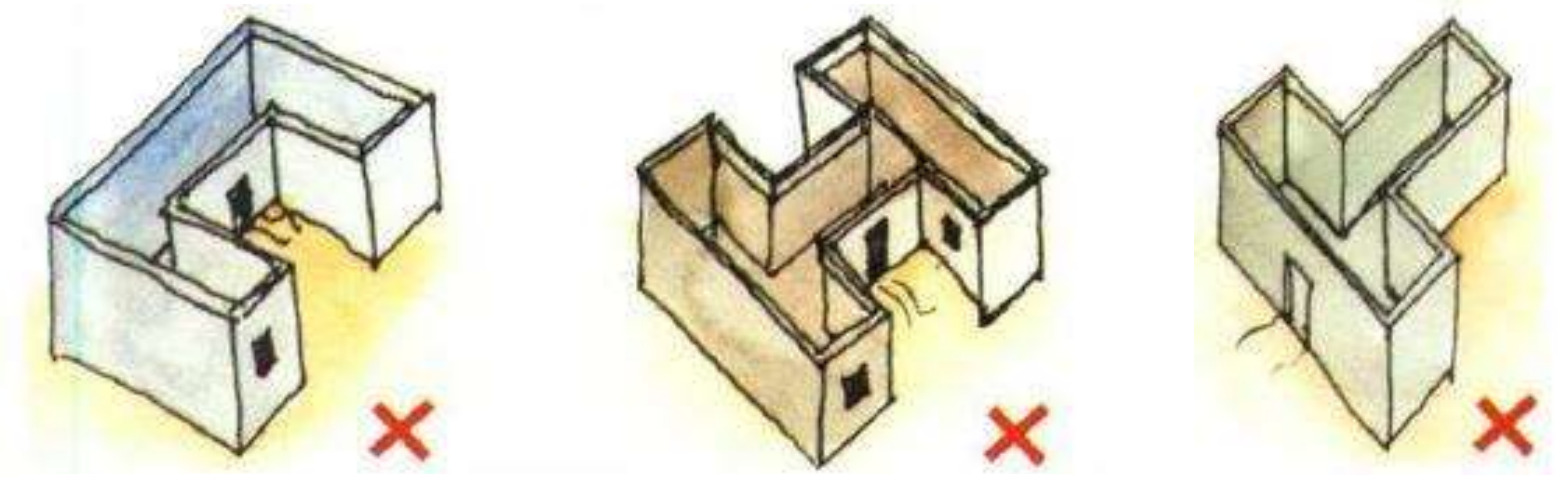
Pounding can occur between adjoining houses due to horizontal vibrations of the two houses

3. Shapes of Houses

Simple shapes are preferred.

Cyclone Earthquake Flood

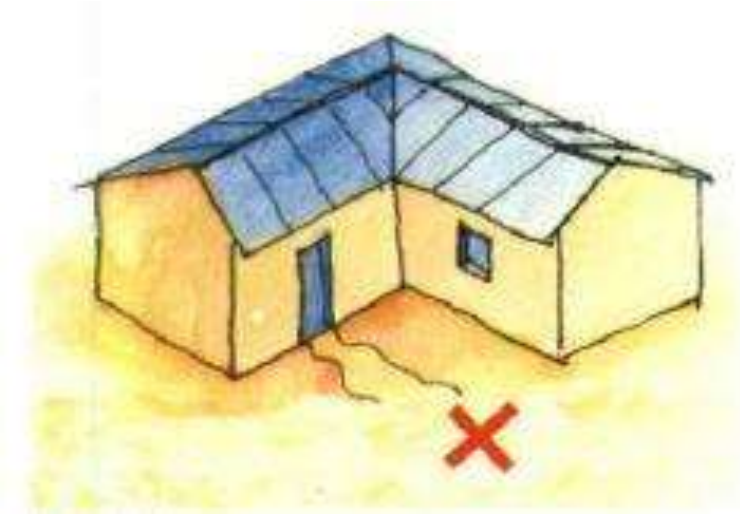
Complex shapes (like H and L) have corners which are more stressed than the rest of the house, and therefore the house may fail there. Pockets where water and wind can get stuck, are weak points in the house.



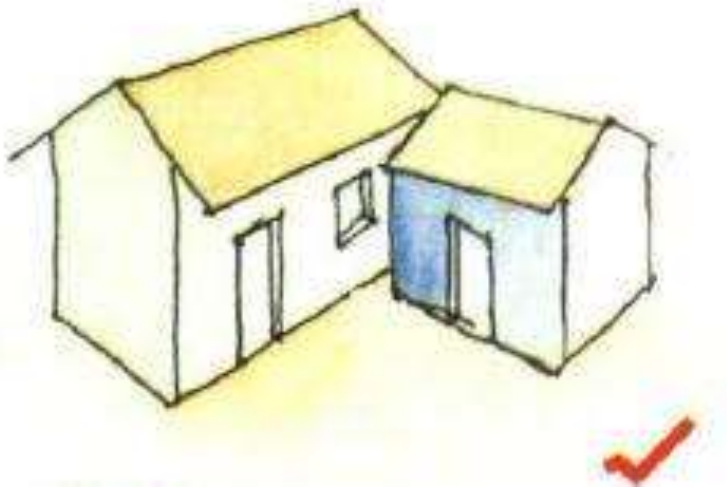
Avoid making buildings with plans having ‘C’, ‘H’, ‘T’, or ‘L’ shapes in hazard-prone areas.

Break complex shapes into simpler shapes.

Cyclone Earthquake Flood

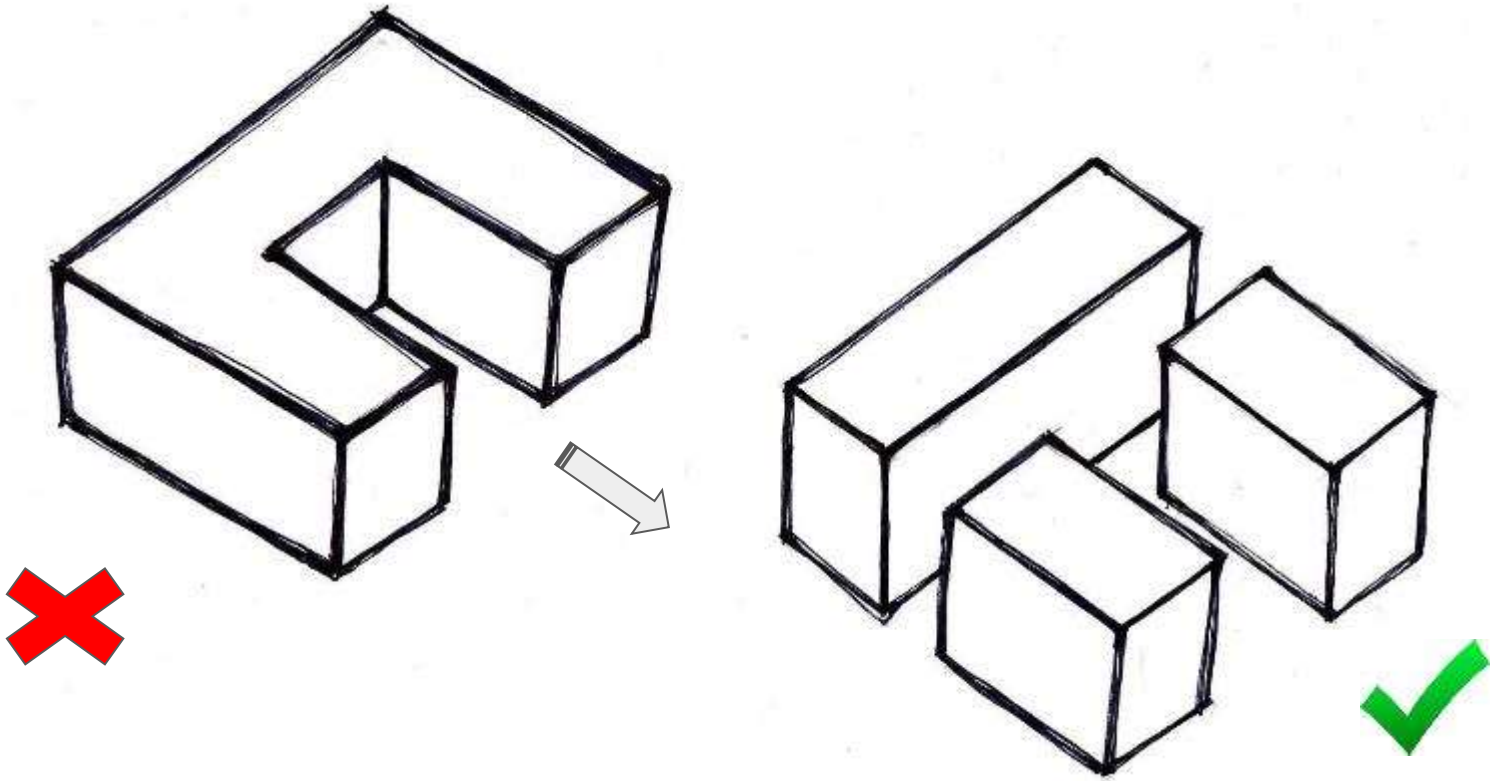


House with a symmetrical plan is safer than the one with an asymmetrical plan.



Divide the building into a number of symmetrical units, which are well separated.

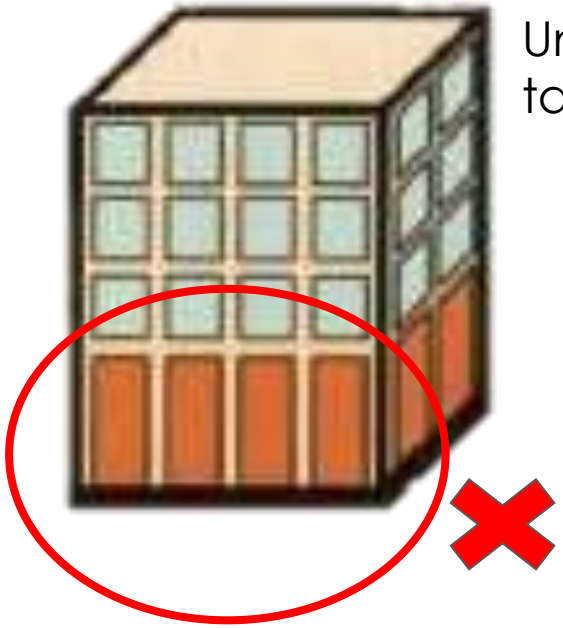
Simple square, rectangle, circle shapes are preferred because they are symmetrical, and hence more stable. They transfer loads to the ground uniformly.



Earthquake

4. Different Storey Heights lead to the house to not behave uniformly during a hazard.

The house will fail at the junction of the two different kinds of storeys, as those storeys will behave differently compared to the rest of the storeys.



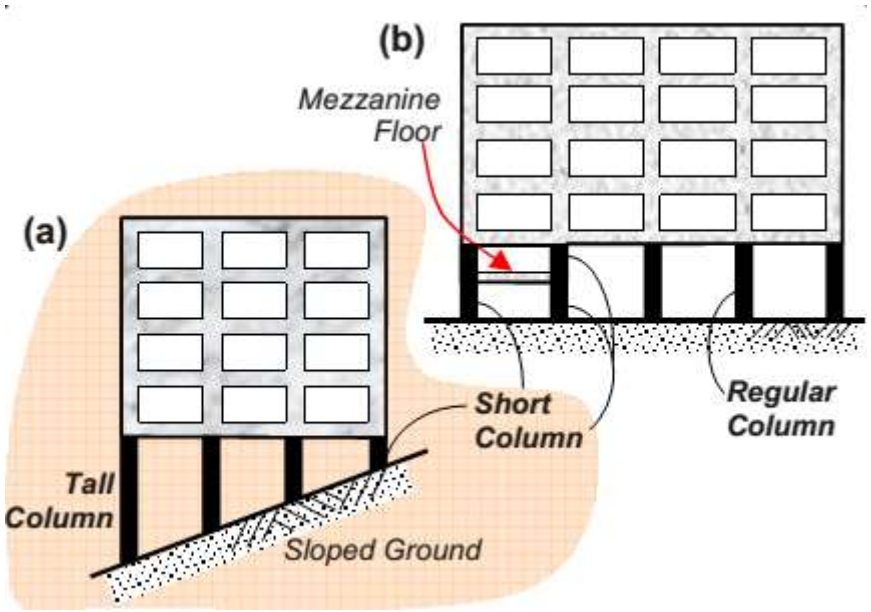
Unusually tall storey

Flexible Storey

5. Short Column

Damage during hazards

A short column is more vulnerable compared to a fully encased column with infill walls. The full height infill walls make the entire column stiff, and hence resistant. With partial infill walls, the column is free to move over a small height, which can make this shorter column vulnerable.



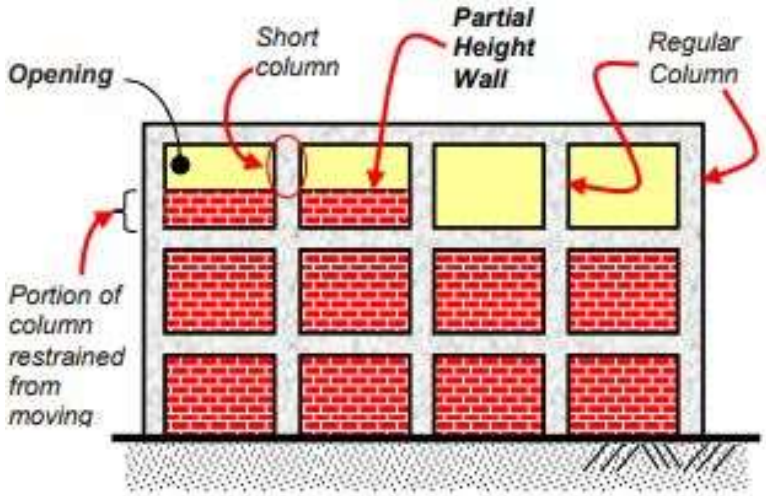
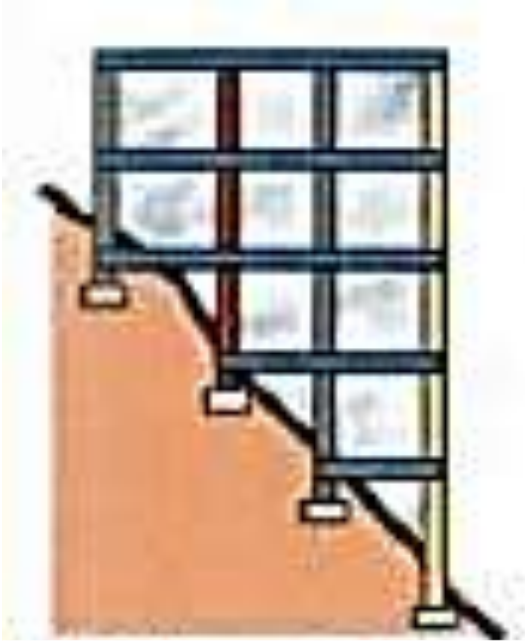
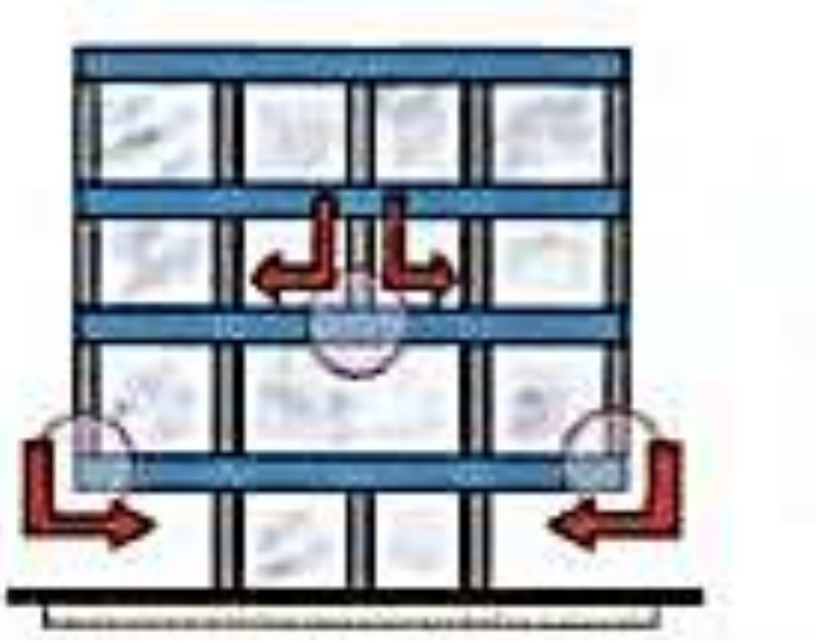


Figure 3: *Short columns effect* in RC buildings when partial height walls adjoin columns – *the effect is implicit here because infill walls are often treated as non-structural elements.*

6. Discontinuous Structural Elements do not allow proper transfer of loads to the ground, and thus cause the building to fail at those junctions.



Sloped Ground



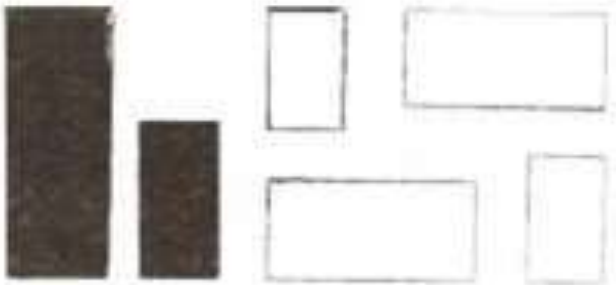
Hanging or Floating Columns

7. Layout of Houses to reduce tunnelling effect

Cyclone Flood

In the two sets of house layouts shown here in plan, in which would the wind move faster?

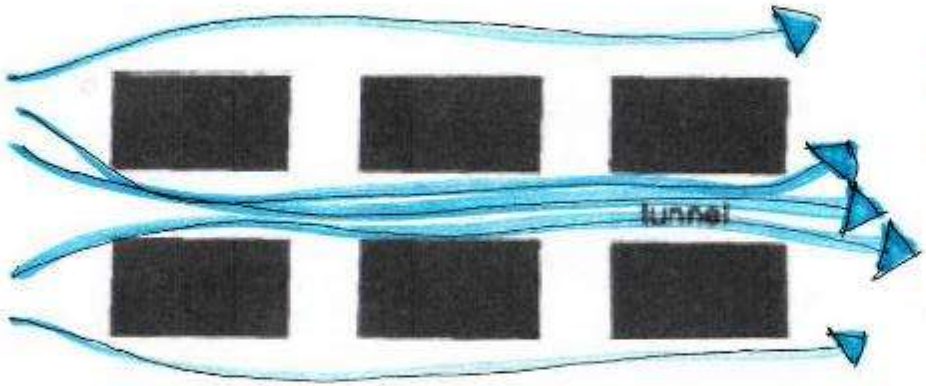
Set 1



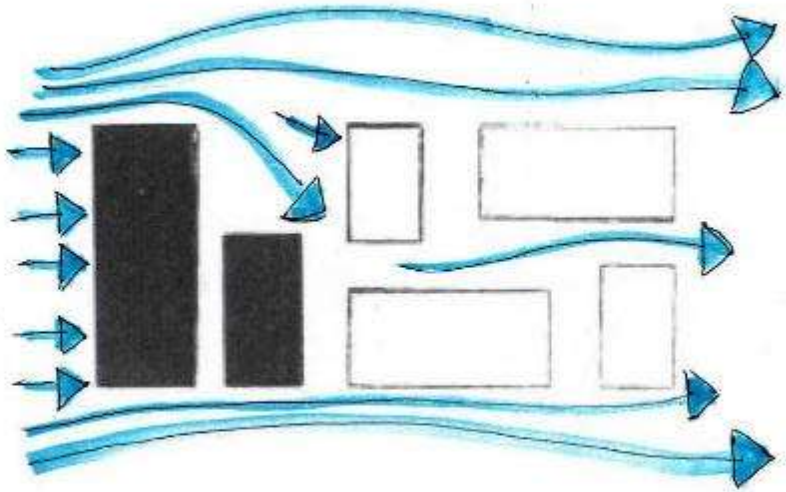
Set 2

7. Layout of Houses to reduce tunnelling effect

Cyclone Flood



Row planning increases speed of wind and water.



Zig-Zag planning reduces speed of wind and water.

8. Planning for Extensions

Earthquake Flood

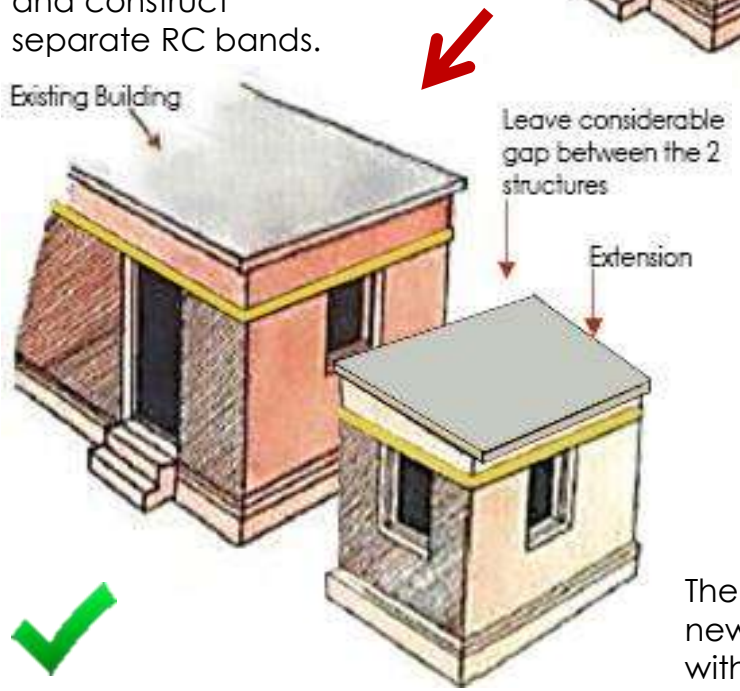
Preferably, **additions to a house should be done as separate buildings** rather than adding to the same building. The new addition will behave as different structure placed next to old building, if not connected properly and therefore their junction would be vulnerable.
If the building has to be extended it must be properly connected to ensure proper load transfer during a hazard.

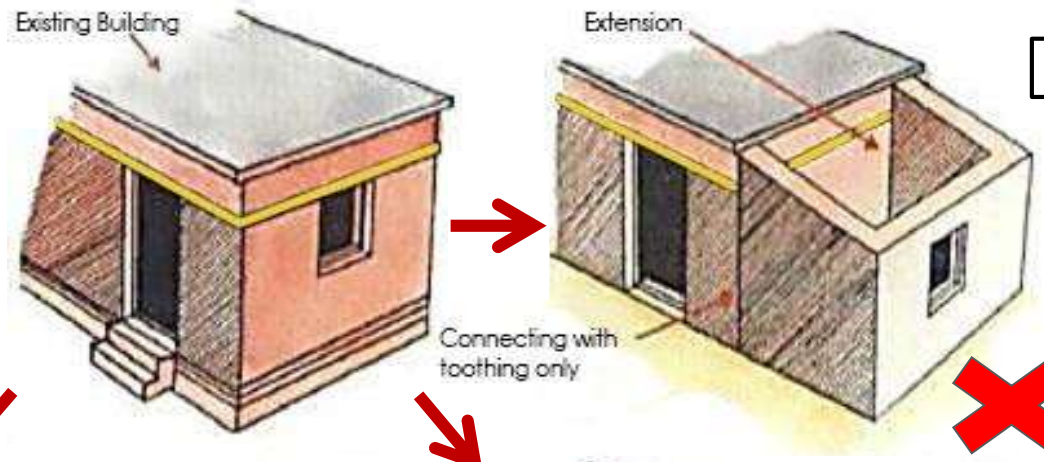
8. Planning for Extensions

Earthquake Flood

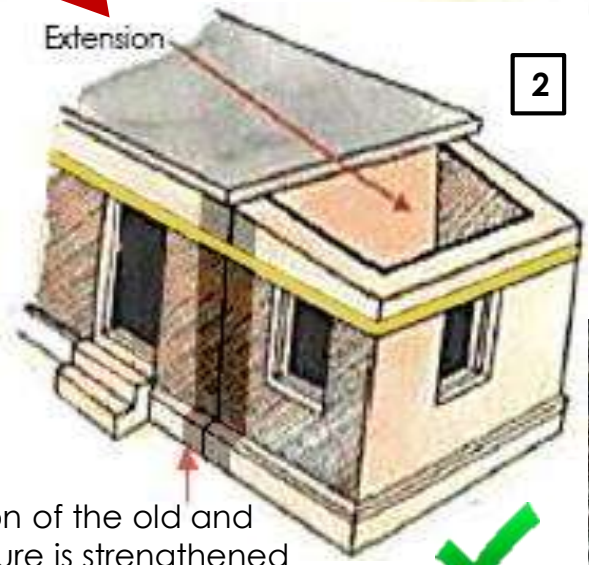
1 (Preferable)

Separate the old and the new structure with a considerable gap and construct separate RC bands.





3 Not a good option, since lintel band is not continuous and the junction between the structures is not strengthened.



The junction of the old and new structure is strengthened with weld wire mesh

2 If the separation between structures is not possible, strengthen the junction with **Weld Wire Mesh**

Summary

1. Simple, symmetric shapes are better.
2. Neither height, length or breadth should be greater unduly in comparison to the other two dimensions.
3. Houses should not be too close to each other.
4. Houses should be symmetric in plan and in elevation.
5. Loads should be transferred to the ground as directly as possible.
6. Houses may be placed in plan in such a way, that they reduce tunnelling effect.
7. Horizontal extensions should ideally be made as separate new structures. If unavoidable, they need to be connected properly so that load can transfer as seamlessly as possible.