Frequently Asked Questions

Question 01:

Explain Hand Moulded Layered Construction.

Answer:

- These are the most primitive and weakest type of constructions because of the low percentage of moisture employed to make the hand-moulding and the poor level of compaction attained.
- All the clay is not activated, either by moisture, or by compaction.
- Even though a small amount of moisture is used (depending on the soil), some horizontal and also vertical fissures normally appear.
- These should be controlled by adding straw as much as possible to attain a reasonable workabity of the mixture.
- If this is not possible, coarse sand could be used as additive, in the smallest experimental proportion.
- An excess of coarse sand will inevitably reduce the wall strength.
- Generally, it will be necessary to moisten the area of the lower layer which will be in contact with the mud, in order to avoid sudden drying of the contact zone, which produces the fissures.

Question 02:

Explain Adobe or block construction.

Answer:

- In the case of cut as well as moulded blocks, the strongest units correspond to plastic or clayey soils.

- However, the block strength plays a secondary role in the masonry strength, since the joints between blocks become critical.
- The blocks used should be well dried in order to avoid future retractions. Blocks are made in different sizes in various countries.
- It may be stated that the dimensions of the blocks, nor the way these are placed, have a serious effect on their strength.
- Traditional practices obtain an adequate block without important fissures, either by mixing sandy and clayey soils or by looking after the block so it dries without restrictions, thus eliminating the fissures.
- The usual good principles of bonds in masonry should be adopted for construction of adobe walls, that is,

(i) All courses should be laid level.

(ii) The vertical joints should be broken between two consecutive courses by overlap of adobe and must be carefully filled with mortar.

(iii) The right angle joints between walls should be made in such manner that the walls are properly joined together and a through vertical joint is avoided.

Question 03:

Elaborate Tapial or pise construction.

Answer:

- Tapial or pise constructions are rammed earth constructions in which moist soil is poured in wooden forms of the walls and compacted to achieve the desired density.
- Whilst adobe constructions acquire their strength by activation of the clay through moisture contained in the soil, tapial constructions owe it to compaction, using small percentages of moisture in the soil.
- High strength is obtained by humidity and compaction when clay is present.

- The use of low moisture content and the control of the amount of clay by adding coarse sand to the soils are required to control the shrinkage fissures on drying.
- If the amount of coarse sand is excessive, the strength diminishes dangerously.
- It is recommended to make wall tests with increasing percentage of sand, until fissuring is reasonably under control.
- The best way to ensure the monolithic structure of the tapial walls is to sufficient quantity of water at the sub joints at every 10 cm.
- The use of excessive amounts of straw in the mud mixture, more than 1:1/4 in volume is self-defeating, because it causes a strength reduction.

Question 04:

Elaborate earthen construction with wood or cane structure.

Answer:

- It consists of vertical posts and horizontal blocking members of wood or cane or bamboo, the panels being filled with cane or bamboo, or some kind of reed matting plastered over both sides with mud.
- The construction could be done in the rudimentary way, building element by element or by using prefabricated panels.
- The behaviour of this type of construction could be very good, as long as the following fundamental rules are observed:
- Good connections between the wood or cane elements, so as to ensure an integral behaviour of the structure.
- Preservation of the wood or cane elements by charring the surface or painting by coal tar, especially in the part embedded in the foundation,

which should preferably be of concrete, stone or bricks laid with cement, lime or gypsum mortar.

- Additionally, it is recommended that the panel filling material should
- consist of wood or cane mesh, over which a layer of mud and straw (1:1 in volume) is placed on each face in the form of plaster. Very often, the
- meshes are knit in themselves and around the structure.
- In houses built as a continuous system as well as in those made with pre-fabricated panels, an upper ring beam should be placed, the purposeof it being two fold:
  (i) Ensure the integral behavior of all walls
  (ii) Distribute evenly the roofing load.
- Only after fixing this upper ring beam and the roof (after completing the nailing), the mud filling must be placed. This will avoid fissuring caused by the strokes of the nailing operation.

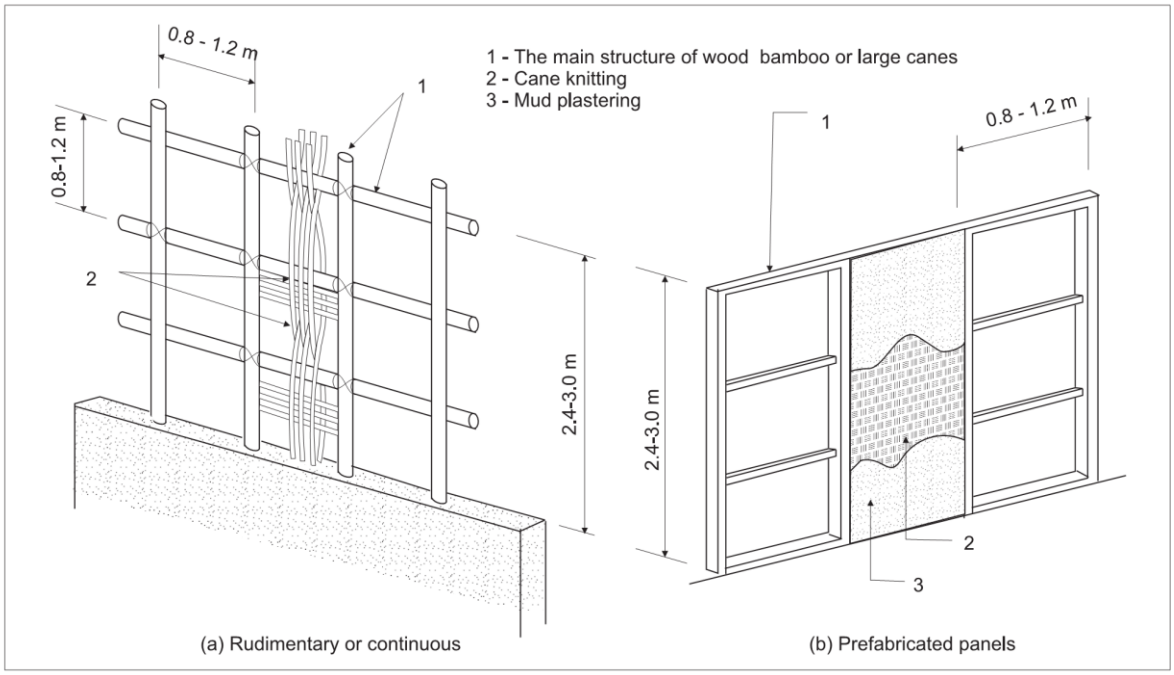

Fig 7.4 Earthen constructions with wood or cane structures

Question 05:

Elaborate about the seismic design of a RC structure.

Answer:

- Reinforced concrete (or simply RC) consists of two primary materials, namely concrete with reinforcing steel bars. Concrete can be molded into any desired shape, and steel bars can be bent into many shapes. Thus, structures of complex shapes are possible with RC.
- Concrete is made of sand, crushed stone (called aggregates) and cement, all mixed with pre-determined amount of water. Concrete can be molded into any desired shape, and steel bars can be bent into many shapes. Thus, structures of complex shapes are possible with RC.
- A typical RC building is made of horizontal members (beams and slabs) and vertical members (columns and walls), and supported by foundations that rest on ground.
- The system comprising of RC columns and connecting beams is called a RC Frame.
- The RC frame participates in resisting the earthquake forces. Earthquake shaking generates inertia forces in the building, which are proportional to the building mass.
- Since most of the building mass is present at floor levels, earthquake-induced inertia forces primarily develop at the floor levels.
- These forces travel downwards - through slab and beams to columns and walls, and then to the foundations from where they are dispersed to the ground.
- As inertia forces accumulate downwards from the top of the building, the columns and walls at lower storeys experience higher earthquake-induced forces and are therefore designed to be stronger than those in storeys above.
- In most buildings, the geometric distortion of the slab is negligible in the horizontal plane; this behavior is known as the rigid diaphragm action.

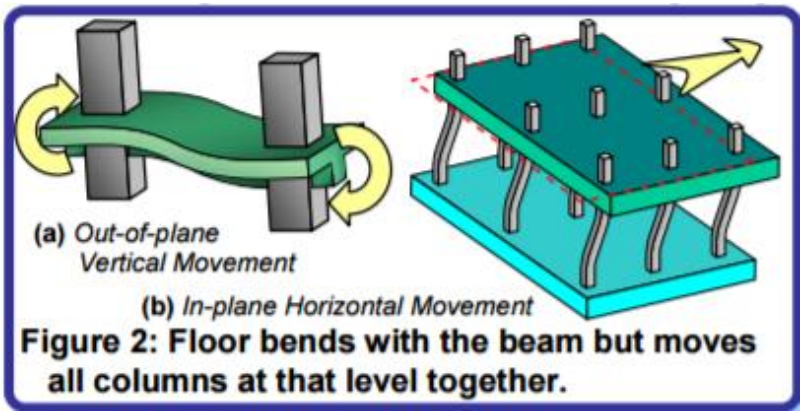

Figure 2: Floor bends with the beam but moves all columns at that level together.

- After columns and floors in a RC building are cast and the concrete hardens, vertical spaces between columns and floors are usually filled-in with masonry walls to demarcate a floor area into functional spaces.
- When columns receive horizontal forces at floor levels, they try to move in the horizontal direction, but masonry walls tend to resist this movement.
- Due to their heavy weight and thickness, these walls attract rather large horizontal forces
- However, since masonry is a brittle material, these walls develop cracks once their ability to carry horizontal load is exceeded.
- Thus, infill walls act like sacrificial fuses in buildings; they develop cracks under severe ground shaking but help share the load of the beams and columns until cracking.

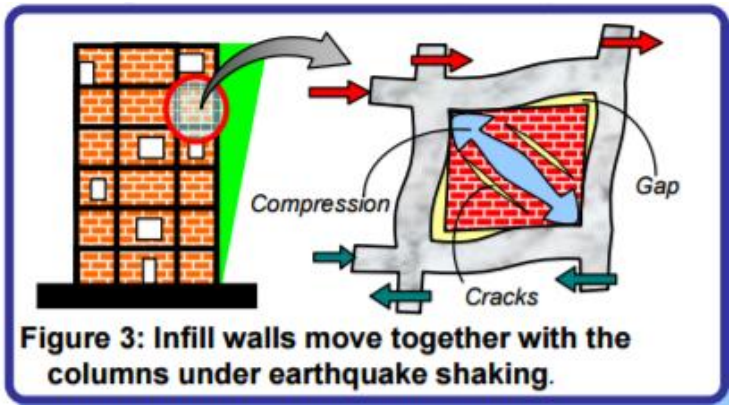

Figure 3: Infill walls move together with the columns under earthquake shaking.

Horizontal Effects :

- Horizontal Earthquake Effects are Different Gravity loading (due to self weight and contents) on buildings causes RC frames to bend resulting in stretching and shortening at various locations.
- Tension is generated at surfaces that stretch and compression at those that shorten.
- Under gravity loads, tension in the beams is at the bottom surface of the beam in the central location and is at the top surface at the ends.
- On the other hand, earthquake loading causes tension on beam and column faces at locations different from those under gravity loading.

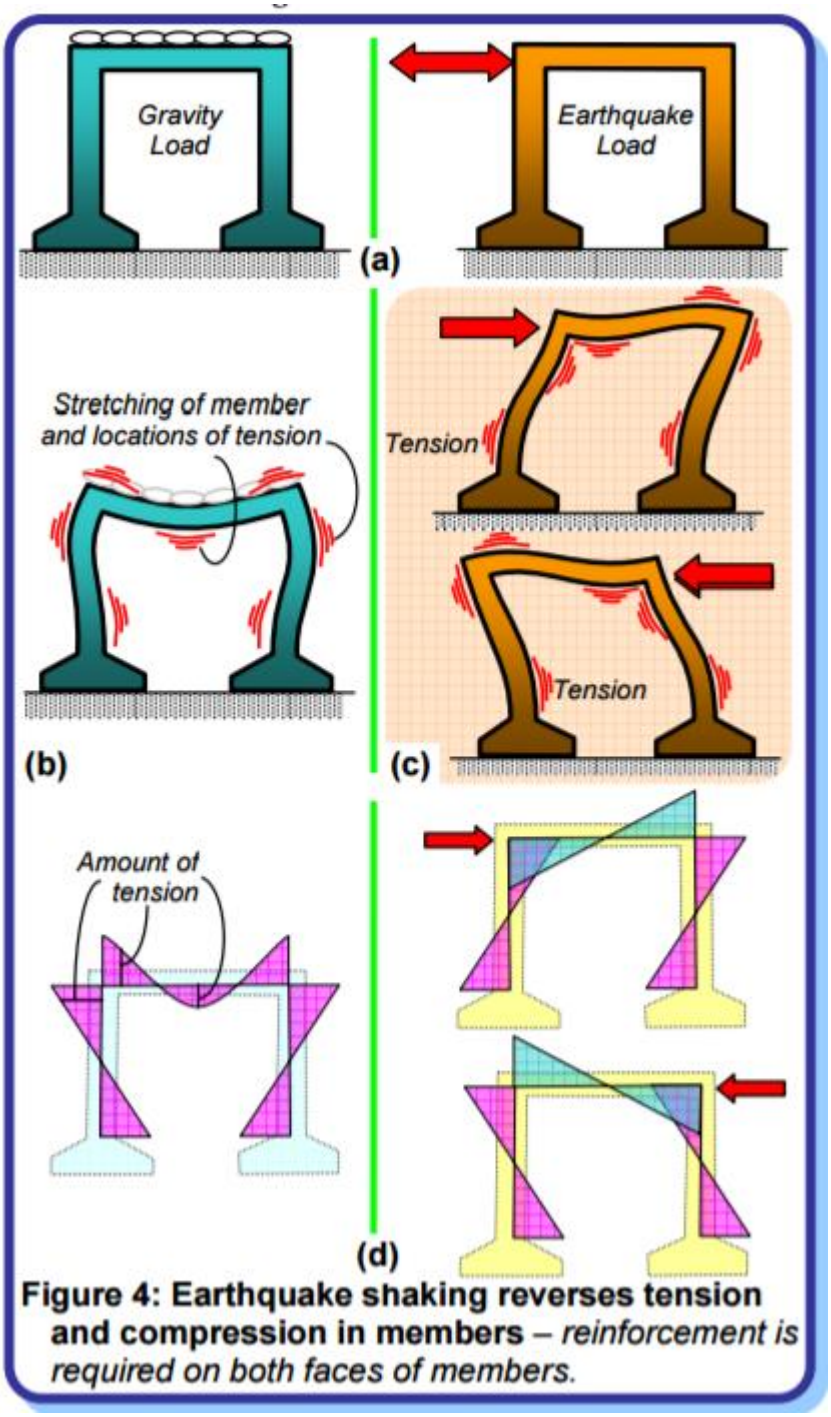

Figure 4: Earthquake shaking reverses tension and compression in members – *reinforcement is required on both faces of members.*

Strength Hierarchy:

- Strength Hierarchy For a building to remain safe during earthquake shaking, columns (which receive forces from beams) should be stronger than beams, and foundations (which receive forces from columns) should be stronger than columns.

- Further, connections between beams & columns and columns & foundations should not fail so that beams can safely transfer forces to columns and columns to foundations.

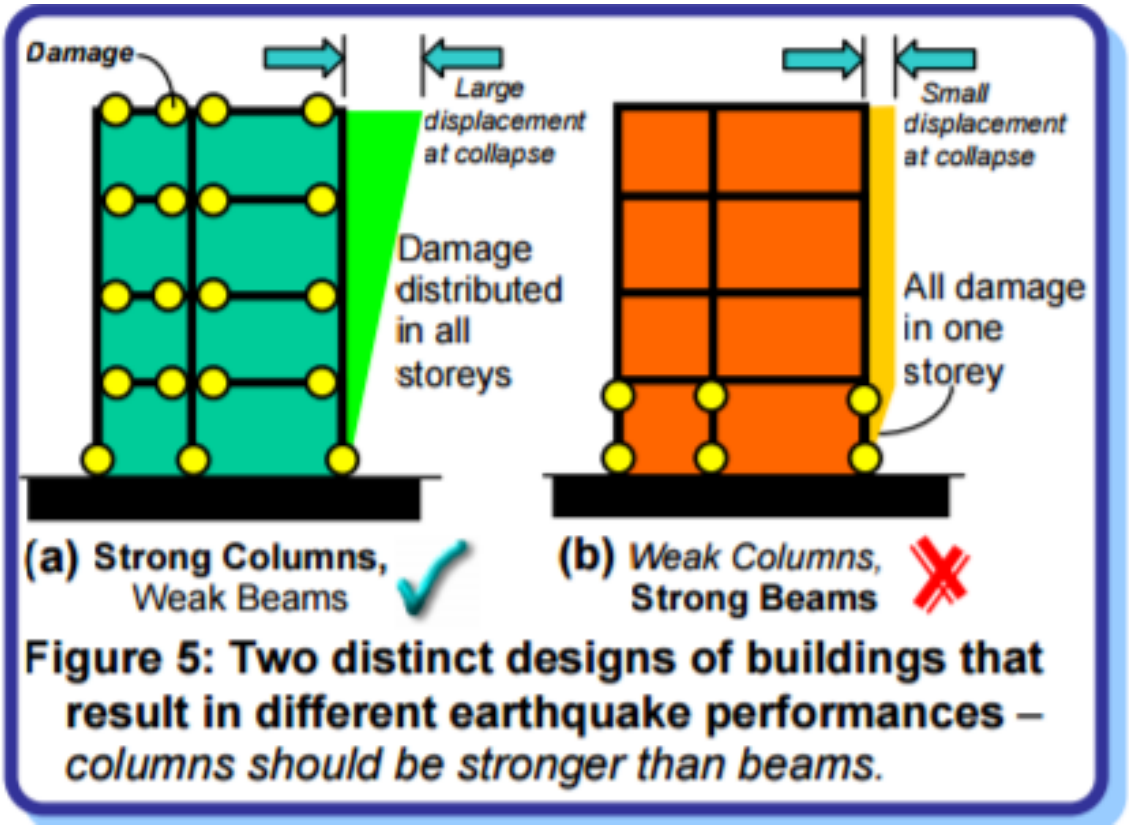

Figure 5: Two distinct designs of buildings that result in different earthquake performances – *columns should be stronger than beams.*

Quiz

Question 01:

Which is the weakest type of earthen construction?

Objectives:

A: Adobe construction

B: Hand Moulded Layered Construction

C: Tapial Construction

D: Pise Consruction

Question 02:

Which is the type of earthen construction where soil is poured into wooden forms of the walls and compaced?

Objectives:

A:Adobe construction

B: Hand Moulded Layered Construction

C: Block Construction

D: Tapial Construction

Question 03:

Which among the following are the main parameters of the seismic analysis of structures?

Objectives:

A: Ductility

B: Stiffness

C: Damping

D: All of the above
