

MID TERM

EXAM

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Section: B

Dept: BE (CE)

Subject: Earthquake
and dynamics

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Q.1

Ans

The type of serious configuration condition mentioned in figure is Soft Story.

The ~~is~~ building in which the stiffness of lower storey is less as compared to all the above storeys

This phenomenon is called Soft and weak storeys

Effect:

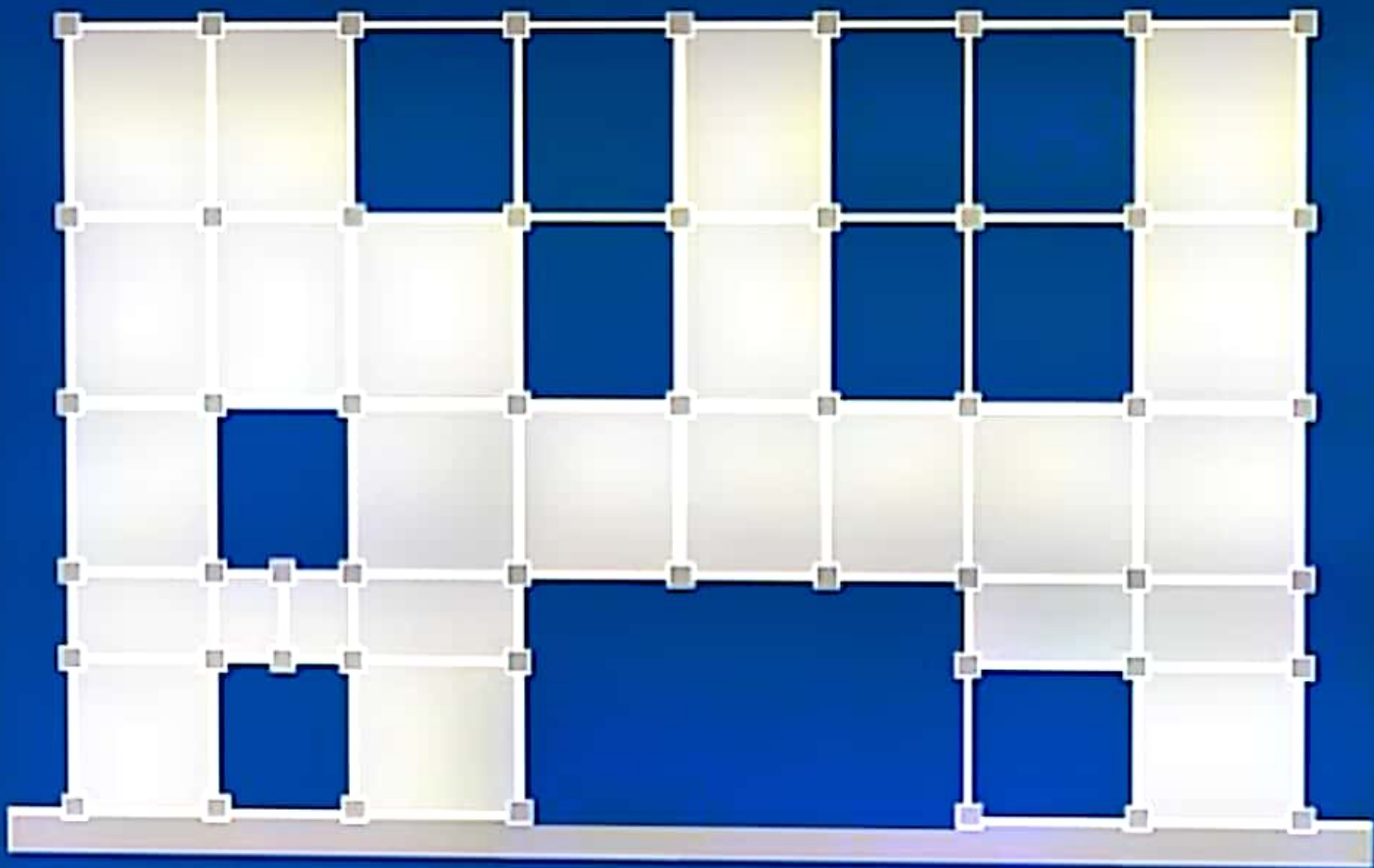
The most prominent of the problems caused by ~~se~~ severe stress concentration is that of the Soft Storey.

The presence of walls in upper storeys make them much stiffer than the upper ground storeys. Thus the upper storeys moves almost together as a single block and most of the horizontal displacement of the building occurs in soft ground storey itself.

Possible Solutions:

- Provide more columns in order to achieve the required strength and to increase the stiffness to overcome soft storey configuration.
- Add bracing to the soft storey of the building.
- Add external buttresses.

→ By specifically designing the first storey for much larger loads and smaller induced displacements than the rest of the structure.



The type of configuration condition in the figure is Discontinuous Shear walls.

The purpose of the shear walls is to collect the diaphragm loads at each floor and transmit them as directly and efficiently to the foundation.

Effects

→ In absence of shear walls the lateral forces caused by earthquake create powerful torsion.

→ When there is a discontinuity in shear wall it means that all the stories of a ~~skew~~ building do not contain shear wall. So this indicates

that there is no continuous load pattern from looft to foundation in absence of Shear wall. the result can be serious. at point of discontinuity during an earthquake.

Solution:

- The solution to the problem of the discontinuous Shear wall is to eliminate the Shear walls.
- If the decision is made to use Shear walls. then their presence must be recognized from the beginning of Schematic design and their size and location made the subject of careful architectural and engineering condition early.

→ Reinforcing a frame by attaching or placing a rigid wall inside it maintains the shape of the frame and prevents rotation at the joints.



The types of Configuration Condition in the figure is Re-entrant corners.

The Re-entrant corner is a common characteristics of building forms that in plan assume the shape of an L, T, H ~~etc~~ etc or a combination of these shapes.

Effects

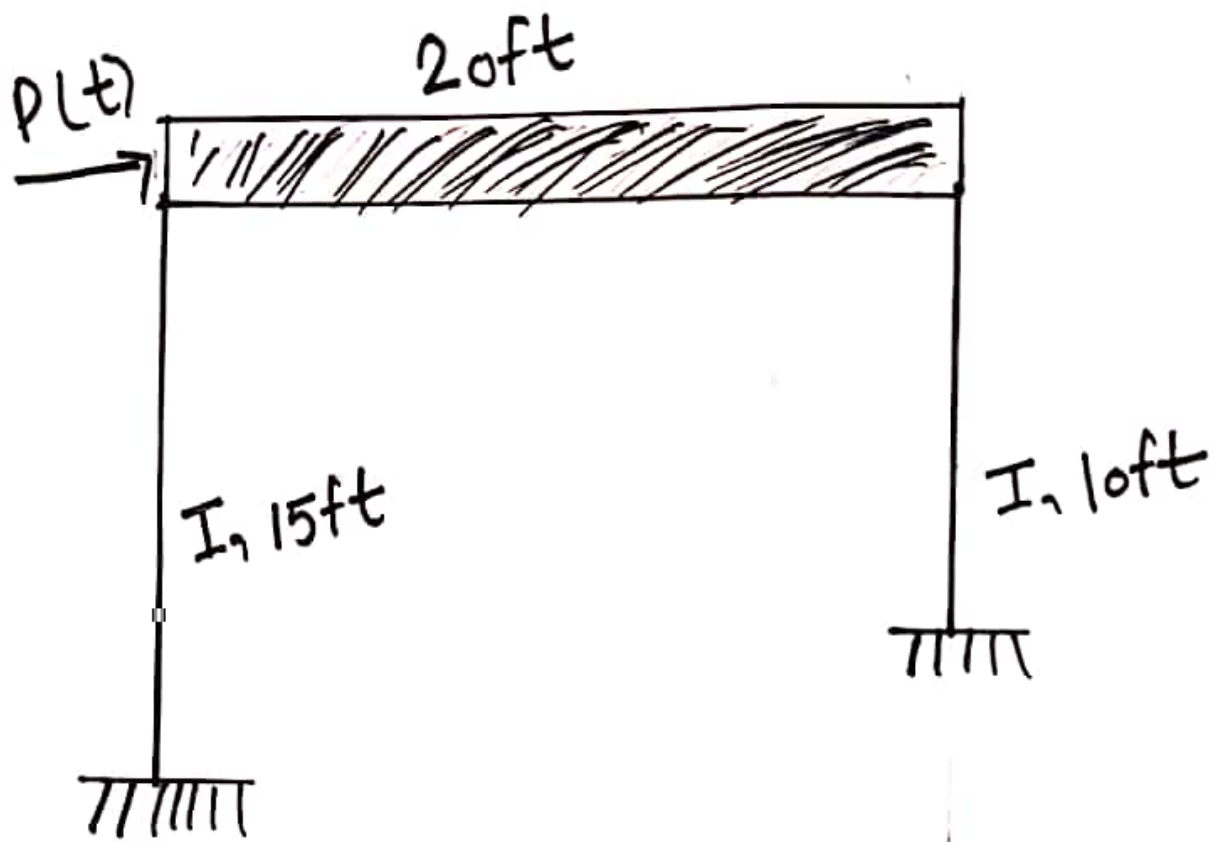
→ Structure consisting of re-entrant corners tends to produce differential motions between different parts of the building that because of stiff elements that tend to be located in this regions result in this region result in located stress concentrations at re-entrant corners.

Torsion is caused because the center of mass and the center of rigidity in this form cannot geometrically earthquake directions the result is rotation the resulting force are very difficult to analyze and predict.

Possible Solution:

- ★ Structurally to separate the building into simpler shapes or to tie the building together more strongly with elements positioned to provide a more balanced resistance.
- ★ The use of shaped rather than right angle re-entrant corner lessens the stress concentration.

Q.2



Given data

$$\Rightarrow E = 29,000 \text{ Ksi}$$

$$\Rightarrow I = 1200 \text{ in}^4$$

\Rightarrow uniformly Distributed Gravity load = 7705 lb/ft

Required data

⇒ Develop Equation of motion
= $p(t) = ?$

Sol:

As $K_{eq} = K_1 + K_2$

$$K = 12EI \left[\frac{1}{h_1^3} + \frac{1}{h_2^3} \right]$$

$$= 12 \times 29,000 \times 1200 \left[\frac{1}{(15 \times 12)^3} + \frac{1}{(10 \times 12)^3} \right]$$

$$K = 313.29 \text{ K/in}$$

$$K = 3759 \text{ K/ft}$$

=>

Now

$$\Rightarrow m = \frac{w}{g} = \frac{7.705 \times 20}{32.2 \text{ ft/sec}^2}$$

$$m = 4.785 \text{ K. Sec}^2/\text{ft}$$

$$\Rightarrow m = 4785 \text{ lb. Sec}^2/\text{ft}$$

Now ~~using~~ using D- A L e m b e r t ' s
principal of dynamic equilibrium

$$p(t) = Ku + mu \text{ --- (1)}$$

As

$$K = 3759 = 3.759 \times 10^6 \text{ lb/ft}$$

putting value we get

$$p(t) = 4785 \ddot{u} + 3.759 \times 10^6 \ddot{u}$$

where u & pt are in ft and lb
respectively