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Subject	Intro to Structure Dynamics and Earth quake Engineering
Exam	Mid Term
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Department	Bs (civil)

Q1

Ans:

The type of serious configuration condition mention in figure is soft story.

The building in which the stifness of lower storey is less as compare to all the above storeys.

This phenomenon is called soft and weak storeys.

Effect:

The most prominent of the problems caused by severe stress concentration is that of the soft storey.

The presence of walls in upper storeys make them much stiffer then 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.

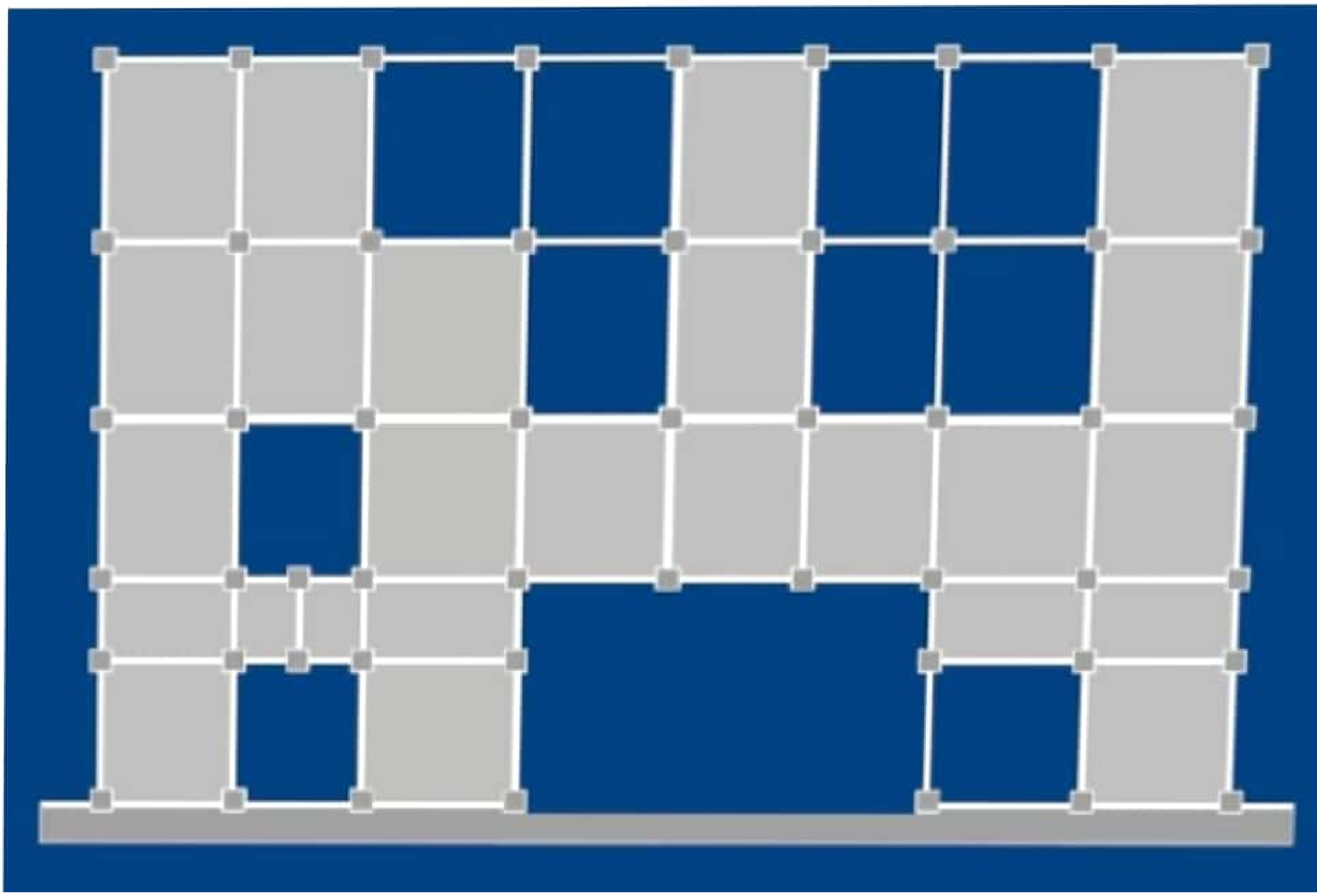
Possible Solutions:

⇒ Provide more columns in order to achive the requuired strength and to increase the stiffness to over come soft storey configuration condition.

⇒ Add bracing to the soft storey of the building.

⇒ Add external butresses.

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



The type of configuration condition in the figure is Discontinous shear walls. The purpose of the shear wall is to collect the diaphragm loads at each floor and transmit them as directly and efficently 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 walls it mean that all the stories of a building doesnot contain shear wall So this indicates that there is no continous load pattern from roof to foundation in absence of shear wall. the result can be serious at point of discontinity 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 begining of schematic design and their size and location made the Subject of carful architectural and engineering coordination 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 characteristic of building forms that in plan assume the shape of an L, T, H etc. or a Combination of there shapes.

Effects:

→ Structure consisting of re-entrant Corners tends to produce differential motions between different using of the building that because of Stiff elements that tend to be located in this regions result in this regions result in located ~~in~~ Stress concentrations at re-entrant Corners.

⇒ other effects of re-entrant corner is torsion. Torsion is caused becaused the center of mass and the center of rigidity in this form cannot geometrically earthquak directions the result is rotation. the resulting force are very difficult to analyze and predict.

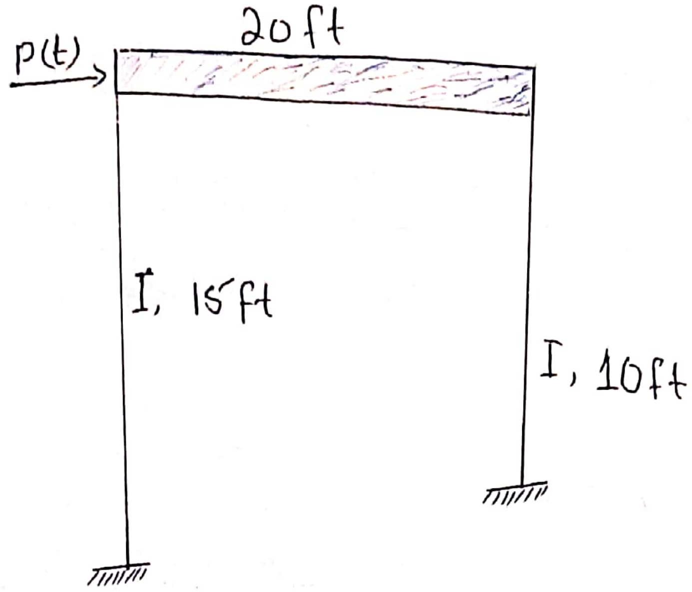
Possible solution

* Structurally to seperate the building into simpler shapes or to tie the building togethers more strongly with elements positioned to provid a more balanced resistance.

* The use of splayed rather than right angle reentrant corner lessens the stress concentration.

Q2

Solution:



Given data

⇒ $E = 29{,}000$ ksi

⇒ $I = 1200 \ in^4$

⇒ uniformly Distributed Gravity Load = ~~77~~ 19 lb/ft

Required data:

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

Solution: As; $K_{eq} = K_1 + K_2$

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

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$$= 12 \times 29{,}000 \times 1200 \times \left[\frac{1}{(15\times12)^3} + \frac{1}{(10\times12)^3}\right]$$

$$\Rightarrow k = 313.29 \text{ k/in}$$

$$\Rightarrow \boxed{k = 3759 \text{ k/ft}}$$

⇒ Now

$$\Rightarrow m = W/g = \frac{7.719 \times 20}{32.2 \text{ ft/sec}^2}$$

$$= 4.794 \text{ k} \cdot \text{sec}^2/\text{ft}$$

$$\Rightarrow m = 4794 \text{ lb} \cdot \text{sec}^2/\text{ft}$$

Now using D-Alembert's principle of dynamic equilibrium.

$$P(t) = ku + m\ddot{u} \quad \text{—①}$$

As $k = 3759 = 3.759 \times 10^6$ lb/ft

putting value we get

$$\boxed{P(t) = 4794\ddot{u} + 3.759 \times 10^6}$$

where u & $p(t)$ are in ft and lb respectively.