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Department : Civil Engineering

Subject : Intro. To Structural Dynamic & Earthquake

Assignment # 01

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Earthquake

Describe the types of the Configuration depicted in Figure 1, 2 & 3 How they can effect seismic performance of a structure and what are their possible solution.

Figure 1 variation in perimeter strength & stiffness

- This problem may occur in building whose configuration is geometrically regular and symmetrical, but nonetheless irregular for seismic design purposes.
- A Building's seismic behavior is strongly influenced by the nature of the perimeter design. If there is wide variation in strength and stiffness around the perimeter, the center of mass will not coincide with the center of resistance, and torsional Forces will tend to cause the building to rotate around the center of resistance

Solutions → The solution to this problem is to reduce the possibility of torsion by endeavoring to balance the resistance around the perimeter.

→ The First strategy is to design a frame structure of appoproximately equal strength and stiffness For the entire perimeter

→ The opaque portion of the perimeter can be contructed of nonstructural cladding, designed so that it does not affect the seismic performance of the Frame. This can be done either by using lightweight cladding or by ensuring that heavy material, such as Concrete or masonary, are isolated From the Frame

Figure 2 Avoid discontinuous shear walls

when shear wall From the main lateral resistant elements of a structure, and there is not a continuous load path through the walls From roof to Foundation, the result can be serious overstreesing at the point of discontinuity. This discontinous shear wall condition represent a special, but common, case of the "soft" First story problem

- The discontinous shear wall is a Fundamental design contradiction; the purpose of a shear wall is to collect diaphragm loads at each Floor and transmit them as directly and efficiently as possible to the Foundation. To interrupt this load path is undesirable.

solutions

- The solution to the problem of the discontinous 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 begaing of schematic design, and their size and location made the subject of careful architectural and engineering coordination early.

Figure 3 Avoid soft-Storey Upper Floors

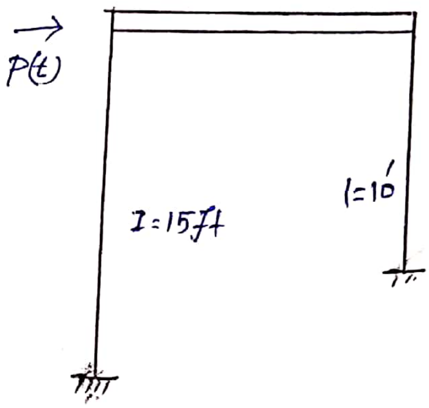
- The most prominent of the problems caused by severe stress concentration is that of the soft story

solution

- provide extra columns
- Add bracing
- Add external buttresses

(3)

Develop the equation of motion of the Frame show in Figure under the action of a leteral dynamic Force p(t) considerd a uniformly Distributed gravity load of (registration number) lb/ft acting on the beam. Neglect damping effect.



Solution

$$m = \frac{W}{g}$$

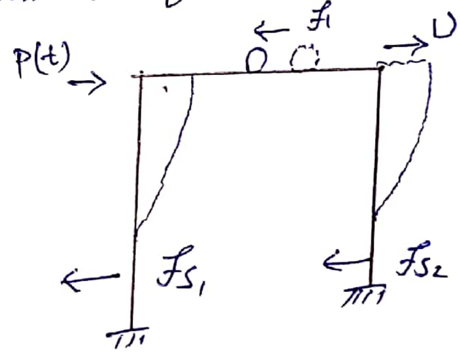
$$m = \frac{7677 \times 20}{32.2}$$

$m = 4768.32\ k\ sec^2/ft$

$m = 4768322.9\ lb.sec^2/ft$

$$\boxed{m = 4768322.9\ Slug}$$

Using D-Alembert's principle of dynamic equilibrium



$$P(t) - f_I - f_{s_1} - f_{s_2} = 0$$

$$P(t) - m\ddot{U} - (f_{s_1} + f_{s_2}) = 0$$

~~$K_T U = m\ddot{U}$~~

$$(K_1 U + K_2 U) + m\ddot{U} = P(t)$$

$(KU) + m\ddot{U} = p(t)$ As $K = 3759\ k/ft$

$$\boxed{4768322\ddot{U} + 3.7 \times 10^6 U = P(t)}$$

∴ U & p(t) are in ft & lb respectively

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