Paper: Intro to structure dynamics and earthquake engineering:

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QNO1: 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 solutions.

ANS:- Figure 1: Discontinuous shear walls:-

The problem shown in the structure is that they have provided discontinuous shear wall which will automatically cause over stressing because there is no continous path for load transfer.

Solution:

(1) Eliminate shear wall.
(2) if you want shear wall to be there then place it by designing their size and location properly with coordination of architact and Engineer.

Figure 2: Soft story effect:-

The ~~gen~~ ground floor has no enough stiffness. It has poor performance against seismic activity. An earthquake may cause sofit story phenomenon

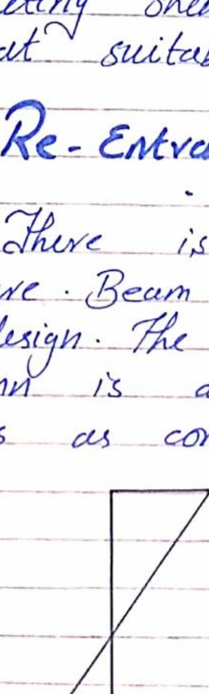
During earthquake the columns of the ground floor may fail due to lateral force. All uper stories have enough strength but due to ground floor soft story phenomenon the building may collapse during earthquake due to lateral forces.

**Solution:-**

To avoid soft stroy phenomenon in ground floor, stiffness should be provided, this may be done by constructing shear walls between columns at suitable locations.

## Figure 3 : Re-Entrant Corners:-

There is a beam-column joint failure. Beam column joints required special design. The Bending moment in a column is always more at the joints as compared to middle portion.



(B·M·D.)

Bending moment diagram.

Now to catter this high bending moment demond the lap splices of longitudinal ~~beam~~ bass should be given at the middle of column (approx. 5'). Also the stirrups should be given at less space upto a distance of "l/3" from the base of column.

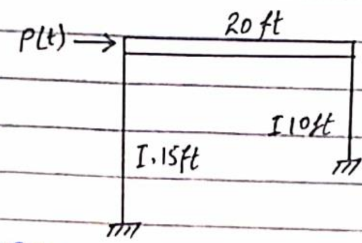
Also to avoid this type of failure during dynamic lateral forces, the columns are to be designed as short columns.

Strong columns and wall beam design should also be followedble column is a critical member.

In the given fig. There are much claddes are provided and thus the story has lack of stiffness so possible rigidity should be provided

In zone 04 which is a high hazard seismic zone so the building should be designed as special moment resisting frame (SMRF).

Q No: 2:- Develop the . . . . . . . . . .
. . . . . . . . . . damping effect.




**Solution:-**

Uniformly distributed load = 7313 lb/ft

= 7.313 k/ft.

Both the columns are higned.

Hight of column 1 = $H_1$ = 15 ft.

Hight of column 2 = $H_2$ = 10 ft.

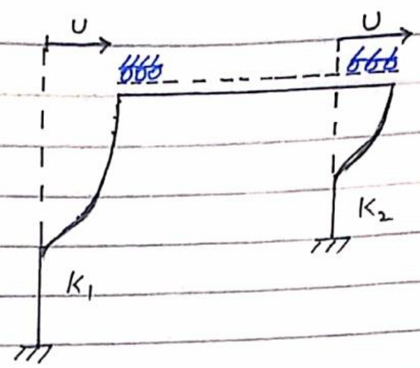
**Required:-**

Equation of motion = ?

Since value of E and I are both not given so we will use it as constant EI.

We need to callculat lateral stiffness of the columns.

For the given combination the equivalent stifness will be.




$$K_{eq} = k_1 + k_2.$$

$$K_{eq} = \frac{12EI}{H_1^3} + \frac{12EI}{H_2^3}$$

$$K_{eq} = 12EI\left(\frac{1}{H_1^3} + \frac{1}{H_2^3}\right)$$

$$K_{eq} = 12EI\left(\frac{1}{(15)^3} + \frac{1}{(10)^3}\right)$$

$$K_{eq} = 12EI\left(1.29 \times 10^{-3}\right).$$

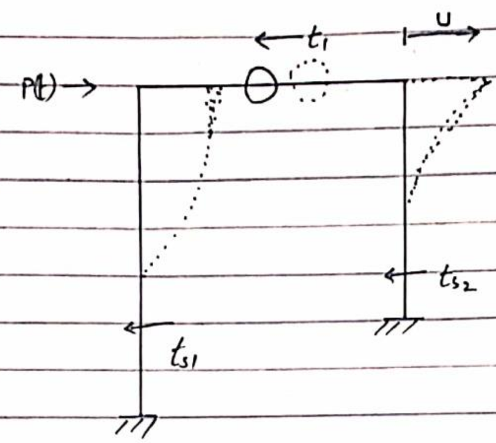
$$\boxed{K_{eq} = 0.0155\,EI \text{ k/ft.}}$$

Now

$$\text{Mass} = \frac{w}{g} = \frac{7.313 \times 20 \text{ K}}{32.2 \text{ ft/sec}^2}$$

$$m = 4.54 \text{ k}\cdot\text{sec}^2/\text{ft}.$$

$$m = 4.54 \text{ slug}.$$




Now

Using D. Alemberts principle of dynamics equilibrium.

$$P(t) - f_I - f_{s1} - f_s = 0.$$

$$P(t) - m\ddot{u} - (f_{s1} + f_{s2}) = 0.$$

$$\Rightarrow P(t) = (f_{s1} + f_{s2}) + m\ddot{u}$$

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

$$\Rightarrow P(t) = (k_{eq} u) + m\ddot{u} \text{ — eq (1)} \quad \because k_{eq} = k_1 + k_2$$

Put $m = 4.54$ slugs.

$k_{eq} = 0.0155\, EI$ in eq (1).

$$\Rightarrow P(t) = (0.0155 EI) u + 4.54 \ddot{u} \rightarrow A.$$

So eq A is required Equation of motion for the given structure.