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SubJect:. Intro to Structure Dynamic nd Earthquak engr

University: Iqra National university.

Depatment: Civil Engineering Batch 2013.

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Question number (ONE) (1)

Q Describe the types of the configuration depicted in Figure 1, 2, and 3. How they can effect seismic performance of a structure and what are their possible Solutions?

1) Figure number ONE:

=> Discontinuous Shear walls:

The Problem shown in the stouture is that they have Provided is continous Shear wall which will automatically causes over streesing because there is no continus path for load transfer.

Solution: ① Elimanate shear wall.

② If you want shear wall to be there then place it by desiging. their size and location properly with coordination of Architect and engineer.
And also this problem with the structure in fig-1 is that it possess Discontinous shear walls. As shear wall are the main contributors in frame for resisting Earthquake loads. The discontinuity is creating extra load and on members below make the structure more shift in upper floors. the time period will very singnificantly. members below will be overstressed and cannot bear torsional effects. Also at G.F in mid portion there are no columns and the joints are over stressed due to long span.
Slon: Reduce the amount of proper

=> S.W and assign it to proper location with minimum eccentricity between centre of Mass and Resistance. and also Assign Coloumns at mid portion.

=> Seismic Performance:: As the structur is frame but there here is wide opening available in mid portion and all the Columns over lIntel are much engough to Swing long and buckle easily even during small considerations of seismic waves. As the buckling is dangerous and all the load will then suddenly transform towards lower portions and may develop major stresses throughout the structure.

Question one part (B)

=> Figure II "Soft storey effect"

The problem with this structure is the soft storey effect i.e ground storey is less stiff than those of the above stories. Soft stories are less shist and more freiable which causes failure of the structure.

=> ① Add Columns ② Add Bracing
=> ③ Add External Buttresses.

=> Its also show the ground floor columns are displaced considerably under lateral Load as the structure above is either too rigid and heavy or this colums are not connected to upper story columns. second reason is strong- beam weak column design a Voilation of

-> ASCE-7.

The ends points of column have reached their inelastic limit and yielded passing permanent displacement. Also there is an absence of adequate shear walls.

=> Solution: The Rft in colums had to be vairied along the height making it elvetile, by which it could have avoid of the collapse second soln is that proper confinement with siesmic hooks at end regions of colume. Allocation of shear walls.

=> Seismic performance :- The configuration in the current status is more easily exposed and it may not survive long enough against severe shaking during seism as the weight of the bulding during dynamic swinging may not by the shores.

Question number one part "c"

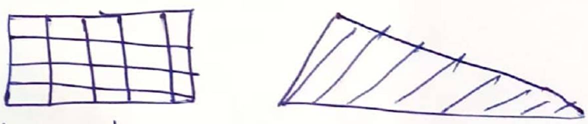
⇒ Figure "3" "Re-entrant corners"

It is because such orientation of structure two problems arises

(1) Differential motion of the building corners.

(2) Torsion in building due to different location of center of mass and Earth quake direction.

(1) Structurally seperments buildings to simple shape.



(2) Tie the buldings by stiff resistant elements.

⇒ The building is also C-shaped and have considerable. Torsional effects due to eccentricity Also the colomns in 1st floor show shear failure means the shear strength is beings achieved earlier than Flexural strength.

=) Also there is variation in time period.

=) The joints are failed mean the its cannot bear the lateral loads as it might lack seismic hooks and transver reinforcement.

=) Also the columns are concected eccentrically to Beams causing overstressing of joints in lateral loads.

=) Solution:- Avoid Torsion by assiginning shar wall at the corner.

Employ Type-2 Joints withe seismic hooks and Transeverse Rft.

R 7 t:

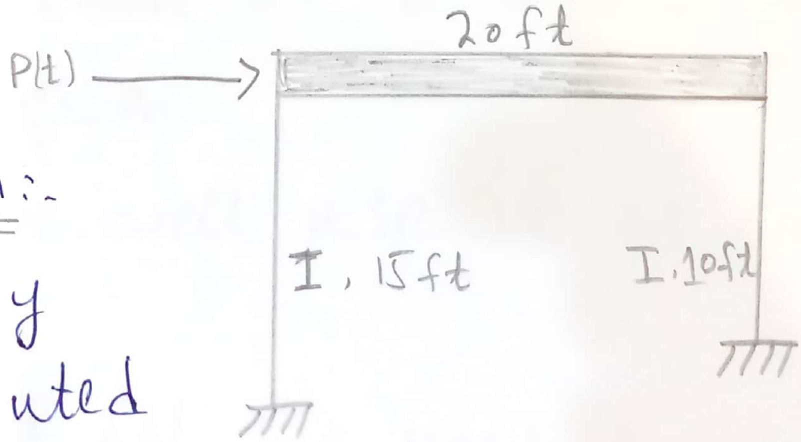
Provide Expansion Joints at the corner.

⇒ Seismic Peformance :- The bulding is not stable and more in severe condiation It is no more easy to have used as servic building because all the upper storey is on the verge to fall down as Joints of colums and beams have been fully damaged and separated.

Question number (Two) (02)

Problem:

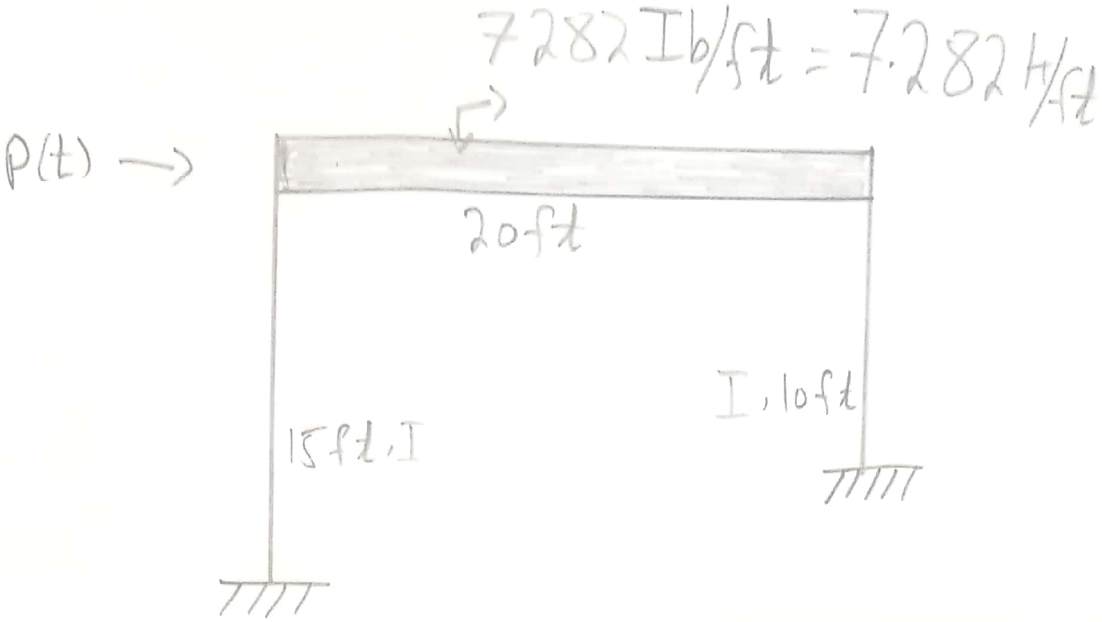
4 Develop the equation of motion of the frame shown in figur 4 under the action of a lateral dynamic force p(t). Consider a uniformly Distbuted gravity load of (ID number 7282. Ib/ft acting on the beam. Neglect damping effect.



Solution:

Uniformly distributed load = 7282 Lb/ft

= 7.282 k/ft.



⇒ Both the columns are higned.

Height of Column 1 = H_1 = 15ft

Height of Column 2 = H_2 = 10ft.

Required:-

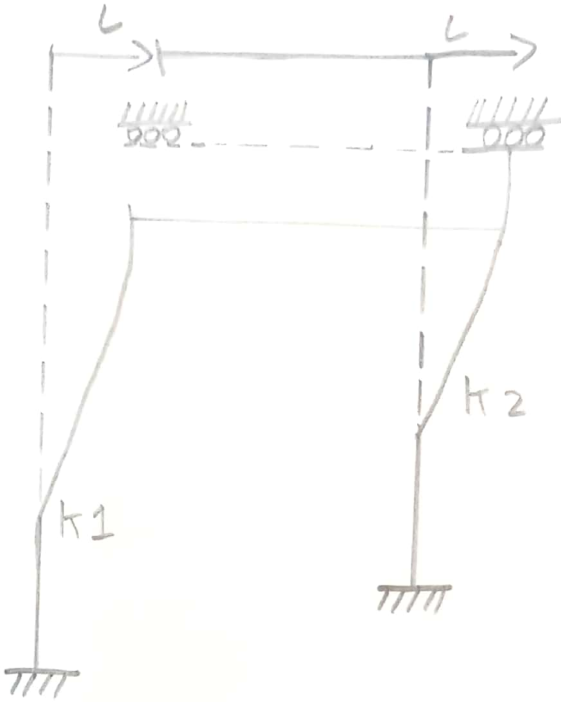
Equation of motion = ?

Since, value of E and I are not given.

So, we well use it as constant E.I.

first of all we need to calculate Lateral stiffness of the columns

=) For the given combination the equivalent stifness will be



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

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

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

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

$$k_{eq} = 12EI\left[1.29\times10^{-3}\right]$$

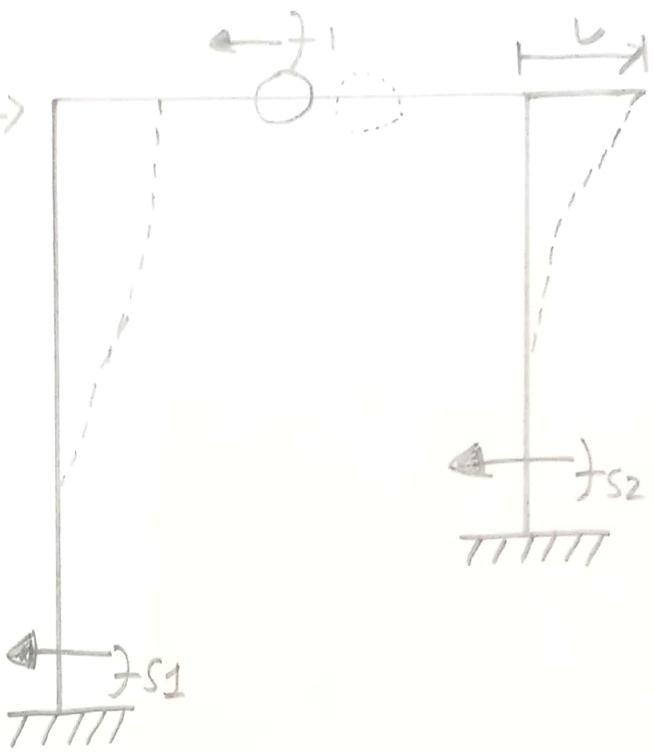
$$\boxed{k_{eq} = 0.0155EI \ k/ft}$$

Now,

$$Mass = \frac{w}{g} = \frac{7.282\times 20k}{32.2\ ft/sec^2}$$

$m = 4.53\ k\cdot sec^2/ft$

$M = 4.53$ slug



Now;

Using D. Alemberts principle of dynamic equilibrium.

$P(t) = f1 - f_{s1} - f_{s2} = 0$

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

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

$\Rightarrow P(t) = (k_1 u + k_2 u) + m\ddot{u}$

$\Rightarrow P(t) = (k_{eq}\, u) + m\ddot{u}$ Ⓐ $\quad \therefore k_{eq} = k_1 + k_2$

Put $m = 4.53$ slugs.
$k_{eq} = 0.0155\, kI$ in eq Ⓐ

$\Rightarrow$ $\boxed{P(t) = (0.0155EI)u + 4.53\ddot{u}}$ $\rightarrow$ Ⓐ

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

Answer $\Rightarrow$