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Subject: earthquake and dynamic

CQNO:1. Describe the types of the configuration depicted in fig 1, 2 and 3 how they can effect Seismic performance of a structure and what are their possible solution?

Ans: figure 1

the structure show in fig 1 seem to be frame structure constructed over a raft foundation where all the beams and columns have been monolithically tied. the seismic performance of the building in such that will develope major concern on mid section of the structure regarding failure as all the load dynamically concentrate at mid b/c of the greater opening here on the building seems to be non-symmetrically over mid therefore it may overturn if partial settlement phenomenon occur on left corner.

Seismic Performence

As the structure is frame but here is wide opening available in mid portion and all the columns over linked linked are much enough to swing long and buckle easily even during small constration ~~seismic wave~~

of Seismic waves. as the bulking is dangerous end all the load will then suddenly ~~to load~~ transform towards lower portions and may develop major stresses throughout the structure

possible solution:-

to make the structure strong enough to absorb all the over burden pressure produced due to earthquake. It is necessary to brace all the columns inclindly so that bulking may be reduced and load may be tranffered toward right or left portion of the structure in this way the stress over mid portion can mainly be made less and building may servive in a good possible way.

figure 2:

building configuration

the fig 2 is a structure having isolated footing being damaged severly due to partical settlement or earthquake also the structure have been shored for the possible temporary ~~Stabilit~~ Stability. An isolated columns each having ~~one~~ ~~supported~~ its own concern to resist loads and stresses and its not dependable on other supporting parralled parts and all they act their own to tranfer load towards the footing

beneath it. having this consideration partial settlement in a single column may produce severe conditions in the whole building

Seismic performence:

the configuration in the current status is more easily exposed and its may not survive long enough against severe shaking during seism as the weight of the building during dynamic swinging may not be ~~resisting~~ resisted by the shores

Possible solution:

the structure can be made possibly ~~stress~~ stable by providing underpins at suitable locations. further it can be good safety measure to decrease the number of storyes so that swing gets difficult during seismic shake external columns may also be casted and beam may then be laid through the available opening in the building so that have a good shear resistance during seism

figure 3

Building Configuration

the building shown in fig 3 is a frame structure having long columns placed over wide spaces. the monolithicy of beams and colums can be questioned as it is been obious

over here from the seperation of beams and columns from each other.

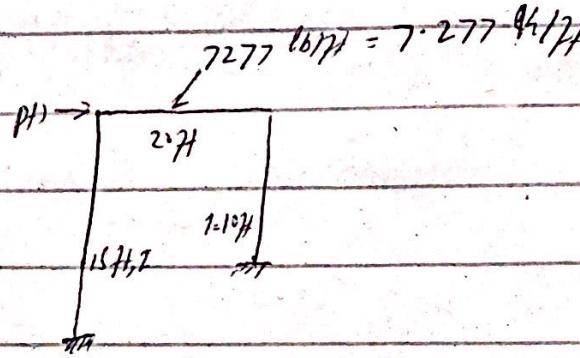
Seismic Performence

the building is not stable and more in sever condition it is not more easy to have used as service building bc all the upper storeys on the verge to fall down as joints of columns and beams have been fully damaged and seperated.

Possible Solution

if possible it is more regarded to demolish the upper story and reconstruded by just providing new beam and columns for this second Storey
Also it will be much better to provide intermidiate columns in between the existed. So that to migrate any ~~disc~~ discrepancy if it is there.

Q: Develop the equation of motion of the frame shown in fig: A under the action of lateral dynamic force P(t) Consider a uniformly distributed gravity load of 7277 lb/ft acting on beam. Neglect damping effect



Solution:

uniformly distributed load = 7277 lb/ft

= 7.277 kip/ft

Both the columns hinged

Height of column 1 = H_1 = 15ft

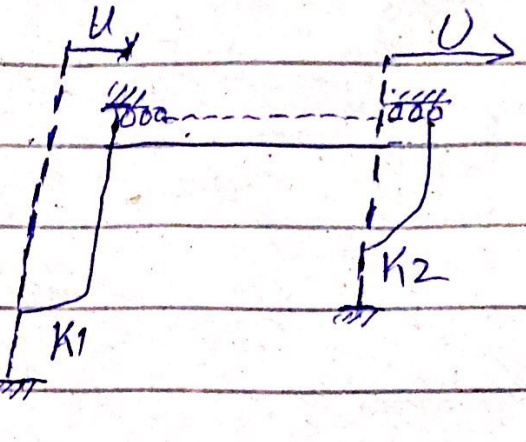
Height of the column 2 = H_2 = 15ft

Need =?

Equation of motion: ?

Since value E and I are not given so we will use as constant E, I of all we need to calculate lateral stiffness of columns for the given combination

the equation stiffness will be



$$K_{eq} = K_1 + K_2$$

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

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

$$K_{eq} = 12EI\left[1.29 \times 10^{-3} \right]$$

$$\boxed{K_{eq} = 0.0155EI \ K/ft}$$

Now

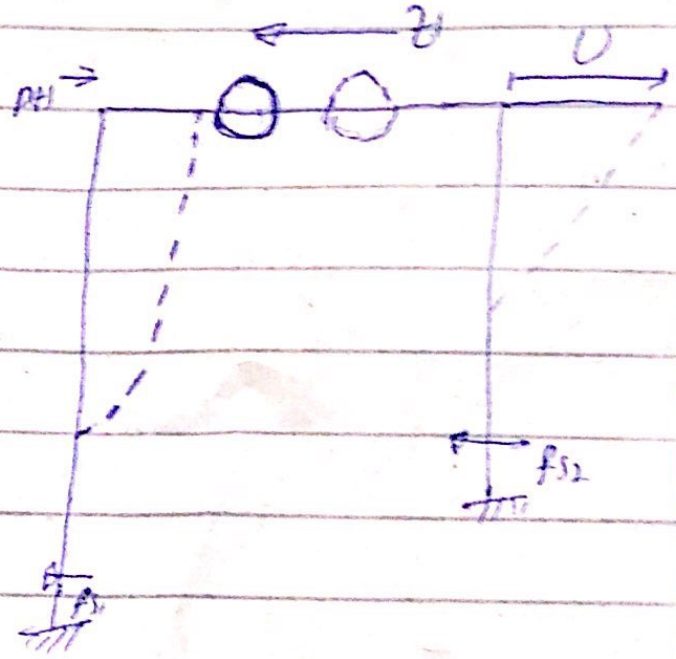
$$Mass = W/g$$

$$m = \frac{7.277 \times 20K}{32.2 ft/sec}$$

$$m = 4.519 \ K.sec^2/ft$$

$$\boxed{m = 4.52 . slug}$$

Now using D. Alembert's principle of dynamic equilibrium



$P(t) - f_1 - f_{S1} - f_{S2} = 0$

$P(t) = m\ddot{u} - (f_{S1} - f_{S2}) = 0$

$P(t) = (f_{S1} + f_{S2}) + m\ddot{u}$

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

~~$P(t) = K_{eq}$~~

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

$P(t) = (K_{eq} u) + m\ddot{u}$ — (A)

put $m = 4.052$ slug

$K_{eq} = 0.01552$ in eq (A)

$$\boxed{P(t) = (0.01552)u + 4.052\ddot{u}} \quad \text{— (A)}$$

So eq (A) is the required equation of the motion for the given structure.