(1)

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Paper ; Introduction to Structural dynamics and Earthquake Engineering

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Q1; Describe the types of the configuration depicted in figure 1, 2, & 3 effect seismic structure and possible. How they can perform of what are their salution?

## * Figure #1

Ans; Figure 1 shows discontinuos shear wall. If Seismic condition occur and there is not a continuos load path through which load transfer from roof to the foundation the result can be serious overstressing at point of discontinuity. Due to the above situation the structure can be demage and callapse at critical point of the structure.

## * *Salution;*

→ The salution to the problem of the discontinuos shear wall is to eliminate the shear walls. If the decision is made to use shear walls then their presence must be recognized from beginning of schematic design and their size and location made the subject of careful ~~arti~~ architectural and engineering coordination early.

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# Figure # 2

## * Performance of Structure;

Ans; Figure 2; shows the soft and weak stories and less stiff at ground level. and above the ground level the structure is more stiff and heavy.

→ The most prominent of the problems caused by Severe stress concentration is that of the soft story. The term has commonly been applied to buildings whose ground level story is less stiff than those above.

→ The building code distinguishes between "soft" and "weak" stories. Soft stories are less stiff or more flexible than the story above weak stories have less stress.

→ A soft or weak story at any height creates a problem. But since the cumulative loads are greater towards the base of the building a discontinuity between the first and second floor tends to result in the most serious condition.

## * *Solution;*

→ The solution of this type of problem in structure is to add the following structure elements such as columns, bracings and external buttresses at soft and weak stories of structure.

# Figure # 3.

## * Performance of Structure;

In figure - 3 the problem shows re-entrant corner.

→ There are two problems created by these shapes. The first is that tend to produce differential motions between different wings of the building that because of stiff elements that tend to be located in this region result in local stress concentrations at the re-entrant corner.

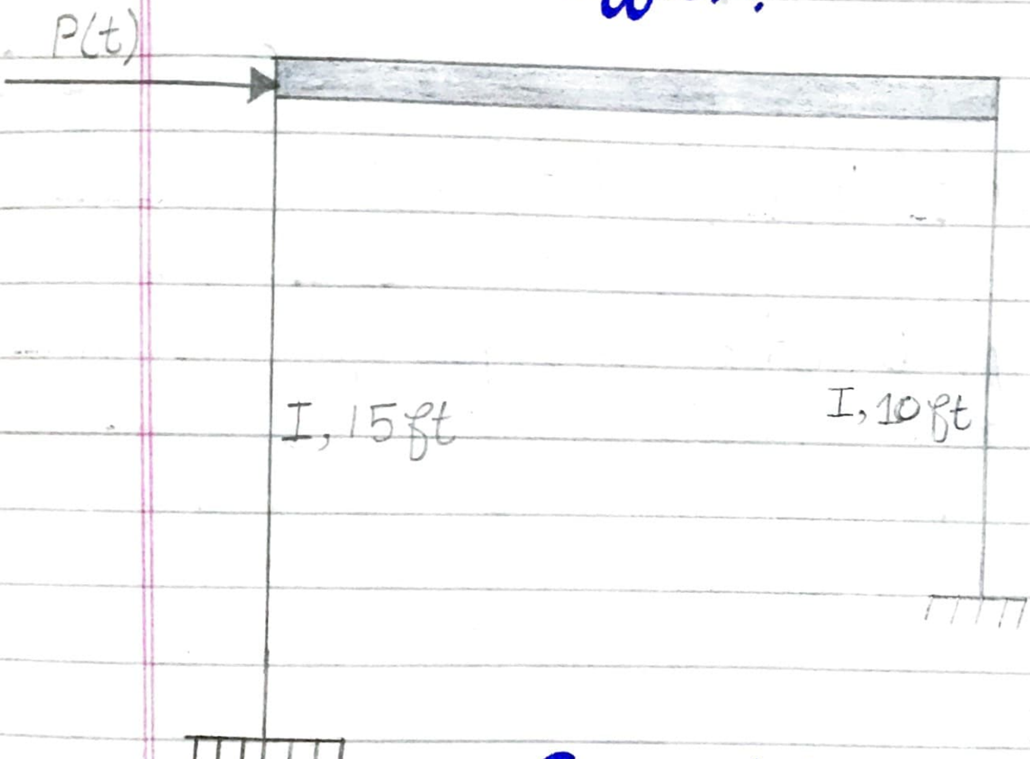
→ The second problem of this form is torsion. which is caused because the center of mass and the center of rigidity in this form cannot geometrically coincide for all possible earthquake directions. The result is rotation. The resulting forces are very difficult to analyze and predict.

# *Salution*

→ There are two basic alternative approaches to the problem of re-entrant corner forms. Structurally to separate the building into simpler shapes or to ~~th~~ tie the building together more strongly with elements positioned to provide a more balanced resistance. The latter salution applies only to smaller buildings. In case of separations building must be sufficiently away to ensure they do not pond together and damage each other in earth quake.

→ The use of splayed rather than right angle re-entrant corner lessens the stress concentration. This is analogues to the way a tapered beam is structurally more desirable than abruptly notched one.

Q3; Develop the equation of motion of the frame shown in problem under the action of a dynamic force P(t). Consider uniformly distributed gravity load of (Registration number) lb/ft acting on the beam. Neglect damping effect?




## Given data

I = 15 ft

I = 10 ft

P(t) = 7686 lb/ft

Length of Beam = 20ft.

## Required data

Equation of motion = ?

# * Solution.

As we know that

$F = ma$

$w = mg$

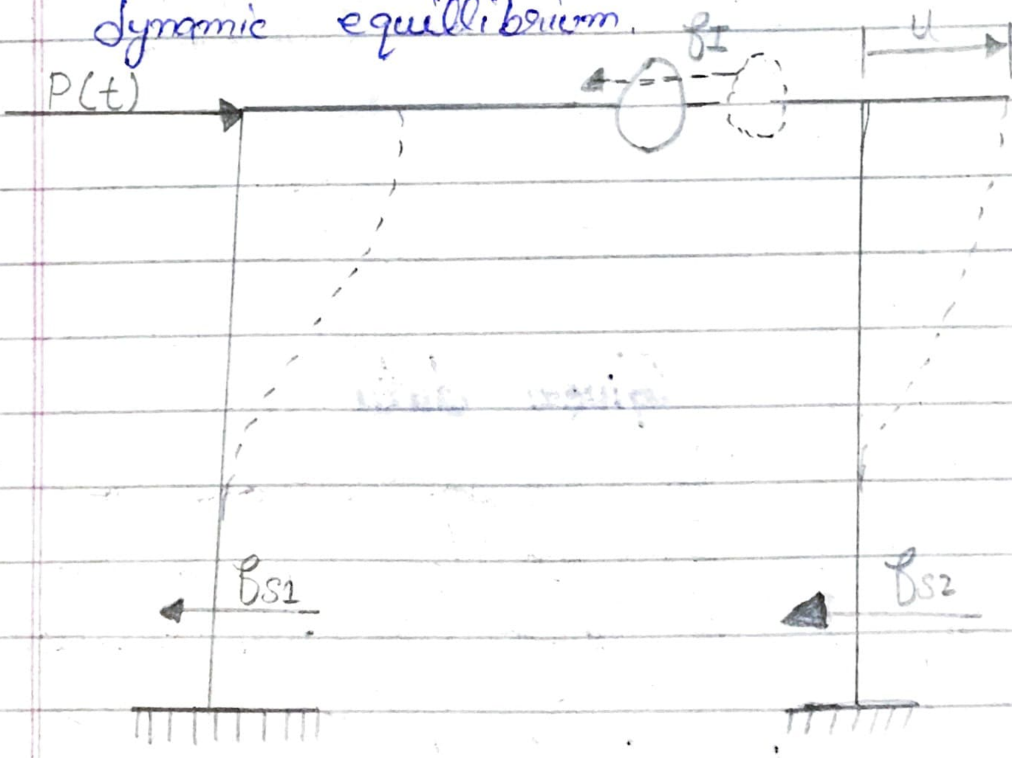
$m = w/g$

Put the values

$$m = \frac{7686 \times 20}{32.2\ ft/sec} = 4773.91\ lb.sec^2/ft.$$

$$m = 4.77391\ K\text{-}sec^2/ft$$

using D-Alembert's principle of dynamic equillibrium.



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$f_I = m\ddot{u}$

$f_{s1} = k_1 u$

$f_{s2} = k_2 u$

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

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

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

$P(t) = ku + m\ddot{u}$ $(k = 3759\ k/ft)$.

Put the values

where $u$ and $P(t)$ are in ft and lb.

$$P(t) = 477391\,\ddot{u} + 3.76 \times 10^6 u$$

Equation of motion.