

# INTRO TO Structural Dynamics & Earthquake Eng

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Section :- A

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Answer:- Figure 1

When shear walls form the main lateral resistant element of a structure, and there is not a continuous load path through the walls from roof to foundation the result can be serious overstressing at point of discontinuity. This discontinuous shear wall condition represent a special, but common, case of the soft first story problem.

- The discontinuous shear wall is a fundamental design contradiction the purpose of a shear wall is to collect diaphragm load at each floor and transmit them as directly and efficiently as possible to the foundation to intercept this load path is undesirable.

- Possible Solution:-

The solution to the problem of the discontinuous 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 beginning of schematic design and their size and location made the subject of careful architectural and engineering coordination early.

## Question # (1)

### Answers:- Figure (2)

- The most prominent of the Problem caused by severe stress concentration is that of the "soft" story. The term has commonly been applied to building 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 strength.
- A soft or weak story at any height creates a problem. but since the cumulative load are greatest towards the base of the building a discontinuity between the first and second floor tends to result in the most serious condition.
- The most prominent of the Problems caused by severe stress concentration is that of the "soft" story.

### Possible solution :-

We can prevent the story or soft story by adding columns, by adding bracing and external buttresses. Basically in this Problem we facing a soft-story effect due to which we prevent this Problem by adding this.

Answer:- Figure 3

- These are two problems created by these shapes. The first is that they 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.

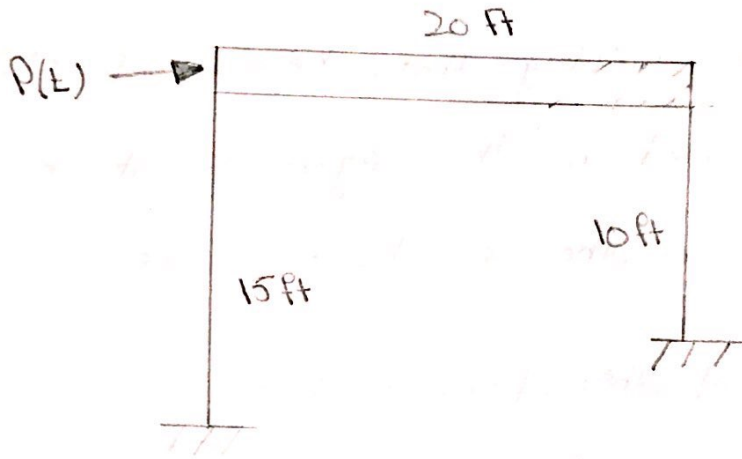
Problem solution:-

There are two basic alternative approaches to the problem of re-entrant-corner forms: structurally to separate the building into simpler shapes, or to tie the building together more strongly with elements positioned to provide a more balanced resistance. (The latter solution applies only to smaller buildings. The use of splayed rather than right angle re-entrant corners lessens the stress concentration.)

This is analogous to the way a tapered beam is structurally more desirable than an abruptly notched one. 14

Question # (2)

Answer:-



$$m = \frac{w}{g} = \frac{7731 \times 20}{32.2}$$

$$m = 4801.86 \text{ lb sec}^2/\text{ft}$$

Using D'Alembert's Principle of dynamic equilibrium,

$$P(t) - F_I - F_{s1} - F_{s2} = 0$$

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

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

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

$$\therefore \text{As } k = 37.57$$

$$4801.86 + 3.76 \times 10^6 u = P(t)$$

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