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SEC: “C”

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QUESTION NO “1”

ANSWER

Figure 1:

Figure 1 is the type of “Discontinuous shear wall”

DISCONTINOUS SHEAR WALL:

“Those lateral force resisting system that do not have a load path continuing directly to the foundation”

EFFECTS:

When shear walls form the main lateral resistant elements 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 the points of discontinuity. This discontinuous shear wall condition represents 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 loads at each floor and transmit them as directly and efficiently as possible to the foundation. To interrupt this load path is undesirable.

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.

FIGURE 2:

Figure 2 is the type of “weak and soft stories”

WEAK AND SOFT STORIES:

“The story which the lateral stiffness is less than 70% to 80% of the stiffness of the story above is refers as weak and soft stories”

EFFECTS:

A soft or weak story at any height creates a problem, but since the Cumulative loads 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.

SOLUTION:

Addition of columns

Addition of bracings

Addition of external buttresses

FIGURE 3:

Figure 3 is the type of “Re-entrant corners”

RE-ENTRANT CORNERS:

“The re-entrant corner is the common characteristic of building forms that, in plan, assume the shape of an L, T, H, etc., or a combination of these shapes”

EFFECTS:

There 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.

SOLUTION:

There are two basic alternative approaches to the problem of reentrant-corner forms:

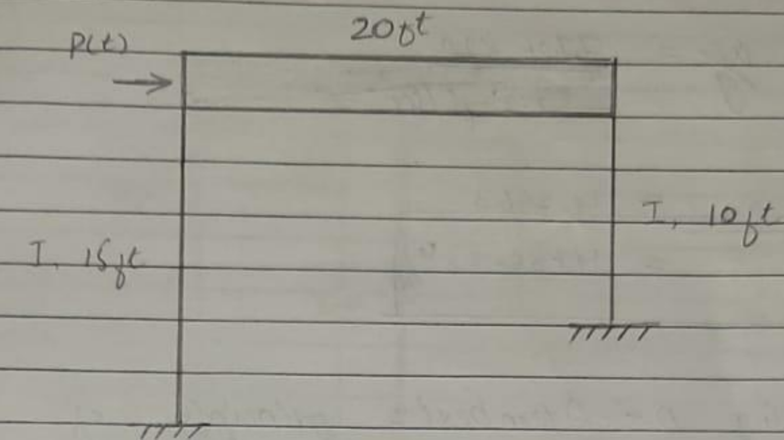
Structurally to separate the building into simpler shapes or to tie the building together more strongly with elements positioned to provide a more balanced resistance. The latter solution applies only to smaller buildings.

In case of separation building must be sufficiently away to ensure they do not pound together and damage each other in an earthquake.

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.

QUESTION NO 2

SOLUTION:



Given Data :

$E = 29000$ ksi
$I = 1200\ in^4$
Uniformly Distributed Gravity Load = 7706

Required :

Develop equation of motion = P(t) = ?

Solution:-

As $K_{eq} = K_1 + K_2$

$$K = 12EI\left[\frac{1}{h_1^3} + \frac{1}{h_2^3}\right]$$

$$= 12 \times 29000 \times 1200 \times \left[\frac{1}{(15\times12)^3} + \frac{1}{(10\times12)^3}\right]$$

$$= 313.29\ k/in$$

$$\boxed{K = 3759\ K/ft}$$

Now,

$$m = \frac{w}{g} = \frac{7.706 \times 20}{32.2 \ ft/sec^2}$$

$$= 4.7863$$

$$\boxed{m = 4786.33 \ sec/ft}$$

Now using D-Alembert's principle of dynamic equilibrium

$$p(t) = Ku + m\ddot{x} \quad \text{——— (i)}$$

As $K = 3759 = 3.759 \times 10^6$ lb/ft

putting value we get

$$\boxed{p(t) = 4786u + 3.759 \times 10^6}$$

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