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Semester :- 12th

Subject :- Earthquake Engg

Submitted to :- Engr. Yaseen Mahmood

:- 2 CR.HRS

Q no 1 :-

Describe the types of configurations depicted in figure 1, 2, 3. How they can effect seismic performance of a structure and what are their possible solutions.

Ans :- Figure 1

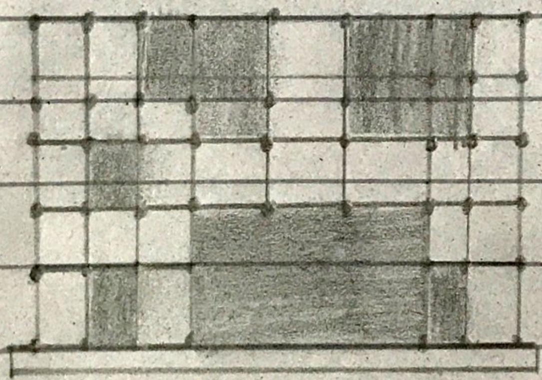


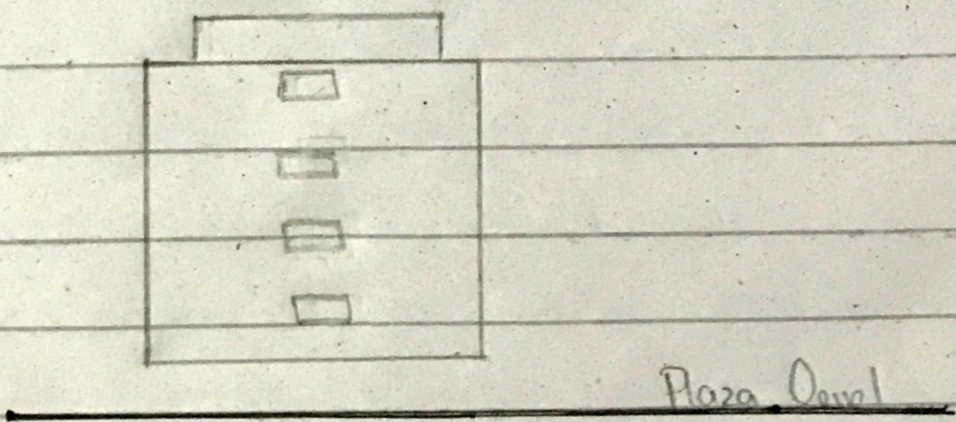
Fig 1

⇒ Avoid Discontinous Shear Walls :-

→ When Shear walls from the main lateral resistant elements of a structure and there is not a continous load

Path through the walls from roof to foundation, the result can be serious overstressing at the points of discontinuity. This discontinous shear wall condition represents a special, but common case of soft first story problem.

→ The discontinous shear wall is a fundamental design contradiction: the purpose of a shear wall is to collect diaphram loads at each floor and transmit them as directly and efficiently as possible to the foundation. To interrupt this load path is underivable.



Cross section, Olive View of hospital, showing the second-floor of plaza and the discontinous shear wall.

Solution:-

-> The solution to the problem of discontinous shear wall is to Elimanate 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 sbject of carefull architectural and engineering coordination early

⇒ Figure 2 :-

⇒ Soft and Weak Stories :-

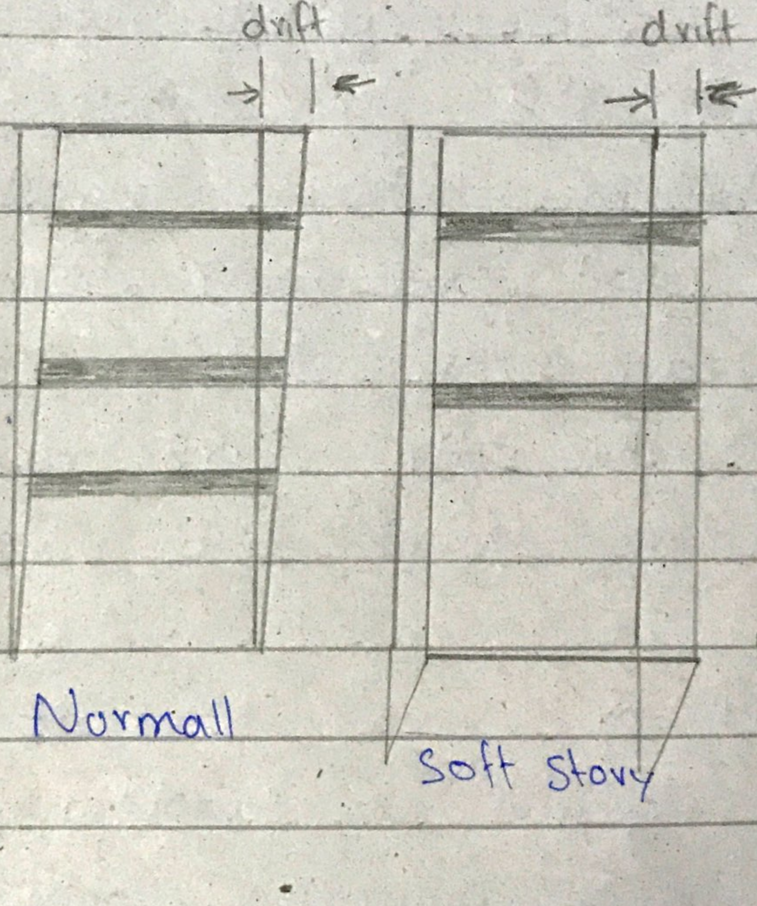
→ The most prominent of the problem caused by severe stress concentration is that of soft story. The term has commonly been applied to buildings whose ground level story is less stiff than those above

→ 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 strength

→ A soft or weak story at any height creates a problem, but since the cumulative loads are greatest towards the base of building, a discontinuity between first & second floor tends to result in the most serious conditions

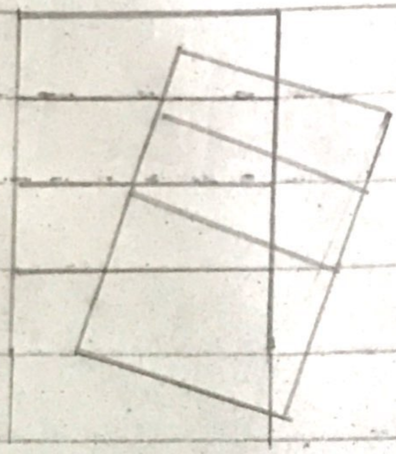
Soft Story effect:-

→ The most prominent of the problems caused by severe stress concentration is that of the soft story.



Normall

Soft Story



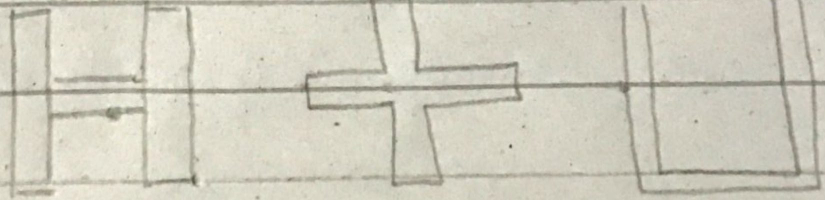
Collapse

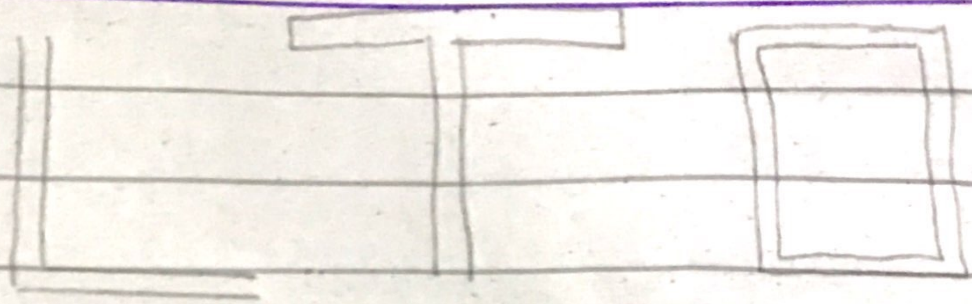
=> The soft story mechanism.

=> Figure 3:-

Re-entrant Corners:-

The re-entrant corners 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





Re-entrant corner plan forms

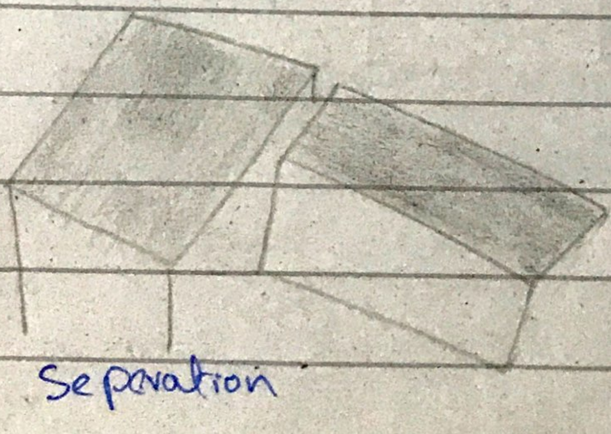
Re-entrant Corners

→ 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 concentration at re-entrant corner.

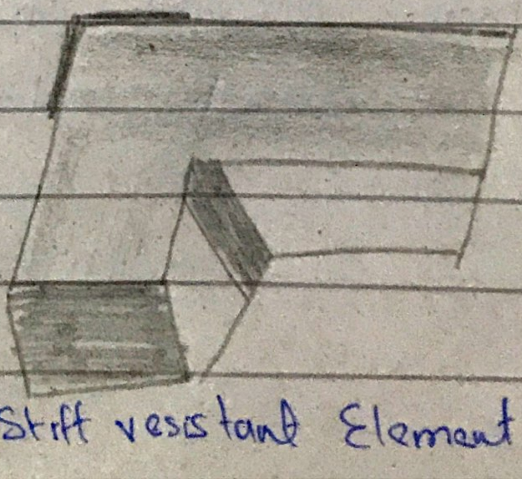
→ The second problem of this form is torsion which is caused because the center of mass and the center of rigidity in this form cannot geometrically conside for all possible earthquake direction. The result is rotation The resulting forces are very difficult to analyze and predict.

⇒ Solutions:-

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 togather more strongly with elements positioned to provide a more balanced resistance (see figure). The latter solution applies only to smaller buildings



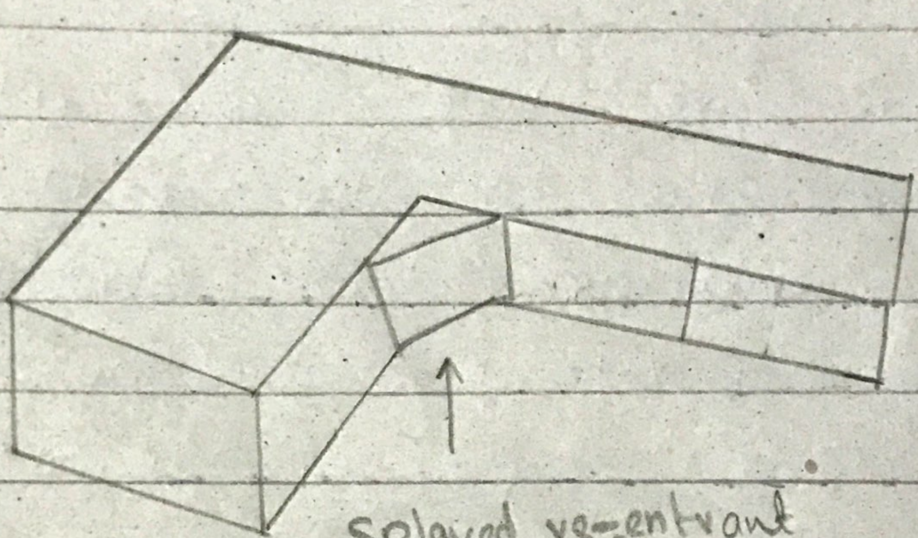
Separation



Stiff resistant Element

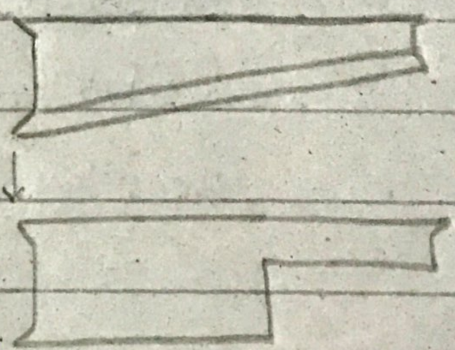
Solution:-

The use of splayed rather than right angle re-entrant corners lessens the stress concentration.



splayed re-entrant corners

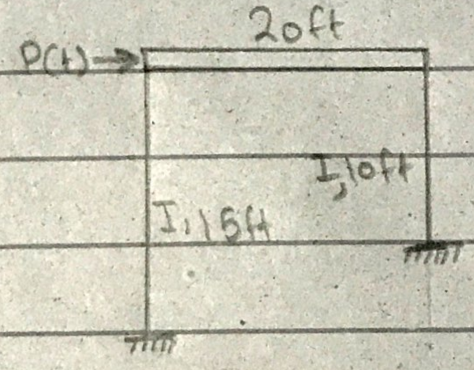
This is analogous to the way a tapered beam is structurally more desirable than an abruptly notched one.



Qno2

Problem:-

Develop the Equation of motion of the frame shown in fig 4 under the action of a lateral dynamic force P(t). Consider a uniformly distributed gravity load of (ID) 7487 lb/ft acting on the beam. Neglect the damping effect.



=> Solution:-

$$m = \frac{w}{g} = \frac{7487 \text{ lb/ft} \times 20 \text{ ft}}{32.2 \text{ ft/sec}^2}$$

$$m = 4650.31 \text{ lb sec}^2/\text{ft}$$

Using D- Alembert's principle of dynamic Equation

$$P(t) - f_1 - f_{s1} - f_{s2} = 0$$

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

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

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

As, $K = 3759$

$$4650.31\,\ddot{u} + 3.76 \times 10^6 u = P(t)$$

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