IQRA NATIONAL UNIVERSITY

INTRO TO STRUCTURAL DYNAMICS
AND EARTHQUAKE ENG

MID TERM EXAM

NAME= MUJAHID AFRIDI

ID = 7775

SECTION = (A)

MODULE= 8th SEMESTER

INSTRUCTOR = ENGR. YASEEN MAHMOOD

INTRO TO STRUCTURAL DYNAMICS AND EARTHQUAKE ENG.. -

Q#01:

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

Ans:

Figure - 1

The detoriation in the Pic is due to discontinues shear wall.

=> 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, This discontinuous shear wall condition represent a special, but common, case of the "soft" first-story Problem.

=> 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.

Effect on the seismic Performance of the structure.

⇒ When the earthquake comes so due to discontinuous shear wall in the structure the building will collapse in the middle and also cracks produce in the middle.

Possible Solution:

1) The possible solution of the problem is to eleminate the shear wall.

2) If the final decision is made to use shear walls, then the presence of shear wall must be kept in mind from the begaining of the schematic design and also the size and location of the shear wall must be decide according to the coordination of engineer and architect.

Figure - 2:

Type of configuration depicted

→ In this figure - 2 is soft and storey.

=> Soft stories are less stiff or more flexible than above all stories while the weak stories have less strength.

=> A soft or weak story at any height creates a problem, but the cumulative loads are greatest towards the base of the building. The discontinuity between the first and second floor tends to result in the most serious condition.

Effect on the seismic Performance of the structure:

=> When the earthquake comes, so the heavier top floor put disproportionate lateral stress to the soft story due to which weak ground floor will be collapse.

Possible Solutions:

1) Give bracing between two columns which will give more support to the columns during the earthquakes.

2) Providing external buttresses to the soft and weak story. Buttresses will reduce the lateral story displacement, story drift and bending moment in column during the earthquakes.

Figure - 3

Type of configuration depicted:

=> There are two problems created by these shapes. The first problem is to produce differential motions between different parts of the building.

=> The type of configuration depicted in Fig-3 is re-entrant corners.
The building shown in Fig-3 is L - shape building.

=> The re-entrant corners is the common characteristics of the building forms that in plane assume the shape of a L, T, H etc or a combination of these shape.

Effect on the seismic Performance of the structure:

=> When the earthquake comes so the diffrential motions produces between the wings of the building because the stiff element located in this region as a result local stress concentration at the re-entrant corner.

=> Also torsion produces which cause because the centre mass and the centre of rigidity in this form cannot geomatrically concide for all possible earthquake directions. As a result of rotation.

Possible Solution:

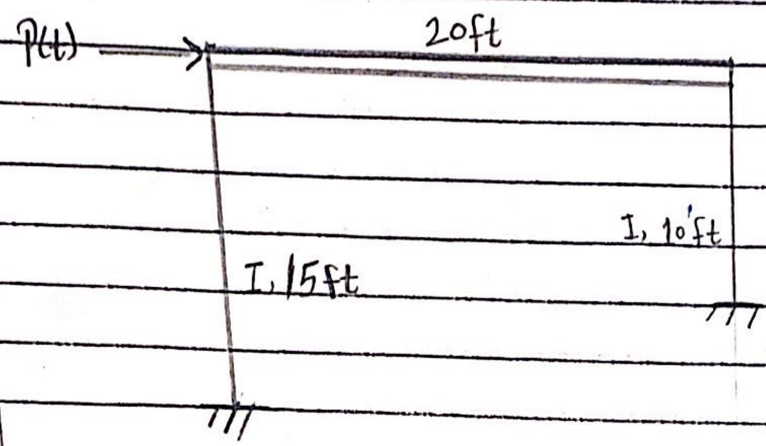
1) The solution of this problem is to separate the building into simpler shapes.

2) Use splayed rather than the right angle re-entrant corners, so the stress concentration will be less.

3) Tie the building together move strongly with elements positioned to provide a more balanced resistance.

Q# 2:

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



Sol:- => Data= $E = 29{,}000$ ksi => $I = 1200\ in^4$

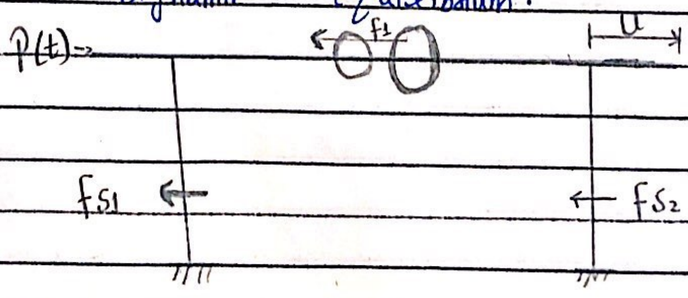
As we know that

$m = w/g$

$m = \frac{7775 \times 20}{32.2}$

$m = 4829.19\ lb.sec^2/ft$

Using D-Alembert's Principle of dynamic equilibrium.



Given data

=> $E = 29{,}000$ ksi

=> $I = 1200\ in^4$

=> Uniformly distributed gravity Load= 7775 lb/ft

Required data:

=> develop equation of motion = P(t)=?

Sol:-

As; $k_{eq} = k_1 + k_2$

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

$= 12 \times 29{,}000 \times 1200 \times \left[\frac{1}{(15\times12)^3} + \frac{1}{(10\times12)^3}\right]$

=> $k = 313.29$ k/in

=> $k = 3759$ k/ft

$$P(t) - f_1 - f_{s_1} - f_{s_2} = 0$$

$$P(t) - m\ddot{u} - (f_{s_1} + f_{s_2}) = 0$$

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

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

As

$$k = 3759\ k/ft = 3759\,k/ft$$

$$4829.12\,\ddot{u} + 3.76 \times 10^6\, u = P(t)$$

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