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Technology, Social Impact

QUANTIFYING PARAMETERS FOR IMPROVED ENERGY DISSIPATION CAPACITY IN LOW-RISE RC OPEN STOREY BUILDINGS

ABSTRACT

- Detrimental effects of irregularities more pronounced due to stiffness and strength variations across the height of the building
- Formation of storey mechanism (at the open storey) most crucial seismic behavior
  - Inelastic energy dissipation capacities of buildings substantially reduced
    - Need to preclude storey mechanism for better energy dissipation
      - Need to arrive at a desirable ductile mechanism that maximizes inelastic energy dissipation capacity in buildings with open storeys
        - Fine tune two design parameters at a moment resisting joint
          - Relative lateral stiffness of columns and beams
          - Relative flexural strength of columns and beams

METHODOLOGY

- Regular low-rise 5 storey buildings located in moderate to high seismic regions considered
- Stiffness and strength irregularities considered for study in the buildings by providing:
  - Open storey in ground storey alone
  - Open storey in an intermediate storey alone
    - Soft storeys are identified by estimating storey stiffness using fundamental mode shapes and mass of the building [$k=m\phi$]
- Observed storey mechanism precluded and poor seismic behavior improved of the study buildings
  - Increasing relative flexural stiffness of column and beams in the open storeys
  - Increasing relative flexural strength of column and beams in the open storey
    - Stiffness ratio: ratio of stiffness of immediate upper storey to stiffness of open storey
    - Column-to-beam strength ratio: ratio of flexural strength of columns to flexural strength of beams

RESULTS and CONCLUSIONS

- Increasing stiffness of the open storey and flexural strength of beam-column joints together help preclude the undesirable open storey mechanism in open ground storey buildings,
- Desirable stiffness ratio range tis 1o 0.6, alongside a CBSR range of 4 to 5, to preclude the undesirable open storey mechanism in open ground storey buildings,
- Intermediate open storey buildings demonstrate extremely poor seismic behaviour, and hence are not recommended

Fig. 1 – Soft Storey Collapse of Olive View Hospital 1971 San Fernando earthquake .

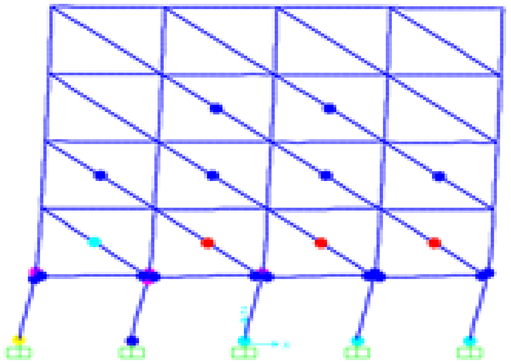

Fig. 2 – Storey Mechanism in a Soft Storey

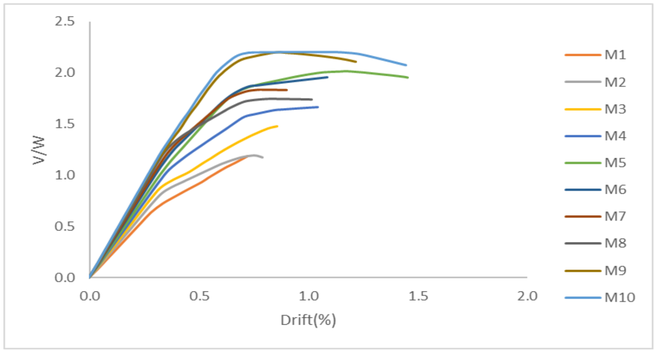

Fig. 3 – Pushover curves of buildings with open ground storey

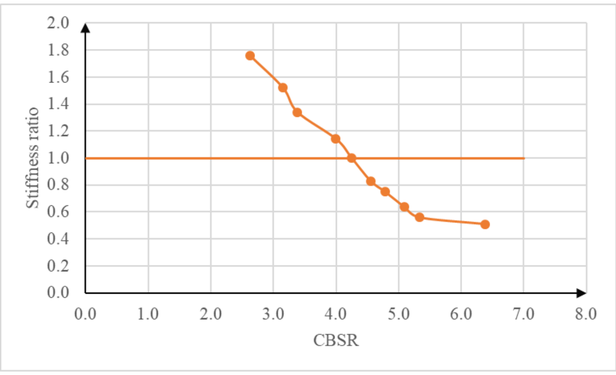

Fig. 4 – Dependence of stiffness ratio with column-to-beam strength ratio for open ground storey

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Earthquake Engineering Research