INTERNATIONAL INSTITUTE OF INFORMATION TECHNOLOGY
HYDERABAD

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Technology, Social Impact

SEISMIC PERFORMANCE OF RC TALL BUILDING WITH COLUMNS RESTING ON TRANSFER STOREY

INTRODUCTION

- Constructions of tall buildings with discontinuous vertical elements, such as columns and structural walls are quite common in India.
- In order to accommodate this vertical discontinuity, vertical elements are typically supported on a transfer girder. This transfer girder has to transfer the vertical and lateral load from upper storey to storey below it. However, such feature creates abrupt change in storey stiffness leading to localised damage near transfer storey, during a major earthquake.

OBJECTIVE

- The Current comparative study is an attempt to understand the increased demand in storey drift for a reinforced concrete moment resisting-structural wall building, with and without a transfer slab.

METHODOLOGY

- Design of buildings for governing load: Either wind or Earthquake
- Performance of design building under few Indian Ground Motions scaled to ***0.24g***
  - Inter-storey drift, base shear etc.

Fig.: Building with transfer storey

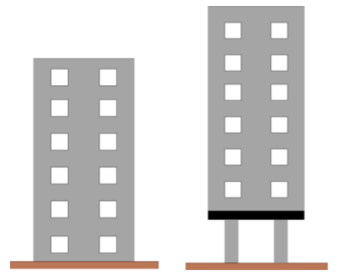
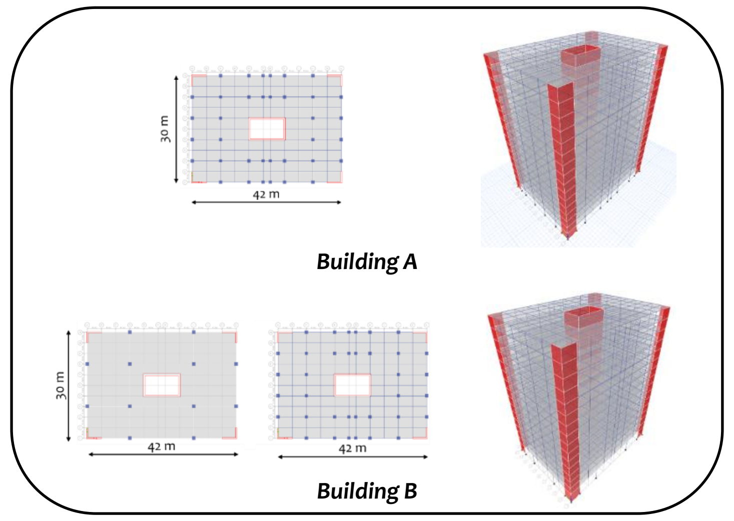


Fig.: Building with and without transfer storey

Table: *Building Structural Configuration Details*

Particular	Building A	Building B
Length (m)	42	42
Breadth (m)	30	30
Height (m)	52.8	54
Typical Floor Height (m)	3.3	3.3
Ground Storey Floor Height (m)	3.3	4.5
Number of Floors	(G+15)	(G+15)
Transfer Slab Thickness	-	1 m



CONCLUSION

1. Linear time history analysis carried for limited number of Indian ground motion for a given case study found that building with transfer slab is performing poor.
2. Further, majority of existing multi-story buildings designed based on previous seismic code will qualify for 'soft storey' as per current code. Hence, from current study it can be extrapolated that such building will also have poor seismic performance. Therefore there is an urgent need of detailed seismic assessment followed by retrofitting of such tall buildings before next big earthquake hits.

RESULTS

Table: *Material and Loading details*

Basic material	Load property	Seismic Load Details
• Slab and Beams: M45 • Columns and Structural Walls: M60 • Steel: HYSD415	• Imposed Load(Typical floor): 4 kN/m² • Imposed Load(Roof): 1.5 kN/m² • Floor Finish:1 kN/m² • Cladding: 2kN/m² • Parapet wall: 4.6 kN/m	• Seismic Zone: IV (0.24g) • Importance factor: 1.2 • Response Reduction factor: 4 • Soil Type: Medium (Type II)

Table: *Ground Motion Characteristics*

Sr No.	Ground Motion Name	Significant Ground Motion Duration (sec)	Peak Ground Acceleration (g)	Period Content (sec)
1.	Bhuj	16.97	0.24	0.75-1.20
2.	Chamoli	14.08	0.24	0.53-0.89
3.	Uttarkashi	07.78	0.24	0.48-0.60

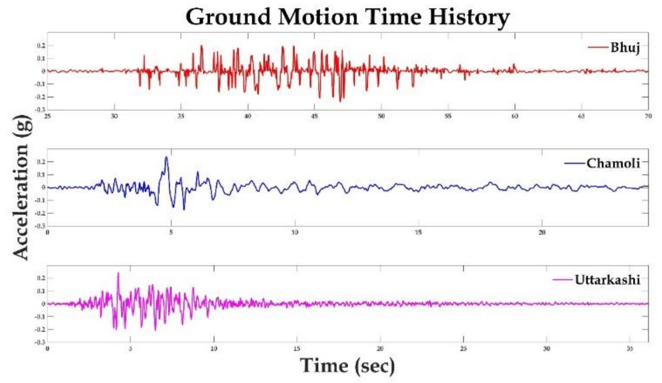


Fig.: Ground motion time histories used for Linear Time History Analysis (LTHA)

Table: *Base shear for all buildings due to LTHA*

Building	Base Shear (kN)					
	Bhuj X	Chamoli X	Uttarkashi X	Bhuj Y	Chamoli Y	Uttarkashi Y
A	116531	82593	84795	97578	66156	69147
B	108243	79661	76683	103641	63300	70150

Table: *Fundamental Natural Periods of buildings*

Building	T_x (sec)			T_y (sec)			T_θ (sec)		
	Mode 1	Mode 2	Mode 3	Mode 1	Mode 2	Mode 3	Mode 1	Mode 2	Mode 3
A	0.891	0.224	0.144	1.056	0.282	0.134	0.817	0.245	0.128
B	0.930	0.226	0.198	1.155	0.289	0.216	0.842	0.247	0.158

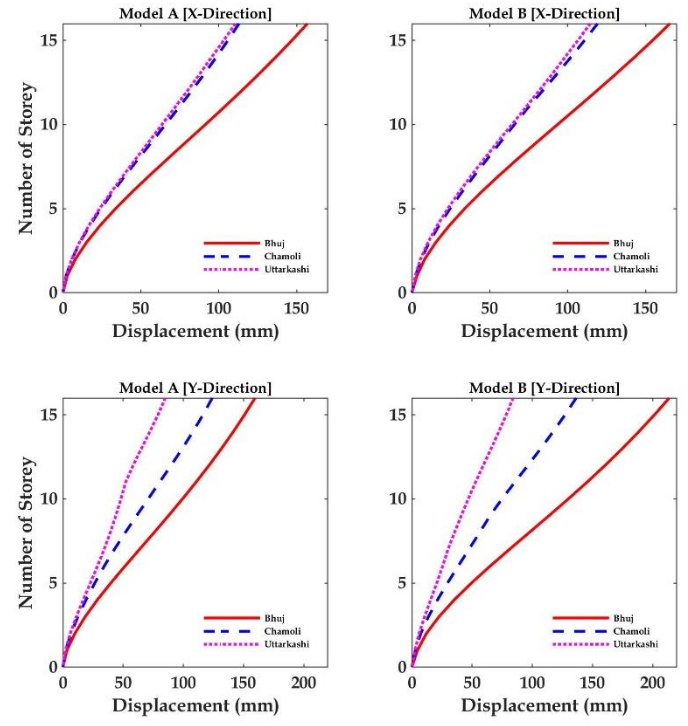


Fig.: Inter-storey drift for LTHA

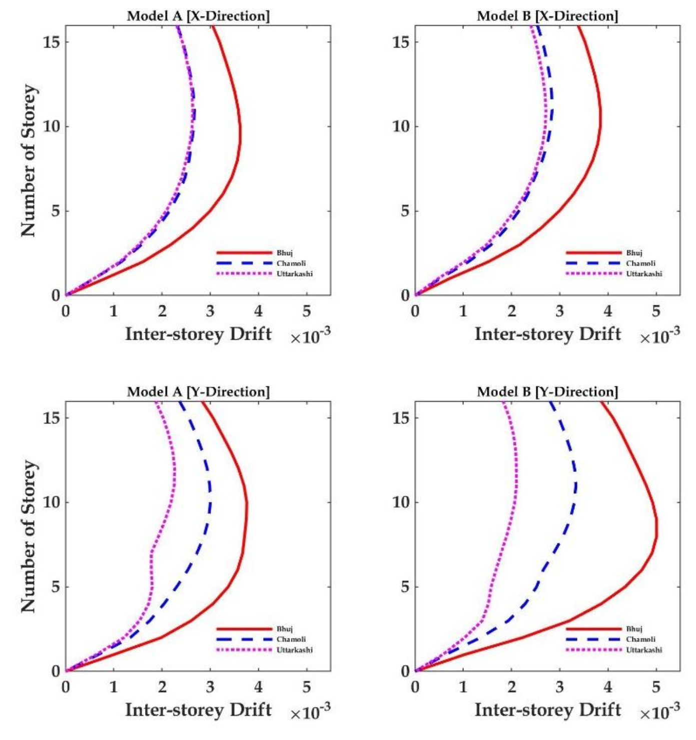


Fig.: Displacement profile for LTHA

Table: *Maximum Displacement for both buildings*

Building	Displacement (mm)					
	Bhuj		Chamoli		Uttarkashi	
	X	Y	X	Y	X	Y
A	157	160	113	124	111	85
B	166	214	119	136	114	84

Table: *Maximum Inter-storey drift for LTHA*

Building	Inter-storey drift					
	Bhuj		Chamoli		Uttarkashi	
	X	Y	X	Y	X	Y
A	0.0036	0.0038	0.0027	0.0030	0.0026	0.0023
B	0.0038	0.0050	0.0028	0.0033	0.0027	0.0021

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