

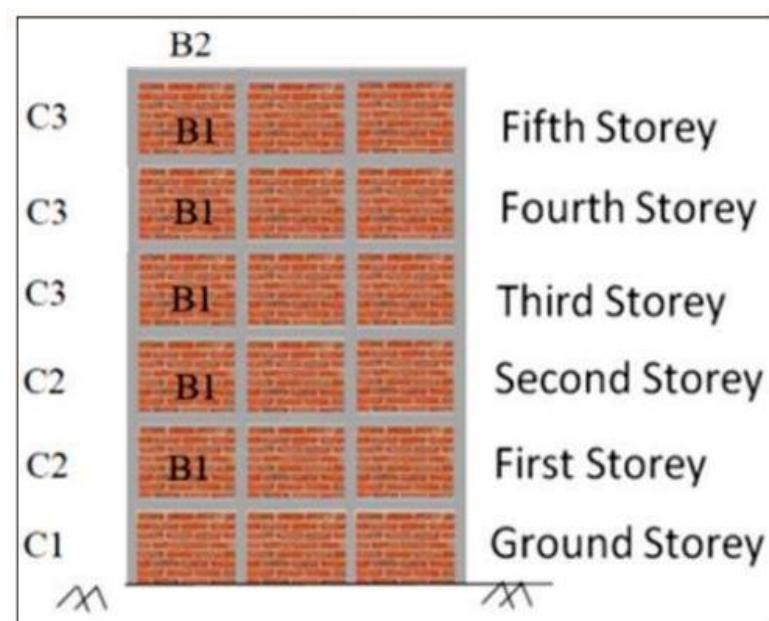


Comparison of Building Performance with Partial and Full Retrofitting Schemes

ABSTRACT

- Buildings damaged in past earthquakes have exemplified the poor performance of RC-MRF buildings due to inadequate design and wrong construction practices. The only way to avoid damage to existing buildings is to retrofit them
- There is a large stock of RC MRF buildings constructed as per old Indian standards. With the latest revisions in codal provisions, these buildings are considered to be inadequately designed.
- Retrofitting is not a common practice among the general public in India. No insurance policies, no government regulations and no trust in the retrofitting process are some of the reasons for it.
- Therefore, a large stock of existing buildings needs to be retrofitted.
- How much to retrofit is the question which needs to be answered to ease out the decision-making process involved in retrofitting.

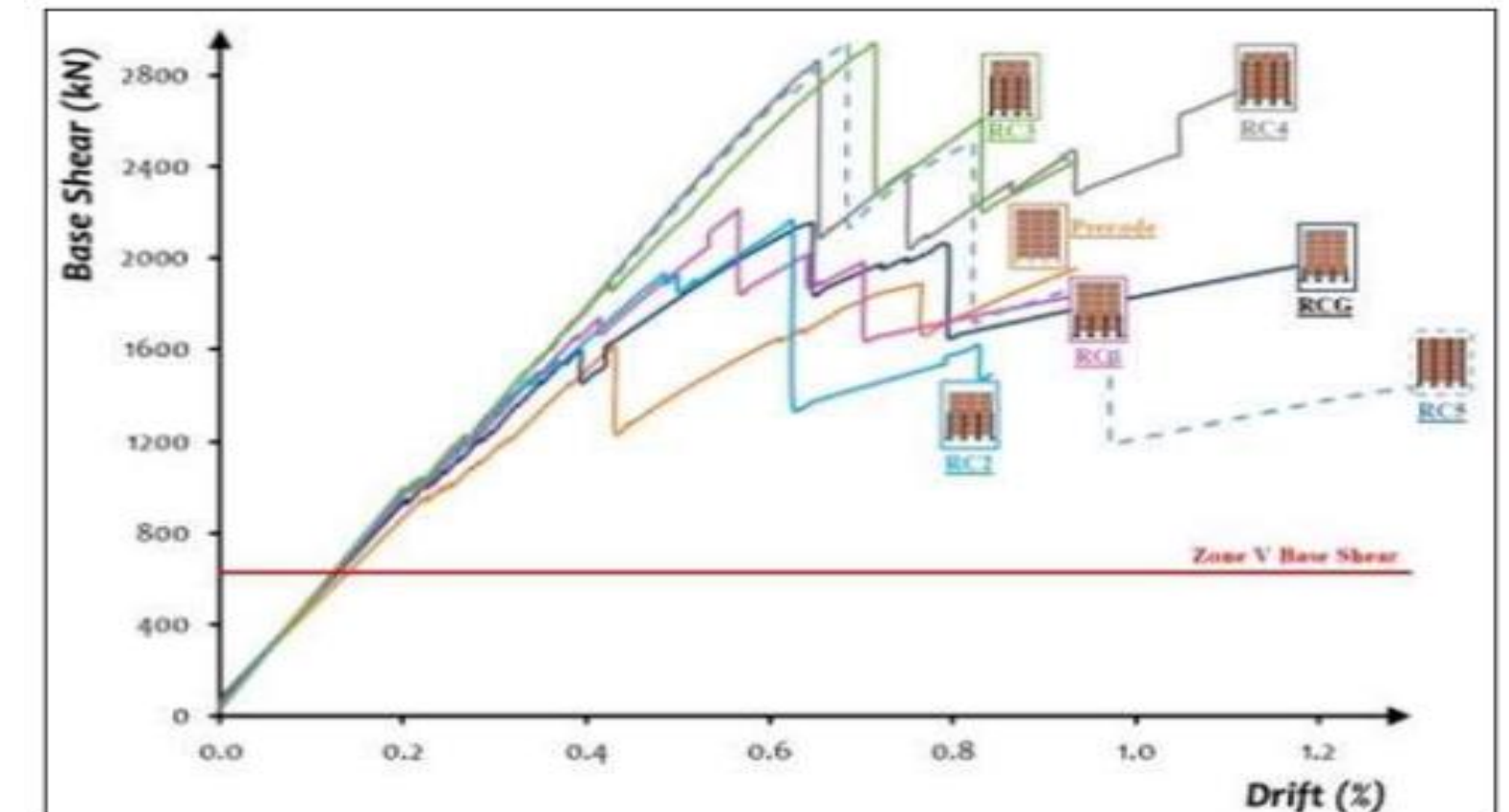
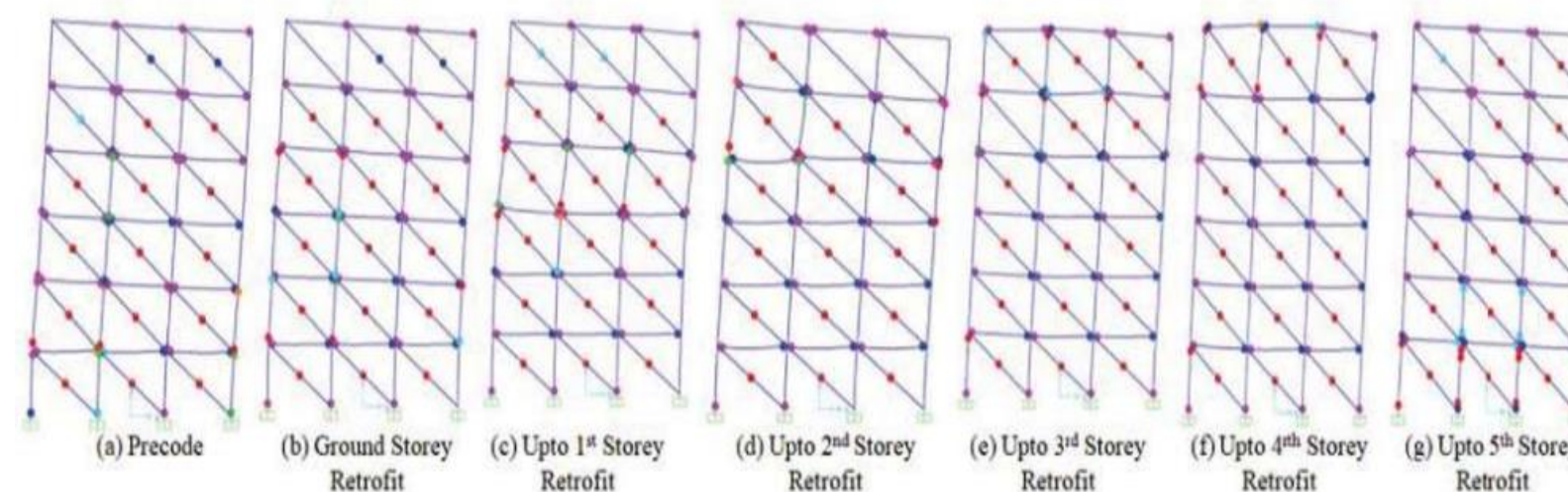
CASE STUDY



Section Name	Precode Size (LXB) (in mm)	Retrofitted size (LXB) (in mm)
C1	300×300	500×500
C2	250×250	450×450
C3	250×250	450×450
B1	230×250	430×450
B2	230×250	430×450

METHODOLOGY

- Before Analysis
 - Numerical modelling of the building in 2D is done in SAP2000
 - Sections are modelled as frame elements with ductile flexural and brittle shear hinges
 - Infill is modelled as a single strut element with brittle axial hinges
 - Shear and axial hinges are user defined whereas flexural hinges are defined program defined hinges
- Pushover Analysis (POA) is performed to understand damage propagation from the hinge mechanism of the building and to know the maximum capacity of the structure.
- After Analysis
 - The capacity is compared with the seismic demand of that area to decide whether retrofitting is required or not.
 - Initially, ground storey columns are retrofitted and POA is performed to study the damage distribution and obtain the updated capacity curve. It is observed that damage shifted to the first storey.
 - Further, the first storey columns are retrofitted and POA is performed again. From the hinge mechanism, it is observed that the damage propagated to the second storey.
 - This process is done until the updated capacity of the building exceeds the seismic demand of the building.



OBSERVATIONS

- Observations from the study are mentioned below.
 1. No capacity increment is observed in the building with partial retrofitting i.e., with retrofitting of one or two storey columns. Though initial strength increased with ground storey retrofitting, however, due to redistribution of forces after the drop in the capacity curve, strength reduced.
 2. Significant capacity increment is observed after retrofitting of the third storey. On further retrofitting to fourth and fifth storey, capacity remained the same. Therefore, the decision of retrofitting shall include a comparison of capacity curves for all RC schemes to decide the storey up to which retrofitting shall be carried.
 3. Better results may be observed if beam strengthening is also done along with column strengthening.