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ANALYSIS AND DESIGN OF COLLEGE BUILDING FOR SEISMIC FORCE AND RECOMMENDATION SUITABLE RETROFITTING

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Abstract: ***Identifying the architectural problems in a building during earthquake. However due to the desire to create an aesthetic and functionally efficient structure, architects suggest wonderful and imaginative structures. But in practice more the irregularities, more difficult for the structure to resist earthquakes or lateral forces.***

- ***Taking Sahyadri College of Engineering and Management building as a case study, we try to bring out the major differences to vertical load carrying building to earthquake resistant buildings.***
- ***For the existing college building which comes under earthquake zone III and which are not designed as per the earthquake codes are then retrofitted with suitable methods.***

To study the architectural problems in different geometrical structures and the solutions by STAAD-Pro using analysis results like ultimate load, ultimate moment, etc.

- ***To introduce the principle of good earthquake resistant building practices.***
- ***To study the effect of shape of the structure on the overall seismic performance.***
- ***To study the portion of structure to be retrofitted if required.***
- ***The objective of design is the achievement of an acceptable probability that structures being designed will perform satisfactorily during their intended life even if earthquake occurs.***

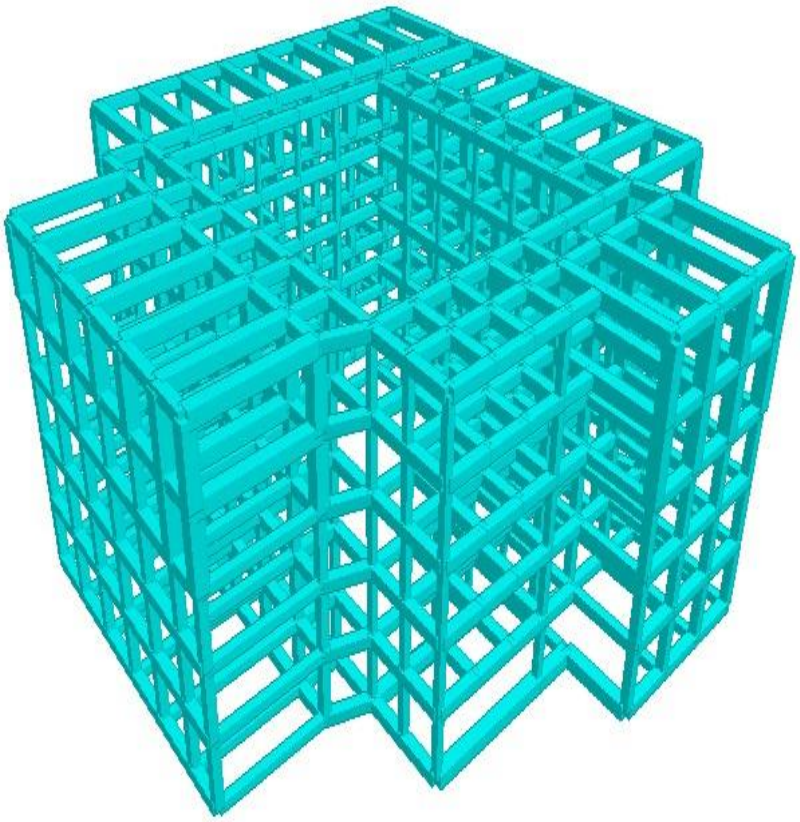
Keywords: ***Damping, Coefficient of Damping, seismic loads, seismicity***

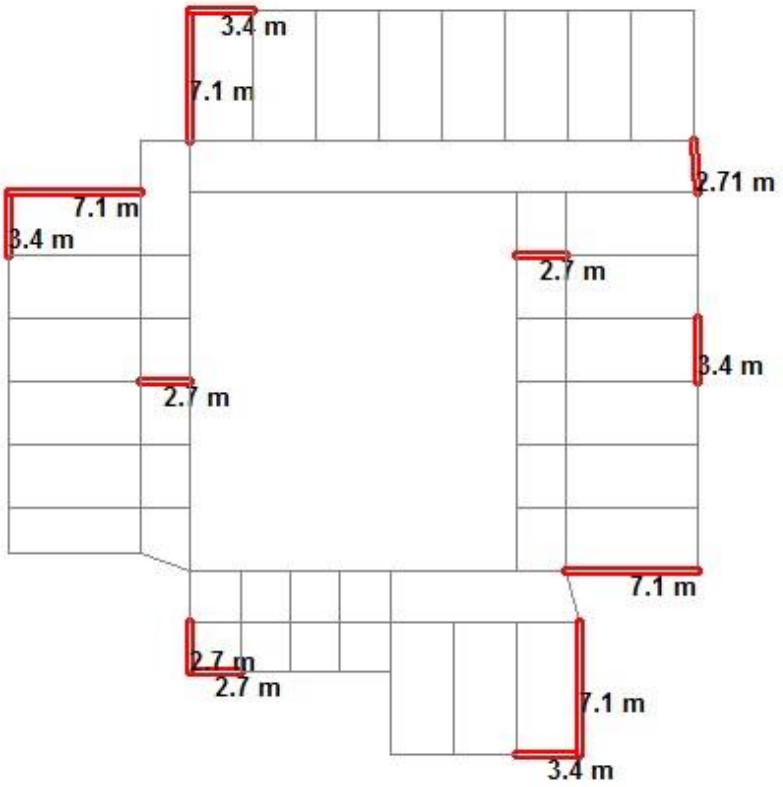
Methodology:

Building is analyzed using a static approach of earthquake analysis. For this purpose STAAD-Pro is used. In this method the earthquake force acts at the nodes or joints of the building. Force at each node is calculated and applied. The design methods used in STAAD- Pro analysis are Limit State Design conforming to Indian Standard Codes of Practice. For earthquake design seismic codes IS:1893-2002 are used and ductile detailing code IS:13920-1993 is used. Complicated and high rise structures need vey time taking and cumbersome calculations using conventional manual methods. STAAD-Pro provides us a fast, efficient, easy to use and accurate platform for analyze and designing structures.

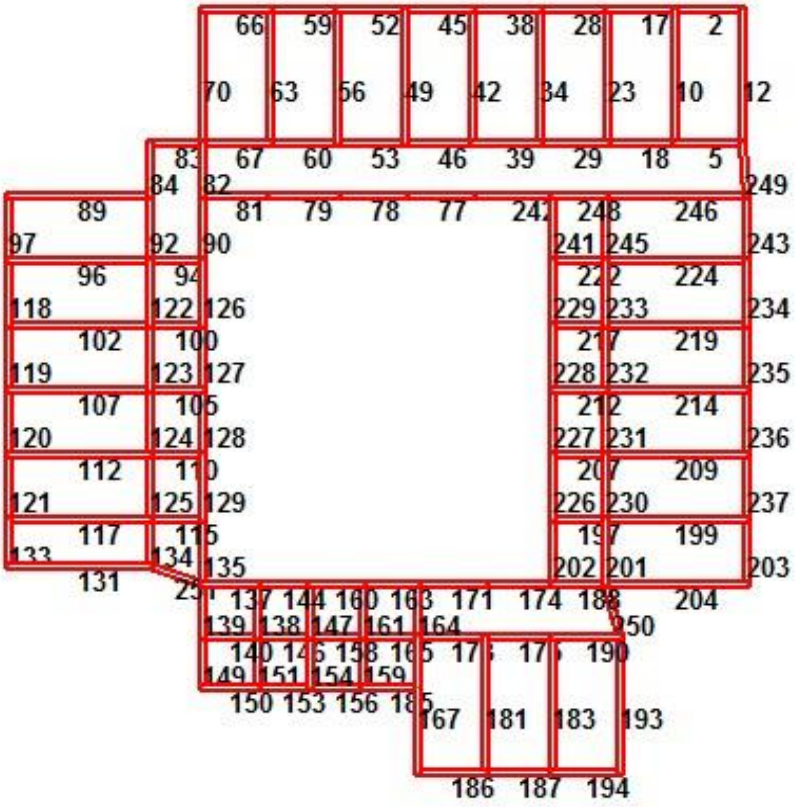
Central public works department and Indian building congress (2007) has brought up a handbook on seismic retrofit of building which gives the behaviour of building, the soil on which it rests on and the earthquake force. It gives method to retrofit all kind of building which include brick, masonry and RC structure.

MODEL OF SCEM COLLEGE BUILDING





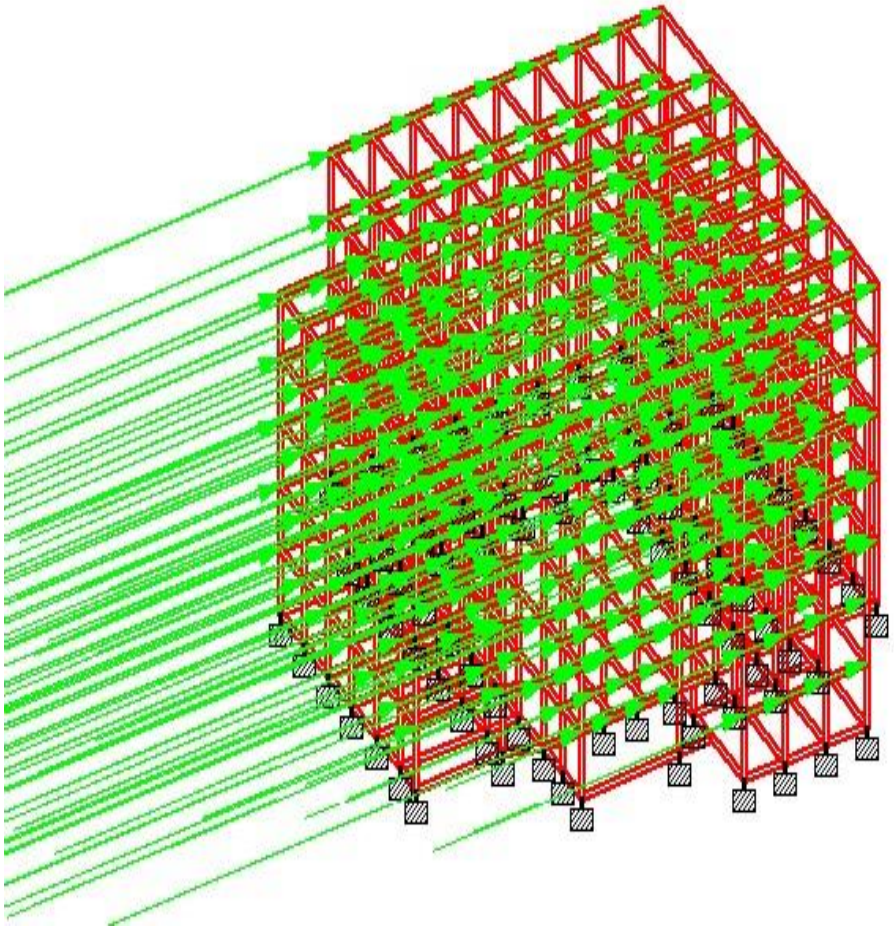
Structural Plan



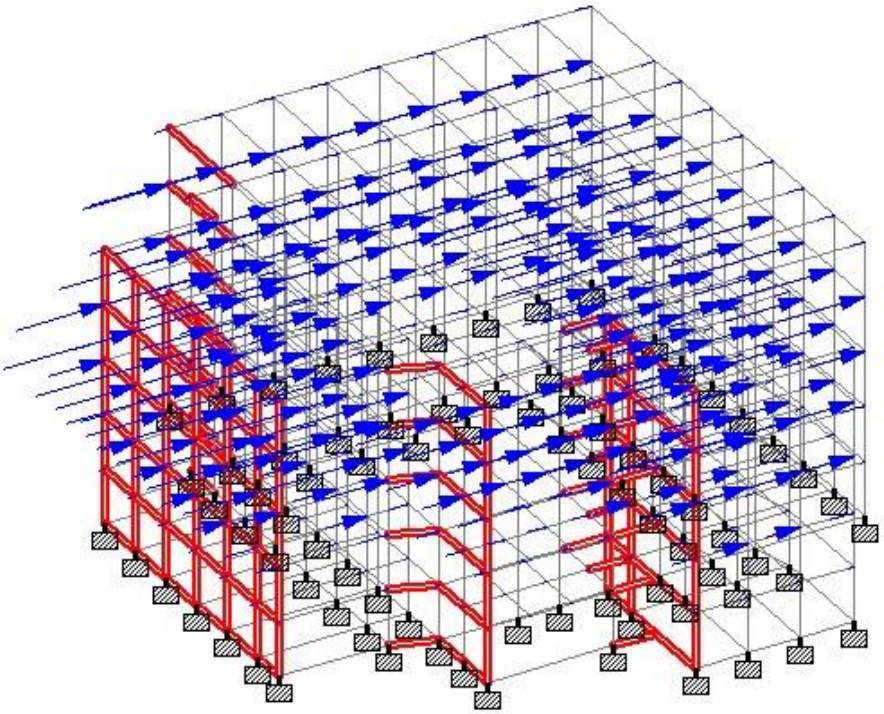
Beam Details

RESULT AND DISCUSSION

FOR EARTHQUAKE LOAD				FOR GRAVITY LOAD ONLY			
BEAM NO	**Mz(KNm)**	**My(KNm)**	**AREA OF STEEL PROVIDED (Sq.mm)**	**BEAM NO**	**Mz(KNm)**	**My(KNm)**	**AREA OF STEEL PROVIDED (Sq.mm)**
672	112	94	4245	672	34	139	4300
850	196	0	4500	850	152	0	1972
797	0	0	1005	797	0	0	565
560	15	175	2230	560	78	9	2000
536	36	284	3692	536	127	2	2000
1220	189	4.5	3800	1220	12	62	1043
1264	238	0	4368	1264	0	0	720
1253	15	331	3435	1253	54	3.5	1122

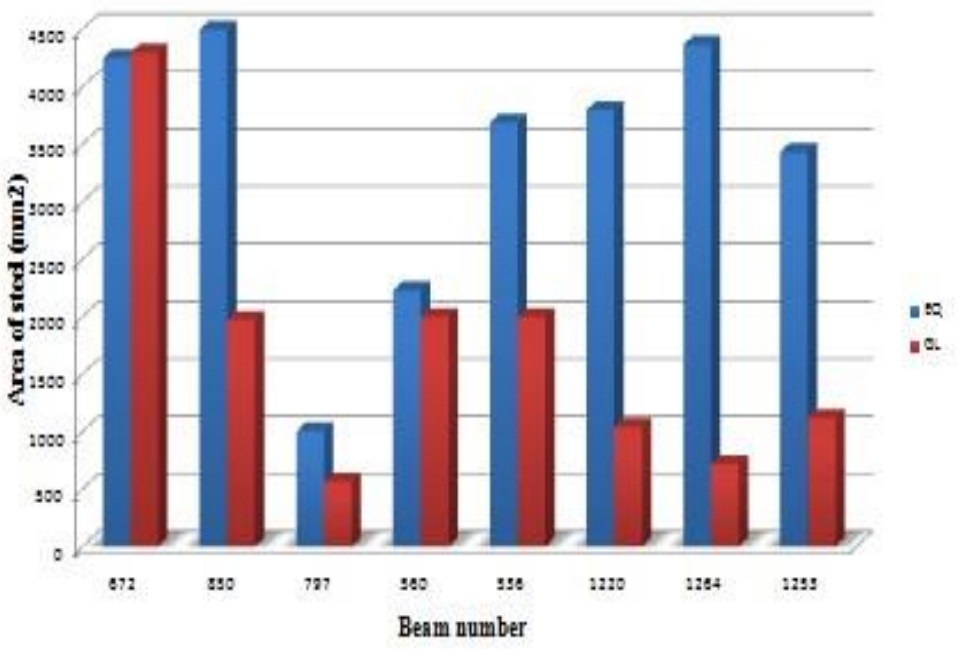


Earthquake force along X- direction (1)



Earthquake load along X- direction (2)

COMPARISON OF REINFORCEMENT DETAILS



Design Result

Following conclusions are derived –

- From the graph above we can see that there is 60% increases in reinforcement in ground floor and 30% increase in the reinforcement in other floors when we consider earthquake design than the gravity design.
- The torsional effect shown in the figure clearly shows the torsion effect is maximum at the re-entrant corner. The four corners are severely affected when subjected to high earthquake force.
- The corner columns with maximum torsion can be strengthened by jacketing- a method of retrofitting, to safeguard the structure.
- In earthquake regions square or circular columns are more efficient than rectangular columns.

After the earthquake in BHUJ, Gujarat, in 2001, there has been a concerted effort to address the seismic vulnerability of existing buildings in India. In the past, building codes where less stringent compare to today's standards. All the existing buildings are not earthquake resistant. Retrofitting is required in all the existing important structures in India. For example, the administrative office or DC offices which contain important information should be protected from any damage from earthquakes. Also collages and hospitals should be earthquake resistant as this provides shelter and treats large people when such natural calamity occurs.

India has ancient monuments which were built without considering engineering aspects. But those structures are very strong that they have very long life span in normal conditions.

These structures have high strength against vertical loads but not in lateral direction. During earthquakes some structure fails due to excess internal loads. These structures cannot be rebuilt considering earthquake loads, Hence we need to use retrofitting techniques to safeguard them.

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