Analysis and Design of 9 Storied RC Building using Various Retrofitting Techniques in SAP-2000.V20

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Abstract - *Now a days, there are so many old buildings which are in the weaken condition as compared to the time they have been built. There are so many reasons for the weakened condition of the building such as earthquake, deterioration of the material used for construction of building, etc. This condition can be improved by retrofitting which proves to be economical rather than replacement of the building. In this paper we are going to analyze and design old existing building in SAP2000.V20 to improve its strength, stability also to increase the life span of the building and to give uniformity to the structure. To achieve above mentioned goals we are going to apply some of the retrofitting techniques such as shear wall, bracings, and column jacketing.*

Key Words: Deterioration, Retrofitting, Shear wall, Bracings, Column jacketing, SAP2000.V20.

1. INTRODUCTION

This paper will give a brief study about earthquake resistant design and the methodology about the seismic evolution and rehabilitation of existing structure . It also provides certain aspects of computer software modeling against the seismic loads and shows the necessity of seismic upgrading in a concrete moment frame building .Seismic evaluation determine which are the vulnerable & weak components & deficiency of building during an expected earthquake . The seismic rehabilitation process aims to improve seismic performance & correct deficiencies by increasing strength , stiffness or deformation capacity and improving connections .Thus the proposed retrofitting implementation can be said successful if it results an increase in strength & ductility capacity of the structure which is greater than the demands imposed by earthquakes .

1.1 Objectives

The main objectives of present study are as below

- To investigate the effects of earthquake forces on the buildings .

- To identify the seismic deficiency of the structure

- To study the effectiveness of retrofitting strategy

- To study the different dynamic properties of structure under seismic waves.

1.2 Scope

The scope of project study is stated below:
- Study is restricted for only existing concrete building.
- Study is restricted for low to moderate storied building.
- Study is restricted for building resting on hard strata.
- Brick masonry infill contribution has been considered

2. Building Modeling

Description of structure

1. The proposed 4-story SMRF RCC building, shown in Fig, is located in zone 4. The code standards used in the design are IS 1893 and IS 456.
2. Foundation soil = Medium
3. Material = M17.5 , Fe 350
4. Plinth = 0.55m , Foundation depth = 0.65m
5. Parapet = 1.5m
6. Slab = 150mm
7. Wall = 300mm (external) , 150mm (internal)
8. Column and beam = 230 x 450mm
9. Live load = 3 KN/m² (floor) , 1.5 KN/m² (roof)
10. Floor finish = 1KN/m²
11. Roof Treatment = 1.5 KN/m²
12. Density of wall = 20 KN/m³
13. Importance factor = 1

2.1 Application of shear wall

In existing building we have considered concrete grade of M17.5 by using knowledge factor. Now to improve the existing structure we are going to use shear wall retrofitting technique having grade of concrete material M20. RSP X, RSP Y, Modal, EQ X, EQ Y, Wall 300,Wall 150, Parapet, Floor Finish, Water proofing, Gravity, Live floor, Live roof these load cases are set to run. Fig.1 shows the shear wall properties.
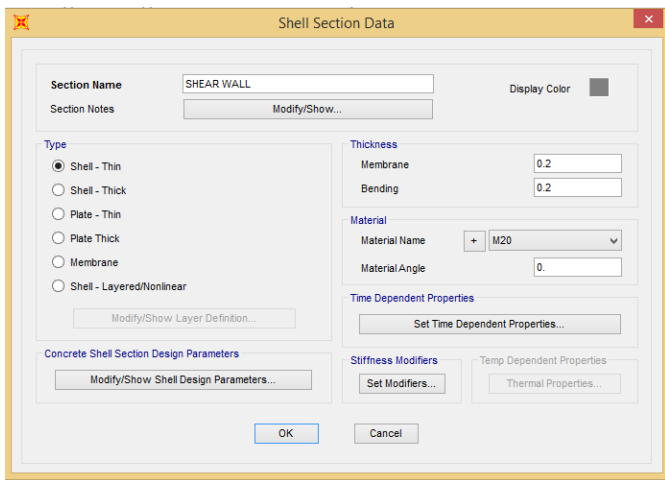
Fig.1 Shell selection data form

After giving required input to the software run the analysis, then start design and take check of the structure and identify all failure. Fig.2 shows the Result of concrete failure.
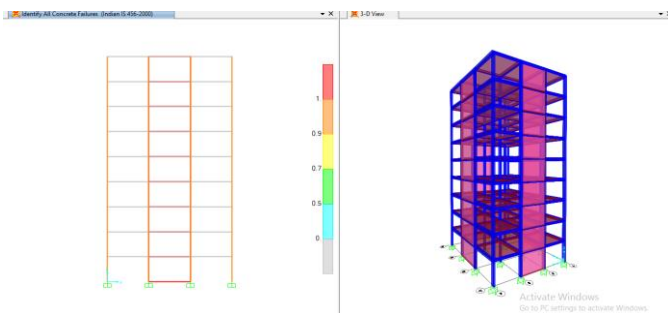

Fig.2 Result of application of shear wall

2.2 Application of bracing

We have to use the file Chinese.GB.pro from the I-wide flange section having YB-WH2000x850x20x55 section. Take the steel grade as HYSD550. Cross bracing type is used for existing building. The results of all the input given to the software is shown in Fig.3
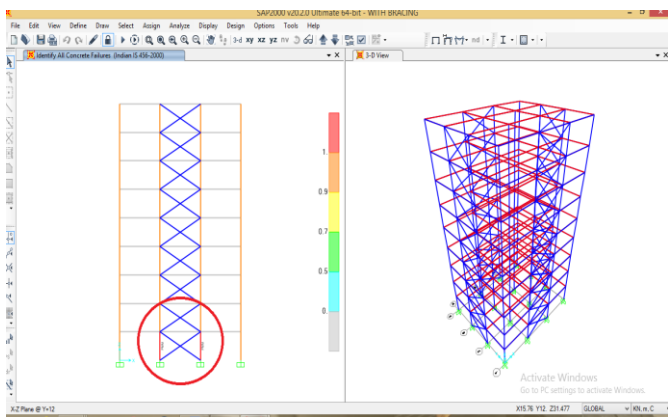

Fig.3 Result of application of bracing

2.3 Application of column jacketing

The deficiencies which are found due to above applied retrofitting techniques are improved by using jacketing technique on deficient structural member.

Design of reinforced concrete column jacket using IS-15988:(2013).

- Existing column details
1. Cross-section = 230x450 with cover 40 mm
2. Grade of concrete = M17.5
3. Grade of steel, Fy = Fe350
4. Gravity load, Pu = 995.34 KN
5. Reinforcement = 8-16Ø

- New column details
1. Cross-section = 430x 650 with cover 40 mm
2. Grade of concrete = M25
3. Grade of steel, Fy = Fe550
4. Gravity load, Pu = 995.34 KN
5. Reinforcement = 14-16Ø

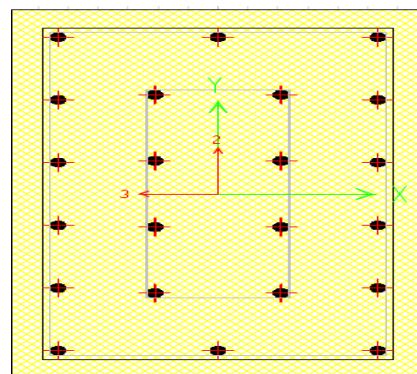Application of column jacketing to the existing column is shown in the Fig.4.

Fig.4 Existing column with jacketing

From the moment curvature curve of the both the sections (i.e. existing column and column with jacketing) the results are compared in the excel sheet.
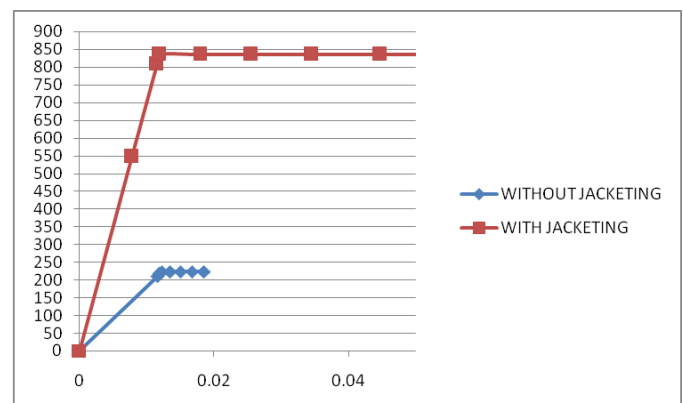

Chart -1: Comparative result in the form of graph

3. CONCLUSION

After studying the above retrofitting techniques such as shear wall, bracing, column jacketing we found that shear wall retrofitting technique is most convenient retrofitting technique for the existing 9 storied RC building. Because of shear wall the failure of the column and beam is negligible for the existing building and the structure has become more stiffened rather than bracing and column jacketing retrofitting techniques. By using software SAP2000.V20 we concluded that the seismic activity can be controlled by application of shear wall.

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