A STUDY ON STEEL BRACING AND DAMPERS IN RC FRAMED BUILDING SUBJECTED TO LATERAL LOADS

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Abstract : In General, Structures are built to facilitate the performance of various activities. The Vibration generated from the ground due to cause of earthquake which makes the structures to collapse. The seismic strength and stiffness of framed structure can be efficiently and economically increased by using steel bracing and dampers. In recent years the use of steel bracing and dampers to RC frames has attracted more attention since it is more economical and can be adopted not only for retrofitting purpose but also as viable alternative to the other retrofitting techniques available. The present study include equivalent static method 16 Models in which 8 of RC Framed and 8 of Steel Framed with using finite element analysis software ETABS was used for analysis.

The building were G+30 storey having the height of one storey 3.2m. The soil type is medium soil type in zone II is considered. The parameter are storey max displacements, story drift, story stiffness, base shear and storey shear are studied. From the study it is concluded that steel bracing reduces the forces in the member storey drift and the lateral displacement is greatly reduced by using X-Bracing of the structure when compared to other bracing and damper.

I. INTRODUCTION

Structures are built to facilitate the performance of various activities, and all the structures should be capable of sustaining the loads coming on them during the service life of the structure. Structure should transfer the gravity loads to ground safely and have adequate strength, stiffness and durability. Quality of the structure relies upon the nature of materials utilized for the development and solidness relies upon the geometrical and cross sectional properties of the structure. Earth quake happens when there is an unsettling influence at some profundity subterranean level causing the vibration of ground surface. These vibrations are absolutely questionable and occur every which way. Earth quakes are profoundly eccentric.

Earth quakes are generally a geological hazard or those living in Earth quake prone areas. The vibration generated from the ground due to cause of Earth quake which makes the structure to collapse. Motion of the Earth quake causes ground to vibrate and structure supported on ground is subjected to this vibration.

Along these lines the dynamic stacking on the structure isn't outer stacking, however because of movement of the help. Quake ground movement is a characteristic danger which causes both financial and life misfortunes. A large portion of this misfortunes are because of harm of structure or breakdown of structure. Henceforth it is important to plan the structure to oppose moderate to extreme seismic Earth quake. During a quake structure is exposed to seismic powers.

The motion in the structure are generated by the Earth quake which produces the waves through soil and rock medium. The characteristics of the structure is the basis ground motion. The structure overcome from the ground motion can resist the motion with its own inertia, which results in the interaction between structure and soil.

II. AIM AND SCOPE OF PRESENT STUDY

The study carried out in using the steel Brasings for RC frames is focused on the retrofitting aspect of the bracing. In recent years the use of steel bracing to RC frames has attracted more attention since it is more economical and can be adopted not only for retrofitting purposes but also as viable alternative to the other retrofitting techniques available.

AIM OF THE PRESENT STUDY

1. To carryout seismic analysis on reinforced concrete framed building braced with steel members.
2. To investigate analytically and conceptually the use of steel bracing schemes for seismic retrofitting of reinforced concrete frames and to investigate the result of such use of steel bracing.
3. To study the different types of Brasings and the behavior of reinforced concrete frame braced with steel members during an Earth quake for different load cases and to find out the structural behavior under various load cases and load combinations.
4. The objective of this study is to determine the degree of effectiveness of different bracing arrangements to increase sustainability of the reinforced concrete frame against an Earth quake.
5. The change in force in the structural members of the reinforced concrete frame and other related parameters are studied.
6. To study the behavior of RC structure under both static and dynamic conditions.

III. SEISMIC RESISTANT DESIGN

Earth quake is the sudden movement of the earth**,** it is caused by the sudden release of strain that has thesaurus over a long time. Earth quake is one of the most scary phenomena of nature. For hundreds of millions of years, the forces of plate tectonics have shaped the earth as the huge plates that from the Earth's surface slowly move over, under, & past each other. The plates are locked together, unable to lose the accumulating energy. It results in breaking of plates causing the Earth quake.

In the event that this occurs in a populated territory, causes numerous passings and wounds and broad property harm. Today we are testing the suspicion that quake are wild and breathes life into erratic peril and property. Researcher have started to appraise the area and probability of future harming seismic Earth quakes. Destinations of most prominent perils are being distinguished, and distinct advancement is being made in planning structures that will withstand the impacts of quake.

The investigation of why and where seismic Earth quakes happen goes under geography. The investigation of the attributes of the seismic Earth quake ground movement and its consequences for designed structures are the subjects of quake building. Specifically, the impacts of quake on structure and the plan of structures to withstand Earth quakes with no or least harm is the subject of seismic Earth quake safe basic plan.

IV METHOD OF ANALYSIS

Most of the old reinforced concrete building framed structures which are high, medium to low rise, were not design for resisting the Earth quakes. Those buildings usually were designed by considering gravity loads without considering the effect of Earth quake load. This makes the unsafe during the Earth quake, and may be damaged if Earth quake occurs. Therefore it is necessary to consider the effect of Earth quake while designing the buildings to minimize the effect of major Earth quakes.

In seismic codes different methods are there for the lateral load analysis. The infill dividers present in the structure are ordinarily considered as non auxiliary component. The nearness of infill dividers isn't considered while investigation and structure. Anyway infill dividers are considered as non basic components, they will in general interface with the edge when the structures are subjected to seismic forces. In this study the gravity load and lateral load analysis for the reinforced concrete frame with steel Brasings as per codes for zone II is carried out. The analysis is carried out by Equivalent Static method & Response Spectrum method. Effort is made to study the effect of Earth quake loads on the R.C frame.

V SEISMIC ANALYSIS OF STEEL BRACED REINFORCED CONCRETE FRAME

5.1 INTRODUCTION

The review of the technical documentation reveals that moment resistant frames are the most common types of structures. The moment resisting frames are poor in stiffness. Based on the above discussion the 30 storey framed building chosen for the study.

5.2 ANALYSIS OF R.C FRAMED BUILDING

The plan and elevation of the reinforced concrete moment resisting frame of 30 storey building chosen for the study is shown in Fig 6.1 and 6.2. The 3D models of the building with and without bracing systems considered are shown in fig 6.3 to 6.8 and dampers are in 6.9 to 7. The storey height is kept constant as 3.2m. In seismic weight calculations as per IS 1893:2002, only 25% of the floor live load is considered. The detailed data given for the building is given in Table 6.1

5.3 DETAILED DATA FOR THE RCC BUILDING

Sl no	Description	Parameter
1	Depth of foundation	2m
2	Floor to floor height	3.2 m
3	Grade of concrete	M 30
4	Grade of steel	HYSD-500
5	Column size	0.6mx.8m
7	Beam size	0.3X.45m
9	Slab thickness	150 mm
10	Unit weight of masonry wall	20 kn/m

5.4 DETAILED DATA FOR THE STEEL BUILDING

Sl no	Description	Parameter
1	Depth of foundation	2m
2	Floor to floor height	3.2 m
3	Grade of concrete	M 30
4	Grade of steel	Fe345
5	Hollow Column size	0.6mx.8mx0.05m
7	Main Beam size	ISMB 450
9	Secondary Beam	ISMB 250
10	Deck Slab	95mm

Table 5.4 Detailed data for Building

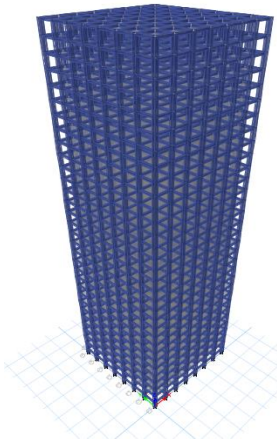

Fig 6.3 Bare frame

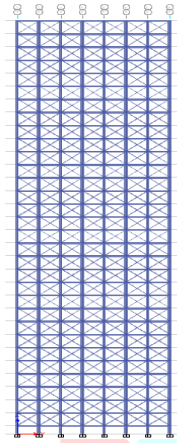

Fig 6.4 X- Brasings

VI EARTHWORK ESTIMATION

All models preliminarily and conservatively designed for load cases according to IS 1893-2002. The results are presented for each of the building modal considered, for different types of Brasings analyzed using ETABS Software. Reinforced concrete building frame without bracing and R.C frame with different types of Brasings are considered for the analysis.

The results for displacements, Baseshear, Storeydrift, BM & Shearforce in Beams and Columns for different building models are presented. Based on the results the most suitable type of bracing is suggested for strengthening of the structure. Hence effect of addition of different types of Brasings systems is studied by performing seismic analysis.

VII RESULTS AND DISCUSSION

7.1 GENERAL

All models preliminarily and conservatively designed for load cases according to IS 1893-2002. The results are presented for each of the building modal considered, for different types of Brasings analyzed using ETABS Software. Reinforced concrete building frame without bracing and R.C frame with different types of Brasings are considered for the analysis. The results for displacements, Baseshear, Storeydrift, BM & Shearforce in Beams and Columns for different building models are presented. Based on the results the most suitable type of bracing is suggested for strengthening of the structure. Hence effect of addition of different types of Brasings systems is studied by performing seismic analysis.

7.2 ANALYSIS

The results of analysis using E-TABS are presented in the tables below. The analysis is carried out in different seismic zones with different Brasings systems were provided to the building frame. The results of Baseshear, max Displacement, Storeydrift, max Story Shear & Story stiffness are presented in the tables 7.1

Table 7.1 BASESHEAR EQX (KN)

Structure type	in X-dir
Bare frame	5527.48
X-bracing	6549.616
Eccentrically forward	5636.356
Eccentrically backward	5636.356
V-bracing	5883.448
Inverted-V	5920.182
FVD 250	12525.14
FVD 500	14098.35

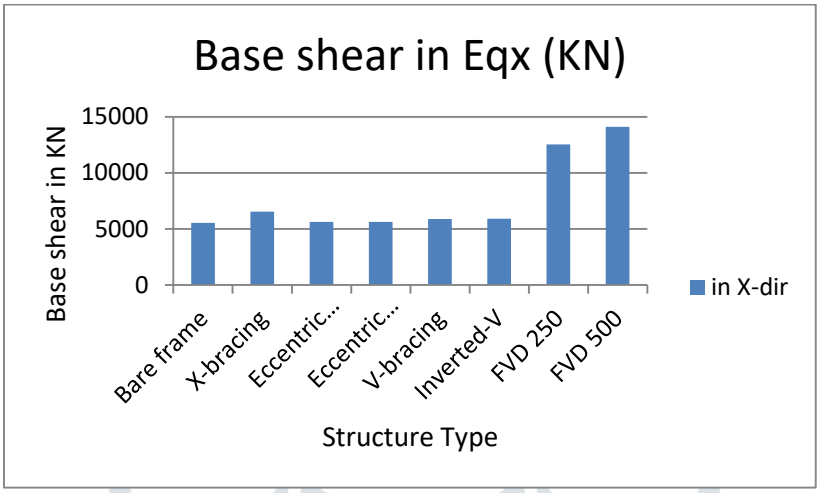

Fig 7.1 BASESHEAR EQX (KN)

VIII CONCLUSION AND SCOPE FOR FURTHER STUDIES

8.1 CONCLUSION

In the present work, behavior of braced RC frame and dampers has been studied by performing analytical investigations. A RC building frame has been analyzed bare frame model and by providing different bracing systems. The following are the conclusions of the study:-

1. The concept of using steel bracing and dampers is advantageous which can be used to resist the seismic forces.
2. Bracing reduces the forces in the members of the frame.
3. Steel Brasings can be used as a retrofitting to the existing building.
4. By using steel Brasings as a force resisting member the safety against collapse of the structure has been increased.
5. Bracing reduces Storeydrift more efficiently as compared to bare frame.
6. When we comparing bracing and damper, more quantity of lateral displacement can be reduces using dampers.
7. The X-Bracing system has generally influences the Baseshear of the structure and reduces it.
8. The steel Brasings for RC frame is the main lateral load resisting system for RC structure.
9. Lateral displacement is greatly reduced by using X-bracing of the structure when compared to other bracing and damper.
10. Also dampers requires regular maintenance for their effective behaviour.

8.2 SCOPE FOR FUTURE STUDY

- Seismic analysis of a asymmetric building frame can be studied by providing steel Brasings.
- In the present study, Equivalent Static Method & Response Spectrum Method has been used for the analysis. Time history analysis and Push Over analysis can also be performed.
- The building frame can be studied by considering different soil conditions.
- The present study has been done by considering plain ground, further study may be undertaken by considering the building to be resting on Sloping ground.
- In this study foundation is considered as fixed, further studies can be done by considering soil structure interaction.

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