SEISMIC PERFORMANCE EVALUATION OF RC BUILDING CONNECTED WITH DIFFERENT TYPES OF BRACINGS

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ABSTRACT *Earthquake-resistant structures are structures designed to protect buildings from earthquakes. While no structure can be entirely immune to damage from earthquakes, the goal of earthquake-resistant construction is to erect structures that fare better during seismic activity than their conventional counterparts. According to building codes, earthquake-resistant structures are intended to withstand the largest earthquake of a certain probability that is likely to occur at their location. This means the loss of life should be minimized by preventing collapse of the buildings for rare earthquakes while the loss of the functionality should be limited for more frequent ones. Now a day's steel bracings technique and shear wall systems are generally using for designing of earth quake resistant structure due to simple construction methods, easy to install and they are reduces the deflection and shear in past studies the earth quack resistant structure is designed by using steel bracings or shear wall systems in present study a comparison made between these two systems along with general building in high seismic zone.*

In the present study a G+8 story is modeled by using ETABS software and analyzed using Response spectrum analysis and the comparison is made between the general buildings, steel bracings buildings to design the earth quake resistant structures. The results like story drift, story shear, story moment, building torsion, time period, and model stiffness were compared.

Key words: *Earthquake, story drift, story shear, story moment, building torsion, time period, model stiffness.*

1. Introduction

Earthquakes are one of nature's most prominent risks to life on this planet and have decimated incalculable urban areas and towns on for all intents and purposes each landmass. They are one of man's most dreaded regular marvels because of real seismic tremors delivering relatively immediate pulverization of structures and different structures. Furthermore, the harm caused by Earthquakes is on the whole connected with synthetic structures. As in the instances of avalanches, seismic tremors likewise cause passing by the harm they instigate in structures, for example, structures, dams, spans and different works of man. Sadly huge numbers of Earthquakes give almost no or no notice before happening and this is one reason why Earthquake building is complex.

Nowadays the townhouse building is basic work of the social advance of the province. Everyday new procedures are being produced for the advancement of living arrangements financially, rapidly and satisfying the prerequisites of the gathering specialists and creators do the crease work, arranging and design, and so on, of the developments. Prepared representatives are trustworthy for doing the illustration works of working with respect to the way of architects and fashioners. The prepared laborer should secure his activity and could likewise be capable

to agree to the guideline of the architect and might likewise pull in the coveted illustration of the building, site designs and format designs and numerous others, with respect to the necessities.

Bracing system

A braced frame is a structural system commonly used in structures subject to lateral loads such as wind and seismic pressure. The members in a braced frame are generally made of structural steel, which can work effectively both in tension and compression.

The beams and columns that form the frame carry vertical loads, and the bracing system carries the lateral loads. The positioning of braces, however, can be problematic as they can interfere with the design of the façade and the position of openings. Buildings adopting high-tech or post-modernist styles have responded to this by expressing bracing as an internal or external design feature.

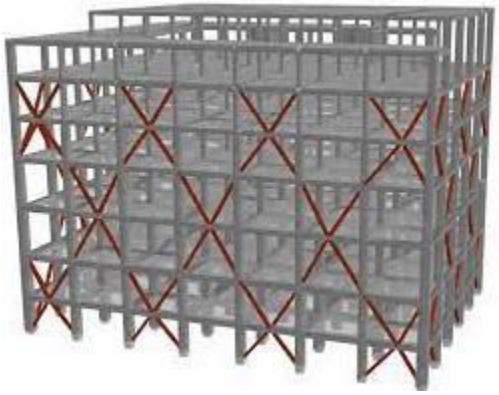


Fig 1: Bracing system

Objective of the study

The following are the main objectives of the project

1. To study the seismic behavior of building by using IS 1893:2002
2. To design the earth quake resistant structure by using steel bracings in zone V.
3. To study the multi story building of G+8 by using
4. To compare the results of story drift, shear force, bending moment, building torsion of buildings for earth quake resistant buildings.
5. To study the multi story buildings in ETABS

2. Literature survey

Nitin Bhojkar, Mahesh Bagade,et al.,(2015) In this paper, the seismic analysis of reinforced concrete (RC) buildings with different types of bracing is studied. A G+9 building is analyzed for seismic zone III as per IS 1893: 2002 using STAAD Pro software. From this paper it was concluded that Steel bracings used as alternative techniques. The lateral displacement of the building is reduced up to 65% by using X type of bracing system.

Sarang H. Kshirsagar, Abhijeet A. Galatage,et al.,(2020) In this Study the seismic analysis of reinforced concrete buildings with different type of bracing (Diagonal, V type, inverted V type, K type, X bracing) is studied. The bracing is provided for outer peripheral columns. A thirteen storey (G+12) building is situated at seismic zone IV. From this study it was concluded that the lateral displacement of building is reduce by the use of diagonal, V type, inverted V type, combined V type, K type, X type of bracing system respectively and X type of bracing reduced maximum displacement.

Dasare Shivani Balaji, Prof. Mrs. KariappaM.S.,et al.,(2022)

In this research, to satisfy the need for more residential and commercial land, we can go for vertical construction, which involves constructing a multistory structure. From this research it was concluded that, The X and V

bracing system reduces the building's lateral movement

3. Methodology

Response spectrum method

The representation of maximum response of idealized single degree freedom system having certain period and damping, during earthquake ground motions. This analysis is carried out according to the code IS 1893-2002 (part1). Here type of soil, seismic zone factor should be entered from IS 1893-2002 (part1). The standard response spectra for type of soil considered is applied to building for the analysis in ETABS 2013 software. Following diagram shows the standard response spectrum for medium soil type and that can be given in the form of time period versus spectral acceleration coefficient (Sa/g).

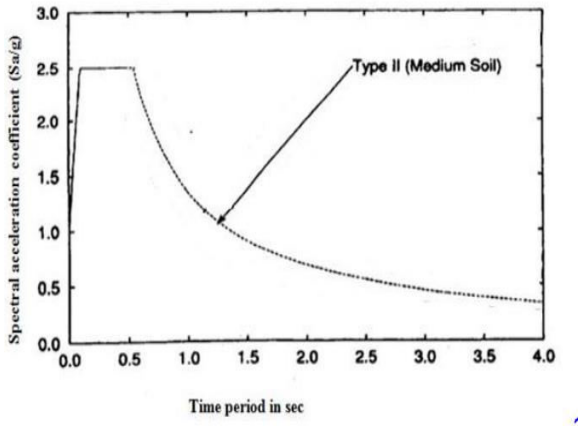


Fig 2: Response spectrum for medium soil type for 5% damping

Types of bracings used in the building

The following are the models used in the current study

1. Building without bracings
2. X Type bracing
3. V Type bracings
4. Inverted V bracings

Types of loads acting on the building

1. Dead load
2. Live load
3. Floor load
4. Earth quack load
5. Wind load

4. Design considerations and modeling of building

Problem statement

In the present study, analysis of G+8 stories building in Zone V seismic zone is carried out in ETABS. Basic parameters considered for the analysis are

1. Grade of concrete : M30
2. Grade of Reinforcing steel : HYSD Fe500
3. Dimensions of beam : 230mmX500mm
4. Dimensions of column : 500mmX500mm
5. Thickness of slab : 150mm
6. Bracings size : ISA 110X110X10
7. Height of bottom story : 3.3m
8. Height of Remaining story : 3m
9. Live load : 3 KN/m2
10. Dead load : 2 KN/m2
11. Density of concrete : 25 KN/m3
12. Seismic Zone : Zone 5
13. Site type : II
14. Importance factor : 1
15. Response reduction factor : 5
16. Damping Ratio : 5%
17. Structure class : C
18. Basic wind speed : 44m/s
19. Risk coefficient (K1) : 1.08
20. Terrain size coefficient (K2) : 1.14

21. Topography factor (K3) : 1.36
22. Wind design code : IS 875: 1987 (Part 3)
23. RCC design code : IS 456:2000
24. Steel design code : IS 800: 2007
25. Earth quake design code : IS 1893 : 2002 (Part 1)

Building model in ETABS Software

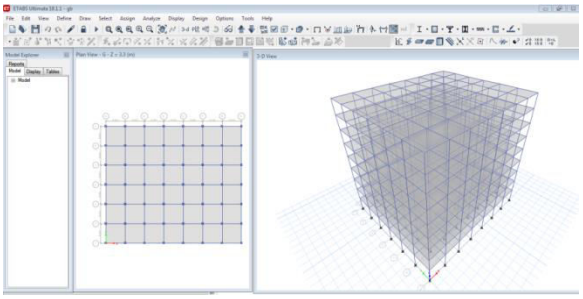


Fig 3: General building without bracings

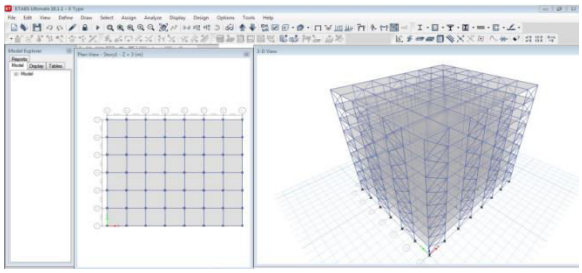


Fig 4: Building with X type bracings

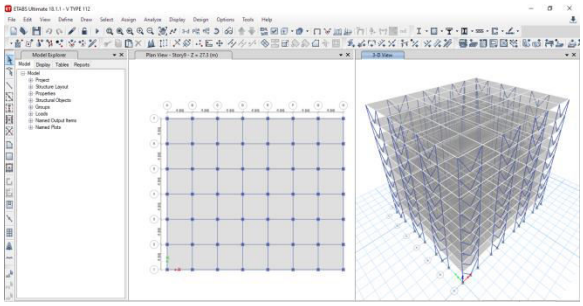


Fig 5: Building with V type bracings

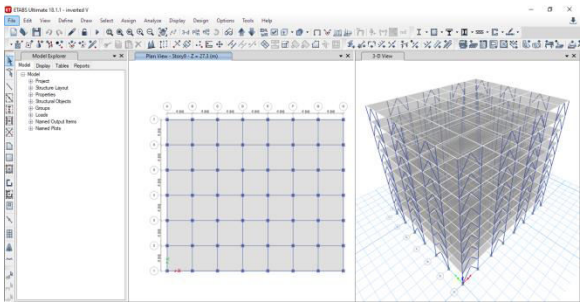
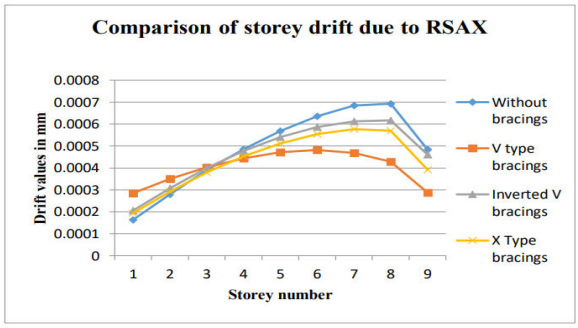


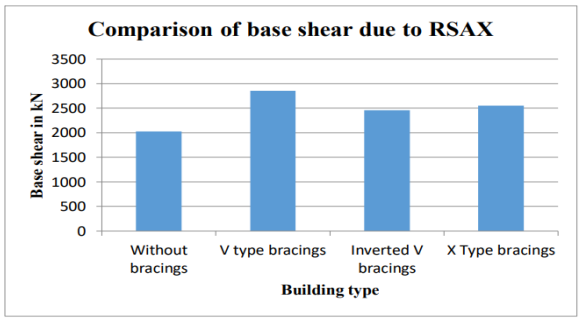
Fig 6: Building with inverted V type bracings

5. Results and analysis

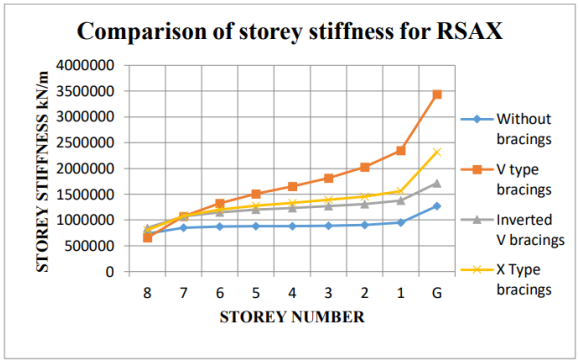
Storey drift



Graph 1: Comparison of storey drifts values

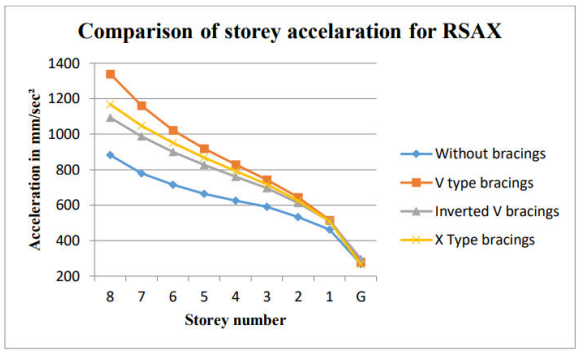


Graph 2: Comparison of base shear



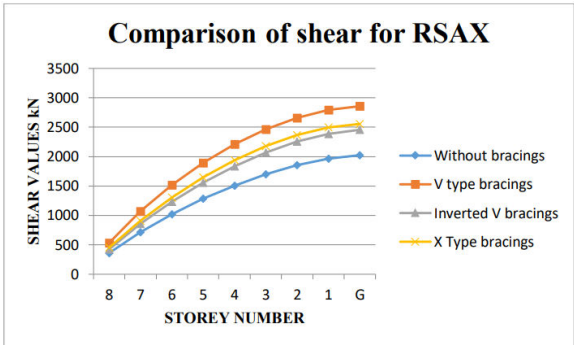
Graph 3: Comparison of storey stiffness

Storey acceleration

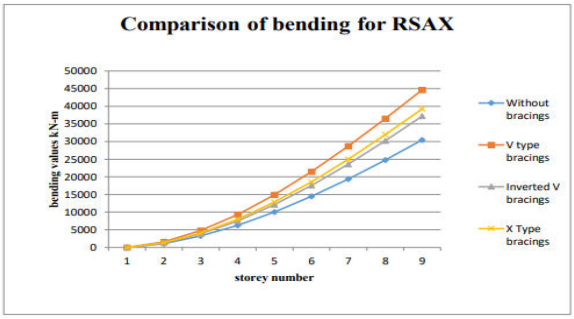


Graph 4: Comparison of storey acceleration

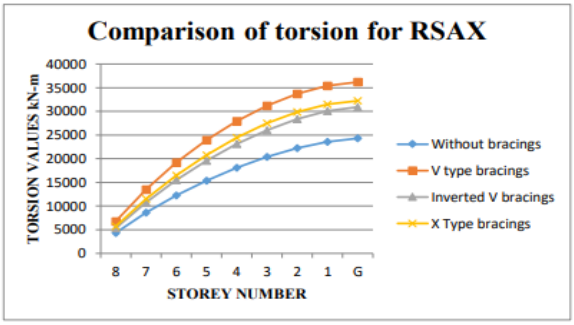
Storey shear forces



Graph 5: Comparison of storey shear forces



Graph 6: Comparison of bending values



Graph 7: Comparison of torsion

6. Conclusion

From this study the following conclusions were made

1. Bracing indicated that the structures with bracing have performance points at less vulnerable damage states than structure without bracing.
2. The provision of bracing enhances the base shear carrying capacity of frames and reduces roof displacement undergone by the structures.
3. The story drift has less value in building with V type bracings than General building, building and other cases
4. The story shear has less value in building with inverted V type bracings than General building, building and other cases
5. The story bending has less value in building with inverted V type bracings than General building, building and other cases
6. The story torsion has less value in building with inverted V type bracings than General building, building and other cases
7. It is observed that the bracing reduces the storey displacement as well as storey drift while it shows maximum storey shear.

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