Behavior Study of RCC Building with and without bracing using STAAD.Pro

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Abstract— In general the structure are analysis as RC structure. RCC high rise building of G + 11 Storey is used for bracing system to improve seismic resistance using various type of r.c.c. bracing system (diagonal type, V type, X type, inverted V type) and arrangement of bracing system. To build the seismically safe structure with adequate lateral resistance. Bracing system is installed between column members to resist the lateral load. Bracing system is easy to installed, economical and occupies less space. The structure is analyzed for seismic zone IV with different types of bracing system and compared with the bare frame with the using of Staad Pro software. The load condition is applied as per IS 1893:2002. Bracing system improve the displacement capacity of the structure. The percentage reduction in storey displacement is found out. It is found that the X type of concrete bracing significantly contributes to the structural stiffness and reduces the maximum storey drift of the frames. The bracing system improves not only the stiffness and strength capacity but also the displacement capacity of the structure.

Keywords: Base Shear, Bending moment, Seismic Analysis, RCC bracing, Deflection, Staad Pro

I. INTRODUCTION

In tall RC [reinforced concrete] building bracing system is provide for stiffness, strength and energy dissipation to resist the lateral load. The study about the different bracing system (diagonal type, V type, inverted v type and X type) and arrangement of bracing system. To build the seismically safe structure with adequate lateral resistance. Bracing system is installed between column members to resist the lateral load. Bracing system is easy to installed, economical and occupies less space. The structure is analyzed for seismic zone III with different types of bracing system and compared with the bare frame with the using of STAAD-PRO v8i software. The load condition is applied as per IS 1893:2002. Bracing system improve the displacement capacity of the structure. Seismic analysis is calculating the response of structure to the earth quake.

Nowadays high rise building is constructed for the purpose of stiffness and lateral load resistance. Larger seismic waves strike the earth surface caused shaking the earth surface in all possible direction. Bracing are the most prominent method used by structural engineers. Increase the lateral load resistance by bracing. There are many braced system in RC structure (like v, Inverted v, K and X, diagonal type) Structures are connected with various activities like sport, healthcare, transport, residence and power generation. Colum and beam distribute the gravity load in to the structure but there are not significant for stability of structure. They provide the different bracing system to transfer the seismic wave in to the structure. With the different method we analyses the structure. Reinforced Concrete bracings are most used in RC structure. Reinforced Concrete bracings transfer the load to the frame. India is fast developing country which demand hybrid structure or building with high seismic resistance. The multistory building requires safety due to earthquake and wind forces. Damage to the RC building causes seismic waves of earthquake and low strength of material used. Bracing stable the multistory building. Reinforced Concrete bracings mostly used in that RC structure. Most of structure collapse due to seismic waves. In this project we are adopting X-type bracing system and V-type bracing system. The RC buildings used in this study are G+11 storied. All building models have same floor plan in X and Z both direction. Four Models were generated in STAAD-PRO Software.

A. Strengthening of RCC Structures with Concrete Bracing Systems

Concrete bracing is a highly efficient and economical method of resisting horizontal forces in a frame structure. Bracing has been used to stabilize laterally the majority of the world's tallest building structures as well as one of the major retrofit measures. Bracing is efficient because the diagonals work in axial stress and therefore call for minimum member sizes in providing stiffness and strength against horizontal shear. A number of researchers have investigated various techniques such as infilling walls, adding walls to existing columns, encasing columns, and adding concrete bracing or steel bracing to improve the strength and/or ductility of existing buildings. A bracing system improves the seismic performance of the frame by increasing its stiffness and capacity. Through the addition of the bracing system, load could be transferred out of the frame and into the braces, bypassing the weak columns while increasing strength. Steel braced frames are efficient structural systems for buildings subjected to seismic or wind lateral loadings.

B. Importance of Seismic Analysis

Earthquake is one of the most unpredictable and massive damage causing phenomena of nature. With immense loss of life and property witnessed in last couple of decades alone in India due to failure of structure caused by earthquake, attention is now being given to detail study related to Earthquake. Although a great deal has been learned about earthquakes and their effects on buildings during the last 50 years, seismic design is still an inexact science. Because seismic design deals with dynamic forces rather than static forces, and because of the many variables involved, it is often difficult to precisely predict the performance of a building in an earthquake and provide the best possible design to resist the resulting lateral forces. Another difficulty with seismic design is that the forces produced by an earthquake are so great that no building can economically and reasonably be designed to completely resist all loads in a major earthquake

without damage. Building codes and analytical methods of designer, therefore, a compromise between what could resist all earthquakes and what is reasonable. Because of this, the current approach in designing earthquake resistant structures is that they should first of all not collapse during major seismic activity. Additionally, the components of buildings should not cause other damage or personal injury even though they may be structurally damaged themselves.

C. Objective

- To understand various types of structures and bracing systems and their behavior.
- To identify the suitable bracing system for resisting the lateral loads efficiently.
- To explain the advantages of braced systems.
- To discuss the limitations of Braced frames.
- To study the method of Detailing bracing systems.

II. LITERATURE REVIEW

A. Kartik Prashar and Jagdeep Gahir

In this paper, the structure is analyzed for seismic zone V with different types of bracing system and compared with the bare frame with the using of ETAB software. The load condition is applied as per IS 1893:2002. Bracing system improve the displacement capacity of the structure. In tall RC [reinforced concrete] building bracing system is provide for stiffness, strength and energy dissipation to resist the lateral load. The study is about the different bracing system (diagonal type, V type, inverted and k type) and arrangement of bracing system. To build the seismically safe structure with adequate lateral resistance. Bracing system is installed between column members to resist the lateral load. Bracing system is easy to installed, economical and occupies less space. Steel bracing system is an efficient and effective lateral load resisting system. Steel braced RC frame as the lateral load resistance system for reinforced concrete structure is a effective technique. Structure with different types of bracing system reduce the storey drift and displacement of the structure. Out of various arrangements of bracing, X- bracing system are more effective in increasing lateral load capacity of structure. Bracing system reduce bending moment and shear force in the column. Steel bracing transfer the lateral load through axial action. The performance of the steel cross bracing is better than other bracing system. Steel bracing can be used to retrofit the existing structure.

B. Mehul M. kanthariya and Mitesh H. Patel

In general the structures are analysis as RC structure RCC high rise building of G + 10 Storey is used for bracing system to improve seismic resistance using various type of R.C.C. bracing system such as single diagonal bracing, Double diagonal bracing in seismic zone III using IS-1893:2002 for RC structure. Compare base shear, bending moment, deflection of a structure analysis by using STAAD PRO V8i. Bracing, which provides stability and resists lateral loads, may be from diagonal steel members or, from a concrete 'core'. In braced construction, beams and columns are designed under vertical load only, assuming the bracing system carries all lateral loads. Braced systems exhibit high lateral stiffness and strength under moderate-to-large magnitude earthquakes. When establishing a Comparison of bending moment of both bracing systems. From the table-1 and chart-1 is represented deflection in single and diagonal bracing systems. Deflection in single diagonal system deflection is more compare to double diagonal bracing system and produce jerk in single diagonal system. From the table-1 and chart-1 is represented shear force in single and diagonal bracing systems. In this chart shown very clearly base shear is high in top in single diagonal bracing system and average decrease to floor to floor.

C. Prof. Bhosle A. Tanaji and Prof. Shaikh A. N.

Concrete braced and steel braced reinforced concrete frame is one of the structural systems used to resist earthquake loads in multistoried buildings. Many existing reinforced concrete buildings need retrofit to overcome deficiencies to resist seismic loads. The use of concrete and steel bracing systems for strengthening seismically inadequate reinforced concrete frames is a viable solution for enhancing earthquake resistance. Concrete and steel bracing is economical, easy to erect, occupies less space and has flexibility to design for meeting the required strength and stiffness. In this study, the seismic analysis of reinforced concrete (RC) buildings with different types of bracing (Diagonal, V type, Inverted V type, Combine V type and X type) is studied. The bracing is provided for peripheral columns and any two parallel sides of building model. A thirteen-storey building is analyzed for seismic zone III as per IS 1893: 2002 using ETAB software. The percentage reduction in storey displacement is found out. It is found that the X type of concrete bracing significantly contributes to the structural stiffness and reduces the maximum storey drift of the frames.

D. Soundarya N. Ghandhi and Y.P. Pawar

Due to earthquake major losses can occurred it may gives damages to structure and in worst case it may collapse. For avoiding this damage of structure steel braces provided to high rise building to provide strength and also for resist lateral load imposed by earthquake and wind. There are ‘n’ numbers of possibilities to arrange steel bracings such as X, V, Inverted V. A building is situated at seismic zone V. The building models are analyzing as per IS 1893:2002 using software ETABS. The main parameters consider is to compare the seismic analysis of buildings for lateral displacement, storey drift, base shear etc. From analysis of 15 storied RC & Steel building with provision of Bracing for different types, following conclusions is drawn.

1) The seismic responses in X and Y direction namely base shear for 15 storied RC structure with X bracing gives maximum result for base shear as compare to without bracing.
2) For structure with bracing X have minimum storey displacement. Storey displacement is uniformly increasing when structure un-braced and it is maximum at top floor of the structure.
3) For structure with bracing have minimum storey drift compared to structure without bracing respectively. Structure with inverted V Bracing gives minimum Storey drift as compare to other X, V. The values of storey drift for all the stories are found to be within the limits i.e. 0.004 times to storey height according to IS 1893:2002

E. Bharat Patel and Rohan mali

The high-rise buildings that are made of RCC frame, the greater importance is given to make structure safe against lateral load. These loads are produced due to wind, earthquakes etc. To resist lateral load acting on or RCC bracing systems are provided. The use of RCC bracing has potential advantage than other bracing like higher stiffness and stability. This study aimed the comparison of different RCC bracing system under seismic behave buildings. Also three structural configurations used in this paper are Moment Resisting Frames (MRFs), X storey (G+10) building. The bracing systems provided on periphery of the column. The frame models are analyzed as per IS: 1893 ETABs software's. The parameters which are considered in this paper for comparing seismic effect of buildings are base shear and storey displacement. The results showed that X-braced frames are more efficient and safe at time of earthquake when compared with moment resisting frames and V-braced frames. In this paper the different braced buildings are studied and the seismic parameters in terms of base shear and storey displacement are compared. The following conclusions are summarized based on analysis: In high rise buildings, the parameters like strength and stiffness are more important. So for this purpose bracing system are adopted to enhance both these parameters. MRF buildings showed higher storey displacement that it is weak as compared other braced buildings, so prone to excessive damage in earthquake. The base shear of braced buildings increased as compared to building without bracing which indicates that the stiffness of building increases. The storey displacement of the building is reduced by 55% to 60% by using XBF and VBF.

III. Research Methodology

The proposed work is planned to be carried out in the following manner.

- Study of IS code IS 1893:2002, IS456:2000 etc.
- Study of Design parameters used in STAAD.
- Preparation of STAAD models for the RC frames with and without bracing.
- Analysis and Design of RC structure.
- Preparation of Comparative Statement on the basis of Design.

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