International Conference On Emerging Trends in Engineering and Management Research
NGSPM's Brahma Valley College of Engineering & Research Institute, Anjaneri, Nashik(MS) (ICETEMR-16)
23rd March 2016, www.conferenceworld.in ISBN: 978-81-932074-7-5

EFFECT OF BRACING ON CRITICAL STOREY OF HIGH RISE FRAME STRUCTURE

Akshay Sonawane[1], Dipak Sonawane[2], Satish Jadhav[3], Rajendra Khemnar[4], Rohit Mahale[5], Prof. Dumbare Sir[6].

[1,2,3,4,5] *B.E.CIVIL Scholar BVCOE&RI (Pune University) Nashik (India)*

[6] *Assistant Professor Civil Dept. BVCOE&RI Nashik.(India)*

ABSTRACT

A Bracing is a system that is provided to reduced the lateral deflection of the structure. The use of braced frames has become more effective in high rise structure and also in seismic design of structure. So this paper aims to find out the effect of bracing on critical storey of structure. In this project a steel frame is modeled with different type of bracing pattern and effect of these different bracing on critical storey is studied for different parameter like storey drift and bending moment in column and story displacement. from the observed result best type of bracing will be selected.

Keywords: Bracing system, concentric and eccentric bracing, lateral storey displacement, Column forces, column moment.

I. INTRODUCTION

This A Braced Frame is designed primarily to resist wind and earthquake forces in and a structural system. These braced frames are made of steel members. Similar to a truss a braced frame is designed to work in tension and compression. Concentric Most braced frames are mostly used. These members intersect at a node, now here the centroid of each the member passes through the same point. Steel braced frame is the structural systems used to resist lateral loads in the multistoried buildings. Steel bracing are much economical, they are easy to erect, and less space is occupied by them and has flexibility to design for meeting the required strength and stiffness. Lateral loads are often resisted by using braced frame but they can interfere with some architectural components. The steel braces are usually placed in vertically aligned spans. Now this system allows an great increase of stiffness with a small amount of added weight, and thus it is very effective for the existing structure in which the poor lateral stiffness is the main problem.

Bracings are provided to increase stiffness and stability of the structure under lateral loading and also to reduce lateral displacement significantly. Concentric bracings increase the lateral stiffness of the frame and usually decrease the lateral drift. Due to increase in the stiffness it may attract a larger inertia force created due to earthquake. Here onwards, while bracings decrease, the amount of shear forces and bending moments in columns, increase the axial compression in the columns to which they are connected. Due to eccentric bracings there is reduction in the lateral stiffness of the system and improve the energy dissipation capacity. In eccentric connection of the braces to beams, lateral stiffness of system depends upon the flexural stiffness of the beams.

II. LITERATURE REVIEW

1. Zasiah Tafheem, Shovona Khusru :- In the present study, a six storied steel building has been modeled and then analyzed due to lateral earthquake and wind loading, dead and live load. The performance of the same steel building has been investigated for different types of bracing system such as concentric (crossed X) bracing and eccentric (V-type) bracing using HSS sections. the reduction in lateral displacement has been found out for different types of bracing system in comparison to building with no bracing. From the present study, it has been found that the concentric (X) bracing reduces more lateral displacement and thus significantly contributes to greater structural stiffness to the structure. The inter-storey drift is greatly reduced in presence of bracing system. As a result, it can be said that bracing system has more influence on the restriction to relative floor to floor lateral displacement.
2. K.K.Sangle , K.M.Bajoria and V.Mhalungkar :- In this paper the linear time history analysis is carried out on high rise steel building with different pattern of bracing system for Northridge earthquake. Natural frequencies, fundamental time period, mode shapes, inter story drift and base shear are calculated with different pattern of bracing system. Aim of study was to compare the results of seismic analysis of high rise steel building with different pattern of bracing system and without bracing system. The result of the present study shows that bracing element will have very important effect on structural behavior under earthquake effect. The diagonal brace-B shows highly effective and economical design of bracing style.
3. Jagadish J. S,Tejas D. Doshi :- present study show the effect of different types of bracing systems in multi storied steel buildings. For this purpose the G+15 stories steel building models is used with same configuration and different bracing systems such as Single-Diagonal, X bracing, Double X bracing, K bracing, V bracing is used. A commercial software package STAAD.ProV8i is used for the analysis of steel buildings and different parameters are compared. Bracings are good to reduce the displacement and in case of K and V-bracing, the displacement is higher than without bracing because of irregularity in shape of the structure. The braced buildings of the storey drift either increases or decreases, as compared to un braced building with the same configuration for the different bracing system.
4. Manish S. Takey Prof. S.S.Vidhale :-This synopsis describes the analysis of high-rise steel building frame with different bracing section. For present work equivalent static analysis is carried out for steel moment resisting building frame having (G+9) storey situated in zone III. The steel moment resisting building frame is analyze by with and without steel bracing system. The analysis of steel bracing and the building are carried out using Software. The braced building of the storey drift decreases as compared to the unbraced building which indicates that the overall response of the building decreases. The displacement of the building decreases depending upon the different bracing system employed and the bracing sizes.

III. SCOPE

The scope of this project is to study steel frame structure for the various types of loading using different sections as bracing at critical storey and to propose the most efficient bracing system which will give optimized solution.

IV. OBJECTIVE

1. To study the effect of different bracing pattern on critical storey.
2. To propose the most efficient bracing system which will give optimized solution.

V. PROBLEM STATEMENT

Ground motion during an earthquake creates complex horizontal displacement patterns in the structures. It is impractical to trace this lateral displacement at each time-step. When building is subjected to lateral or torsional deflections under the action of lateral loads, the resulting oscillatory movement can induce a wide range of responses in the building. The response of building is in terms of lateral displacement and large storey drift, which decreases lateral strength and stiffness of building. The total seismic base shear as experienced by a building during an earthquake is dependent on its natural period, the seismic force distribution is dependent on the distribution of stiffness and mass along the height.

As the lateral stiffness is a major consideration in the analysis of tall buildings, it is necessary to reduce this response, Different structural forms of tall buildings can be used which improve the lateral stiffness and reduce the drift. The need for a bracing system arises that can increase the lateral strength and stiffness of building and reduces lateral displacement and storey drift. A different research has suggested to implement bracing system in a building, so that the building will be strengthen and can sustain during seismic response.

VI. METHODOLOGY

A study is undertaken which involve linear analysis of steel building and study the behavior of the structure. Materials which are used are structural steel of grade Fe 250 Mpa.

The methodology worked out to achieve the above-mentioned objectives is as follows:

i) Review the existing literatures

ii) Select a building model for the study.

iii) Model the selected building with different type of bracings. Models need to consider grades of steel section 250.

Model 1: Normal building with critical storey.

Model 2: Building with diagonal bracing at critical section.

Model 3: Building with cross bracing at critical section.

Model 4: Building with inverted V bracing at critical section.

Model 5: Building with V bracing at critical section.

iv) Linear analysis of the selected building model and a comparative study on the results obtained from the analyses.

v) Observations of results and discussions.

VII. STRUCTURAL MODELING

The study in this thesis is based on basically on linear analysis of steel frames with different bracing models at critical storey. Different configurations of frames are selected such as cross bracing, diagonal bracing, V and inverted V bracing and analyzed.

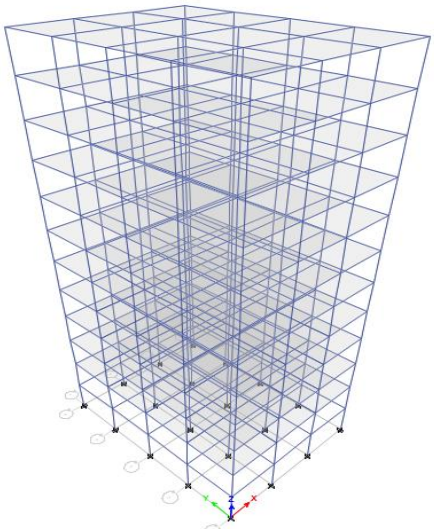

Figure 1:3D view of model

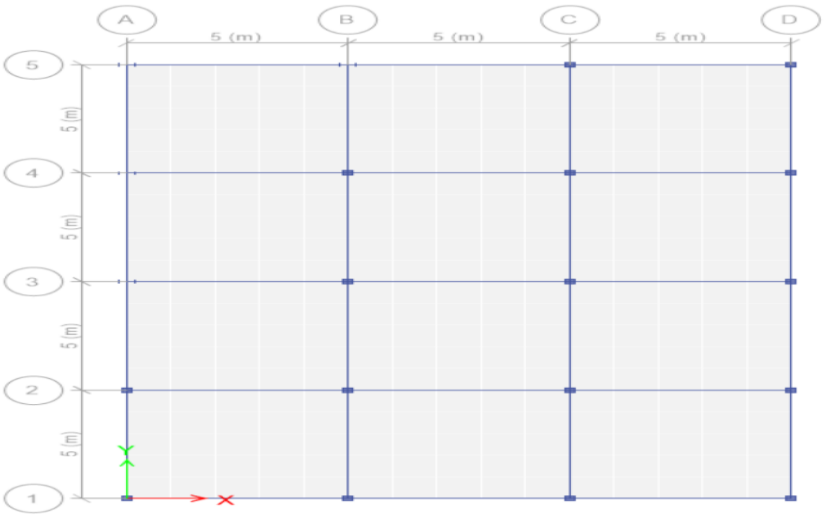

Figure 2:Plan of model

Table 1:Model description

Name of parameter	Value	Unit
Number of stories	11	Nos.
Storey height	3.5	M
Total height of the structure	41	M
Length in long direction	20	M
Length in short direction	15	M
Size of column (Fe 250)(Hollow)		
Ground level to storey3	400x400x12	mm x mm x mm
Storey3 to storey 7	350x350x12	mm x mm x mm
Storey7 up to storey 11	230x230x08	mm x mm x mm
Size of beam (Fe 250)	ISHB-350	-
Size of column (Fe 310)(Hollow)		
Ground level to storey3	375x375x10	mm x mm x mm
storey3 to storey 7	325x325x10	mm x mm x mm
Storey7 up to storey 11	200x200x08	mm x mm x mm
Size of beam (Fe 310)	ISMB-350	-
Thickness of Deck	150	Mm
Density of concrete	25	kN/m^3
Density of Siporex brick	5.88	kN/m^3
Wall load	3.7	kN/m
(2) Floor finish	1	kN/m^2
Live load	4	kN/m^2
Importance factor (I)	1	-
Seismic zone	III	-
Responded reduction factor	5	-
Soil type	Hard soil	-
Time period (X)	0.9528	Sec
Time period (Y)	0.8251	Sec

VIII. SUMMARY

The literature study reveals that many works have been done by many researchers in the area of steel frame structure with different type of bracing systems. However, not much work has been carried out on critical storey of steel structures. Hence it was decided to focus on study of bracing on critical storey of high rise frame structure with various types of bracings such as cross bracing, diagonal bracing, inverted V bracing, and V bracing systems using ETABS2013.

REFERENCE

[1]. Zasiah Tafheem, Shovona Khusru "Structural behavior of steel building with concentric and eccentric bracing: A comparative study" Volume 4, No 1, 2013 ISSN 0976 – 4399

[2]. K.Sangle, K.M. Bajoria and V. Mhalungkar "Seismic analysis of high rise steel frame building with and without bracing " *15WCEE LISBOA 2012*

[3]. Jagadish J. S, Tejas D. Doshi "A Study On Bracing Systems on High Rise Steel Structures" *International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181* Vol. 2 Issue 7, July - 2013

[4]. Manish S. Takey Prof. S.S. Vidhale "Seismic response of steel building with linear bracing system (a software approach)" *International Journal of Electronics, Communication & Soft Computing Science and Engineering ISSN: 2277-9477,* Volume2, Issue 1

[5]. Adithya. M, Swathi rani K.S, Shruthi H K and Dr. Ramesh B.R "Study On Effective Bracing Systems for High Rise Steel Structures" *SSRG International Journal of Civil Engineering (SSRG-IJCE)* – Volume 2 Issue 2 February 2015.

[6]. Y.U. Kulkarni and Prof. P. K. Joshi "Analysis and design of various bracing system in high rise steel structures." *International Journal of Advance Research in Science and Engineering JARSE,* Vol. No.3, Issue No.11, November 2014 ISSN-2319-8354(E)

[7]. A Jesumi, M.G. Rajendran "Bracing System for Steel Towers" *International Journal of Engineering Research and Applications* Vol. 3, Issue 2, March -April 2013, pp.729-732

[8]. IS: 875(Part-2)- 1987 "Code of Practice for Design Loads (Other than Earthquake) buildings and structures", Part-2 Imposed loads, Bureau of Indian Standards, New Delhi

[9]. IS: 1893-2002, "Criteria for Earthquake Resistance and Construction of Buildings", Bureau of Indian standards, New Delhi.