International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 10 Issue 7 ǁ July 2022 ǁ PP. 423-429

Analysis and Comparative Study of Steel Bracing in Reinforced Concrete Building Under Seismic and Wind Load

Shivani B. Dasare,Prof. Mrs. Kariappa M.S.
[*1]*Masters of Technology (CIVIL-Structure. Bidve College of Engineering, Latur;Dr. Babasaheb Ambedkar Technological University, Lonere*
[2]*Department of Civil Engineering, M.S. Bidve College of Engineering Latur, Dr. Babasaheb Ambedkar Technological University, Lonere*

Abstract
India is today a rapidly expanding nation, and as its population rises, more infrastructure is required. Indiais today a rapidly expanding nation, and as its population rises, more infrastructure is required. India's infrastructure is anticipated to expand at a CAGR of about 7% during the forecast period. Population increase is causing a rise in housing demand, which is increasing daily. To satisfy the need for more residential and commercial land, we can go for vertical construction, which involves constructing a multistory structure. Knowing how to endure gravity loads is the fundamental function of a reinforced concrete structure. But lateral loads from earthquakes and winds can be more damaging to multistory buildings. Multi-story structures are susceptible to excessive deformation; thus, some measures must be taken to reduce this risk. As part of our earthquake resistant structural design, we provide bracing systems. The primary goal of this study is to use an equivalent static approach to analyse seismic and wind loads. This study carefully compares the X and V bracing systems, which are thought to be among the most effective during earthquakes. In this investigation, RC constructions with six, eight, and ten story were utilised.
Keywords: *Infrastructure, bracing, earthquakes,multistory, structural, resistant seismic, static, construction, story, susceptible, concrete, gravity, fundamental, deformation*

Date of Submission: 02-07-2022 Date of acceptance: 14-07-2022

I. INTRODUCTION

Reinforced concrete building is mainly designed only to resist the gravity loads that are acting on the structure, therefore while designing the building engineers do not pay more attention to the seismic loads than can cause building collapse.

We know every body can have elastic, inelastic behaviour. Due to high amount of deflection, shear value basically the structure may collapse. So, we need to design it as per Earthquake resistant structural design. The traditional earthquake-resistant design philosophy requires that normal building should be able to resist shaking with no collapse of structure. Among the six categories of earthquake resistant structural design, we chose bracing system as it is proven to be cost effective in comparison to moment resisting frames apart from simple connection details that makes construction easy.

Types of bracing:
there are two types of bracing systems,
1). Concentric and 2). Ecentric
As concentric bracing increases the lateral stiffness of the frame.
Lateral drift is reduced in this process.
The bracings are attached to the perimeter frame and minimize the disruptions in the structure during and after construction.
A viable solution for enhancing earthquake resistance is to use steel bracing systems for strengthening and retrofitting seismically inadequate reinforced concrete frames. Earthquake can cause irreparable damages to buildings. So, strengthening against such seismic motion is the better option by considering economy.

1.1.1 OBJECTIVES

1). To perform analysis of seismic forces.
2). To perform analysis of wind forces.
3). To investigate the arrangement of X and V steel bracings in a structure against the unbraced.

4). To investigate the efficient bracing system in the multi-storeyed structural building by following,
a). Story displacement,
b). Story drift,
c). Stiffness,
d). Maximum story drift.
5). To strengthen the multi-storeyed building.
6). To study the difference between unbraced and braced system applied to the 6 & 8 storeyed building.

1.1.2 METHODOLOGY

This project aims to satisfy the upcoming needs of the developing cities who would need to expand their town in coming years and they'll need to construct vertical constructions and they will utilize this by expanding the floor levels i.e., they'll higher up the floor level, so we have considered G+6 and G+8 and carried out seismic and wind analysis of different combinations:

1). Unbraced building with no lateral load resisting system.
2).X-Braced building.
3). V-Braced building

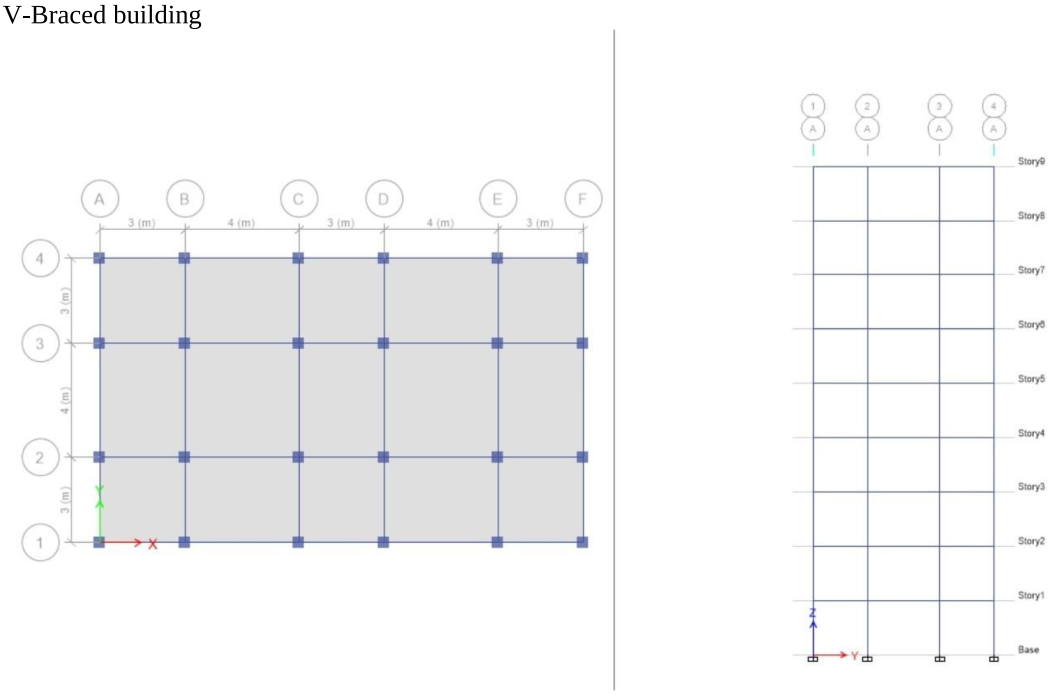


Figure1: PLAN AND ELEVATION OF UNBRACED G+8 BUILDING

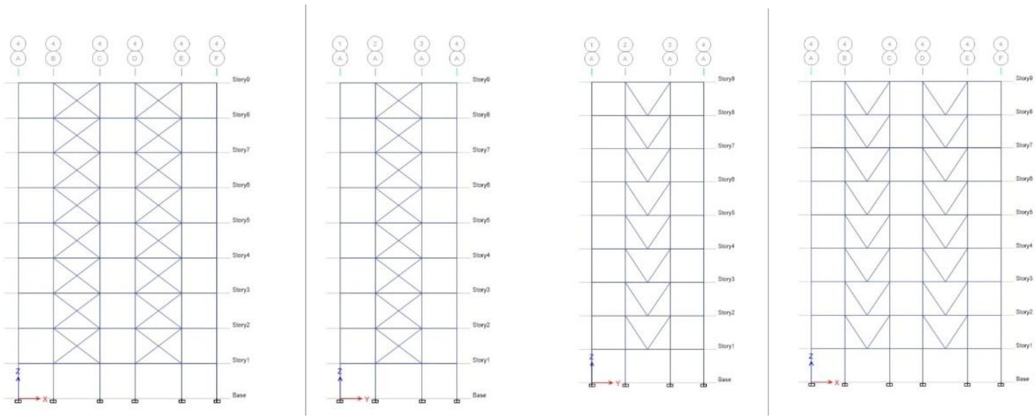


Figure2: PLAN AND ELEVATION OF X & V G+8 BUILDING

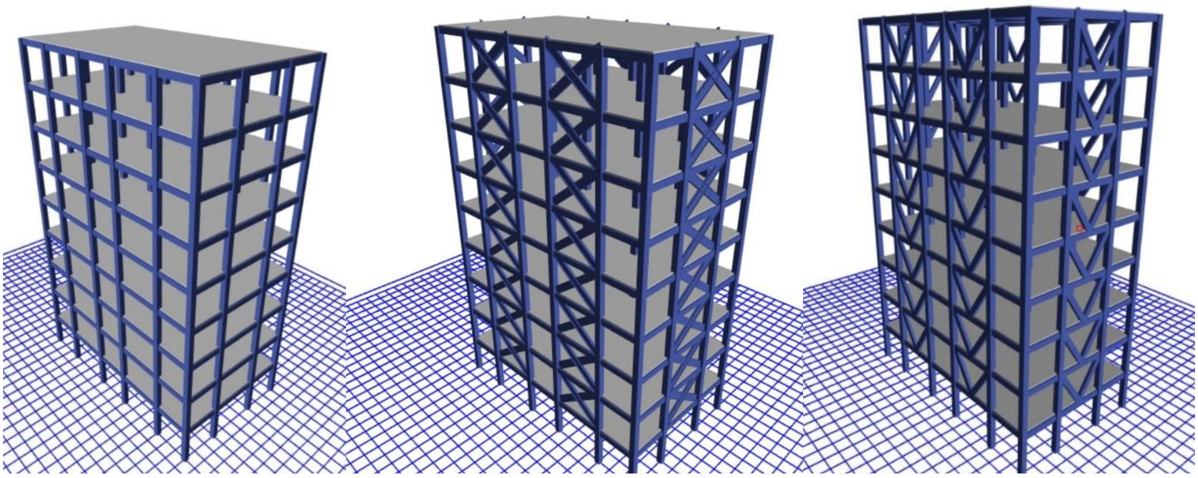


Figure3: 3D RENDERED VIEW OF UNBRACED,X& V G+8 BUILDING

1.2 METHOD OF ANALYSIS

1.2.1 The Present Study is Donefor the Below Mentioned Analysis
1). Equivalent static analysis Method
2). Wind load analysis method.

1.2.2 PARAMETRIC STUDY

Table 1 represents the data considered for modelling

Table 1: Rerun Column, Specification.

DESCRIPTION	VALUES
1. NO. OF STORY	G+8 AND G+6
2. HEIGHT OF EACH STORY	3m
3.SIZE OF BEAM	400 x 230 mm
4.SIZE OF COLUMN	400 x 400 mm
5.THICKNESS OF SLAB	150mm
6.STEEL BRACING	ISMB500
7.WALL LOAD	13.8 KN/m
8.LIVE LOAD	3.5 KN/
9.TOTAL HEIGHT	27 m, 21m

1.2.3 Seismic and Wind Loading details of the Building Model

Table 2 indicates the seismic and wind loading data;

Table 2:Seismic and Wind Loading Details

DESCRIPTION	VALUES
1.EARTHQUAKE ZONE	V-0.36
2.IMPORTANCE FACTOR	1
3.WIND SPEED	44 m/s
4.TERRAIN CATEGORY	4
5.Cp	0.86, 0.5
6.ANGLE X	0, 180
7.ANGLE Y	90, 270
8.GLOBAL X	1.75KN/sq.m
9.GLOBAL Y	1.75KN/sq.m

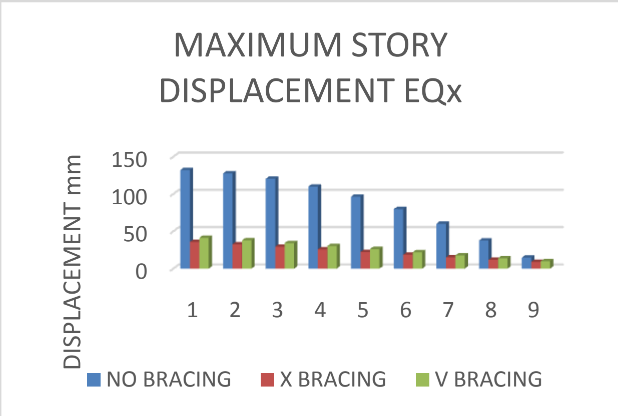
2.2.4 Maximum Displacement, Maximum Story Drift and Stiffness

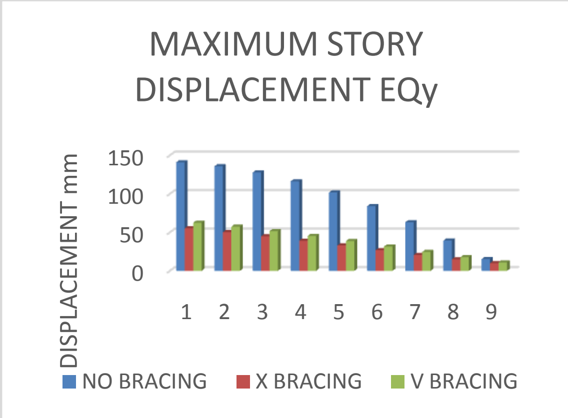
Table 3MAX. DISPLACEMENT, STORY DRIFT AND STIFFNESS

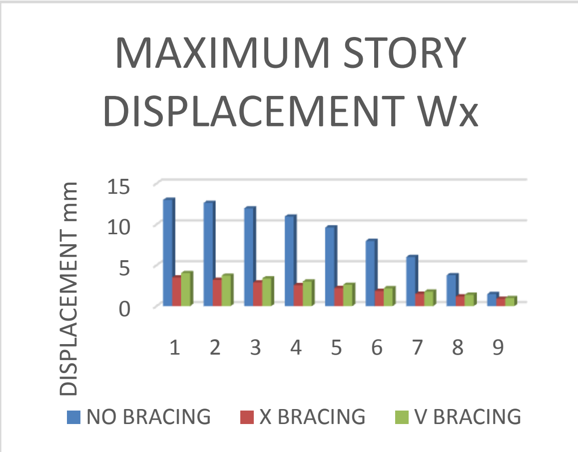
	UNBRACED	X-BRACING	V-BRACING
MAXIMUM STORY DISPLACEMENT	EQx EQy Wx Wy	EQx EQy Wx Wy	EQx EQy Wx Wy
MAXIMUM STORY DRIFT	EQx EQy Wx Wy	EQx EQy Wx Wy	EQx EQy Wx Wy
STIFFNESS	EQx EQy Wx Wy	EQx EQy Wx Wy	EQx EQy Wx Wy

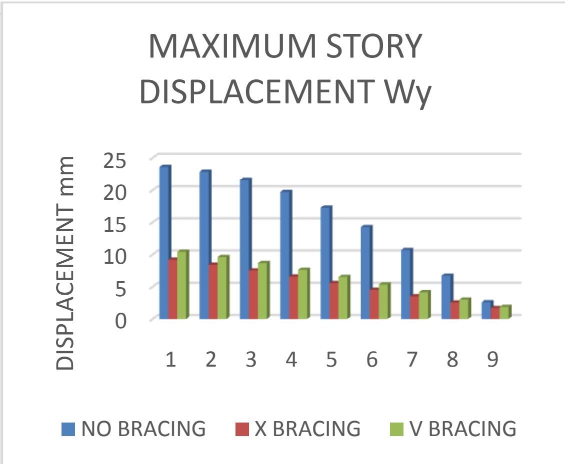
II. RESULT

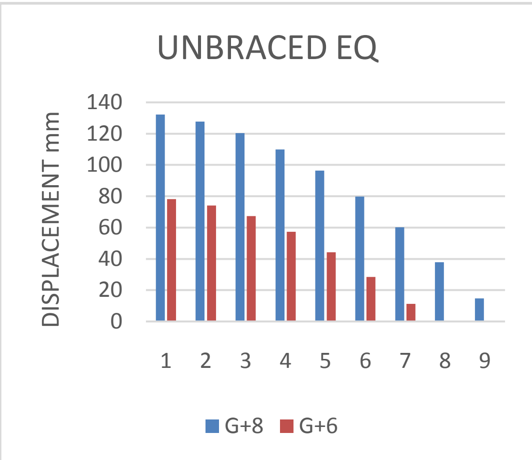
The results obtained are as shown below in the terms of graphs

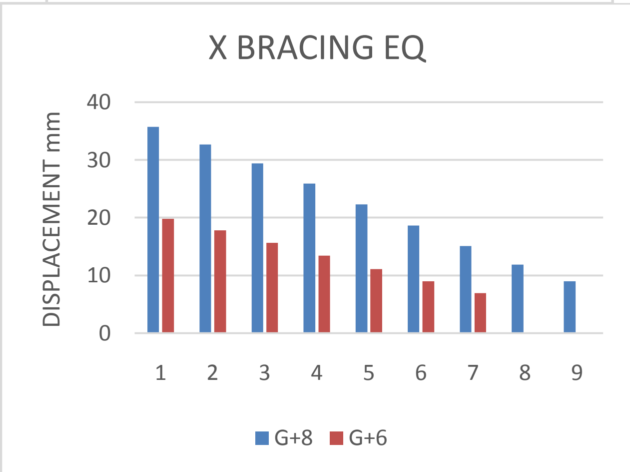


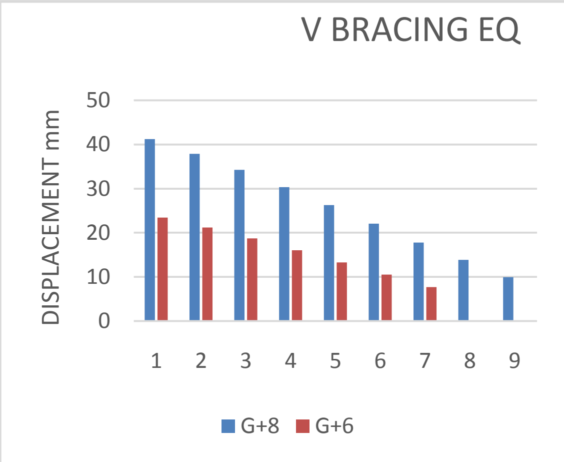


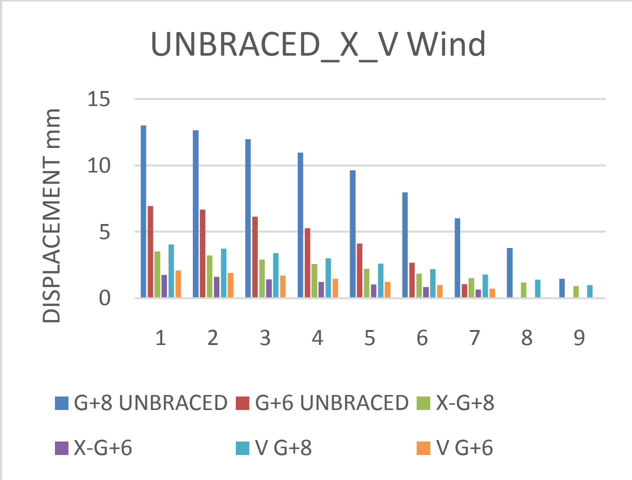


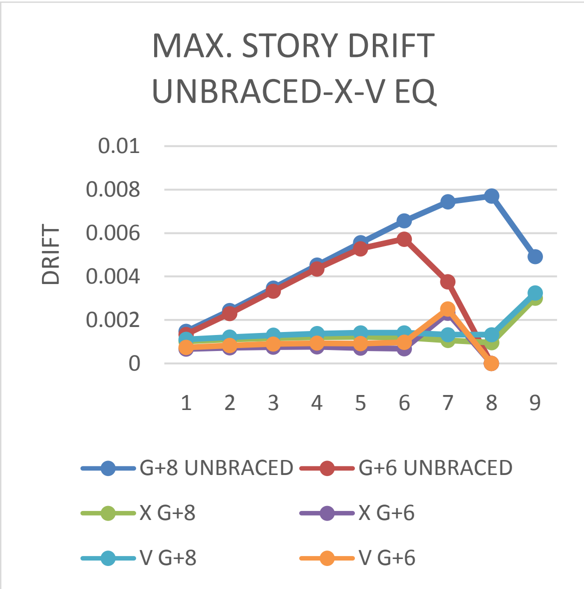


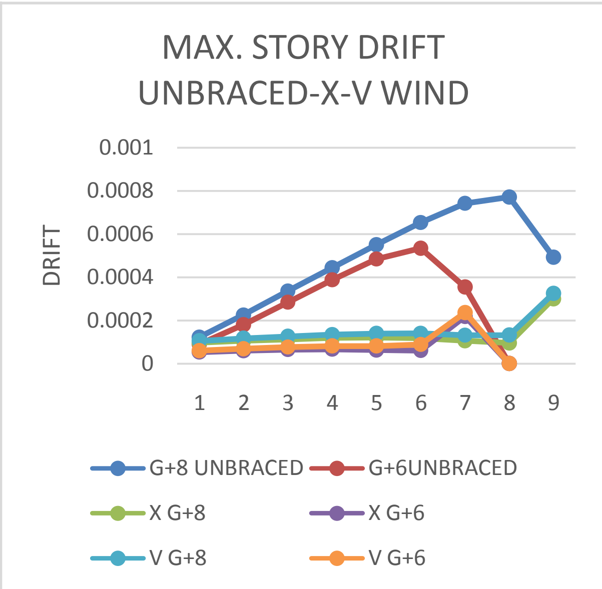


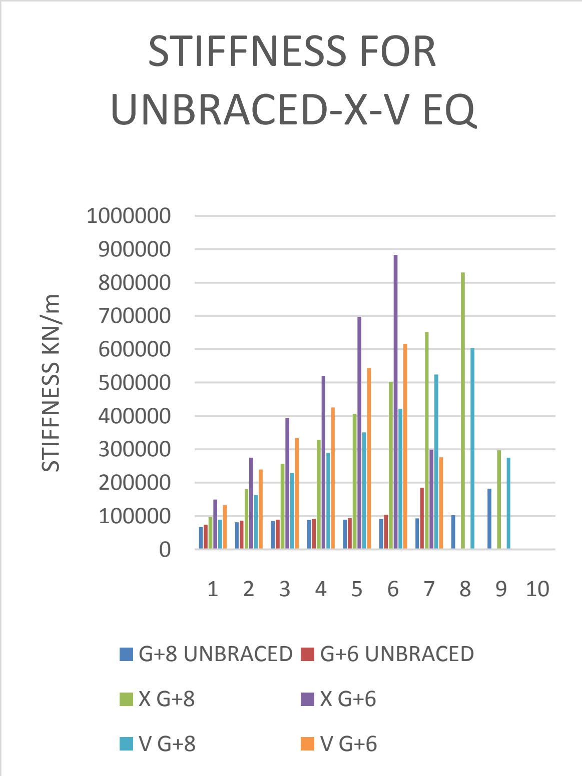


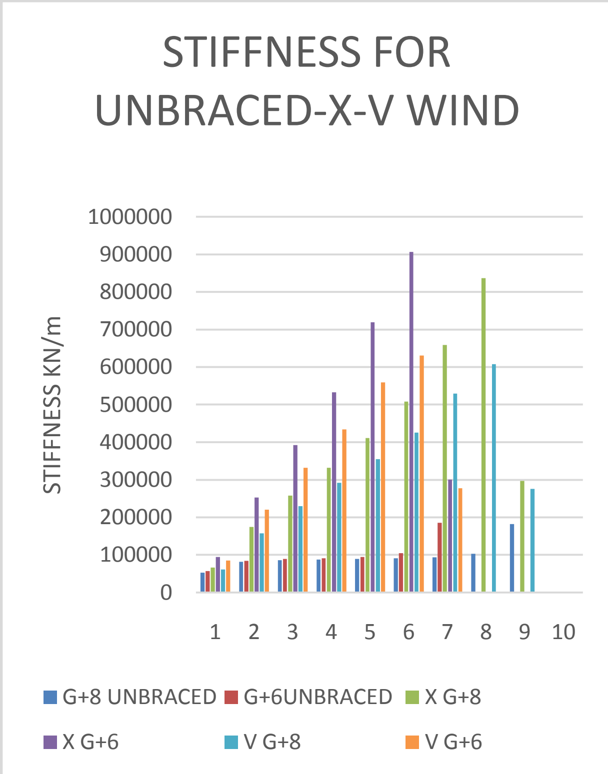

V BRACING EQ
DISPLACEMENT mm
50
40
30
20
10
0
1 2 3 4 5 6 7 8 9
G+8 G+6


UNBRACED_X_V Wind
DISPLACEMENT mm
15
10
5
0
1 2 3 4 5 6 7 8 9
G+8 UNBRACED G+6 UNBRACED X-G+8
X-G+6 V G+8 V G+6


MAX. STORY DRIFT
UNBRACED-X-V EQ
DRIFT
0.01
0.008
0.006
0.004
0.002
0
1 2 3 4 5 6 7 8 9
G+8 UNBRACED G+6 UNBRACED
X G+8 X G+6
V G+8 V G+6


MAX. STORY DRIFT
UNBRACED-X-V WIND
DRIFT
0.001
0.0008
0.0006
0.0004
0.0002
0
1 2 3 4 5 6 7 8 9
G+8 UNBRACED G+6UNBRACED
X G+8 X G+6
V G+8 V G+6





III. CONCLUSION

To investigate the G+8 and G+6 reinforced concrete buildings in this project, seismic analysis and wind analysis were conducted. We then installed X and V type bracings to make the buildings earthquake resistant, and bracings can also be utilized as a successful retrofitting approach.Studying the lateral displacement, maximum story drift, and stiffness of the unbraced, X braced, and V braced in RCC buildings allows us to draw the following conclusion:

1As an alternative method, steel bracings can be employed.
2.The X and V bracing system reduces the building's lateral movement.
3.By utilizing X and V bracing, the building's stiffness is increased.
4. X braces are more effective than V braces at reducing lateral displacement and story drift.
5. For multistory structures located in seismically active areas, the steel bracing system is a reliable and efficient retrofitting method.
6.Increasein the lateral load capacity of a structure are more effectively achieved with X bracing.
7. The effect of seismic forces is altered by the modification in the bracing section.
8.When comparing G+8 and G+6, we see that as the building's height rises, the displacement value rises and the drift value rises as well.
9.Additionally, the displacement and base shear diminish as the stiffness increases, minimizing the soft storey effect.
10. Bracings transfer lateral stresses to beams and columns, and it is important to note that X bracing in a braced reinforced concrete frame sustains a significant amount of lateral load.

REFERENCES

[1]. IS 1893 (PART 1) 2002, Indian Standard Criteria for Earthquake Resistant Design of Structures, Bureau of Indian Standards, New Delhi.
[2]. IS 800:1984, Indian Standard Code of Practice for General Construction, in Steel.
[3]. Shrikande and Agrawal, Earthquake Resistant Structures (PHI Learning Private Limited, New Delhi, 2010)
[4]. Paul G and Agarwal P., Experimental verification of seismic evaluation of RC framed building designed as per previous IS codes before and after retrofitting by using steel bracing, Asian Journal of Civil Engineering (building and housing), 13,2012,165-179.
[5]. Prof. Bhosle ashwini tanaji, Prof. Shaikh A. N. (2015), Analysis of Reinforced Concrete Building with Different Arrangement of Concrete and Steel Bracing system, IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684, pISSN: 2320- 334X, Volume 12, Issue 5.
[6]. Some concepts in Earthquake Behaviour of Buildings -C.V.R. Murthy, Rupen Goswami, A.R. Vijaynarayan, Vipul V. Mehta
[7]. Prof. Prakarsh SangaV (2015) Comparative Study of Analysis and Design of R.C. and Steel Structures, International Journal of Scientific & Engineering Research, Volume 6, Issue 2, February-2015
[8]. Sachin Dhiman, Mohammed Nauman (2015),Behavior of Multistory Steel Structure with Different Types of Bracing Systems, International Refereed Journal of Engineering and Science (IRJES) ISSN (Online) 2319-183X, (Print) 2319-1821.

[9]. Viswanath K.G et.al. (2010), Seismic Analysis of Steel Braced Reinforced Concrete Frames, Internationaljournal of civil and structural engineering Volume 1, No 1, 2010.
[10]. Bhavin H. Zaveri et.al [2016], A Review on the Comparative Study of Steel, RCC and Composite Building, International Journal of Innovative Research in Science, Engineering and Technology. Vol. 5, Issue 1, January2016.
[11]. Akhila Lakshmi N H1, Swarthy S. Kumar (2013), Dynamic Analysis of an Irregular RC Building with Different Bracing Systems, International Journal of Science and Research (IJSR) ISSN (Online): 23197064.