iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 13 Issue: VIII Month of publication: August 2025

DOI: https://doi.org/10.22214/ijraset.2025.73868

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue VIII Aug 2025- Available at www.ijraset.com

Analysis and Design of Shear Wall with Openings and Bracings in Multi-Storey Irregular Building

Kum. K Navyasri
Department of Civil Engineering, University College of Engineering (Autonomous), Osmania University, Hyderabad, Telangana, India

Abstract: At present days, constructing a structure with all the regular configurations is not feasible in most of the cases due to the irregular plot dimensions, aesthetic visual and functional requirements in the urban cities. The structure with more irregular configuration either horizontally or vertically are more vulnerable to earthquake & wind forces which leads to collapse of structure, property loss and casualties. When an earthquake occurs, nearly all buildings in the area are exposed to seismic forces. When a tall structure is subjected to lateral or torsional deflections under the action of seismic loads, the resulting oscillatory movement can induce a wide range of response in the building occupants. Therefore, lateral stiffness is an important consideration in the design of multi storey structures. The improvement of reinforced concrete frame structure against lateral loading can be achieved by providing shear walls and cross bracings. In this study, a G+19 storey important service and community building with re-entrant corners has been analyzed and designed with shear wall with openings and cross bracings. Significance of shear walls and bracings has been studied with the help of nine models. This analysis and design was made as per IS 1893:2016 codal provision by using ETABS 20 software. The building models are analyzed by response spectrum method using ETABS software. The main parameters compared in this study are lateral displacement, storey drift, base shear, overturning moment and storey stiffness. Shear wall without openings shows better performance when compared to all models. Compared to bare frame, displacement is reduced by 38.6%, drift reduced by 37.6%, storey shear increased by 114.8% and storey stiffness increased to 25.6x10^{6} kN/m. Performance of building with the combination of shear wall with openings and bracings is good. Compared to bare frame, displacement is reduced by 37.2%, drift reduced by 34.4%, storey shear increased by 74% and storey stiffness increased to 19.4x10^{6} kN/m. The results of model 4 and model 9 are almost equal. Combination of shear wall with openings and bracings will helps to achieve the economy and also increases the strength.
Keywords: Shear Wall, Bracings, Irregular Building, Seismic Analysis, ETABS, Storey Drift, Structural Stability

I. INTRODUCTION

A. General Introduction

When designing a building, it is important to consider the various irregularities that may exist in its structure. These irregularities can have a significant impact on the integrity and stability of the building, particularly in seismic zones. In this article, we will explore the different types of irregularities that can occur in building structures and their effects on the overall design. There are two main categories of irregularities that can be present in a building structure: vertical irregularity and horizontal (plan) irregularity.
Vertical irregularities refer to the irregular distribution of elements in the vertical plane of the building. These irregularities can include vertical set-back irregularity, re-entrant corners irregularity, mass irregularity, and stiffness irregularity. It is important to note that these irregularities can weaken the structure and lead to potential damage or collapse. Horizontal irregularities are characterized by irregular plot areas in which construction is carried out. These irregular structures are often proposed to make full use of the available land. However, designing such structures for seismic zone areas can be a complex task. Without proper analysis, irregular structures are vulnerable to earthquakes. Shear walls play a crucial role in providing earthquake and wind resisting strength to structures. These walls act as horizontal diaphragms that distribute lateral loads through the structure, parallel to the force of action. By adding shear walls to a building, its stability under lateral loading is enhanced. The orientation and location of shear walls significantly influence the behavior of the structure under lateral loads, as they determine the load distribution within the structure.

B. Re-entrant Corners

Re-entrant corners are another type of irregularity that can be present in a building's plan shape. A re-entrant corner occurs when the configuration of a building includes an inside corner. According to IS 1893 (Part 1): 2016, a building is considered to have a re-entrant corner if the projection of the corner is greater than 15 percent of its overall plan dimension in any plan direction.

C. Seismic Analysis

The purpose of seismic analysis is to evaluate the behavior of a structure when its foundation is subjected to dynamic loads and excitations. These loads can be of any type, such as the weight of people, wind, furniture, snow, or those caused by ground shaking (such as earthquakes); blasting activity near structures also causes ground movement. Static loads are very large, slow or static on time rate charts. Additionally, if the applied force changes significantly over time, it is classified as a dynamic force. The results of dynamic analysis are primarily expressed in terms of displacement and acceleration. This is because, unlike static analysis, forces are instantaneous with respect to time. Dynamic analysis shows the actual behavior of the structure compared to static analysis techniques. The equivalent structural analysis method is suitable for simple regular buildings of low to medium height.

D. Response Spectrum Analysis

The response spectrum analysis provides a linear-dynamic assessment of a building's response to lateral/seismic force. It considers the building's response to different modes of vibration independently and combines them to study their combined effects. Response spectrum analysis plays a crucial role in determining the peak response of a structure subjected to lateral/earthquake forces. By plotting the response spectrum curve, engineers can evaluate the structure's performance in past earthquake events. This analysis helps determine engineering properties like the natural period of vibration, foundation types, damping properties, importance factors, and structural ductility. Dynamic analysis offers valuable insights into a structure's behavior compared to static analysis methods. While equivalent static analysis works well for simple and regular buildings, dynamic analysis captures the instantaneous force changes over time. The outcomes of dynamic analysis are expressed mainly through displacement and acceleration, which provide more accurate representations of a structure's response to dynamic forces. The response spectrum for acceleration is expressed in terms of gravity and is called the average acceleration coefficient (Sa/g). The design acceleration spectrum specified in IS 1893-2016, for 5% damping factor.

E. Shear Wall

Shear walls are structurally engineered walls built into the frame of a building to increase lateral stiffness against ground movements and other types of lateral forces. Wall panels placed on the walls of buildings are intended to withstand lateral forces. A load-bearing wall is a cantilevered wall made of reinforced concrete that is built vertically from a foundation or footing. The shear wall design and details must be ductile to resist lateral forces and dissipate energy through the bending compliance of one or more plastic hinges. By installing shear walls, we can withstand not only earthquake force but also wind force (lateral force), increasing the strength of the structure. By installing shear walls in RC buildings, the rigidity of the structure is increased compared to buildings without shear walls, and lateral displacement is also minimized.

Research shows that the location of shear walls within a building plays an important role in the seismic design of the building. Many studies have shown that the most appropriate location for placing shear walls is where the center of gravity and center of mass have the same stiffness. In most cases, buildings with wall shears installed at the outer corners or edges of the building will have more effective results in reducing the lateral displacement of the building. Also, shear walls should be placed symmetrically to reduce the negative effects of torsion during construction.

F. Shear Wall with Openings

In building construction, shear walls play a crucial role in ensuring structural stability and resilience. Sometimes, these shear walls need to have openings for functional purposes, such as doors, windows, and other types of openings. These openings can be arranged vertically or in a staggered manner, and their size and location may vary depending on the specific needs and purposes they serve. It is essential to design and detail buildings with shear walls properly to ensure their optimal performance, especially in the face of earthquakes. Aside from their functional importance, openings in shear walls also provide benefits like ventilation, sunlight, and aesthetic appeal.

G. Bracings

A braced frame is a structural system specifically designed to withstand high wind forces and seismic activity. Unlike beams and columns, which primarily bear vertical loads, bracing systems are responsible for managing lateral loads acting on structures. By minimizing lateral deflection, bracings help maintain the structural integrity of buildings. They serve a crucial role in preventing buckling of main beams, enhancing the overall strength of the structure.

Bracings are installed to ensure additional safety against external loads, primarily in steel structures subjected to lateral forces from wind and earthquakes. By reinforcing the building with steel members, bracings enhance both tensile and compressive strength.

II. AIMS AND OBJECTIVES OF WORK

1) To investigate the most suitable location of shear wall and bracing on the basis of storey displacement under lateral loading.
2) To determine the seismic parameters of the structure such as storey displacement, storey drift, storey shear, overturning moment and storey stiffness.
3) To compare the results obtained due to the provision of shear wall and bracings with the results obtained in bare frame.
4) To compare the results of Limit state of Serviceability and Limit state of Strength.
5) To determine the best lateral load resisting system among the shear wall and bracing.

III. SCOPE OF PRESENT WORK

Very few buildings in India are properly designed by civil engineers. Proper analysis and design of architectural structures subjected to static and dynamic loads is very important. Another important factor when analyzing these systems is to consider the irregular shapes of tall buildings.

The accuracy and performance of the proposed structure are tested by linear dynamic analysis of the shear wall and stiffened frame system. For validation, the proposed model is performed considering a structural system in which shear walls and bracing are modeled using ETABS software. This analysis of lateral load-bearing elements in a building helps to increase the stability of the structure against displacements and reduce bending moments of vertical elements (columns). The scope of the study includes comparison of storey displacement, storey drift, storey shear force, overturning moment, and storey stiffness of G+19 storey irregular buildings of nine different models using ETABS software.

IV. LITERATURE REVIEW

Boria Anya, Tamal Ghosh [1] (2021), the present literature focuses on two different models with and without using shear walls at different positions. The article showcases the parametric study in terms of storey drift, displacement and base shear comparison for different location of shear wall in the building. The results are unique and fruitful for future attention.

Mohammad A. et al. [2] (2015), done comparative analysis of reinforced concrete frame building with bracing and shear wall. The reinforced concrete building (OMRF) having (G+15) storied were analysed in seismic zones II to V by using linear static method as per IS 1893 (PART 1):2002 in STAAD.Pro V8i. In this research, researchers concluded that shear wall element resist more lateral deflection than braced frame and bare frame. Also location of shear wall and bracings has significant effect on performance of the building. X bracing showed minimum possible bending moments comparison to other forms of bracings, reduced 35% to 45% lateral displacement of the building.

Thorat et al [3] (2014), had investigated seismic behaviour of RC Multi-Storied building with different shear wall versus bracing systems. The elastic dynamic method, response spectrum method was used to find out lateral displacement collaborated STAAD.Pro V8i. Comparison of floor displacement and axial force in members were done. Seismic zone III was considered for analysis. They come to the point that centrally situated shear wall and bracing elements resisted lateral displacements very efficiently as when shear wall is provided at core of the building reduced action of forces, lateral deflection or displacement and drift.

Biradar et al [4] (2014), studied on seismic response of RC structure by using different bracing systems. The seven models have been made and behaviour of all cases was determined by linear static and dynamic analysis, non-linear static and dynamic analysis using ETABS. Results comprised fundamental time period, base shear, storey drift has been evaluated and equated with bare frame. The conclusion is that cross bracing giving less seismic response leading to serviceable and stiff model, base shear obtained from IS code is not on a good agreement with values obtained from equivalent static and response spectrum analysis.

Shahzad Jamil Sardar et.al [5] (2013), modeled a 25 storey building zone V and analysed by changing the location of shear wall to determine various parameters like storey drift, storey shear and displacement using ETABS. Both static and dynamic analysis was done to determine and compare the base shear. Compared to other models, when shear wall placed at centre and four shear wall placed at outer edge parallel to X and Y direction model showed lesser displacement and inter storey drift with maximum base shear in addition strength and stiffness of the structure has been increased.

Nanjma Nainan et.al [6] (2012), conducted analytical study on dynamic response of seismo resistant building frames. The effects of change in height of shear wall on storey displacement in the dynamic response of building frames were obtained. From the study it was concluded that it is sufficient to raise the shear wall up to mid height of building frames instead of raising up to entire height of the building.

Rachakonda Divya, K.Murali [7] (2022), Analysed a structure with horizontal irregularity, vertical irregularity, stiffness irregularity and mass irregularity buildings with and without shear wall is considered and responses of the buildings are compared. Modelling of these 4 types of models with shear walls and without shear walls are done using ETABS software for G + 15 storey. The goal of the study is to compare model results like stiffness, displacement, shear and drift values and find out which model performs better. Vertical geometrical irregular building with shear wall has shown considerably better performance than other irregular buildings.

Ashish Kumar Gupta, Saleem Akhtar, Aslam Hussain [8] (2020), in this paper, seismic analysis has been done on G+ 10 storeys building in Zone IV. The analysis has been done considering shear wall of RCC and steel plate. Parameters like axial load, displacement, Overturning moment, stiffness etc. are determined for different location of shear wall.

Richa Gupta, Alfia Bano [9] (2019), this paper focuses on the performance of various shapes of shear wall in zone 5 namely: L-shaped, I-shaped, Rectangular-shaped & C-shaped. In this study G+6, G+16 and G+25 storeyed building is modelled and analysed for lateral displacement, storey stiffness, storey drift using ETABS-2016 software. The analysis of the building is done by using response spectrum method and the results obtained from this method are plotted graphically.

Barjesh Kumar, Gurpreet Singh [10] (2018), this paper concerned with different study cases of RCC buildings which consist of dissimilar types of shear wall i.e. I, T, L etc. and bracing systems i.e. X, V, Knee etc., their effect on parameters like bending moment, shear force, lateral displacement, fundamental time period, seismic base shear, storey drift. This project work concluded performance of shear wall and bracings under exposed conditions covering various geometries and orientations through structure analysis using software research applications.

Kasliwal.N.A et al [11] (2016), studied seismic analysis of reinforced concrete building with unrelated positions and numbers of shear wall. The reinforced concrete building having (G+9) stories with seismic zone V is analysed by using response spectrum method as per IS 1892 (PART 1):2002. Dynamic analysis has been done to know base shear, storey drift and displacement using ETABS. In this research, they concluded that building with complete shear wall shows lesser lateral displacement as compared to other frames. Also frame with shear wall from first storey carried good results and corner shear wall is good with low cost type.

Aarathi Harini T and G Senthil Kumar [12] (2015), analysed a seven storey building without opening, with vertical openings, and with staggered openings. The study was carried out using linear elastic analysis, with the help of finite element software ETABS, using response spectrum method. The comparative results showed that the time period, displacement, base shear and stress distribution around the openings depend on the arrangement of openings. They concluded that staggered openings in shear wall proved to be highly advantageous and they were found to provide better lateral resistance than shear walls with vertical openings.

M. Mosoarca [13] (2014), the paper presented the results of the theoretical and experimental tests on failure modes of three types of reinforced concrete shear walls with staggered openings which were compared to those obtained from walls with vertical ordered openings as far as the seismic response was concerned. The failure modes of the structural walls under seismic stress had been identified using calculus programs and cyclic alternated experimental tests.

Rahangdale and Satone [14] (2013), they stated that, shear wall systems are one of the most commonly used lateral load resisting member in high rise building. Shear wall has high in plane stiffness and strength which can be used simultaneously to resist large horizontal loads and support gravity loads. Incorporation of shear wall has become inevitable in multi-storey building to resist lateral forces. According to them, efficient and ideal location of shear wall of G+5 storey building in Zone IV is presented with some preliminary investigation which is analyzed by changing various position of shear wall with different shapes to determine parameter like axial load and moments. This analysis is done by using standard package STADD-PRO.

B.Kameshwari et al. [15] (2011), analysed the influence of drift and inter storey drift of the structure on various configuration of shear wall panels on high rise structures. The bare frame was compared with various configurations like i) Conventional shear wall ii) Alternate arrangement of shear wall iii) Diagonal arrangement of shear wall iv) ZigZag arrangement of shear wall v) Influence of lift core shear wall. From the study it was found that ZigZag shear wall enhanced the strength and stiffness of structure compared to other types. In earthquake prone areas diagonal shear wall was found to be effective for structures.

V. METHODOLOGY

In this chapter, a multi-storey irregular building has been modeled and analyzed considering all loads like Dead load, Live load, Seismic load as per as IS 1893 (Part 1) : 2016 standard and Wind Load as per as IS 875 : 2015 standard. In this study, the analysis of structure is carried out for lateral loads using Response Spectrum Method.

In this work, a high-rise G+19 building with re-entrant corners subjected to high seismic loads is analyzed and designed. This building is believed to be located in Bhuj, one of the most earthquake-prone regions (Zone V) of India. To improve the stability of the building against lateral loads, additional structural elements such as shear walls and braces are inserted into the structure and analyzed. This was modeled and analyzed using ETABS 20 software.

TABLE I
LIST OF MODELS DEVELOPED FOR PRESENT WORK

Model No.	Type of Model
Model 1	Irregular building without shear wall
Model 2	Irregular building with shear wall openings at corners on each side
Model 3	Irregular building with shear wall openings at centre on each side
Model 4	Irregular building with shear walls at corners on each side
Model 5	Irregular building with shear walls at centre on each side
Model 6	Irregular building with cross bracings at corners on each side
Model 7	Irregular building with cross bracings at centre on each side
Model 8	Irregular building with shear walls and bracings on two opposite sides
Model 9	Irregular building with shear wall& bracings combination at each corner

TABLE II
GEOMETRIC DETAILS OF BUILDING

Description	Specification
Plan dimension	Irregular
No. of stories	G+19
Typical storey height	3 m
Bottom storey height	3.2 m
Thickness of shear wall	250 mm
Thickness of slab	150 mm

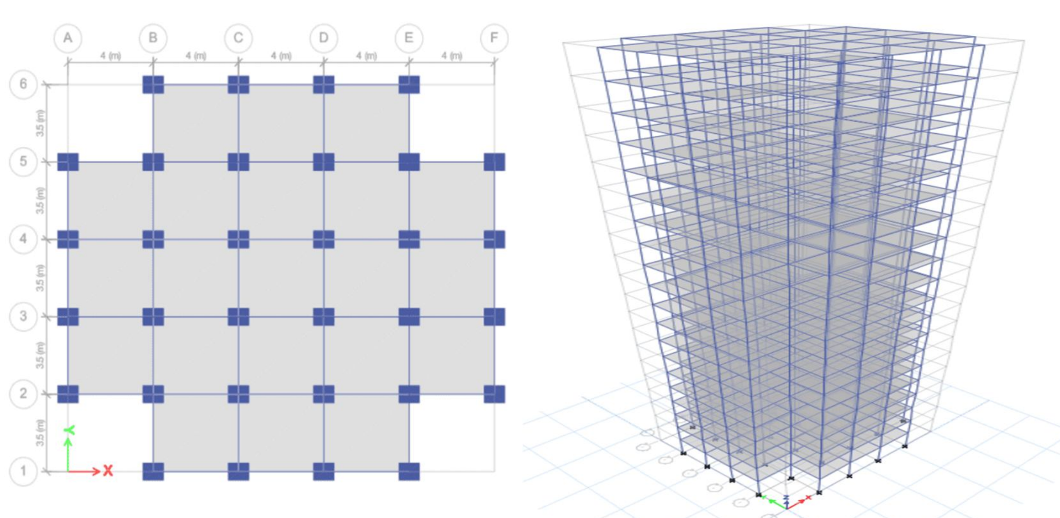


Fig. 1 Plan and 3D view of Irregular building without shear wall

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue VIII Aug 2025- Available at www.ijraset.com

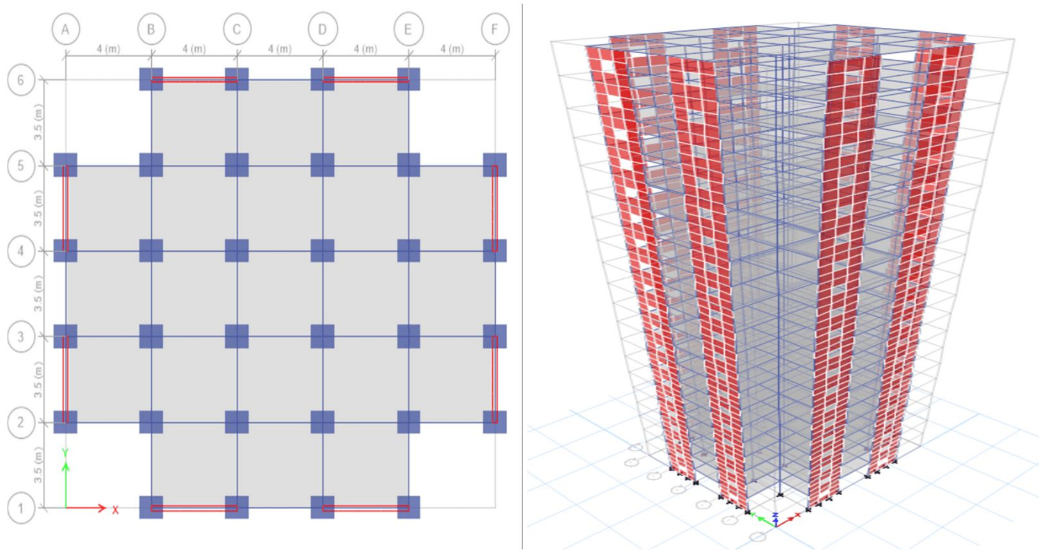


Fig. 2 Plan and 3D view of Irregular building with shear wall openings at corners on each side

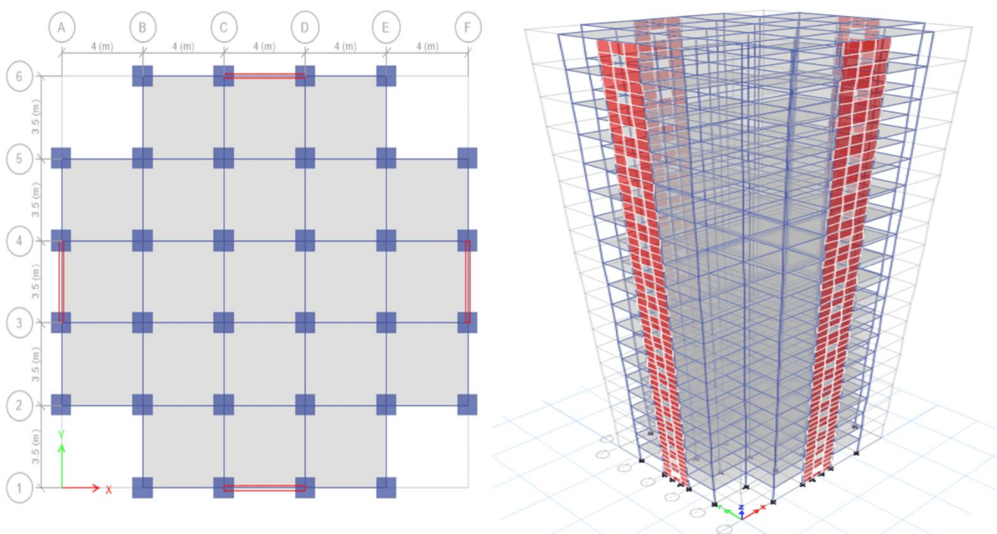


Fig. 3 Plan and 3D view of Irregular building with shear wall openings at centre on each side

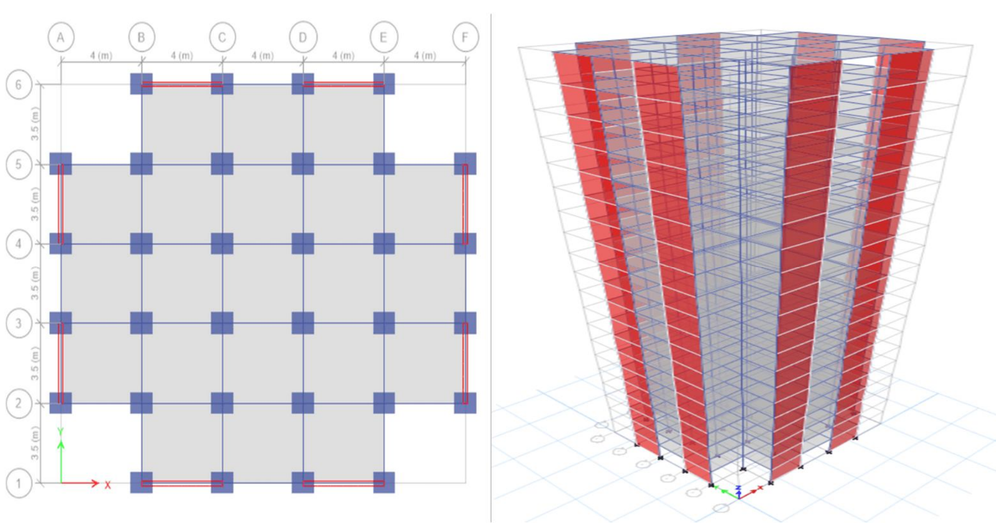


Fig. 4 Plan and 3D view of Irregular building with shear walls at corners on each side

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue VIII Aug 2025- Available at www.ijraset.com

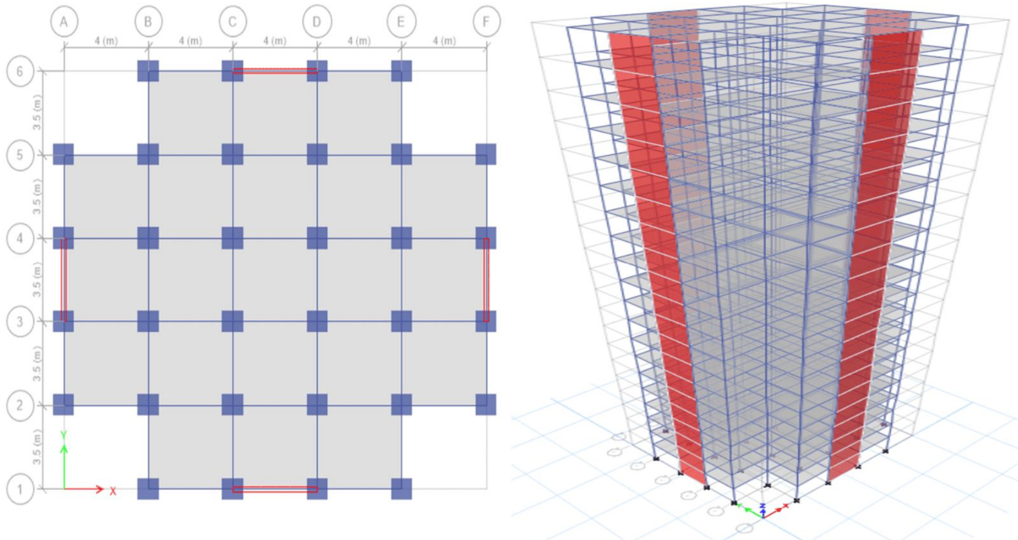


Fig. 5 Plan and 3D view of Irregular building with shear walls at centre on each side

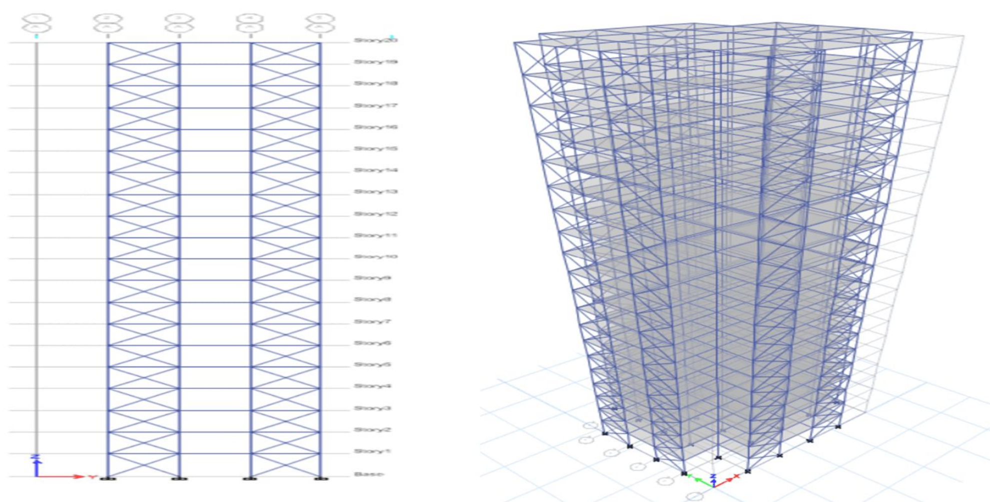


Fig. 6 Elevation and 3D view of Irregular building with cross bracings at corners on each side

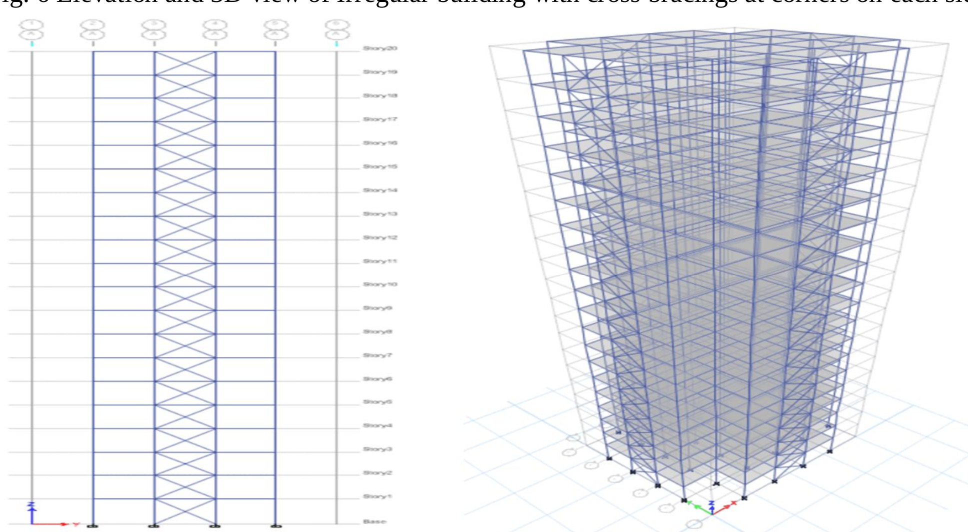


Fig. 7 Elevation and 3D view of Irregular building with cross bracings at centre on each side

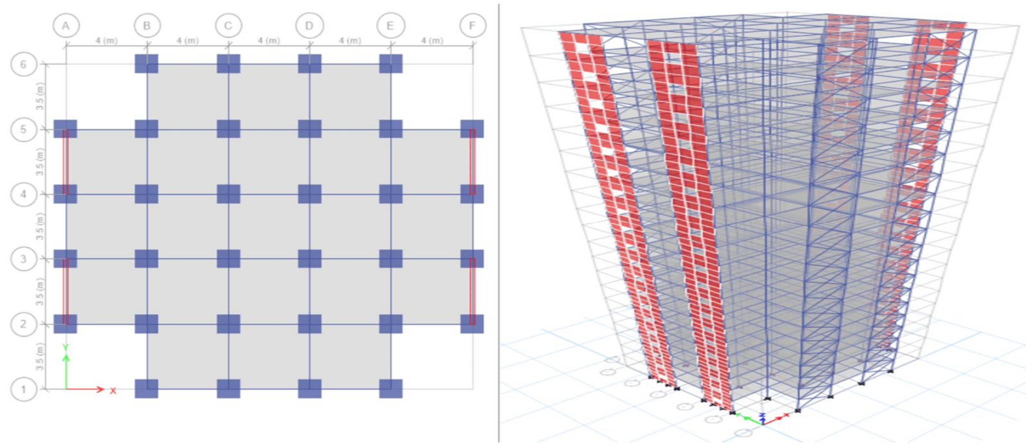


Fig. 8 Plan and 3D view of Irregular building with shear walls and bracings on two opposite sides

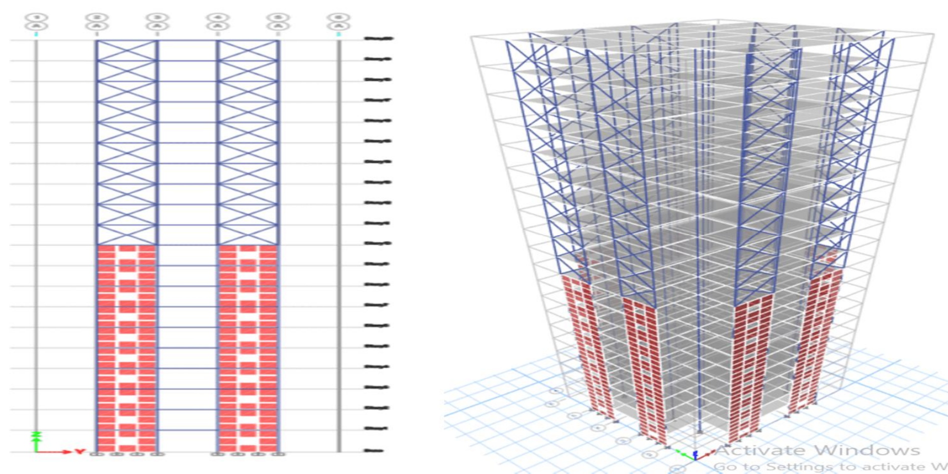


Fig. 9 Elevation and 3D view of Irregular building with shear wall& bracings combination at each corner

VI. RESULTS AND DISCUSSIONS

Structural analysis is performed on all nine models using ETABS software. The parameters determined by the analysis include the storey deflection, storey drift, storey shear force, overturning moment, and storey stiffness that occur when the structure is subjected to earthquake loads. The results are given below graphical form.

A. *Storey Response Plots*

Fig. 10 Relationship between storey level and displacement

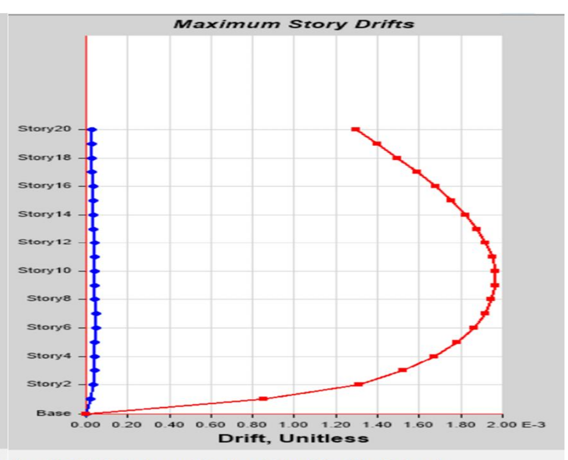


Fig. 11 Relationship between storey level and drift

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue VIII Aug 2025- Available at www.ijraset.com

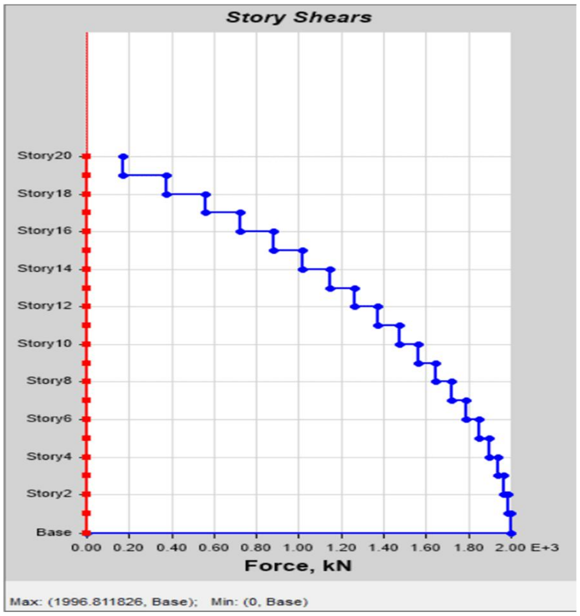


Fig. 12 Relationship between storey level and storey shear

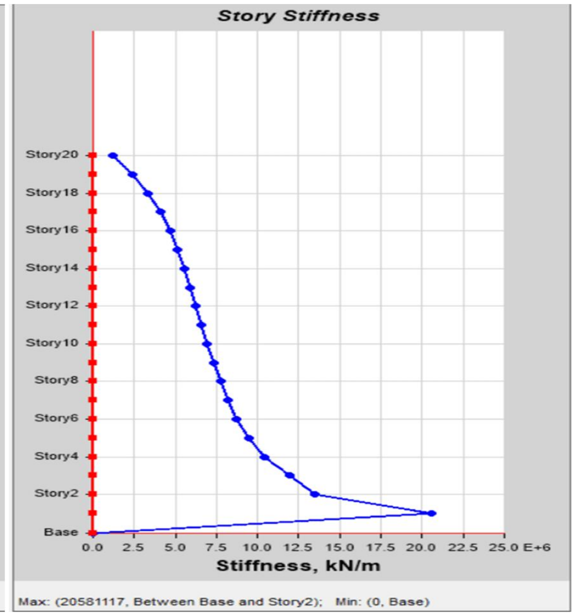


Fig. 13 Relationship between storey level and storey stiffness

From Fig. 10, It has been concluded that storey displacement increases with increase in height of structure. For all the models, the maximum displacement is occurred at the top storey of building and the displacement is zero at the base.

From Fig. 11, If we observe from the base of the structure the storey drift increases and then decreased at top. Maximum storey drift occurred at the middle of the structure.

Base shear is the maximum lateral force or the reaction force that occurs at the base of the structure due to the ground motion during earthquake. From Fig. 12, It has been concluded that the maximum storey shear occurred at the base of the structure.

Storey stiffness indicates the resistance offered during the occurrence of earthquake. We can say that the structure acts as rigid at the base. So the stiffness is maximum at the base of the structure.

B. Comparision of Parameters with Various Models

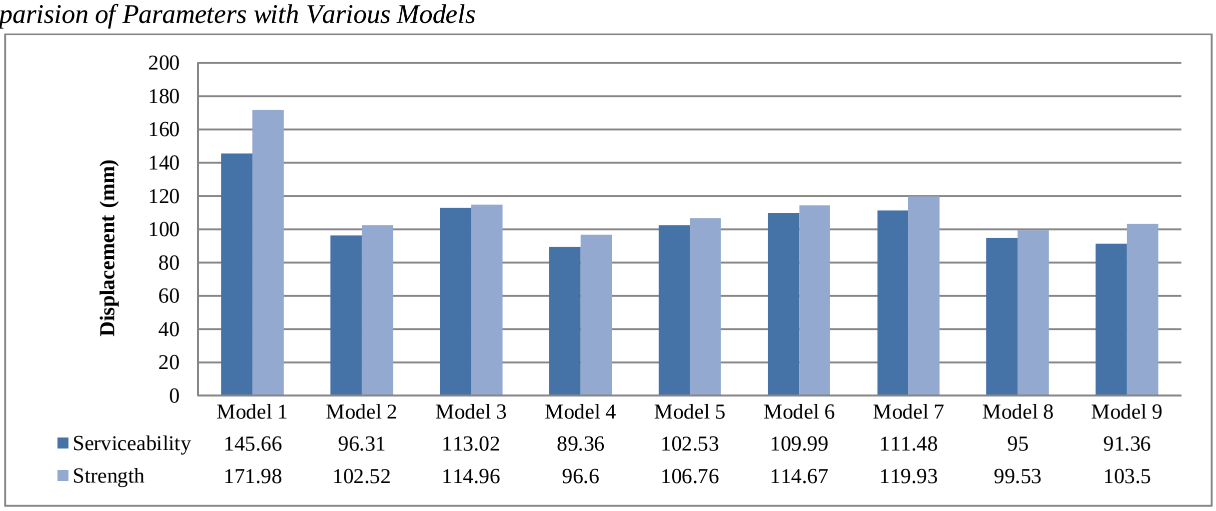
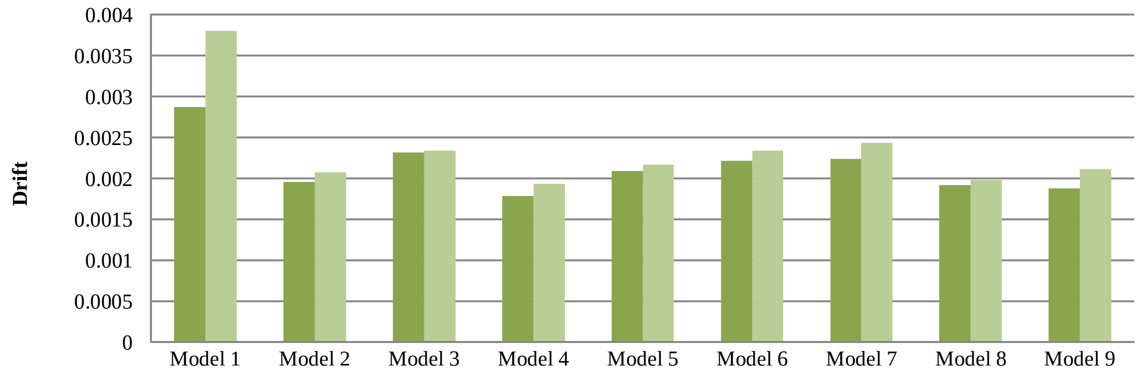


Fig. 14 Maximum displacement for various models

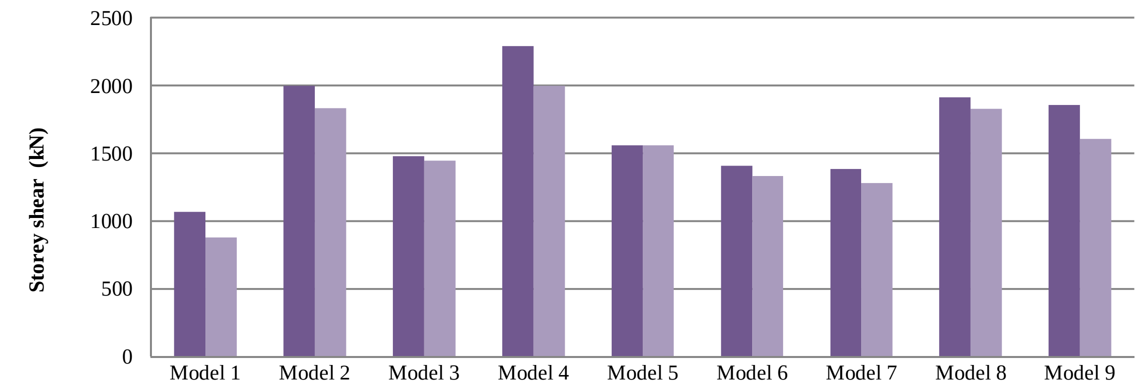
The maximum displacement for bare frame (model 1) is 145.66 mm in serviceability criteria and 171.98 mm in strength criteria which exceeds the maximum limit. After providing the shear walls in model 4 displacement reduced to 89.36 mm in serviceability criteria and 96.6 mm in strength criteria. After providing bracings in serviceability criteria displacement reduced to 109.99 mm in model 6. For shear wall and bracing combination in model 9 displacement reduced to 91.36 mm.



	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Serviceability	0.00287	0.00196	0.00232	0.00179	0.00209	0.00222	0.00224	0.00192	0.00188
Strength	0.0038	0.00208	0.00234	0.00194	0.00217	0.00234	0.00244	0.00198	0.00212

Fig. 15 Maximum storey drifts for various models

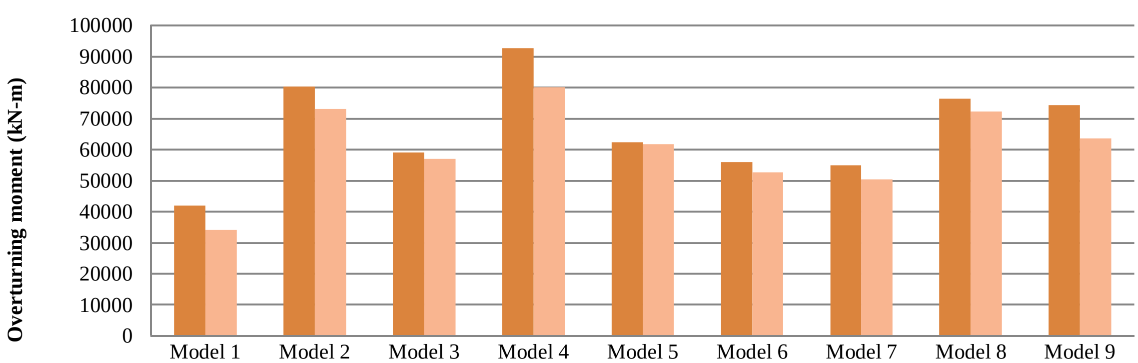
The storey drift for bare frame is 0.00287 in serviceability criteria and 0.0038 in strength criteria and it is maximum when compared to all models. Storey drift is minimum for model 4 that is 0.00179 in serviceability criteria and 0.00194 in strength criteria.



	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Serviceability	1067.49	1996.81	1479.06	2293.33	1559.01	1408.04	1386.34	1912.62	1857.64
Strength	881.1	1833.64	1447.8	2000.67	1557.54	1335.29	1282.59	1827.29	1606.21

Fig. 16 Maximum storey shear for various models

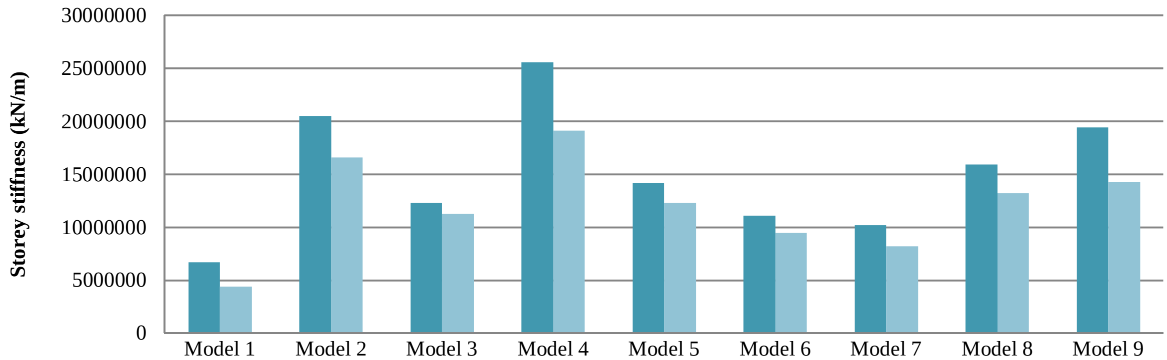
Storey shear for the bare frame is 1067.49 kN in serviceability criteria and 881.1 kN in strength criteria. After providing shear walls in model 4 it is increased to 2293.33 kN in serviceability criteria and 2000.67 kN in strength criteria. After providing bracings in model 6 storey shear increased only up to 1408.04 kN in serviceability criteria and 1335.29 kN in strength criteria. For shear walls and bracings combination in model 8 storey shear reached to 1912.62 kN in serviceability criteria and 1827.29 kN in strength criteria.



	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Serviceability	41966.57	80420.5	59017.29	92778.41	62357.52	56062.49	55058.2	76371.74	74367.81
Strength	34127.67	73143.7	57053.33	80148.83	61735.63	52651.54	50394.85	72374.71	63611.14

Fig. 17 Maximum overturning moments for various models

The overturning moment is minimum for bare frame that is 41966.57 kN-m in serviceability criteria and 34127.67 kN-m in strength criteria. Among all the models overturning moment is maximum for model 4 that is 92778.41 kN-m in serviceability criteria and 80148.83 kN-m in strength criteria.



	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Serviceability	6700000	20500000	12300000	25600000	14200000	11100000	10200000	15900000	19400000
Strength	4400000	16600000	11300000	19100000	12300000	9500000	8200000	13200000	14300000

Fig. 18 Maximum storey stiffness for various models

From the graph, it is very much clear that storey stiffness is significantly higher for building provided with shear walls that is 25.6×10^6 kN/m in serviceability criteria and 19.1×10^6 kN/m in strength criteria. Storey stiffness very much lower for normal reinforced concrete building that is 6.7×10^6 kN/m in serviceability criteria and 4.4×10^6 kN/m in strength criteria.

VII. CONCLUSIONS

Shear walls and bracings are placed in such a way that the symmetry of the structure is maintained. From the comparison of the results it is found that the optimum location of shear wall with openings, without openings and bracings is found at the corners of the building. The performance of building without any lateral force resisting member is poor. For serviceability criteria, the maximum displacement for bare frame is 145.66 mm which exceeds maximum limit and stiffness for the bare frame is 6.7×10^6 kN/m which is less compared to the building with shear walls and bracings. For strength criteria, the maximum displacement for bare frame is 171.98 mm and stiffness is 4.4×10^6 kN/m.

Shear wall with openings shows better performance. For serviceability criteria, after comparing to bare frame displacement is reduced by 33.8%, drift reduced by 31.7%, storey shear increased by 87% and storey stiffness increased to 20.5×10^6 kN/m. For strength criteria, after comparing to bare frame displacement is reduced by 40.3%, drift reduced by 45.2%, storey shear increased by 108.1% and storey stiffness increased to 16.6×10^6 kN/m.

Shear wall without openings shows better performance when compared to all models. For serviceability criteria, after comparing to bare frame displacement is reduced by 38.6%, drift reduced by 37.6%, storey shear increased by 114.8% and storey stiffness increased to 25.6×10^6 kN/m. For strength criteria, after comparing to bare frame displacement is reduced by 43.8%, drift reduced by 48.9%, storey shear increased by 127% and storey stiffness increased to 19.1×10^6 kN/m.

After providing the bracings, displacements are within the limits. For serviceability criteria, after compared to bare frame displacement is reduced by 24.4%, drift reduced by 22.6%, storey shear increased by 31.9% and storey stiffness increased to 11.1×10^6 kN/m. For strength criteria, after compared to bare frame displacement is reduced by 33.3%, drift reduced by 38.4%, storey shear increased by 51.5% and storey stiffness increased to 9.5×10^6 kN/m.

Building with the combination of shear wall with openings and bracings shows better performance. For serviceability criteria, after comparing to bare frame displacement is reduced by 37.2%, drift reduced by 34.4%, storey shear increased by 74% and storey stiffness increased to 19.4×10^6 kN/m. For strength criteria, after comparing to bare frame displacement is reduced by 39.8%, drift reduced by 44.2%, storey shear increased by 82.2% and storey stiffness increased to 14.3×10^6 kN/m.

The presence of openings in shear wall give approximately same result as that of the shear wall without opening. So by providing openings in shear wall ultimately helps to achieve the economy.

From the results we can say that, If the building is safe in limit state of strength then it is automatically safe in limit state of serviceability.

REFERENCES

[1] Anubhav Boshat, Dr. R.R.L Birali, Prof. GargiDanda (2022), "Design and Analysis of Shear Wall for 10 Storey Building", International Journal of Advances in Engineering and Management (IJAEM), Volume 4, Issue 7, 1055-1074.

[2] Rachakonda Divya, K. Murali (2022), "Comparative analysis of behaviour of horizontal and vertical irregular buildings with and without using shear walls by ETABS software", Materials Today: Proceedings 52, 1821–1830.

[3] Boria Anya, Tamal Ghosh (2021), "A Study on Effect of Shear Wall in Seismic Analysis of Building", IOP Conference Series: Earth and Environmental Science 796.

[4] Pradyut Anand (2021), "A Review on Performance of Shear Walls and Cost Optimization of the Structures based on Different Shear Walls Position", International Journal of Engineering Research & Technology, Vol. 10 Issue 04.

[5] S. Bharath, B. V. Vishal, S. Kavitha, and P. Mamatha (2021), "Seismic Analysis of Irregular Multi-storey Building with Bracing and Shear Wall Using Flat Slab".

[6] Ashish Kumar Gupta, Dr. Saleem Akhtar, Dr. Aslam Hussain (2020), "Analysis of A Tall Building with Shear Wall of RCC and Steel Plate", International Journal of Engineering Research & Technology (IJERT), Vol. 9 Issue 01.

[7] H.R.Nikhade, A.R.Nikhade, M.R.Wagh, R.M.Bhagat, S.G.Hirekhan, A.R.Gajbhiye (2019), "Critical Study on Curtailment of Shear Walls on Building", International Research Journal of Engineering and Management Studies (IRJEMS), Volume: 03 Issue: 04.

[8] Richa Gupta, Alfia Bano (2019), "Performance Evaluation of Various Shapes of Shear Wall using Response Spectrum Analysis", International Journal of Recent Technology and Engineering (IJRTE), Volume-8, Issue-1.

[9] Barjesh Kumar, Gurpreet Singh (2018), "A Review on Seismic Response of Multi Storied RC Building with Different Shear Wall and Bracing Systems", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 7, Issue 2.

[10] Rajat Bongilwar, V R Harne and Aditya Chopade (2018), "Significance of Shear Wall in Multi-Storey Structure With Seismic Analysis", IOP Conf. Series: Material Science and Engineering 330.

[11] Sylviya B, P. Eswaramoorthi (2018), "Analysis of RCC Building with Shear Walls at Various Locations and In Different Seismic Zones", International Journal of Innovative Technology and Exploring Engineering (IJITEE), Volume-8 Issue-2.

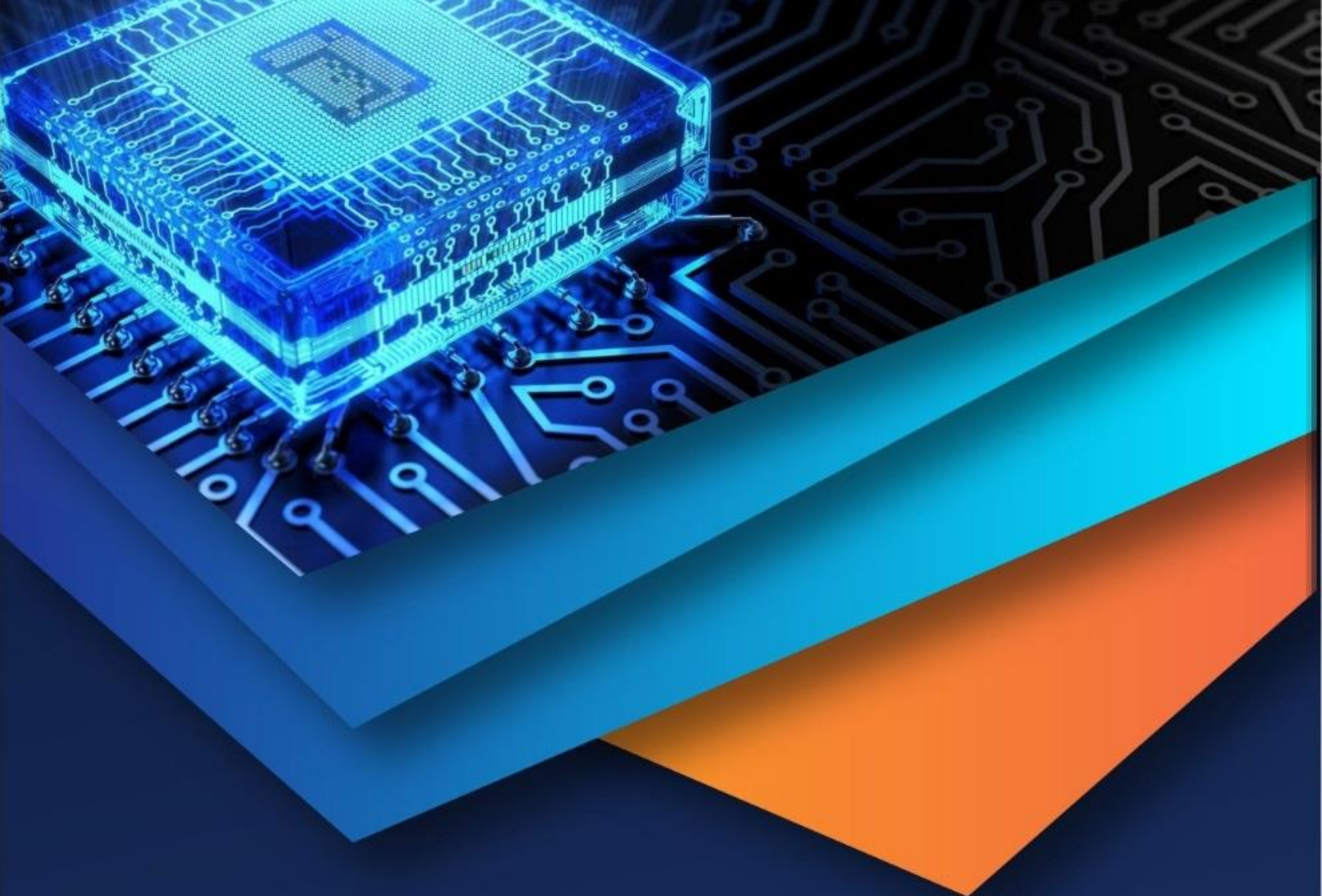
[12] Abhija Mohan, Arathi S (2017), "Comparison of RC Shear Wall with Openings in Regular and Irregular Building", International Journal of Engineering Research & Technology (IJERT), Vol. 6 Issue 06.

[13] Dharanya A, Gayathri S , Deepika M (2017), "Comparison study of shear wall and bracings under seismic loading in multi-storey Residential Building", International Journal of ChemTech Research, Vol.10 No.8, pp 417-424.

[14] Harshal M. Banubakode, BhushanH.Shinde (2017), "Influence of openings in Shear wall in High Rise Building", IJEDR Volume 5, Issue 2.

[15] R.Resmi, S.YaminiRoja (2016), "A Review on Performance of Shear Wall", International Journal of Applied Engineering Research, Vol. 11 No.3.

[16] Ruchi Sharma, Jignesh A. Amin (2015),"Effects of opening in shear walls of 30- storey building", Journal of Materials and Engineering Structures 2, 44–55.



10.22214/IJRASET

INDEX COPERNICUS

45.98

IMPACT FACTOR: 7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY