International Journal for Research in Engineering Application & Management (IJREAM)
ISSN : 2454-9150 Vol-10, Issue-07, Oct 2024

Performance of Regular and Irregular Building Plan with Shear Wall and Dampers

Syed Muzamil, Structural Engineering, Veerappa Nisty Engineering College Shorapur, Yadgir, Karnataka, India, syedmuzamil@743@gmail.com

Abstract **With the massive loss of life and property experienced in the last several years , Due to the breakdown of constructions caused by earthquakes in India during the last few decades ,the country is now paying attention . being given to the evaluation of the adequacy of strength in framed RC structures to resist strong ground motions. In this project a G+20 multi storey building of regular and irregular configuration with four different structures such as bare frame, dampers , shear wall , dampers and shear wall under seismic load. In this project a G+20 multi storey building is studied for seismic load using ETABS. Assuming the material properties , dimensions of beam and column for the analysis and the analysis carried out by Response Spectrum method. After analysis the results such as storey displacement , storey drift , storey stiffness , time period and base shear were compared with different models and also the effects of shear walls and dampers on the bare frame were studied. For the analysis the different loads are considered as per IS 875 code. The seismic Zone III and Zone IV was considered and properties of these zones were taken according to IS: 1893-2002 part 1 code.**

Keywords —Plan regular building , Plan irregular building ,Dampers , Shear wall , AutoCAD , ETABS

I. INTRODUCTION

For meeting their demands in every area, human civilisation needed buildings. But it's not just about constructing things; it's about making-sure those things are efficient enough to do their intended function. At this point, structural analysis—a subfield of civil engineering—comes into play. While new software is always being developed, there are numerous ancient approaches that might be utilised to tackle design problems. Lot of buildings out there with haphazard layouts on both the ground and upper levels. Seismic damage is more severe in buildings and structures when the distribution of stiffness, mass, and strength is not uniform. Torsional motion is characteristic of earthquakes that have occurred in the past. Buildings were thought to be torsionally balanced if they had an equal distribution of mass & stiffness across all stories and into design to withstand the lateral strains applied by an earthquake. Because of constraints like architectural requirements and functional considerations, obtaining such condition is very challenging.

II. OBJECTIVES

1. For purpose of researching STOREY stiffness, shear, displacement, and time.
2. In order to learn how shear walls and dampers affect both flat and curved structures.
3. In order to learn how dampers affect the structural behaviour of tall structures.
4. Utilising Response Spectrum Method, we will compare and contrast regular and irregular structures.
5. In order to evaluate the differences between actions of normal and non-standard construction.

III. METHODOLOGY

The performance of a Reinforced Concrete framed structure is dependent on both the members themselves and the joints that make up the frame. Under earthquake stress conditions, the joints in Reinforced Concrete framed buildings can experience very high loads. Recent earthquakes have wreaked havoc on many nations, including India, causing devastating devastation. The structural performance, particularly the beam-column junction performance, is critical to preventing this kind of damage. Research into the use of various materials, such as dampers and shear walls, to enhance the load bearing capability of Reinforced Concrete framed structures is ongoing.

IV. Building details

The primary objective of acquiring this knowledge is to examine the seismic behaviour of high-rise buildings framed with Reinforced Concrete when applied or exposed to seismic stresses using different models. Below, you can see the building's assumed column and beam size, orientation, and location, as well as G+20 story RC frame that have used for this research. We looked at this framed construction made of Reinforced Concrete. The location of the beams and

 DOI : 10.35291/2454-9150.2024.0371

ISSN : 2454-9150 Vol-10, Issue-07, Oct 2024

columns, & other factors in the architectural design, are utilised for determining their names.

Description of Models

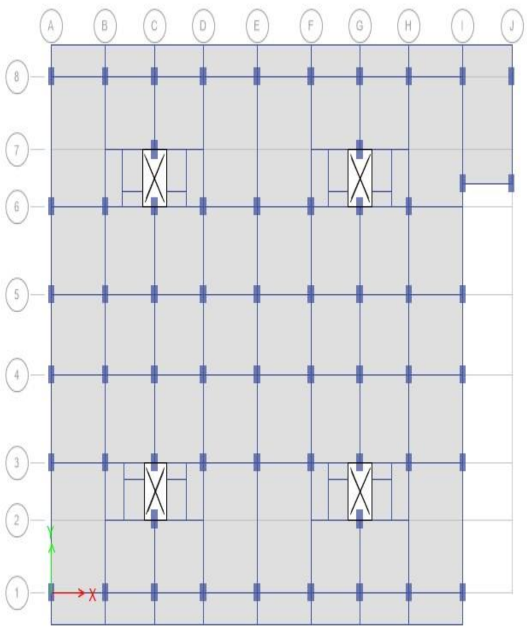
Description of models for regular plan (ZONE III and ZONE IV)

1. Bare frame moddel
2. Bare frame with dampers
3. Bare frame with shear wall
4. Bare frame with shear wall and dampers

Description of models for irregular plan (ZONE III and ZONE IV)

1. Bare frame model
2. Bare frame with damper
3. Bare frame with shear wall
4. Bare frame with shear wall and damper

5. Layout of the plan for every model is shown in figures below



5. Modeling different models in ETABS-Software:

Regular Plan-Models

Fig 4.1 Regular building plan

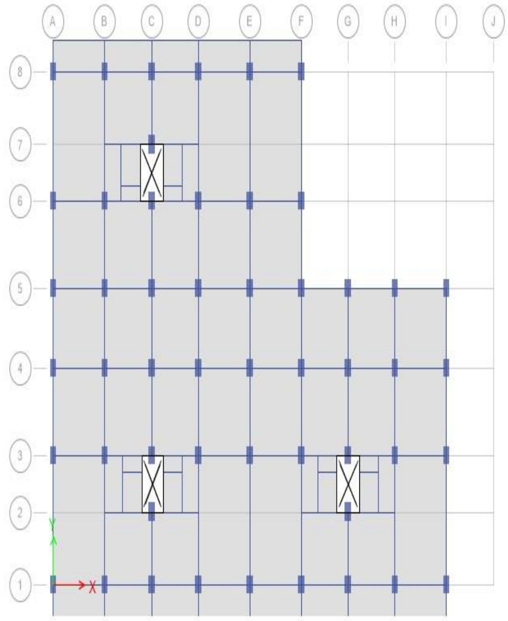


Fig 4.2 Plan of the irregular building

 DOI : 10.35291/2454-9150.2024.0371

ISSN : 2454-9150 Vol-10, Issue-07, Oct 2024

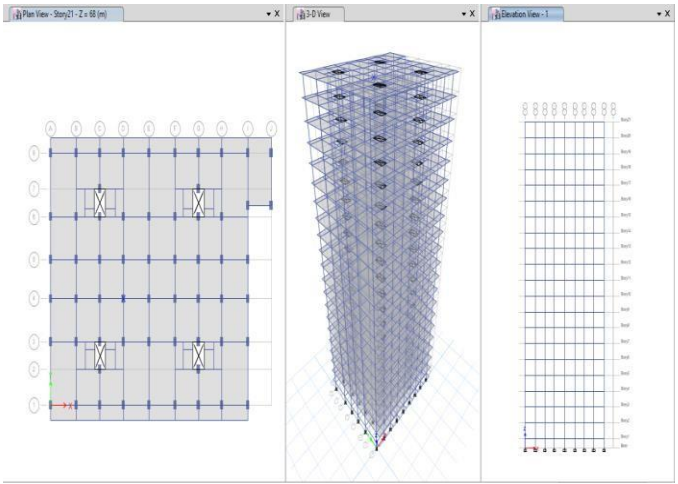


Fig 5.1 Plan, 3D model & Elevation of bare-frame for frame regular-plan

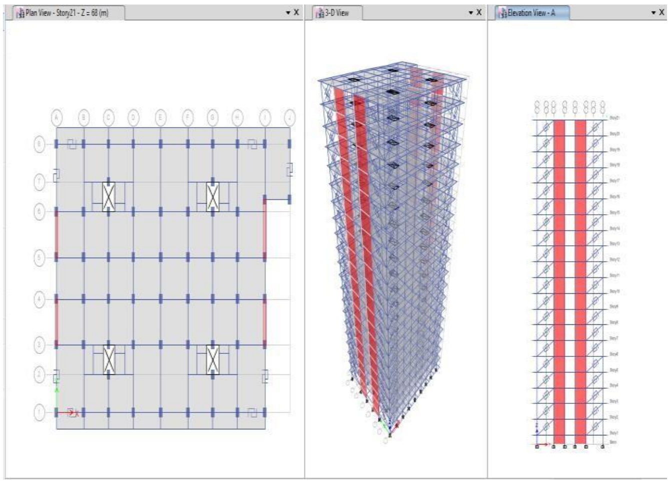


Fig 5.4 Plan, 3D model & Elevation of bare-with dampers & shear wall for regular-plan

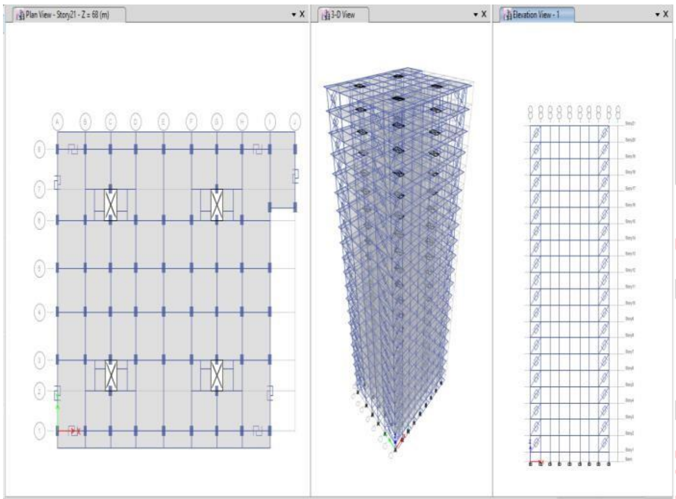


Fig 5.2 Plan, 3D model and Elevation of bare-bare-frame with damper for regular plan

IRREGULAR PLAN MODELS

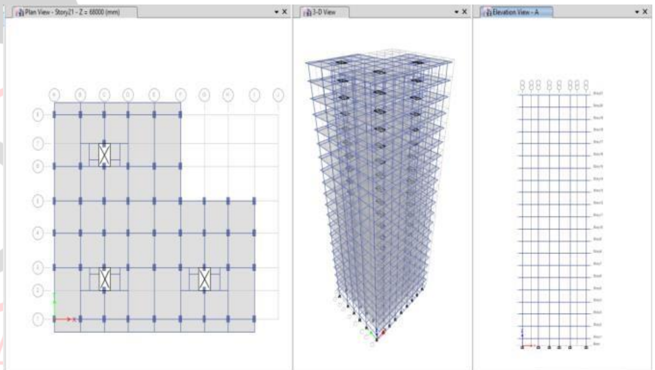


Fig 5.5 Plan, 3D model & Elevation of frame for irregular-plan

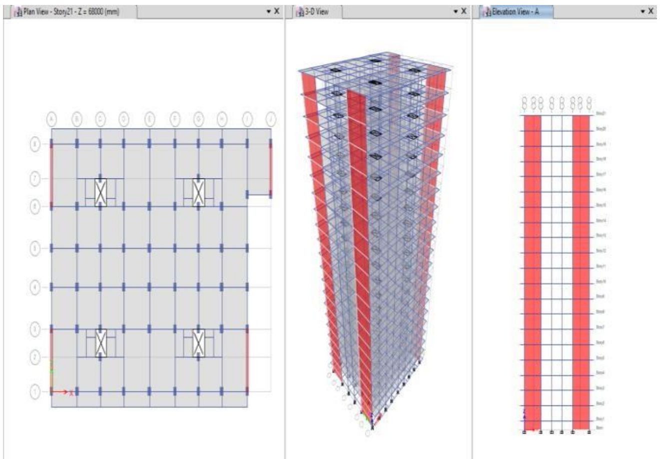
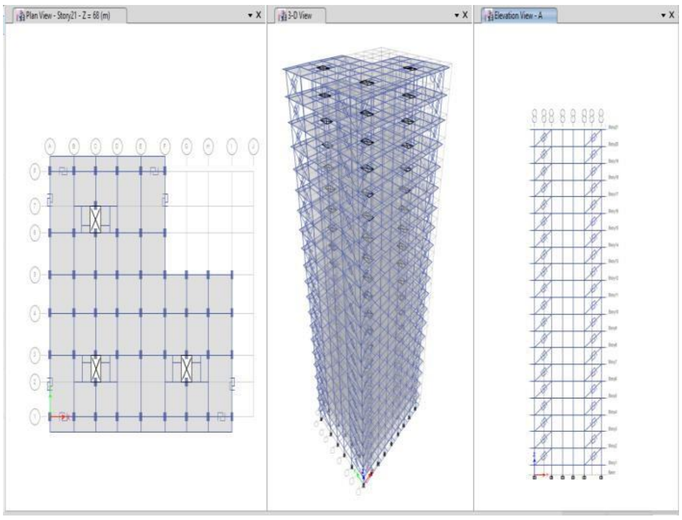


Fig 5.3 Plan, 3D model & Elevation of bare-frame with shear-wall for regular-plan



DOI : 10.35291/2454-9150.2024.0371

Fig 5.6 Plan, 3D model & Elevation of bare-frame with damper for irregular- plan

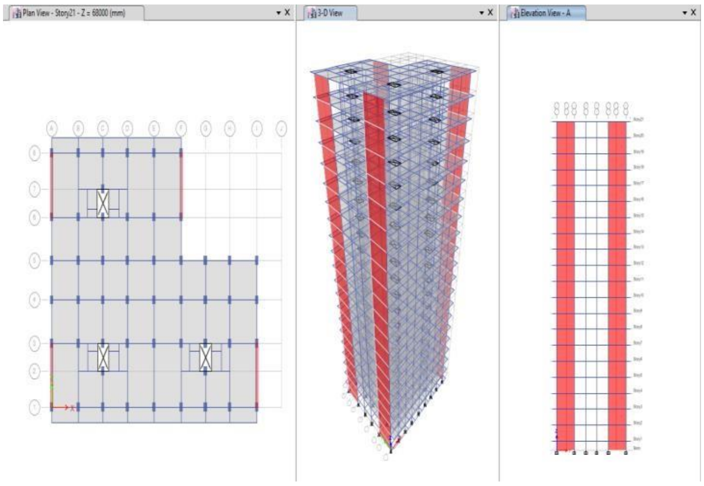


Fig 5.7 Plan, 3D-model & Elevation of bare-frame with shear wall for irregular-plan

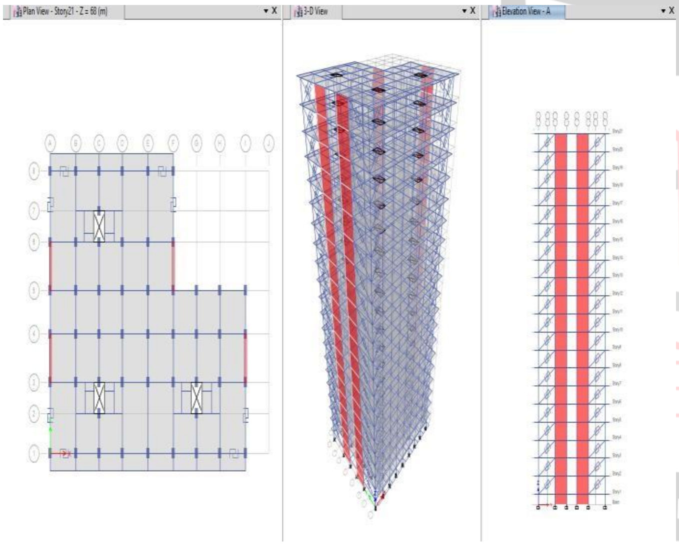


Fig 5.8 Plan, 3D-model & Elevation of bare-frame with dampers & shear wall for irregular plan

V. RESULT

1. A time reduction of 1.083% compared to bare-frame model is achieved in the regular & irregular models with shear-walls. Adding damper to a bare-frame model shortens time period by 5.35 percent; adding a shear-wall and a damper together shortens time period by 8.27 percent.
2. While damper with damper bare-frame, storey displacing decreases by 8.88% in X-direction and 12.27% in Y-direction. Adding shear wall decreases displacement by 10.79% in X-direction and 7.22% in the Y-direction, correspondingly, when comparing to bare-frame model. With strucure zone-III, adding both a damper and a shear-wall reduces the displacement by 11.38% in the X-direction and 35.34% in Y-direction, respectively.
3. Adding a damper to an uncovered frame raises the drift by 14.11% in X-direction and 14.93% in the Y-direction, whereas adding a shear wall reduces the drift by 22.85% in the X-direction & increases it by 497.3% in the Y-direction for a typical structure.
4. For irregular-building zone-III, adding a damper to an uncovered frame causes a 16.18% rise in X-direction drift and a 10.38% decrease in Ydirection drift; adding a shear wall causes a 19.31% reduction in X-direction drift and a 37.56% increase in Y-direction drift.
5. After adding the damper with bare frame, the Storey-stiffness in X-direction decreases by 8.66% and in Y-direction it increases by 5.32% for regular buildings. However, when shear-walls are also added, the Storey-stiffness in regular building zones III and IV increases by 29.08% in X-direction and decreases by 6.43% in the Y-direction. Finally, when shear walls & dampers are added, the Storeystiffness in regular buildings zones III and IV increases by 16.41% in X-direction & by 15.43% in Y-direction. Adding a damper to an otherwise bare-frame increases the Storey shear in the X-direction by 6.86% for a typical structure.
6. For irregular buildings, addition of a damper to bare-frame increases the storey shear by 9.27% in the X-direction.

VI. Conclusion

- The research found that improving stiffness in models via the application of friction dampers in bare-frames efficiently minimises the time period, drift, and displacement. For managing and reduce the structure's seismic reaction, friction damper devices are crucial.
- Reducing storey displacement & storey drifting in both regular & irregular models, the usage of shear wall in bare-frame is found to be quite effective.
- It is determined that, from a storey-shear perspective, models with dampers and shear walls exhibit higher storey-shear than models without shear walls. While comparing to regular models, irregular ones experience the most displacement and drift. So, it seems that irregularly shaped structures are more-likely to experience significant deformation and damage

 DOI : 10.35291/2454-9150.2024.0371

from intense ground motions compared to regular-plan buildings.

- This term denotes substntial lateral force that is anticipated to occur at the base of a structure as a consequence of seismic ground motion.

REFERENCES

[1] MohammedArshad Hussin Aamir, Prof.Amaresh.S.Patil "Comparitive study of seismic performance of regular and irregular plan buildings with dampers, shear walls and infill walls".International Journal of Technical Innovation in Modern Engineering and

[2] Science(IJTIMES), Volume 4, Issue 7,July-2018, e-IISN:2455-2585.

[3] Deepna U, Arjun S Menon,S.Balamurugan "A comparative study on shear wall concept in accordance its seismic behavior". International Journal of Engineering and Technology, Volume 7,Issue 4.5, 2018,e-182-187.

[4] Puneet Sajjan , Praveen Biradar "Study on the effect of viscous damper for RCC frame structure".International

[5] Journal Research in Engineering and Technology(IJRET), Volume:05, Issue:09,eISSN:2319-1163,pISSN:2321-7308.

[6] Sanjay Sengupta "Study of shear walls in multistoried buildings with different thickness and reinforcement percentage for all seismic zones in India". International

[7] Journal Research of Enginerring and Technology(IJRET),Volume:03,Issue:11,eISSN:23197 308.

[8] S K Abid Sharief, M Shiva Rama Krishna, S V

[9] Surendhar "A Case Study on Seismic Analysis of an

[10] Irregular Structure". International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8 Issue-6, April 2019 .

[11] Chaitra H N, Dr B Shivakumara Swamy "Study On Performance Of Regular And Vertically Irregular

[12] Structure With Dampers, Shear Wall And Infill Wall". International Research Journal of Engineering and

[13] Technology (IRJET), Volume: 03 Issue: 10 | Oct 2016, p-ISSN: 2395-0072.

[14] Kapil P. Gunjal , Prof. Sanket S. Sanghai " Seismic Analysis of Building Using Dampers In Shear

[15] Walls".International Journal of Innovations in Engineering and Science, Volume: 4,Issue No:6, 2019,e-ISSN:2456-3463.

[16] Rakhimol. S and Ms. Smrithi Cheriyath "Seismic Response Control of Irregular Shaped RCC Buildings by using Nonlinear Viscous Damper". International Journal of Engineering Research and Technology (IJERT), Volume 6, Issue 06, ISSN: 2278-0181.

[17] Mayuri M. Baviskar and Prof. L. G. Kalurkar "Storey Response of G+40 Horizontally Connected Buildings with Dampers". International Journal of Engineering Research and Technology(IJERT), Volume:09,

[18] Issue:07,July-2020, ISSN: 2278-0181.

[19] Ankit Jain "Performance of High Rise Structure with Dampers at Different Location". International Journal of Engineering Research and Technology(IJERT), Volume:05, Issue:07, July-2016, ISSN: 2278-0181.

 DOI : 10.35291/2454-9150.2024.0371