A Comparative Review of Structural Performance in Multi-Storey Buildings with Steel Bracing and Shear Walls

Narendra Kumar Yadav [1] Vijay Kumar Shukla [2] Kamlesh Ratre[3]

1. M.Tech Scholar, Civil Engineering VEC Ambikapur
2. Assistant Professor, department of Civil Engineering VEC Ambikapur
3. Assistant Professor, department of Mechanical Engineering VEC Ambikapur

ABSTRACT

In this study, we compared cross section steel bracing and shear wall in multi-storey buildings. We analyzed the advantages and disadvantages of both options, including strength, ductility, material requirement, construction complexity, and fire and corrosion resistance. The results show that cross section steel bracing provides higher strength-to-weight ratio, while shear wall provides higher ductility and better insulation. This comparison can help construction engineers and architects to choose the appropriate option for structural support. In this research, we have compared cross section steel bracing and shear wall in multi-storey buildings. Our findings show that cross section steel bracing provides higher strength and lower cost, while shear wall provides higher ductility and better sound insulation. This study can help construction engineers and architects to choose suitable options for structural support.

Keywords:-*Cross section steel bracing, Shear wall,*

Introduction

To ensure the structural safety and stability of multi-storey buildings, the selection of structural support systems is a critical factor. Cross section steel bracing and shear walls are two popular options used by construction engineers and architects. However, it is necessary to compare and analyze these two options to determine which option best suits the needs of a specific project.
Here are some more things can include in introduction:-

1. Problem identification: Identify the need and problems of structural support systems in multi-storey buildings.

2. Research objective: State the purpose and goal of comparing cross section steel bracing and shear wall.

3. Literature review: Mention earlier research and studies that relate to this topic.

4. Description of methods: Describe the methods and techniques used in your research.

5. Relevance of results: Explain the relevance and significance of the results of your research. Here is an example:
The need for structural support systems in multi-storey buildings is increasing, but it is necessary to compare and analyze between these systems. In this research, we have compared cross section steel bracing and shear wall, analyzing their strength, ductility, material requirement, construction complexity, and fire and corrosion resistance.

Litrature Review

Kappos Manafpour (2000)[1] has been presented a new seismic design methodology for RC buildings is based on a feasible partial inelastic model of the structure and performance criteria for two distinct limit states. The procedure has been developed in a format that can be used in design codes such as Eurocode 8. Time-History (Non-linear dynamic) and Pushover (Non-linear static) analysis were investigated. The adopted method outperformed the standard code procedure in terms of seismic performance, at least for regular RC frame buildings. It was discovered that behavior under "life-safety" earthquake was easier to control than under serviceability earthquake because performance criteria involving ductility requirements of members for "life-safety" earthquake were adopted.

Viswanath K.G. et al. (2010),8 studied the implementation of reinforced solid structures using concentric steel supports in a seismic manner. Researchers may have used Staad Expert software to investigate buildings of four, eight, twelve, and sixteen stories that are located above seismic zone IV. 1893: 2002 (Part-1). The viability of the steel supporting distribution along the building's stature and its impact on the seismic execution of the fabrication may have been prioritised. Those supporting the periphery columns may have been provided. An analysis using X-type bracings may have revealed a decrease in the buildings' parallel displacements. Braces made of steel were discovered to lessen flexure How much shear is required on the beams? Additionally, columns Additionally, choose between parallel and pivotal loads. On bring base bowing, building frames for X-sort supporting may have been found. In terms of illustration compared to various forms of assistance. It has been discovered that steel supporting framework may be a better optional choice for seismic retrofitting. In addition, they do not include the total weight of the fabrication.

Anshuman et al.(2011),4 Elastic and elastoplastic assessments were carried out on a fifteen-story building in earthquake zone IV and bending moment and storey drift were estimated in both situations. After installing a shear wall, shear forces and bending moments were significantly reduced. The inelastic analysis performance point was tiny and within the elastic limit, thus the results obtained using elastic analysis were satisfactory.

Kameswari et al.(2011),5 examined the drift and inter-story drift of a high-rise building with various shear wall panel configurations and contrasted it with bare frame drift. The designs taken into consideration are: (1) Traditional shear walls (2) Different shear wall configuration (3) Shear walls arranged diagonally (4) Shear walls arranged zigzag (5) The lift core walls' effect. Because it reduces lateral drift and increases the structure's strength and stiffness, the zigzag shear wall arrangement was shown to be superior to alternative layouts and greater efficacy in seismically active regions when compared to other wall types.

Chandurkar and Pajgade (2013),2 conducted a thorough analysis using four distinct models to find the best location for the shear wall in a multi-story building. The program ETAB Nonlinear v 9.5.0 was used to simulate the buildings. Following an analysis 7 essential parameters such as lateral displacement, story drift, and total cost required for the ground floor were found in both cases by replacing the column with a shear wall in a ten-story earthquake-resistant building located in zones II, III, IV, and V. It was concluded that the model 4, which uses a shear wall in a short span at the corner, is more cost-effective than other models. It has been noted that shear walls are cost-effective and efficient for high-rise structures, and that placing them in suitable places significantly lessens earthquake-related displacement. Shear walls absorb a significant amount of horizontal forces if their diameters are large.

R.Harne (2014),3 used STAAD Pro to assess a six-story building that was subject to zone II earthquake loading, and the seismic coefficient method (IS 1893 Part II) was used to compute the earthquake load. Four distinct cases—a structure without a shear wall, a structure with an L-shaped shear wall, a structure with a shear wall around its periphery, and a structure with a cross-shaped shear wall—were examined. Compared to other forms of shear walls, the lateral displacement of columns in buildings with shear walls along their periphery is lessened. Of all the shear walls taken into consideration, it was discovered that the peripheral shear wall is the most effective.

Kalpana et al.(2016),6 For several models, the structural architecture was analysed at varying heights with and without a shear wall. For the various building models under consideration, the outcomes in terms of axial forces, lateral displacement, and bending moment in the structural shear walls with changing height are compared. Both five-story buildings with and without shear walls were surveyed. The analysis software STAAD Pro was used to prepare the model. The author came to the conclusion that, with an earthquake load, node displacements are greater in Zone V than in Zone III, and that displacements are smaller in buildings with shear walls than in buildings without them.

Dodiya et al.(2018),7 The multi-story structure with shear wall was analysed using ETABS modelling software. Equivalent static, response spectrum, and time history approaches were used. The building had an area of 376m2 and a height of 60m. The total number of floors was 20, and the slab thickness was 150mm. The column size was 900x600mm. The author determined that creating a shear wall in the opposite direction performs better and more efficiently than any other scenarios. Furthermore, having a shear wall in an appropriate location is desirable, and the structure performs better whether it is an existing or new structure the logical expansions that in these situations the repair would not be as successful.

C.V.R. Murty, Datta Jayanta, S.K. Agrawal (2004),12 Steel Twin Lintel Belt for Seismic Reinforcement of Brick Masonry Structures. In an attempt to strengthen the brick masonry constructions, the authors tested them with precast R.C. roofing. The cause of the collapse is out-of-plane, in-plane. and an incorrect roof/slab connection with masonry walls. According to their research, twin lintel belts, vertical corner reinforcement, and appropriate anchorage between slab roof sections offer superior seismic resilience when compared to conventional repair techniques. According to them, this system is susceptible to powerful ground motions that are both vertical and horizontal.

Lakshmanan D. (2006),9 The structures in this Pushover analysis were completed using SAP 2000.There is a Sap 2000 assessment available that looks at several repair approaches to enhance the seismic performance of reinforced concrete buildings. Discussions are held regarding the behaviours of repaired beams at beam column joints. It is noted that innate flaws in the information provided in the even after repairs, beam-column junctions still exhibit reflection, despite the performance factors showing a noticeable improvement.

Ubair Gull Khan (2020),10 Around the world, elevated structures are being constructed in ever-increasing numbers. This is done in order to establish land markings as well as out of concern for the dense population in business districts, urban communities, and spare spaces. These structures are designed to be similarly light and adaptable, with relatively little common damping, because the seismic burden following up on a structure is a component of the structure itself load. As a result, the structures become more vibration inclined under wind and tremor stacking. Several plan modifications are possible to ensure the effective operation of tall structures. These modifications range from the use of inactive and dynamic control devices to the addition of elective basic frameworks**.**

Umachagi et al. (2013),11 Due to their affordable, efficient, and safe construction, dampers have gained popularity recently as a means of controlling structural vibration. This study provides a summary of the literature on damper behaviour on seismically vulnerable structures. The evaluation covers a variety of damper types, including frictional, metallic, and viscoelastic dampers**.**

Chavan and Jadhav (2014),13 investigated using Staad Expert's proportional static technique the seismic assessment of a strengthened solid to identify unique supportive courses of action. writing computer programs. Diagonal, V-type, modified V-type, and X-type were the recognised routes of action. It was possible to observe that the biggest uprooting decreased with the use of X-type supporting, and parallel relocation fell by 60%. Expand from the exposed frame towards the use of X-type bracing, towards which construct shear of the structure may also have been discovered, indicating expand Prior to firmness.

Chandurkar and Pajgade (2013),14 evaluated using ETAB version 9.5 the response of a 10-story building intended for a seismic shear wall. Due to opposition to evolving those areas around shear walls in the multi-story fabrication, fundamental centring may have been to look at those progress. Three models from the alleged double kind structural framework and one from an uncovered span structural framework were the four models that were examined. Shear walls in short compass during corners saw incredible effects. Previously, it was discovered that the larger extent of the shear wall was insufficient at 10 stories or less. For highly determinate constructions, shear walls are a sensible and effective substitute. Potentially pulling in forces, it may have been observed that the shear wall's evolving positions.

Esmaili et al. (2008),15 Consider the structural angle of a 56-story secondary tower, recognised for a secondary seismic zone. Previously, Tehran. The building's seismic assessment may have been conducted out using a nonlinear changing examination. The old building required principle walls as well as side walls that served as shear walls and were connected to the fundamental wall via beam coupling. Those conclusions may have been based on the time-dependent nature of cement. Steel supporting framework, if a possibility to be Provided vitality absorption to ductility, but all pivotal load camwood have a negative affect on their execution. It is also conceptually Furthermore, it is financially inadvisable to use shear walls as both gravity and support frameworks.

Kumar et al. (2017),16 used modelling ETABS software to design and analyse a G+9 storey earthquake-resistant building with a shear wall. This study computed and applied the earthquake load to a multi-story building with a plan size of 26 m x 26 m and 10 no. of (G+9) floors at a height of 40 m. According to the author's conclusion, shear walls are among the best structural components for withstanding lateral stresses during an earthquake. They also give buildings more stiffness, which lessens the likelihood that the structure and its contents would be damaged.

Sah , Singh , Kundu et al. (2018),17 Since earthquakes are a big problem in countries such as India and Nepal, we built and analysed a seismically resistant multi-story building with shear walls and raft foundation. A multi-storey residential structure in Zone III is analysed and designed, with B+G+13 storeys, each with a 3-meter height and a car parking facility in the basement.

Shailesh Agrawal and Ajay Chourasia (2003),18 Using a pushover approach, we conducted a nonlinear static study of RC buildings before and after retrofitting. A comparison of strength characteristics and pushover curves showed increased ductility. The building's stiffness remained consistent until the linear stage, then increased in capacity and deformation after retrofitting in the nonlinear stage. Retrofitting resulted in a net gain in building strength, as measured by base shear.

Sudhir K. Jain (2002),19 This study introduces the concept of pushover analysis, which is quickly gaining popularity in the field as a tool for designing new structures, evaluating the seismic safety of existing structures, and creating effective plans for seismic retrofitting structures. It is demonstrated how selecting a seismic retrofitting plan and methods can benefit from this analytical technique.

Abhijit Mukherjee and Amit R.Kalyani (2004),20 This paper presents a structural upgrade design method based on fibre reinforced composite (FRC) and covers the design of FRC-enhanced RCC elements, an upgrade strategy for RCC frames, and the application of the upgraded upgrade strategy for retrofitting RCC frames using the Capacity Spectrum Method.

Problem Identification

Shear walls are structural elements that provide strength to a structure by absorbing parallel loads such as seismic and wind loads. When the cement area shrinks and the support becomes intermittent due to openings, the wall's strength and quality may need to be compromised. The responses to providing apertures and the method of conducting a shear wall without openings should be taken into consideration. Thus, it is essential to demonstrate the value of the work on the analysis and plan. post-impacts of claimed shear walls as well Seismic restrictions would be linked. An other instance must be created for this work. beyond those, the RCC shear wall's configuration and inspection should be worthwhile. absurd Even more intriguing consequences and conclusions. This work is worthwhile. plans for shear wall frameworks that require the assistance of a system that resists lateral loads in the design of tall buildings. The purpose of this effort is to compare many factors like reinforcement, deflection, story shear, and base shear under lateral stresses depending on dynamic requirements of a building's columns and other structural elements Shear wall placement is determined by a variety of characteristics using analysis approaches that are in contrast.

Conclusion

Two forces act on structures: gravity and lateral forces. Shear failure of a structure is caused by lateral forces as wind loads, seismic stresses, etc. Earthquakes are transitory ground vibrations brought on by the abrupt release of strain energy that has been stored in the crust of the earth. These seismic waves radiate outward from the fault location in all directions. It results in the loss of both lives and property. Shear walls are engineered to counteract lateral forces like seismic stresses, and they do so with great resistance. Shear walls are stiff vertical components that have the ability to transfer lateral forces parallel to their planes from external walls, floors, and roofs to the foundation. It has been determined through a review of the literature that the shear wall's parameters, such as size and position, have a greater impact on the stiffness and reactivity of the frame shear wall construction. By constructing shear walls, the structures will be more rigid and less likely to sustain damage to their contents and structure.

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