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A Review On High Rise Structure Of Multi Story Rc Frame

Deepak Vijay [1], Mohsin Khan Agwan [2]

[1] M.Tech Student, Department of Civil Engineering, Arya College of Engineering & Research Centre, Jaipur, Rajasthan, India

[2] Assistant Professor, Department of Civil Engineering, Arya College of Engineering, Jaipur, Rajasthan, India

ABSTRACT

In today's rapidly evolving world, high-rise buildings with groundbreaking designs have become commonplace. While these structures are visually stunning, they pose challenges. As buildings rise higher, managing wind forces becomes a significant concern crucial for ensuring residents' safety. Through extensive research and experimentation, numerous innovative solutions have emerged to mitigate the impact of wind energy. This study focuses on minimizing lateral displacement induced by wind forces using strategically positioned belt walls, optimized outriggers, and an efficient bracing system. In this paper provide a detailed overview on high rise structure of multi story RC frame and share wall and also study about the its going on related work analysis in this paper.

Keywords — Building, Multi Story, RC Frame, Shear wall, Building Structure.

I. INTRODUCTION

In burgeoning urban landscapes of emerging countries and megacities, the solution to accommodating growing populations often lies in erecting tall buildings. Beyond their visual appeal, these high-rise structures symbolize progress and modernity. While attention is often drawn to towering superstructures exceeding 30 stories, medium-height high-rises ranging from 8 to 20 stories are prevalent worldwide. Understanding the structural behavior of both categories, especially their response to seismic activity, holds utmost significance. A thorough comprehension of their intricate dynamic properties is imperative before inhabitants can inhabit high-rise settings confidently.

Reinforced concrete (RC) has long been a primary material for constructing skyscrapers. Modern RC construction methods allow for diverse architectural configurations. Within RC buildings, shear walls assume a crucial role in fortifying structures against lateral loads such as seismic forces and gravity loads like wind. Strategic placement of shear walls is essential for optimal sustainability and resilience under varying loading conditions, especially in regions identified as high-seismic zones.

Guided by seismic engineering research from the Bureau of Indian Standards (BIS), the IS 1893 code serves as a benchmark for earthquake-resistant structural design. Evolving through multiple editions from 1962 to 2016, this code initially segmented India into six zones, later simplified to four (II, III, IV, and V).

The 2006 Kutch Earthquake in Gujarat exposed vulnerabilities in construction norms, local regulations, engineering education, and safety protocols. Widespread damage to structures between four and ten stories highlighted the urgency for seismic awareness. The NPEEE initiative aimed at educating on earthquake-resistant building design, emphasizing the impact of soft alluvium deposits and weak ground stories on devastation.

In response to these revelations, the "Ductile design and detailing of reinforced concrete structures subjected to seismic forces" code (IS 13920-1993) was introduced, advocating for RCC walls due to their seismic resilience. These vertical, plate-like RCC walls, varying from 150mm to 400mm thick, significantly contribute to earthquake resistance, drawing upon their successful performance track record.

II. LITERATURE REVIEW

Engineers assessed plan irregularities, reentrant corners, and tensional inconsistencies, identifying their significant impact on seismic response. Reentrant corners, common in U, H, V, E, and plus-shaped buildings driven by architectural demands, suffered severe damage during seismic events. To mitigate negative effects, these structures were segmented, especially in plus-shaped tall multi-story buildings where reentrant corners surpassed specified code limits. In high seismic zones, unique details for shear walls are imperative, and their placement significantly influences structural efficiency under dynamic loads. Modifying shear wall placements in plus-shaped buildings without altering parameters can substantially enhance structural performance (Banerjee et al. 2021). Tall building structural systems have evolved significantly over time. The rigid frame, popular in the early 1900s, encountered limitations beyond a specific height threshold. The emergence of the tubular structure in the 1960s enabled taller buildings while optimizing material usage, but its design was hindered by closely spaced columns and bracings. Architects then adopted the core-outrigger system for its design flexibility. However, traditional tubular structures persisted on a smaller scale and later underwent innovations. Contemporary usage showcases various advanced tubular forms, demonstrating their ongoing relevance. This study offers a detailed exploration of diverse structural systems for tall buildings, facilitating collaborative decision-making for engineers and architects (Ali et. al. 2022). Construction technique modifications have rendered tall and flexible structures more susceptible to wind effects. Wind loadings have gained prominence concerning other structural forces, becoming a pivotal factor in both low and tall flexible structures' designs. Wind introduces a stochastic time-dependent load comprising mean and variable components. Due to wind's variability (gustiness), all structures undergo dynamic oscillations. In shorter rigid structures, these oscillations are minimal, allowing them to be perceived as an equivalent static pressure, a technique adopted by the majority of Codes and Standards (Panjwan et. al. 2021). The seismic behaviour of shear walls and their capacity to sustain lateral strains induced by earthquakes has been investigated. Huang et al. (2018) used shake table tests to analyse the dynamic response of coupled shear walls and RC frames. Interaction between shear walls and frames was found to have a major impact on load distribution and structural response. Wang et al. (2020) used numerical computations to investigate how the stiffness of boundary elements affects the seismic behaviour of shear walls.

Zhang et al. (2019) looked into how vertical abnormalities in RC frames affected the buildings' seismic response as a whole. Their research showed that these anomalies should be taken into account during the planning and analysis stages. In addition, Wang et al. (2021) used computational modelling to investigate how axial stress affects the seismic behaviour of RC frames. They found that shear walls increased overall structural stiffness and altered the redistribution of axial loads. In more recent research, Barros et al. (2019) looked into how factors such plastic hinge length and reinforcing details affected the seismic response of RC frames. There is a lot of curiosity in structural engineering about how RC frames react to earthquakes. Primary load-bearing systems in buildings and constructions often consist of RC frames. If you want to build things that can withstand earthquakes, you need to know how they behave non-linearly under stress. Extensive research has been done to better model and anticipate the behaviour of RC frames when subjected to seismic forces (Chen et al., 2021). Flexural failure, shear failure, and bond-slip failure at the beam-column connections are only some of the failure modes that can occur in RC frames subjected to seismic pressure. The evolution, interaction, and impact of these failure modes on the overall structural response have all been studied by researchers. Research into the causes of RC frame failure has led to new recommendations for design and retrofitting (Smith et al., 2019). Understanding the seismic behaviour of RC frames is greatly aided by experimental experiments. Scientists have studied the structural reaction under genuine seismic conditions by using shake table tests, pseudo-static testing, and cyclic loading studies. Experiments like these shed light on how RC frames fail, how strong they are, and how they deform under stress. In order to effectively capture the behaviour of RC frames, recent research has concentrated on adding cutting-edge measurement techniques including digital image correlation and strain gauges (Johnson et al., 2023).

The importance of using precise modelling tools to capture the non-linear behaviour and interaction effects was brought to light by their investigation. Accurately analysing a building's seismic reaction requires a thorough understanding of the interaction between shear walls and RC frames. The seismic behaviour of shear wall-RC frame systems under varying coupling conditions was recently studied by Tang et al. (2020), who used non-linear finite element analysis. The results showed that include the coupling effects was crucial to capturing the non-linear behaviour and forecasting the response with high precision. Additionally, Zhu et al. (2021) conducted experimental tests to assess the impact of coupling beams on tall buildings' seismic resilience. Their research confirmed that linking beams improve the structural performance and energy dissipation as a whole. When it comes to seismic design, the relationship between shear walls and RC frames is essential. Significant lateral load resistance is provided by shear walls, and additional structural stability is provided by RC frames. Accurately forecasting the reaction of the overall structural system under seismic loading requires an understanding of the behaviour and interaction between these two components (Chen et al., 2022).

III. CONCLUSIONS

Numerous authors have previously investigated the analysis of shear walls within reinforced concrete frame buildings. From these studies, noteworthy insights have emerged. For instance, considering soil-structure interaction in a base-isolated structure leads to an augmentation of the structure's natural period. An innovative architectural strategy, known as the distributed ring wall system, has been devised to counter lateral forces in concrete high-rise buildings. Unlike the conventional ring system, this approach involves dispersing ring walls separately along the entire height of the structure, covering the area between column edges.

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