"COMPARATIVE STUDY ANALYSIS OF MULTI STOREYED RC FRAMED BUILDINGS WITH AAC BLOCK INFILL WALLS AND BRACING SYSTEMS USING WITH & WITHOUT SHEAR WALL"

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Abstract - Structural engineering encompasses the activities of designing, constructing, and maintaining various structures. The study and design of structures that sustain or resist loads in accordance with the needs of buildings are the focus of structural engineering. In framed buildings, infill walls play a vital role in enhancing the structural rigidity. Among the various lightweight and flexible materials used for infill, Autoclaved Aerated Concrete (AAC) blocks are commonly employed. This study focuses on conducting response spectrum analysis through E-tabs software to evaluate the seismic performance of a multi-story RC framed building with AAC block infill walls and bracing systems, considering both with and without shear walls. A comparative analysis of key parameters such as base shear, displacement, besides storey drift was conducted between these models and the bracing systems in multi-story RC framed models. In this study, I analyse a G+30, G+40 & G+50 buildings with a AAC infill wall with and without shear wall also with a bracing system with and with out shear wall in zone 3 of a strong seismic zone. Models are the subject of a dynamics analysis. Model output seismic parameters, including base shear, maximum storey displacement, also maximum storey drift using ETAB 2019, a modelling and analysis programme.

***Key Words*: Multi Storey Building, AAC Infill Wall, Breacing System, Shear Wall**

1.INTRODUCTION

People are more excited and eager to relocate from rural to urban areas in the current development era in order to take advantage of the increased amenities and improve the prosperity of their life. Due to urbanisation, land will be scarce and expensive even if it is accessible, making it out of reach for the average middle-class person. The multi-story building has to be constructed over time. According to technical expertise, whenever it is necessary to design a building that is rising vertically, the influence of lateral load dramatically increases and poses a significant challenge to their stability. At the top of the structure, the lateral loads for multi storeyed structure are very important. the lateral pressures impacting the structure caused story drift and even lead to uplifting the column.

1.1 (AAC) Blocks Infilled wall

The approximate dimensions of an AAC block are 600/625 mm 200/240 mm 100-300 mm. Density is around one-third that of a standard clay brick part. One of the most significant advantages of the AAC over conventional cementation construction materials are its decreased environmental effect. It produces less efflorescence. It has excellent thermal insulation. Because the material can be directed and cut to size onsite using common carbon steel band saws, handsaws, and drills, installation is simple and rapid. AAC is now utilized in many nations throughout the world. The most essential factors influencing seismic building configuration are overall geometry, the structural arrangements, and load routes. The influence of Horizontal or else Plan Aspect Ratio (L/B ratio) on multi storey R.C. framed building with the AAC infill walls is studied in this study, where B stands the base width also L is the building frame length.

1.2 BRACING

The bracing system is responsible for supporting the lateral loads, while the beams & columns comprising the frame bear the vertical loads. However, the placement of braces can pose challenges as it may inhibit with the design of the façade and the positioning of openings. In response, buildings designed in high-tech or post-modernist styles have incorporated bracing as an architectural feature, either on the interior or exterior of the structure.

2. Literature Review

Mohammed Nauman and Nazrul Islam (2014) conducted a study on the behavior of reinforced concrete multistory structures with and without infill walls. Reinforced concrete framed structures are widely used worldwide due to their ease of construction and efficient progress. In these structures, brick or block masonry is often incorporated as infill panels, providing supplementary lateral stiffness to the overall structure. The behavior of such structures differs significantly from bare frame structures.

Abdul Karim and Srinivasa (2015) conducted an analysis of a G+20 structure using the software E-TABS. Their study compared regular buildings with, without outriggers, as well as irregular buildings with, without outriggers using centrally rigid shear walls and steel bracings as outriggers. The analysis was performed through equivalent static analysis & response spectrum method. The study investigated the reduction in time period, overall stiffness, and minimized storey drift achieved through the outrigger system. The results indicated that outriggers were more effective than steel X-bracing in improving seismic performance of the structures.

Ali J. Hamad (2014) conducted a study on the materials, manufacture, properties, and application of aerated lightweight concrete. The study highlighted the advantages of lightweight concrete over conventional concrete, such as improved thermal and acoustic insulation and reduced structural weight, leading to cost savings. The paper provided a classification of lightweight concrete based on production methods and utilization purposes, discussing the materials used and their properties for each type. The study concluded that lightweight concrete exhibits a higher strength to weight ratio, enhanced thermal & sound insulation, and reduced dead load, making it suitable for various applications. The three types of light-weight concrete discussed were light-weight aggregate concrete, aerated concrete, and no-fines concrete.

Kumbhar S.S and Rajguru R.S (2015) conducted a study on the seismic analysis of masonry infill in multi-story RC buildings. They selected AAC (Autoclaved Aerated Concrete) blocks as the material for infill due to their lightweight and other useful properties. The study modeled a bare frame and an AAC block infilled frame with & without openings using ETABS software. The results indicated that infilled frames exhibited less storey displacement and drift compared to bare frames. Partially infilled frames showed higher displacement and drift compared to fully infilled frames. The study also highlighted that infilled frames had higher storey shear compared to bare frames.

3. Methodology

In all the structures, models are analysed to study the multi-storeyed RC framed buildings with AAC block infill walls and bracing systems with & with out shear wall is to be analysed and effect of diverse lateral load resisting i.e. Bare frame structure by means of the parameters for the design as per code IS-1893-2016-Part-1 for seismic zone III i.e., Finite element analysis is carried out using ETABS 19. The building models will undergo analysis for both earthquake and wind loads, following the guidelines specified in IS 1893-2016 Part-1 for seismic actions and IS 875-2015 Part-III for wind loads. The storey height will remain consistent at 3 meters for typical floors, while the ground floor will have a height of 3.5 meters. The seismic analysis of building models will be conducted using the Equivalent Static method and Response Spectrum methods, specifically for zone III with special moment resisting frames. Additionally, a wind analysis will be performed considering a basic wind speed of 44 m/s.

Fig -1: CROSS BRACING WITH SHEAR WALL

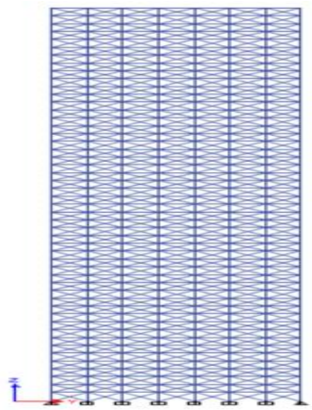

Fig -1: CROSS BRACING WITHOUT SHEAR WALL

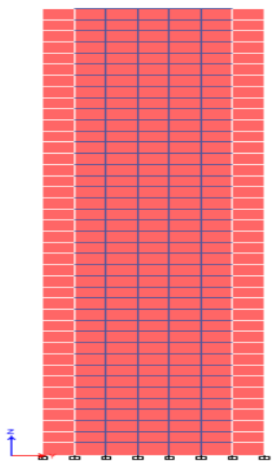

Fig -3: AAC BLOCK WITH SHEAR WALL

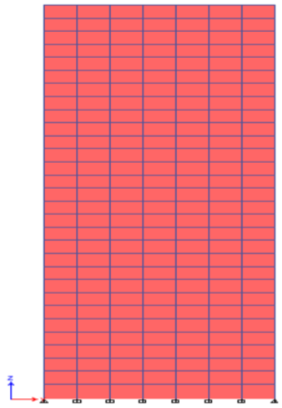

Fig -4: AAC BLOCK WITHOUT SHEAR WALL

4. Results

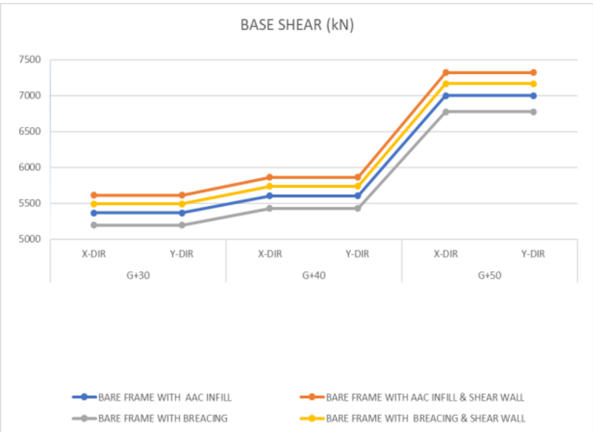

Fig -5: Comparative analysis of Base Shear between a Bare Frame with AAC block infill wall, a Bare Frame with AAC block infill wall and shear wall, a Bare Frame with bracing system, and a Bare Frame with a bracing system and shear wall.

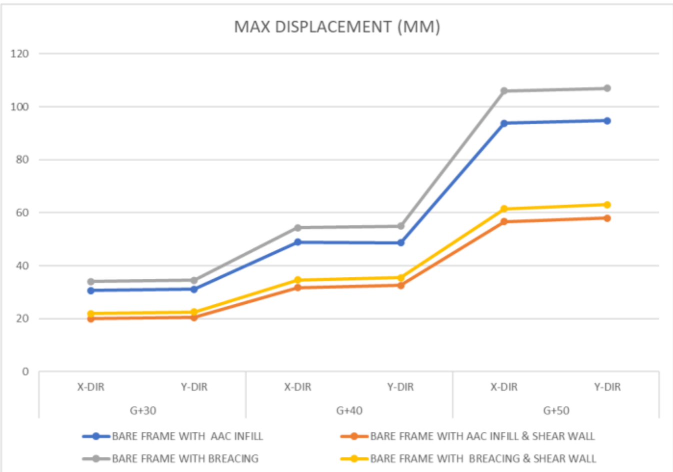

Fig -6: Maximum Storey Displacement Comparison between Bare Frame with AAC block infill wall, Bare Frame with AAC block infill Wall & shear wall and Bare frame with bracing system, Bare Frame with a bracing system & shear wall.

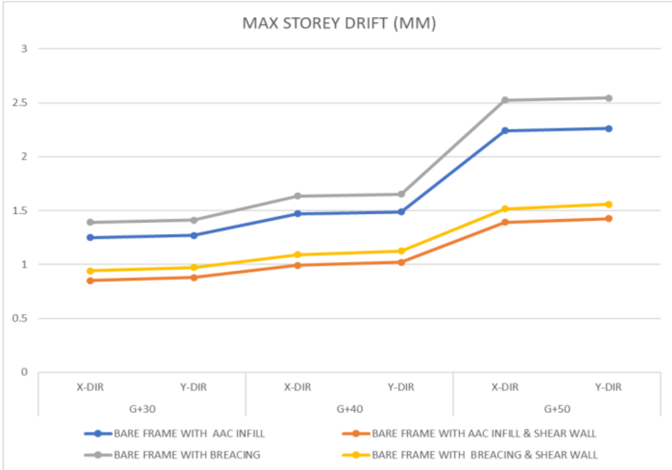

Fig -7: Maximum Storey Drift Comparison between Bare Frame with AAC block infill wall, Bare Frame with AAC block infill Wall & shear wall and Bare frame with bracing system, Bare Frame with a bracing system & shear wall .

5. CONCLUSIONS

A study of the seismic behaviour of multiple-story buildings with shear walls was conducted using a suitable analytical model of RC frames with AAC infill and bracing systems. The use of lateral load resisting systems, such as shear walls, increases stiffness and is more efficient than bare frame buildings, which do not have any load resisting systems. According to our findings, ductile RC frame members with a response reduction factor of 5 are suitable for multi-story RC framed buildings with AAC masonry infills and bracing systems in the upper stories. The base shear is lower in buildings with a bracing system, both fully and partially, compared to buildings with AAC block infill. Buildings with AAC block infill, combined with a shear wall, exhibit lower displacement compared to buildings with a fully braced system. Buildings with AAC block infill, without a shear wall, have lower displacement compared to buildings with a fully braced system without a shear wall. This study concludes that incorporating AAC block infill walls and a bracing system into RC framed multi-storey buildings with shear walls leads to a reduction in displacement, drift, and base moment. This reduction can potentially decrease the size and depth of the foundation.

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