

Seismic analysis of Outrigger, Shear wall and Flag wall System In High Rise Structure

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Abstract: Lateral forces are the most important factors to be considered when it comes to controlling lateral deflection of the building. And for that several lateral load resisting systems have been implemented in the field since years. In present study, comparison on effectiveness of Outrigger system and flag wall system is considered. In present study G+59 and G+69 story buildings will be modeled and analyses for Reinforced cement concrete structure with double outrigger and flag wall at various height (0.4H +0.2H), (0.4H +0.6H), (0.4H +0.8H), (0.4H +1.0H) to identify its effectiveness in High rise structure in Zone V and Medium Soil with Regular Structure. Dynamic wind analysis and Response Spectrum analysis was carried out. Parameters to be considered Maximum story displacement, Story Drift, Time Period and Base Shear. Modeling and Analysis was done using ETABS.

Index Terms – Shear wall, Flag wall, Outrigger system, Gust Factor, Response Structure Analysis,

I. INTRODUCTION

Flag wall are reinforced concrete walls (RC walls) in selected floors, not reaching the foundation, which provides additional stiffness, strength and ductility to the overall structure. They can be effective in reducing overall lateral drifts, inter-story drifts and building time periods similar to outriggers.

In the conventional outrigger system, the outrigger trusses or girders are connected directly to shear walls or braced frames at the core and to columns located outboard of the core. Generally, but not necessarily, the columns are at the outer edges of the building. The number of outriggers over the height of the building can vary from one to three or more. The outrigger trusses, which are connected to the core and to columns outboard of the core, restrain rotation of the core and convert part of the moment in the core into a vertical couple at the columns. Shortening and elongation of the columns and deformation of the trusses will allow some rotation of the core at the outrigger. In most designs, the rotation is small enough that the core undergoes reverse curvature below the outrigger.

In the virtual outrigger also known as belt truss system, outrigger trusses connected directly to the core and to outboard columns are eliminated and outrigger trusses are connected between peripheral column of building to use floor diaphragms, which are typically very stiff and strong in their own plane, to transfer moment in the form of a horizontal couple from the core to trusses or walls that are not connected directly to the core.

II. OBJECTIVES

- To find response of structure under seismic load with Outrigger system
- To find response of structure under seismic load with Flag wall
- To find response of structure under dynamic wind load with Outrigger system
- To find response of structure under dynamic wind load with Flag wall
- Comparison of outrigger system and Flag wall.

III. LITERATURE REVIEW

⁴Manoj Pillai, Roshni John, investigated that flag wall reduces the time period as compared to Conventional SMRF up to 20%. The story displacement of the structure was reduced up to 30 % when provided with flag wall.

⁸S. A. Reddy, N. Anwar investigated that Flag walls can be effectively used as an alternative of outriggers to control the global seismic response of the building. When increasing number story flag walls system having less base shear compare to core wall system and reduce up to 14.5 % .

⁵Pradeep K M, M.R. Suresh, investigated that Structure provided with concrete outrigger and belt truss structural system shows significant variation in lateral displacement for L shaped structured with reduction of 19.41 % in Y direction provided with concrete outrigger at the mid height of the structure than the steel outrigger.

²Jatin B. Khatri, Brijesh R. Raychanda, Narendra R. Pokar investigate that in the double outrigger system displacement decreasing in regular structure up to 23 % and displacement in irregulars structure up to 16 % compare core wall system in response spectrum analysis. In the dynamic wind load analysis displacement decreasing in regular structure up to 18.60 % and In the dynamic wind load analysis displacement decreasing in irregular structure up to 14.70 %.

IV. METHODOLOGY

In present work the analysis of following structure with different location of flag wall and outrigger system has been carried out.

- i) Regular Building with core wall Rectangular in Plan with Flag wall At (0.2H+0.4H), (0.4H+0.6H), (0.4H+0.8H), (0.4H+1.0H).
- ii) Regular Vertical Building with core wall Rectangular in Plan with Outrigger System at (0.2H+0.4H), (0.4H+0.6H), (0.4H+0.8H), (0.4H+1.0H).

The plan areas of the all structures are same for the analysis; also, the beam and column dimensions are same. The materials such as Poisson ratio, Density of RCC, Density of Masonry, Young’s modulus, compressive strength of steel and concrete etc. are kept constant in all buildings.

Comparison of the parameters considered in the study of double outrigger system and flag wall structures.

- Dynamic wind analysis is carried out for soil condition II.
- The Response spectrum analysis for Zone V and soil II.
- The result parameter includes the Displacement, Story Drift and Base shear

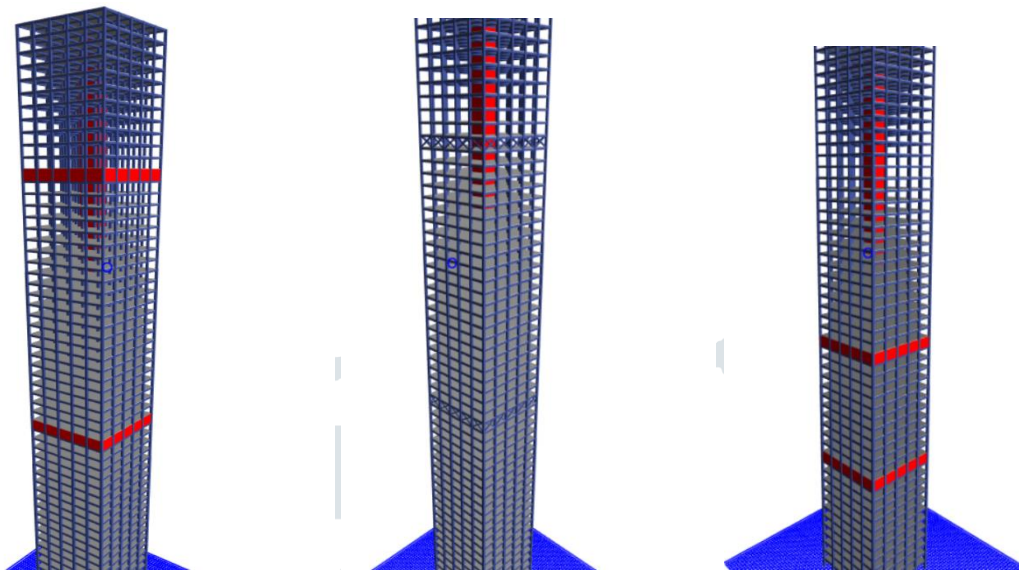


Fig 2 – outrigger and flag wall system

V. RESULTS

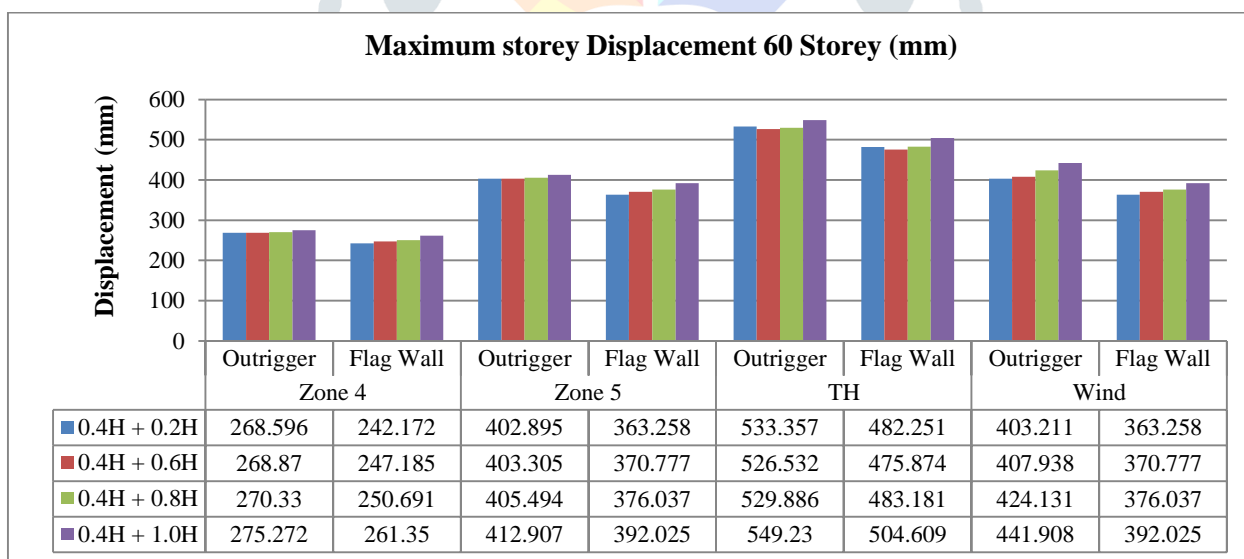


Fig 2 - Maximum Storey Displacement (mm) Storey 60

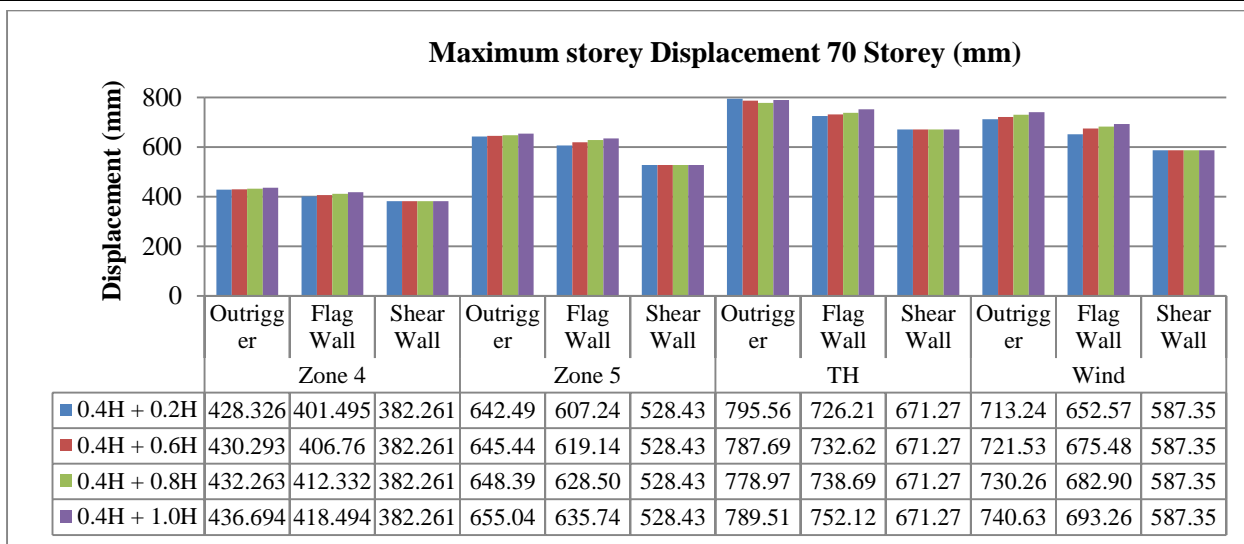


Fig 3 - Maximum Storey Displacement (mm) Storey 70

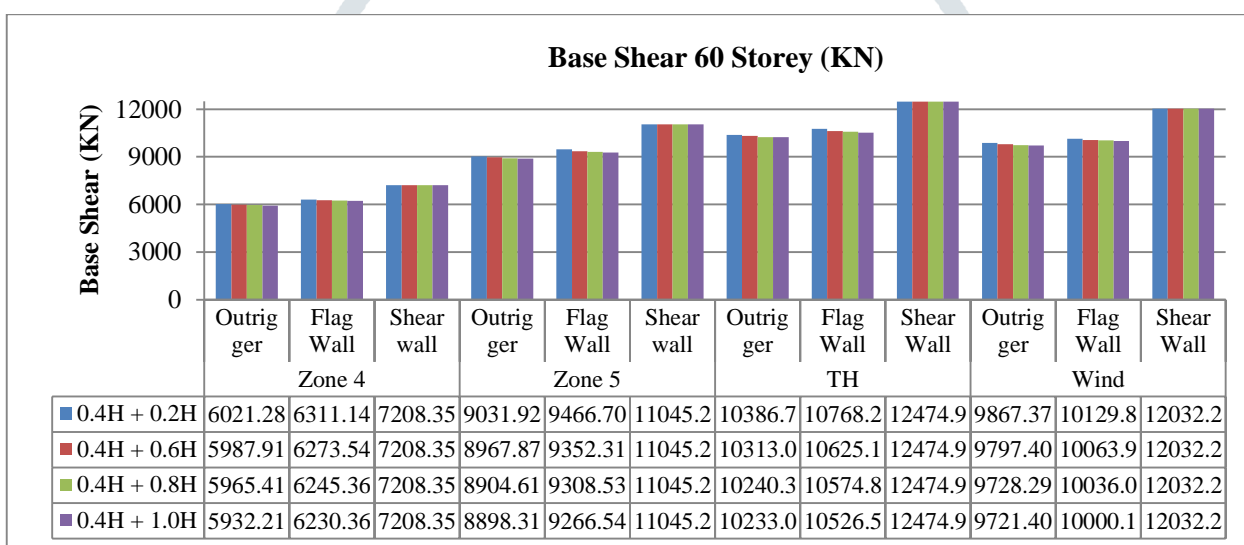


Fig 4 – Base Shear (KN) Storey 60

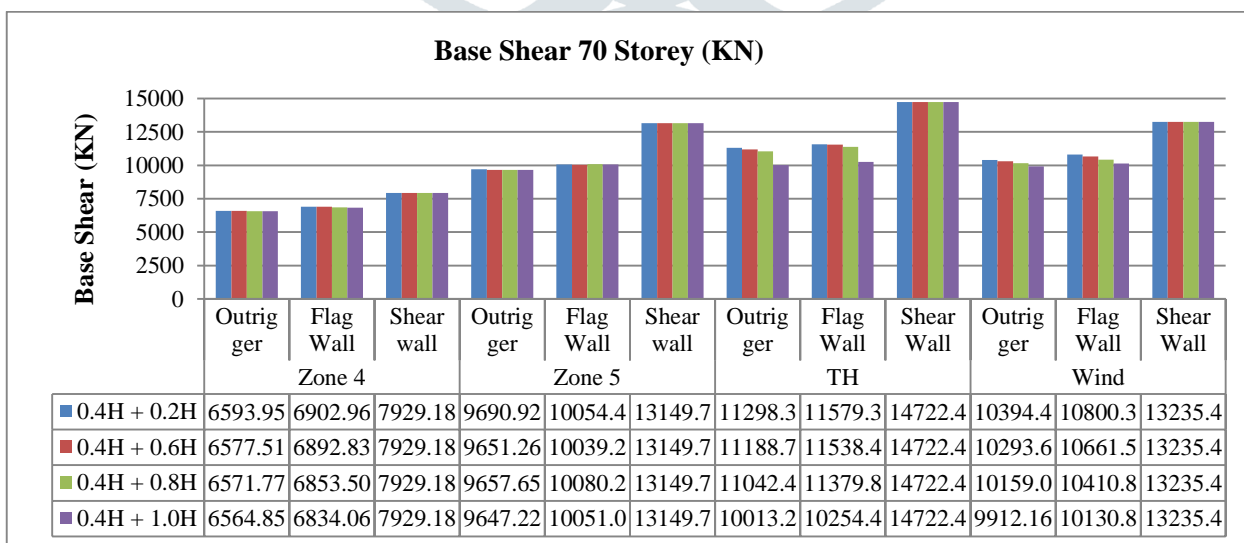


Fig 5 – Base Shear (KN) Storey 70

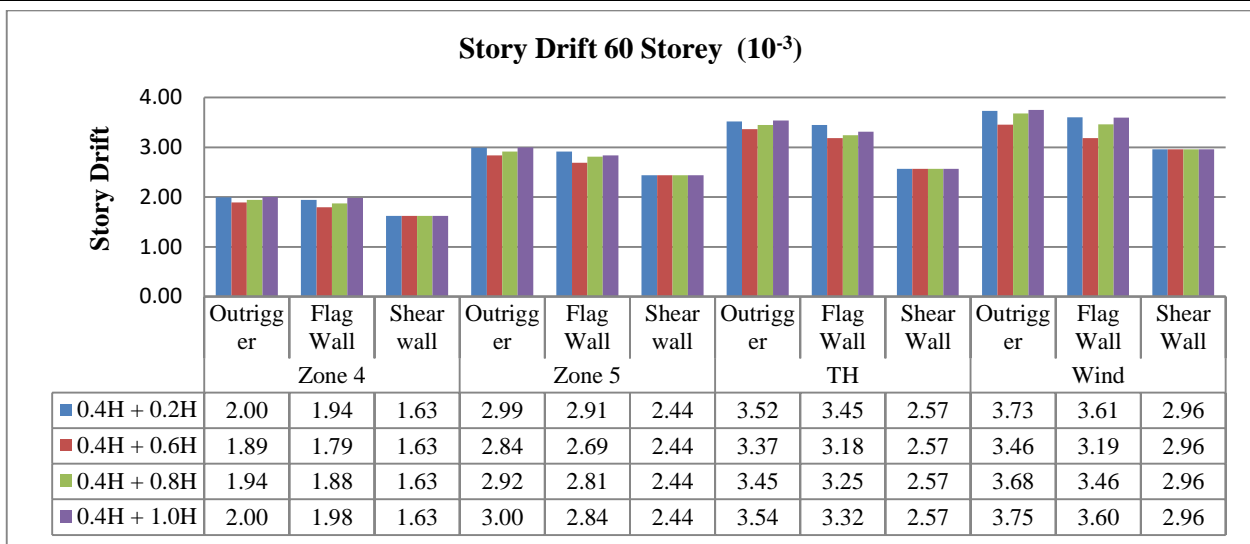


Fig 6 – Story Drift Story 60

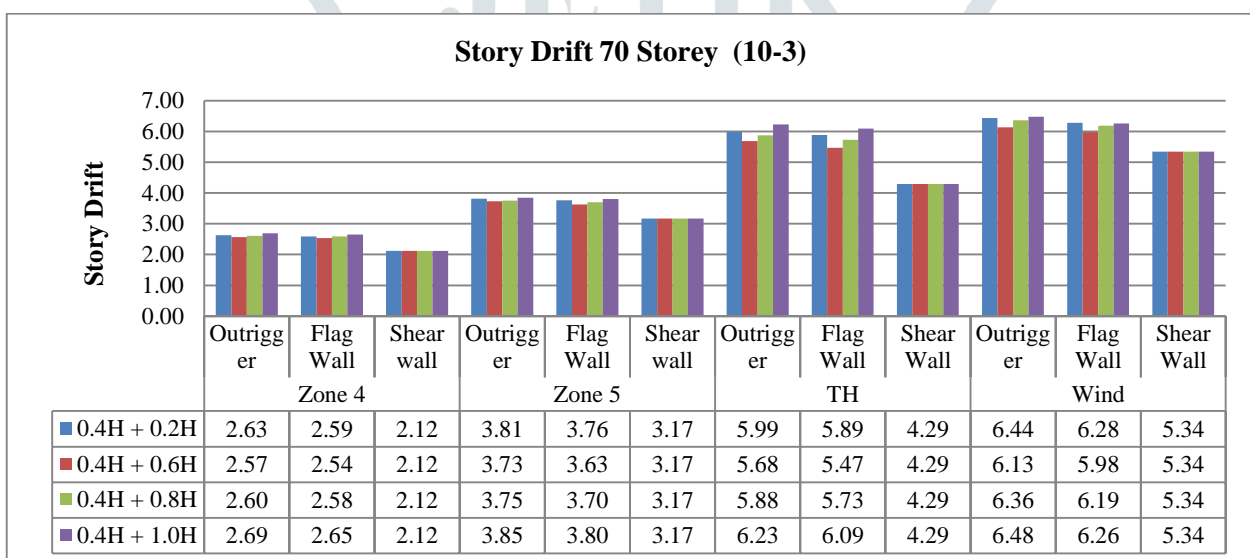


Fig 7 – Story Drift Story 70

VI. CONCLUSION

- The values of Maximum Displacement least for location of outrigger and flag wall system is (0.4H+0.2H).
- The values of Base Shear least for location of outrigger and flag wall system is (0.4H + 1.0H).
- The values of Drift least for location of outrigger and flag wall system is (0.4H+0.6H).
- The values of Maximum Displacement are least in Shear wall system.
- Maximum displacement is less in flag wall compared to outrigger.
- So, overall the high-rise structure with flag wall at is more efficient.

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