Comparative Study on Solid And Coupled Shear Wall

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Abstract- *Structural design of high rise building is governed by lateral loads due to wind or earthquake. Lateral load resistance of structure is provided by interior structural system or exterior structural system. Usually shear wall core, braced frame and their combination with frames are interior system, where lateral load resisted by centrally located elements. While framed tube, braced tube structural system resist lateral loads by elements provided on periphery of structure. It is very important that the selected structural system is such that the structural elements are utilized effectively while satisfying the design requirements. Recently Coupled shear walls are one of the systems commonly used in medium and high rise structures to resist lateral forces. The present study is aimed to understand the different structural aspects related to this system. Linear dynamic analysis of different structures has been performed in ETABS using response spectrum method. Analysis results in terms of top storey displacement, base shear and time period have been compared to understand the variations. Finally, found out the performance of model with coupled shear wall withis same as solid shear wall and better performance than conventional structure. Coupled Shear Wall is the potential option in multi-storey buildings when there opening is provided between two shear walls in multi-storey buildings.*

Keywords- Solid Shear Wall, Coupled Shear Wall, Coupling Beam, Conventional Building, High rise building, Seismic behaviour.

I. INTRODUCTION

A shear wall is a wall which is designed to resists hear force and lateral force which causes the bulk of damage in earthquakes. Many building codes mandate the use of shear walls to make homes safer and more stable, and learning about shear walls is an important part of an architectural education. Architects are obliged to think about shear walls and other safety features when they design a structure, so that they can accommodate the walls to make the structure sound while also aesthetically pleasing.

A coupled shear wall is part of a shear wall system, made of coupling beams and wall piers. It provides more openings, which increase the functional flexibility in architecture. Furthermore, by coupling individual flexural walls, the lateral loads resisting behaviour changes to one where over turning moments are resisted partially by an axial compression–tension couple across the wall system rather than by the individual flexural action of the walls.

II. OBJECTIVES OF THE WORK

The objectives of present work are:-

1. To review the existing literature related to coupled shear wall system.
2. To study the effectiveness of solid shear wall structural system over conventional system
3. To analyse the building with solid and coupled shear wall, and study the behaviour of the building.

III. MODELLING AND ANALYSIS

In this section dynamic analysis of Conventional Structure as well as Solid Shear Wall Structure and Coupled shear wall system has been carried out to understand the behaviour of these structures under dynamic loading. Plan of all structures has been kept same. All the structure consists of 12 stories with each story height of 3.5 meters. The structures are assumed to be located in Seismic zone 4 with medium soil. All the structure have structural configuration is symmetrical.

Building Configuration

i. Plan Dimensions – 25 m X 15 m
ii. Story Height – 3.5 m
iii. Column Size – 600 mm X 600 mm
iv. Depth of Coupling Beam – 1800 mm
v. Size of Opening - 1.8 m X 1.7 m
vi. Shear Wall Thickness – 230 mm
vii. Beam Size – 300 mm X 450 mm
viii. Slab Thickness – 150 mm
ix. Wall Thickness – 230 mm
x. Parapet Height – 1.2 m

Earthquake force data:

i. Earthquake load for the building has been calculated as per IS 1893(par 1) : 2005
ii. Zone factor – 0.36
iii. Seismic zone – V
iv. Importance factor (I) – 1
v. Reduction factor (R) – 5

Etab Models

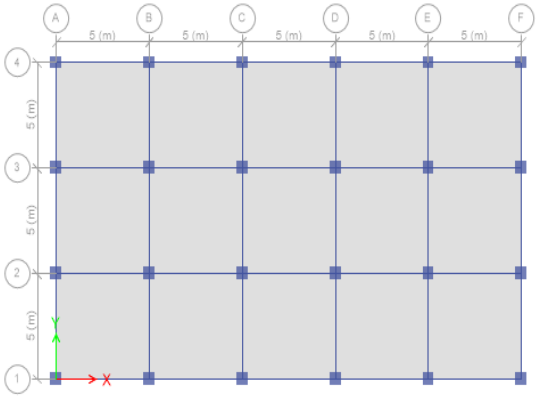

Fig.1 Plan of Conventional Structure

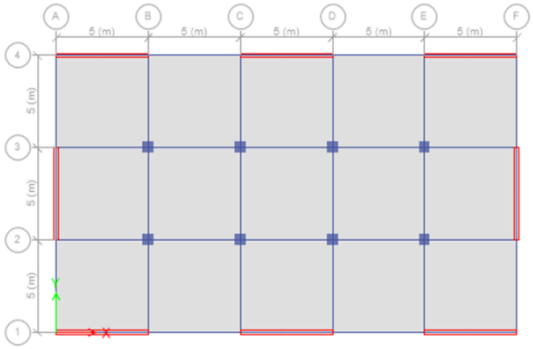

Fig. 2Plan of Solid and Coupled Shear Wall Structure

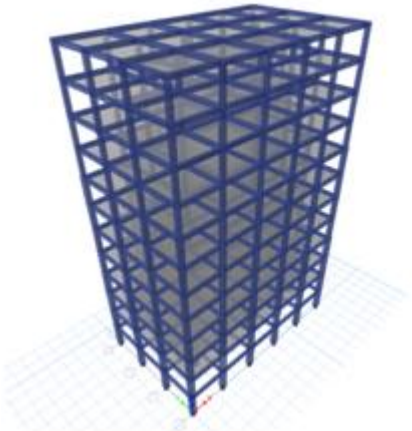

Fig. 3 3D ofConventional Structure

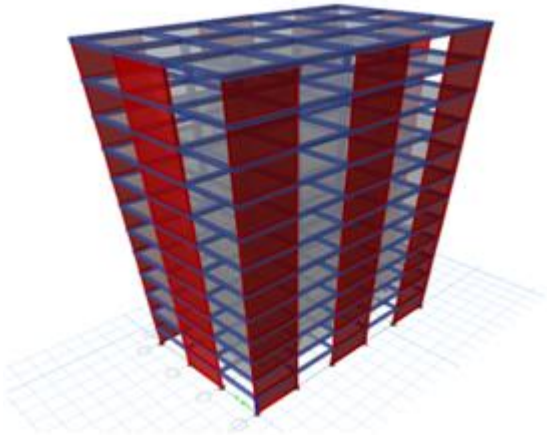

Fig. 4 3D ofSolid Shear Wall Structure

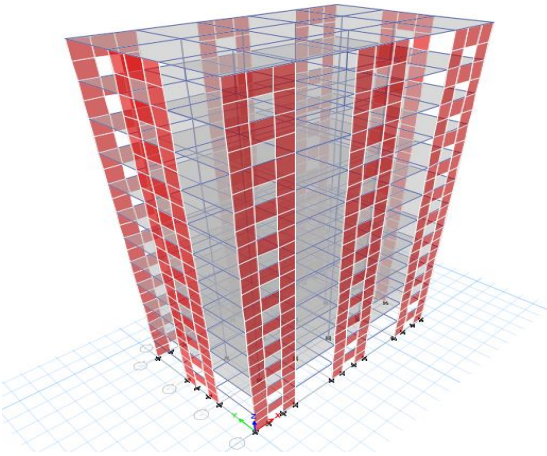

Fig. 5 3D ofCoupled Shear Wall Structure

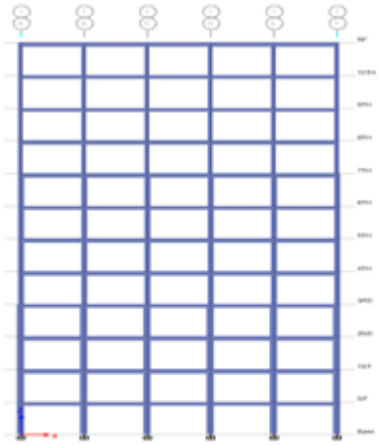

Fig. 6 Elevation of Conventional Structure

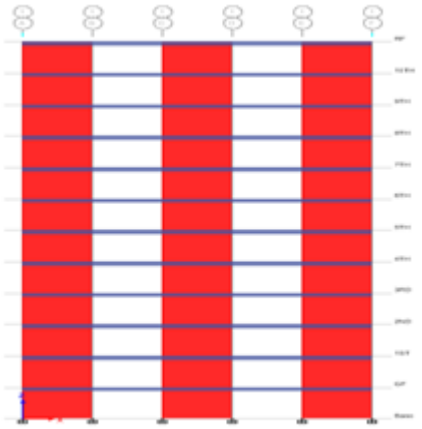

Fig. 7 Elevation of Solid Shear Wall Structure

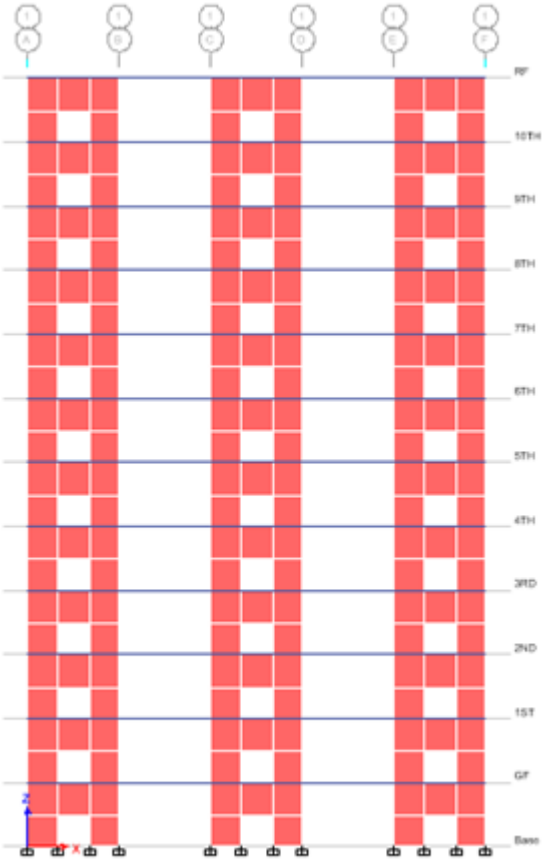

Fig. 8Elevation of Coupled Shear Wall Sturcture

IV. RESULT AND DISCUSSION

Comparative Response Spectrum Analysis results are

TIME PERIOD (Second)

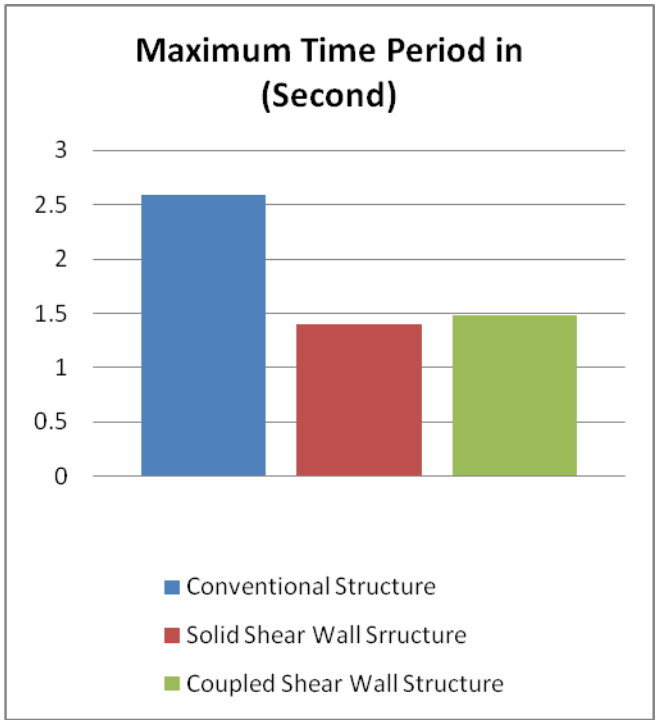

Fig. 9 Time Period

MAXIMUM STORY DISPLACEMENT (mm)

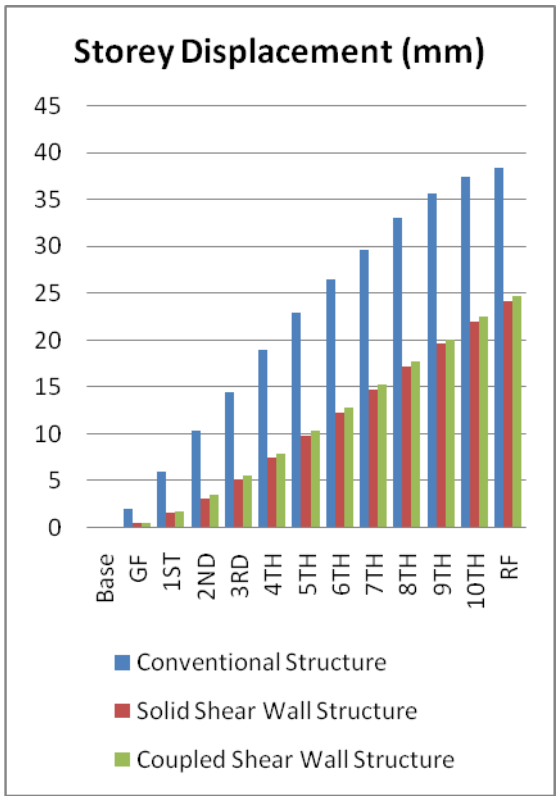

Fig. 10Maximum Story Displacements

BASE SHEARS (kN)

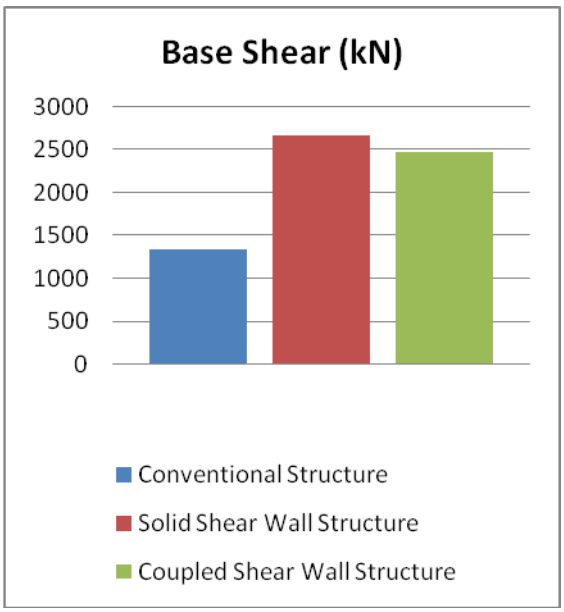

Fig. 11Base Shear

V. CONCLUSION

In the comparison of results of Conventional Structure, Solid Shear Wall Structure and Coupled Shear Wall Structure it is concluded:

- Coupled shear wall with 1800 mm depth shows approximately same results of solid shear wall.
- Building with solid shear wall is more stable than building with coupled shear wall, because storey displacements are less in the case of building with Coupled Shear Wall.
- Coupled Shear Wall with Coupling Beams is the potential option in multi-storey buildings when there opening is provided between two shear walls in multi-storey buildings.

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