Effect of Coupling Beam In Coupled Shear Wall Structure

Mahaling Ambulge[1], Shaikh A. N.[2]
[1]Dept of Civil Engineering
[2]Assistant Professor, Dept of Civil Engineering
[1, 2] M. S. Bidve Engineering College, Latur. 413512, India.

Abstract- *Recently Coupled shear walls are one of the systems commonly used in medium and high rise structures to resist lateral forces. Yet these systems should not collapse or be induced severe damage during earthquake actions. For this reason, coupled shear walls must have high strength, high ductility, high energy absorption capacity and high shear stiffness to limit lateral deformations. So we generally preferred solids hear wall. Generally, shear walls are located at the sides of the building, or at the core of the building to counter the earthquake forces. If the building consists of either external shear walls or internal shear walls then it is necessary to provide openings in these walls. In order to accommodate these doors, windows in the shear walls it is necessary to pierce them. The size and location of the opening may vary from the architectural and functional point of view. Coupled shear walls consist of two shear walls interconnected by beams along their height. 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 with critical slenderness ratio is equal to one is same as solid shear wall and better performance than other three coupled shear wall models.*

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

I. INTRODUCTION

A coupled shear wall is a structure composed of two secluded or isolated shear walls that are connected by beams or slabs in height wise manner. Normally, shear walls are incorporated with openings, just to allocate elevator doors, windows, shafts, stairwells, service ducts in the buildings which are unavoidable. Thus the walls on each side of opening must be coupled either by beams or by floors labs or by combination of both the elements. The beams used for coupling the isolated walls are called coupling beams. The overriding purpose of the coupling beams is to assemble the walls and make them act as a single composite can til ever unit. Consequently, the horizontal stiffness is also improved when compared to the uncoupled shear walls.

This introduction of coupling beam effectively increases the axial forces, there by reducing bending moments in the walls and also the lateral deflection in the structures. And the performance of the coupled shear wall is decided by the combined action of shear and flexure.

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 assess the behaviour of the coupled shear wall and the influence of the size of the coupling beam on the system.
3. To find the critical slenderness ratio of coupling beam.

III. MODELLING AND ANALYSIS

To study the effect of Coupled Shear Wall System with variation in coupled beam size, structures with number of stories as 12 with variation coupled beam aspect ratio ranging from 1 to 6 has been taken for the study. Story height has been kept 3.5 m for all the structures. All the structures are same in plan. 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. Shear Wall Thickness – 230 mm
v. Beam Size – 300 mm X 450 mm
vi. Slab Thickness – 150 mm
vii. Wall Thickness – 230 mm

viii. 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

Specification of Structures

Four Coupled shear wall structures of height 12 storeys with their different cases of coupled beam size variation and one solid shear wall structure were modelled and analysed.

Table1 Geometric parameters for Coupled Shear Wall Structure

Structure /Members	Model 03	Model 04	Model 05	Model 06
Length of coupling beam (Lb)	1.8 m	1.8 m	1.8 m	1.8 m
Depth of Coupling beam (d)	1800 mm	720 mm	450 mm	300 mm
Height of Opening (h)	1.70 m	2.78 m	3.05 m	3.20 m
Wall Pier length on each side of coupling beam	1.6 m	1.6 m	1.6 m	1.6 m
Coupling beam aspect ratio (Lb/d)	1	2.5	4	6

Etab Models

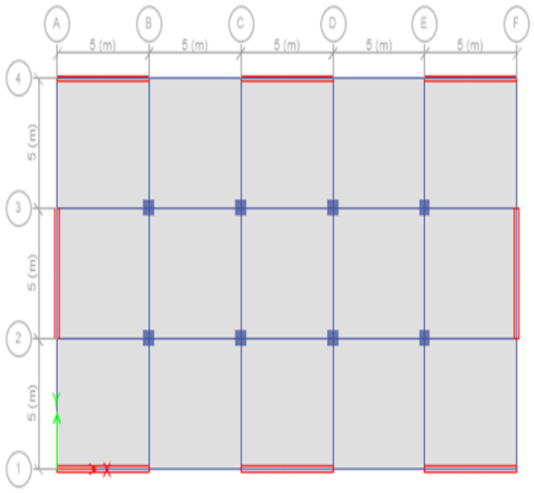

Fig. 1Plan of Solid and Coupled Shear Wall Structure

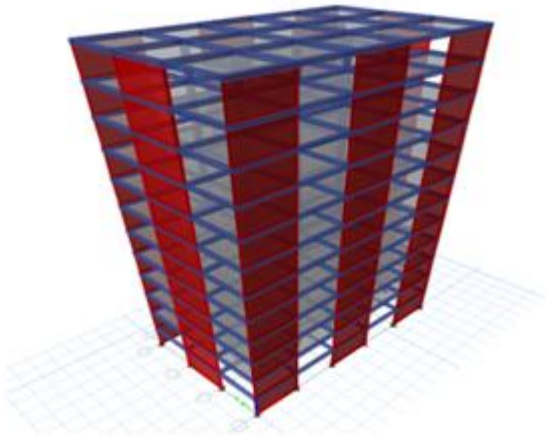

Fig. 2 3D ofSolid Shear Wall Structure Model 02

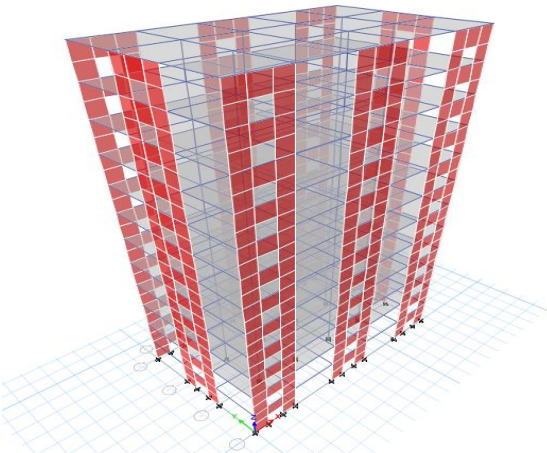

Fig. 3 3D ofCoupled Shear Wall Structure Model 03

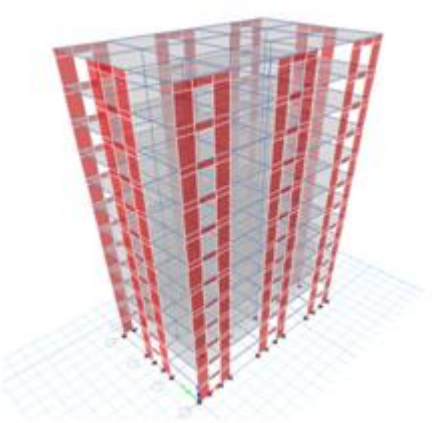

Fig. 4 3D ofCoupled Shear Wall Structure Model 04

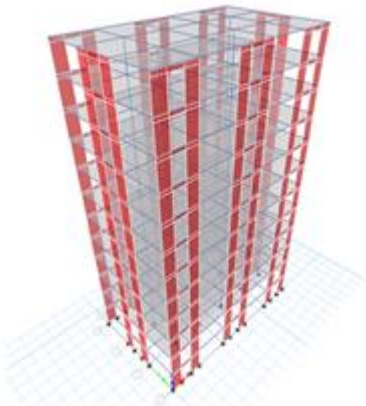

Fig. 5 3D ofCoupled Shear Wall Structure Model 05

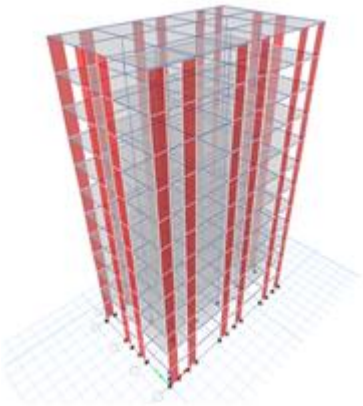

Fig. 6 3D ofCoupled Shear Wall Structure Model 05

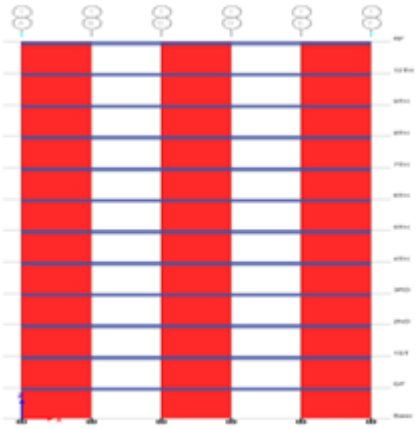

Fig. 7Elevation of Solid Shear Wall Structure Model 02

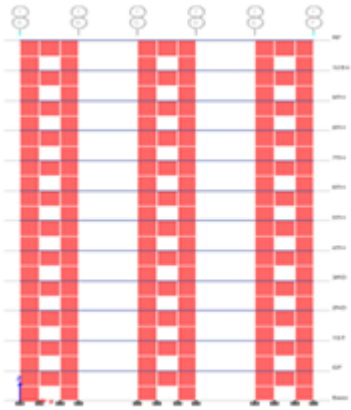

Fig. 8Elevation of Coupled Shear Wall Structure Model 03

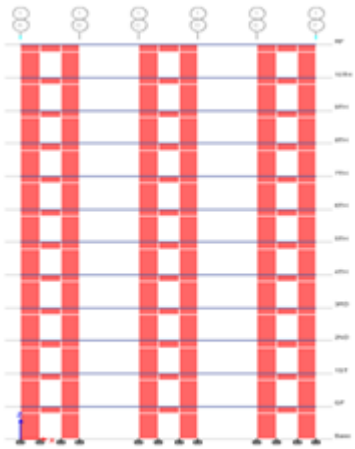

Fig. 9Elevation of Coupled Shear Wall Structure Model 04

Fig. 10Elevation of Coupled Shear Wall Structure Model 05

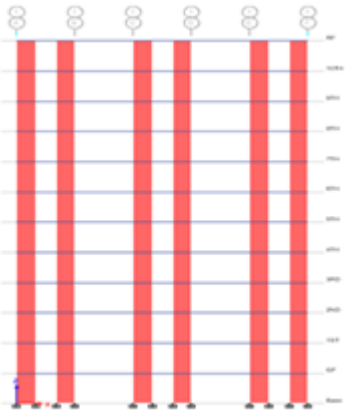

Fig. 11Elevation of Coupled Shear Wall Structure Model 06

IV. RESULT AND DISCUSSION

Comparative Response Spectrum Analysis results are

TIME PERIOD (Second)

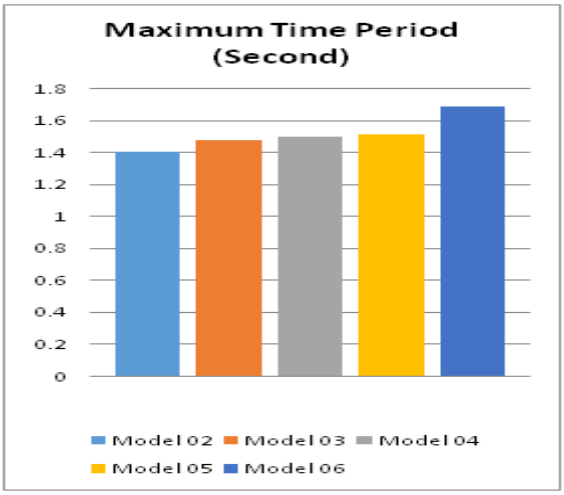

Fig. 12 Time Period

MAXIMUM STORY DISPLACEMENT (mm)

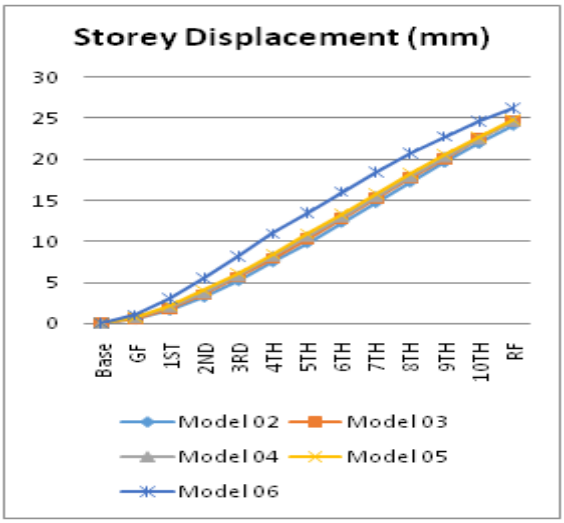

Fig. 13Maximum Story Displacements

BASE SHEARS (kN)

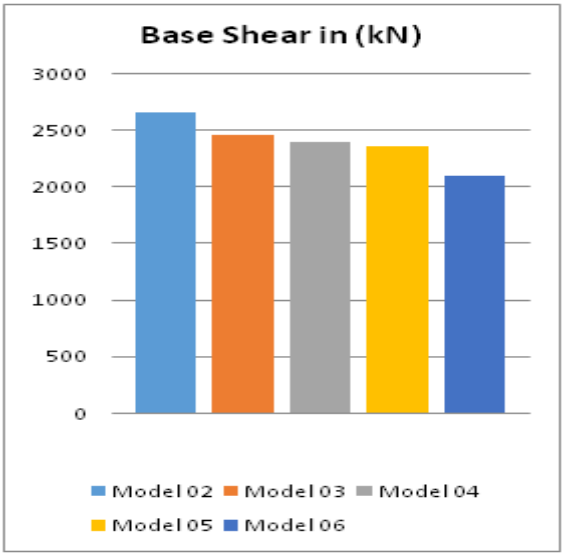

Fig. 14Base Shear

V. CONCLUSION

In the comparison of results of various types of coupled shear wall structures it is concluded:

- Coupled beam size significantly influences the structural parameters of coupled shear wall structure.
- Coupledshearwallwith1800 mm depth shows approximately same results of solid shear wall. So the critical slenderness ratio of the coupling beam is equal to one.
- When the size of the opening is increased the coupled shear wall system behaves as a single wall unit.

There is less participation of coupling beam if the opening is oversized and vice versa. It is clearly evident that there is effect on the depth of the coupling beam for undersized and oversized openings.

- 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.

REFERENCES

[1] P. S. Kumbhare, A. C. Saoji(2012),Effectiveness of Changing Reinforced Concrete Shear Wall Location on Multi-storeyed Building, International Journal of Engineering Research and Applications, Vol. 2, Issue 5,pp.1072-1076

[2] Romy Mohan and C Prabha(2011), Dynamic Analysis of RCC Buildings with Shear Wall, International Journal of Earth Sciences and Engineering, Volume 04,pp659-662

[3] Himalee Rahangdale and S.R.Satone(2013), Design And Analysis of Multistoreied Building With Effect of Shear Wall, International Journal of Engineering Research and Applications (IJERA), Vol. 3, Issue 3, May-Jun2013,pp.223-232

[4] M.D. Kevadkar, P.B. Kodag(2013),Lateral Load Analysis of R.C.C. Building International Journal ofModern Engineering Research (IJMER),Vol.3,Issue.3,pp-1428-1434

[5] Varsha R. Harne(2014), Comparative Study of Strength of RC Shear Wall at Different Location on Multi-storied Residential Building, International Journal of Civil Engineering Research.Volume5,pp.391-400