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A Study on Seismic Behaviour of Symmetrical Coupled Shear Wall Systems with Different Height to Depth Ratio of Coupling Beams

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Abstract

Reinforced concrete structural walls with coupling beams are widely used as the primary lateral load bearing elements in high rise buildings. This paper describe a study deals with effect of depth variation of coupling beam at different story intervals Many researchers shown that there is uncertainty in the estimation of the effective stiffness of RC coupling beams. So here the analysis of high rise building with different story height namely 15 stories & 25 stories with symmetry is considered with the effect of span / depth ratio 1,3,5,&6 and aspect ratio of high of building to width of building 4.6,7.65,& 10.7 effect on coupling beam. The analysis will be carried out by preparing different models in ETABS 2016 software in this study. Medium soil is considered in this study. The behavior of coupled shear wall is mainly due to coupling beam.
Keyword- Base Moment, Base Shear, Coupling Beam, Coupling Degree, Coupled Shear Wall, High Rise Building, Max Displacement Story Drift, Time Period

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I. INTRODUCTION

A coupled shear divider is a piece of a shear divider framework, made of coupling pillars and divider docks. It gives more openings, which increment the useful adaptability in engineering. Moreover, by coupling individual flexural dividers, the horizontal burdens opposing conduct changes to one where toppling minutes are opposed halfway by a hub compression strain couple over the divider framework as opposed to by the individual flexural activity of the dividers.

The key parameter in coupled shear dividers, solidness proportion of coupling bars to divider docks, is a delegate of the level of coupling between divider wharfs. Over coupling ought to be maintained a strategic distance from, which makes the framework go about as a solitary penetrated divider with little casing activity. So also, light coupling ought to likewise be evaded as it makes the framework carry on like two detached dividers. Since the coupling activity between divider wharfs is created through shear compel in the coupling shafts, right demonstrating of coupling pillars may considerably influence the general reaction of coupled shear dividers.

Coupling pillars are a vital individual from a sidelong power opposing framework. It couples or joins two autonomous frameworks. the point when two autonomous shear dividers or concentric propped edges or anything that is opposing parallel burdens and you need to interface them to decrease the toppling impact or increment the general firmness of the framework then you will utilize a coupling shaft to associate both the frameworks.

Coupling shaft ought to be structured so that over coupling and under coupling is averted or maintained a strategic distance from, in light of the fact that the previous would make the framework to carry on as a solitary strong divider with little edge activity and the last will make the framework demonstration like two isolated dividers. Additionally, whenever coupled shaft proportioned appropriately above second floor of building, plastic pivots are produced and exposed to comparative turns at the pillar end over structure stature in the meantime. This lead to convey input vitality dissemination over the stature of the structure in the coupling pillars rather than focus generally in the divider wharfs of the principal story.

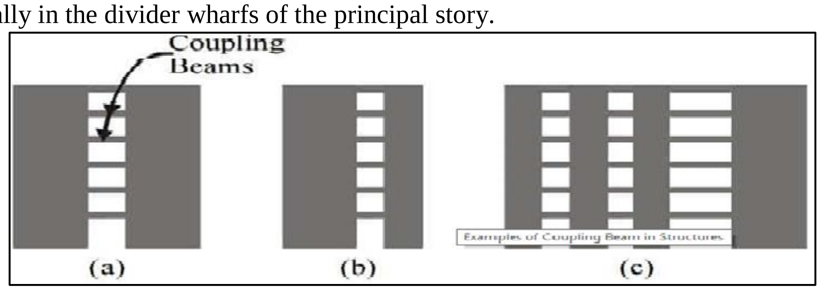

Fig. 1: Example of Coupling Beam in Structure

The principle capacity of coupling shaft is dissemination of vitality and enhancing solidness and quality of the horizontal load arrangement of the structure. Favored coupling bar execution is gotten when it is intended to be enough solid and hardened. Extra, coupling shafts should yield before the divider wharfs, show malleable conduct, and have extensive vitality assimilation qualities. The coupling shafts give exchange of vertical powers between the neighboring dividers, which is makes a casing like coupling activity that is opposes a segment of the aggregate toppling minute incited by the seismic activity.

A. Coupling Degree

The total base moment, Mw of the coupled wall structures.

$$M_w = M_{tw} + M_{cw} + N_{cwb}L_c$$

Where, M_{tw} and M_{cw} are the base minutes in the pressure and pressure side dividers, separately, $N_{cwb} = N_{twb}$, and L_c is the separation between the centroids of the strain and pressure side dividers. At that point, the commitment of the divider pivotal powers from coupling to the aggregate sidelong obstruction of the framework can be communicated by the Coupling Degree.

$$CD = \frac{Ncwb\ Lc}{Mw} = \frac{Ncwb\ Lc}{Mtw+Mcw+Ncwb*Lc}$$

II. METHOD OF ANALYSIS

The examination will be completed by getting ready diverse models in ETABS 2016 programming. "Comparable static investigation and reaction range examination is completed utilizing rules as indicated by IS: 1893-2002."

III. MODELLING PARAMETERS

- Type of frame: Special RC moment resisting frame fixed at the base.
- Seismic zone: IV
- Number of storey: 15, 25 and 35
- Type of soil: Hard
- Floor height: 3 m
- Depth of Slab: 150 mm
- Size of beam: (300 × 600) mm
- Thickness of shear wall: 200 mm
- Thickness of coupling beam: 200 mm
- Spacing between frames: 4.5 m along x and y-directions
- Live load on floor: 3 KN/m2
- Materials: M 30 concrete, Fe 415 steel Material
- Damping of structure: 5 percent
- Response spectra: As per IS1893 (Part-1): 2002

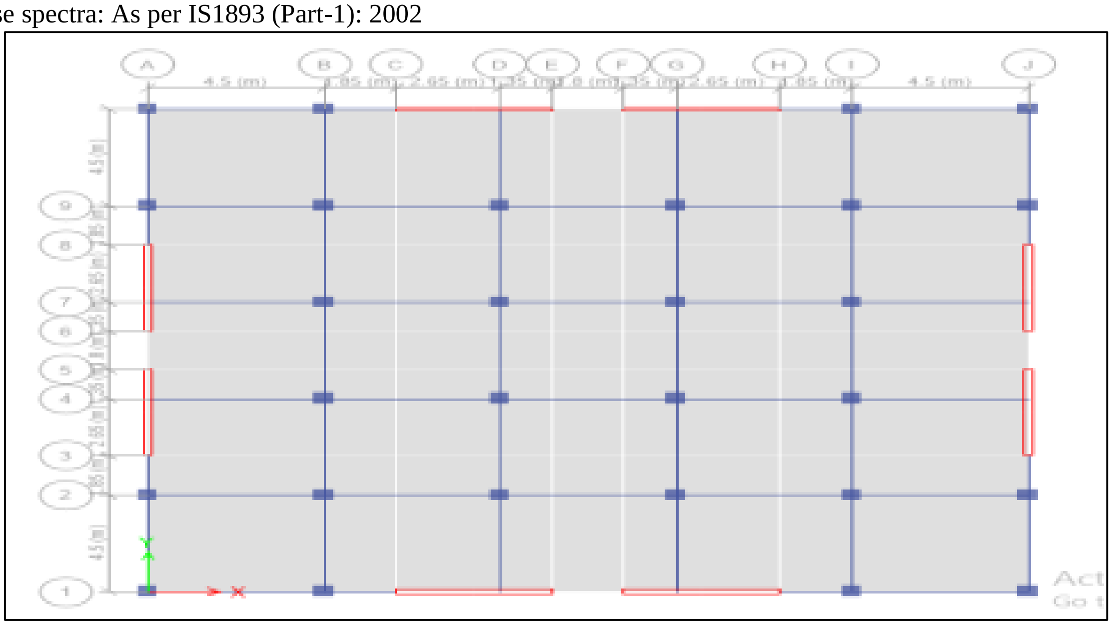

Fig. 2: Plan of a structure

Column size: 1-8 story: (950×950) mm
9-16 story: (750×750) mm
17-25 story: (600×600) mm

IV. RESULTS AND DISCUSSION

Coupling beam depth of base shear(Medium soil)					
No Copling Beam		*300 mm*	*360 mm*	*600 mm*	*1800 mm*
15 stoery	*3065.78*	*3290.95*	*3344.5*	*3560.28*	*4639.42*
25 stoery	*2797.13*	*3029.86*	*3066.15*	*3274.42*	*4315.78*

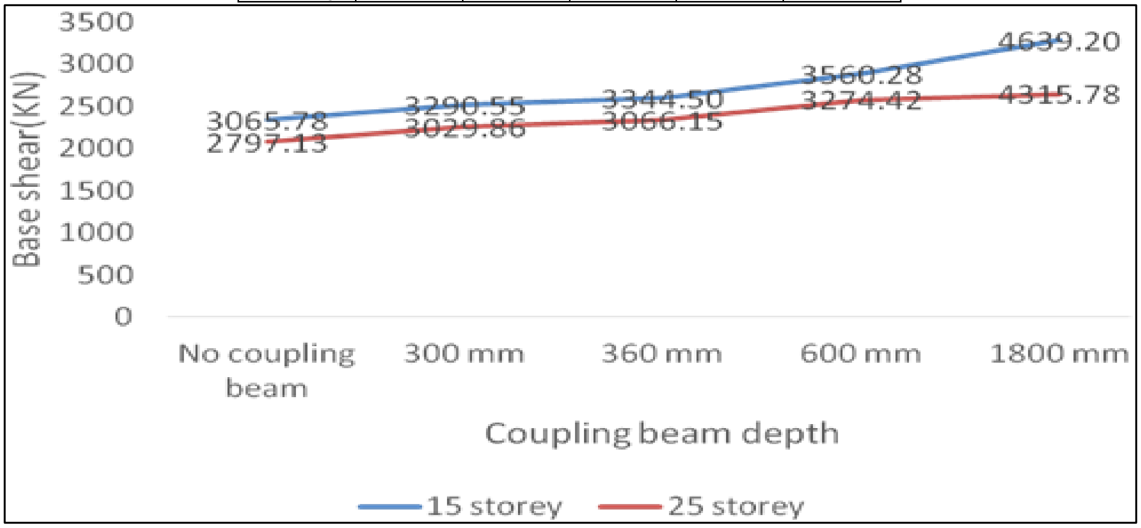

Fig. 3: Comparison of Base Shear for Medium Soil in KN

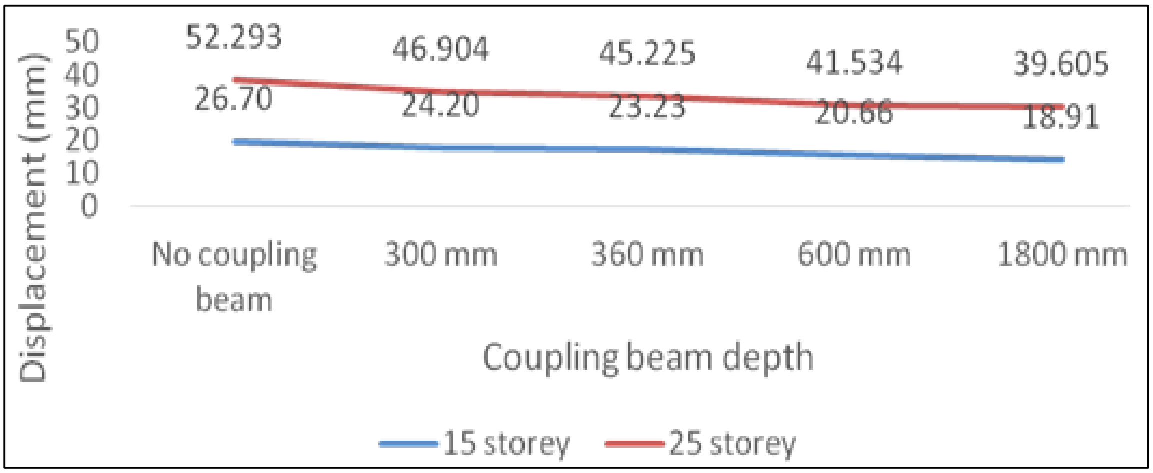

Fig. 4: Comparison Displacement for Medium Soil in mm

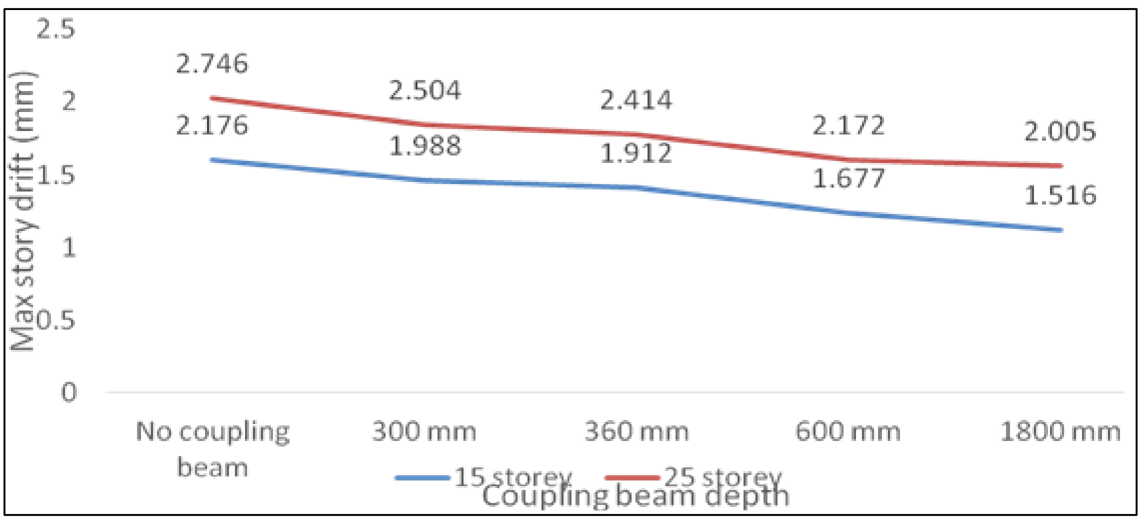

Fig. 5: Comparison of Max Story Drift for Medium Soil in mm

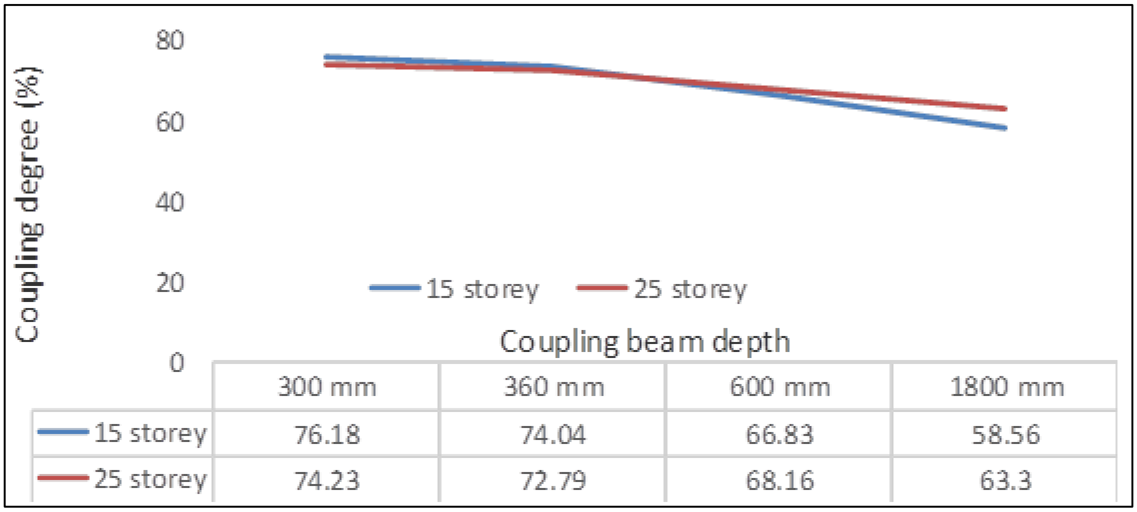

Fig. 6: Coupling Degree for Medium soil in %

V. CONCLUSION

- From the result it is observed that for medium soil, base shear is maximum for 15 storeys with coupling beam as compared to the other model and minimum for 25 storeys with 1800mm depth coupling beam.
- Base shear is maximum in 15 storey building with 1800mm depth of coupling beam as compared to the other model and minimum for 25 storeys with coupling beam of 1800 for medium soil.
- Drift is maximum for 25 storeys with coupling beam as compared to the other model and minimum for 15 storeys with 1800mm depth of coupling beam for hard soil.
- Coupling degree is decreases as depth of coupling beam increases.
- As the depth of coupling beam decreases, stiffness coefficient and coupling index decreases.
- Time period is decreases as the depth of coupling beam increases.

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