Study the Effect on Deflection by using the Shear Wall in Multi Storey Building with the Help of STAAD Pro

Manjeet Dua[1], Er. Sumit Rana [2] & Nitin Verma[3]
[1]M-Tech Student, RPIIT Technical Campus, Karnal-Haryana,India
[2] Assistant Professor, CUM HOD, RPETGI, Karnal-Haryana,India
3 Assistant Professor, Chandigarh University, Gharuan, Mohali-Punjab,India

***Abstract*:**

The main object of this thesis is design, analyses and calculation of deflection by comparing of two G+15 storey buildings to ensure the required safety and serviceability requirements against the deflection in different loads and load combination (i.e. wall load, live load, dead load and earthquake load).
The structure shall be designed for housing G+15, each building have same loading, same geometry, same zone and the same soil condition. The main difference is of the Shear wall. In 21st century due to huge population the no of areas in units are decreasing day by day. Few years back the populations were not so vast so they used to stay in Horizontal system(due to large area available per person).But now a day's people preferring Vertical System(high rise building due to shortage of area).In high rise buildings we should concern about all the forces that act on a building ,its own weight as well as the soil bearing capacity .For external forces that act on the building the beam, column and reinforcement should be good enough to counteract these forces successfully. And the soil should be good enough to pass the load successfully to the foundation. For loose soil we preferred deep foundation (pile).If we will do so much calculation for a high rise building manually then it will take more time as well as human errors can be occurred. So the use of STAAD-ProV8i (Select series 6) will make it easy. STAAD- ProV8i (Select series 6) can solve typical problem like Static analysis, Seismic analysis and Natural frequency. These type of problem can be solved by STAAD- ProV8i (Select series 6) along with IS-CODE. Moreover STAAD-ProV8i (Select series 6) has a greater advantage than the manual technique as it gives more accurate and precise result than the manual technique.
Generally shear wall can be defined as structural vertical member that is able to resist combination of shear, moment and axial load induced by lateral load and gravity load transfer to the wall from other structural member. Reinforced concrete walls, which include lift wells or shear walls, are the usual requirements of Multi Storey Buildings.
Design by coinciding centroid and mass center of the building is the ideal for a Structure. An introduction of shear wall represents a structurally efficient solution to stiffen a building structural system because the main function of a shear wall is to increase the rigidity for lateral load resistance.

I. INTRODUCTION

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In modern tall buildings, shear walls are commonly used as a vertical structural element for resisting the lateral loads that may be induced by the effect of wind and earthquakes which cause the failure of structure as shown in figure Shear walls of varying cross sections i.e. rectangular shapes to more irregular cores such as channel, T, L, barbell shape, box etc. can be used. Provision of walls helps to divide an enclose space, whereas of cores to contain and convey services such as elevator. Wall openings are inevitably required for windows in external walls and for doors or corridors in inner walls or in lift cores. The size and location of openings may vary from architectural and functional point of view.

The use of shear wall structure has gained popularity in high rise building structure, especially in the construction of service apartment or office/ commercial tower. It has been proven that this system provides efficient structural system for multistorey building in the range of 30-35 storey's (MARSONO & SUBEDI, 2000). In the past 30 years of the record service history of tall building containing shear wall element, none has collapsed during strong winds and earthquakes FINTEL, 1995).

II. LITERATURE REVIEW

Bindhu et al. presented an experimental study of exterior beam-column joints with two non-conventional reinforcement arrangements. One exterior beam-column joint of a six story building in seismic zone III of India was designed for earthquake loading. The transverse reinforcement of the joint assemblages were detailed as per IS 13920:1993 and IS 456:2000 respectively. The proposed nonconventional reinforcement was provided in the form of diagonal reinforcement on the faces of the joint, as a replacement of stirrups in the joint region for joints detailed as per IS 13920 and as additional reinforcement for joints detailed as per IS 456. These newly proposed detailing have the basic advantage of reducing the reinforcement congestion at the joint region. In order to study and compare the performance of joint with different detailing, four types of one-third scale specimens were cast (two numbers in each type). All the specimens were tested under reverse cyclic loading, with appropriate axial load. From the test results, it was found that the beam-column joint having confining reinforcement as per IS: 456 with nonconventional detailing performed well. Test results indicate that the non conventionally detailed specimens, have an improvement in average ductility of 16% and 119% than their conventionally detailed counter parts. Further, the joint shear capacity of the non –conventionally detailed specimens is improved by 8.4% and 15.6% than the corresponding specimens respectively. Good correlation is found between the theoretical and experimental results.

Chalioris et al. investigated the effectiveness of cross inclined bars (X bars) as joint shear reinforcement in exterior reinforced beam-column connections under cyclic deformations. The arrangement consisted of the cross inclined bars alone and also in combination with common stirrups or vertical bars. The authors found enhanced cyclic performance and improved damage mode with flexural hinges at beam joint interface.

Memon et al. carried out research on different aspects of analysis and design of tall buildings consisting of shear walls, connecting beams and coupling slabs. An extensive programme of experimental study was chalked out. A few models of relatively large scale were cast and tested. The results of an RCC model which was tested by applying a point load at the top simulating an equivalent static lateral force due to wind and earthquake are presented here. Relatively large scaled models consisting of two planar walls solely connected by beams consisting of five storeys have been tested. Hydraulic jacks were used to apply the load. Load cells together with digital display system measured the intensity of load. Desired mode of failure was achieved. This was particularly due to failure of connecting beams. The above literature review indicates that the behaviour of shear wall under various types of loading, the provision of transverse and confining reinforcement, the role of stirrups in shear transfer at the joint and the detailing of the joints are the main issues. The review shows that additional cross inclined bars at the joint core introduce an additional new mechanism of shear transfer. However the review indicates insufficient information regarding the interaction between the shear wall and the diaphragm. Hence in this investigation an attempt has been made to understand the behaviour of shear wall to diaphragm

Connection portion. From the analysis, it was observed that compared to other models shear wall placed at end of L section is best suited for base shear since end portion of the flange always oscillate more during earthquake.

Shahabodin. Zaregarizi conducted comparative investigation on using shear wall and infill to improve seismic performance of existing buildings. Static nonlinear analysis was done to compare the effectiveness of both methods. From the results, it was observed that concrete infills have considerable strength while brick one showed lower strength. On the contrary, brick infills accepted large displacement than concrete ones. It was concluded that the combination of brick and concrete infills reduced the negative effects when they both used individually.

Mithesh Surana et al. focused on estimation of seismic performance of shear wall and shear wall core buildings designed for Indian codes. Non-linear pushover analysis was used in this study. For modeling the shear wall, the commonly used models like wide column model and shell element model were validated using experimental results available in earlier literature. Both the models showed identical strength for shear wall and shear wall cores. In case of ductility capacity of shear wall and shear wall cores, wide column model underestimates whereas the shell element model overestimates. It has been found that stiffness obtained from moment-curvature analysis is matched with experimental results. But shell element model showed high stiffness initially and later it is reduced due to cracking and finally matched with experimental results. To evaluate the performance of “Dual systems” which is designed as per Indian code, these models were implemented. It has been noted that buildings with shear walls placed at periphery showed excellent performance than buildings with centrally placed shear wall core.

Chun Ni et al. described the performance of shear walls with diagonal or transverse lumber sheathing. A total of 16 full-scale shear walls were tested to determine the effects of hold-owns, vertical load and width of lumber sheathing on in-plane shear capacity.4) The in-plane shear capacities of shear walls with double diagonal lumber sheathing are 2-3 times higher than that of shear walls with single diagonal lumber sheathing.

Michael R. Dupuis et al. analyzed seismic performance of shear wall buildings with gravity-induced lateral demands using OpenSees software. The inelastic response of concrete shear wall buildings was investigated. From the result, it was demonstrated that a seismic ratcheting effect can develop and amplify inelastic displacement demands. But the effect is more prevalent in coupled shear walls than cantilevered shear walls.

III. RESULTS

A. Analysis

Analysis of building is done using STAAD Pro. The models were prepared in the STADD Pro. Software by using different cross sections of RC shear wall viz. Box type, L type and cross type shear wall and these are located at different location such as along periphery, at corner and at middle positions.

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B. Types Of Load Use

Dead Load (DL)

Wall Load (WL)

Live Load (LL)

Live Load in Seismic (LLS)

Earth Quake force in X direction (EQX)

Earth Quake force in Z direction (EQZ)

C. Load combintion

For seismic load analysis of a building the code refers following load combination.

LOAD COMB 10 DL+WL+LL

LOAD COMB 11 EQX+DL+WL+LLS

LOAD COMB 12 -EQX+DL+WL+LLS

LOAD COMB 13 EQZ+DL+WL+LLS

LOAD COMB 14 -EQZ+DL+WL+LLS

LOAD COMB 15 1.5DL+1.5WL+1.5LL

LOAD COMB 16 1.5EQX+1.5DL+1.5WL

LOAD COMB 17 -1.5EQX+1.5DL+1.5WL

LOAD COMB 18 1.5EQZ+1.5DL+1.5WL

LOAD COMB 19 -1.5EQZ+1.5DL+1.5WL

LOAD COMB 20 1.2EQX+1.2DL+1.2WL+1.2LLS

LOAD COMB 21 -1.2EQX+1.2DL+1.2WL+1.2LLS

LOAD COMB 22 1.2EQZ+1.2DL+1.2WL+1.2LLS

LOAD COMB 23 -1.2EQZ+1.2DL+1.2WL+1.2LLS

D. *Comparision Of Two G+15 Building*

After the basic work is done. Then it was made with two different STADD models of G+15 storey building was made with the combination with SHEAR WALL shear wall and without Shear Wall .The Beam and column size of both buildings are same.

E. Followings are the input data for concrete design, deflection and shear bending of a g+15 storey building

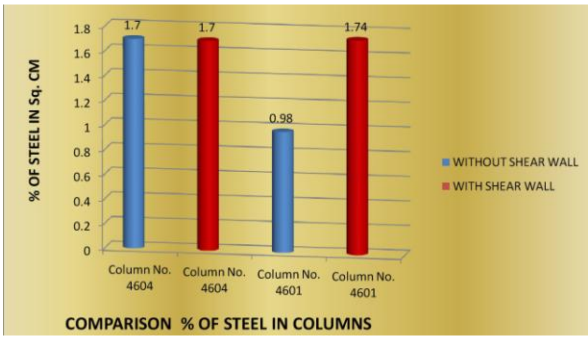
a. Type of structure --> multi-storey fixed jointed plane frame.
b. Seismic zone II (IS 1893 (part 1):2002)
c. Number of stories 16, (G+15)
d. Floor height 2.95 m
e. Imposed load 2 kn/m2 on each floor and 1 kn/m2 on roof.
f. Materials Concrete (M 35) and Reinforcement (Fe415).
g. Depth of slab 125 mm thick
h. Specific weight of RCC 25kn/m3.
i. Specific weight of infill 19.2 kn/m3
j. Type of soil medium soil.
k. Response spectra As per IS 1893.

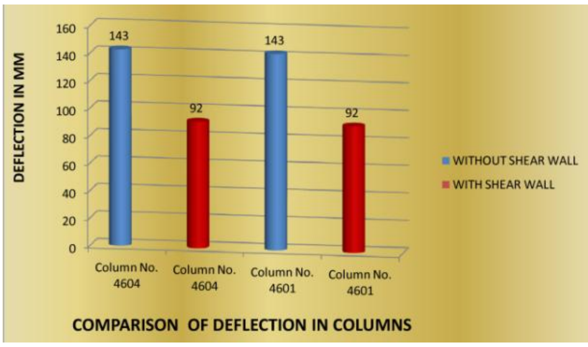
IV. CONCLUSIONS

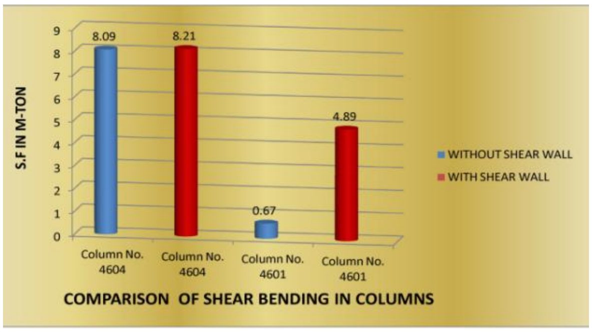
a. The conclusions made from the undertaken research study are enumerated below:
b. Based on the above results from analysis of the two building models, following conclusions may be made:
c. It is observed from the above analysis that the displacement observed in first model, which is without shear wall building shows maximum displacement compared to the models having shear wall at different locations.
d. The best location of shear in multi-storey building near the core of the building.
e. Finally it is concluded that, optimization using genetic algorithm is a best procedure for finding

best solution among several solution, in present work model-2 shows best place of shear wall in (G+10) building. By providing shear wall to the high rise buildings, Structural seismic behavior will be affected to a great extent and also the stiffness and the strength of the buildings will be increased.

f. Among all the load combination, the load combination of 1.5EQX+1.5DL+1.5WL is found to be more critical combination for all the models.
g. The lateral deflection of column for building with type 2 shear wall is reduced as compared to all models.
h. The shear force is maximum at the ground level.
i. The bending moment is maximum at roof level.
j. It has been observed that the top deflection is reduced after providing the shear wall in the frame in X-direction as well as in Y-direction.







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