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Review paper on Flat slab with shear wall at different loacation

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Abstract — *Flat plate is a reinforced concrete slab supported directly by concrete columns without the use of beams, column flares or drop panels. Flat plate system has been adopted in many buildings constructed recently taking advantage of the reduced floor height to meet the economical and architectural demands. However, In Multistoried structures the flat plate floor system has week resistance to lateral loads like wind and earthquake. The present paper work was made in the interest of studying various research works involved in enhancement of flat slab, shear wall and flat slab with shear wall and their behavior towards lateral loads.*

Keywords-*Flat slab, Shear wall, Response spectrum analysis, seismic zones, Base shear, Time period*

I. INTRODUCTION

Reinforced concrete has been used for building construction since the middle of the 19th century, first for some parts of buildings, and then for the entire building structure. Reinforced concrete is a major construction material for civil infrastructure in current society. Construction has always preceded the development of structural design methodology. Dramatic collapse of buildings has been observed after each disastrous earthquake, resulting in loss of life.
A flat slab is a reinforced concrete slab supported directly by concrete columns without the use of beams. Reinforced concrete flat slabs are one of the most popular floor systems used in residential buildings, car parks and many other structures. They represent elegant and easy-to-construct floor systems. Flat slabs are favored by both architects and clients because of their aesthetic appeal and economic advantage. Reinforced concrete flat slabs are commonly used in construction as they provide a number of benefits to the designer including: 1.Thin sections allowing for greater roof heights and lighter floors, 2.Exposed ceilings, 3.Flexible column arrangements, this is more difficult to achieve for a beam-column design,4.Fast and cheap construction using simple formwork.

However, flat slabs have a lower stiffness in comparison to a beam-column floor plan which can lead to relatively large deflections. In addition to this, the shear capacity can also be reduced in particular around the column head where large shear forces can develop. There are two main failure modes of flat slabs: 1.Flexural Failure and 2.Punching Shear Failure.

Slabs are designed to fail by flexural failure, the failure mode is ductile therefore giving relatively large deflections under excessive loading, and also cracks will appear on the bottom surface before failure occurs. These signs allow the problem to be addressed before failure occurs.

Punching shear failure by comparison is a brittle failure mode when shear reinforcement is not added, meaning failure will occur before significant deflections take place, in addition to this any cracks that will develop before failure will propagate from the top surface. Since this surface is typically covered, it is unlikely that there will be sufficient warning available before failure occurs.

II. LITERATURE REVIEW

M. Altug ERBERIK, Amr S. ELNASHAI (2004)[6] discussed about Flat-slab RC buildings exhibit several advantages over conventional moment resisting frames. However the structural effectiveness of flat-slab construction is hindered by its alleged inferior performance under earthquake loading. This is a possible reason for the observation that no fragility analysis has been undertaken for this widely-used structural system. This study focuses on the derivation of fragility curves using medium-rise flat-slab buildings with masonry infill walls. The developed curves were compared with those in the literature, derived for moment-resisting RC frames. This study also concluded that earthquake losses for flat-slab structures are in the same range as for moment-resisting frames for low limit states, and considerably different at high damage levels.

Prof. K S Sable, Er. V A Ghodechor, Prof. S B Kandekar (2012)[20] focuses on tall commercial buildings are primarily a response to the demand by business activities to be as close to each other, and to the city centre as possible, thereby putting intense pressure on the available land space. Structures with a large degree of indeterminacy is superior to one with less indeterminacy, because of more members are monolithically connected to each other and if yielding takes place in any one of them, then a redistribution of forces takes place. Therefore it is necessary to analyze seismic behavior of building for different heights to see what changes are going to occur if the height of conventional building and flat slab building changes.

Fayazuddin Ahmed Syed, B. Dean Kumar, Y. Chandrasekhar, B.L.P. Swami (2012)[7] studied analysis of Flat Plate Multistoried Frames With and Without Shear Walls under Wind Loads. It is seen that the column moments for flat plate floor system building with Shear walls has decreased by 69.17 % & 58.2 % when compared with flat floor system, conventional beam supported slab system. The Shear walls with flat plates contribute towards reducing the column axial force even in the middle frame region also. In the case of other building frames there is similar reduction in column axial force when wind is acting. The flat plate floor system can be further strengthened against the lateral loads by providing Shear walls also. The drift becomes minimum, so that there is 65.77% reduction in the drift in this case

Dr. Uttamasha Gupta, Shruti Ratnaparkhe, Padma Gome (2012)[8] studies about flat slab building structures which are more significantly flexible than traditional concrete frame/wall or frame structures, thus becoming more vulnerable to seismic loading. Therefore, the characteristics of the seismic behavior of flat slab buildings suggest that additional measures for guiding the conception and design of these structures in seismic regions are needed. To improve the performance of building having flat slabs under seismic loading, provision of part shear walls is proposed in the present work. The object of the this work is to compare the behavior of multi-storey buildings having flat slabs with drops to the two way slabs with beams and to study the effect of part shear walls on the performance of these two types of buildings under seismic forces. This work provides a good source of information on the parameters lateral displacement and storey drift.

Anuj Chandiwala (2012)[1] studied a 10 storey RC building located in seismic zone III which is on medium soil. The different building configurations were i) Shear wall at end of L section ii) L Shear wall at junction of 2 flange portion iii) Two parallel L shear wall at junction of 2 flange portion iv) Tube type shear wall at junction of 2 flange portion v) Two parallel shear wall at end of flange 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.

Kiran S. Patil, N.G.Gore, P.J. Salunke (2013)[15] study about optimum design of reinforced concrete flat slab with drop panel according to the Indian code (IS 456-2000) is presented. The objective function is the total cost of the structure including the cost of slab and columns. The cost of each structural element covers that of material and labour for reinforcement, concrete and formwork. The structure is model and analyzed using the direct design method. The optimization process is done for different grade of concrete and steel. The comparative results for different grade of concrete and steel is presented in tabulated form. Optimization for reinforced concrete flat slab buildings is illustrated and the results of the optimum and conventional design procedures are compared. The model is analyzed and design by using MATLAB software. Optimization is formulated is in nonlinear programming problem (NLPP) by using sequential unconstrained minimization technique (SUMT).

Rajib Kumar Biswas, Md. Meraj Uddin, Md. Arman Chowdhury, Md. Al- imran Khan (2013)[18] compared the performance of 15 storey flat plate building with and without shear wall and diagonal bracing under wind and seismic loads on the factors such as lateral drift, displacement and column axial load. It was found that Flat plate is good in perspective of gravity load. But it experienced that flat plate building can’t stand strongly against wind, seismic or other lateral forces. As a result, more than any other structural component, the lateral force-resisting structure has significant impact on space planning. So it is essential for a structure to have lateral resistance by providing Shear wall.

Ravi Kumar Makode, Saleem Akhtar, Geeta Batham (2014)[12] [12] discussed about the flat slab buildings in which slab is directly rested on columns, have been adopted in many buildings constructed recently due to the advantage of reduced floor to floor heights to meet the economical and architectural demands. Axial force in end columns of flat slab building is more compare to grid slab. Base shear of flat slab building is less than the grid slab building.

Sumit Pawah, Vivek Tiwari, Madhavi Prajapati (2014)[22] focuses to compare behavior of flat slab with old traditional two way slab along with effect of shear walls on their performance. The parametric studies comprise of maximum lateral displacement, storey drift and axial forces generated in the column. For these case studies they have created models for two way slabs with shear wall and flat slab with shear wall, for each plan size of 16X24 m and 15X25 m, analyzed with Staad Pro. 2006 for seismic zones III, IV and V with varying height 21m, 27 m, 33 m and 39 m. This investigation also tells us about seismic behavior of heavy slab without end restrained. For stabilization of variable parameter shear wall are provided at corner from bottom to top for calculation. Results comprises of study of 36 models, for each plan size, 18 models are analyzed for varying seismic zone. From conclusion it is seen that part shear wall are not enough to keep displacement in limits. In case of larger plans increase in column reinforcement is 0.6 to 1 % without shear walls and 0.2 to 0.6 % with shear walls.

P. V. Sumanth Chowdary and Senthil Pandian. M. (2014)[14] study the solution for shear wall location and type of shear wall in seismic prone areas. The effectiveness of RCC shear wall building is studied with help of four different models. Model one is bare frame system and remaining three types are different shear wall buildings. An earthquake load is applied to 8 storey building located in different zones. The performance of building is evaluated in terms of lateral displacements of each storey. The analysis is done by using structural finite element analysis (SAP2000) software.

P.S. Lande and A.B. Raut (2015)[16] presents a study of investigations carried out in order to identify the seismic response of systems (a) flat slab building (b) flat slab with parametric beams (c) flat slab with shear wall (d) flat slab with drop panel (e) conventional building the aforementioned hypothetical systems were studied for two different storey height located in zone v. and analyzed by using ETABS nonlinear version 9.7.3. linear dynamic analysis i.e. response spectrum analysis is performed on the system to get the seismic behavior.

P. Srinivasulu, A. Dattatreya Kumar (2015)[13] investigate the behaviour of flat slab in 4 different cases as (a) flat slab structure without drop, (b) Flat slab structure with column drop, (c) Flat slab structure with shear wall, (d) Flat slab structure with column drop and shear wall together, through response spectrum method, by using ETABS software. The behaviour of the flat slab is investigated in terms of story displacements, frequency, base shear, story level accelerations. And also most severe problem in flat slabs is punching shear failure. During the earthquake, unbalanced moments can produce significant shear stresses that causes slab column connections to brittle punching shear failure. This paper also investigates on which type of combination produces less punching shear at slab column joint.

R. S. Surumi K. P. Jaya S. Greeshma (2015)[17] [17] investigation carried out to study the seismic behavior of shear wall–flat slab connections with various reinforcement detailing at the joint region. The modelling and assessment of scaled down exterior wall–slab connection sub-assemblages subjected to static reverse cyclic loading is presented. Three-dimensional nonlinear finite element models with different reinforcement detailing at the joint region were developed using ABAQUS/CAE software. The concrete damage plasticity model was used to model. It concludes that The provision of shear reinforcement in the joint core region can be an effective option for detailing exterior wall—flat slab connection in seismic risk regions.

Kavish Patwari, L. G. Kalurkar (2016)[11] the combined effect of with and without shear wall of flat slab building on the seismic behavior of high rise building with various positions of shear wall studied. For that, 11 storey model is created in Etabs. To study the effect of different location of shear wall on high rise structure, linear dynamic analysis (Response spectrum analysis) in software ETABs is carried out. Seismic parameters like time period, base shear, storey displacement and storey drift are checked out.

CONCLUSION

The proposed conclusions of the project may be:

- The flat slab building shows poor seismic response as compare to conventional building due less lateral stiffness.
- As shear walls provide better resistance to lateral load, hence it is important to find behavior of flat slab building provided with shears walls and its effective positions in building.
- Due to wind loading the column moments for flat plate floor system building are increased compared to conventional building, while flat slab with shear wall has decreased compared with flat plate and conventional building.
- Flat plate system with shear wall is the best choice to safeguard the building against the lateral loads.
- Building with shear wall is preferred because of considerable difference in storey displacement, base reaction, and storey drift.
- Structure with shear wall along periphery is suitable for the effect of wind load and earthquake load on the performance of building.

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