Review on Seismic Performance of Flat Slab Structures by Evaluation of R Factor

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Abstract

Flat slab system is simply a beamless slab system in which slabs directly rests on columns. Flat slab system nowadays widely used in structural systems than slab-beam-column framed system because of its speedy construction, easier formwork, use of space and architectural significance. Response reduction factor is a ratio of elastic base shear to design base shear. This paper deals with the literature review of different authors on seismic behavior of reinforced concrete and flat slab frame structure. The object of this study is to evaluate response reduction factor and check its adequacy in flat slab structure. And also to compare pushover curves by pushover analysis.

Keywords: Flat slab system, Pushover analysis, Seismic loading, STAAD.pro, Response Reduction Factor

I. INTRODUCTION

Flat slab system nowadays widely used in structural systems than traditional slab-beam-column framed system because of its speedy construction & typical type of construction in this construction slab is construct monolithically with supporting columns, easier formwork, use of space and architectural significance. Flat slab system mostly used where we require large rooms such as auditorium, theatre halls, showrooms of shops and so on. In flat slab system two types of failure occurs namely flexural failure and punching shear failure. Large deflection due to excessive loading is responsible for flexural failure. Before failure occurs crack will appear on bottom surface of slab. Punching shear failure occurs when we does not provide shear reinforcement. Before failure occurs cracks will propagate from top surface of slab. To overcome this problem we provide drop panel and column head at columns.

Response reduction factor is dependent upon ductility factor, strength factor, structural redundancy and damping. Actual intensity of earthquake is reduced by response reduction factor ‘R’.

This paper deals with the evaluation of response reduction factor for flat slab at all seismic zones and comparison of pushover curves by pushover analysis.

II. LITERATURE REVIEW

A. R.P.Apostolsk, G.S.Necevska-Cvetanovska, J.P.Cvetanovska and N.Mircic worked on Seismic Performance of Flat-Slab Building Structural Systems.

In this paper they studied frame structure, purely flat-slab system and flat slab system strengthened by perimeter beams and RC walls. For analysis they used finite element method and SAP 2000 Software. In their analytical study they compare the results for different structural systems with respect to time-period, mode shapes, maximal displacements, relative storey drift and time histories of absolute displacements at top. In between frame structure and purely flat slab system they compare the results of bearing capacity and deformability. From their conclusion they say that first purely flat slab system is more flexible for horizontal loads than traditional RC frame structure. Secondly when we do certain modifications with structural elements i.e. strengthened perimeter beams and RC walls in flat slab system it improves low bearing capacity and deformability of system.


In this paper they studied comparison of linear analysis of flat slab structure with traditional frame structure and they also studied the comparison of flat slab structure with shear wall and traditional frame structure with shear wall. For modeling and analysis they use SAP 2000 software. They concluded that flat slab structure has low base shear capacity and large deflection than traditional frame structure. Hence traditional frame structure is much better than flat slab structure. Secondly performance of flat slab structure is improved by use of shear wall than purely flat slab structure.
C. Prof. K.S. Sable, Er. V.A. Ghodechor, Prof. S.B. Kondekar worked on Comparative Study of Seismic Behaviour of Multistory Flat Slab and Conventional Reinforced Concrete Framed Structure.

In this paper they studied the seismic behavior of multistory flat slab, multistory flat slab with shear wall and conventional reinforced concrete framed structure at different floor heights. For modeling and analysis they used STAAD.pro software. They compare the analytical results of natural time period, average response acceleration, base shear, storey drift and degree of indeterminacy. They concluded that time period for flat slab and flat slab with shear wall is same while it is less than conventional frame structure. Base shear of flat slab structure is more as compared to conventional frame structure. Storey drift in flat slab structure is more than conventional frame structure.

D. Sanjay P.N., Mahesh Prabhu K. and Umesh S.S. worked on Behaviour of Flat Slab RCC Structure Under Earthquake Loading.

They studied comparison between flat slab structure without drop and flat slab structure with drop. They investigate seismic behavior of flat slab structure with two soil conditions- soil type 1 (Hard soil) and soil type 2 (medium soil). Earthquake zone they consider as zone 2, zone 3, zone 4. Analysis has been done by equivalent static and Response Spectrum methods. For modeling of structure they used ETABS software. They compare the results of different parameters like natural time period, storey drift, base shear and bending moment.


They studied the comparison between the results in flat slab structure by using finite element method and equivalent frame method. They proposed efficient analytical method using super elements to save computational time and memory. They analyse two types of flat slab structures first flat slab structure with regular plan and second flat slab structure with irregular plan. They considered stiffness degradation by equivalent frame method in flat slab structure with regular plan only.

III. CONCLUSION

Most of the researchers did analysis on flat slab structure under seismic loading. Most of them used SAP software for modeling and analysis of flat slab structure. But still there is a lack of study on structural behavior and performance of the flat slab structure by considering response reduction factor only. So now it is necessary to find out seismic behavior of flat slab structure by considering response reduction factor and compare its analytical results with conventional frame structure. The second object of the study is to compare the pushover curves by pushover analysis.

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