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Literature Review- Comparative Seismic Performance of Post-Tensioned and RCC Flat Slab by using E-TABS

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Abstract – *The Structural Engineering is the branch of Civil Engineering where the behavior of the structure is to be determined where building is constructed at site location and identify the various forces like shear force and axial forces, bending moments and displacement etc.whose acted on the respective structure. While analysis of such multi-storied and complex designs of structure by means of manual calculation is impossible to perform for an individual, so, hence different types of softwares are used for analysis and design purpose like are STAAD Pro V8i, ANSYS, ETAB, SAP-2000 etc. In the present study the process involves to determine the sizes of components of the structure and to check for stability of the structure for various external forces which we are applying on it. In this study comprises of building having G+11 floors system and in commercial type. One model having RCC Flat Slab and other one having Post-tensioned Flat Slab. A Flat Slab is a two-way Reinforced concrete slab that usually does not have beams and girders and the loads are transferred directly to the supporting columns. In this Study ,Slab will be analyze for Post-Tensioning and comparatively study will be made with conventional RCC Flat slab on various parameters like base shear, storey drift, storey shear, storey stiffness etc. In this study, aim is to compare the behavior of PT flat slab structure and RCC flab slab structure under the same seismic loading. In the present study , an attempt is made to compare the design and cost effectiveness of PT flat slab system with respect to reinforced concrete flat slab system.*

Keywords*- ETABS-2017, Seismic Analysis, Flat Slab*

I- INTRODUCTION

In today's world the exploding population creating the disasters like land scarcity which leads us to the bringing some new construction technology and commercial structures. A normal building structure has number of beams in it. But while taking flat slabs no beams are casted separately. A structure is said to be more stable when it satisfy the stability. Two approximate methods are adopted by the codes for the design and analyze the flat slab or say flat plate. These methods can be used provided the limitations specified therein are satisfied. The two design methods are i) The direct design method, ii) The equivalent frame method. In a developing country like India the benefits of pre-stressing and particularly of post-tensioning are yet to be recognized. The inherent hurdle is undoubtedly the higher initial investment that is required from the clients. This has to be overlooked considering the significant benefits of post-tensioning and the high benefit-aspect ratio that can be advantageously procured. In the present study an attempt is made to be compare the design and cost effectiveness of post-tensioned flat slab with respect to the reinforced concrete flat slab system.

II- LITERATURE REVIEW

1) Boskey Bahoria (2010): In the present study the design of the post-tensioned flat slab is done by using two methods, load balancing method and equivalent frame method. The technical study of the post-tensioned flat slab by varying the span by 0.5 m interval is done and results of the different

parameters such as thickness of slab, grade of concrete, loss due to stress, normal reinforcement, reinforcement for the shear, Member of tendons, stressing force per tendons and deflection etc. are presented in the graphical form. A design of post-tensioned beam is also done. For the study of post-tensioned flat slab and beams a case study of multistory office building (G+4floor system) is taken and it is designed by four cases, the post-tensioned flat slab, post-tensioned beams and the RCC flat slab and the RCC slab and beams. After the design of these four cases the comparative study with respect to economy is carried out. The analysis, design and the estimation of the office building of the four floors systems is done. The study shows the variation of the rate per square meter for these four different cases.

2) U. Prawatwong (2008): This paper presents an technical study on the seismic activity of two three fifth scale post-tensioned interior slab column connection models, one without drop panel and another on with drop panel. The model without drop panelled was designed and constructed to represents a typical connection between interior column and post-tensioned flat plate with bonded tendons are found in Thailand. The another model was leads to represent an improved design of typical post-tensioned slab-column connections by using drop panel. Both models were tested under a constant same gravitational load.

   Based on the experimental results of both specimens, the following conclusions are drawn:

   a. During the test, each specimen behaved like a linear elastic system with low energy dissipation ,as indicated by long and arrow hysteretic loops . No pinching henomenon was observed in the hysteretic loops of both specimens.
   b. The test results suggest that the gravity shear ratio (Vg/V0) is the major variable which can brings the drift capacity and ductility of bonded PT interior connections, as comparable to both RF concrete and unbonded PT flat slab connections.
   c. The test results also suggest that the ACI 318-05's design drift limit could be used for bonded Post-Tensioned slab-column connections. More testing on bonded Post-Tensioned connections is highly recommended to confirm this point.

3) Jnanesh Reddy RK(2017): In the present study the attempt is made to comparing the cost effectiveness of Post-Tensioned flat slab systems with respect to RF concrete flat slab system. Both the systems are analyzed using RAPT and ETABS respectively which is based on the design methodology. There are many other benefits of using PT slab. As the thickness of the slab is much lesser than the R.C.C flat slab, aesthetic look of the building may get enhanced leading to a clear height for a longer distance. Hence, using a PT Slab is more advisable for a commercial building than using a R.C.C Flat Slab. Construction of a structure using Post-Tensioned Slab also leads to a lighter structure as the Dead Load gets reduced.

4) S.S. Patil(2014): The objective of this paper is to present the use of flat slab construction in India. The applicability in buildings followed by a comparative description of flat slab building structure designs based on Indian Standard code 456:2000 and American Concrete Institute code ACI-318. In practical it was observed that the Post-Tensioned structure doesn't reduce thickness of slab and also doesn't reduce in the cost of structure. Due to issues related with Post-Tensioned construction in India and its higher cost, conventional RF Concrete should be the preferred choice for spans up to 10 meters. Design of conventional RCC flat plate/slab in India, utilizing Indian codes, has many shortcomings, which will be addressed and revised soon.

5) Shriraj. S. Malvade(2017): The ultimatum of this paper the author is to give a reviews on the response and properties of Post-tensioned flat slab during earthquake shocks and compare with normal flat slab. A study on analysis and behavior Of Post-tensioned flat slab is been done in this thesis. Modeling and analysis of flat slab and PT flat slab is done using SAFE. Stretching one cable produces secondary moment and hence strip moments in both direction changes abruptly. Hyper static moments are affecting during the construction stage. In stage wise construction hyper static moments play important role. In the flat plate varying eccentricity is not very much possible due to small thickness of slab but force can be worked out for new moments. Due to post-tensioning of flat plates slab there is no much effect on axial force but shear and moment on column increases.

III- SUMMARY OF LITERATURE REVIEW

1) Boskey Bahoria gives the idea about the post-tensioned flat slab building structure having four cases depending upon by varying the span length by 0.5 m interval and discuss the comparative study of four cases with respect to economy.
2) U. Prawatwong makes a two models one with drop panel shows the connections between slab-column and another is without drop panel shows connection between interior columns with PT flat plate and bonded tendons having seismic performance on two three fifth scale pattern under constant gravity load to investigate the seismic performance.
3) In this paper Jnanesh Reddy RK compares the cost effectiveness of the post-tensioned flat slab with respect to RCC flat slab by using RAPT and ETABS softwares giving the final statement that PT flat slab is more advisable than RCC flat slab because it reduced the dead load by reducing thickness of slab.
4) S.S. Patil gives the objective regarding the use of flat slab/plate in India by utilizing IS 456:2000 and ACI-318 codes,realized that while using flat slab in Practical neither reduced thickness of slab nor cost of structure. And gives the preferred choice conventional RCC for span upto 10 meters.
5) The main objective given by Shriraj.S. Malvade in this paper to gives the responses of post-tensioned flat slab with normal flat slab in the influence of seismic activity.

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