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Comparative Study of Conventional Slab, Flat Slab & Post-Tensioned Flat Slab on ETABS Software

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ABSTRACT

In the current scenario Post-Tensioning method is more popular due to its application using this method we can design the most economic and most safe design. Whenever we are designing using this method we need to more safety measures has to be made for shear and deflection criteria for the slabs. In any developing country like our country India the benefits of post stressing and particularly of Post-Tensioning are yet to be recognized. in the cutting-edge overview, an endeavor is made to examine the fee viability, sturdiness, best, maintainability of submit-Tensioned degree piece frameworks as for constructed up full-size level chunk framework. The purpose for this examination paper new is development innovation issues in India and find out reasons, seriousness, impacts to embody modifications. The exploration have to be cleared a street for executing modifications in improvement initiatives techniques and alleviate it is assets in social and hierarchical adjustments in firms to expand advantage, take care of their opponents and control challenge to restrict cost and timetable overwhelm. This research work thesis is focused on comparative study of Conventional slab, flat slab and post- tensioned flat slab. In this research work, an attempt has been made to compare the study between Conventional slab, flat slab, and post -tensioned flat slab for G+10 storey building with different span length. This type of slab has been analyzed and designed by ETABS software

Keywords – Conventional slab, flat slab, post -tensioned flat slab, G+10 storey building, and ETABS software

INTRODUCTION

Despite the fact that the primary idea to apply pre-stressing to concrete became made as early as 1886, in the US. It became handiest a end result of the studies of the famed French engineer Eugene Freyssinet within the 1930s. Pre-strain concrete may be define as concrete in which inner compressive stresses are deliberately advent for you to counteract the tensile stresses as a consequence of outside loads to a preferred degree. In easy words a pre-compressed concrete is called pre-stressed concrete

The development in the present condition in the field of pre-stressed concrete is due to the ongoing research carried out during the last 90 years of engineering and scientific achievements in this field. Jacksone de san Francisco filed for a patent in 1886 in the construction of artificial stones and concrete pavements, in which pre-stress were introduce by tensioning the reinforced road set in sleeves. Dohring Germany designs the slab and small size beam in 1888, using wire in concrete embedded tensioning to prevent cracks.

Pre-stress the idea to the Austrian engineer first proposed to counter the stresses due to loads in Mandlebin 1896. Losses in pre-stress concrete due to shorting of concrete is introduced by M koenen of Germany in 1907 and important of losses in pre-stress due to shrinkage is developed by Steiner in the US around 1908.
The use of unbound tendon in pre-stress was the first demonstrated by Dischinger in 1928. The developments of the vibration techniques for the production of high strength concrete and the invention of the double – acting jack for stressing high tensile steel wires are considered to be the most significant contribution develop by Freynssinet between 1928 & 1933.

In concrete members pre-stress are commonly applied by tensioning the tendon done using by hydraulic jacks. The tensioning processes can be either done before casting of concrete the method is known as pre tensioning and after casting of concrete this method is known as post tensioning methods. This techniques used for slab design, cracking free tennis courts.

RESEARCH METHODOLOGY

[1] Literature review.
[2] Modeling the conventional slab system in G+10 multi storey building in ETABS software by giving all the necessary data i.e. section property, material property, loads as per the Indian code.
Modeling the flat slab system in G+10 multi storey building in ETABS software by giving all the necessary data i.e. section property, material property, loads as per the Indian code.

[3] Modeling the post tensioned flat slab system in G+10 multi storey building in ETABS software by giving all the necessary data i.e. section property, material property, loads as per the Indian code, and post tensioning data.
[4] Analysis and design of all the three system.
[5] Results comparison between all the three systems.

MODELLING:

We are using G+10 storey in which, the base storey height is 4m and top most floor height is 4.6m and rest of the intermediate heights is 3.6m.AndUnsymmetrical building size is 32.25m x19.55m.
Planning and detailing of building Detailed plan of the building are as follows:-

Planning

Project type: Commercial shopping complex & office spaces. No. of floor = G+10
Total Length of building = 32.25m
Total width of building =19.55m
Ground Floor height = 4m
Intermediate floor height = 3.6 m
Roof top height = 4.6 m
Total height of building = 41 m
Construction phase =03

Material property

The concrete grade for R.C.C. and PT are as follows:-
The grade of concrete used for beam and column: - M35
The grade of concrete used for conventional slab: - M35
The grade of concrete used for flat slab: - M35
The grade of concrete used for post tensioned flat slab:-M35
Note: - M35 is the design mix as per the Indian code IS 10262:2009.
Material data entered for making the grade of concrete in ETABS are in the format are as in image given below: in Figure 1 Material property of concrete

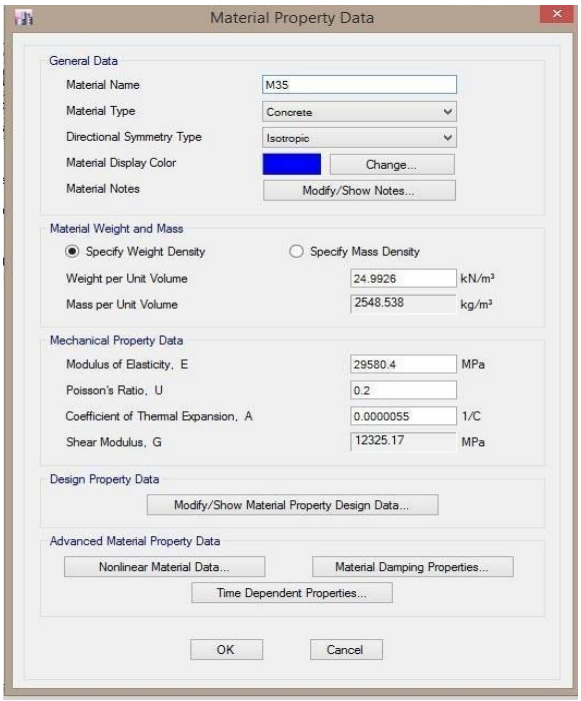


Figure 1 Material property of concrete

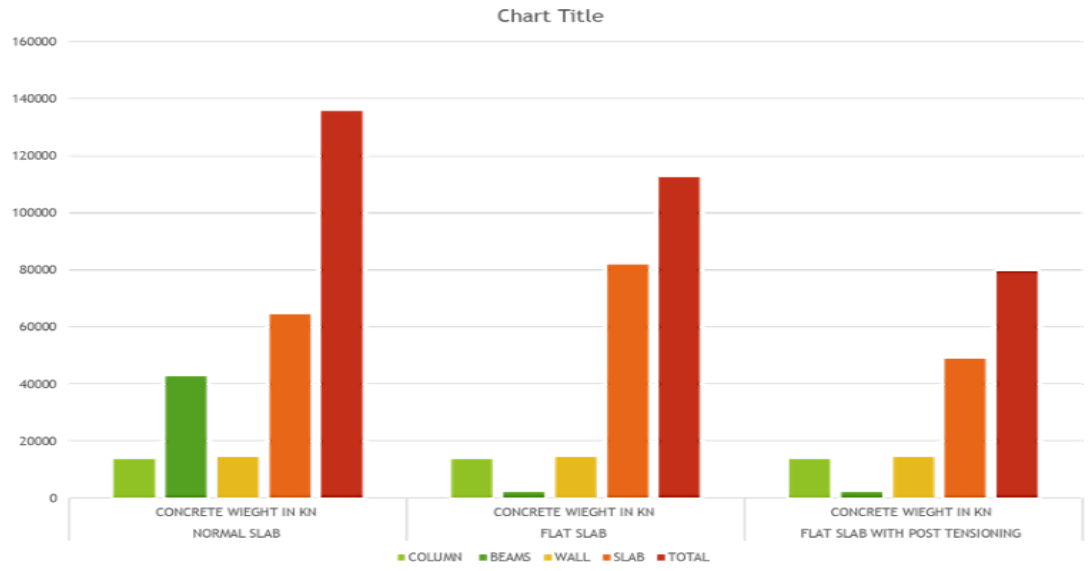
RESULTS AND DISCUSSIONS

The design and analysis of such type of slab are complicated and time consuming therefore ETABS software is used to analysis and design of conventional slab, flat slab .likewise post tensioned flat slab is also designed in ETABS software. The detail of reinforcement after designing the structure have been taken out and compared so as to check the differences in different structural system. The result shows that while comparing the value of the concrete in normal slab, flat slab and post tensioning slab.
The comparison of concrete in different slab models is as follows

TABLE 1COMPARISION OF CONCRETE

COMPARISION OF CONCRETE						
SLAB TYPE		**NORMAL SLAB**		**FLAT SLAB**	**FLAT SLAB WITH POST TENSIONING**	
ELEMENT TYPE	**MATERIAL**	**CONCRETE WIEGHTINKN**	**PIECES**	**CONCRETE WIEGHT IN KN**	**CONCRETE WIEGHT IN KN**	**PIECES**
Column	M35	13730.9441	220	13730.9441	13730.9441	220
Beam	M35	42890.0135	517	2271.3791	2271.3791	22
Wall	M35	14599.8875	88	14599.8875	14599.8875	88
Floor	M35	64545.0171	11	81980.5992	49058.3407	11
	TOTAL:-	135765.8622		112582.8099	79660.5514	

Concrete amount is reduced in post tensioning slab rather than normal slab, and flat slab. The amount of concrete is reduced 29% in PT slab rather than conventional flat slab and 41%reducetheconcretecomparewithnormalslab.
In graphical format the comparison of concrete are as follows:-



Graph 1 Comparison of concrete

Comparing the results of maximum moment and shear in columns:-

While comparing the maximum moment and shear in the columns, we found the maximum moment and shear is in normal slab as compare to flat slab and post tensioned flat slab.

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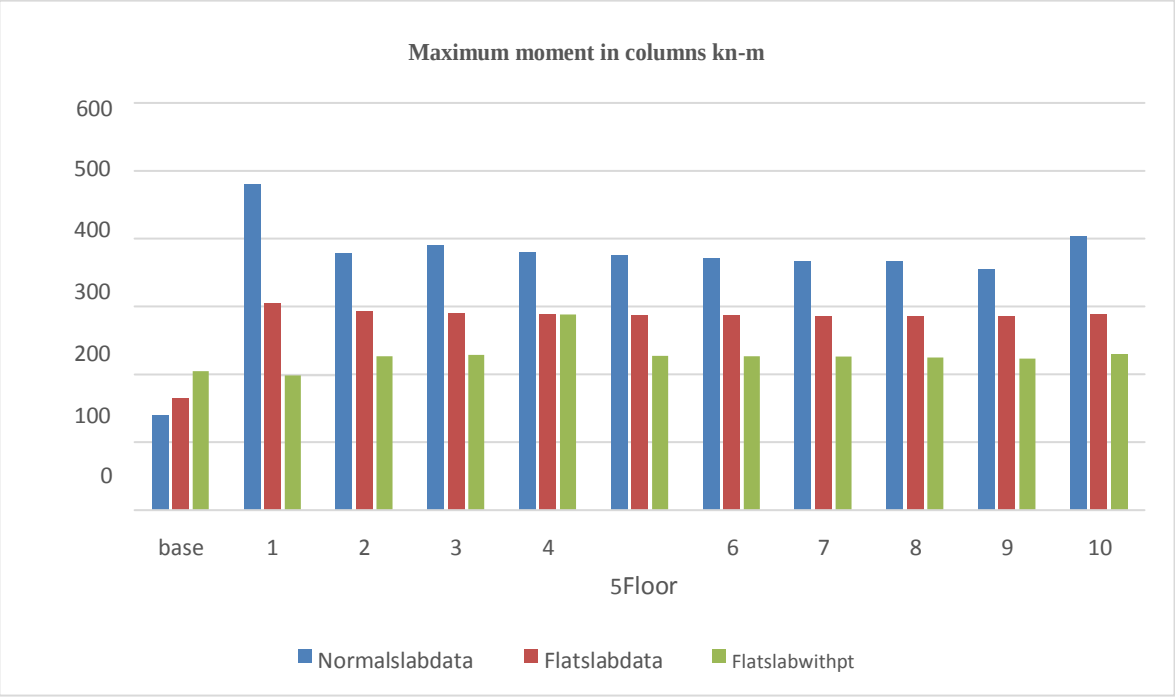
TABLE 2 Comparison of Maximum Moment in columns

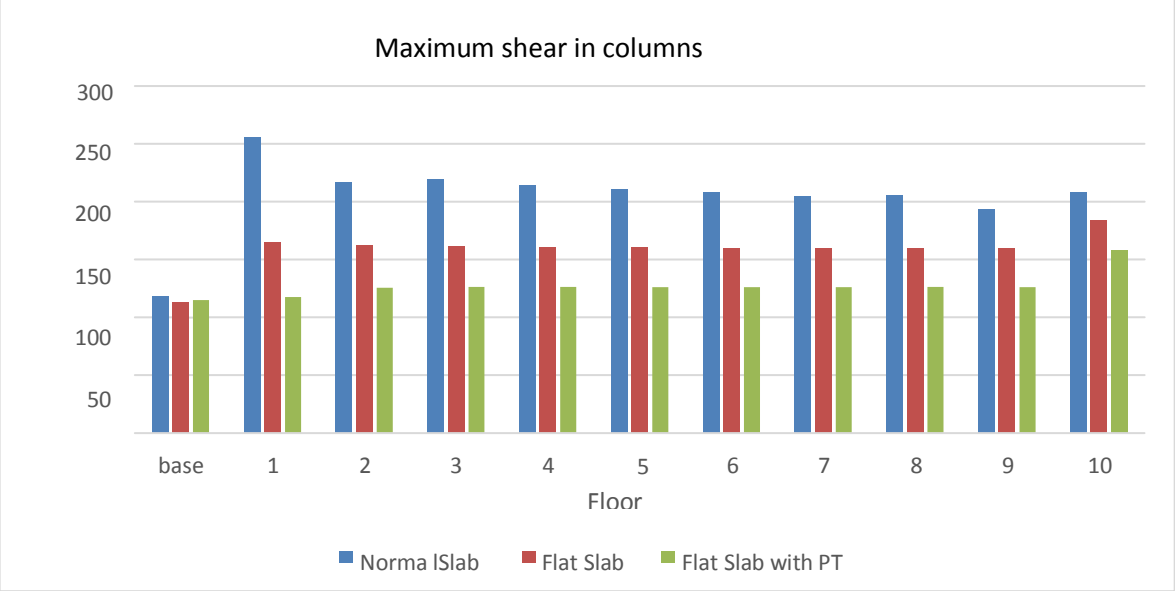
Maximum moment in columns kn-m			
Base	Normal Slab	Flat Slab	Flat Slab with PT
1	140.1039	164.4755	205.061
2	479.799	304.600	198.653
3	378.6362	292.492	227.020
4	390.552	289.104	228.568
5	379.697	287.682	288.061
6	375.0168	286.981	227.512
7	370.466	286.396	226.925
8	366.655	285.681	226.185
9	366.357	284.830	224.650
10	355.673	285.225	223.212
11	403.447	288.226	229.226



Comparison of Maximum Moment in columns

Comparison of Maximum shear force in columns

Maximum shear force in columns in kn			
Base	Normal Slab	Flat Slab	Flat Slab with PT
1	118.497	112.857	114.825
2	255.356	164.988	117.5052
3	217.040	162.408	125.686
4	219.371	161.398	126.347
5	213.826	160.802	126.262
6	210.656	160.402	126.121
7	207.838	160.072	126.005
8	204.960	159.708	126.070
9	205.888	159.371	126.253
10	193.101	159.909	126.106
11	208.256	184.205	158.200



Graph. 3 Comparison of Maximum shear force in columns

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