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COMPARATIVE STUDY OF RCC AND PRESTRESSED CONCRETE ONE WAY CONTINUOUS SLAB FOR VARIOUS SPANS

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Abstract

This paper presents the **Comparative Study of R.C.C. and Prestressed Concrete One Way Continuous Slab,** which include the design and estimates of **R.C.C. and Pre-stressed concrete Slab of various spans**. The aim of this work is to design large span R.C.C. one way continuous slab as well as prestressed concrete one way continuous slab variety and then compare the results. The idea is to reach a superior conclusion regarding the superiority of the two techniques over one another. A couple of cases were comprehensively analyses by ETABS 2015 software and designed manually of both the R.C.C. and Prestressed concrete one way continuous slab. Based on the manual design procedure, a computer program in MS EXCEL was developed for designing both R.C.C. and prestressed concrete one way continuous slab. A separate program was developed for estimating. A number of cases were studied from 10m, 12m, 15m and 18m span. In India R.C.C structures are commonly used for residential as well as commercial buildings or we can say for short span buildings. In R.C.C. slab depth of slab increases with increase with span because of deflection limitation. To surmise, prestressed concrete slab is most suitable for longer span because it gives lesser dead weight as compare to the RCC slab.

Index Term: *Slab, R.C.C, Prestressed concrete, ETABS, MS EXCEL*

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1. INTRODUCTION

Importance & Necessity: Concrete frame structures are a very common or perhaps the most common type of modern building internationally. As the name suggests, this type of building consist of a frame or skeleton of concrete. Horizontal members of this frame are called beams, and vertical members are called columns. A human walks on flat planes of concrete called slab. To construct a frame we used Reinforced Cement Concrete commonly called as RCC, this is one of the construction technique that made construction very easy and brought a boom to field of construction. In RCC structure cement concrete can take up immense compression but weak in tension whereas steel is good in withstanding both tension and compression. No doubt, RCC framed structure is very easy to construct when the span ranging from 3 m to 7.5 m but it is not suitable when the span is large and it becomes very cumbersome for large span as the span increased the cross sectional dimension of member is also increases and it directly increases the self-weight of the member.

Prestressed concrete is the most recent major form of construction introduced in the structural engineering because it has its own advantage like, the size or dimension of structural members are reduced, which may increase the clearances or reduce storey heights. It also permits the use of large spans (greater than 30 m) with shallow members, even when heavy load are encountered. The prestressing technique has eliminated the weakness of concrete in tension and hence crack free members of structure are obtained.

High strength concrete is necessary in prestressed concrete, as the material offers high resistance in tension, shear, bond and bearing. In the zone of anchorages, the bearing stresses being higher, high –strength concrete is invariably preferred to minimize costs. High –strength concrete is less liable to shrinkage cracks, and has a higher modulus of elasticity and smaller ultimate creep strain, resulting

in smaller loss of prestress in steel. The use of high – strength concrete results in a reduction in the cross sectional dimensions of prestressed concrete structural elements. With a reduced deadweight of the material, longer span become technically and economically practicable. As we considered the high rise structure which is in the case of large floor and roof covering using prestressed concrete as material, there are several types of structural forms for

Table 2) Comparison of maximum shear force for

SHERA FORCE		
Span (M)	**Shear Fore(kN)**	**% Increase**
10	365	---
12	462	26.57
15	657	80.00
18	907	148.493

different span

adoption. The aim of this work is to design a frame of RCC as well as prestressed concrete variety for various spans and then compare the results. This

BENDING MOMENT		
Span (M)	**Bending Moment (kN.m)**	**% Increase**
10	619	---
12	1011	63.32
15	2082	236.34
18	3773	509.53

idea is to reach a definite conclusion regarding the superiority of the two techniques over each other.

2. METHODOLOGY

2.1 BUILDING DESCRIPTION

The study is carried out on reinforced concrete moment resisting frame and prestressed concrete moment resisting frame with various spans. The plan of the building is shown in figure 1.the building considered is single storey commercial building. The columns provided are rectangular columns. Height of storey is kept 4.5m excluding depth of foundation and other concerned data is given in tabular form in table 1

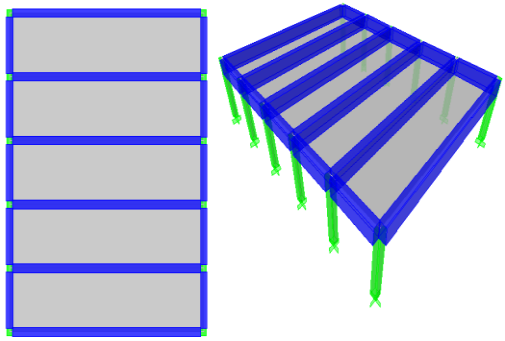


Fig 1. Typical Plan of building

Table 1. Details of specification for model

Plan dimensions	10x22.5 m
Total height of building	6.0 m
Height of storey	4.5m
Depth of foundation	1.5m
Size of beams	300x750 mm
Size of columns	500x500 mm
Thickness of slab	150 mm
Thickness of external walls	230 mm
Floor finishes	1.5 kN/m^2
Live load at floor	4 kN/m^2
Grade of Concrete	M35
Grade of Steel	Fe500
Density of Concrete	25 kN/m^3
Density of brick masonry	20 kN/m^3

3. RESULT AND DISCUSSION

Table 4 to Table 6 below gives the result obtained for R.C.C. and Prestressed Concrete frame structure with respect to the different span. The results contains the comparison of slab of R.C.C. frame structure and of prestressed concrete frame structure

Graph 1 where R.C.C slab are compared with prestressed concrete slab with different span and cost comparison shows. While calculating the cost of prestressed slab cost of accessories like spilt cones, bearing plates, sheathing duct and skilled labor rates are consider.

Table 4) Comparison of slab thickness for RCC and Prestressed concrete frame structure for different span

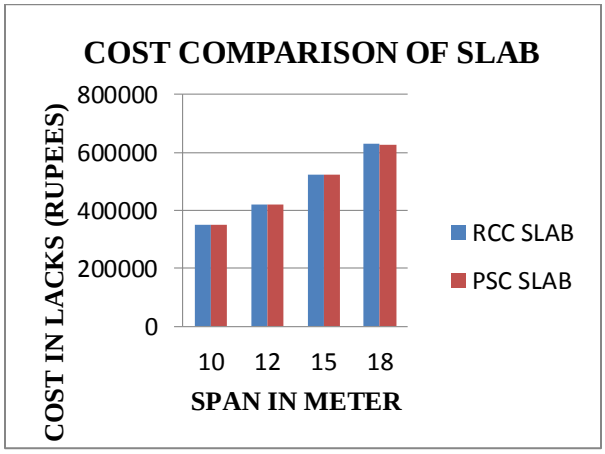
SPAN	**RCC**	**PRESTRESSED**	**%**

(M)	DEPTH (MM)	DEPTH (MM)	REDUCTION
10	150	130	15
12	150	130	15
15	150	130	15
18	150	130	15

Table 5) Comparison of quantity of concrete for slab for RCC and Prestressed concrete frame structure for different span

SPAN (M)	RCC CONCRETE QTY (m^3)	PRESTRESSED CONCRETE QTY(m^3)	% REDUCTION
10	34	29	15
12	41	35	15
15	51	44	15
18	61	53	15

Table 6) Comparison of total cost of R.C.C. slab and One Prestressed concrete slab for different span.



Graph 1) Cost Comparison of slab

4. CONCLUSION

Based on the study conducted, it could be concluded that the prestressed concrete slab gives lesser dead weight as compare to RCC one way continuous slab. RCC slab is economical for span 10 m to 12 m but beyond that the prestressed concrete one way slab is suitable because it gives lesser depth as compare to the RCC slab and achieves economy. As the span is increasing the cost percentage also goes on increasing with reduction in beam and slab section. In prestressed concrete frame structure the beam section is reduced and it will give more headroom and results in lesser deflection as compared to R.C.C. frame structure.

SPAN (M)	RCC SLAB COST IN LACK	PRESTRESSED SLAB COST IN LACK	% REDUCTION
10	350272.70	349979.20	0.08
12	421626.50	419552.40	0.49
15	525074.60	523382.70	0.32
18	628522.70	627660.10	0.13

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