Comparison of Design Methods of Conventional & Prestressed Flat Slab by Various Codes

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***Abstract*— Flat slab system of construction is one in which the beams used in the conventional methods of construction are done away with. The slab rests on the column directly and load from the slab is directly transferred to the columns and then to the foundation. The thickness of slab near the support with the column is increased to support with the columns is increased to support heavy loads, and these are called drops, or columns are generally provided with column heads or column capitals.**

As per local conditions and availability/ depends on the materials have adopted the different types of methods for design of flat slabs and given their guidelines in their respective codes. The scope of this project is to try and illustrate the methods used for flat slab design using various International Codes like Indian Code, Euro Code, American Code & New Zealand Code. For carrying out this project, a panel of a flat slab with dimensions 9.0 x9.0 m and super imposed load & live load 7.00 *KN* /m^2 was assumed for the analysis & Design.

***Keywords* — IS Code, Euro Code, ACI Code, Newzealand Code.**

I. INTRODUCTION

In the post-tensioning approach, concrete is cast while there is no stress in the tendons. When the concrete is hardened, the tendons are stretched through hydraulic jacks bearing against the concrete. The tendon force is transferred to the member through necessary anchorage wedges or similar blocks at the end of the member. A flexible duct may be used to house the tendons so that bond is not developed between the wires and the concrete while casting or curing of the concrete. The duct gets bonded to the concrete as the concrete hardens. The tendons can be inserted into the duct and then stressed. Then grouting can be done to transfer the stress to the concrete.

More over economic structures compared to the use of pre-stressing steels with a very high tensile strength instead of normal reinforcements.

For the Larger spans and greater slenderness ratio, which results to reduced dead load, which also has a advantages effect upon the columns as well as foundations and reduces the overall height of the buildings or advantages to the client by adding additional floors.

II. LITERATURE REVIEW

Based on the researched been Park.E.H.Kim *et al* [1] and Y. H. Luo, A. Durrani [2] By increment in savings of saving in concrete and steel since, due to the working of the entire concrete cross-section more slenderness designs are possible compared to RCC., P/A stress provided by post-tensioning may prevent tensile stresses occurs.

Bharath reddy and Devdas menon derived [3] proposed optimal design of Prestressed concrete using Genetic algorithms by determining cross-sectional dimensions.

V. Kalyanaraman and Rony Raj Mathew[4] due to complex sectional geometry the design was done with FEA and frame analysis, the design used variable sections and calculated sectional parameters to determine the loads.Based on the stress distribution sizes has been designed.

III. METHODOLOGY

IS Code:

For pre-tensioned Prestressed concrete, the minimum grade of concrete shall be M 40.

For post-tensioned Prestressed concrete, the minimum grade of concrete shall be M 30.

Grouted Post tension system Tensile stress to be limited to 4.4 $N/mm^{2.}$

At Transfer,

Design Hypothetical Flexural Stress : $0.36(f_{ci})^{1/2}$

Design Compressive Stress : $0.40\ f_{ci}$

Crack width : 0.2 mm

Newzealand Code:

For pre-tensioned Prestressed concrete, the minimum grade of concrete shall be M 35.

For post-tensioned prestressed concrete, the minimum grade of concrete shall be M 35.

Grouted Post tension system Tensile stress to be limited to 3.0 N/mm^2.

At Transfer

Design Hypothetical Flexural Stress : $0.5(f'_{ci})^{1/2}$

Design Compressive Stress : $0.60\ f'_{ci}$

Crack width : 0.1 mm

Euro Code:

For pre-tensioned concrete, the minimum grade of concrete shall be M 35.

For post-tensioned concrete, the minimum grade of concrete shall be M 35.

Grouted Post tension system tensile stress to be limited to 3.0 $N/mm^{2.}$

At Transfer

Design Hypothetical Flexural Stress : $0.36(f'_{ci})^{1/2}$

Design Compressive Stress : $0.40\ f'_{ci}$

Crack width : 0.1 mm

ACI Code:

For post-tensioned Prestressed concrete, the minimum grade of concrete shall be M 35.

Grouted Post tension system Tensile stress to be limited to 3.0 $N/mm^{2.}$

At Transfer

Design Hypothetical Flexural Stress : $0.5(f'_{ci})^{1/2}$

Design Compressive Stress : $0.6\ f'_{ci}$

Crack width : 0.2 mm

IV. RESULT AND DISCUSSION

Code	IS456/IS1343	NZS 3101	Eurocode-2	ACI-318
Mimimum Grade of concrete for [ost Tensioning System(N/mm²)	30	35	35	35
Shape of test specimen for concrete strength (mm)	Cube 150x150x150	Cylinder 152.4x304.8	Cylinder 152.4x304.8	Cylinder 152.4x304.8
Grade of steel (N/mm²)	415	420	500	413.7
Thickness of the slab (mm)	250	250	250	250
Thickness of the Drop (mm)	500	500	500	500
Support Moment (KN-m)	886	753	543	693
Moment Carrying Capacity due to Tendons at supports (KN-m)				
Positive Moment (KN-m)	244	298	244	229
Moment Carrying Capacity due to Tendons mid span (KN-m)	370	299	333	302
Punching Shear	Safe	Safe	Safe	Safe
Tensile Stress (N/mm²)	4.14	3	4.4	3
Minimum Grade of concrete during transfer stage (N/mm²)	25	25	25	25

V. CONCLUSION

- ✓ Based on the comparative with different codes we concluded that ACI 318, NZS 3101& euro codes are most effective in designing of flat slabs.
- ✓ In the modern Post tensioning system, construction Sequence becomes faster in the 7 days cycle for a flat slab system.
- ✓ As per Indian code we are using cube strength but in international standards cylindrical are used which gives higher strength compared to cube.
- ✓ Drop panel/Drop capital is very important criteria are increasing the shear strength/capacity of the slab.
- ✓ Enhance resistance to punching failure at the junction of concrete slab & column.
- ✓ By providing the column heads in slab, we are increasing rigidity of slab.
- ✓ Based on the IS codes, NZS code & ACI code the total design moments (Mo) are same for the interior span.
- ✓ According to Indian standard (IS 456) for RCC code has recommended characteristic strength of concrete as M20, M25, and M30 and above M35 for high strength concrete. For design consideration the strength of concrete is taken as 2/3 of actual strength this is to compensate with difference between actual strength of concrete and cube strength of concrete in structure. After that we apply factor of safety of 1.5.As per Indian standard actually we are using 46% of total concrete characteristic strength. While in International standard it is taken into account of 85% of total strength achieved by test and then apply factor of safety which is same as Indian standard taken in to actual strength is 57%.

- ✓ In Pre-fabricated sections to be integrated into the design for ease of construction.

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Codes

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