JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

REVIEW PAPER ON REINFORCED CONCRETE SLABS

Syed Asim Ahmed,
Student, B.E,
Civil Engineering Department.

Dr. M.A.Kalam,
Associate Professor,
Civil Engineering Department.

Deccan College of Engineering and Technology.

Abstract

Reinforced concrete slabs are essential structural elements widely used in construction projects due to their versatility and durability. The primary objective of this study is to explore the key aspects of RCC slab design and construction techniques, highlighting the principles of reinforcement placement, material selection, and load-bearing capacity. Additionally, the abstract discusses the importance of quality control measures during slab construction to ensure structural integrity and longevity. By synthesizing relevant literature and engineering practices, this abstract provides valuable insights into the fundamental principles governing RCC slab design and construction, contributing to the advancement of structural engineering knowledge and practice.

Keywords

Conventional slab, flat slab, long span frames, building height, quality control.

INTRODUCTION

Slabs are 2-D planar structural member whose thickness is small as compared to its length & breadth. Slabs are most frequently used as roof covering and floor in various shapes such as squares, rectangular, circular, triangular etc in building.

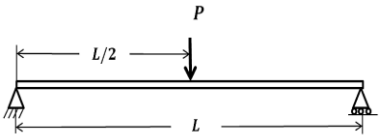
Slabs supports mainly transverse loads and transfers them to the Supports by bending action in one or more direction slabs may be supported on monolithic concrete beams, steel beams, walls (or) directly over the columns. The loads which are transferred by the slab are:

Dead Load / Self Weight

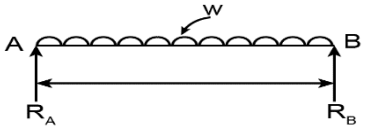
Example: Weight of material used in construction.

Live Load: Types of Live Load are,

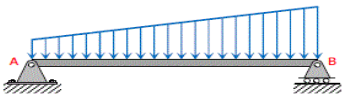
Point Load:



Uniformly Distributed Load:



Uniformly Varying Load:



Finishing Load

Types of Slabs based on Spanning Direction :

One-Way Slab- Spanning in one Direction

If the slab is supported on all four edges and the ratio of longer span to shorter span (Ly/Lx) is greater than 2.

Q) Determine whether the slab is spanning in one direction or not, Dimensions of slabs are 3m x 9m.

Sol: Given,

Dimensions 3m x 9m Ly/Lx = 9/3 = 3>2

Therefore, The given slab is spanning in one direction.

Two-Way Slab

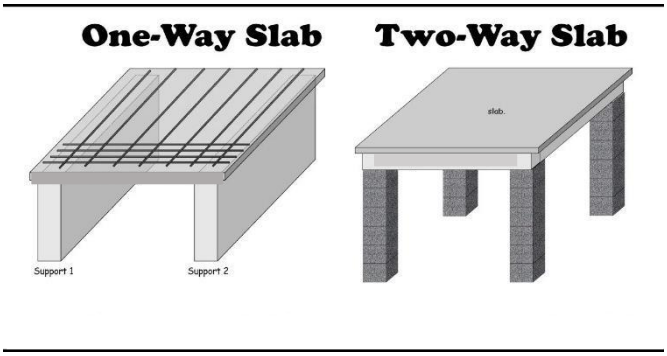
The slabs are supported on all the four edges and the ratio of longer span to the shorter span (Ly/Lx) is less than or equal to 2.

Determine whether the slab is One way or Two way, Whose dimension is 4m x 7m.

Sol: Given,

Dimension 4m x 7m Ly/Lx = 7/4 = 1.75 < 2

Therefore, The given slab is two way slab.



Types of Slabs based on Support Condition:

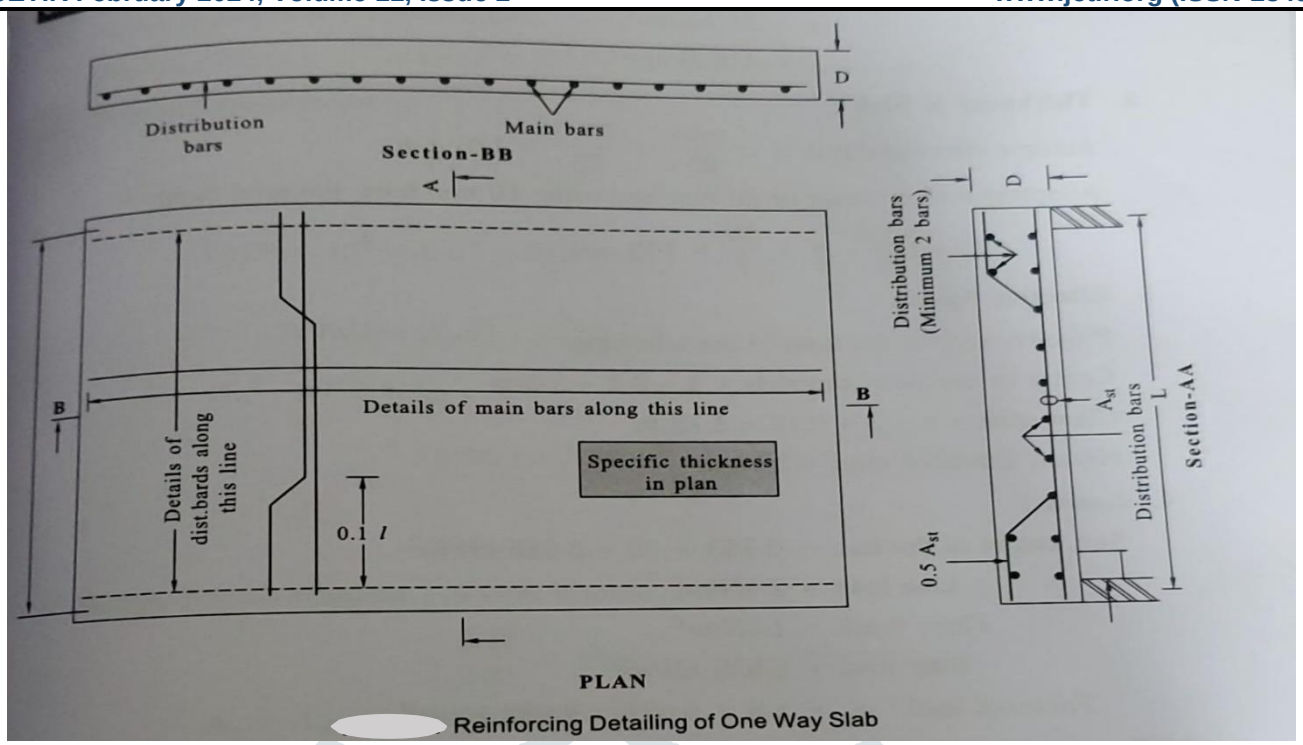
Simply Supported Slabs
Cantilever Slabs
Restrained Slabs (with fixed or continuous edges)
Continuous Slabs
Flat Slabs

METHOD:

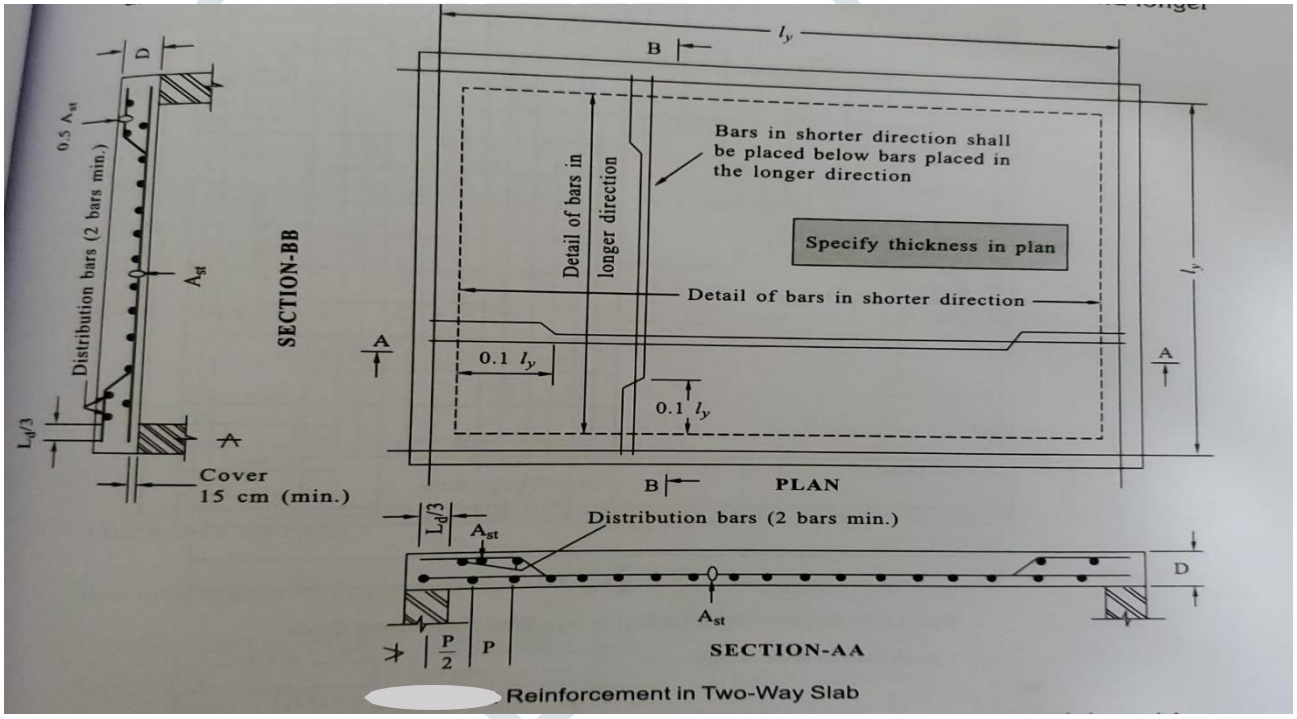
Design of One-Way Slab:	**Design of Two-Way Slab:**
Step 1: Ly/Lx > 2 ⟹ One-Way Slab	Step 1: y/Lx <= 2 ⟹ Two-Way SlabD = d + cover d = span/25 Cover = 50mm Effective Span : Lex = Lx + d (m) Ley = Ly + d (m)Ly/Lx < 2
Step 2: Finding Overall Depth &Effective Span : D = d + cover d = span/ 20 Cover = 30mm Effective Span = Clear Span + d	Step 2: Total Load = Self weight + Floor Finish + Live Load. Factored Load (Wu) = 1.5xTotal Load Mux = αx + W(Lx)^2Muy = αy + W(Lx)^2Vu = Wu L/ 2

Step 3: Total Load = Self Weight + Live Load + Floor Finish Factored Load(Wu) = 1.5xTotal Load Mu = Wu L^2 /8Vu = Wu L /2	Step 3: Min Depth Required:)Mux=0.138Fck*bd^2 d < d(act) (Safe)
Step 4: Min Depth Required: Mu=0.138Fck*bd^2	Step 4: Finding Area of Steel Required:

[b=1000]always Comparing d values d<d(act) [Safe]	(-)Mux=0.87Fy*Ast*d*(1-Fy*Ast/Fck*bd) (+)Mux=0.87Fy*Ast*d*(1-Fy*Ast/Fck*bd) (-)Muy=0.87Fy*Ast*d*(1-Fy*Ast/Fck*bd) (+)Muy=0.87Fy*Ast*d*(1-Fy*Ast/Fck*bd)
Step 5: Finding Area of Steel Required: Mu=0.87Fy*Ast*d*(1-Fy*Ast/Fck*bd) Minimum Reinforcement 12% of Gross Area(HYSD)(or) =0.15% of Gross Area(MildSteel) Ast > Astmin (OK)	Step 5: Along X- Direction (Spacing) (-)S = ast/Ast x1000 (+)S = ast/Ast x1000 Along Y- Direction (Spacing) (-)S = ast/Ast x1000 (+)S = ast/Ast x1000 Conditions: 1)3d(max spacing) 2)300mm,Which ever is less.
Step 6: Spacing: S = ast/Ast x1000 3d (max spacing) 300mm, Which ever is less.	Step 6: Reinforcement in Edge Strip: Ast* = 0.12%of Gross Area S = ast/Ast x1000 5d (max spacing) 450mm, Which ever is less.
Step 7: Distribution Reinforcement: Ast* = 0.12% of bD S = ast/Ast x1000 5d (max spacing) 450mm, which ever is less.	Step 7: Torsion Reinforcement: At = ¾ Astx Distance over which torsion reinforcement is to be provided is 1/5 * Lx S = ast/Ast x1000 (use 6mm ø)



Reinforcing Detailing of One Way Slab



Reinforcement in Two-Way Slab

REINFORCED CONCRETE SLAB :

Reinforced concrete means making concrete stronger with the help of steel (or) strengthening of concrete with steel is called as Reinforced Concrete.

Study of Preparation of Concrete Mixture

Concrete is made by mixing of cement, fine aggregate, coarse aggregate and water. Water plays a vital role in the strength of concrete. On quantity of water, variations takes place in the strengthof concrete.

Strength of Concrete is achieved on the basis of ratio of water andcement.

Ratios For Slabs:

Cement: Fine Aggregate: Coarse Aggregate	1:2:4
	1:1.5:3

Tests conducted for Slabs:

Check For Shear:

Shear Force: The ultimate shear force caused be the load affecting theslab at a distance equal to the effective depth (d) from the face of the beam.

$\tau v = Vu/bd$, Vu = Shear Force

Pt = Ast x 100 /bd , Pt = Percentage of SteelIf,

$\tau v < \tau c < \tau cmax$

Then Shear is OK.

Check For Deflection :

Deflection is defined as the vertical displacement of a point on a loaded beam (or) The deflection at any point on the axis of beam isthe distance between the position before and after bending.

L/d ratio of slab based on different support condition, For Ex: L/d = 20 (for simply supported slab)

Pt = Ast x 100 /bd ,

Fs = 0.58 x Fy

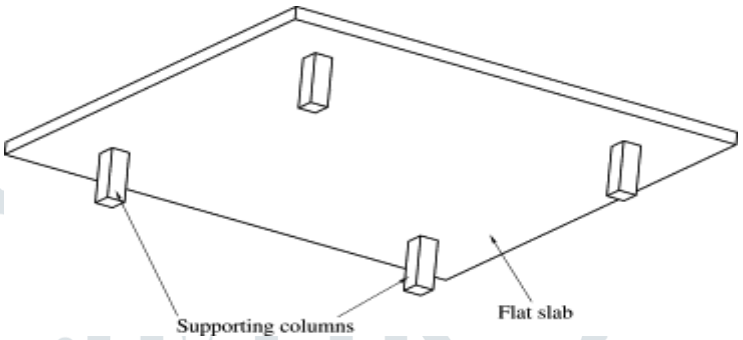
Fy = Grade of SteelIf,

L/d provided <Modification Factor x L/d ratio>

Then Deflection Control is Safe.

FLAT SLABS:

Now a days most commonly used slabs are Flats Slabs, A slab supported directly on the column without any intermediate beams iscalled as Flat Slab.



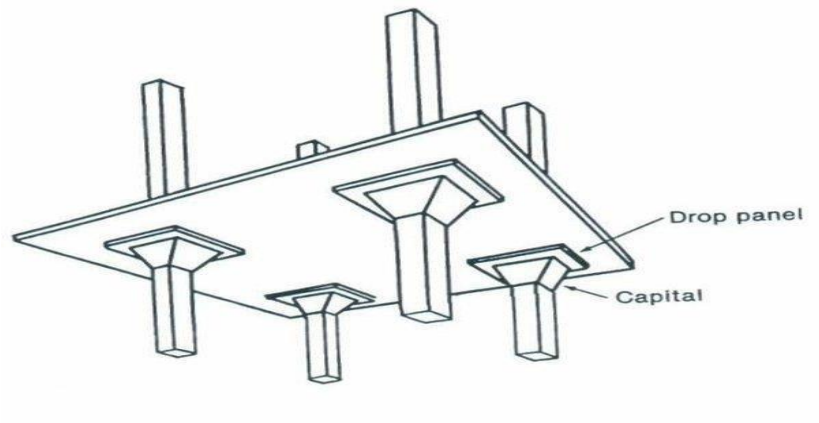
Drop: Drop is the thickened portion of slab over the column.

Column Head/ Column Capital: The flared portion of the column atthe top where the slab is supported.

Why drops and column head are used in flat slabs?

In flat slabs, Large bending moments and shear forces are induced in the vicinity of columns. Therefore the columns are flared at the top called column heads or column capital, And slabs are thickened around the column capitals called drops for reducing the stresses dueto moments and shears.

Drops panels increases the shear strength of the flat slab floor and column head resists the punching shear.



The loads in conventional slabs are transferred through beams to columns and through beams to foundation/footings, but in flat slabs the loads are uniformly distributed and directly transferred to the columns and from columns to the foundation/footing.

Advantages of using flat slab in construction:

Flat slabs are commonly used in Constructing Buildings, Shopping Malls, Parking Area, Auditorium, Convention Halls & etc.

Flat slabs require less reinforcement as compared to conventional slab because they don't have beams, Beams requires more diameter reinforcement and filling of beam requires more concrete so if beams are absent then the cost for reinforcement and concrete decreases andalso it needs less form work,

Usually in construction of buildings when conventional slabs are laid, The major problem arising is the beam appearing in the middleof hall and rooms,

To hide these beams the false sealing are used, which are made up ofgypsum (CaSO4 2H2 O) [or] Plaster of Paris (CaSO4 ½ H2O). The false ceilings have lesser life and the colour might fade away, For attraction the lights bulbs are installed in the false ceilings which are connected in series connection so if one bulb fails the whole light bulb won't work.

As in the above picture if the beam is just above the bed area then the fan cannot be installed in the beam so it would be installed at other place and the person sleeping on the bed cannot enjoy the air comingfrom the running of fan.

And Chandelier cannot be installed if the beam is appearing the hall.

The height of the slab can be taken as per convenient when we areusing flat slabs, but if we are using conventional slabs the minimum height ranges from 8-10 feet.

The less height flat slabs are used in mainly parking area of the shopping malls and the cinema theatres, Alon with the parking the less height slabs are used in the godowns (for the stoage of goods inthe malls and shops),

And more height flat slabs are used in ware houses, convention hallsand auditorium.

Flat slabs can easily adapt changes in the building plan as they don't have any beams in the plan, then addition (or) removal of partition walls to create different layouts can be done easily.

Disadvantages:

Performance of flat slab frames is very poor during seismic event. To transfer the entire lateral load in shear wall, it is mentioned that lateral load resistance of flat slab frames shall be ignored in all seismic regions.

The Flat slabs have medium span time, And they are not suitable for the brittle masonry partition supporting. The thickness of slab is more because of uniformly distribution of loads.

Conclusion

RCC slabs represent a cornerstone of modern construction, embodying the principles of strength, durability, and functionality. Through ongoing research, education, and professional collaboration, the field of structural engineering will continue to refine and optimize RCC slab design and construction practices, contributing to the advancement of the built environment and the safety of infrastructure worldwide.