2nd International Conference on Current Research Trends in Engineering and Technology
© 2018 IJSRSET | Volume 4 | Issue 5 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section: Engineering and Technology

Review on Comparative Study on R.C.C Flat Slab and R.C.C Grid Slab

Taha Kharodawala[1], Asif Khan[2], Akshayraj Parmar[3], Paresh Parmar[4], Kishan Kadivar[5], Shahrukh Khan Pathan[6]

U.G. Student, Department of Civil Engineering, Sigma Institute of Engineering, Vadodara, Gujarat, India[1,2,3,4,5]
Assistant Professor, Department of Civil Engineering, Sigma Institute of Engineering, Vadodara, Gujarat, India[6]

ABSTRACT

The traditional method of construction is to support slab by beam and beam by columns it is known as beam slab load transfer construction technique, but the modern technique developed is gaining more popularity as it can provide better aesthetical appearance compared to traditional method for shopping mall, offices, warehouses, public community hall, theatres etc. By adopting modern techniques construction work can be carried out faster with economic consideration. The aim of project is to determine the most economical slab between flat slab and grid slab. To study related design & analysis of flat slab and grid slab with conditions where it is preferable with advantages & disadvantages of providing flat slab and grid slab. At last we are going to give cost estimation graph with comparison of flat slab and grid slab for the plan dimension of 30m x 30m. Rates will be taken according to government schedule.

Keywords: R.C.C Flat Slab, R.C.C Grid Slab

I. INTRODUCTION

Nowadays, flat slabs are a common solution for building because they are economical, easy and fast to build. A reinforced concrete flat slab also called as beamless slab, is a slab supported directly by columns without beams or girders. A flat slab may be solid slab or may have recesses formed on the soffit so that the soffit comprises a series of ribs in two directions. From the consideration of deflection control IS 456:2000 specifies minimum thickness in terms of space to effective depth ratio for this purpose larger span is to be considerable. The proportioning elements of flat slab are as follows:

Column strip- column strip means a design strip having a width of o.25l1 on each side of the column centre line.

Middle Strip- middle strip means a design strip bounded on each of its opposite sides by the column strip Panel- panel means that part of slab bounded on each of its four sides by the centre line of a column or centre line of adjacent spans. For span from 5 to 9m thin flat slab are preferred solution for the construction of in-situ concrete frame building, where a square or near square grid is used, they are provided in theatres, factories, mills, shopping complex and other buildings.

Flat Slab are classified as:

- Flat slab
- Flat slab with drop panels
- Flat slab with column head

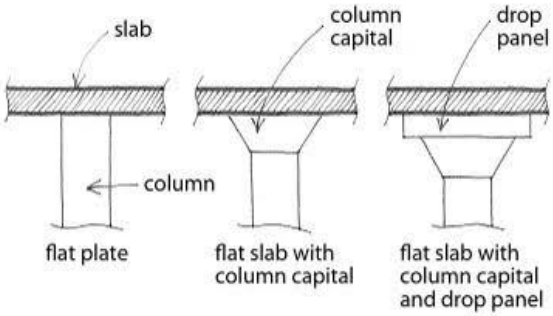

Figure 1: Classification of flat slab

Grid Slab:

A grid slab is a type of building material that as two-directional reinforcement on the outside of the material forming a cross grid. Grid floor system consisting of beams spaced at regular intervals in perpendicular directions, monolithic with slab. Grid slab is favorable for flat site, it is economical for larger spans only. They are adopted for architectural reasons for large rooms such as auditorium, vestibules, theatre halls, shopping malls, show rooms where columns obstructs the movement and free space also increases which gives good aesthetics. The rectangular or square voids formed in the ceiling is advantageous for providing services like air conditioning, plumbing, lighting, insulation materials, wiring. Grid slab are flexible but at places where loads are heavier it is not favourable because in grid slabs intermediate columns are not provided. The solid fills in grid slab provides strength required for shear transfer to the supports. The fills also reduce the compression stresses at the soffit of the floor around the supports, thus avoiding the necessity of bottom reinforcement on site.

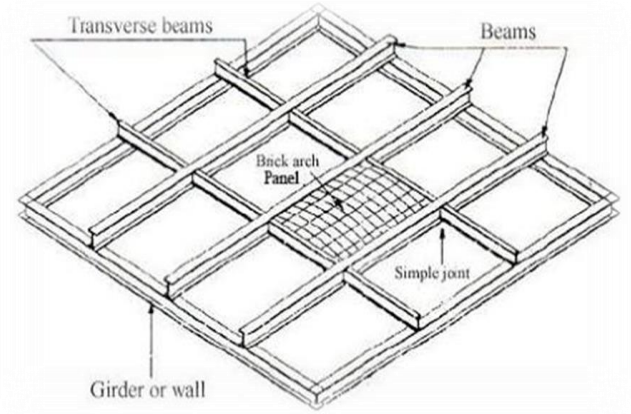

Figure 2: Appearance of grid slab

II. METHODS AND MATERIAL

Direct design method: In this method, empirical coefficients are used to find out the design moments at various locations, this method is adopted in design.

Equivalent frame method: In this method, the structure is divided into plane continuous frame and the analysis is carried out, this method is not adopted here.

The R.C.C Flat slab & Grid Slab was designed manually for plan dimension 30m x 30m as per IS456:2000 limit state design. The live load of 5 KN/m^2 was taken as per IS875 (Part2). M20 grade concrete and Fe415 grade steel is used.

Flat Slab

The bending moment was taken as

Absolute B.M. = $(W \times L_2 \times L_{n1}^2) / 8$

For interior panel:

The total design moment is distributed in following proportions:

Negative design moment: 0.65

Positive design moment: 0.35

Table 1: Distribution factors

	Column Strip	Middle strip
(-ve) B.M	0.75 X MD_n	0.25 X MD_n
(+ve) B.M	0.60 X MD_p	0.40 X MD_p

For exterior panel:

The total design moment is distributed in following proportions:

Interior negative design moment = [0.75 – {0.10 / (1 + (1 / α_c)}]

Positive design moment = [0.63 – {0.28 / (1 + (1 / α_c)}]

Table 2: Distribution factors

	Column Strip	Middle strip
(-ve) B.M	1 X MD_n	-
(+ve) B.M	0.60 X MD_p	0.40 X MD_p

Grid Slab

Table 3: Bending moment coefficient

Case no	Type of panel	Moments considered	α_x	α_y
1	Interior panel			
		Negative moment at continuous edge	0.032	0.032
		Positive moment at mid-span	0.024	0.024
2	One Edge Discontinuous			
		Negative moment at continuous edge	0.037	0.037
		Positive moment at mid-span	0.28	0.028
3	Two Adjacent Edges Discontinuous			
		Negative moment at continuous edge	0.047	0.047
		Positive moment at mid-span	0.035	0.035

Moments per unit width are given by the following equation:

$M_x = \alpha_x w l_x^2$

$M_y = \alpha_y w l_x^2$

III. RESULTS AND DISCUSSION

Flat Slab:

The flat slab is a two-way slab bending in both the directions and hence the reinforcement in both the directions are necessary. Exact theoretical analysis is quite complex and can be made by numerical techniques like finite element method.

Table 4: Design data for flat slab

Plan dimensions	30 m X 30 m
Structure	Flat slab
Floor finish	1 KN/m^2
Dead load	4.5 KN/m^2
Live load	5 KN/m^2
Total design load	15.75 KN/m^2
Thickness of flat slab	160 mm
Depth of drop	200 mm
Average depth of slab	180 mm
Drop panel dimensions	1.7m X 1.7m
Column strip	1.25 m
Middle strip	2.5 m
Panel type	Interior & exterior panel
Grade of concrete	20 N/mm^2
Grade of steel	415 N/mm^2
$\tau c > \tau v$	Safe

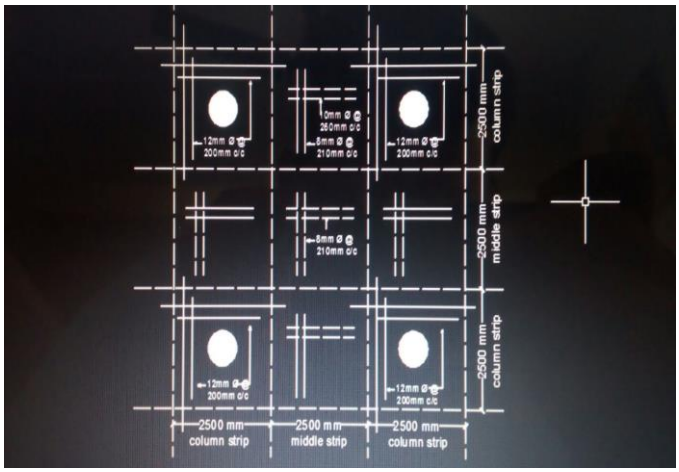

Figure 3: Flat Slab detailing

Waffle Slab:

Waffle slab are two-way spanning ribbed slab, the moments in the ribs may be determined by using the coefficients for two-way solid slabs. Load transfer from grid slabs to the supporting beams shall be assumed as per two-way solid slabs.

We have carried out manual design on plan dimension of 30m X 30m on panel dimension of 5m X 5m on R.C.C Flat Slab & R.C.C Grid Slab.

Plan dimensions	30 m X 30 m
Structure	Grid slab
Floor finishes	1 KN/m^2
Live load	5 KN/m^2
Total design load	6.92 KN/m^2
Topping	75 mm
Panel dimensions	5 m X 5 m
Width of panel edge	500 mm
Panel type	Interior one edge discontinuous, two adjacent sides discontinuous.
$\tau c < \tau v$	Shear design required
Grade of concrete	20 N/mm^2
Grade of steel	415 N/mm^2

Table 5: Design data for grid slab

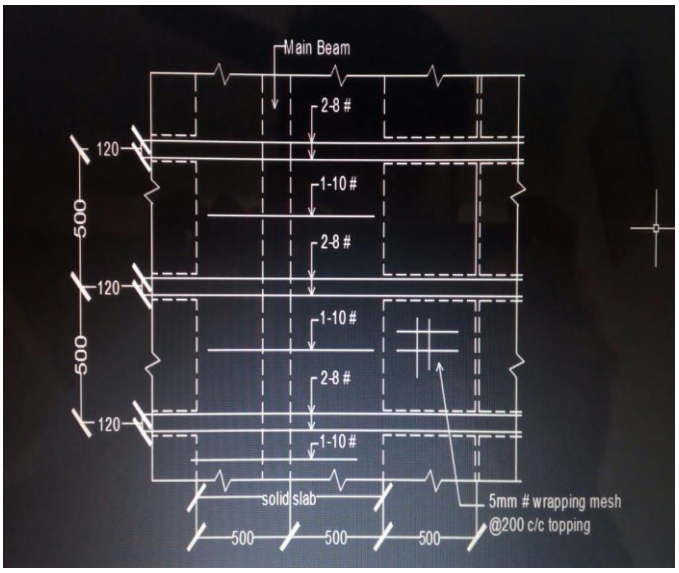

Figure 4: Grid slab detailing

IV. CONCLUSION

- ✓ Requirement of concrete is more in grid slab as compared to flat slab with drop and flat slab without drop.
- ✓ Steel required in flat slab without drop is more as compared to flat slab with drop and grid slab.
- ✓ Flat slab with drop is economical than flat slab without drop and grid slab.

V. REFERENCES

[1] Uzma A. Shaikh, Prof. Mohd. Shahezad, " Study On Economical Aspect Of R.C.C Beam Slab Construction and Grid Slab Construction", IJERT, 2014.

[2] Vakas K. Rahman, Prof. A. R. Mundhada, "Comparative Study Of RCC and Prestressed Concrete Flat Slabs", IJMER, 2013.

[3] Muhammed Yoosaf K.T, Ramadass S, Jayasree Ramanujam, "Finite Element Analysis and Parametric Study Of Grid Floor Slab", AJER, 2013.

[4] Navjot Kaur Bhatia, Tushar Golait "Studying Response Of Flat Slabs And Grid Slabs Systems In conventional R.C.C Buildings", IJTRD, 2016.

[5] Sumit Pahwa , Vivek Tiwari , Madhavi Prajapati "Comparative Study Of Flat Slab

With Old Traditional Two Way Slab", IJLTET, 2014.

[6] Boskey Vishal Bahoria, Dhananjay K. Parbat, "Analysis and Design of RCC and Post-tensioned Flat Slab Considering Seismic Effect", IACSIT, 2013.

[7] Dr. H.S Patel, Ibrahim S. Vepari, "Study On Economical Aspects Of Long Span Slabs", NCRTET, 2011.

[8] Harshal Deshpande, Radhika Joshi, Prashant Bangar,"Design Considerations for Reinforced Concrete Flat Slab Floor System", IJSER, 2014.

[9] Indrajit Chowdhury, Jitendra P. Singh, "Analysis and Design Of Waffle Slab With Different Boundary Conditions", TICJ, 2010.

[10] IS 456 : 2000, Plain and Reinforced Concrete Code Of Practice.

[11] DR. H. J. Shah, Reinforced Concrete Vol II, Seventh Edition, 2014.