

LIMIT STATE DESIGN OF RESIDENTIAL BUILDING

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Abstract— This study deals with the construction of a Stilt+4storeyed R.C.C. Framed structure as a residential building. All the rooms of the building are provided with sufficient living facilities with plenty of special features such as electrical works, wooden works, flooring with ceramic tiles, etc. with ISI standards. The building is constructed with vastu and also properly designed and constructed with all safety measures. The materials selected for the construction of the building are done in accordance to the BIS codal provisions. The building is constructed in such a way that it ensures proper day-light and air-circulation in all the rooms. Water supply for the building is ensured by bore well as well as public water supply line. All the basic needs for a building are taken in to account and are provided.

Index Terms—R.C.C. Framed Structure, BIS Codal Provisions, Stilt

I. INTRODUCTION

The plan of the structure is drawn using AUTOCAD. The specifications for which the plan was created are as follows:

- | | | | |
|-------|----------------------|---|--|
| i. | Site Location | : | cathedral road
Chennai. |
| ii. | Plan area | : | 378.35 sq.m. |
| iii. | Floor area | : | 325.25 sq.m. |
| iv. | Floor to Plan area | : | 0.80m |
| v. | Facing | : | WEST |
| vi. | Height of structure | : | 40ft (30' – cumulative
height of floors + 10' – height of headroom) |
| vii. | Height of each floor | : | 10' |
| viii. | No of floors | : | 5 (G+4) |
| ix. | Parking area | : | 325.25 sq.m. |
| x. | No. of flats | : | 8 (2 at first floor and
typical to all
floors) |
| xi. | Feature | : | 3 BHK apartment |
| xii. | Area of each flat | : | 110.12 sq.m. |
| xiii. | Room dimension | : | Bedroom – 3.9m x
4.3m
Kitchen – 3.1m x 3.4m
Living – 4.2m x 3.9m
Common Toilet – 1.7m x 1.2m |

As per the specifications, first/second floor plan, ground floor plan, plinth beam details and centre line details are drawn. These figures are given in Appendix – 1.

The following materials are to be used for construction of residential apartment at Perungalathur:

- i. M25 grade concrete ($f_{ck} = 25 \text{ kN/m}^2$)
- ii. Fe 500 HYSD bars ($f_y = 500 \text{ kN/m}^2$)

II. STRUCTURAL DESIGN FOR PROPOSED SYSTEM

1. LEVEL AT THE SITE: - The level at the site must be higher than that of its surrounding so as to provide good drainage.
2. CLIMATE CONDITION:- The intensity of the rainfall and sub soil water level should be low as to avoid dampness in the building.
3. SUB-SOIL CONDITION: - A hard strata should be available at a reasonable depth so as to construct the foundation of the building safely and economically.
4. BUILDING: - Any structure constructed of what so ever material and used for residential, business education or other purposes is called building.
5. MEASUREMENT : - The measurement of excavation shall be in cum as per for rectangular trench width of the conc., multiplied by vertical depth of foundation from ground level and multiplied by the length of trench.
6. TYPES OF THE BUILDING :-
 1. Based on occupancy
 2. Based on type of construction

7. SPECIFICATIONS:-

EXCAVATION: - Foundation trenches shall be dug out to the exact width of foundation concrete and the sides shall be vertical.

FINISH OF TRENCH: - The bottom of foundation trenches shall be perfectly levelled both longitudinally and transversely.

TRENCH FILLING: - After the conc. has been laid, masonry has been constructed the remaining portion of the trenches shall be filled up with earth in layers of 15cm and watered and well rammed. The earth filling shall be free from rubbish and refuse mater

1. Foundation: Framed structure, R.C.C 1:1½:3 mixes for column footing, columns, beams and slabs as per structural design.

2. Basement: Basement 2'-0" above existing road level, filling in basement with Quarry dust, flooring concrete 1:4:8 using (40mm graded metal)

3. Superstructure:

- (i) All round 9" B.W in c.m 1:5 for superstructure with necessary cut lintels, loft & sunshade arrangement.
- (ii) Clear Room height
- (iii) Stilt Parking 8'-0" ht
- (iv) FF / SF & TF- 10'-0" ht
- (v) Staircase head room 8'-0" ht.
- (vi) 9" B.W parapet wall 3' ht. all-round in Terrace

CURING: - After about two hours lying when concrete has begun to harden, it shall be kept damp by covering with wet gunny bag or wet sand for 24 hours and then kept damp continuously for 15 days. Christo Ananth et al. [5] proposed a system, this fully automatic vehicle is equipped by micro controller, motor driving mechanism and battery. The power stored in the battery is used to drive the DC motor that causes the movement to AGV. The speed of rotation of DC motor i.e., velocity of AGV is controlled by the microprocessor controller. This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased.

III. COMPONENTS OF A BUILDING

1. **FOUNDATION:** - It is the lowest part of a structure below the ground level which is direct contact with ground and transmitted all the dead, live and other loads to the soil on which the structure rests.
2. **PLINTH:** - The portion of a building and the top of the floor immediately above the ground is known as plinth. The level of the surrounding ground is known as formation level of the ground floor of the building is known as plinth level
3. **WALLS:** - Walls are provided to enclose or divide the floor space in desired pattern in addition wall provided privacy security and give protection against sun, rain, cold and other undesired effect of the weather.
4. **COLUMN:** - A column may be defined as an isolated load bearing member, the width of which is neither less than its thickness. It carries the axially compressive load.
5. **FLOORS:** - Floors are flat supporting elements of a building. They divided a building into different levels. There by creating more accommodation on a given plot of land. The basic purpose of a floor is to provide a firm and other items like stores, furniture, equipment etc.
6. **DOORS, WINDOWS AND VENTILATORS:** - A door may be defined as a barrier secured in an opening left in a wall to provide usual means of access to a building, room or passage. Windows and ventilators are provided for sun light, fresh air and ventilation purposes.
7. **ROOF:** - It is the uppermost component of a building and its function is to cover the space below it of a room and protect it from rain, snow, sun, wind etc.

8. **BUILDING FINISHES:** - A building is considered incomplete till such time the surface of its components is given appropriate treatment. Building finishes include items like plastering, painting, pointing, white/colour washing, varnishes and distempering etc.

By: R.MANIVANNAN, ME	RM Engineering Consultants		Project :
Date: 10/07/15			
Chd.FBR			Subject: SLAB S1
		Dept: structural engineering	

TWO WAY SLAB DESIGN

	lg. Span (L_x)	sh. Span (L_y)
Panel size	= 3.70	3.58
	f_{ck}	N/mm ²
	= 25	
	f_y	N/mm ²
	= 415	

EDGE	1	INTERIOR PANEL
COND.		
L_x/L_y	= 1.04	
(Assume D=)	= 125 mm	
Dead load of the slab	= D*25 = 3.13	K_N/m^2
Floor finishes	= 3.00	K_N/m^2
Live load	= 1.50	K_N/m^2
Total load (w)	= 7.63	K_N/m^2
$\alpha_x(-y/g)$	= 0.0340	
$\alpha_x(+y/g)$	= 0.0256	
$\alpha_y(-y/g)$	= 0.0320	
$\alpha_y(+y/g)$	= 0.0240	

The Factored Moments are	Moment At	10	12
	in K_N/m	8 tor	tor
	in m ²	mm	mm
	c/c	c/c	c/c
$M_x(-y/g)$	$\alpha_x(-y/g)$		
= $w_y L_x^2 * 1.5$	= 4.98	140	359
$M_x(+y/g)$	$\alpha_x(+y/g)$	= 3.75	105
		480	750
		1080	

$M_x(-y/g)$	$\square_y(-y/g)$			
$= \frac{M_x(-y/g)}{I_x} \times 1.5$	$= \frac{M_x(-y/g)}{I_x} \times 1.5$	4.69	143	350 548 788
$M_x(+y/g)$	$\square_y(+y/g)$			
$= \frac{M_x(+y/g)}{I_x} \times 1.5$	$= \frac{M_x(+y/g)}{I_x} \times 1.5$	3.52	107	470 735 1058
d_{req}	$= \sqrt[3]{\frac{M_x \times 10^6}{0.138 \times f_{ck} \times b}}$	=	120	mm
D_{prov}		=	125	mm
$d_{x,prov}$		=	101	mm
$d_{y,prov}$		=	93	mm
Provide	125 mm Thk	8 tor @ 300	mm c/c in Shorter direction &	
		8 tor @ 300	mm c/c in longer direction	
Check for Deflection :				
Percentage of Tension reinforcement @ mid span		=	0.17	
$f_y = 0.58 \times f_{yk}$	Area of c/c of steel required	=	151	N/mm ²
	Area of c/c of steel provided			
Basic span/eff depth ratio for continuous slabs		=	32	
Modification factor		=	2.00	
Coefficient for max ratio of span/eff depth		=	65	
Effective Depth required		=	55	< 101 mm
				SAFE

The following were observed at site Kings Trinity located at Mudichur:

- Reinforcement detail for two way slab
- Cover blocks were used to maintain clear cover as per design, to avoid corrosion of reinforcement. As discussed in the previous work, Christo Ananth et al. [6] proposed a system, this fully automatic vehicle is equipped by micro controller, motor driving mechanism and battery. The power stored in the battery is used to drive the DC motor that causes the movement to AGV. The speed of rotation of DC motor i.e., velocity of AGV is controlled by the microprocessor controller. This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all

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Fig.1. Beam – column joint at corner

IV. CONCLUSION

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