DESIGN AND MATERIAL COST COMPARISON OF RCC AND PRESTRESSED CONCRETE MULTISTOREY BUILDING



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DEPARTMENT OF CIVIL ENGINEERING JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY WAKNAGHAT, SOLAN-173234, HIMACHAL PRADESH, INDIA

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CERTIFICATE

This is to certify that the work entitled, "Design and material cost comparison of RCC and Prestressed concrete multisorey building" submitted by Ishan Tyagi-111624 and Apoorv Goyal-111664 in partial fulfilment for the award of degree of Bachelor of Technology in Civil Engineering of Jaypee University of Information Technology has been carried out under my supervision. This work has not been submitted partially or wholly to any other university or institute for the award of this or any other degree or diploma.

Mr. Chandra Pal Gautam Associate professor Department of Civil Engineering, JUIT Signature..... Date.....

Dr. Ashok Kumar Gupta Professor & Head Department of Civil Engineering, JUIT Signature..... Date.....

ACKNOWLEDGEMENT

We are extremely grateful to our project guide **Mr. Chandra Pal Gautam** for giving us directions and providing feedback. His thinking and straight forward attitude has inspired us to work for the project with great pace.

We take this opportunity to express our sincere gratitude to the Head of Department of Civil Engineering, **Dr. Ashok Kumar Gupta** for giving us the opportunity to do project on "**Design** and material cost Comparison of RCC and Prestressed concrete multi-storey building" so as to develop our understanding of the subjects.

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ABSTRACT

Structural design is the primary aspect of civil engineering. The very basis of construction of any building, residential house or dams, bridges, culverts, canals etc. is designing. Structural engineering has existed since humans first started to construct their own structures.

In these modern days the Buildings are made to fulfil our basic aspects and better serviceability. It is not an issue to construct a Building any how its, important to construct an efficient building which will serve for many years without showing any failure. The principle objective of this project is to design the RCC and prestressed concrete multi-storey building using Ms excel and then compare the cost estimation of RCC and prestressed concrete building and later the results will be compared by a software .The idea is to reach a definite conclusion regarding the superiority of the two design over one another.

Overall, the concepts and procedures of designing the basic components of a multistorey building are described. Apart from that, the planning of the building with regard to appropriate directions for the respective rooms, choosing position of beams and columns are also properly explained.

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<u>CHAPTER 1:</u> <u>INTRODUCTION</u>

Without any semblance of doubt, reinforced cement concrete construction has been the most revolutionary construction technique of modern times. Combining the high compressive strength of concrete with high tensile strength and elasticity of steel has resulted in a composite material that is strong, durable and economical. Moreover, it is time tested.

One of the greatest assets of "homo-sapiens" is the quest for excellence. The human being has constantly refused to sit over his laurels and become complacent. This has often resulted in new invention and improved products and techniques. Very weak tensile strength of concrete lead to discovery of R.C.C. The problem of serviceability associated with the R.C.C. structures sent the human mind working over-time. The solution was found in prestressing.

Like ordinary reinforced concrete, prestressed concrete consists of concrete resisting compression and reinforcement carrying tension. Prestressing became essential in many applications in order to fully utilize the compressive strength of reinforced concrete and to eliminate or control cracking and deflection. Prestressed concrete is the most recent major form of construction introduced in the structural engineering. It has become a well-established method of construction as the technology is now available in all developed and in many developing countries. Today, prestressing is used in buildings, underground structures, communication towers, floating storage and offshore structures, power stations, nuclear reactor vessels, and numerous types of bridge systems.

The aim of this project is to design a six storey residential building as close as done by various construction firms. In this project we have working design of structure as well. Next step is to replace some structural elements of this RCC structure with Prestressed elements and compare the material cost of two structures. The idea is to reach a definite conclusion on feasibility and increased use of prestressed concrete in buildings.

1.1. TYPES OF BUILDING

a) HIGH-RISE BUILDINGS

A high rise building is a building that has multiple floors above ground in the building. Multistorey building aim to increase the area of the building without increasing the area of the land the building is built on, hence saving land and, in most cases money.

b) LOW-RISE BUILDING

Residential buildings are called houses/homes. Single family and multifamily dwellings are typically built as shelter and living space. These building types may range from one-room wood-framed, masonry, or adobe dwellings to multi-million dollar high- rise buildings able to house thousands of people. Generally three rows or less are considered low rise.

1.2. TYPES OF LOADS

DEAD LOAD

Dead loads are permanent or stationary loads which are transferred to the structure throughout their life span. Dead load is primarily due to self-weight of structural members, permanent partition walls, fixed permanent equipment and weighs of different materials. The unit weights may be taken from IS: 875(part 1)

LIVE LOAD

Live loads are those loads which are transient and can change in magnitude. They include all objects found with in a building during its life as well as external environmental effects such as loads due to the sun, earth or weather. IS 875 (part-2) deals with the imposed loads on roofs, floors, stairs, balconies, etc., for various occupancies.

1.3. MATERIALS

M 25 concrete for RCC, M 40 concrete for prestressed designing, cold twisted high yield strength deformed bars grade Fe 415 conforming to IS: 1786.

1.4. REINFORCED CEMENT CONCRETE

The concrete of the mixture of cement, sand, water and aggregate in a certain proportion with steel bars by a known method is termed as Reinforcement Cement Concrete. Reinforced cement concrete work may be cast-in-situ or Precast as may be directed by Engineer-in-charge according to the nature of work. The most common form of concrete consists of mineral aggregate (gravel & sand), Portland cement and water. After mixing, the cement hydrates and eventually hardens into a stone like material. Recently a large number of additives known as concrete additives are also added to enhance the quality of concrete. Plasticizers, superplasticizers, accelerators, retarders, pozalonic materials, air entertaining agents, fibres, polymers and silica furies are the additives used in concrete. Hardened concrete has high compressive strength and low tensile strength. Concrete is generally strengthened using steel bars or rods known as rebars in tension zone. Such elements are "reinforced concrete" concrete can be moulded to any complex shape using suitable form work and it has high durability, better appearance, fire resistance and economical. For a strong, ductile and durable construction the reinforcement shall have high strength, high tensile strain and good bond to concrete and thermal compatibility.

1.5. PRESTRESSED CONCRETE

Precast concrete consists of concrete (a mixture of cement, water, aggregates and admixtures) that is cast into a specific shape at a location other than its in-service position. The concrete is placed into a form, typically wood or steel, and cured before being stripped from the form, usually the following day. These components are then transported to the construction site for erection into place. Precast concrete can be plant-cast or site-cast, but this book deals specifically with plant-cast concrete. Precast concrete components are reinforced with either conventional reinforcing bars, strands with high tensile strength, or a combination of both. The strands are pretensioned in the form before the concrete is poured. Once the concrete has cured to a specific strength, the strands are cut (detensioned). As the strands, having bonded to the concrete, attempt to regain their original untensioned length, they bond to the concrete and apply a compressive force. This "precompression" increases load-carrying capacity to the components and helps control cracking to specified limits allowed by building codes.

<u>CHAPTER 2:</u> LITERATURE REVIEW

"Research and applications of precast/prestressed concrete systems in Indonesia"

The capabilities of both state and private sectors to supply good quality low-cost housing units in Indonesia have always been a vital issue. As a country with 220 million inhabitants, the needs of providing low-cost residential units are enormous. Around mid-1980s the Indonesian government started to seriously promote the construction of low-cost multi-storey residential buildings, especially in the big cities. However, not until 2004, i.e. when the State Ministry for People's Housing Affairs launched a national movement to construct *one million* low-cost residential units, precast concrete has been known widely as an appealing alternative building construction material. Since then precast concrete has been used intensively. Several recent research works were Precast Concrete Wall Panel with Precast/Prestressed Half Slab, Beam Column Joint (exterior & interior) and Cast on Site Concrete Wall with Hollow Core Slab plus Topping. It was found that structural construction cost efficiency around 5-10% was generally obtained by replacing conventional structural systems with precast/prestressed concrete. It has also been proved that the construction speed was able to be increased significantly in-line with the achievement of better quality works and more eco-friendly.

Comparative Study of RCC and Prestressed Concrete Flat Slabs"

This paper presents the comparison of R.C.C. and Prestressed Concrete Flat Slab. This work includes the design and estimates for R.C.C. and Prestressed Concrete flat slabs of various spans. The aim of this work is to design R.C.C. as well as prestressed concrete flat slabs for various spans and then compare the results. Programming in MS EXCEL is done to design both types of flat slabs. The idea is to reach a definite conclusion regarding the superiority of the two techniques over one another. Results reveal that a R.C.C. flat slab is cheaper than pre-stressed concrete flat slabs for smaller spans but vice versa is true for larger spans. This work includes the design and

estimate for Flat Slabs of various spans, ranging from 6.0 M to 12.0 M, by R.C.C. and Prestressed Concrete techniques. For smaller spans, associated with normal building works, prestressed concrete construction becomes too cumbersome, irrespective of the economics involved. Intensity of assumed loading is kept sufficient enough, so that the factored bending moment will be comparable to that developing in cases of commercial buildings. Post-tensioning is preferred as it is in vogue, in construction of large span slabs. Based on the study conducted, it could be concluded that RCC flat slabs are economical up to 9m span but beyond that pre-stressed concrete flat slabs become a better choice. The cost advantage in percentage terms goes on increasing in favour of prestressed concrete with increasing span. Besides, pre-stressed concrete flat slabs being thinner provide greater headroom & result in lesser seismic forces. Better durability of prestressed concrete structures is already a well-established fact.

Analysis Of Wind-Induced Response Of Tall Reinforced Concrete Building Based On Data Collected By GPS And Precise Inclination Sensor"

In this study, the behaviour of a tall reinforced concrete building (30 stories) under wind load has been monitored by GPS and inclination sensors. Data collected by these sensors have been analysed in the time and frequency domains. Relative displacements are key to assessing structural dynamics. This paper presents the preliminary results of measurement and analysis of a tall reinforced concrete tall building under a small scale wind loading. The full scale measurement were performed with the aid of GPS, inclination sensor and anemometer. The measured wind induced response of the building from both sensors has been analysed in both the time and frequency domains in order to detect the natural frequency of the building and to compare the measured frequency with the predicted frequency from the Finite Element method (FEM). In this study, GPS, inclinometer and anemometer have been installed on a tall reinforced concrete building. The data have been collected during a small scale wind event, mostly in the South-West direction. The measured wind-induced response of the building from both sensors has been analysed in both the time and frequency domains for the purpose of detecting natural frequency of the building and comparing the sensors with each other as well as comparing the measured frequency with the predicted frequency obtained from FEM.

Comparative study of flexural behaviour of reinforced concrete beam and prestressed concrete beam"

The aim of present work is to compare the economics and structural behaviour of the reinforced concrete and prestressed concrete beams and finding out the suitability of each. In order to study structural behaviour of reinforced concrete and prestressed concrete flexure members, it is proposed to cast the beams of 2.5 m and 3.0 m spans of each type with the same cross-section of 100 mm width and 150mm overall depth. For reinforced concrete beam, it is proposed to have a concrete grade of M20 and H.Y.S.D. (Fe415) steel reinforcement, which are normally used in practice. For prestressed concrete beam, it is proposed to use a concrete grade M35 and H.T.S. wires of 3.75 mm diameter with ultimate tensile strength of 1475 N/mm².As can be seem from the results tabulated and graphs of load v/s deflection that the deflection for first few loads was well matching with the theoretical values. Also the graph shows a linear pattern for these values. But afterwards the rate of increase in deflection increases with load and this may be because of the cracking of concrete. Thus it can be Conclude that the cracking moment is the one at which the linear pattern of graph ends.

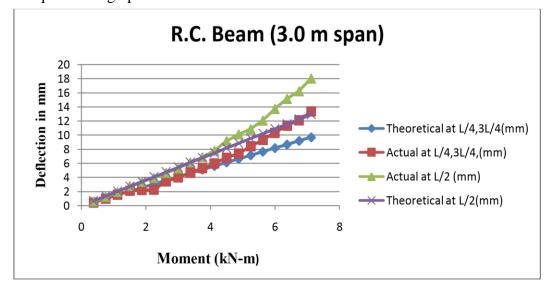


Fig. 1: Moment vs Deflection for RC beam 3m span

<u>CHAPTER 3:</u> LAYOUT AND DETAILS OF STRUCTURE

We have taken a 6 storey (G+5) residential building which has 6 1BHK apartments on each floor and a common lobby. The building is provided with doglegged staircase for accessing different floors as well as lift facility is also provided. Building has parking area on ground floor and common roof.

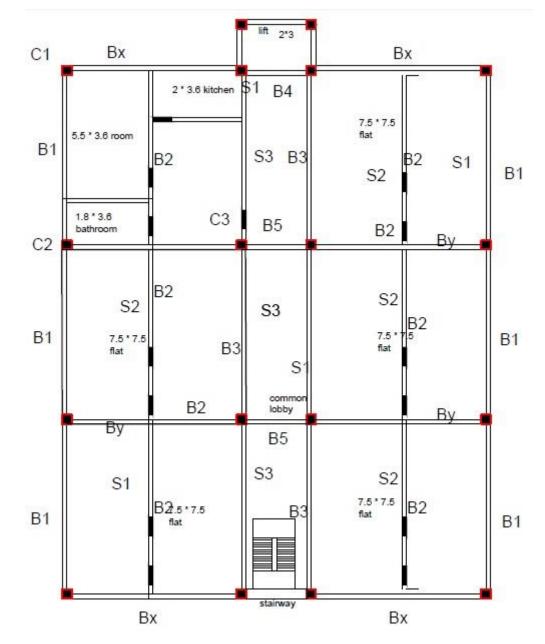
The factor that has been considered while selecting the building site is as follows:-

- Access to park & playground.
- Availability of public utility services, especially water, electricity & sewage disposal.
- Contour of land in relation the building cost. Cost of land.
- Distance from places of work.
- Ease of drainage.
- Location with respect to school, collage & public buildings.
- Nature of use of adjacent area.
- Transport facilities.

3.1 MINIMUM FLOOR AREA & HEIGHT OF ROOMS

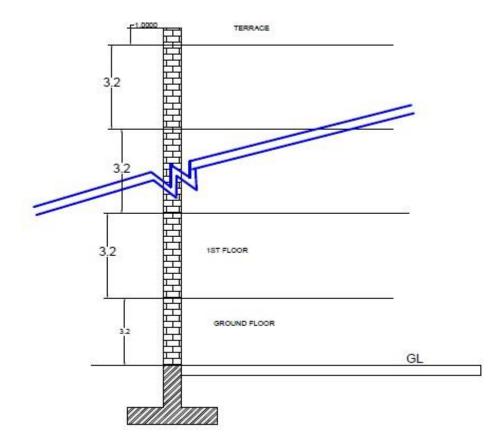
FLOOR AREA

• LIVING	5.3m * 3.6m (19.08 m2)
• BED ROOM	5.5m * 3.6m (19.8 m2)
• KITCHEN	2m *3.6m (7.2 m2)
• BATH & LATTRINE	1.8m * 3.6m (6.48 m2)
• HEIGHT OF EACH FLOOR	3.2 m



1) Plan was made using Autocad.

2) Elevation of building



3.2 LOADING ON STRUCTURE

The structure is designed for dead load and live load cases. Dead load has been calculated using IS code 875:2000 part 1 and live load has been taken for residential building from IS code 875:2000 part 2.

<u>CHAPTER 4:</u> <u>DESIGN OF STRUCTURE</u>

4.1 DESIGN OF RCC SLAB

4.1.1 GENERAL

A slab is a flat two dimensional planar structural element having thickness small compared to its other two dimensions. It provides a working flat surface or a covering shelter in buildings. It primarily transfer the load by bending in one or two directions. Reinforced concrete slabs are used in floors, roofs and walls of buildings and as the decks of bridges. The floor system of structure can take many forms such as in situ solid slab, ribbed slab or pre-cast units. Slabs maybe supported on monolithic concrete beam, steel beams, walls or directly over the columns. Concrete slab behave primarily as flexural members and the design is similar to that of beams.

4.1.2 CLASSIFICATION OF SLABS

Slabs are classified based on many aspects:

(1) Based of shape: Square, rectangular, circular and polygonal in shape.

(2) **Based on type of support:** Slab supported on walls, Slab supported on beams, Slab supported on columns (Flat slabs).

(3) Based on support or boundary condition: Simply supported, Cantilever slab,

Overhanging slab, Fixed or Continues slab.

(4) Based on use: Roof slab, Floor slab, Foundation slab, Water tank slab.

(5) **Basis of cross section or sectional configuration:** Ribbed slab/Grid slab, Solid slab, Filler slab, folded plate

(6) **Basis of spanning directions:**

One way slab – Spanning in one direction

Two way slab _ Spanning in two direction

Two way slabs

There are two types of two way slabs

- (a) Simply supported slab
- (b) Restrained slabs

a. Two way simply supported slabs

The bending moments Mx and My for a rectangular slabs simply supported on all four edges with corners free to lift or the slabs do not having adequate provisions to prevent lifting of corners are obtained using coefficients given in Table 1 (Table 27,IS 456-2000)

b. Two way Restrained slabs

When the two way slabs are supported on beam or when the corners of the slabs are prevented from lifting the bending moment coefficients are obtained from Table 2 (Table 26, IS456-2000) depending on the type of boundary conditions. These coefficients are obtained using yield line theory. Since, the slabs are restrained; negative moment arises near the supports. We have considered our slabs to be restrained.

We have divided the design of slab on the type of boundary conditions for two way slabs. In our structure we have these two types of two way slabs:

- Two adjacent sides discontinuous (type 1)
- One short edge discontinuous (type 2)

One way slabs

The slabs spanning in one direction and continuous over supports are called one way continuous slabs. These are idealized as continuous beam of unit width. For slabs of uniform section which support substantially UDL over three or more spans which do not differ by more than 15% of the longest, the B.M and S.F are obtained using the coefficients available in Table 12 and Table 13 of IS 456-2000. For moments at supports where two unequal spans meet or in case where the slabs are not equally loaded, the average of the two values for the negative moments at supports may be taken. Alternatively, the moments may be obtained by moment distribution or any other methods.

4.1.3 DESIGN OF ROOF SLAB

Slabs are designed using limit state method as per IS 456:2000. In roof slab we have taken live load=1.5 KN/m2 from table 2 of IS 875:2000 part 2: Imposed loads on various types of roofs. We have taken different panels of slabs and designed them individually and found the critical panel for which the whole slab is designed.

4.1.4 DESIGN OF FLOORS SLAB

Each floor has same structure and same loading so design of slab for one floor gives design of slab of all floors. Live load on floor slab is 2 KN/m2 taken from IS 875: 2000 part 2 for residential buildings. We have taken different panels of slabs and designed them individually and found the critical panel for which the whole slab is designed.

4.2 DESIGN OF RCC BEAMS

Beam is a member which transfers the loads from slab to columns and then foundation to soil.

- Beam is a tension member.
- Span of slabs, which decide the spacing of beams.

Following are the loads which are acting on the beams.

- Dead load
- Live load

In this structure we have considered beams as T and L beams for design purpose. This structure also has secondary beams. We have used yield line theory for load distribution from slabs to beam.

			1	DESIGN OF ROOF SLAB (S1)
1 Trail depth and effective span				M25
Clear span	length	7.5		FE 415
	width	3.6	m	MONOLITHIC
				KNOWN DATA clear cover 20(mild exposure)
	L/B ratio	2		density of conc.=25 kn/m3
	Type of slab	two way		dia of main bars =10mm
				bc 1 : two adjacent discontinuous
From deflection criteria {I/d=26*m}	depth	123.40	mm	assuming width of beam=250mm modification factor=1.2
	D		mm	
	deff	125	mm	taking dia of bars as 10mm
	Ly	7.625		
	Lx α(Iy/Ix)	3.725		
2 LOAD ON SLAB		2.000		
	Self Weight	3 75	KN/m2	
	Imposed Load		KN/m2	TABLE 2 IMPOSED LOADS ON VARIOUS TYPES OF ROOFS
	floor finish		KN/m2	TABLE 2 INFOSED LOADS ON VARIOUS TIFES OF ROOTS
	Ultimate Load W		KN/m2	(Access provided) IS 875 part 2
	ax(+)	0.069		The boundary condition of slab in two adjacent edges
	αγ(+)	0.089		discontinuous (case 4, Table 9.5.2) IS 456-2000
3 positive moment at mid span	1~1	0.035		
	short span	7.97	KNm/m	t
	long span		KNm/m	1
4 negative moment at edges				
		40.00	16 1	
	short span	10.63	KNm/m	as αx(-)=4*αx(+)/3
	long span	22 50	KNm/m	
	long span	22.33	KINII/III	
5 Minimum depth required from				
Maximum BM consideration		02.424		
	d'	82.421 design is safe	mm	
		design is sare		
6 area of reinforcement(per m width)				4
6 area of reinforcement(per in width)				
short span	ast for + moment	225.000	mm2/m	$\left[\frac{dA_{tr}}{bd}\right]_{pagd} = \frac{f_{ck}}{2f_v} \left[1 - \sqrt{1 - 4.598M_u/(f_{ck}bd^2)}\right]$
	ast for - moment		mm2/m	Ju 2 Jy C
long span		000.044		
	ast for + moment ast for - moment	5396.241	mm2/m	
7 spacing of bars	ast for - moment	333.110	111112/111	
providing bars of dia	1(0 mm		
	spacing for short span M(+)	300.000	mm/m	check : less than 300mm or 3d
	spacing for short span M(-)	300.000		whichever is less
	spacing for long span M(+)	198.112		
	spacing for long span M(-)	145.608		300
		145.000		
8 check for cracking		-		
steel should be more than 0.15% of th	e gross area =	225	mm2/m	
	- Bross area	ok	111112/111	
			1	
9 detailing of reinforcement				10 mm bars @ 10 mm b
	based on requirements of reinf		lated above the	10 mm bars @ 10 mm l ↑ 146 /
	based on requirements of reinf detailing in middle strip and ed	forcements calcu		
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	detailing in middle strip and ed	forcements calcu		
	detailing in middle strip and ed	forcements calcu lge strip(.1Lx or gure.	.1Ly) is shown in	
	detailing in middle strip and ed fig Nominal top steel(.5 ast) is pro-	forcements calcu Ige strip(.1Lx or uure.	.1Ly) is shown in	
	detailing in middle strip and ed fig Nominal top steel(.5 ast) is pro-	forcements calcu lge strip(.1Lx or gure.	.1Ly) is shown in	
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	detailing in middle strip and ed fig Nominal top steel(.5 ast) is pro- mor	forcements calcu Ige strip(.1Lx or uure.	.1Ly) is shown in	
9 detailing of reinforcement	detailing in middle strip and ed fig Nominal top steel(.5 ast) is pr mor mesh extending 0.2Lx on each side in 4 layers	forcements calcu Ige strip(.1Lx or uure.	.1Ly) is shown in	
9 detailing of reinforcement	detailing in middle strip and ed fig Nominal top steel(.5 ast) is primor mor mesh extending 0.2Lx on each side in 4 layers at corner of two edges	forcements calcu dge strip(.1Lx or jure. ovided at edges ments	.1Ly) is shown in agaist negative	
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9 detailing of reinforcement	detailing in middle strip and ed fig Nominal top steel(.5 ast) is pr mor mesh extending 0.2Lx on each side in 4 layers at corner of two edges discontinuous ast =	forcements calcu dge strip(.1Lx or uure. Tovided at edges ments 404.339	.1Ly) is shown in agaist negative mm2/m	2/x 146 147 146 147 147 148 148 148 148 148 148 148 148
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9 detailing of reinforcement	detailing in middle strip and ed fig Nominal top steel(.5 ast) is pr mor mesh extending 0.2Lx on each side in 4 layers at corner of two edges discontinuous ast = at corner with one edges	forcements calcu dge strip(.1Lx or uure. Tovided at edges ments 404.339	.1Ly) is shown in agaist negative mm2/m	2/y D C C C C C C C C C C C C C C C C C C
9 detailing of reinforcement	detailing in middle strip and ed fig Nominal top steel(.5 ast) is pr mor mesh extending 0.2Lx on each side in 4 layers at corner of two edges discontinuous ast = at corner with one edges	forcements calcu dge strip(.1Lx or uure. Tovided at edges ments 404.339	.1Ly) is shown in agaist negative mm2/m	2/x 146 147 146 147 147 148 148 148 148 148 148 148 148

LAst

SECTION - A A

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10 mm bars @ 300.000

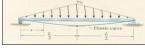
10

10 mm bars @ 300.000

			DESIGN OF ONE WAY SLAB(S3)
Trial depth and effective span	î.	1 1	
		2.5	
clear span	length	7.5 m	MONOLITHIC
	width	2.6 m	KNOWN DATA clear cover 20mm(mild exposure)
			density of conc.=25 kn/m3
	L/B ratio	2.9	modification factor=1.2
	type of slab	one way	
From deflection criteria {I/d=(20+26/2)*m}	depth	103.261 mm	assuming width of beam=250mm
(/ = (== ==, =,)	D	120 mm	Assume a uniform thickness for both end span and
	deff	96 mm	interior span. The 'end span', which is critical, is
	Lx	7.596 m	discontinuous on one edge and continuous at the
	Ly	2.696 m	other.
	-1	2.050 m	
load on Slab			1
	Self Weight	3 KN/m2	1
	Imposed Load	1.5 KN/m2	1
	floor finish	0.3 KN/m2	1
	factored L.L	2.25 KN/m2	1
	factored D.L	4.95 KN/m2	1
	Inclored D.L	4.33 NIV/112	1
Moment calculation			1
For end span	Mu(end)	-2.181 Knm/m	$\int \frac{w_{n,0,1} + w_{n,0,1}}{2\pi} b^2 = \text{at end support}$
	Mu(mid)	4.634 Knm/m	$M_{-} = \begin{pmatrix} -\frac{w_{-}}{w_{-}} \\ -\frac{w_{-}}{w_{-}} \end{pmatrix} $ i at mislopan
	Mu(interior)	-5.415 Knm/m	
For interior case	Mu(mid)	-5.415 Knm/m 3.611 Knm/m	$-\left[\frac{w_{k,nt}}{2\alpha}+\frac{w_{k,nt}}{2\alpha}\right]^2$ at insterior support
For interior span		-5.415 Knm/m	$\sqrt{\frac{(w_{xxx}, w_{xx})}{(w_{xx}, w_{xx})}} \ge 4 \text{ midspan}$
	Mu(interior)	-5.415 Knm/m	$\left\{ \frac{1}{16} + \frac{12}{12} \right\}$ For interior span
Minimum depth required			
from Maximum BM			
	d'	37.331 mm	4
	-		
	-	design is safe	
area of reinforcement(per m width)			
width)		design is safe	
	ast @ end support	design is safe	
width)		design is safe 63.61 mm2/m 136.94 mm2/m	$\frac{(\mathcal{A}_{H})_{eqd}}{\mathcal{A}_{H}} = \frac{f_{cb}}{1 - \sqrt{1 - 4.598M_{e}}/(f_{sb}d^{2})}$
width) for end span	ast @ end support ast @ mid span ast @ interior support	design is safe 63.61 mm2/m 136.94 mm2/m 160.70 mm2/m	$\frac{(A_w)_{eqd}}{bd} = \frac{f_{,k}}{2f_s} \Big[1 - \sqrt{1 - 4.598M_s} / (f_{,k}bd^2) \Big]$
width)	ast @ end support ast @ mid span ast @ mid span ast @ mid span	design is safe 63.61 mm2/m 136.94 mm2/m 106.070 mm2/m 106.15 mm2/m	$\left[\frac{(\mathcal{A}_{dr})_{qeqd}}{bd} = \frac{f_{cb}}{2f_y} \left[1 - \sqrt{1 - 4.598M_u/(f_{cb}bd^2)}\right]$
width) for end span	ast @ end support ast @ mid span ast @ interior support	design is safe 63.61 mm2/m 136.94 mm2/m 160.70 mm2/m	$\frac{(A_{tt}\frac{1}{2}_{regl})}{bd} = \frac{f_{cb}}{2f_{y}} \left[1 - \sqrt{1 - 4.598M_{y}/(f_{cb}bd^{2})} \right]$
width) for end span for interior span	ast @ end support ast @ inid span ast @ interior support ast @ interior support ast @ interior support	design is safe 63.61 mm2/m 136.94 mm2/m 106.070 mm2/m 106.15 mm2/m	$\frac{(A_{dr})_{eqd}}{bd} = \frac{f_{ct}}{2f_{y}} \Big[1 - \sqrt{1 - 4.598M_{w}/(f_{ct}bd^{2})} \Big]$
width) for end span	ast @ end support ast @ inid span ast @ interior support ast @ interior support ast @ interior support	design is safe 63.61 mm2/m 136.94 mm2/m 106.070 mm2/m 106.15 mm2/m	$\frac{(A_{dr})_{qqd}}{bd} = \frac{f_{cb}}{2f_{j}} \left[1 - \sqrt{1 - 4.598M_{u}/(f_{cb}bd^{2})} \right]$
width) for end span for interior span distribution bars Ast min=.001	ast @ end support ast @ inid span ast @ interior support ast @ interior support ast @ interior support	design is safe 63.61 mm2/m 136.94 mm2/m 106.15 mm2/m 160.70 mm2/m	$\frac{(A_{tt}\frac{1}{2}e_{tt})}{bd} = \frac{f_{tt}}{2f_{y}} \Big[1 - \sqrt{1 - 4.598M_{y}/(f_{tt}bd^{2})} \Big]$
width) for end span for interior span distribution bars Ast min=.001 spacing of bars	ast @ end support ast @ mid span ast @ interior support ast @ mid span ast @ interior support 2bD	design is safe 63.61 mm2/m 136.94 mm2/m 160.70 mm2/m 160.70 mm2/m 160.70 mm2/m 140.70 mm2/m 140.70 mm2/m	$\frac{(A_{dr})_{eqd}}{bd} = \frac{f_{cb}}{2f_{p}} \left[1 - \sqrt{1 - 4.598M_{w}/(f_{cb}bd^{2})} \right]$
width) for end span for interior span distribution bars Ast min=.001 spacing of bars providing bars of dia	ast @ end support ast @ mid span ast @ interior support ast @ interior support 2bD	design is safe 63.61 mm2/m 136.94 mm2/m 106.15 mm2/m 160.70 mm2/m 144 mm2/m 0 0	
width) for end span for interior span distribution bars Ast min=.001 spacing of bars	ast @ end support ast @ mid span ast @ mid span ast @ mid span ast @ mid span ast @ miterior support 2bD	design is safe 63.61 mm2/m 136.94 mm2/m 160.70 mm2/m 160.70 mm2/m 160.70 mm2/m 1404 mm2/m 0 0 1234 mm/m	check : less than 300mm or 3d
width) for end span for interior span distribution bars Ast min=.001 spacing of bars providing bars of dia	ast @ end support ast @ mid span ast @ interior support ast @ mid span ast @ interior support 2bD	design is safe 63.61 mm2/m 136.94 mm2/m 160.70 mm2/m 160.70 mm2/m 160.70 mm2/m 144 mm2/m 0 0 1234 mm/m 573.2617 mm/m	
width) for end span for interior span for interior span distribution bars Ast min=001 spacing of bars providing bars of dia for end span	ast @ end support ast @ mid span ast @ interior support ast @ interior support ast @ interior support 2bD spacing @ end support spacing @ mid span spacing @ mid span spacing @ mid span	design is safe 63.61 mm2/m 136.94 mm2/m 106.15 mm2/m 106.070 mm2/m 106.070 mm2/m 144 mm2/m 0 1234 mm/m 573.2617 mm/m 488.4778 mm/m	check : less than 300mm or 3d
width) for end span for interior span distribution bars Ast min=.001 spacing of bars providing bars of dia	ast @ end support ast @ mid span ast @ mid span ast @ interior support ast @ interior support 2bD spacing @ end support spacing @ ind span spacing @ ind span	design is safe 63.61 mm2/m 136.94 mm2/m 160.70 mm2/m 160.70 mm2/m 160.70 mm2/m 144 mm2/m 0 0 1234 mm/m 573.2617 mm/m	check : less than 300mm or 3d
width) for end span for interior span for interior span distribution bars Ast min=001 spacing of bars providing bars of dia for end span	ast @ end support ast @ mid span ast @ interior support ast @ interior support ast @ interior support 2bD spacing @ end support spacing @ mid span spacing @ mid span spacing @ mid span	design is safe 63.61 mm2/m 136.94 mm2/m 160.70 mm2/m 106.15 mm2/m 106.70 mm2/m 144 mm2/m 0 1234 732.2617 mm/m 732.8158 mm/m	check : less than 300mm or 3d whichever is less
width) for end span for interior span distribution bars Ast min=:001 spacing of bars providing bars of dia for end span	ast @ end support ast @ mid span ast @ mid span ast @ interior support ast @ interior support 2bD spacing @ end support spacing @ ind span spacing @ ind span	design is safe 63.61 mm2/m 136.94 mm2/m 160.70 mm2/m 106.15 mm2/m 106.70 mm2/m 144 mm2/m 0 1234 732.2617 mm/m 732.8158 mm/m	check : less than 300mm or 3d whichever is less
width) for end span for interior span distribution bars Ast min=.001 spacing of bars providing Dars of dia for end span for interior span	ast @ end support ast @ mid span ast @ mid span ast @ mid span ast @ interior support 2bD spacing @ end support spacing @ mid span spacing @ interior support spacing @ interior support spacing @ interior support	design is safe 63.61 mm2/m 136.94 mm2/m 160.70 mm2/m 160.70 mm2/m 160.70 mm2/m 160.70 mm2/m 167.70 mm2/m 167.70 mm2/m 167.70 mm2/m 167.70 mm2/m 167.70 mm2/m 167.70 mm2/m 168.770 mm/m 739.6158 mm/m 488.4778 mm/m	check : less than 300mm or 3d whichever is less
width) for end span for interior span distribution bars Ast min=.001 spacing of bars providing Dars of dia for end span for interior span	ast @ end support ast @ mid span ast @ interior support ast @ interior support ast @ interior support bbb spacing @ end support spacing @ interior support	design is safe 63.61 mm2/m 136.94 mm2/m 106.15 mm2/m 106.15 mm2/m 144 mm2/m 144 mm2/m 144 mm2/m 484.4778 mm/m 288 mm/m 288 mm/m 288 mm/m	check : less than 300mm or 3d whichever is less
width) for end span for interior span distribution bars Ast min=.001 spacing of bars providing Dars of dia for end span for interior span	ast @ end support ast @ mid span ast @ mid span ast @ mid span ast @ interior support ast @ interior support spacing @ ind span spacing @ ind span spacing @ interior support spacing @ interior support	design is safe 63.61 mm2/m 136.94 mm2/m 106.70 mm2/m 106.15 mm2/m 106.70 mm2/m 104.14 mm2/m 105.70 mm2/m 104.71 mm2/m 105.70 mm2/m 104.71 mm2/m 105.75 mm1/m 1234 mm/m 739.5155 mm1/m 288 mm/m 288 mm/m 288 mm/m 288 mm/m 288 mm/m	check : less than 300mm or 3d whichever is less 288
width) for end span for interior span distribution bars Ast min=.001 spacing of bars providing Dars of dia for end span for interior span	ast @ end support ast @ mid span ast @ interior support ast @ interior support ast @ interior support bbb spacing @ end support spacing @ interior support	design is safe 63.61 mm2/m 136.94 mm2/m 106.15 mm2/m 106.15 mm2/m 144 mm2/m 144 mm2/m 144 mm2/m 484.4778 mm/m 288 mm/m 288 mm/m 288 mm/m	check : less than 300mm or 3d whichever is less 288 8 * @ 165 c/c 0.3/1 0.3/2
width) for end span for interior span distribution bars Ast min=.001 spacing of bars providing Dars of dia for end span for interior span	ast @ end support ast @ mid span ast @ mid span ast @ mid span ast @ interior support ast @ interior support spacing @ end support spacing @ intid span spacing @ intid span	design is safe 63.61 mm2/m 136.94 mm2/m 106.70 mm2/m 106.15 mm2/m 160.70 mm2/m 1234 mm/m 1235 mm/m 286 mm/m 288 mm/m 288 mm/m 288 mm/m	check : less than 300mm or 3d whichever is less 288 $8^{+} @ 165 c/c \qquad 8^{+} @ 165 c/c \qquad 0.3l_1 \qquad 0.3l_2$
width) for end span for interior span distribution bars Ast min=.001 spacing of bars providing Dars of dia for end span for interior span	ast @ end support ast @ mid span ast @ mid span ast @ mid span ast @ interior support ast @ interior support spacing @ ind span spacing @ ind span spacing @ interior support spacing @ interior support	design is safe 63.61 mm2/m 136.94 mm2/m 106.70 mm2/m 106.15 mm2/m 106.70 mm2/m 104.14 mm2/m 105.70 mm2/m 104.71 mm2/m 105.70 mm2/m 104.71 mm2/m 105.75 mm1/m 1234 mm/m 739.5155 mm1/m 288 mm/m 288 mm/m 288 mm/m 288 mm/m 288 mm/m	check : less than 300mm or 3d whichever is less 288 $8^{+} @ 165 c/c \qquad 8^{+} @ 165 c/c \qquad 0.3l_1 \qquad 0.3l_2$
width) for end span for interior span distribution bars Ast min=.001 spacing of bars providing bars of dia for end span for interior span after check	ast @ end support ast @ mid span ast @ mid span ast @ mid span ast @ interior support ast @ interior support spacing @ end support spacing @ intid span spacing @ intid span	design is safe 63.61 mm2/m 136.94 mm2/m 106.70 mm2/m 106.15 mm2/m 160.70 mm2/m 1234 mm/m 1235 mm/m 286 mm/m 288 mm/m 288 mm/m 288 mm/m	check : less than 300mm or 3d whichever is less 288 $8^{+} @ 165 c/c$ $8^{+} @ 165 c/c$ $0.3l_1$ $0.3l_2$ $0.1l_1$ $8^{+} @ 300 c/c$ $0.15l_2$ $8^{+} @ 300 c/c$
width) for end span for interior span distribution bars Ast min=.001 spacing of bars providing bars of dia for end span for interior span after check	ast @ end support ast @ mid span ast @ mid span ast @ mid span ast @ interior support ast @ interior support spacing @ end support spacing @ intid span spacing @ intid span	design is safe 63.61 mm2/m 136.94 mm2/m 106.70 mm2/m 106.15 mm2/m 160.70 mm2/m 1234 mm/m 1235 mm/m 286 mm/m 288 mm/m 288 mm/m 288 mm/m	check : less than 300mm or 3d whichever is less 288 $8^{*} @ 165 c/c$ $8^{*} @ 165 c/c$ $0.3l_{1}$ $0.3l_{2}$ $0.15l_{2}$ $8^{*} @ 300 c/c$ $0.15l_{2}$ $8^{*} @ 300 c/c$
width) for end span for interior span distribution bars Ast min=.001 spacing of bars providing bars of dia for end span for interior span after check	ast @ end support ast @ mid span ast @ mid span ast @ mid span ast @ interior support ast @ interior support 200	design is safe 63.61 mm2/m 136.94 mm2/m 160.70 mm2/m 160.70 mm2/m 160.70 mm2/m 160.70 mm2/m 160.70 mm2/m 160.70 mm2/m 484 mm1/m 484 475 285 mm/m 288 mm/m	check : less than 300mm or 3d whichever is less 288 8*@ 165 c/c 8*@ 165 c/c 0.3/1 0.3/2 250 0 1 8*@ 300 c/c 8*@ 300 c/c 0.15/1 8*@ 300 c/c 250 0 1 8*@ 300 c/c 1 8*@ 300
vidth) for end span for interior span distribution bars Ast min=.001 spacing of bars providing bars of dia for end span for interior span	ast @ end support ast @ mid span ast @ mid span ast @ mid span ast @ interior support ast @ interior support spacing @ end support spacing @ intid span spacing @ interior support spacing of distribution steel	design is safe 63.61 mm2/m 136.94 mm2/m 160.70 mm2/m 1234 mm/m 739.5155 mm/m 288 mm/m	check : less than 300mm or 3d whichever is less 288 $8^{+} \oplus 165 c/c$ $0.3l_1$ $0.3l_2$ $0.15l_2$ $8^{+} \oplus 300 c/c$
vidth) for end span for interior span distribution bars Ast min=.001 spacing of bars providing bars of dia for end span for interior span after check	ast @ end support ast @ mid span ast @ interior support ast @ interior support ast @ interior support 2bD spacing @ end support spacing @ interior support spacing of distribution steel based on requirements of rein the detailing in middle span	design is safe 63.61 mm2/m 136.94 mm2/m 106.70 mm2/m 106.15 mm2/m 160.70 mm2/m 144 mm2/m 0 0 1234 mm/m 573.2617 mm/m 288 mm/m	check : less than 300mm or 3d whichever is less 228 $8^{+} @ 165 c/c$ $8^{+} @ 105 c/c$ $0.3/_1$ $0.3/_2$ $0.15/_2$ $8^{+} @ 300 c/c$ $0.15/_2$ $8^{+} @ 300 c/c$ $0.15/_1$ $8^{+} @ 300 c/c$ $0.25/_1$ $0.25/_2$ $8^{+} @ 105 c/c$
width) for end span for interior span distribution bars Ast min=.001 spacing of bars providing bars of dia for end span for interior span after check	ast @ end support ast @ mid span ast @ mid span ast @ mid span ast @ interior support ast @ interior support spacing @ end support spacing @ mid span spacing @ interior support spacing d distribution steel	design is safe 63.61 mm2/m 136.94 mm2/m 106.70 mm2/m 106.15 mm2/m 160.70 mm2/m 144 mm2/m 0 0 1234 mm/m 573.2617 mm/m 288 mm/m	check : less than 300mm or 3d whichever is less 288 8 * @ 165 c/c 0.1/ ₁ 8 * @ 300 c/c 250 0 1 * * @ 300 c/c 8 * @ 300 c/c 8 * @ 300 c/c 8 * @ 300 c/c 8 * @ 300 c/c

DESIGN OF L-BEAMS IN MAIN SLAB(B1)

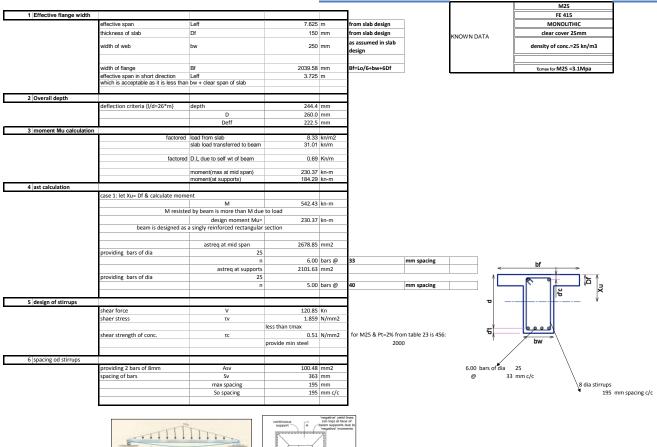
							M25	
1 Effective flange width							FE 415	
, i i i i i i i i i i i i i i i i i i i	effective span in long direction	Leff	7.625	m	from slab design		MONOLITHIC	
		Df						
	thickness of slab	Df	150	mm	from slab design	KNOWN DATA	clear cover 25mm	
	width of web	bw	250	mm	as assumed in slab design		density of conc.=25 kn/m3	
		1					modification factor =1.2	
	width of flange	Bf	1144.79	mm	Bf=Lo/12+bw+3Df		τ _{cmax} for M25 =3.1Mpa	
	effective span in short direction	Leff	3.725			L		
	which is acceptable as it is less that		0.120		1			
					1			
2 Overall depth					1			
	deflection criteria {I/d=26*m}	depth	244.4	mm	1			
	denection chiteria (i/d=20 mj	D	260.0		-			
		Deff	222.5	mm				
3 moment Mu calculation								
	factored	load from slab		kn/m2	4			
	11	slab load transferred to beam		kn/m kn/m	for 100 mmparapett brick wall of	1 m hoight		
		load from parapet wall			from IS 875-II table 2			
	factored	D.L due to self wt of beam	0.69	Kn/m	nom is 875-n table .	2		
		mement(mey et mid en en)	131.56	lun m				
		moment(max at mid span) moment(at supports)	105.25					
4 ast calculation		moment(at supports)	105.25	KII-III	4			
4 ast calculation					-			
	case 1: let Xu= Df & calculate mom				4			
		M	246.502	kn-m	1			
	M resiste	ed by beam is more than M due						
		design moment Mu=		kn-m				
	beam is designed as	a singly reinforced rectangular	section					
		astreg at mid span	1864.34	mm2				
	providing bars of dia	25			1			
		n	4.00	bars @	50 mm spac	ing	< bf	
		astreg at supports	1446.65					
	providing bars of dia	25	1110.05					
	providing bars of ala	n	2.00	bars @	67 mm spac	ing	Xr St	
5 data a fatta a			3.00	Dars @	or Innispac	-	σ	
5 design of stirrups					4	- σ		
	shear force	V	69.02		4			
	shaer stress	τν		N/mm2	4			
			less than tmax			5		
	shear strength of conc.	τς		N/mm2	J	0		
			provide min steel				bw	
						/		
6 spacing of stirrups					1		\	
	providing 2 bars of 8mm	Asv	100.48	mm2	1	4 bars of dia	25	
	spacing of bars	Sv		mm	1		mm spacing	
		max spacing		mm	1	a. 50	8 dia stirrups	
		So spacing		mm c/c	1		195 mm spacing	clc
		Su spacing	195		1		155 mm spacing	c/ L
		1			1			
				'negative' yield (on top) at fai	1 lines			
		T	support A	(on top) at fai beam supports 'negative' mor	due to			
		1111		regative mor	nenis			





load transferred to beam using yield line theory

DESIGN OF SECONDARY T-BEAMS IN MAIN SLAB(B2)





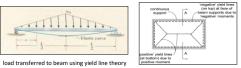
load transferred to beam using yield line theory

DESIGN OF LONG T-BEAMS IN COMMON LOBBY SLAB(B3)

					-			M25	
1 Effective flange width								FE 415	
	effective span in longer direction	Leff	7.625	m	from slab design			MONOLITHIC	
	thickness of slab	Df	150	mm	from slab design	1	KNOWN DATA	clear cover 25mm	
	width of web	bw	250	mm	as assumed in slab design			density of conc.=25 kn/m3	
	effective span	in shorter direction	2.85	m					
	width of flange	Bf	2039.58	mm	Bf=Lo/12+bw+3Df			Tcmax for M25 =3.1Mpa	
									4
	which is acceptable as it	is less than bw + clear span of	slab		1				
2 Overall depth					1				
•	deflection criteria {I/d=2	depth	244.4	mm	1				
		D	260.0	mm	1				
		Deff	222.5	mm	1				
3 moment Mu calculation					1				
	factored	load from slab		kn/m2]				
		slab load transferred to beam	27.73	kn/m					
	factored	D.L due to self wt of beam	0.69	Kn/m					
	lactorea	D.E dde to sen wt or beam	0.05	TXI/III					
		moment(max at mid span)	206.55	kn-m	1				
		moment(at supports)	165.24	Kn=m					
4 ast calculation									
	case 1: let Xu= Df & calcu								
		M	542.427	kn-m					
	M re	sisted by beam is more than N							
		design moment Mu=		kn-m					
	beam is designe	d as a singly reinforced rectar	gular section						
		astreq at midspan	2377.33	mm2					
	providing bars of dia	25						bf	
		n		bars @	40	mm spacin	g	×	
		astreq atsupport	1869.77	mm2			î		l 🖆 î
	providing bars of dia	25					I'		, S
		n	4.00	bars @	50	mm spacin	<u> </u>	a	4
5 design of stirrups			100.05		-		U		
	shear force	V	108.35						
	shaer stress	τν		N/mm2	for M25 & Pt=2%		ļ		
	sheer strength of some		less than tmax	N/mm2	from table 23 is 456:		5		
	shear strength of conc.	τς	provide min steel	N/mm2	2000		1	bw	
			provide min steer		2000				
6 spacing od stirrups							/		
	providing 2 bars of 8mm	Asv	100.48	mm2			5.00 bars of dia	25	
	spacing of bars	Sv	363	mm]		@ 40	mm c/c	
		max spacing	195	mm]			8 dia stirrups	
		So spacing	195	mm c/c				▼ 195	mm spacing c/c
					J				
			continuous _~	'negative' yield (on top) at face beam supports of	ines a of				
	-	0	support A	'negative' mom	lue to ents				

and the second	continuous (on top) at face of support A beam support due to regative moments
load transferred to beam using yield line theory	positive' yield lines A (at bottom) due to positive moment

							DESIGN OF L-	BEAMS IN LO	3BY (B4)
									M25
1 Effective flange width		ĺ	1		1				FE 415
j	effective span in shorter dir	Leff	3	m	from slab design	1			MONOLITHIC
	thickness of slab	Df		mm	from slab design	1			clear cover 25mm
					as assumed in slab	1	KNOWN DATA		
	width of web	bw	400	mm	design			d	ensity of conc.=25 kn/m3
	width of flange	Bf	2130.00	mm	Bf=Lo/12+bw+3Df				Tcmax for M25 =3.1Mpa
	-				51-10/12-00-001	1			
	which is acceptable as it is le	ess than bw + clear span of sla	b 		1				
2 Overall depth	La confidente P	leff/15=	200.0						
	let overall depth D=	Deff	200.0						
		Dem	230.0	mm					
3 moment Mu calculation									
3 moment wu calculation		load from slab	8.33	kn/m2	•				
	actored	slab load transferred to beam		kn/m	1				
	factored	load from parapet wall		kn/m	for 100 mmparapett b				
		D.L due to self wt of beam	0.00	Kn/m	from IS	875-II table	e 2		
		moment(max at mid span)		kn-m	1				
4		moment(at support)	12.96	kn-m	4				
4 ast calculation									
	case 1: let Xu= Df & calculate								
		M	588.17394	kn-m					
	M res	isted by beam is more than M							
		design moment Mu=		kn-m					
	beam is designed	as a singly reinforced rectang	ular section						
		astreq at mid span	196.37	mm2					
	providing bars of dia	10							
		n		bars @	117	mm spaci	ng		bf
		astprov	235.50					~	
		astreq at support	156.88	mm2				1	
	providing bars of dia	10							
		n	2.00	bars @	175	mm spaci	ng		XL
4 check for deflection cor	ntrol	0/ steel	1.00		4			σ	
		%steel Fs	1.00	N/mm2	1				
	modification factor	m			of IS 456 : 2000]	1			
		L/d	13.04			1		5	0000
		L/dmax	18.78		1			1	hur
			safe					· /	bw
	L				4			×	
5 design of stirrups					1			3 bars of 2	20mm dia @ 175mm spacing
	shear force	v	21.60		1				\
	shaer stress	τν		N/mm2	1				7
			less than tmax						172.5 mm space
	shear strength of conc.	τς		N/mm2	for M25 & Pt=1% f	rom table 2	3 is 456: 2000		
			design for (E47-I	-45)bd	1				
					1				
6 spacing od stirrups					1				
	providing 2 bars of 8mm	Asv	100.48		4				
	spacing of bars	Sv		mm					
		max spacing So spacing	172.5	mm c/c					



DESIGN OF SHORT T-BEAMS IN LOBBY SLAB(B5)

								M25	
1 Effective flange width					I			FE 415	
	effective span in shorter dir	Leff	3	m	from slab design			MONOLITHIC	
	thickness of slab	Df	150	mm	from slab design		KNOWN DATA	clear cover 25mm	
					as assumed in slab		KNOWN DATA		
	width of web	bw	250	mm	design			density of conc.=25 kn/m3	
	effective span in longer dir	L'eff	7.505	m	-				
	width of flange	Bf	1500.00		Bf=Lo/12+bw+3Df			τcmax for M25 =3.1Mpa	
	which is acceptable as it is less	s than bw + clear span of slab			1				
2 Overall depth									
	let overall depth D=	leff/15=							
		Deff	150.0	mm					
3 moment Mu calculation									
3 moment wu calculation		load from slab	8.33	kn/m2					
		slab load transferred to beam	24.98	kn/m	1				
					1				
	factored	D.L due to self wt of beam	0.00	Kn/m	4				
		moment(max at mid span)	28.10	kn-m	1				
		moment(at support)		kn-m	1				
4 ast calculation					Ι				
	case 1: let Xu= Df & calculate m				I				
		М	176.175	kn-m	1				
	M resis	ed by beam is more than M d			l				
		design moment Mu=		kn-m	l				
	beam is designed a	s a singly reinforced rectangul	ar section						
		a star a star of design	540.20		1				
	and the state of the	astreq at midspan	540.38	mm2					
	providing bars of dia	20		bars @	100	mm spacin	19		
		astprov	628.00		100	mm spacin	ig	bf	
		ast reg at support	428.62					1	
	providing bars of dia	20						1 🔊 🕂	Ĵā î
		n		bars @	100	mm spacin	Ig	Grand Contraction of the second secon	, ×
5 check for deflection con	trol				· · · · · · · · · · · · · · · · · · ·		•		
		%steel	1.00		I			σσ	
	modification factor	Fs		N/mm2	of IS 456 : 2000]				
	modification factor	m L/d	15.00		0113 436 . 2000j				
		L/dmax	18.45		1			5 6000	
			safe		1			bw bw	
6 design of stirrups					Ļ		2	bars of 20mm dia @ 175mm spacing	9
	shear force	V	37.46		1				\
	shaer stress	τν	less than tmax	N/mm2				112.5	★ mm spacing c/c
	shear strength of conc.	τς		N/mm2	for M25 & Pt=1% from	table 23 is	\$ 456: 2000	112.5	min spacing oc
	silear screnger or conc.	ii.	provide min steel	11/11/12	101 1125 0110 12/01101		150.2000		
			provide min steel		1				
7 spacing od stirrups					t i i i i i i i i i i i i i i i i i i i				
· · · · · · ·	providing 2 bars of 8mm	Asv	100.48		1				
	spacing of bars	Sv max spacing	363	mm	4				
		So spacing		mm c/c	1				
		or opening							
			continuous support A	'negative' yield (on top) at fao beam supports o 'negative' mom	ines of outs toto				
	load transferred to bean	i using yield line theory	Provide a construction of the second s						

M25 1 Effective flange width FE 415 ffective span in long direction Leff 7.625 m rom slab design MONOLITHIC from slab design thickness of slab Df 150 mm clear cover 25mm KNOWN DATA as assumed in slab ridth of web 250 mm density of conc.=25 kn/m3 bw design modification factor =1.2 ridth of flange Bf 1144.79 mm Bf=Lo/12+bw+3Df max for M25 =3.1Mpa effective span in short direction Leff which is acceptable as it is less than bw + clear span of slab 3.725 m 2 Overall depth eflection criteria {I/d=26*m} 244.4 mm depth D 260.0 mm 222.5 mm Deff 3 moment Mu calculatio factored load from slab 8.33 kn/m2 slab load transferred on half beam in form of triangle load 15.51 kn/m concentrated laod due to secondary beam factored load from parapet wall factored D.L due to self wt of beam 59.11 kn 1.91 kn/m 0.69 Kn/m or 100 mmparapett brick wall of 1 m height from IS 875-II table 2 max moment at midspan 115.14 kn-m 92.11 kn-m calculated by drawing BMD oment at support 4 ast calculation Т case 1: let Xu= Df & calculate moment м 246.502 kn-m M resisted by beam is more than M due to load 115.14 kn-m design moment Mu= beam is designed as a singly reinforced rectangular section astreq at midspan 1600.23 mm2 bf providing bars of dia 25 4.00 bars @ 1248.22 mm2 A IN mm spacing astreq at support d'c providing bars of dia 25 3.00 bars @ mm spacing σ 5 design of stirrups calculated by drawing BMD hear force 69.02 Kn 1.062 N/mm2 haer stress τν less than τmax t, 0.51 N/mm2 hear strength of conc. τc provide min steel bw 6 spacing od stirrups providing 2 bars of 8mm 100.48 mm2 4 bars of dia 25 Asv pacing of bars Sv 363 mm 195 mm at 50 mm spacing dia stirrups 195 mm spacing c/c max spacing So spacing 195 mm c/c

DESIGN OF L-BEAMS IN MAIN SLAB(Bx)

w0	continuous support A beam supports due to 'negative' yield lines (on top) at face of beam supports due to 'negative' inegative' ineg
Elastic curve	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	positive' yield lines
load transferred to beam using yield line theory	(at bottom) due to

Г

$ \frac{\left \begin{array}{c c c c c c c c c c c c c c c c c c c $	1 Trail depth and effective sp	an	_		DESIGN OF FLOOR SLAB (F1) M25
$ \begin{array}{ c } \hline \hline$			7.6	~	
	Clear span				
		width	3.0	m	
$ \begin{array}{ c } \hline \hline \begin{tabular}{ c } \hline \hline \$		l ype of slab	two way		
$\frac{1}{4} \frac{1}{4} \frac{1}{4} \frac{1}{2} \frac{1}$	From defloction oritoria (I/d-2	6*m) donth	102.40	mm	
$\frac{1}{2} \frac{1}{2} \frac{1}$	From deliection chiteria (/d=2				
$\frac{ \mathbf{x}_{i} ^{2}}{ \mathbf{x}_{i} ^{2}} = \frac{ \mathbf{x}_{i} ^{2}}{ \mathbf{x}_{i} $		deff			taking dia of bars as 10mm
$\frac{1}{2} \left[2000 \text{ On SLAB} \qquad \text{is the Watch } & 2 000 \\ \hline \\ 2 \left[2000 \text{ On SLAB} \qquad \text{is the Watch } & 2 000 \\ \hline \\ 1 \left[1000 \text{ Strable models and } & 2 000 \\ \hline \\ 1000 \text{ final h} & 1 2 (1000 \text{ final h} & 1 (1000 \text{ final h} & 1 (1000 \text{ final h} & 1 (1000 final $					
$\frac{2 [conc 008 SLAB}{ conc 0 08 SLAB} = \frac{1}{ conc 0 $					4
Set Work Imposed LoadTABLE 1 MPOSED RUOR LOADS FOR DUPTINITY COLSPACE RUOR LOADS FOR <td>2 LOAD ON SLAB</td> <td>a(iy/ix)</td> <td>2.000</td> <td></td> <td></td>	2 LOAD ON SLAB	a(iy/ix)	2.000		
Table 1 Interest RODE RODE RODE RODE RODE RODE RODE RODE	2 LOAD ON SEAD	Self Weight	3 75	KN/m2	1
$\frac{ }{ } \frac{ }{ } \frac{ }{ } \frac{ }{ }$	-				TABLE 1 IMPOSED FLOOR LOADS FOR
$\frac{ l }{ l } = \frac{ l }{ l $					
$\frac{1}{3} packet moment at mid span of the field of th$					
3 positive moment at milling span divid span 0.00 (NAMM 4 nogative moment at edges infort span 2.00 (NAMM 4 nogative moment at edges infort span 1.2.00 (NAMM 5 Minimum digst hequides from infort span 2.00 (NAMM 6 area of relationement (Mage span 2.00 (NAMM as oc()-4* co(+)3 6 minimum digst hequides from infort span infort span 6 area of relationement(ger mukth) infort span infort span 6 area of relationement(ger mukth) infort span infort span 6 area of relationement(ger mukth) infort span infort span 9 area of relationement(ger mukth) infort span (Mage span (αx(+)	0.069		The boundary condition of slab in two adjacent edges
$\frac{ }{ } \frac{ }{ } \frac{ }{ } \frac{ }{ }$			0.035		discontinuous (case 4, Table 9.5.2) IS 456-2000
$\frac{1}{4} \log_{2} \sin \alpha \mod 1 \times 1 \otimes 2 \otimes$	3 positive moment at mid spa			101	4
$\frac{4 \text{ negative moments at edges}}{ $					
$\frac{ \mathbf{x} _{q}}{ \mathbf{x} _{q}} = \frac{ \mathbf{x} _{q}}{ \mathbf{x} _{q}$	4 negative moment at edges	iong span	20.00	- Sector H	1
$\frac{\log \log \log n}{\log \log \log n} = \frac{27.47 \text{ KNnim}}{27.47 \text{ KNnim}}$ $\frac{1}{5} \frac{\log \log \log n}{M(1)} = \frac{1}{27.51 \text{ KNnim}} = \frac{1}{27.51 $					
$\log \log $	1	short span	12.93	KNm/m	$as \alpha x(-)=4^{*}\alpha x(+)/3$
8 Mainum Repti regular form 90.856 mm 9 Mainum Reconsideration d' 90.856 mm 4 design is safe d' design is safe 4 design is safe d' design is safe 4 design is safe d' design is safe 5 and for + moment 225.000 mm/2m 4 design is safe design is safe 7 spacing of bars 10 mm 9 design is spacing for short span M(+) 123.225 mm/2m 9 detailing of minforcement dis spacing for sign span M(+) 112.315 mm/m 9 detailing of minforcement dis spacing for sign span M(+) 112.315 mm/m 9 detailing of minforcement dis spacing for sign span M(+) 112.315 mm/m 9 detailing of minforcement moments dis spacing for sign span M(+) 112.315 mm/m 9 detailing of minforcement dis on regularements of reinforcements calculated above, the detailing in middle strp and edge strpi (1 Lor 1.1) is shown figure so 10 test should be more than 0.15% of the grave span M(+) dis on mexit so 10 test should be mor		long oppo	07.17	Khim/m	
* Maximum BM consideration 0' 90.856 mm 6 area of reinforcementiper m width)	Belining and the set of the		27.47	יאוא <i>י</i> ת/m	
$\frac{1}{10 \text{ tensional reinforcement at corners}} = \frac{1}{10 \text{ tensional reinforcement at corners}} = \frac{1}{200,000 \text{ tensional reinforcement constant at corners}} = \frac{1}{200,000 tensional reinforcement c$					
$\frac{\left(4,\frac{1}{2},\frac{1}{2}\right)}{4 \text{ bot span}} = \frac{f_{a}}{2f_{a}}\left[1-\sqrt{1-4.598M_{a}}/(f_{a}M^{2})\right]$ $\frac{(4,\frac{1}{2},\frac{1}{2})}{b} = \frac{f_{a}}{2f_{a}}\left[1-\sqrt{1-4.598M_{a}}/(f_{a}M^{2})\right]$ $(4$	Maximum Bivi consideration		00 806	mm	4
6area of reinforcement/per m width)($d_{ab} \frac{1}{10000000000000000000000000000000000$		u			1
$\frac{1}{10 \text{ torsional reinforcement}} \frac{1}{10 \text{ torsional response sets}} \frac{1}{10 \text{ torsional reinforcement}} \frac{1}{10 \text{ torsional reinforcement}} \frac{1}{10 \text{ torsional reinforcement}} \frac{1}{10 \text{ torsional sets}} \frac{1}{10 $			uesign is sure		
$\frac{1}{10 \text{ torsional reinforcement}} \frac{1}{10 \text{ torsional response sets}} \frac{1}{10 \text{ torsional reinforcement}} \frac{1}{10 \text{ torsional reinforcement}} \frac{1}{10 \text{ torsional reinforcement}} \frac{1}{10 \text{ torsional sets}} \frac{1}{10 $	6 area of reinforcement(per r	n width)			
is as for - moment 298/219 mm/2m is on as for - moment 488.208 mm/2m as for - moment 468.208 mm/2m as for - moment 667.998 mm/2m providing bars of dia spacing for short span M(+) spacing for long span M(+) 263.229 mm/m spacing for long span M(+) 263.229 mm/m spacing for long span M(+) 263.229 mm/m spacing for long span M(+) 160.792 mm/m steel should be more than 0.15% of the grooss area = 0x of detailing of reinforcement 0x detailing in middle strip and edge strip1.11 cor .11y is shown in figure. 10 mm bars @ 10 torsional reinforcement at corners moments detailing of reinforcement at corners spacing to rive deges detailing of dia deges agaist negative moments 10 mm bars @ 10 torsional reinforcement at corners spacing to rive deges decorrinous ast- 250.500 mm/2m decorrinous ast- 250.500 mm/2m					$(A_{zt})_{regd} = \frac{f_{ck}}{1 - \sqrt{1 - 4.598M}/(f_{c} \cdot hd^2)}$
long span ast for - moment 667.990 mm2m 2 spacing of bars 10 mm moment providing bars of dia spacing for short span M(-) 100.022 mm/m spacing for inder span M(-) 100.022 mm/m 300 8 check for cracking 300 steel should be more than 0.15% of the gross area = 0k 300 9 detailing of reinforcement 0k 300 9 detailing in middle strip and edge strip(1.10 or .11/) is shown in figure. 10 mm bars @ 10 mm bars @ 10 to issee and edge strip(1.10 or .11/) is shown in figure. 10 mm bars @ 10 mm bars @ 10 to issee and edge strip(1.10 or .11/) is shown in figure. 10 mm bars @ 10 mm bars @ 10 to issee and edge strip(1.10 or .11/) is shown in figure. 10 mm bars @ 10 mm bars @ 10 to contenue asta 500.000 mm2m 10 mm bars @ 10 mm bars @ 10 to contenue asta 500.000 mm2m 10 mm bars @ 10 mm bars @ 10 to contenue asta 500.000 mm2m 10 mm2m 10 mm bars @ 10 mm bars @ 10 to contenue asta 500.0000 mm2m <	short span	ast for + moment	225.000	mm2/m	$\frac{bd}{bd} = \frac{2f_y}{2f_y} \left[1 - \sqrt{1 - 1 - 1 - 1} - 1} - 1}}}}}}}}}}}}$
ast for + moment 488.208 mm2/m ast for - moment 667.999 mm2/m def regular Providing bars of dia spacing for short span M(+) 203.202 mm/m 300.000 m/m Spacing for long span M(+) 106.7922 mm/m beck: less than 300mm or 3d whichever is less Spacing for long span M(+) 117.515 mm/m 300 S check for cracking		ast for - moment	298.219	mm2/m	1
2 spacing of bars imm providing bars of dia 10 mm ispacing of bars 10 mm ispacing for short span M(-) 2263.220 mm/m spacing for long span M(-) 106.792 mm/m spacing of reinforcement 10 mm ispacing of reinforcement ispacing for long span M(-) ispacing of reinforcement ispacing of reinforcement ispace of reinforcement ispace of the space of the s	long span				
2 packing of bars ispacing for short span M(+) 10 mm m/m 4 spacing for short span M(+) 300.000 mm/m 5 spacing for long span M(-) 160.792 mm/m 300 spacing for long span M(-) 117.515 mm/m 8 check for cracking spacing of reinforcement 300 9 detailing of reinforcement ok spacing of long span M(-) 117.515 9 detailing of reinforcement ok spacing of long span M(-) 10 mm bars @ 10 mm bars @ 10 total long in middle strip and edge strip(1, Lix or.1Ly) is shown in figure. 10 mmemts 10 mmemts 10 total long in adding of 2.8x on each dist in 4 bayes store in A bayes 250.500 mm.2/m 10 store in accorner of two edges dist of adding of 2.8x on each dist in 4 bayes 100.999 mm.2/m 10 store in accorner of two edges dist of adding of 2.8x on each dist of the span dist of adding of 2.8x on each dist of the span dist of the sp					
providing bars of dia	7 marine of here	ast for - moment	667.999	mm2/m	
spacing for short span M(+) 300.000 mm/m spacing for short span M(+) 160.792 mm/m spacing for long span M(+) 117.515 mm/m spacing for long span M(+) 117.515 mm/m steel should be more than 0.15% of the gross area = 0k 9 detailing of reinforcement 0k 10 moments 10 steel should be more than 0.15% of the gross area = 0k 9 detailing of reinforcement 11 detailing in middle strip and dge strip.11k or .11y is shown in figure. 10 Nominal top steel(5 ast) is provided at edges agaist negative moments 10 10 torsional reinforcement at corners second at edges agaist negative moments 10 torsional reinforcement at corners 500.999 mm/m at corner of two edges 500.999 mm/m at corner with one edges 200.500 mm/m 10 torsional reinforcement at corners 500.999 mm/m at corner with one edges 200.500 mm/m 10 torsional reinforcement at corners 500.999 mm/m at corner with one edges 20.500 mm/m 10 torsional reinforcement at corners 500.999 mm/m at corner with one edges 20.500 mm/m			10 mm		
spacing for short span M(-) 2263229 mm/m spacing for short span M(-) 160.792 mm/m spacing for long span M(-) 117.515 mm/m spacing for long span M(-) 117.515 mm/m steel should be more than 0.15% of the gross area = 0x 9 detailing of reinforcement 0x based on requirements of reinforcements calculated above ,the detailing in middle strip and edges agaist negative moments 10 mm bars @ 10 torsional reinforcement at corners Nominal top steel(,5 ast) is provided at edges agaist negative moments 10 torsional reinforcement at corner who ne edges 500.998 mm2/m idecontinuous ast= 500.500 mm2/m	providing bars of dia			mm/m	
spacing for long span M(+) 160.722 mm/m spacing for long span M(-) 117.515 mm/m 8 check for cracking - steel should be more than 0.15% of the gross area = - ok - 9 detailing of reinforcement - based on requirements of reinforcements calculated above, the detailing in middle strip and edge strip(.1k or .1ky) is shown in figure. 10 mm bars @ 10 torsional reinforcement at corners - 10 torsional reinforcement with one edges 500.999 mm2/m at corner with one edges 500.999 mm2/m discontinuous ast= 500.999 mm2/m at corner with one edges 250.500 mm2/m					whichever is less
spacing for long span M(-) 117.515 mm/m 300 8 check for cracking steel should be more than 0.15% of the gross area =					
steel should be more than 0.15% of the gross area = 225 mm2/m 9 detailing of reinforcement 0k 10 based on requirements of reinforcements calculated above, the detailing in middle strip and edge strip. (1x or .1v) is shown in figure. 10 mm bars @ 10 mm bars @ 10 torsional reinforcement at corners moments 10 10 10 torsional reinforcement at corners mesh extending 0.2Lx on each side in 4 layers discontinuous ast = 500.999 mm2/m 10 toroner with one edges discontinuous ast = 250.500 mm2/m 10 10 10 toroner with one edges discontinuous ast = 250.500 mm2/m 10 10					300
steel should be more than 0.15% of the gross area = 225 mm2/m 9 detailing of reinforcement 0k 10 based on requirements of reinforcements calculated above, the detailing in middle strip and edge strip. (1x or .1v) is shown in figure. 10 mm bars @ 10 mm bars @ 10 torsional reinforcement at corners moments 10 10 10 torsional reinforcement at corners mesh extending 0.2Lx on each side in 4 layers discontinuous ast = 500.999 mm2/m 10 toroner with one edges discontinuous ast = 250.500 mm2/m 10 10 10 toroner with one edges discontinuous ast = 250.500 mm2/m 10 10					
9 detailing of reinforcement 0 mm bars @ 10 mm bars @ 9 detailing in middle strip and edge strip(.11x or .11y) is shown in figure. 10 mm bars @ 10 mm bars @ 10 torrsional reinforcement at corners mesh extending 0.21x on each side in 4 layers discontinuous ast = 500.999 mm2/m 10 torrner with noe edges discontinuous ast = 500.999 mm2/m 2/mm2/m 10 torrner with noe edges discontinuous ast = 500.999 mm2/m 10 torrner with noe edges discontinuous ast = 250.500 mm2/m	8 check for cracking				
9 detailing of reinforcement 10 mm bars @ 10 mm bars @ 10 mm bars @ 10 based on requirements of reinforcements calculated above, the detailing in middle strip and edge strip(.1k or .1k) is shown in figure. 10 mm bars @ 118 10 torsional reinforcement at corners mesh extending 0.2Lx on each side in 4 layers at corner with one edges to cornerwith one edges to corner with one edges to cor	steel should be more than 0	.15% of the gross area =		mm2/m	
based on requirements of reinforcements calculated above, the detailing in middle strip and edge strip(.1k or .1k) is shown in figure. Nominal top steel(.5 ast) is provided at edges agaist negative moments 10 torsional reinforcement at corners side in 4 layers at corner with one edges at corner with one edges discontinuous ast= 250.500 mm2/m			ok		4
based on requirements of reinforcements calculated above, the detailing in middle strip and edge strip(.1k or .1k) is shown in figure. Nominal top steel(.5 ast) is provided at edges agaist negative moments 10 torsional reinforcement at corners side in 4 layers at corner with one edges at corner with one edges discontinuous ast= 250.500 mm2/m	9 detailing of reinforcement				10 mm bars @ _ 10 mm bars
based on requirements of reinforcements calculated above, the detailing in middle strip (11x or .11y) is shown in figure. Nominal top steel(5 ast) is provided at edges agaist negative moments 10 torsional reinforcement at corners side in 4 layers at corner of two edges 500.999 mm2/m discontinuous ast= 500.999 mm2/m discontinuous ast= 10 torse with one edges 250.500 mm2/m					
detailing in middle strip and edge strip(.1Lx or. 1Ly) is shown in figure. Nominal top steel(.5 ast) is provided at edges agaist negative moments 10 torsional reinforcement at corners at corner of two edges discontinuous ast = 500.999 mm2/m discontinuous ast = 250.500 mm2/m		based on requirements of col	forcements colo	lated above the	118 1
interview interview 10 torsional reinforcement at corners mesh extending 0.2Lx on each side in 4 layers at corner of two edges for 0.999 mm2/m discontinuous ast= at corner with one edges 500.999 mm2/m 2/m 2/m 2/m 2/m 2/m 2/m 2/m 2/m 2					
In the second				.129713 3110 0011 111	
Normal top steel(-) all is plowled a ledges gass i legative moments In the system of the edges is a corner with one edges is a corner with on		'	0		
Normal top steel(-) all is plowled a ledges gass i legative moments In the system of the edges is a corner with one edges is a corner with on					
				agaist negative	
			ments		
	10 torsional reinforcement at o				
	1	mesh extending 0.2Lx on each			
			500		
		discontinuous ast =	500.999	mm2/m	
	1	at corner with one edges	250.500	mm2/m	
	L	discontinuous ast=			
					╕└┣┫───┼──┼┨┹╢╴╢╶╝╵╴╴╴╴┇┇╡╡
TT 15 GA (MIN.)					
TT 15 CA (MIR.)					
					TISCH (MIN)
					DISTRIBUTION BARS (2 BARS MIN.)

2

10 mm bars @ 263.000

1p ▲0 mm bars @ 300.000 LAst

SECTIONAA

		-		M25
Trial depth and effective span				FE 415
clear span	length	7.5	m	MONOLITHIC
	width	2.6	m	KNOWN DATA clear cover 20mm(mild exposure)
				density of conc.=25 kn/m3
	L/B ratio	2.9	1	modification factor=1.2
	type of slab	one way		
From deflection criteria {I/d=(20+26/2)*m}	depth	103.261	mm	assuming width of beam=250mm
	D	120	mm	Assume a uniform thickness for both end span and
	deff		mm	interior span.The 'end span', which is critical, is
	Lx	7.596		discontinuous on one edge and continuous at the
	Ly	2.696	m	other.
				4
load on Slab	Self Weight	-	KN/m2	4
	Imposed Load		KN/m2 KN/m2	
	floor finish		KN/m2 KN/m2	FROM TABLE 1 IMPOSED LOADS
	factored L.L		KN/m2	
	factored D.L		KN/m2	-
	10000100 D.L	0		1
Moment calculation				
	Mu(end)	-2.726	Knm/m	$=\left(\frac{w_{x,22}+w_{y,22}}{24}\right)^{2} \text{at end apport}$
-	Mu(mid)		Knm/m	$M_u = \left\{ + \left(\frac{w_{u,DL}}{12} + \frac{w_{u,DL}}{10} \right) \right\}^{i}$ at midspan
	Mu(interior)		Knm/m	$\frac{12}{(\frac{w_{e,0}}{2}, \frac{w_{e,12}}{2})^2}$ at interior support
	Mu(mid)		Knm/m	
	Mu(interior)	-6.784	Knm/m	$= \left(+ \left(\frac{w_{n,0L}}{16} + \frac{w_{n,1L}}{12} \right)^2 \text{ at midspan} \right)$ For interior span
Minimum danth assuring d				1 S C FOI INVERSE SPOIL
Minimum depth required from Maximum BM				
consideration				
	d'	41.819	mm	-
	-	design is s		
area of reinforcement(per m				
width)				4
				-
for end span	ast @ end support		mm2/m	(Ar) have for a second se
	ast @ mid span		mm2/m	$\frac{(A_{II})_{uod}}{bd} = \frac{f_{ck}}{2f_c} \left[1 - \sqrt{1 - 4.598M_u/(f_{ck}bd^2)} \right]$
for interior span	ast @ interior support ast @ mid span		mm2/m mm2/m	
	ast @ mid span ast @ interior support		mm2/m mm2/m	
	ase e interior support	202.03		-
distribution bars Ast min=.0012	2bD	144	mm2/m	
spacing of bars				
providing bars of dia	10	004 4405		
for end span	spacing @ end support spacing @ mid span	984.4165 453.9046	mm/m	- check : less than 300mm or 3d
	spacing @ interior support	386.9872		whichever is less
for interior span	spacing @ mid span	585.0117		
	spacing @ interior support	386.9872	mm/m	288
after check	spacing @ end support	288	mm/m	-
	spacing @ mid span		mm/m	-
	spacing @ interior support	288	mm/m	1
	spacing @ mid span		mm/m	0.3/1 0.3/2
	spacing @ interior support	288	mm/m	8 W 105 V/C A A A A A A A A A A A A A A A A A A A
	spacing of distribution steel	288	mm/m	0.14
	g or distribution atopi			
detailing of reinforcement				
				8 * @ 300 c/c
	based on requirements of			
	above ,the detailing in mid			0.25/1 0.25/2 8*@ 165 c/c

					L	DESIGN OF L-BEAMS IN	MAIN SLAB(FB1)
							M25
1 Effective flange width							FE 415
	effective span in long direction	Leff	7.625	m	from slab design		MONOLITHIC
	thickness of slab	Df	150	mm	from slab design	KNOWN DATA	clear cover 25mm
	width of web	bw	250	mm	as assumed in slab design	KNOWN DATA	density of conc.=25 kn/m3
					uesign		modification factor =1.2
	width of flange	Bf	1144.79	mm	Bf=Lo/12+bw+3Df		τ _{cmax} for M25 =3.1Mpa
	effective span in short direction	Leff	3.725		DI-LO/1210W13D1		temax for WI25 -5.1WIpa
	which is acceptable as it is less that				-		
2 Overall depth							
	deflection criteria {I/d=26*m}	depth	244.4				
		D	260.0				
		Deff	222.5	mm			
3 moment Mu calculation							
	factored	load from slab		kn/m2	_		
	factored	slab load transferred to beam load from Partition wall		kn/m kn/m	for 100 mm thick parapett	brick wall	
		D.L due to self wt of beam		Kn/m	from IS 875-II		
		D.E GOD TO BOIL WE OF DEGILI	0.09				
		moment(max at mid span)	186.47	kn-m	1		
		moment(at support)	149.17				
4 ast calculation							
	case 1: let Xu= Df & calculate mon	nent					
		М	246.502	kn-m			
	M resiste	d by beam is more than M due					
		design moment Mu=		kn-m			
	beam is designed as	a singly reinforced rectangular	section				
		astreq at midspan	2851.04	mm2			
	providing bars of dia	25					bf
	L	n		bars @	33 mr	n spacing	
		astreq at support	2161.53	mm2		1	
	providing bars of dia	25			ļ		Xu
	I	n	5.00	bars @	40 mn	n spacing	al al
5 design of stirrups						· ·	· · · · · · · · · · · · · · · · · · ·
	shear force	V	97.82		-		
	shaer stress	τν		N/mm2	-		
	l		less than tmax		-	5	beed
	shear strength of conc.	τς		N/mm2	_	-1	bw
			provide min steel	-	-		
	1				-	/	
6 spacing od stirrups					-		. \
	providing 2 bars of 8mm	Asv	100.48		_	6 bars of dia	
	spacing of bars	Sv		mm	-	at 33	mm spacing
		max spacing		mm	-		8 dia stirrups
		So spacing	195	mm c/c	-		195 mm spacing c
	L				_		
		e Elastic curve	support A	'negative' yiek (on top) at fa beam supports 'negative' mor	due to		

load transferred to beam using yield line theory

DESIGN OF SECONDARY T-BEAMS IN MAIN SLAB(FB2)

								• • • • • • • • • • • • • • • • • • • •	
								M25	
1 Effective flange width	Î	Î			1			FE 415	
	effective span	Leff	7.625	m	from slab design	7		MONOLITHIC	
	thickness of slab	Df		mm	from slab design	-		clear cover 25mm	
			150		-	-	KNOWN DATA		i i
	width of web	bw	250	mm	as assumed in slab			density of conc.=25 kn/m3	
					design	_			1
									1
	width of flange	Bf	2039.58	mm	Bf=Lo/6+bw+6Df			Tcmax for M25 =3.1Mpa	
	effective span in short direction	Leff	3.725	m		-			
	which is acceptable as it is less than	bw + clear span of slab							
2 Overall depth									
	deflection criteria {I/d=26*m}	depth	244.4						
		D	260.0						
		Deff	219	mm					
3 moment Mu calculation									
	factored	load from slab		kn/m2					
		slab load transferred to beam	37.72		(as 400 mm this), a see	a att hai als soull			
		load from Partition wall		kn/m	for 100 mm thick parag	S 875-II table 2			
	factored	D.L due to self wt of beam	0.69	Kn/m	iromi	5 675-II table 2			
		moment(max at mid span)	323.52	kn-m					
		moment(at support)	258.81						
4 ast calculation		momental oupporty	200.01	Not the					
4 ast calculation	case 1: let Xu= Df & calculate mom	ent							
	case 1. let xu= bi & calculate mon	M	542.43	ke e	-				
	Mirecister	d by beam is more than M due		KIPIII	-				
	WITESISCE	design moment Mu=	323.52	lun an	-				
	hoom is designed as	a singly reinforced rectangular		KN-M					
	beatit is designed as	a singly reinforced rectangular	section		-				
			2020.04		-				
		astreq at midspan	3930.04	mm2	-				
	providing bars of dia	32						bf	
		n		bars @	40	mm spacing	-	>	
		astreq at support		mm2			1		
	providing bars of dia	32					└─		
		n	4.00	bars @	50	mm spacing		X	
5 design of stirrups							- v	··	
	shear force	v	169.71						
	shaer stress	τν	2.611	N/mm2					
			less than tmax						
	shear strength of conc.	τς	0.51	N/mm2	for M25 & Pt=2% fro	m table 23 is 456:	5		
			provide min steel		200	0		bw	
							/	/ \	
6 spacing od stirrups]				
	providing 2 bars of 8mm	Asv	100.48	mm2	1		5.00 bars of dia	32	
	spacing of bars	Sv	363	mm			@ 44	0 mm c/c	
		max spacing	195	mm				8 dia stirrups	
		So spacing	195	mm c/c					mm spacing c/c
			support	'negative' yield (on top) at fao beam supports o 'negative' mom	lines e of Jue to ents				
	load transferred to beam	Hastic curve	positive yield lines A (al bottom) due to positive moment						

DESIGN OF LONG T-BEAMS IN COMMON LOBBY SLAB(FB3)

										M25	
1 Ef	ffective flange width									FE 415	
		effective span in longer direction	Leff	7.625	m	from slab design				MONOLITHIC	
		thickness of slab	Df	150	mm	from slab design		KNOWN DATA	c	lear cover 25mm	
		width of web	bw	250	mm	as assumed in slab design			densi	ty of conc.=25 kn/m3	
		effective span	in shorter direction	2.85	m		1				
		width of flange	Bf	2039.58	mm	Bf=Lo/12+bw+3Df]		Tcm	ax for M25 =3.1Mpa	
		which is acceptable as it	is less than bw + clear span of	of slab							
2 0	verall depth					1					
		deflection criteria {I/d=26	depth	244.4	mm						
			D	260.0	mm						
			Deff	222.5							
3 m	oment Mu calculation										
		factored	load from slab	10.13	kn/m2	1					
			slab load transferred to beam		kn/m						
		factored	load from Partition wall		kn/m	for 100 mm thick para	apett brick w	/all			
		factored	D.L due to self wt of beam	0.69	Kn/m	from IS 87	75-II table 2				
			moment(max at mid span)	294.54							
			moment(at support)	235.63	kn-m						
4 as	st calculation										
		case 1: let Xu= Df & calcu	late moment								
			M	542.427	kn-m						
		M re	esisted by beam is more than N	A due to load							
			design moment Mu=	294.54	kn-m						
		beam is designe	ed as a singly reinforced rectan	igular section							
			astreg at midspan	3527.37	mm2						
		providing bars of dia	25		1						
			n	8.00	bars @	25	mm spacin	g	<	bf ,	-
			astreg at support					ř – – – – – – – – – – – – – – – – – – –	A	¥	A. A
		providing bars of dia	25						Ĩ	R 9 k	Ja^
			n		bars @	33	mm spacin	g		di C	×
5 de	esign of stirrups						1	τ		σ	4
		shear force	V	154.51	Kn				·		
		shaer stress	τν		N/mm2					11 11	
		311001 301033		less than tmax	14/11112	for M25 & Pt=2%			1	11 11	
		shear strength of conc.	τς		N/mm2	from table 23 is 456:		Ę	:Ľ	000	
		shear strength of conc.		provide min steel	14/11112	2000			1	bw	
				provide min sceer		2000				544	
C	pacing od stirrups					1			/		
6 sp	acing ou surrups	providing 3 have of 9	Anu	100.48		4		8.00 bars of dia			
		providing 2 bars of 8mm									
		spacing of bars	Sv		mm			@	25 mm c/c		
			max spacing		mm					8 dia stirrups	
			So spacing	195	mm c/c					. 195	mm spacing c/c
			Elastic curve	Confinuous A	'negative' yield i (on top) at faco beam supports d 'negative' mom	ines of ue to ents					

- <u>L</u>_____

load transferred to beam using yield line theory

yield lines A om) due to (at bott positiv

						DESIGN OF L-E	BEAMS IN LOBBY (FB4)
					_		M25
1 Effective flange width		1		1	Ĩ		FE 415
	effective span in shorter dir	Leff	3	m	from slab design		MONOLITHIC
	thickness of slab	Df		mm	from slab design		cloar cover 2Emm
			230		as assumed in slab	KNOWN DA	
	width of web	bw	400	mm	design		density of conc.=25 kn/m3
					design		
	width of flange	Bf	2130.00	mm	Bf=Lo/12+bw+3Df		τcmax for M25 =3.1Mpa
	which is acceptable as it is le	ess than bw + clear span of sla	b				
2 Overall depth					ł		
	let overall depth D=	leff/15=	200.0	mm	ł		
	iet overall deptil D-	Deff		mm			
		Den	230.0				
3 moment Mu calculation					ł		
3 moment wu calculation		load from slab	10.10	kn/m2	ł		
	actored	slab load transferred to beam		kn/m2	1		
		side isau transieneu to bealti	15.19	- SAVIII	1		
	factored	D.L due to self wt of beam	0.00	Kn/m	1		
				1	1		
		moment(max at mid span)		kn-m	1		
		moment(at support)	13.67	kn-m	ļ		
4 ast calculation					1		
	case 1: let Xu= Df & calculat	e moment					
		M	588.17394	kn-m			
	M res	isted by beam is more than M	due to load				
		design moment Mu=	17.09	kn-m			
	beam is designed	as a singly reinforced rectang	ular section	1	1		
					1		
		astreg at midspan	207.22	mm2	1		
	providing bars of dia	20					
		n		bars @	175	mm spacing	
		astprov	628.00				< bf
		astreg at support	165.54		1		
	providing bars of dia	20			1		
	providing bars of ald	n		bars @	175	mm spacing	X I I I I I I I I I I I I I I I I I I I
5 check for deflection cor	atrol		2.00	10013 @		spacing	·
C_SHEEK IN GENECIUM CO		%steel	1.00		t		
		Fs		N/mm2	1		
	modification factor	m			of IS 456 : 2000]		
		L/d	13.04				5 000
		L/dmax	25.62		1		bw
			safe				uw
-					ł		
6 design of stirrups					1		2 bars of 20mm dia @ 75mm spacing
	shear force	v	22.78		1		\
	shaer stress	τν		N/mm2	1		Ţ
			less than tmax	1			 172.5 mm spacing c/c
	shear strength of conc.	τς		N/mm2	for M25 & Pt=1% from	table 23 is 456: 2000	
			design for (E47-	E45)bd	I		
					1		
7 spacing od stirrups					I		
	providing 2 bars of 8mm	Asv	100.48		I		
	spacing of bars	Sv		mm			
		max spacing	172.5		{		
		So spacing	1/2.5	mm c/c	1		
		1	1	1	J		
		,		Second and a second			
			support	'negative' yield (on top) at face beam supports of	e of lue to		
	TT	TT	support	'negative' mom	ents		
		TITLE C		4			

Ioad transferred to beam using yield line theory

response very line of the line

DESIGN OF SHORT T-BEAMS IN LOBBY SLAB(FB5) Т

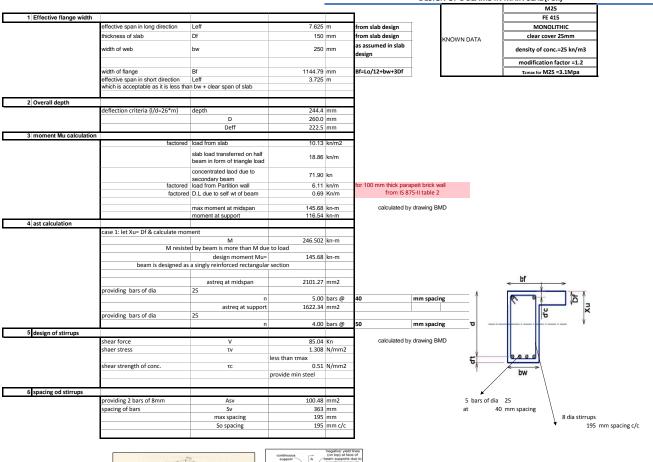
M25

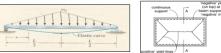
		,			-		M25
1 Effective flange width						-	FE 415
	effective span in shorter dir			m	from slab design		MONOLITHIC
	thickness of slab	Df	150	mm	from slab design	KNOWN DATA	clear cover 25mm
	width of web	bw	250	mm	as assumed in slab design	_	density of conc.=25 kn/m3
	effective span in longer dir	L'eff	7.505				
	width of flange	Bf	1500.00	mm	Bf=Lo/12+bw+3Df		Temax for M25 =3.1Mpa
	which is acceptable as it is le	ess than bw + clear span of sla	b				
2 Overall depth					1		
	let overall depth D=	leff/15=	200.0	mm	I		
		Deff	150.0	mm]		
3 moment Mu calculation					1		
	factored	load from slab slab load transferred to beam		kn/m2			
		siab load transiened to beam	30.38	NIVIII			
	factored	D.L due to self wt of beam		Kn/m	}		
		moment(max at mid span)	34.17	kn-m	1		
		moment(at support)	27.34	kn-m	4		
4 ast calculation					4		
	case 1: let Xu= Df & calculate		476 475	1			
	Miror	M isted by beam is more than M	176.175	kn-m			
	IVI TES	design moment Mu=		kn-m			
	heam is designed	as a singly reinforced rectang		KH-III	-		
	beattris designed	as a singly reinforceu rectang			-		
		astreg at midspan	663.49	mm2			
	providing bars of dia	20		111112			
	providing bars of dia	20		bars @	67	mm spacing	
		astprov	942.00		07	initi spacing	< <u>bf</u>
		astreg at support	542.00				
	providing bars of dia	20			1		
		n		bars @	100	mm spacing	× ×
5 check for deflection con	trol				1		v σ
		%steel	2.00		I		o
		Fs		N/mm2		7	
	modification factor	m		Ref. Fig.4	of IS 456 : 2000]		
		L/d L/dmax	20.00				= <u> </u>
		Erdinax	safe		1		
					1		bw
6 design of stirrups					T		3 bars of 20mm dia @ 175mm spacing
	shear force	V	45.56]		
	shaer stress	τν	1.215	N/mm2]		+
			less than tmax				112.5 mm spacing c/c
	shear strength of conc.	τς		N/mm2	for M25 & Pt=1% fro	om table 23 is 456: 2000	
			provide min steel				
					1		
7 spacing od stirrups					4		
	providing 2 bars of 8mm spacing of bars	Asv Sv	100.48	mm2 mm	1		
	spacing or bars	max spacing	112.5				
		So spacing		mm c/c	1		
		10 ⁷ 11	continuous	'negative' yield (on top) at fao	lines e of		
	erill.		support A	inegative' mom	ents		

(at) por



load transferred to beam using yield line theory





load transferred to beam using yield line theory

A

DESIGN OF L-BEAMS IN MAIN SLAB(FBx)

4.3 DESIGN OF RCC COLUMNS

Columns are compression members.

• Larger spacing columns because stocking columns in lower stores of multi storied buildings.

• Columns are transmitted loads which are coming from slabs to foundations. Larger spans of beams shall also be avoided from the consideration of controlling the deflection & cracking.

COLUMNS:

The column which takes load are:

- (a) Slab loads
- (b) Beam loads
- (c) Wall loads
- (d) Self. Weight of column

DESIGN OF COLUMN C11

1	slenderness ratio and column	classification			Т
	length	L	3200	mm	unsupported length
	width	В		mm	
	thickness	D		mm	-
	thickness		300	mm	-
			2000		
	Ley	Lex	2080	mm	restrained in motion and rotat
		Lex/D	6.9		4
		Lex/B	6.9		-
			short column		1
2	minimum eccentricity	check			т
		ex	20	mm	4
		ey		mm	
	ex min	.05D		mm	-
	ey min	.05B		mm	~
			r moment		~
					4
3	loading on colum]
	factored load	Pu	365.84		
	Moment	My	22.64		
	Moment	Mz	27.28	KNm	1
					7
4	calculation of moment capac	ity of section			4
I	for first trial let percentage of steel	p	0.400		1
	let percentage of steel	p p/Fck	0.400		
	Uniaxial moment capacity in x-x	ругск	0.0100		
	Uniaxial moment capacity in x-x	let d'	40.00	mm	1
		d'/D	0.13		1
			d'/D =.15 will be	used	
		Pu/fckBD	0.16	uscu	1
		Mu/fckBD^2	0.10		using chart 45
		Mux1	47.25	KNm	doing chart 15
	Uniaxial moment capacity in y-y	WIGAT	47.25	KINIII	-
		let d'	40.00	mm	-
		d'/D	0.13		~
			d'/D =.15 will be		
		Pu/fckBD	0.16		
		Mu/fckBD^2	0.07		using chart 45
		Muy1	47.25	KNm	
	calculation of Puz				
		p	0.400		1
		Puz/Ag	12.5		using chart 63
		Puz	1125	KN	
		Pu/Puz	0.33		1
		Muz/Mux1	0.58		1
1		Muy/Muy1	0.48		1
	referring chart 64 t]
		Muz/Mux1	0.6		using chart 64
		hen	ce 0k		
5	area of steel (Asc)	1			т
5	area or steel (ASC)	Asc	2EU	mm2	4
1		Ast min		mm2	1
		Ast max		mm2	1
		Ast provided		mm2	-
L			,20		4
	of bars and pitch of tie reinforcement				I
6 no		1.0	mm		1
6 no	providing bars of dia				
6 no		10 n	10	bars	
<u>6</u> no	providing bars of dia no of bars		10	bars	
<u>6 no</u>	providing bars of dia no of bars pitch of tie bars of 8mm stirrups				
6 no	providing bars of dia no of bars pitch of tie bars of 8mm stirrups least lateral dimension		300	mm	
6 no	providing bars of dia no of bars pitch of tie bars of 8mm stirrups least lateral dimension 16 times least bar dia		300 160	mm mm	
6 no	providing bars of dia no of bars pitch of tie bars of 8mm stirrups least lateral dimension		300 160	mm	

	M25
	FE 415
KNOWN DATA	MONOLITHIC
KNOWN DATA	clear cover 30mm
	density of conc.=25 kn/m3
	modification factor =1.2

DESIGN OF COLUMN C12

1	slenderness ratio and column	classification			T
	length	L	3200	mm	unsupported length
	width	В	350	mm	
	thickness	D		mm	-
			200		1
	1	Lau	2080		restrained in motion and rotat
	Ley	Lex		mm	restrained in motion and rotat
		Lex/D	10.4		_
		Lex/B	5.9		-
			short column		1
2	minimum eccentricity	check		1	T
-		ex	20	mm	1
				mm	-
	ex min	ey .05D		mm	-
		.05B		mm	-
	ey min		r moment		-
L		ucsignite	inomene		1
3	loading on colum	n]
	factored load	Pu	66.258		
	Moment	My	5.348	KNm	
	Moment	Mz	58.53	KNm	
4	calculation of moment capac	ity of section			1
I	for first trial				
	let percentage of steel	р	1.200		
		p/Fck	0.05		
	Uniaxial moment capacity in x-x				
		let d'	40.00		
		d'/D	0.20		
		chart fo	d'/D =.2 will be		
		Pu/fckBD	0.04		
		Mu/fckBD^2	0.1		using chart 46
		Mux1	35	KNm	
	Uniaxial moment capacity in y-y				
		let d'	40.00	mm	
		d'/D	0.11		
		chart for	d'/D =.15 will be	e used	
		Pu/fckBD	0.04		
		Mu/fckBD^2	0.13		using chart 45
		Muy1	79.625	KNm	
	calculation of Puz				
		р	1.200		
		Puz/Ag	15.5		using chart 63
		Puz	1085	KN	
I		Pu/Puz	0.06		
I		Muz/Mux1	0.15		
I		Muy/Muy1	0.74		
I	referring chart 64 t				
		Muz/Mux1	0.25		using chart 64
		hen	ce 0k		
5	area of steel (Asc)				Т
, ,		Asc	040	mm2	4
I		Ast min		mm2	1
		Ast max		mm2	-
		Ast provided		mm2	-
		, reprovided			_
6 no	of bars and pitch of tie reinforcement]
I	providing bars of dia		mm		-1
	no of bars	n	11	bars	-1
	pitch of tie bars of 8mm stirrups				-
I	least lateral dimension		200	mm	1
	16 times least bar dia			mm	1
I					1
				mm	
	maximum spacing required			mm	-

	M25
	FE 415
KNOWN DATA	MONOLITHIC
KNOWN DATA	clear cover 30mm
	density of conc.=25 kn/m3
	modification factor =1.2

DESIGN OF COLUMN C13

1	slenderness ratio and column	classification			Т
	length	L	3200	mm	unsupported length
	width	В		mm	
		D			-
	thickness		300	mm	-
			2000		
	Ley	Lex	2080	mm	restrained in motion and rotat
		Lex/D	6.9		4
		Lex/B	6.9		-
			short column		J
2	minimum eccentricity	check			Т
		ex	20	mm	4
		ey		mm	-
	ex min	.05D		mm	-
	ey min	.05B		mm	1
			r moment		1
					-
3	loading on colum]
	factored load	Pu	41.34		
	Moment	My	31.73		4
	Moment	Mz	27.7	KNm	1
					7
4	calculation of moment capac	ity of section			-
	for first trial let percentage of steel		1.200		-
	let percentage of steel	p p/Fck	0.0480		4
	Uniaxial moment capacity in x-x	ругск	0.0460		4
	Offiaxial moment capacity in x-x	let d'	40.00	mm	-
		d'/D	0.13		-
			d'/D =.15 will be	used	1
		Pu/fckBD	0.02	uscu	1
		Mu/fckBD^2	0.02		using chart 45
		Mux1		KNm	doing chart is
	Uniaxial moment capacity in y-y	WIGAT		KINIII	-
	onidatel montene capacity in y y	let d'	40.00	mm	-
		d'/D	0.13		1
			d'/D =.15 will be		1
		Pu/fckBD	0.02		1
		Mu/fckBD^2	0.08		using chart 45
		Muy1	54	KNm	
	calculation of Puz				1
		р	1.200		
		Puz/Ag	15.5		using chart 63
1		Puz	1395	KN	
		Pu/Puz	0.03		
		Muz/Mux1	0.59		
Í		Muy/Muy1	0.51		_
1	referring chart 64 t				
		Muz/Mux1	0.5		using chart 64
		hen	ce 0k		
5	area of steel (Asc)				Т
		Asc	1020	mm2	1
Í		Ast min		mm2	1
Í		Ast max		mm2	1
		Ast provided		mm2	1
I	· ·			-	-
6 no	of bars and pitch of tie reinforcement]
	providing bars of dia		mm		-
	no of bars	n	10	bars	-
	pitch of tie bars of 8mm stirrups				-
	pitch of the bars of offill stiffups				-1
			200		
	least lateral dimension		300		-
	least lateral dimension 16 times least bar dia		192	mm	-
	least lateral dimension		192		-

	M25
	FE 415
KNOWN DATA	MONOLITHIC
KNOWN DATA	clear cover 30mm
	density of conc.=25 kn/m3
	modification factor =1.2

FLOOR NO	COLUMN	DIMENSION(mm*mm)	Pu (KN)	My (KNm)	Mz (KNm)	DIA OF BAR(mm)	NO. OF BARS	STRIRRUPS SPACING (mm)
6	1	300*300	365.84	22.64	27.28	10	10	120
	2	350*200	66.258	5.348	58.53	10	10	120
	3	300*300	41.34	31.73	27.7	12	10	150
5	1	300*300	731.426	35.72	43.63	12	12	150
	2	350*200	178.97	3.91	94.66	16	8	160
	3	300*300	111.12	49.56	44.93	16	10	215
4	1	300*300	1097.6	30.43	37.11	16	9	215
	2	350*200	358.17	3.87	77.99	16	8	160
	3	300*300	221.43	41.61	37.8	16	10	215
3	1	300*300	1464.51	30.5	37.27	16	10	215
	2	350*200	537.42	3.04	78.49	16	8	160
	3	300*300	331.98	41.71	38.03	16	11	215
2	1	350*350	1832.4	33.874	41.65	20	11	260
	2	350*250	716.72	2.179	88.36	16	11	210
	3	300*300	442.3	46.17	42.79	16	12	216
1	1	350*350	2201.535	24.2	30.09	20	12	260
1 ¹		350*250	896.15	1.43	66.05	20	8	200
		300*300	552.14	34.665	30.97	20 20	8 8	210 260

4.4 DESIGN OF RCC FOOTINGS

Loads from columns is transferred to footings which is ultimately transferred to ground. Since our structure is designed for live and dead load only thus we have designed the foundations as square foundations. Bearing capacity of soil has been taken as 250 kN/m^2 for a site "THE ORCHARD" in sector-128 of NOIDA (U.P).

4.4.1 The important purpose of foundation are as follows;

1. To transfer forces from superstructure to firm soil below.

2. To distribute stresses evenly on foundation soil such that foundation soil neither fails nor experiences excessive settlement.

3. To develop an anchor for stability against overturning.

4. To provide an even surface for smooth construction of superstructure.

4.4.2 Based on the position with respect to ground level, Footings are classified into two types;

- 1. Shallow Foundations
- 2. Deep Foundations

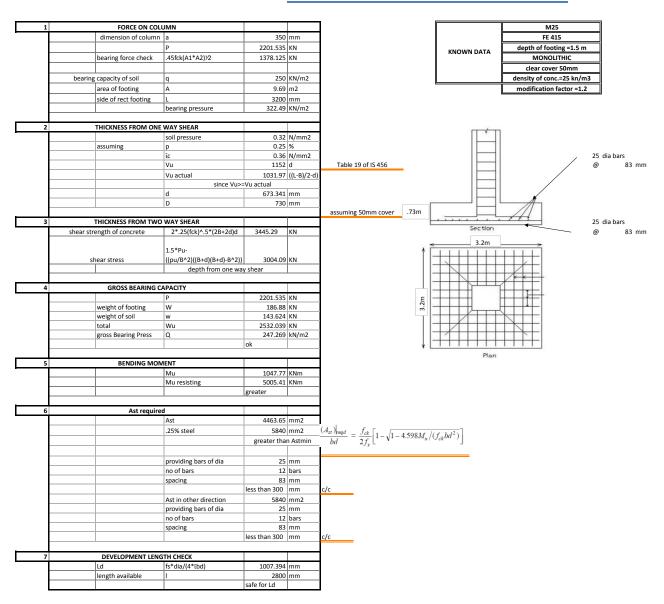
Types of Shallow Foundations

4.4.3 The different types of shallow foundations are as follows:

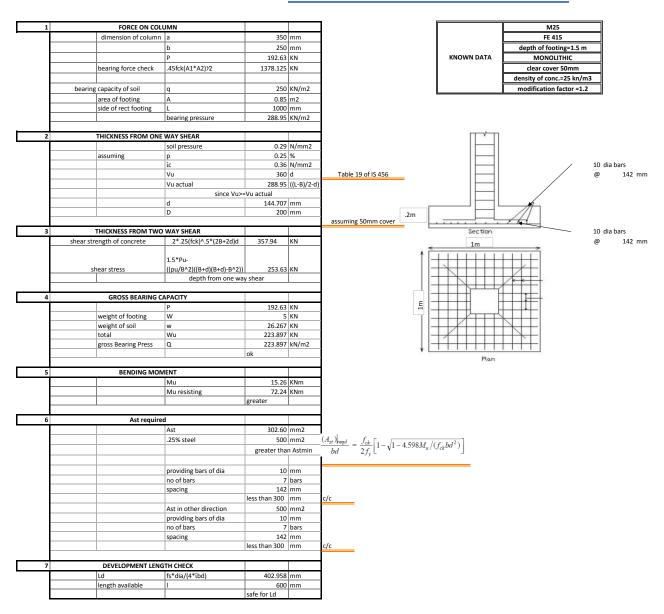
- Isolated Footing
- Combined footing
- Strap Footing
- Strip Footing
- Mat/Raft Foundation
- Wall footing

> We have designed our foundation as isolated footings.

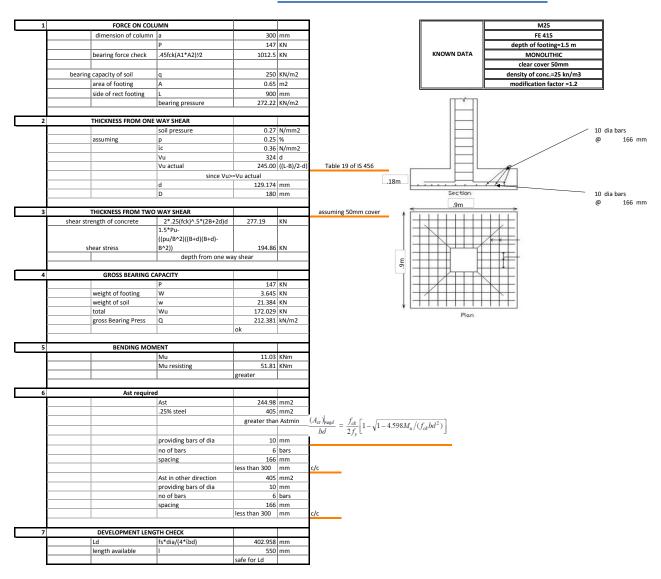
DESIGN OF FOOTING F1



DESIGN OF FOOTING F2



DESIGN OF FOOTING F3



4.5 DESIGN OF RCC STAIRS

Stairs consist of steps arranged in a series for purpose of giving access to different floors of a building. Since a stair is often the only means of communication between the various floors of a building, the location of the stair requires good and careful consideration.

4.5.1 Types of stair cases

Geometric classification

- 1. Straight stairs (with or without intermediate landing)
- 2. quarter-turn stairs
- 3. dog-legged stairs
- 4. Open well stairs
- 5. Spiral stairs
- 6. Helicoidally stairs
- 7. Slab less stair case
- 8. Free standing stair case

• Structural Classification

- 1. Stairs with cantilever steps
- 2. Stair slab spanning transversely (or horizontally between stringer beams or walls)
- 3. Stair slab spanning longitudinally
- 4. Slabless or raiser and tread type
- 5. Spiral stair case
- 6. Helicoidally slab stair case
- 7. 3D or free standing stair slab

• Classification based on span

Based on type of span, following are the two types of stair cases;

_ Horizontally spanning or transversely spanning stairs. Figure 1

- _ Longitudinally spanning stairs. For details refer IS: 456-2000 and SP (34).
- We have designed dog legged stairs for our structure.

DESIGN OF STAIRCASE

1	PROPORTIONING OF S	TAIRS			7
	riser	R	180	mm	4
	trade	Т		mm	-
	inclined length of step	(R^2+T^2)^.5	308.1		-
		Н	3.2		-
	height of ea		1.6		-
	neight of eac		1.0		-
	no of risers	r	9		-
	no of steps	S	8		-
	length of going	Lg	2000	mm	
	widht of hall		3600	mm	-
	width of landing	b	800	mm	
	gap betweer	n flights	200	mm	
	width of steps	w	800	mm	
			_		_
2	DEPTH OF WAIST SLAB				
	effective span of going	Lg	2250		_
	effective span of landing	LI	925	mm	_
	using deflection criteria	d		mm	_
		D		mm	_
		d	135	mm	greater than 80mn
-		1			-
3	LOAD CALCULATIONS				4
	loads on going			1411/ 2	-1
	dead load of v			KN/m2	-1
	weight of flo			KN/m2	-
	weight of			KN/m2	from is 075 !!
	imposed			KN/m2	from is 875-II
	total lo	1		KN/m2 KN/m2	-
	factored load	W1	13.49	KN/mz	-
	loads on landing slabs				-
	self weight of la	nding slab	1	KN/m2	-
	floor fin			KN/m2	-
	imposed			KN/m2	-
	total lo			KN/m2	-
	factored load	W2		KN/m2	1
		1		, ,	-
4	BENDING MOMENT A	ND SHEAR FORCES			1
]		
	max positive moment	M(+)	8.54	KNm/m	
	max negative moment	M(-)	5.693	KNm/m	_
	max shear force	V	15.181	KN/m	_
					4
5	CHECK FOR DEPT	н			4
					_
	limiting depth	d lim	55.623	mm	_
			ok		-
c		.			4
6	CHECK FOR SHEA				4
1	nominal shear stress	τv	0.10	N/mm2	-1
	percentage of steel	p To	0.222	N/m 2	(a) 40 2 11 - FIC 45
	percentage of steel shear strength of conc	Tc	0.222 0.29	N/mm2	(cl. 40.2.11 of IS 45
			0.222 0.29	N/mm2	(cl. 40.2.11 of IS 45
	shear strength of conc	Ţc depth safe agair	0.222 0.29	N/mm2	(cl. 40.2.11 of IS 45
7	calculation of area	Ţc depth safe agair	0.222 0.29	N/mm2	(cl. 40.2.11 of IS 450
7	shear strength of conc	Tc depth safe agair	0.222 0.29 hst shear		(cl. 40.2.11 of IS 45)
7	Shear strength of conc	Ţc depth safe agair	0.222 0.29 hst shear	N/mm2 mm2/m	(cl. 40.2.11 of IS 45
7	calculation of area	Tc depth safe agair OF STEEL Ast main	0.222 0.29 nst shear 240	mm2/m	(cl. 40.2.11 of IS 45)
7	CALCULATION OF AREA (waist slab landing slab	Tc depth safe agair	0.222 0.29 nst shear 240		(cl. 40.2.11 of IS 45)
7	Shear strength of conc	Tc depth safe agair OF STEEL Ast main Ast main	0.222 0.29 ist shear 240 240	mm2/m mm2/m	(cl. 40.2.11 of IS 450
7	CALCULATION OF AREA (waist slab landing slab	Tc depth safe agair OF STEEL Ast main	0.222 0.29 ist shear 240 240	mm2/m	(cl. 40.2.11 of IS 45)
7	CALCULATION OF AREA (waist slab landing slab distribution bars	Tc depth safe agair OF STEEL Ast main Ast main Ast main Ast	0.222 0.29 ist shear 240 240	mm2/m mm2/m	(cl. 40.2.11 of IS 45)
	CALCULATION OF AREA O Waist slab landing slab distribution bars	Tc depth safe agair OF STEEL Ast main Ast main Ast main Ast	0.222 0.29 ist shear 240 240	mm2/m mm2/m	(cl. 40.2.11 of IS 45)
	CALCULATION OF AREA of waist slab landing slab distribution bars NO OF BARS AND SPA waist slab	CING	0.222 0.29 ist shear 240 240	mm2/m mm2/m	(cl. 40.2.11 of IS 45)
	CALCULATION OF AREA O Waist slab landing slab distribution bars	CING	0.222 0.29 ist shear 240 240 192 mm	mm2/m mm2/m mm2/m	(cl. 40.2.11 of IS 45)
	CALCULATION OF AREA of waist slab landing slab distribution bars NO OF BARS AND SPA waist slab	CING Tc depth safe again DF STEEL Ast main Ast main Ast CING 8 0 0 8 0 0 8 0 0 0 0 0 0 0 0 0 0 0 0 0	0.222 0.29 Isst shear 240 240 192 mm 5	mm2/m mm2/m mm2/m bars/m	
	CALCULATION OF AREA of waist slab landing slab distribution bars NO OF BARS AND SPA waist slab	CING	0.222 0.29 Isst shear 240 240 192 mm 5	mm2/m mm2/m mm2/m	(cl. 40.2.11 of IS 45)
	Shear strength of conc CALCULATION OF AREA waist slab landing slab distribution bars NO OF BARS AND SPA waist slab taking dia of bars as	Tc depth safe again OF STEEL Ast main Ast main Ast main Ast address Ast In of bars spacing of bars	0.222 0.29 Isst shear 240 240 192 mm 5	mm2/m mm2/m mm2/m bars/m	
	Shear strength of conc CALCULATION OF AREA waist slab landing slab NO OF BARS AND SPA waist slab taking dia of bars as landing slab	Tc depth safe again OF STEEL Ast main Ast main Ast main Ast address Ast In of bars spacing of bars	0.222 0.29 Ist shear 240 240 192 mm 5 200 mm	mm2/m mm2/m mm2/m bars/m	
	Shear strength of conc CALCULATION OF AREA waist slab landing slab NO OF BARS AND SPA waist slab taking dia of bars as landing slab	Tc depth safe again OF STEEL Ast main Ast main Ast main Ast st CING CCING spacing of bars spacing of bars 8 0 8 0 8 0 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	0.222 0.29 ist shear 240 240 192 mm 5 200 mm 5	mm2/m mm2/m mm2/m bars/m mm/m	
	Shear strength of conc CALCULATION OF AREA waist slab landing slab NO OF BARS AND SPA waist slab taking dia of bars as landing slab	Tc depth safe again OF STEEL Ast main Ast main Ast main Ast ast CING KCING spacing of bars spacing of bars no of bars spacing of bars Ast No of bars	0.222 0.29 ist shear 240 240 192 mm 5 200 mm 5	mm2/m mm2/m mm2/m bars/m mm/m bars/m	
	Shear strength of conc CALCULATION OF AREA waist slab landing slab distribution bars NO OF BARS AND SPA waist slab taking dia of bars as landing slab taking dia of bars as	Tc depth safe again OF STEEL Ast main Ast main Ast Ast Ast cling spacing of bars	0.222 0.29 ist shear 240 240 192 mm 5 200 mm 5	mm2/m mm2/m mm2/m bars/m mm/m bars/m	
	Shear strength of conc CALCULATION OF AREA (waist slab landing slab MO OF BARS AND SPA waist slab taking dia of bars as landing slab taking dia of bars as distribution bars	Tc depth safe again OF STEEL Ast main Ast main Ast Ast Ast cling spacing of bars	0.222 0.29 ist shear 240 240 192 mm 5 200 mm 5 200 mm	mm2/m mm2/m mm2/m bars/m mm/m bars/m	
	Shear strength of conc CALCULATION OF AREA (waist slab landing slab MO OF BARS AND SPA waist slab taking dia of bars as landing slab taking dia of bars as distribution bars	Tc depth safe again OF STEEL Ast main Ast main Ast main Ast are according to the second s	0.222 0.29 ist shear 240 240 192 mm 5 200 mm 5 200 mm	mm2/m mm2/m mm2/m bars/m mm/m bars/m mm/m	

	M25
	FE 415
KNOWN DATA	MONOLITHIC
KNOWN DATA	clear cover 30mm
	density of conc.=25 kn/m3
	modification factor =1.2

4.6 DESIGN OF PRESTRESSED CONCRETE SLABS

4.6.1 ADVANTAGES OF POST-TENSIONED FLOORS

The primary advantages of post-tensioned floors over conventional reinforced concrete in-situ floors may be summarized as follows:

a. Longer Spans

Longer spans can be used reducing the number of columns. This results in larger, column free floor areas which greatly increase the flexibility of use for the structure and can result in higher rental returns.

b. Overall Structural Cost

The total cost of materials, labour and formwork required to construct a floor is reduced for spans greater than 7 metres, thereby providing superior economy.

c. Reduced Floor to Floor Height

For the same imposed load, thinner slabs can be used. The reduced section depths allow minimum building height with resultant savings in facade costs. Alternatively, for taller buildings it can allow more floors to be constructed within the original building envelope.

d. Deflection Free Slabs

Undesirable deflections under service loads can be virtually eliminated.

e. Waterproof Slabs

Post-tensioned slabs can be designed to be crack free and therefore waterproof slabs are possible. Achievement of this objective depends upon careful design, detailing and construction. The choice of concrete mix and curing methods along with quality workmanship also plays a key role.

f. Early Formwork Stripping

The earlier stripping of formwork and reduced back propping requirements enable faster construction cycles and quick re-use of formwork. This increase in speed of construction is explained further in the next section on economics.

g. Materials Handling

The reduced material quantities in concrete and reinforcement greatly benefit on-site carnage requirements. The strength of post-tensioning strand is approximately 4 times that of conventional reinforcement. Therefore the total weight of reinforcing material is greatly reduced.

h. Column and Footing Design

The reduced floor dead loads may be utilized in more economical design of the reinforced concrete columns and footings. In multi-storey buildings, reduced column sizes may increase the floor net let table area.

These advantages can result in significant savings in overall costs. There are also some situations where the height of the building is limited, in which the reduced storey height has allowed additional storey's to be constructed within the building envelope.

4.6.2 MODIFICATION IN THE STRUCTURE

In RCC design we had to use secondary beams because the slab span was too long but by using the advantage of longer spans in prestressed design we have taken effective span of slab as 7.625 m, by doing this we were able to remove secondary beams in the structure. This way we have tried to reduce the cost and bring out the comparison between the two designs.

4.6.3 SPECIFICATIONS OF PRESTRESSED DESIGN

- Grade of concrete: 40 N/mm²
- Specification of strand: 7 wire strands EN 10138 BS 5896
- Cost of strand = Rs. 40/kg

Nominal diameter	Tensile strength	Mass	Cross Sectional	Tolerance on mass	Minimum breaking strength	Maximum breaking strength	Yield strength at 0.1 % Elongation
mm	Мра	g/m	mm2	%	KN	KN	KN
12.5	1860	726.3	93.0	± 2	173.0	199.0	149.0

1 Depth o	of slab and effect	ive span							
clear span		- 7.5	m						
	E	3 7.5	m						
	L /D untin								
	L/B ratio	1		_					
From deflection criteria	donth	two way 149.0384615	mm	-					
{I/d=50}	depth D		mm	_					
	Ly	7.65		-					
	Lx	7.65		-					
	α(Iy/Ix)	1	1	-					
2 Load and m	oment calculatio	n							
self weight of slab	w1	5.625	KN/m2	TABLE 2 IN	IPOSED LOA	ADS ON VAR	IOUS TYPE	S OF ROOFS	
Live load on slab	w2	2.25	KN/m2						
Floor finish	w3	0.45	KN/m2	(Access pro	ovided)	IS 875 part	2		
total ultimate load	W	8.325	KN/m2						
Moment in middle strip									
	Mx		KNm/m						
	My	17.05	KNm/m	_					
				_					
Total Moment	Mx	175.17		_					
	My	130.45	KNm						
				_					
3 Prestressing force		25		-					
taking cover to rein			mm	-					
dist b/w top kern	A cable Px	2060.9	mm	-					
Prestressing force	Px Py	1534.7		_					
Force in each cable	F		KN	_					
No. of cables	Nx	143		-					
	Ny	11		_					
	,								
4 Spacing of tendons									
	Sx	410	mm						
	Sy		mm						
		-:	-						
THE C/	ABLE PROFILE IS L	INEAR	1						
	-			_					
5 Check for Limit state of col				7 wire stra					
dia of strand	D	-	mm	EN 10138 -		1000			
Area of 7 wire strand	Ap		mm2	BS	12.5	1860	726.3	93	
Tensile Srength	Fp Fck		N/mm2 N/mm2	-					
		0.202		-					
	ApFp/bdFck	0.202		-					
	- /	0.94		From IS 13	43-1980	1			
		0.94	1	101115 13	43-1390	1			
	Fpu/.87Fp		N/mm2						
	Fpu	1521.108		From IS 13	12-1000	1			
	Fpu Xu/d	1521.108 0.414		From IS 13	43-1980]			
Limiting moment	Fpu	1521.108		From IS 13	43-1980]			

CHAPTER 5: COST ESTIMATION OF STRUCTURE

Cost estimation of the structure has been done by preparing the bar bending schedule for area of steel calculated. Cost of concreting has been estimated by calculating the volume of each structural element and multiplying it by cost of per m³ of concrete.

Cost of $1m^3$ of M25 grade concrete = Rs. 3615.60 Cost of $1m^3$ of M40 grade concrete = Rs. 4728.00 Cost of 415 grade steel per kg = Rs. 42

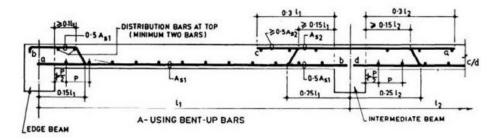
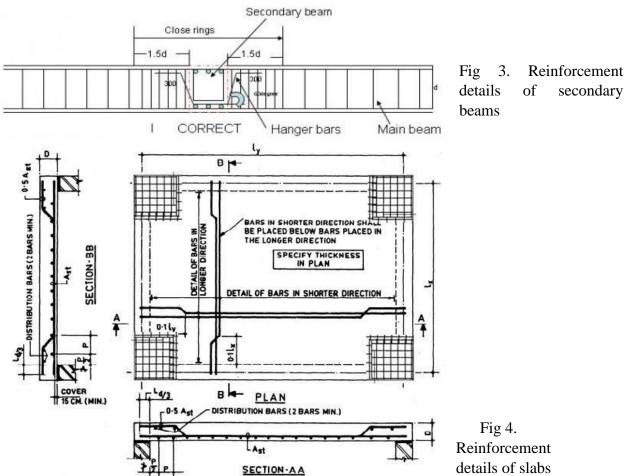


Fig 2. Reinforcement details of primary beams



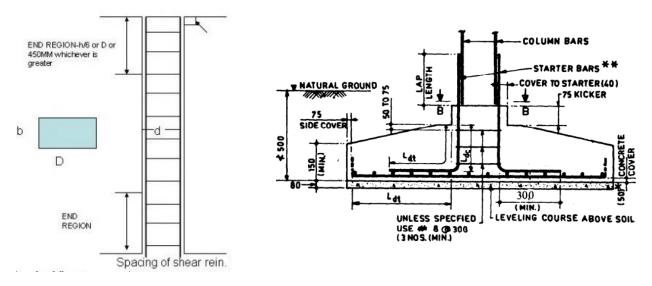
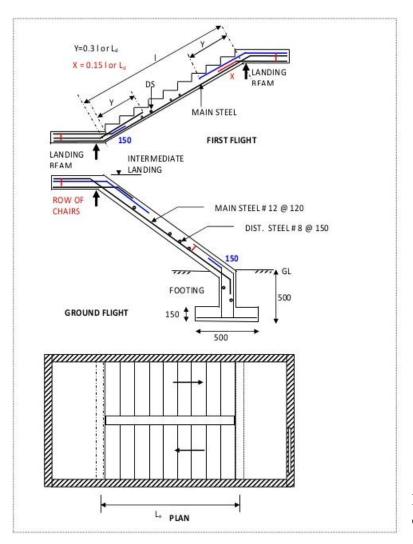
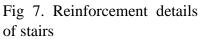


Fig 5. Reinforcement details of column

Fig 6.Reinforcement details of footings





							CONCRETE C	OST ESTIMATION							
R	ROOF	SLAE	3					R	DOF I	BEAI	M				
Element	No.s	Le	ngth	Width	Height	Volume	Cost	Element	No.s	L	ength	Width	Height	Volume	Cost
S 1		4	7.625	3.725	0.15	17.04	61616.6	B 1		6	7.625	0.25	0.26	2.974	10751.8
S 2		8	7.625	3.725	0.15	34.08	123233.2	B 2		6	7.625	0.25	0.26	2.974	10751.8
S 3		3	7.596	2.696	0.12	7.372	26655.55	В 3		6	7.625	0.25	0.26	2.974	10751.8
								B 4		2	3	0.25	0.26	0.39	1410.08
								B 5		2	3	0.25	0.26	0.39	1410.08
								Вx		8	7.625	0.25	0.26	3.965	14335.8
Total cost	t of conc	rete				Rs	211505.4	Total of c	ost of co	ncrete	2			Rs	49411.6
FLOO	R SLA	В						FLOOI	r bea	M					
Element	No.s	Le	ength	Width	Height	Volume	Cost	Element	No.s	Ŀ	ength	Width	Height	Volume	Cost
F 1		4	7.625	3.725	0.15	17.042	61616.6	FB 1		6	7.625	0.25	0.26	2.97375	10751.8
F 2		8	7.625	3.725	0.15	34.08	123233.2	FB 2		6	7.625	0.25	0.26	2.97375	10751.8
F 3		3	7.596	2.696	0.12	7.37	26655.55	FB 3		6	7.625	0.25	0.26	2.97375	10751.8
								FB 4		2	3	0.25	0.26	0.39	1410.08
								FB 5		2	3	0.25	0.26	0.39	1410.08
								FB x		8	7.625	0.25	0.26	3.965	14335.8
		erete				Rs	211505.4	Total cost	of conc	rete				Rs	49411.6
Totoal co	st of con	icrete				ns									
Totoal co						Rs	1057527	Total cost				1	1	Rs	247058

COCNCRETE COST ESTIMATION

cost of 1 m3 of concrete

3615.6 Rs

COLUMNS

Element	No.s	Length		Width	Height	Volume	Cost
C 11		4	3.2	0.3	0.3	1.152	4165.171
C 12	:	8	3.2	0.35	0.2	1.792	6479.155
C 13		4	3.2	0.3	0.3	1.152	4165.171
C 21		4	3.2	0.3	0.3	1.152	4165.171
C 22	:	8	3.2	0.35	0.2	1.792	6479.155
C 23		4	3.2	0.3	0.3	1.152	4165.171
C 31		4	3.2	0.3	0.3	1.152	4165.171
C 32	:	8	3.2	0.35	0.2	1.792	6479.155
C 33		4	3.2	0.3	0.3	1.152	4165.171
C 41		4	3.2	0.3	0.3	1.152	4165.171
C 42	:	8	3.2	0.35	0.2	1.792	6479.155
C 43		4	3.2	0.3	0.3	1.152	4165.171
C 51		4	3.2	0.35	0.35	1.568	5669.261
C 52	:	8	3.2	0.35	0.25	2.24	8098.944
C 53		4	3.2	0.3	0.3	1.152	4165.171
C 61		4	3.2	0.35	0.35	1.568	5669.261
C 62	:	8	3.2	0.35	0.25	2.24	8098.944
C 63		4	3.2	0.3	0.3	1.152	4165.171
					TOTAL	RS	95104.74

COCNCRETE COST ESTIMATION

cost of 1 m3 of concrete 3615.6 Rs

FOOTING

Details	Element	No.s	l	ength	Width	Height	Volume	Cost
Footing Base	F1		4	3.2	3.	2 0.73	29.9008	108109.3
Footing Column			4	0.35	0.3	5 1	0.49	1771.644
					Total		109881	Rs
Footing Base	F 2		4	1		1 0.2	0.8	2892.48
Footing Column			4	0.35	0.2	5 1	0.35	1265.46
					Total		4157.94	Rs
Footing base	F 3		8	0.9	0.	9 0.18	1.1664	4217.236
Footing base			8	0.3	0.	3 1	0.72	2603.232
					Total		6820.468	Rs

STAIRS CASE

	Element	No.s	Length		Width	Height	Volume	Cost
Going	steps	9	6	0.8	0.25	0.18	1.728	6247.757
Going Going	slab	1	2	2	0.8	0.16	3.072	11107.12
Landing	slab	2	6	0.8	0.8	0.16	2.6624	9626.173
					Total		26981.05	Rs

	BBS Ref:														
Bar Mar k	Description of Elements	ø of Bar s	Nºof Elmt S	N⁰of Bars	Total Nº	Cutting length (m)	Cod e	A	в	с	D	E	F	Shape	Weigh t (Kg)
								SLA	B S1						
	MAIN REINFROCEMENT	T10	4	13	13 Nº	10.1139	222	6862.5	41.4	3210	100			6862.5 41.4 3210 100	324.163
	MAIN REINFROCEMENT	T10	4	53	212 №	4.9139	222	3193.9	41.4	1620	100			<u>3193.9</u> 41.4 1620 100	642.102
	MAIN REINFROCEMENT	T10	4	13	13 Nº	10.1139	222	9150	41.4	922.5	100			9150 41.4 922.5 100	324.163
	MAIN REINFROCEMENT	T10	4	53	212 №	4.9139	222	4281.4	41.4	532.5	100			4281.4 532.5 100	642.102
5	TORSIONAL BARS	T8	24	3	72 Nº	1.525	100	1525						1525	43.314
6	TORSIONAL BARS	T8	24	3	72 Nº	0.725	100	725						725	20.592

		Туре	your nar	ne of cor	npany he	ere.								
Name of Pro	ject		1	RESIDENTIA	AL BUILDIN	G								
Name of Structure ROOF SLAB AND BEAMS														
		<u>SUMMA</u>	RY OF R	EINFORG	CEMENT	STEEL								
Size of bar	T8	T10	T12	T16	T20	T25	T32	Total						
Weight (Kg)	649	6278	0	0	0	7286	0	14213						
						TOTAL COS	Τ	₹ 596,928.07						

								SLA	B S2					
	MAIN REINFROCEMENT	T10	16	13	13 Nº	10.1139	222	6862.5	41.4	3210	100		41.4 3210 100	1296.654
2	MAIN REINFROCEMENT	T10	8	53	424 Nº	4.9139	222	3193.9	41.4	1620	100		41.4 1620 100	1284.205
4	MAIN REINFROCEMENT	т10	8	53	424 Nº	4.9139	222	4281.4	41.4	532.5	100		9150 41.4 922.5 100	1284.205
5	TORSIONAL BARS	T8	32	3	96 Nº	1.525	100	1525					4281.4	57.751
6	TORSIONAL BARS	T8	32	3	96 Nº	0.725	100	725					1525	27.456
								SLA	B S3					
	MAIN REINFROCEMENT	T10	3	10	10 Nº	10.1139	222	6862.5	41.4	3210	100		41.4 3210 6862.5 100	187.017
	DISTRIBUTION BARS	T8	3	27	81 Nº	3.045	200	160	2725	160	/		160 2725 160	97.296
													TOTAL STEEL IN SLABS	6231

TOTAL STEEL IN SLABS

202 32 192

77.748

								BEA	M B1					
1	ANCHORAGE BARS	T10	6	2	12 Nº	7.625	100	7625					7625	56.481
2	MAIN BARS	T25	6	2	12 Nº	8.7875	200	200	8388	200			200 8387.5 200	406.83
3	BENTUP BARS	T25	6	3	18 Nº	10.08029	483	1089.3	74.5	5686	180	3050	1089.28 74.52 3050 74.52 180 5686.48	700.02
4	STIRRUPS	Т8	6	40	240 №	0.82	501	202	192	32			202 32	77.748

								BEA	M B2					
1	ANCHORAGE BARS	T10	6	2	12 Nº	7.625	100	7625					7625	56.481
2	MAIN BARS	T25	6	3	18 Nº	8.7875	200	200	8388	200			200 8387.5 200	610.24
3	BENTUP BARS	T25	6	5	30 Nº	14.27404	483	3050	74.5	7845	180	3050	<u>3050</u> 74.52 74.52 7845	1652.1
4	STIRRUPS	Т8	6	40	240 №	0.82	501	202	192	32			202 32	77.748
_								BEA	M B3					
1	ANCHORAGE BARS	T10	6	2	12 №	7.625	100	7625					725	56.481
2	MAIN BARS	T25	6	3	18 Nº	8.7875	200	200	8388	200			200 8387.5 200	610.24
3	BENTUP BARS	T25	6	4	24 Nº	14.27404	483	3050	74.5	7845	180	3050	3050 74.52 7845	1321.7

								BEA	M B5					
1	ANCHORAGE BARS	T10	2	2	4 Nº	3	100	3000					3000	7.4074
2	MAIN BARS	T25	2	1	2 Nº	3.7	200	200	8388	200			200 8387.5 200	28.549
3	BENTUP BARS	T25	2	2	4 Nº	5.94904	483	1200	74.5	3220	180	1200	1200 74.52 3220 180	91.806
4	STIRRUPS	Т8	2	40	80 Nº	0.82	501	202	192	32			202 32	25.916

40 240 Nº 0.82 501 202 192 32

T8 6

4

STIRRUPS

								BEA	M B4					
1	ANCHORAGE BARS	T10	2	2	4 Nº	3.625	100	3625					725	8.9506
2	MAIN BARS	T10	2	2	4 Nº	4.1475	200	80	3988	80			80 3987.5 80	10.241
3	BENTUP BARS	T10	2	1	2 Nº	5.08029	483	517.86	74.5	2858	180	1450	517.857 74.52 1450 2857 91 180	6.272
4	STIRRUPS	Т8	2	21	42 Nº	0.82	501	202	192	32			202 32	13.606

						M	AIN BA	RS WITH	SECON	IDARY I	OAD.			
1	ANCHORAGE BARS	T10	8	2	16 Nº	7.625	100	7625					725	75.309
2	MAIN BARS	T25	8	2	16 Nº	8.7875	200	200	8388	200			200 8387.5 200	542.44
3	BENTUP BARS	T25	8	3	24 Nº	14.27404	483	3050	74.5	7845	180	3050	<u>3050</u> 74.52 7845	1321.7
4	STIRRUPS	T8	8	50	400 Nº	0.82	501	202	192	32			202 32 192	129.58
5	HANGER BARS	T10	8	5	40 Nº	0.649	483	300	74.5	200	180	74.5	6862.5 41.4 41.4 3210 100	16.025
													TOTAL STEEL IN BEAMS	7981.6

	BBS Ref:														
Bar Mar k	Description of Elements		Nºof Elmt S	N⁰of Bars	Total Nº	Cutting length (m)	Cod e	A	в	с	D	E	F	Shape	Weigh t (Kg)
								SLA	B S1						
	MAIN REINFROCEMENT	T10	4	13	13 Nº	10.1139	222	6862.5	41.4	3210	100			6862.5 41.4 3210 100	324.163
	MAIN REINFROCEMENT	T10	4	48	192 №	4.9139	222	3193.9	41.4	1620	100			3193.9 41.4 1620 100	581.527
	MAIN REINFROCEMENT	T10	4	15	15 Nº	10.1139	222	9150	41.4	922.5	100			9150 41.4 922.5 100	374.035
	MAIN REINFROCEMENT	T10	4	53	212 №	4.9139	222	4281.4	41.4	532.5	100			4281.4 41.4 532.5 100	642.102
5	TORSIONAL BARS	T8	24	3	72 Nº	1.525	100	1525							43.314
6	TORSIONAL BARS	T8	24	3	72 Nº	0.725	100	725						725	20.592

Name of Pro	ject		F	RESIDENTIA	AL BUILDIN	G									
Name of Stru	Name of Structure FLOOR SLABS AND BEAMS														
		SUMMA	RY OF R	EINFOR	CEMENT	STEEL									
Size of bar	T8	T10	T12	T16	T20	T25	T32	Total							
Weight (Kg)	649	5904	0	0	0	5066	2832	14451							
						TOTAL COS	ST	₹ 606.943.83							

								SLA	B S2					
1	MAIN REINFROCEMENT	T10	16	13	13 Nº	10.1139	222	6862.5	41.4	3210	100		41.4 3210 100	1296.654
2	MAIN REINFROCEMENT	T10	8	38	304 Nº	4.9139	222	3193.9	41.4	1620	100		41.4 1620 100	920.750
4	MAIN REINFROCEMENT	T10	8	53	424 №	4.9139	222	4281.4	41.4	532.5	100		9150 41.4 922.5 100	1284.205
5	TORSIONAL BARS	T8	32	3	96 Nº	1.525	100	1525					4281.4	57.751
6	TORSIONAL BARS	T8	32	3	96 Nº	0.725	100	725					1525	27.456
								CI A	B S3					
			_					304	0 33			-	 	
1	MAIN REINFROCEMENT	T10	3	10	10 Nº	10.1139	222	6862.5	41.4	3210	100		6862.5 41.4 3210 100	187.017
2	DISTRIBUTION BARS	Т8	3	27	81 Nº	3.045	200	160	2725	160	/		160 2725 160	97.296
													TOTAL STEEL IN SLAPS	5956.0

RUCEMENT														•		
RIBUTION	T8	3	27	81 Nº	3.045	200	160	2725	160	/		160	2725	160	97.296	
												TOTAL STEE	IN SLABS		5856.9	
							BEA	M B1								

1	ANCHORAGE BARS	T10	6	2	12 Nº	7.625	100	7625					7625	56.481
2	MAIN BARS	T25	6	2	12 Nº	8.7875	200	200	8388	200			200 8387.5 200	406.83
3	BENTUP BARS	T25	6	5	30 Nº	10.08029	483	1089.3	74.5	5686	180	3050	1089.285 74.52 74.52 180	1166.7
4	STIRRUPS	T8	6	40	240 №	0.82	501	202	192	32			202 32	77.748

Г

								BEA	M B2						
1	ANCHORAGE BARS	T10	6	2	12 Nº	7.625	100	7625						7625	56.481
2	MAIN BARS	T32	6	2	12 №	8.7875	200	200	8388	200				200 8387.5 J 200	666.55
3	BENTUP BARS	Т32	6	4	24 Nº	14.27404	483	3050	74.5	7845	180	3050		<u>3050</u> 74.5274.52 3050 7845 180	2165.4
4	STIRRUPS	Т8	6	40	240 №	0.82	501	202	192	32				202 32	77.748
					-			BEA	M B3	_	-		-	1	
1	ANCHORAGE BARS	T10	6	2	12 Nº	7.625	100	7625						725	56.481
2	MAIN BARS	T25	6	2	12 Nº	8.7875	200	200	8388	200				200 8387.5 200	406.83
3	BENTUP BARS	T25	6	2	12 Nº	14.27404	483	3050	74.5	7845	180	3050		<u>3050</u> 74.52 7845	660.84
4	STIRRUPS	Т8	6	40	240 №	0.82	501	202	192	32				202 32	77.748

								BEA	M B5					
1	ANCHORAGE BARS	T10	2	2	4 Nº	3	100	3000					3000	7.4074
2	MAIN BARS	T25	2	1	2 Nº	3.7	200	200	8388	200			200 8387.5 200	28.549
3	BENTUP BARS	T25	2	2	4 Nº	5.94904	483	1200	74.5	3220	180	1200	1200 74.5274.52 3220 1200 180	91.806
4	STIRRUPS	T8	2	40	80 Nº	0.82	501	202	192	32			202 32	25.916

								BEA	M B4					
1	ANCHORAGE BARS	T10	2	2	4 Nº	3.625	100	3625					725	8.9506
2	MAIN BARS	T10	2	2	4 Nº	4.1475	200	80	3988	80			80 3987.5 80	10.241
3	BENTUP BARS	T10	2	1	2 Nº	5.08029	483	517.86	74.5	2858	180	1450	517.8571 74.52 74.52 180 2857.912	6.272
4	STIRRUPS	т8	2	21	42 Nº	0.82	501	202	192	32			202 32	13.606

						м	AIN BA	RS WITH	SECON	IDARY I	.OAD			
1	ANCHORAGE BARS	T10	8	2	16 Nº	7.625	100	7625					725	75.309
2	MAIN BARS	T25	8	2	16 Nº	8.7875	200	200	8388	200			200 8387.5 200	542.44
3	BENTUP BARS	T25	8	4	32 Nº	14.27404	483	3050	74.5	7845	180	3050	<u>3050</u> 74.52 7845	1762.2
4	STIRRUPS	T8	8	50	400 №	0.82	501	202	192	32			202 32 192	129.58
5	HANGER BARS	T10	8	5	40 Nº	0.649	483	300	74.5	200	180	74.5	6862.5 41.4 41.4 3210	16.025
													TOTAL STEEL IN BEAMS	8594.2

Bar Mark	Description of Elements	ø of Bars	Nºof Elmts	Nºof Bars	Total Nº	Cutting lenath (m)	Code	Α	В	С	D	E	F	Shape	Weig (Ka
								с	11					~	_
1	MAIN REINFORCEMENT	10	4	5	20	3.776	222	1400	96	2280	15			1400 96 2280 15	46.5
2	MAIN REINFORCEMENT	10	4	5	20	3.776	222	2200	96	1480	15			2200 96 1480 15	46.5
	ONCEPTENT	1													
3	STIRRUPS	8	4	27	108	1.448	501	265	265	192				265 265 192	61.6
															_
					0										0
								с	12						
1	MAIN	10	8	5	40	3.776	222	1400	96	2280	15			1400 96 2280 15	93.0
2	REINFORCEMENT MAIN	10	8	6	48	3.776	222	2200	96	1480	15			96 1480	111.
2	REINFORCEMENT	10			-10	5.770		2200	50	1400	15			2200 1480 15	
3	STIRRUPS	8	8	27	216	1.348	501	165	320	192				165 320 192	114.
			l												
															0
								с	13						
1	MAIN	12	4	5	20	3.776	222	1400	96	2280	15			1400 96 2280 15	67.0
2	REINFORCEMENT MAIN	12	4	5	20	3.776	222	2200		1400	15			96 1480	67.0
2	REINFORCEMENT	12	4	5	20	3.776	222	2200	96	1480	15			2200 1400 15	67.0
3	STIRRUPS	8	4	22	88	1.448	0	265	265	192				265 265 192	50.2
-															
															0
								с	21						
1	MAIN	12	4	6	24	4.096	222	1400	96	2600	15			1400 96 2600 15	87.2
	REINFORCEMENT MAIN													1400 2000 15	-
2	REINFORCEMENT	12	4	6	24	4.096	222	2200	96	1800	15			2200 96 1800 15	87.2
3	STIRRUPS	8	4	22	88	1.448	501	765	265	107				265 265 192	50.2
ر	311KKUPS	ľ	1	22	00	1.448	201	265	265	192				265 192	50.2
															0
								r	22			ı			<u> </u>
	MAIN	1.	-					-						96 2600 15	-
1	REINFORCEMENT	16	8	4	32	4.096	222	1400	96	2600	15				206.
2	MAIN REINFORCEMENT	16	8	4	32	4.096	222	2200	96	1800	15			2200 96 1800 15	206.
														315	
3	STIRRUPS	8	8	20	160	1.348	501	165	315	192				165 315 192	85.0
			1									1			0
															0
								c	23						
1	MAIN REINFORCEMENT	16	4	5	20	4.096	222	1400	96	2600	15			1400 96 2600 15	129.
2	MAIN	16	4	5	20	4.096	222	2200	96	1800	15			2200 96 1800 15	129.
	REINFORCEMENT													(
3	STIRRUPS	8	4	15	60	1.448	501	265	265	192				265 265 192	34.2
			1		0							1			-
					-				31						
	MAIN	1						-						1400 96 2600 15	
1	REINFORCEMENT MAIN	16	4	4	16	4.096	222	1400	96	2600	15			1400	103.
2	REINFORCEMENT	16	4	4	16	4.096	222	2200	96	1800	15			2200 96 1800 15	103.
3	STIRRUPS	8	1	15	15	1.448	501	265	265	192				265 192	8.5
5	STIRROFS	°	1	15	15	1.440	501	205	203	192				265 265 192	0.5
			-												
								с	32						
	MAIN	40				1.000	222			2600	45			96 2600 15	2000
1	REINFORCEMENT	16	8	4	32	4.096	222	1400	96	2600	15			1400	206
2	REINFORCEMENT	16	8	4	32	4.096	222	2200	96	1800	15			2200 96 1800 15	206
3	STIRRUPS	8	8	20	160	1.348	501	165	315	192				165 315 192	85.0
5	5.10055	Ľ	Ĩ	20	100	1.0-10	501	103	513	172				165 192	05.0
_				_							_		_		
								с	33						
1	MAIN	16	4	5	20	4.096	222	1400	96	2600	15			1400 96 2600 15	129
	REINFORCEMENT MAIN													96 1800 10	-
2	REINFORCEMENT	16	4	5	20	4.096	222	2200	96	1800	15			2200 99 1800 15	129
3	STIRRUPS	8	4	15	60	1.448	501	265	265	192				265 265 192	34.2
		I	1		L				I			I	I		1
								с	41						
1	MAIN	16	4	5	20	4.096	222	1400	96	2600	15			1400 96 2600 15	129
2	REINFORCEMENT MAIN	16	4	5	20	4.096	222	2200	96	1800	15			96 1800	129.
-	REINFORCEMENT		-	5				2200		1000					12.9.
3	STIRRUPS	8	4	15	60	1.448	501	265	265	192				265 265 192	34.2
			I									l	l		
		_	-	-	_		_	с	42	_	-		_		-
	MAIN	16	8	4	32	4.096	222	1400	96	2600	15			1400 96 2600 15	206.
1	REINFORCEMENT MAIN													96 1800	-
1	REINFORCEMENT	16	8	4	32	4.096	222	2200	96	1800	15			2200 96 1800 15	206.
1		8	8	20	160	1.348	501	165	315	192				165 315 192	85.0
2	STIRRUPS		1 ⁻			2.0.10								103 132	55.0
	STIRRUPS		1				_								
2	STIRRUPS		1												
2	STIRRUPS		1					c	43						
2	STIRRUPS				~	4.00-	22-			2625	15			96/ 7600 1	
2		16	4	6	24	4.096	222	C 1400	43 96	2600	15			<u>1400</u> <u>96</u> <u>2600</u> 15 2200 <u>96</u> 1800 15	155.

Type your name o	f company here.

RESIDENTIAL BUILDING

Name of Project

Name of Str	ucture		COLUM	NS OF ALL 6	FLOORS			
		SUMMA	RY OF R	REINFOR	CEMENT	STEEL		
Size of bar	Т8	T10	T12	T16	T20	T25	T32	Total
Weight (Kg)	966	298	309	3464	1939	0	0	6976

TOTAL COST

₹ 292,972.25

3	STIRRUPS	8	4	15	60	1.448	501	265	265	192			265 265 192	34.272
					·									
								с	51					
1	MAIN REINFORCEMENT	20	4	6	24	4.096	222	1400	96	2600	15		1400 96 2600 15	242.37
2	MAIN REINFORCEMENT	20	4	6	24	4.096	222	2200	96	1800	15		2200 96 1800 15	242.37
3	STIRRUPS	8	4	13	52	1.648	501	315	315	192			315 192	33.805
								с	52					
1	MAIN REINFORCEMENT	16	8	6	48	4.096	222	1400	96	2600	15		1400 96 2600 15	310.23
2	MAIN REINFORCEMENT	16	8	6	48	4.096	222	2200	96	1800	15		2200 96 1800 15	310.23
3	STIRRUPS	8	8	16	128	1.548	501	215	315	192			215 315 192	78.163
								с	53					
1	MAIN REINFORCEMENT	16	4	6	24	4.096	222	1400	96	2600	15		1400 96 2600 15	155.11
2	MAIN REINFORCEMENT	16	4	6	24	4.096	222	2200	96	1800	15		2200 96 1800 15	155.11
3	STIRRUPS	8	4	15	60	1.448	501	265	265	192			265 265 192	34.272

<u> </u>								с	61					
1	MAIN REINFORCEMENT	20	4	6	24	4.096	222	1400	96	2600	15		1400 96 2600 15	242.37
2	MAIN REINFORCEMENT	20	4	6	24	4.096	222	2200	96	1800	15		2200 96 1800 15	242.37
3	STIRRUPS	8	4	13	52	1.648	501	315	315	192			315 192	33.805

								С	62					
1	MAIN REINFORCEMENT	20	8	4	32	4.096	222	1400	96	2600	15		<u>1400</u> 96 2600 15 3	323.16
2	MAIN REINFORCEMENT	20	8	4	32	4.096	222	2200	96	1800	15		2200 96 1800 15 3	323.16
3	STIRRUPS	8	8	16	128	1.548	501	215	315	192			215 315 192 7	78.163

	C63													
1	MAIN REINFORCEMENT	20	4	4	16	4.096	222	1400	96	2600	15		1400 ⁹⁶ 2600 15 1	161.58
2	MAIN REINFORCEMENT	20	4	4	16	4.096	222	2200	96	1800	15		2200 96 1800 15 1	161.58
3	STIRRUPS	8	4	13	52	1.448	501	265	265	192			265 265 192	29.703

	BBS Ref:														
Bar Mar	Description of Elements	ø of Bar	Nºof Elmt	Nºof Bars	Total Nº	Cutting length (m)	Code	A	в	с	D	E	F	Shape	Weigh t (Ka)
								F:	L						
1	MAIN REINFORCEMENT	25	4	12	48	3.45	200	200	3050	200				200 3050 200	637.94
2	MAIN REINFORCEMENT	25	4	12	48	3.45	200	200	3050	200				200 3050 200	637.94
3	STARTER BARS	20	4	4	16	2	111	500	1500					500 1500	78.895
4	STIRRUPS	8	4	5	20	1.544	501	315	315	192				315 315 192	12.181
								E	2						
1	MAIN REINFORCEMENT	10	4	7	28	3.21	200	80	3050	80				80 3050 80	55.399
2	MAIN REINFORCEMENT	10	4	7	28	3.21	200	80	3050	80				80 3050 80	55.399
3	STARTER BARS	10	4	4	16	1.9	111	400	1500					400 1500	18.738
4	STIRRUPS	8	4	5	20	1.344	501	215	315	192				215 315 192	10.604
								F:	3						
1	MAIN REINFORCEMENT	10	8	6	48	3.21	200	80	3050	80				80 3050 80	94.97
2	MAIN REINFORCEMENT	10	8	6	48	3.21	200	80	3050	80				80 3050 80	94.97
3	STARTER BARS	10	8	4	32	1.9	111	400	1500					400 1500	37.475
4	STIRRUPS	8	8	5	40	1.344	501	265	265	192				215 265 192	21.207

Type your	name o	of company	here.
	RESID	ENTIAL BUILDI	NG

	Type your name of company neres												
Name of Pr	oject			RESIDENTIA	AL BUILDIN	G							
Name of St	ructure			FOOTINGS									
	SUMMARY OF REINFORCEMENT STEEL												
Size of bar	Size of bar T8 T10 T12 T16 T20 T25 T32 Total												
	Neight (Kg) 44 357 0 0 79 1276 0 1756												

Bar Mar	Description of Elements	ø of Bars			Total Nº	Cutting length (m)	Cod e	A	В	С	D	E	F	Shape	Weigh t (Ka)
								STAI	RS						
1	MAIN REINFORCEMENT	8	11	5	55	3.68	222	840	2000	840				840 2000 840	79.842
2	LANDING REINFORCEMENT	8	11	10	110	2.15	304	350	840	100	860			100 860 350 840	93.294
3	DISTRIBUTION REINFORCEMENT	8	11	24	264	0.75	100	750						750	78.107

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FIRST STAIR															
1	MAIN REINFORCEMENT	8	1	5	5	3.68	213	840	840	2000			840 840 2000	7.2584	Name of Project
2	LANDING REINFORCEMENT	8	1	10	10	2.15	304	350	840	100	860		100 860 350 840	8.4813	Name of Structur
3	DISTRIBUTION REINFORCEMENT	8	1	24	24	0.75	100	750					750	7.1006	

Type your name of company here.

RESIDENTIAL BUILDING STAIRS

Name of Structure

1

	SUMMARY OF REINFORCEMENT STEEL												
Size of bar	Т8	T10	T12	T16	T20	T25	T32	Total					
Weight (Kg)	274	0	0	0	0	0	0	274					
						TOTAL CO	бТ	11,511.48					

COST ESTIMATION OF PRESTRESSED SLABS

S NO.	ELEMENT	LENGTH(m)	WIDTH(m)	DEPTH(mm)	VOLUME(m3)	COST/m3	TOTAL COST	1
	1 SLAB	7.65	7.65	150	8.78	4728	41,504.16	:
					TOTAL COST OF 6*6 S	LABS	1,494,149.65	
STRAN S NO.	DS COST ELEMENT	DIAMETER(mm)	NO OF STRANDS	LENGTH(m)	WEIGHT/LENGTH(gm)	TOTAL WEIGHT(kg)	COST/Kg	TOTAL COST
5 NU.						(6)	. 0	
	1 7 wire strands	12.5	25	7.65	726.3	138.90	40	5556.20
	2 7 wire strands	12.5	30	7.65	726.3	166.69	40	6667.43
					тота	COST OF 6*6 SLABS		233,360.19

RESULTS

The result of this project is shown in this table which shows the material cost of all the elements of the structure separately and thus bringing out the comparison of effectiveness of two methods.

CONCRETE COST

In PSC design we have replaced only two way RCC slabs with PSC slabs and removed the secondary beams (B2) from each floor and increasing the depth of rest of the beams by 40 mm.

RCC	COST	PSC	COST
TWO WAY SLABS	11,09,098.80	TWO WAY SLABS	14,94,149.65
ONE WAY SLABS	1,59,933.30	ONE WAY SLABS	1,59,933.30
BEAMS	2,96,470.19	BEAMS	2,65,041.56
COLUMNS	95,104.74	COLUMNS	95,104.74
FOOTINGS	1,20,859.40	FOOTINGS	1,20,859.40
STAIRS	26,981.05	STAIRS	26,981.05
TOTAL COST	18,08,447.50	TOTAL COST	21,62,069.70

Percentage increase in the cost of concrete using PSC slabs = 19.55 %

REINFORCEMENT COST

In PSC design we have used strands only in two way slabs and distributed the steel of secondary beams to other beams.

RCC	COST	PSC	COST
TWO WAY SLABS	14,20,004.12	TWO WAY SLABS	2,33,360.19
ONE WAY SLABS	71,646.87	ONE WAY SLABS	71,646.87
BEAMS	21,40,009.20	BEAMS	21,40,009.20
COLUMNS	2,92,972.25	COLUMNS	2,92,972.25
FOOTINGS	73,740.57	FOOTINGS	73,740.57
STAIRS	11,511.48	STAIRS	11,511.48
TOTAL	40,09,884.50	TOTAL	28,23,240.56

Percentage decrease in the cost of reinforcement using PSC design = 29.59 %

Total percentage saving in material cost of whole structure by PSC design in slabs = 14.30 %

CONCLUSION

There is a definite trend towards large spans in buildings due to the fact that there is now more emphasis on providing large uninterrupted floor space which can result in higher rental returns. Post-tensioning is an economical way of achieving these larger spans. For spans 7.5 meters and over, post-tensioning will certainly be economic and, as the spans increase, so do the savings. The most significant factor affecting the cost of slab system post-tensioning is the tendon length. Other factors create a scatter of results leading to an upper and lower bound. Not with standing this, it is always advisable to obtain budget prices from a post-tensioning supplier.

However, other factors such as floor to floor heights, services, etc., must be taken into account in the selection of the floor structure. For high rise construction and highly repetitive floor plates, the use of more specialized structural schemes are appropriate with emphasis on systems formwork. In our structure of residential building using post tensioned slabs we are able to save 14% cost.

FUTURE SCOPE

Due to increasing trend of large span floors with uninterrupted floor space the future scope of this project is substantial. In this project we have used post tensioned slabs of span 7.5m. In future the structure could be designed with longer spans. Also one can use PSC in other elements of structure like beams, columns etc. and then compare the material cost of two structures. And to assess the actual effectiveness of replacing RCC with PSC can be done by comparing the overall cost of structure including the installation cost of strands, transportation cost, type of labour required in erection of structure, material handling cost, speed of erection of structure and many other factors that may increase or decrease the cost of structure using these two design methods. Thus whether the use of PSC in design of buildings should increase or not can be truly ascertained.

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APPENDIX I

STRAND SPECIFICATIONS

7 wire strands EN 10138 – BS 5896

	Nominal diameter	Tensile strength	Mass	Cross sectional area	Tolerance on mass	Minimum breaking strength	Maximum breaking strength	Yield strength at 0.1 % elongation
	mm	MPa	g/m	mm²	%	kN	kN	kN
	6.85	2060	220.2	28.2	± 2	58.1	66.8	51.1
BS	7	2060	234.3	30.0	± 2	61.8	71.1	54.4
	8	1860	296.8	38.0	± 2	70.7	81.3	60.8
BS	9.3	1860	406.1	52.0	± 2	96.7	111.0	83.2
BS	9.6	1960	429.6	55.0	± 2	102.0	117.0	87.7
BS	11.3	1860	585.8	75.0	± 2	140.0	161.0	120.0
BS	12.5	1860	726.3	93.0	± 2	173.0	199.0	149.0
BS	12.9	1860	781.0	100.0	± 2	186.0	214.0	160.0
BS	15.2	1770	1086.0	139.0	± 2	246.0	283.0	212.0
BS	15.2	1860	1086.0	139.0	± 2	259.0	298.0	223.0
	15.3	1770	1093.0	140.0	± 2	248.0	285.0	213.0
BS	15.7	1770	1172.0	150.0	± 2	266.0	306.0	229.0
	15.7	1860	1172.0	150.0	± 2	279.0	321.0	240.0

APPENDIX II

• MIX DESIGN OF M25

As per IS 10262-2009 & MORT&H

total cost of 1 m3 of	concrete		3615.6	Rs.	_
total cost of admixtur	e		9.6	Rs.	
total cost of coarse ag			775		
total cost c of coarse)	308		
total cost o of fine agg			539		
total cost of cement			1984	-	
cost of admixture		6 Rs / kg			
cost of coarse agg.		1350 Rs / m3		(20 mm)	
cost of coarse agg.		1300 Rs/ m3		(10 mm)	
cost of fine agg.		1200 Rs/ m3			
cost of water		free			
cost of cement		6.2 Rs/kg			
water cement ratio	0.43				
mass of admixture	1.6 kg/m3				
mass of 10 mm	380 kg/m3	V	ol. of coar	rse agg.	0.237 m3
mass of 20 mm	977 kg/m3		o. Of coar		0.574 m3
mass of coarse agg.	1356 kg/m	3			
mass of fine agg,	751 kg/m3	V	ol. of fine	agg.	0.449 m3
mass of water	138 kg/m3				
mass of cement	320 kg/m3	(S	SD condi	tion)	

APPENDIX III

• MIX DESIGN OF M40

M40 MIX DESIGN AND COST	
mass of Cement	445 kg/m3
mass of Water	160 kg/m3
mass of Fine aggregate	520 kg/m3
mass of Coarse aggregate 20 mm	361 kg/m3
mass of Coarse aggregate 10 mm	896 kg/m3
Admixture = 0.6 % by weight of cement	4.4 kg/m3
cost of cement	6.2 Rs/kg
cost of water	free
cost of fine agg.	.7 Rs/kg
cost of coarse agg. (10mm)	1 Rs/kg
cost of coarse agg. (20mm)	.9 Rs/kg
cost of admixture	100 Rs /m3
total cost of cement	2759 R
total cost of fine agg.	364 R
total cost of coarse agg. (10 mm)	361 R
total cost of coarse agg. (20 mm)	806.4 R
total cost of admixture	440 R
total cost of 1 m3 of concrete	4730.4 R

APPENDIX IV

• COST OF Fe415 GRADE TMT REINFORCEMENT.

size(mm)	rates rs/kg	VAT(4%)	sales tax/kg	total cost /kg	weight Kg/m
-					
8	41	4	1.64	42.64	0.395
10	40.5	4	1.62	42.12	0.617
12	40	4	1.6	41.6	0.888
16	40	4	1.6	41.6	1.5
18	40	4	1.6	41.6	2
20	40	4	1.6	41.6	2.47
22	40	4	1.6	41.6	2.98
25	40	4	1.6	41.6	3.85
28	40	4	1.6	41.6	4.83
32	40	4	1.6	41.6	6.31