



Planning, Designing and Estimation of a Bank Building

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Abstract:

The primary objective of this project is to gain sufficient knowledge in planning, designing and estimation of a building. Our project deals with the plan and design of a Bank building. It is a reinforced concrete framed structure consisting of G +2 with adequate facilities. IS 456:2000 codes is the basic code for general construction in concrete structures, hence all the structural members are designed using limit state method in accordance with the IS 456:2000 code and design aids. The planning of any building in India will be recognized by National Building Code (NBC), hence the building is planned in accordance with the National Building Code of India. The bank building has proper ventilation, it is provided with sufficient doors, windows. Water supply and electrification are also provided. The ceiling height is provided as 3.2m, for assembly buildings as mentioned Building Code (NBC).

1. INTRODUCTION

1.1 General: The main objective of our project is to know the various design aspects like planning, design and estimation etc. We have planned to design a bank building consisting of three floors (G+2).The planning is done as per the requirements and regulations given by the National Building Code (NBC).

1.2 Practical considerations: Besides all the fundamentals of planning discussed, following practical points should be additionally considered:

- 1) The elements of the building should be strong and capable to withstand the likely adverse effects of natural agencies.
- 2) Strength, stability, convenience and comfort of the occupants should be the first consideration in planning.
- 3) Elevation should be simple but attractive. The number of doors and windows provided should be less for a bank building.
- 4) The provisions of built in furniture at proper places are useful from the point of view of utility.
- 5) Since the plan is for a bank building, the locker rooms must be secured with thicker walls than usual.

1.3 Planning considerations: The plan and detailing was drawn using Auto CAD. The proposed area of the bank is 486sq.m. The shape of the building is rectangular in plan. The building consists of ground floor, first floor and second floor. The parking space is provided around the building. The floor height of the building is 3.2m.The height of the parapet wall is 1m.The staircase is provided with enough safe.

Area of each floor is given below

Ground floor	= 171sq.m
First floor	= 171sq.m
Second floor	= 171sq.m
Total area	= 513sq.m

2 Specifications

Footing: Earth work excavation for foundation is proposed to a depth of 1.50m.below the ground level. For design, the safe bearing capacity of soil is assumed as 200KN/m².Isolated

footings are provided with a concrete grade of M20. The maximum axial load 1600 KN as arrived from design is taken for the design of the footing.

Damp proof course: The damp proof course is to be provided around the plinth level using C.M 1:3 with a thickness of 20mm. The column below the ground level are also provided with damp proof course of C.M 1:3

2.1 Plinth: The plinth beam will be at a level of 0.5m above the ground level. M20 grade of concrete is used and Fe415 steel was used for plinth design.

2.2 Frames: All the R.C.C. structural components are designed using M20 grade concrete and Fe415 steel. Each member is designed separately for its loading condition. And its location as per the IS 456:2000 and SP-16 codes. The dimension of slab, beam, column and footing are designed according to the IS 456:2000 code. The columns and beams are designed by using staad pro.

2.3 Super Structure: The super structure is proposed in CM.1:6 using second class brick work. Brick partition walls of 110mm thick are also proposed using the C.M 1:4 with a width of 300mm as a safety measure.

2.4 Roof: R.C.C Roof in M20 concrete is to be laid. A layer of weathering coarse using brick jelly lime mortar is to be used. Considering the future expansion of the structure, the roof slab is also designed as same as that of the floor slabs.

2.5 Flooring: In each floor, all the rooms are to be provided with P.C.C. 1:5:10 as flooring base. The floors of entrance, toilet floors, staircase and entire flat are to be finished with granite tiles over the P.C.C. 1:2:4 flooring.

2.6 Plastering: All walls and structural members including the basement will be plastered smooth with C.M. 1:5 externally and internally, using 12mm thick plastering mortar

2.7 Doors and windows: The main door will be of steel having a sliding shutter. The other doors inside the bank are to be provided with aluminum panel. The windows are to be provided with steel and glazing is provided to supply a good light from outside.

2.8 Staircase: The stair will be of M20 grade concrete and Fe415 steel with a rise of 150mm and tread of 300mm. The staircase is designed as spanning parallel to landing slab referring to IS 456-2000.

2.9 White washing, Colour washing, Painting: All the inner walls are to be finished with a first coat of white cement wash and then colouring as required. All the joiners and iron works are to be finished with two coats of synthetic enamel paint. The toilet walls are to be provided with mat finishing

3. METHODOLOGY

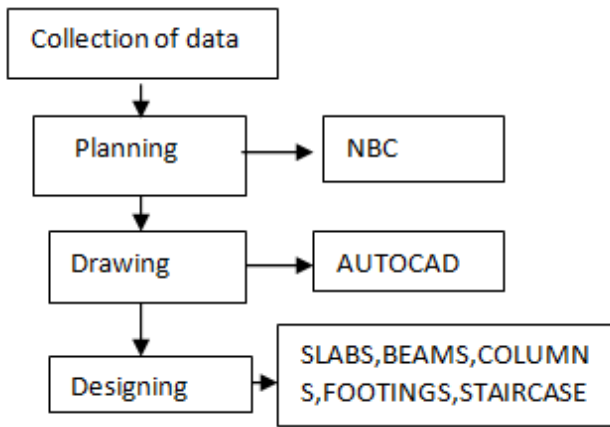


Figure.1. flow chart design

3.1 Introduction: Proper nomenclature of floors and storey’s and also unified and improved methods of designating the structural members eliminate the possible confusion and led to less efforts and saving in time in the preparation of design calculation and drawings There are two main methods to design the structural members, they are working stress method and limit state method. Here, we adopt the limit state method for designing all the structural members involved, in our project. The structures are designed to its elastic limit in the working stress method, whereas in the limit state method of design, the structural members are designed up to its plastic limits. Both the methods are having the safety value. But, the most economical method is the limits state method, which is adopted in every constructional design nowadays. Hence we planned to go for the limit state method of design. For our project work we took only for important structural members to design they are slab, beam, column and footing. The slab is designed by assuming it as simply supported with four edges discontinuous, for easier design calculation. The beam is designed by knowing its span and its location (inner and outer). The beam has to carry the self-weight of slab and live load of 4KN on its self-weight also. The live load on each beam will be calculated separately by considering the load transmission diagram. In some beams where the wall is constructed above it, the self-weight of wall has to be added. The column and footing design are made by knowing the maximum axial load on each column. The column and beam are designed by using staad pro.

4. DESIGN OF SLAB

Slab 1: Two adjacent edges discontinuous Data

Depth of slab
Effective span

- Loads:**
1. Self-weight of slab
 2. Floor finish
 3. Live load
 4. Total service load
 5. Ultimate load

Ultimate moments and shear forces
Check for depth $M_{max} = 0.138 f_{ck} b d^2$
Reinforcements (Short and long span)

$$M_u = 0.87 f_y A_{st} d [1 - (f_y A_{st} / b d f_{ck})]$$

BEAM NO. 214 DESIGN RESULTS

M20 Fe415 (Main) Fe415 (Sec.)
LENGTH: 3000.0 mm SIZE: 300.0 mm X 300.0 mm
COVER: 25.0 mm
SUMMARY OF REINF. AREA (Sq.mm)

SECTION	0.0 mm	750.0 mm	1500.0 mm	2250.0 mm	3000.0 mm
TOP REINF. (Sq. mm)	515.00	0.00	0.00	0.00	476.33
BOTTOM REINF. (Sq. mm)	0.00	165.90	267.51	165.90	0.00

SUMMARY OF PROVIDED REINF. AREA

SECTION	0.0 mm	750.0 mm	1500.0 mm	2250.0 mm	3000.0 mm
TOP REINF.1 layer(s)	7-10 ϕ	2-10 ϕ	2-10 ϕ	2-10 ϕ	7-10 ϕ
BOTTOM REINF.1 layer(s)	2-10 ϕ	3-10 ϕ	4-10 ϕ	3-10 ϕ	2-10 ϕ
SHEAR REINF.	2 legged 8 ϕ	2 legged 8 ϕ	2 legged 8 ϕ	2 legged 8 ϕ	2 legged 8 ϕ
REINF. @	120 mm c/c	120 mm c/c	120 mm c/c	120 mm c/c	120 mm c/c

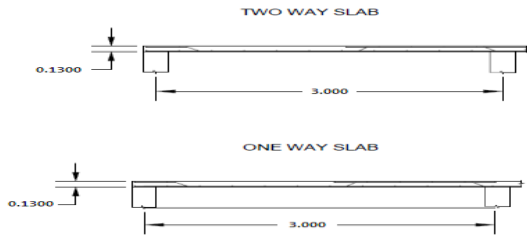
SHEAR DESIGN RESULTS AT DISTANCE d (EFFECTIVE DEPTH) FROM FACE OF THE SUPPORT

SHEAR DESIGN RESULTS AT 415.0 mm AWAY FROM START SUPPORT
 $VY = 63.03$ $MX = 0.02$ $LD = 5$
 Provide 2 Legged 8 ϕ @ 120 mm c/c

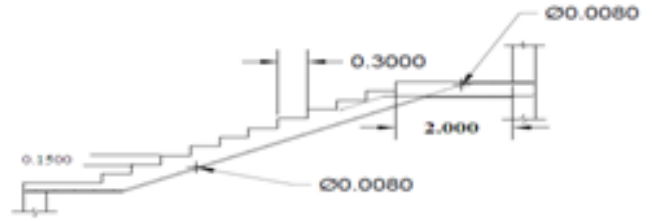
SHEAR DESIGN RESULTS AT 415.0 mm AWAY FROM END SUPPORT
 $VY = -61.00$ $MX = 0.02$ $LD = 5$
 Provide 2 Legged 8 ϕ @ 120 mm c/c

5. TESTS AND RESULTS:

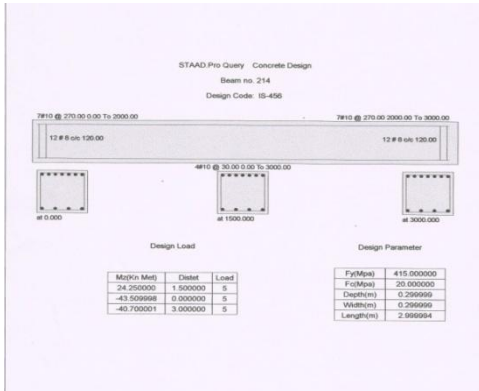
**REINFORCEMENT DETAILS:
SLAB REINFORCEMENT**



STAIR CASE – REINFORCEMENT DETAILS:

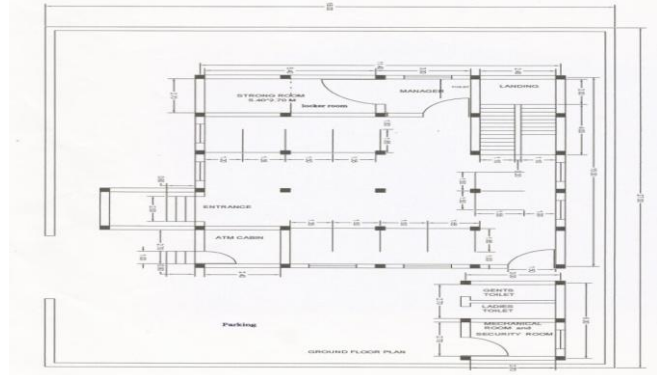


BEAM- REINFORCEMENT DETAILS

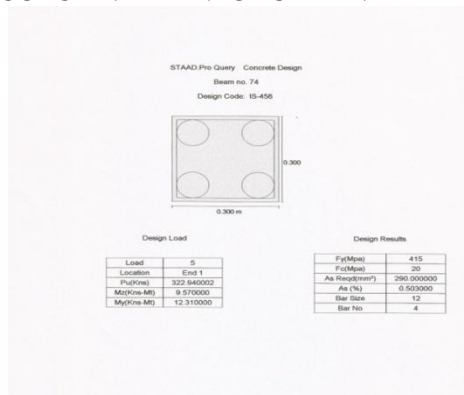


PLANS

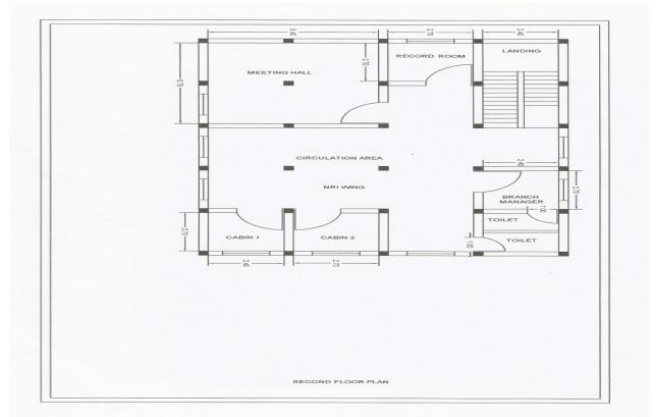
GROUND FLOOR PLAN



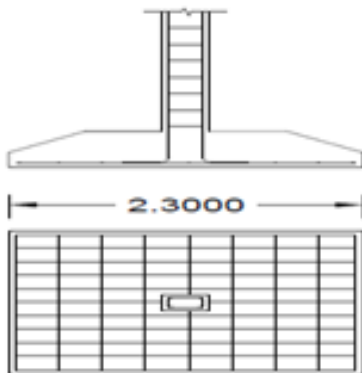
COLUMN – REINFORCEMENT DETAILS



FIRST FLOOR PLAN



FOOTING – REINFORCEMENT DETAILS



SECOND FLOOR PLAN

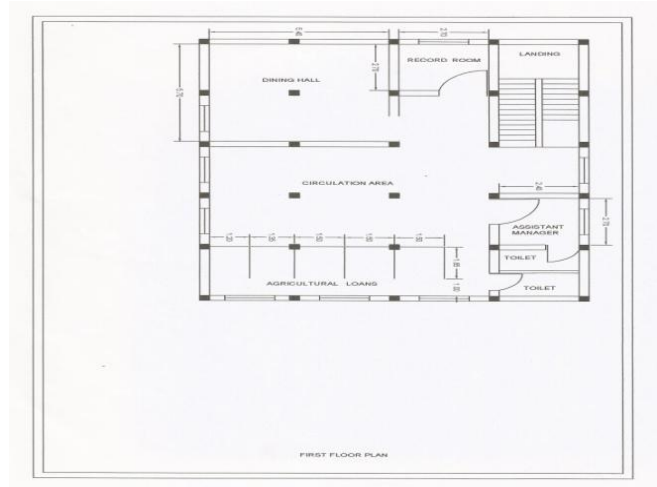


Table.1.Data Sheet

Qty	Description of work	Rate	Per	Amount
Earth work excavation and depositing on bank with initial lead of 10.00m and initial lift of 2.00m in loamy and clayey soils like block cotton, red earth and ordinary gravelly soils for foundations unit 1.00cum.				
10cum	Rate as per S.S.R for loamy and clay soils like block cotton, red earth and ordinary gravelly soils	396.50	10cum	396.50

Item No.	Description of work	No.	Measurements			Contents (Quantity)	Total Quantity
			Length (4)	Width (5)	Depth (6)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I Earth work excavation in all soils including initial lead, lift and labour charges etc., complete							
a.	Mechanical & Security room	4*1	1.00	1.00	0.90	3.60	76.65
b.	Toilets	2*1	1.00	1.00	0.90	1.80	
c.	Steps & Portico	2*1	1.00	1.00	0.90	1.80	
d.	Circulation area including counters	14*1	1.50	1.50	1.20	26.25	
e.	Managers room	4*1	1.50	1.50	1.20	10.80	
f.	Strong room	4*1	1.50	1.50	1.20	10.80	
g.	Stair case	4*1	1.50	1.50	1.20	10.80	
h.	ATM cabin	4*1	1.50	1.50	1.20	10.80	
II Laying of PCC M10 (1:3:6) using 40mm HBG metal including cost and conveyance of all materials and labour charges etc.,							
a.	Mechanical & Security room	4*1	1.00	1.00	0.15	6.00	16.70
b.	Toilets	2*1	1.00	1.00	0.15	0.30	
c.	Steps & Portico	2*1	1.00	1.00	0.15	0.30	
d.	Circulation area including counters	14*1	1.50	1.50	0.15	4.725	
e.	Managers room	4*1	1.50	1.50	0.15	1.35	
f.	Strong room	4*1	1.50	1.50	0.15	1.35	
g.	Stair case	4*1	1.50	1.50	0.15	1.35	
h.	ATM cabin	4*1	1.50	1.50	0.15	1.35	
III Laying of Footing with M20 concrete using 20mm HBG metal including cost and conveyance of all materials and Labour charges etc., complete							
a.	Mechanical & Security room Trapezoidal portion Rectangular portion	4*1	0.80	0.80	0.45	1.152	
		4*1	1.30	1.30	0.30	2.028	
b.	Toilets Trapezoidal portion Rectangular portion	2*1	0.80	0.80	0.45	0.576	
		2*1	1.30	1.30	0.30	1.014	
c.	Steps & Portico Trapezoidal portion Rectangular portion	2*1	0.80	0.80	0.40	0.512	
		2*1	1.30	1.30	0.20	0.676	

10cum	Add 50% extra for foundation	396.50x0.5 =198.25	10cum	198.25
			Total	594.75
2. Refilling the foundations with excavated soils(other than sand) complying with standard specifications.				
10cum	Refilling with excavated soils for filling foundations as per S.S.R 2013-2014	98.8	10cum	98.8
			Total	98.8
3. Plain Cement concrete (1:3:6) mix using 40mm size HBG metal unit 1.00cum (Bed Concrete)				
0.22cum	40mm size HBG metal	1324	1.00cum	291.28
0.46cum	Sand	285.50	1.00cum	131.33
0.153cum (0.46/3)	Cement	4980	1.0 MT	761.94
0.06no (0.20x30%)	Mason 1 st class	350	Each	21.00
0.14no (0.20x70%)	Mason 2 nd class	320	Each	44.80
1.80no	Man mazdoor	280	Each	504.00
1.40no	Woman mazdoor	280	Each	392.00
	TOTAL			2146.07
	LI&LA @ 13%			278.99
	TOTAL			2425.06
	Corporation Allowances @ 25%			606.27
	Grand total			3031.33
4. Cement concrete M20 mix using 20mm size HBG metal for using it R.C.C items (Footings)				
0.92cum	20mm size HBG metal	1502	1.00cum	1381.84
0.46cum	Sand	285.50	1.00cum	131.33
0.23cum (0.46/2)	Cement	4980	1.0 MT	1145.40
0.12no (0.40x30%)	Mason 1 st class	350	Each	42.00
0.28no (0.40x70%)	Mason 2 nd class	320	Each	89.60
2.10no	Man mazdoor	280	Each	588.00
3.50no	Woman mazdoor	280	Each	980
	TOTAL			4358.17
	LI&LA @ 13%			566.56
	TOTAL			4924.73
	Corporation Allowances @ 25%			1231.18
	Grand total			6155.92
5. R.C.C. 1:2:4 with 20mm size H.B.G. metal with 120kgs of steel/cum or concrete for beams and lintels.				
1.00cum	C.C. 1:2:4	6155.92	1cum	6155.92
120kgs	Cost of steel	57000.00	1 MT	6840.00
120kgs	Fabrication charges of steel	3.00	1 kg	360
1.00cum	Centering charges	1988.10	1 MT	1988.10
	Sundries			0.05
			Total	15344.07
6. Brick work in cement mortar (1:3)				
512 nos	1 st class Bricks(190x90x90mm)	5208.80	1000	2663.84
0.20cum	Cement mortar (1:3)	2419.40	1cum	483.88
0.42Nos	Brick layer 1 st class	350.00	Each	147.00
0.98Nos	Brick layer 2 nd class	320.00	Each	313.60
0.70Nos	Man mazdoor	280.00	Each	196.00
2.10Nos	Woman mazdoor	280.00	Each	588.00
	TOTAL			4392.32

	LI&LA @ 13%			571.01
	TOTAL			5798.72
	Corporation Allowances @ 25%			1449.68
	Grand total			7248.40
7. Plastering with CM 1:4, 12mm thick to brick masonry 10.00sqm				
0.15cum	CM 1:4	2390.40	1.0cum	358.56
0.33 (1.1x30%)	No Brick layer 1 st class	350.00	Each	115.50
0.77 (1.1x70%)	No Brick layer 2 nd class	320.00	Each	246.40
0.50 No	Man mazdoor	280.00	Each	140.00
1.10 No	Woman mazdoor	280.00	Each	308.00
	Sundries		L.S	0.03
	TOTAL			1168.49
8. Flooring with marble in LM (1:2) and pointed with CM (1:3) using 50mm thick slab – 10 sqm.				
10.50sqm	Marble slab (50mm thick)	1080.00	1m ²	11340.00
10.00sqm	Pointing with cement mortar	2390.00	10sqm	2390.00
0.96Nos	Mason 1 st class	350.00	Each	336.00
2.24Nos	Mason 2 nd class	320.00	Each	716.80
2.20Nos	Man mazdoor	280.00	Each	616.00
1.10Nos	Woman mazdoor	280.00	Each	308.00
	TOTAL			15706.00
	LI&LA @ 13%			2041.78
	TOTAL			17747.78
	Corporation allowances @ 25%			4436.95
	Grand total			22184.73
9. White washing Double coat – 100sqm.				
0.07 cum	Fine screened shell lime	220	50kg	443.52
L.S.	Gum, cangee, water on prickly pler, jice, including necessary fire wood	134	--	134
0.48Nos	Brick layer 1 st class	350.00	Each	168.00
1.12Nos	Brick layer 2 nd class	320.00	Each	358.40
0.50Nos	Man mazdoor	280.00	Each	140.00
2.70Nos	Woman mazdoor	280.00	Each	756.00
	TOTAL			1999.92
	LI&LA @ 13%			259.99
	TOTAL			2259.91
	Corporation Allowances @ 25%			564.98
	Grand total			2824.89
10. Fixing charges				
	Fixing of doors			
	Labour charges			
	Total			
	Fixing of windows			
	Labour charges			
	Total			
	Fixing of ventilators			
	Labour charges			
	Total			

Table.2. Abstract Estimate

Qty	Description of work	Rate	Per	Amount
76.65cum	Earth work excavation and depositing on bank with initial lead of 10.00m and initial lift of 2.00m in loamy and clayey soils like block cotton, red earth and ordinary gravelly soils for foundation unit 1.00cum	594.75	10cum	4,558.75
49.62cum	Refilling with excavated soils for filling foundations as per S.S.R. 2013-2014	98.80	10cum	490.25
16.70cum	Plain Cement Concrete 1:3:6 mix using 40mm size HBG metal unit 1.00cum	3031.33	1cum	50623.22
155.135cum	R.C.C. M20 with 20mm size HBG metal for using it R.C.C. items (Plinth, columns, beams and lintels)	15344.07	1cum	23,80,402.30
163.45cum	Brick work in Cement Mortar (1:3)	7248.40	1cum	11,84,750.98
63.82cum	R.C.C. M20 for slabs of specified thickness	15344.07	1cum	979258.55
11.832cum	R.C.C. M20 concrete for strong room	15344.07	1cum	1,81,551.04
1558.06sqm	Plastering with CM 1:4, 12mm thick to brick masonry 10.00sqm	1168.49	10sqm	1,82,057.75
518.25sqm	Flooring with marble in CM (1:2) and pointed with CM (1:3) using 50mm thick slab – 10 sqm	22184.73	10sqm	11,49,723.63
1558.06sqm	White washing Double coat – 100 sqm	2824.89	100sqm	44013.482
	Steel Reinforcement in R.C.C.			
	Fixing of windows			
	fixing of ventilators			

6. CONCLUSIONS:

In this project **PLANNING, DESIGNING AND ESTIMATION OF A BANK BUILDING**. We all the members of our team have learned to plan a building with referring to National Building Code of India -2005. This bank building project has made us to learn Drawing and drafting the building plans using Auto cad software. In this bank building project we learnt to create the models by giving nodes and property to the structural elements using analysis and also we learnt to the same structure with corresponding loads as given **IS 875 part 1&2** using analysis. This project is very useful in making us learn the design by referring to the IS 456:2000 for each slab and beam. SP: 16 codes alone are used for easier design of slab, yet we learned to design the columns and beams by using staad pro software. The important thing that we done were referring to a lot of books for designing and we are very much satisfied with exposing to field of design.

7. REFERENCES:

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- [4]. Murugan.M (2007) 'Structural Analysis' Samuthira Publications.
- [5]. NBC –National building of India, Bureau of Indian Standards, New Delhi.