Designing and Estimation of Twin House

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Abstract - *In this paper, to designing and estimating a house, it is necessary to do surveying to find out the area for construction which is followed by planning, designing to get reinforcement details, including forecasting the cost of construction by estimation for quantities of the materials those to be known. This paper comprises the effective planning particularly in land use by deciding to make a plan for twin house by avoiding over exploitation of space. The plan of house is represented in this paper by using Auto CAD. In this paper, design part is carried as per codal provision given in IS Code 456:2000, SP-16. All the details which we got from the design is given in the report and also figures which displaying the various detailing regarding the slab, beam, footing design are presented in the report. The Accurate quantities for the concrete and brickwork can be calculated from the layout drawings (plan).For estimating, the central line method is used here for getting relatively accurate cost of construction. The structural system cost is found out and whole result of the project is presented in this paper would be useful for design professionals and quantity surveyors.*

Keywords – *Twin house, planning, Cost, Design, Estimation*

I. INTRODUCTION

The main aim of this project is to achieve an acceptable probability that structures being planned and designed will perform satisfactorily during their intended life. With an adequate degree of safety, the twin house designed should withstand and sustain all the loads and deformations of normal construction and have adequate durability and adequate resistance to the ill effects of misuse and fire.The account should be taken of accepted theories, experiment and the need to design for durability and to attain strength. Not only calculations alone produce safe, serviceable and durable structures, also suitable materials, quality control, adequate detailing and good supervision are equally important.

As per the requirements of the **Standard method of measurement of building works** the quantities are normally described in this paper. There are two methods for estimating as follows:

a) Individual wall method
b) Central line method

From this, central line method is used here [3].The construction phase is based on term Quantity take off [QTO] which is function for procurement and predicting the construction costs [2].All theaccurate quantities of the concrete and brickwork will be able to calculate from the layout drawings (plan).It is also significant to know the quantities of materialsincluding reinforcement details for estimating the cost of the structure. The structural system cost which isgoing to find and its whole result of the project is presented in this paper would be useful for design professionals and quantity surveyors [5].

SCOPE

1.) In this emerging world, the requirements of houses are more. To overcome that requirement, the twin houses are built by proper utilization of area.

2.) By constructing the twin house, the consumption of area is less, it leads to enhance the opportunities for both agriculture and residential purpose.

3.) The design plans and specifications contain no errors and meet the appropriate code as well as owner requirements**.**

II. METHODOLGY

2.1 DATA COLLECTION

The detail about the site or area at which twin house is going to construct is needed to collect completely such as orientation of buildings near by the site, also about the surrounding things.

2.2 ANALYSIS

After all the data collected, it is necessary to analysis all data which we collected to proceed the step by planning, drawing the plan using AutoCAD, designing and estimation. Also any other research thesis or base papers which are related to our have to analyze to get an idea for preceding the further process and completing this project.

2.2 DRAWING (2D PLAN)

Planning should involve deciding the size of rooms, floor area of rooms and heights, thickness of wall, residential accommodation for various classes of employees, utilization of space. Before planning, we have to do survey for finding the total area of the site and to make boundary line for reducing or restricting the future problems due to over exploitation of any other extra area or plots or space of construction.In our plan, there are 32 rooms, floors (G+1)and plinth area 3100 sq. feet. The plan drawn by using AutoCAD is shown below.

In our plan, there are 32 rooms, floors are (G+1) and plinth area 3100 sq. feet. In the following pages, the plan drawn by using AutoCAD is shown.

2.4 DESIGNING

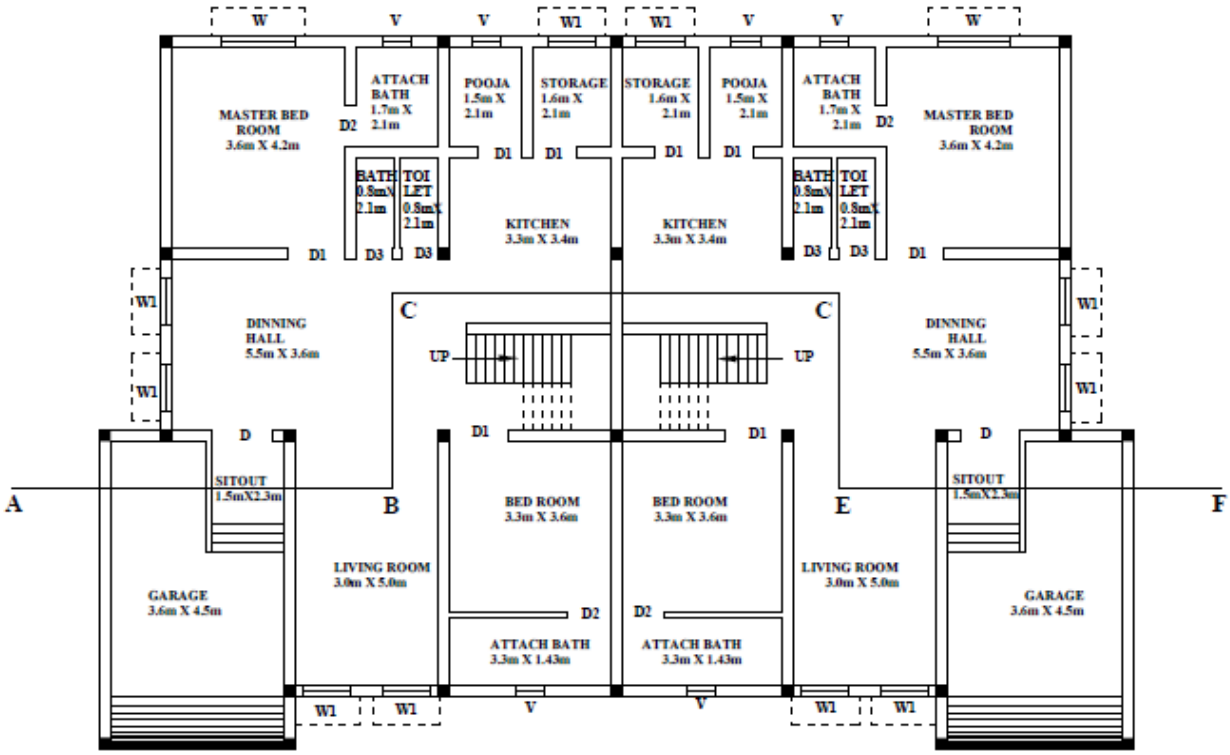
Reinforced cement concrete members can be designed by one of the following methods.

A) WORKING STRESS METHOD

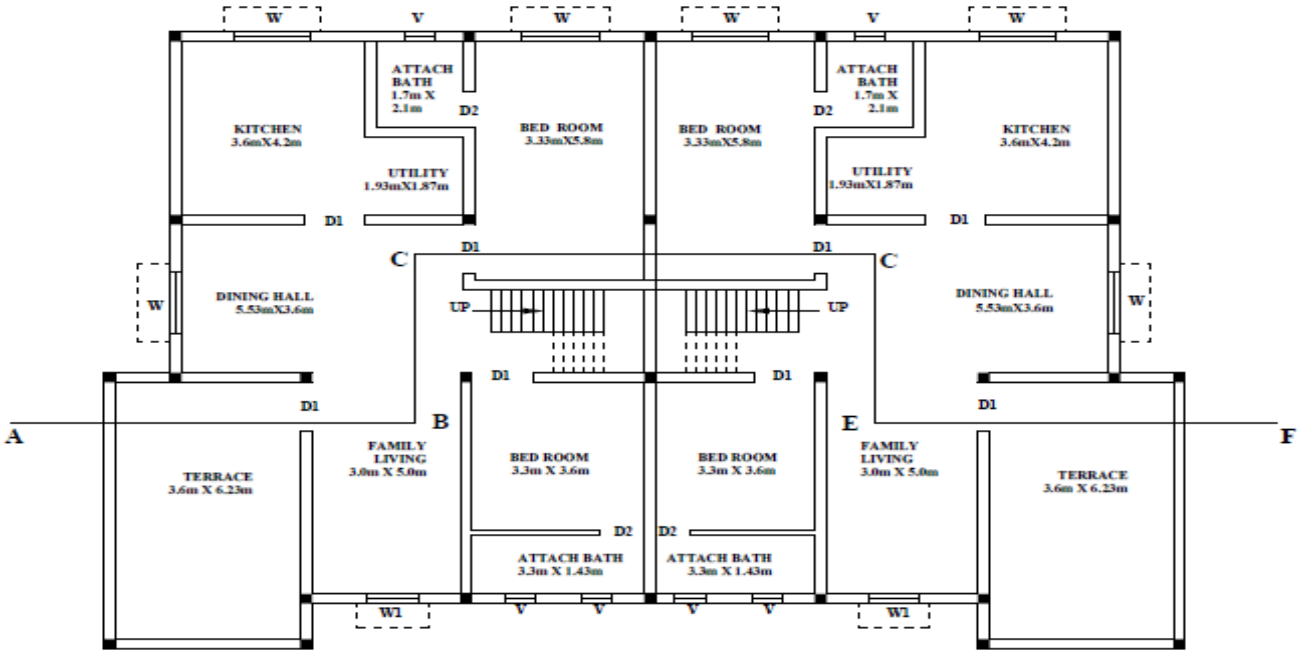
This is method based on the elastic theory in which the material concrete and steel are assumed to be wellstressed above their elastic limit under the load.

B) LIMIT STATE METHOD

This method of design is based on the plastic theory. Partial factor of safety are used in this method to determine the design loads and to design strength. The design aids to IS 456:2000 published by Bureau of Indian Standards made by the design by limit state method very simple and so this method is being widely used in practice and it was adopted here for designing.



GROUND FLOOR



FIRST FLOOR

2.4.1. SLABA concrete slab is a common structural element of modern buildings. Two types of slabs are:

One way slab: When the ratio of long direction to short direction of slab is greater than 2, it can be called as a one way slab.

Two way slab: Two way slab needs moment resisting reinforcement in both directions. If the ratio of long and short side is less than 2, then it is two way slab.

TABLE 1.DESIGN OF SLAB

S.NO	TYPE OF SLAB	SIZE OF SLAB (mm)	MAIN REINFORCEMENT		DISTRIBUTION REINFORCEMENT		DEPTH (mm)
			DIAMETER (mm)	SPACING (mm)	DIAMETER (mm)	SPACING (mm)	
1	Two way slab	3600x4200	10	300	8	180	130
2	Two way slab	5260x2100	10	290	8	160	200
3	Two way slab	6530x5130	10	200	8	180	230

FIGURE 1.1 SLAB 1

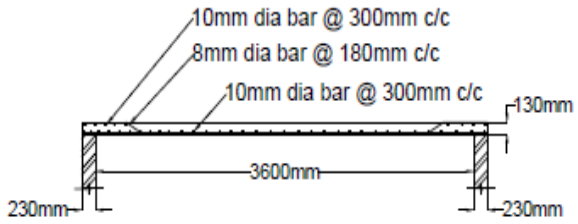


FIGURE1.2 SLAB2

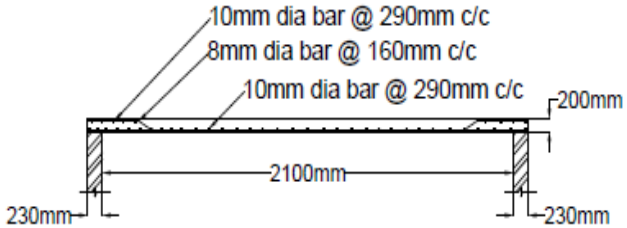
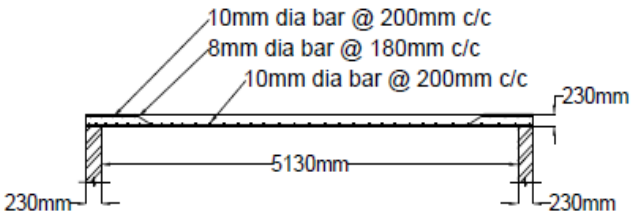


FIGURE 1.3SLAB 3



2.4.2. BEAM A beam has to be generally designed for the actions such as bending moment, shear force and twisting moments developed by the lateral loads. The size of a beam is designed considering the maximum B.M in it and generally kept uniform throughout its length.

Singly reinforced beamsA singly reinforced beam is a beam provided with longitudinal reinforcement in the tension zone only.

Doubly reinforced beamis called as beams reinforced with steel in compression and tension zones. Some other types are Under-Reinforced,Over-Reinforced and Balance-Reinforced beam

TABLE 2. DESIGN OF BEAM

S.NO	TYPE OF BEAM	SIZE OF BEAM (mm)	SPAN (mm)	COVER (mm)	MAIN REINFORCEMENT		DISTRIBUTION REINFORCEMENT		DEPTH (mm)
					DIAMETER (mm)	SPACING (mm)	DIAMETER (mm)	SPACING (mm)	
1	Doubly reinforced beam	300x485	5530	30	20	300	16	200	430
2	Doubly reinforced beam	155x335	5000	25	20	300	16	200	365

FIGURE 2.1 BEAM 1

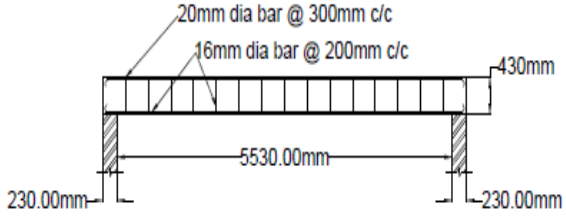
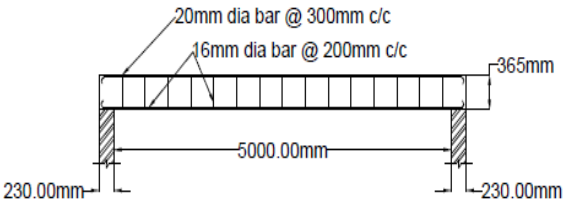


FIGURE 2.2 BEAM 2



2.4.3 FOOTING

A foundation was the lowest and supporting layer of a structure. Foundations are generally divided into two categories.

(a) Shallow foundations

(b) Deep foundations

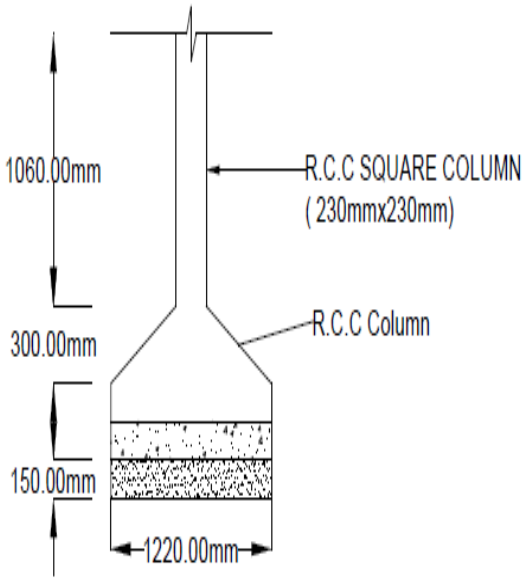
Types of footing

- Isolated Column Footings
- Combined Footings
- Continuous Footings
- Mat Footing/Raft Footing

TABLE 3. DESIGN OF FOOTING

S.NO	TYPE OF FOOTING	SIZE OF FOOTING (mm)	SIZE OF COLUMN (mm)	AXIAL LOAD (KN)	MAIN REINFORCEMENT		DISTRIBUTION REINFORCEMENT	
					DIAMETER (mm)	SPACING (mm)	DIAMETER (mm)	SPACING (mm)
1	Trapezoidal footing	1220x1220	230x230	162	10	300	8	240

FIGURE3.1



2.5 ESTIMATION For all engineering works, it is required to know beforehand the cost of construction known as estimated cost. If the estimated cost is greater than money available, then attempts are made to reduce the cost by reducing the work or by changing the specifications. From these methods given below, central line method is used here for estimating to get relatively accurate and perfect cost of construction. The abstract estimation is presented below for both the floors. Methods of Estimates:

1) Individual wall method
2) Central line method

Methods of Estimates

1) Individual wall method:

In this method, measure or find out external length of running in longitudinal direction in-to-in (of cross or short walls in-to-in) and calculate the same rule applies to excavation in foundation, to concrete in foundation and to masonry.

a)Long Wall=out to out= c/c of length + b/2+b/2

a)Short wall= in to in = c/c of length − b/2 − b/2

2) Central line method:

In this method, sum-total length of central lines of walls, long and short, has to found out. Find total length of central lines of wall of same type long and short having same type of foundation and footings and then find quantities by the total center length by respective breadth and height. From this two types, we are using central line method for estimation.

ABSTRACT ESTIMATION FOR GROUND FLOOR

S.NO	Particulars of Item	Quantity	Unit	Rate	Per	Amount
1	Earthwork excavation	69.18	m^3	900	% m^3	622.62
2	Earthwork in filling	31.29	m^3	750	% m^3	234.69
3	CC 1:3:6 in foundation	6.25	m^3	1100	/m^3	6876.10
4	RCC Work	86.43	m^3	1200	/m^3	103725.60
5	Mild steel reinforcement	57.25	m^3	855	/m^3	48953.00
6	Damp proof course	33.22	m^2	110	/m^2	3654.86
7	First class brick work	99.75	m^3	1250	/m^3	124692.50
8	Woodwork	6.14	m^3	14000	/ m^3	86016.00
9	Iron gate	5.76	m^2	650	/m^2	3744.00
10	12mm plaster in 1:6cm (inside outside)	793.82	m^2	300	/m^2	238147.80
11	2.5cm c.c 1:2:4 floor over	231.54	m^2	250	/m^2	57885.00
12	2.5cm c.c 1:2:4 nosing in steps meat cement finished	61.80	m	250	/m	15450.00
13	6mm plastering for ceiling	259.59	m^2	300	/m^2	77878.80
14	White washing	863.05	m^2	250	/m^2	215764.00
15	Color washing	190.36	m^2	300	/m^2	57109.80
16	Miscellaneous item	214.40	m	500	/m	107200.00
					TOTAL	**1147954.70**

AMOUNT CALCULATION FOR GROUND FLOOR

TOTAL = Rs. 1147954.7

Add 8% for water supply and sanitary works = Rs.91836.38

Add 8% for Electrification works = Rs. 91836.38

TOTAL= Rs.1331627.53

Add 2% for Contingencies = Rs.26632.55

Add 3% for Work charge Establishment= Rs.39948.82

GRAND TOTAL FOR GROUNG FLOOR= Rs.1398208.9

ABSTRACT ESTIMATION FOR FIRST FLOOR

S.NO	Particulars of Item	Quantity	Unit	Rate	Per	Amount
1	LC in roof terracing	306.31	m^2	110	/ m^2	33694.40
2	RCC work	37.59	m^3	1200	/ m^3	45116.40
3	2.5cm cc 1:2:4 nosing in steps of staircase neat cement finished	52.80	m	250	/m	13200.00
4	1st class brick work	117.40	m^3	1250	/m^3	146751.20
5	Woodwork	4.58	m^3	14000	/m^3	64176.00
6	12mm plaster in 1:6cm (inside+outside)	743.30	m^2	300	/m^2	222992.10
7	Flooring 2.5cm CC	230.89	m^2	250	/m^2	57724.50
8	6mm Plastering for ceiling	252.05	m^2	300	/m^2	75616.20
9	White washing	801.99	m^2	250	/m^2	200498.70
10	Color washing	193.33	m^2	300	/m^2	58000.80
11	Miscellaneous item	159.40	m	500	/m	79700.00
					TOTAL	**997470.40**

AMOUNT CALCULATION FOR FIRST FLOOR

TOTAL = Rs.997470.43

Add 8% for water supply and sanitary works = Rs.79797.63

Add 8% for Electrification works = Rs.79797.63

TOTAL= Rs.1157065.69

Add 2% for Contingencies = Rs.23141.31

Add 3% for Work charged Establishment= Rs.34711.97

GRAND TOTAL FOR FIRST FLOOR = Rs.1214918.97

TOTAL AMOUNT CALCULATION

TOTAL (GF + FF) = Rs.2613127.87

Cement (450 Bags) = Rs.180000.00

Fine aggregate (242.735 cu.m) = Rs.776755.00

Course aggregate(125.56 cu.m) = Rs. 401792.00

Bricks (108577 NOS) = Rs.651462.00

Steels (11664 kg) = Rs.886464.00

TOTALLY ESTIMATED COST =Rs.55,09,600.87

III.CONCLUSION

It is concluded that the design by manual method satisfies the entire requirement and it would be sufficient for construction of building with .In this work a twin house has been properly designed as per IS456-2000, IS 875- Part 1 and Part 2, SP 16:1980.The proposed twin house is a framed structure. The structural designs are done by using LSM (Limit State Method).The design using LSM(Limit State Method) produces a structure that fit for the intended purpose during a planned life. After designing is done, estimation for the twin house by central line method and the cost is estimated as per PWD current rate schedule. The major parameters that influence the cost escalation in construction industry are steel, cement, aggregate, bricks, composite materials, equipments and labor costs are found. Thus the objective of this project has been achieved and successfully evaluated.

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