

ESTIMATION OF A RESIDENTIAL BUILDING

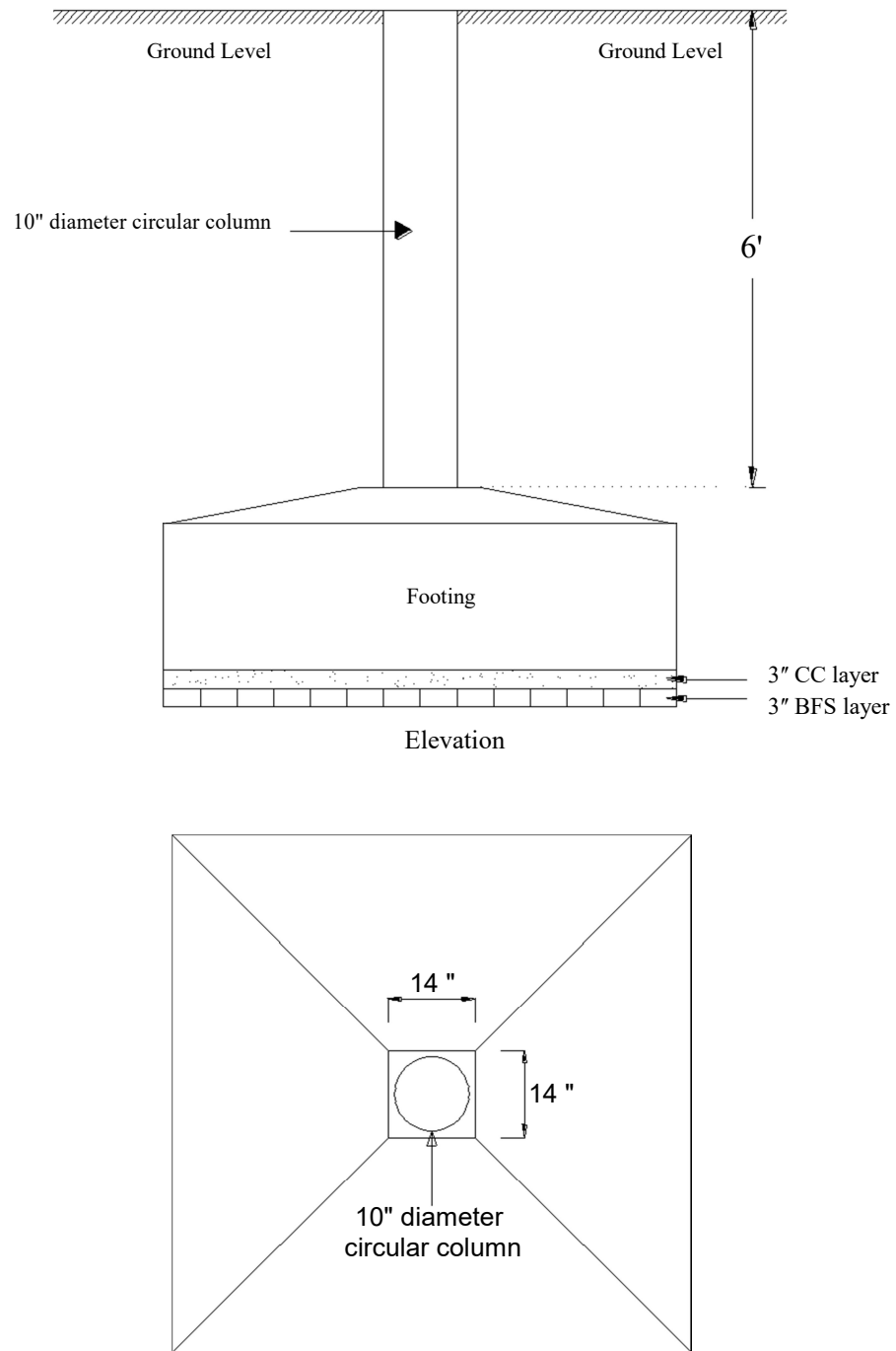


Figure 1: Plan and Elevation of Foundation

2. Worked Out Problem.

Estimate the materials required for the following residential building. Also find out the cost of all materials.

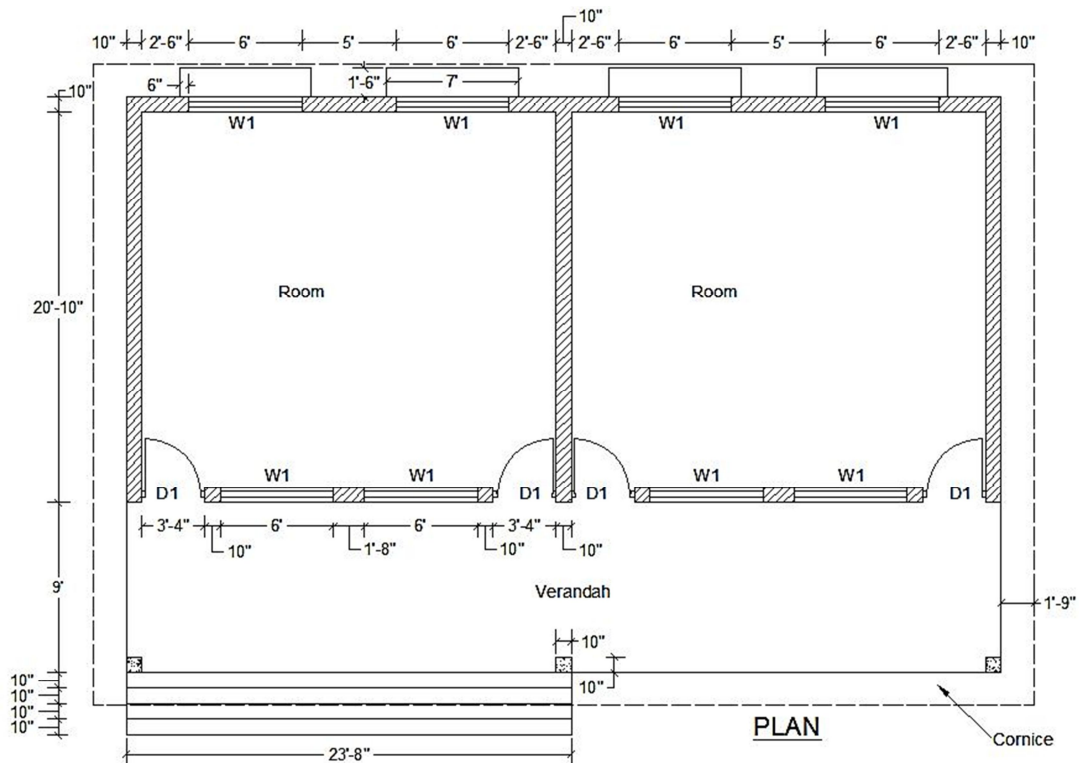
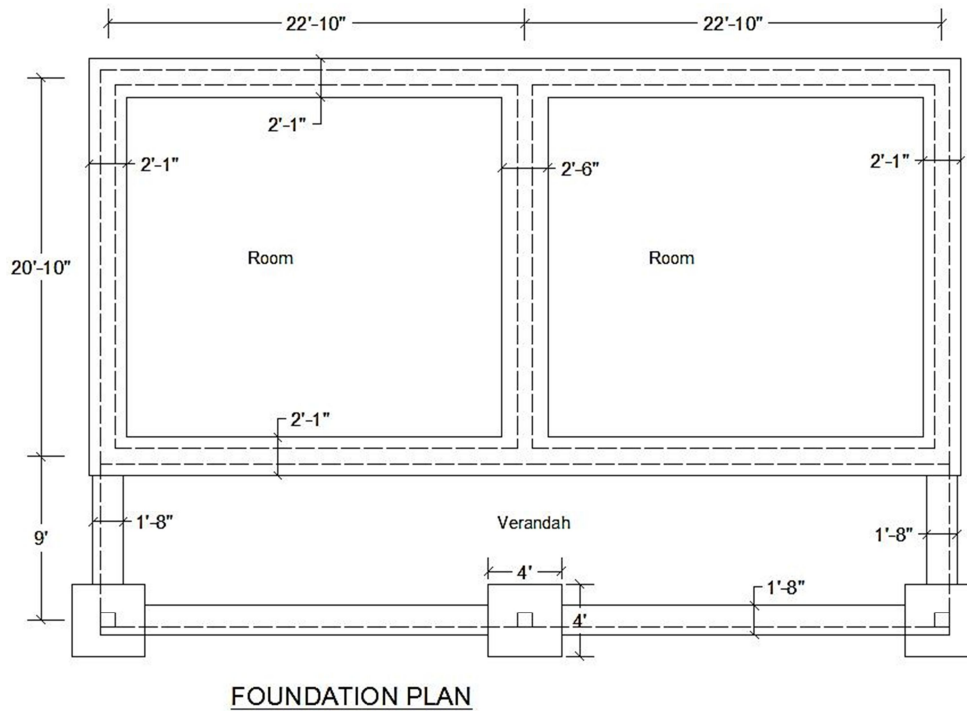


Figure 2: Building Plan



FOUNDATION PLAN

Figure 3: Foundation Plan

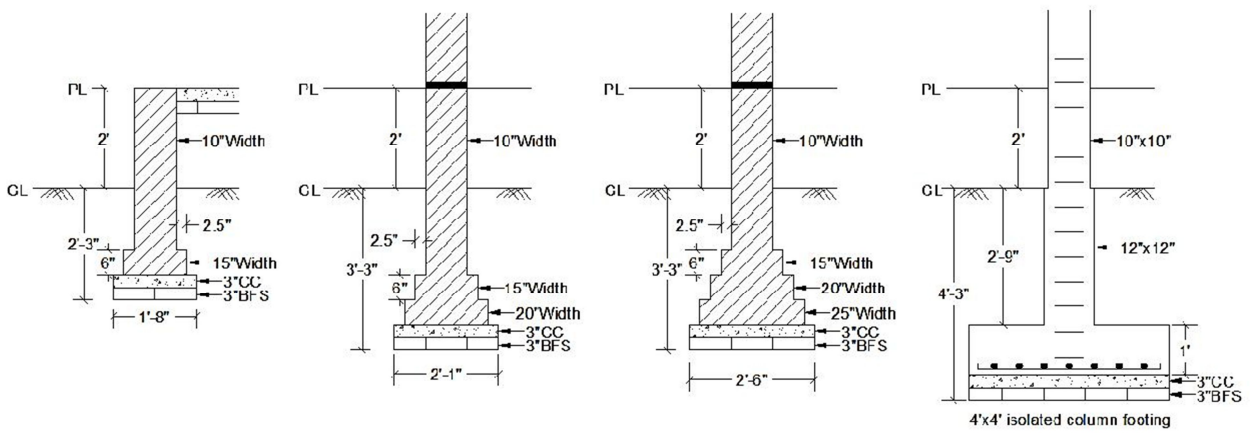


Figure 4: Cross Sections of Foundations

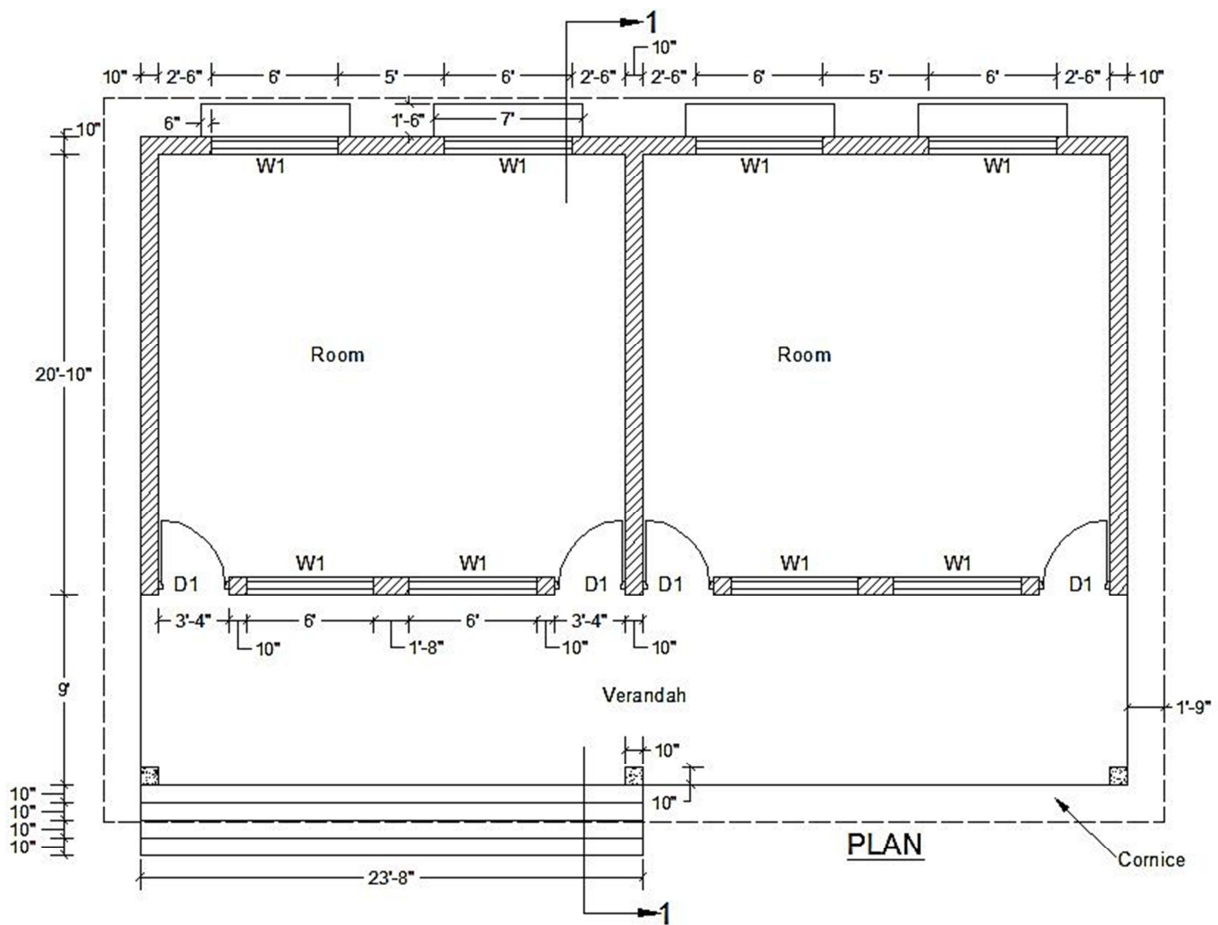


Figure 5: Building Plan with Section Lines

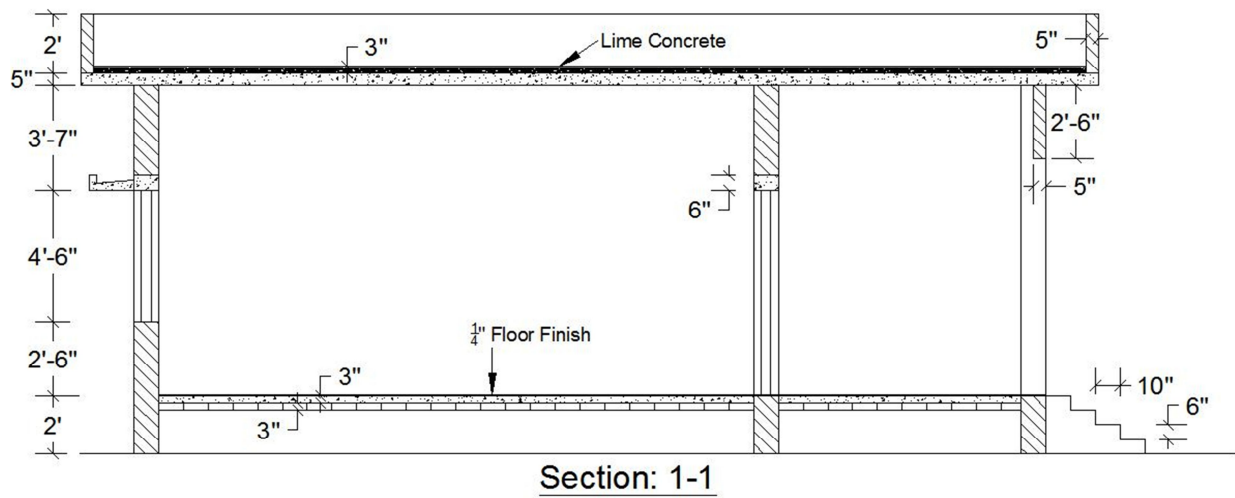


Figure 6: Elevation at Section 1-1

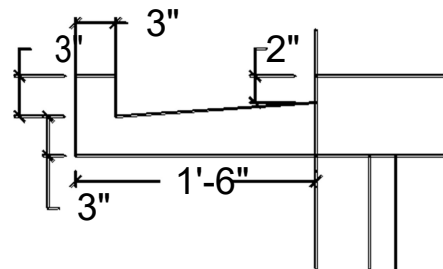


Figure 2-7: Sunshade

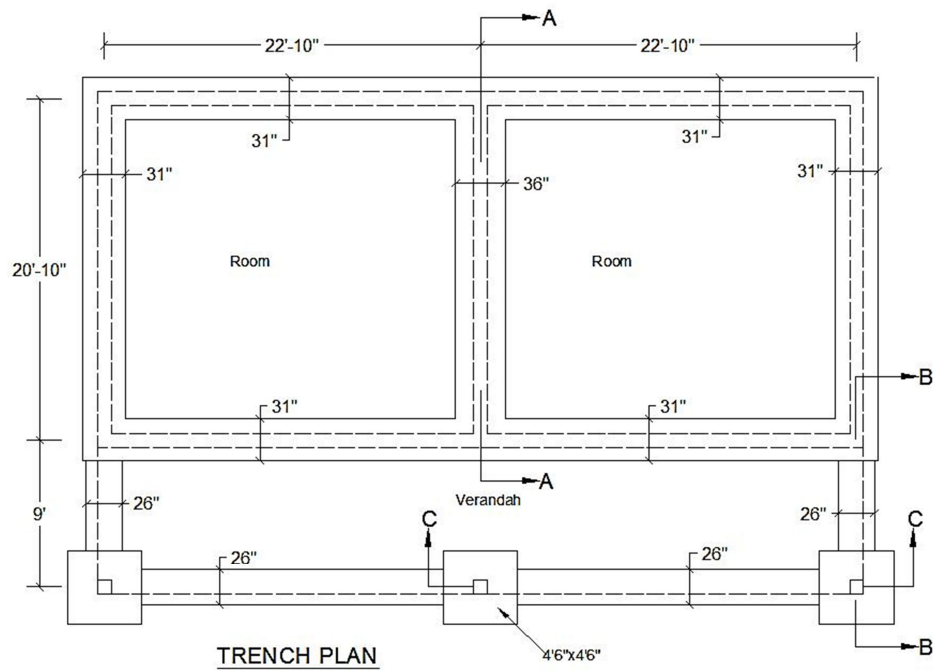


Figure 8: Foundation Plan

Here,

V= Volume

L= Length along center line

B= Thickness/ Width

H= Height

Earthwork excavation: (Volume)

For 25" wall foundation-

$$\text{Length} = 20'10'' \times 2 + 22'10'' \times 4 = 133'$$

$$\text{Width} = 2'1'' + 3'' \times 2 \text{ (extra in both side)} =$$

$$31'' \text{ Height} = 3'3''$$

$$\text{Volume} = L \times W \times H = 1116.65 \text{ ft}^3$$

For 30" wall foundation-

$$\text{Length} = 20'10'' - 31'' = 18'3''$$

$$\text{Width} = 2'6'' + 3'' \times 2 \text{ (extra in both side)} =$$

$$36'' \text{ Height} = 3'3''$$

$$\text{Volume} = L \times W \times H = 177.94$$

ft^3 Column foundation-

$$\text{Volume} = L \times W \times H = (4'6'' \times 4'6'' \times 4'3'') \times 3 = 258.19$$

ft^3 For 20" wall foundation-

$$\text{Length} = (9' - 31'' / 2 - 4'6'' / 2 \text{ (column footing)}) \times 2 + (22'10'' - 4'6'') \times 2 = 47'7''$$

$$\text{Width} = 20'' + 3'' \times 2 \text{ (extra in both side)} = 26'' \text{ Height} =$$

$$2'3''$$

$$\text{Volume} = L \times W \times H = 231.97 \text{ ft}^3$$

$$\text{Total volume} = (1116.65 + 177.94 + 258.19 + 231.97) = 1784.75 \text{ ft}^3$$

BFS (one layer below foundation): (Area)

For 25" wall foundation-

$$\text{Length} = 20'10'' \times 2 + 22'10'' \times 4 = 133'$$

$$\text{Width} = 2'1'' = 25''$$

$$\text{Area} = L \times W = 277.08 \text{ ft}^2$$

For 30" wall foundation-

$$\text{Length} = 20'10'' - 2'1'' = 18'9''$$

$$\text{Width} = 2'6'' = 30''$$

$$\text{Area} = L \times W = 46.875 \text{ ft}^2$$

For column foundation-

$$\text{Length} = 4'$$

$$\text{Width} = 4'$$

$$\text{Area} = L \times W = 3 \times (4' \times 4') = 48 \text{ ft}^2$$

For 20" wall foundation-

$$\text{Length} = (9' - 1'3''/2 \text{ (due to 25" wall foundation)} - 1'2 \text{ (due to column footing)}) \times 2 + (22'10'' - 1'2 - 1'2) \times 2 = 59'5''$$

$$\text{Width} = 1'8'' = 20''$$

$$\text{Area} = L \times W = 99.03 \text{ ft}^2$$

$$\text{Total Area of BFS} = (277.08 + 46.875 + 48 + 99.03) = 470.985 \text{ ft}^2$$

Cement concrete in foundation: (Volume)

To find volume of CC, multiply by the total area of BFS with thickness (3").

$$\text{Total volume of CC} = 470.985 \text{ ft}^2 \times 3''/12 = 117.75 \text{ ft}^3$$

Brickwork in foundation (up to GL): (Volume)

For 25" wall foundation-

$$20'' \text{ width: } 133' \times 20'' / 12 \times 6'' / 12 = 110.83 \text{ ft}^3$$

$$15'' \text{ width: } 133' \times 15'' / 12 \times 6'' / 12 = 83.12 \text{ ft}^3$$

$$10'' \text{ width: } 133' \times 10'' / 12 \times 21'' / 12 = 193.95 \text{ ft}^3$$

$$\text{Total} = 387.9 \text{ ft}^3$$

For 30'' wall foundation-

$$25'' \text{ width: } (18'9'' + 2.5'' \times 2) \times 25'' / 12 \times 6'' / 12 = 19.97 \text{ ft}^3$$

$$20'' \text{ width: } (19'2'' + 2.5'' \times 2) \times 20'' / 12 \times 6'' / 12 = 16.32 \text{ ft}^3$$

$$15'' \text{ width: } (19'7'' + 2.5'' \times 2) \times 15'' / 12 \times 6'' / 12 = 12.5 \text{ ft}^3$$

$$10'' \text{ width: } (19'7'' + 2.5'' \times 2) \times 10'' / 12 \times 15'' / 12 = 20.83$$

$$\text{ft}^3 \text{ Total} = 69.62 \text{ ft}^3$$

For 20'' wall foundation-

$$15'' \text{ width: } (59'5'' + 2.5'' \times 2) \times 15'' / 12 \times 6'' / 12 = 37.4 \text{ ft}^3$$

$$10'' \text{ width: } (59'5'' + 2.5'' \times 2) \times 10'' / 12 \times 15'' / 12 = 62.33$$

$$\text{ft}^3 \text{ Total} = 99.73 \text{ ft}^3$$

Brickwork in foundation from GL to PL: (volume)

$$25'' \text{ wall foundation} = 133' \times 10'' \times 2' = 221.67 \text{ ft}^3$$

$$30'' \text{ wall foundation} = 20' \times 10'' \times 2' = 33.33 \text{ ft}^3$$

$$20'' \text{ wall foundation} = ((9' - 5'' - 5'' + 22'10'' - 5'' - 5'') \times 2) \times 10'' \times 2' = 100.56$$

$$\text{ft}^3 \text{ Total} = 355.56 \text{ ft}^3$$

RCC in footing up to GL: (Volume)

$$\text{Base slab of footing} = 3 \times (4' \times 4' \times 1') = 48 \text{ ft}^3$$

$$\text{Column up to GL} = 3 \times (1' \times 1' \times 2'9'') = 8.25 \text{ ft}^3$$

$$\text{Total} = 56.25 \text{ ft}^3$$

RCC in column from GL to PL: (Volume)

$$\text{Concrete volume} = 3 \times 10'' \times 10'' \times 2' = 4.167 \text{ ft}^3$$

DPC (Damp Proof Course): (Volume)

$$\text{Thickness} = 1.5''$$

$$25'' \text{ foundation} = 133' \times 10'' / 12 \times 1.5'' / 12 = 13.6 \text{ ft}^3$$

$$30'' \text{ foundation} = 20' \times 10'' / 12 \times 1.5'' / 12 = 2.1 \text{ ft}^3$$

$$\text{Deduct (door strip)} = 4' \times 3'4'' \times 10'' \times 1.5'' = 1.39 \text{ ft}^3$$

BFS (one layer) in Floors: (Area)

$$\text{Main room} = 2 \times (22' \times 20') = 880 \text{ ft}^2$$

$$\text{Verandah} = (46'6'' - 20'' \text{ (due to foundation below)}) \times (9' - 10'') = 366.1 \text{ ft}^2$$

$$\text{Total} = 1246.1 \text{ ft}^2$$

CC (cement concrete) in Floors: (Volume)

To find volume of CC, multiply by the total area of BFS with thickness (3'').

$$\text{Total volume} = 1246.1 \text{ ft}^2 \times 3'' / 12 = 311.53 \text{ ft}^3$$

Floor finish (thickness 1/4''): (Volume)

$$1. \text{ Main room} = 2 \times 22' \times 20' \times 0.25'' / 12 = 18.33 \text{ ft}^3$$

$$2. \text{ Door} = 4 \times 3'4'' \times 10'' / 12 \times 0.25'' / 12 = 0.23 \text{ ft}^3$$

$$3. \text{ Verandah} = 46'6'' \times 9' \times 0.25'' / 12 = 8.72 \text{ ft}^3$$

$$\text{Deduct (due to column)} = 3 \times 10'' \times 10'' \times 0.25'' = 0.043 \text{ ft}^3$$

$$4. \text{ Stair steps} = 4 \times 23'8'' \times 1'4'' \times 0.25'' / 12 = 2.63 \text{ ft}^3$$

$$\text{Total} = 29.87 \text{ ft}^3$$

Brick wall in superstructure: (Volume)

$$\text{Wall} = (133' + 20') \times 10'' \times 10'7'' = 1349.375 \text{ ft}^3$$

Deduct:

$$1. \text{ Door (D1)} = 4 \times 3'4'' \times 10'' \times 7' = 77.78 \text{ ft}^3$$

$$2. \text{ Window (W1)} = 8 \times 6' \times 10'' \times 4'6'' = 180 \text{ ft}^3$$

$$3. \text{ Lintel over W1} = 4 \times (6' + 2 \times 6'') \times 10'' \times 6'' = 11.67 \text{ ft}^3$$

$$4. \text{ Lintel over D1+W1} = (22' \times 2 + 10'' + 2 \times 6'') \times 10'' \times 6'' = 19.1 \text{ ft}^3$$

$$\text{Total} = 1060.825 \text{ ft}^3$$

RCC in column: (Volume)

$$\text{RCC volume} = 3 \times 10'' \times 10'' \times 10'7'' = 22.05 \text{ ft}^3$$

RCC in lintel: (Volume)

$$\text{Lintel over W1} = 4 \times 7' \times 10'' \times 6'' = 11.67 \text{ ft}^3$$

$$\text{Lintel over D1+W1} = 45'10'' \times 10'' \times 6'' = 19.1 \text{ ft}^3; \text{ Total} = 30.77 \text{ ft}^3$$

RCC in roof: (Volume)

$$\text{RCC volume} = (46'6'' + 2 \times 1'9'') \times (30'8'' + 2 \times 1'9'') \times 5'' = 711.81 \text{ ft}^3$$

LC (Lime concrete) in roof: (Volume)

$$\text{LC volume} = (50' - 10'') \times (34'2'' - 10'') \times 3'' = 409.72 \text{ ft}^3$$

Bricks in parapet: (Volume)

$$\text{Brick} = (2 \times (50' - 5'' + 34'2'' - 5'')) \times 5'' \times 2' = 138.89 \text{ ft}^3$$

Brick work in stair: (Volume)

$$1. \text{ 1st step: } 23'8'' \times 10'' \times 6'' = 9.86 \text{ ft}^3$$

$$2. \text{ 2nd step: } 23'8'' \times 20'' \times 6'' = 19.72 \text{ ft}^3$$

$$3. \text{ 3rd step: } 23'8'' \times 30'' \times 6'' = 29.58 \text{ ft}^3$$

$$4. \text{ 4th step: } 23'8'' \times 40'' \times 6'' = 39.44 \text{ ft}^3$$

$$\text{Total} = 98.6 \text{ ft}^3$$

R.C.C. in drop wall: (Volume)

$$\text{Length} = (9' - 10'') \times 2 + (22'10'' - 10'') \times 2 = 60'4''$$

$$\text{Width} = 5''$$

$$\text{Height} = 2'6''$$

$$\text{Volume} = 62.85 \text{ ft}^3$$

R.C.C. in sunshade: (Volume)

$$\text{RCC Volume} = 4 \times ((3'' \times 6'') + (0.5 \times (3'' + 4'') \times 15'')) \times 7' = 13.71 \text{ ft}^3$$

Inside Plastering (thickness 0.25''): (Volume) Mix ratio- C:S= 1:6

1. Inside wall

$$a) \text{ Main room} = 2 \times 84' \times (10'7'' - 10'' \text{ skirting}) \times 0.25'' = 34.125$$

$$\text{ft}^3 \text{ Deduct, Door} = 4 \times 3'4'' \times (7' - 10'' \text{ skirting}) \times 0.25'' = 2.18 \text{ ft}^3$$

$$\text{Window} = 8 \times 6' \times 4'6'' \times 0.25'' = 4.5 \text{ ft}^3$$

$$\text{Total} = 27.45 \text{ ft}^3$$

$$b) \text{ Verandah} = (22'10'' \times 2 + 10'') \times (10'7'' - 10'' \text{ skirting}) \times 0.25'' = 9.45$$

$$\text{ft}^3 \text{ Deduct, Door} = 4 \times 3'4'' \times (7' - 10'' \text{ skirting}) \times 0.25'' = 2.18 \text{ ft}^3$$

$$\text{Window} = 4 \times 6' \times 4'6'' \times 0.25'' = 2.25 \text{ ft}^3$$

$$\text{Droop wall} = 2 \times 5'' \times 2'6'' \times 0.25'' = 0.043 \text{ ft}^3$$

$$\text{Total} = 4.98 \text{ ft}^3$$

2. Ceiling

$$a) \text{ Main room} = 2 \times 22' \times 20' \times 0.25'' = 18.33 \text{ ft}^3$$

$$\text{b) Verandah} = 46'6'' \times 9' \times 0.25'' = 8.72 \text{ ft}^3$$

$$\text{Deduct, Column} = 3 \times 10'' \times 10'' \times 0.25'' = 0.0434 \text{ ft}^3$$

$$\text{Drop wall} = 60'4'' \times 5'' \times 0.25'' = 0.524 \text{ ft}^3$$

$$\text{Total} = 26.48 \text{ ft}^3$$

3. Edges

$$\text{a) Door edges} = 4 \times (6'2'' + 3'4'' + 6'2'') \times 10'' \times 0.25'' = 1.09 \text{ ft}^3$$

$$\text{b) Window edges} = 8 \times (6' \times 2 + 4'6'' \times 2) \times 10'' \times 0.25'' = 2.92 \text{ ft}^3$$

$$\text{Total} = 4.01 \text{ ft}^3$$

4. Drop wall (inside face)

$$\text{a) Inside face} = 60'4'' \times 2'6'' \times 0.25'' = 3.14 \text{ ft}^3$$

$$\text{b) Bottom edge} = 60'4'' \times 5'' \times 0.25'' = 0.524 \text{ ft}^3$$

$$\text{Total} = 3.66 \text{ ft}^3$$

$$\text{Total volume of inside plastering} = 66.58 \text{ ft}^3$$

Outside plastering (thickness 0.5''): (Volume) Mix ratio- C:S= 1:4

$$1. \text{ GL to PL} = (46'6'' \times 2 + 30'8'' \times 2) \times 2' \times 0.5'' = 12.86$$

$$\text{ft}^3 \text{ Deduct, Stair} = 23'8'' \times 2' \times 0.5'' = 1.97 \text{ ft}^3$$

$$\text{Total} = 10.89 \text{ ft}^3$$

$$2. \text{ Outside wall} = (46'6'' + 21'8'' \times 2) \times 10'7'' \times 0.5'' = 39.61$$

$$\text{ft}^3 \text{ Deduct, Window} = 4 \times 6' \times 4'6'' \times 0.5'' = 4.5 \text{ ft}^3$$

$$\text{Sunshade} = 4 \times 7' \times 4'' \times 0.5'' = 0.39 \text{ ft}^3$$

$$\text{Total} = 34.72 \text{ ft}^3$$

$$3. \text{ Columns} = 3 \times (10'' \times 4) \times (10'7'' - 10'') \times 0.5'' = 4.06$$

$$\text{ft}^3 \text{ Deduct, Drop wall} = 6 \times (2'6'' \times 5'' \times 0.5'') = 0.26 \text{ ft}^3$$

$$\text{Total} = 3.8 \text{ ft}^3$$

4. Stairs

$$\begin{aligned} \text{1st step} &= 2 \times 10'' \times 6'' \times 0.5'' = 60 \text{ in}^3 = 0.035 \text{ ft}^3, \text{ 2nd step} = 2 \times 60 \text{ in}^3 = 0.07 \text{ ft}^3, \\ \text{3rd step} &= 3 \times 60 \text{ in}^3 = 0.1 \text{ ft}^3, \text{ 4th step} = 4 \times 60 \text{ in}^3 = 0.14 \text{ ft}^3 \text{ Total} = \\ &0.345 \text{ ft}^3 \end{aligned}$$

5. Parapet

$$\begin{aligned} \text{a) Inside} &= (49'2'' \times 2 + 33'4'' \times 2) \times 2' \times 0.5'' = 13.75 \text{ ft}^3 \\ \text{b) Outside} &= (50' \times 2 + 34'2'' \times 2) \times 2' \times 0.5'' = 14.03 \text{ ft}^3 \\ \text{c) Top} &= (49'7'' \times 2 + 33'9'' \times 2) \times 5'' \times 0.5'' = 2.9 \text{ ft}^3 \\ \text{Total} &= 30.68 \text{ ft}^3 \end{aligned}$$

6. Sunshade

$$\begin{aligned} \text{a) Bottom face} &= 4 \times (7' \times 1'6'' \times 0.5'') = 1.75 \text{ ft}^3 \\ \text{b) Side edge} &= 4 \times [\{(6'' \times 3'' + 0.5 \times (3'' + 4'')) \times 15''\} \times 2 \times 0.5''] = 0.16 \text{ ft}^3 \\ \text{c) Front face} &= 4 \times (7' \times 6'' \times 0.5'') = 0.58 \text{ ft}^3 \\ \text{d) Top face} &= 4 \times \{7' \times (3'' + 3'' + 15.04'') \times 0.5''\} = 2.05 \text{ ft}^3 \\ \text{e) Inside face} &= 4 \times (3'' \times 7' \times 0.5'') = 0.29 \text{ ft}^3 \\ \text{Total} &= 4.83 \text{ ft}^3 \end{aligned}$$

7. Cornice

$$\begin{aligned} \text{a) Side edge} &= (50' \times 2 + 34'2'' \times 2) \times 5'' \times 0.5'' = 2.92 \text{ ft}^3 \\ \text{b) Bottom edge} &= \{(30'8'' + 1'9'') \times 2 + (46'6'' + 1'9'') \times 2\} \times 1'9'' \times 0.5'' = 11.76 \text{ ft}^3 \\ \text{Total} &= 14.68 \text{ ft}^3 \end{aligned}$$

8. Drop wall

$$\begin{aligned} \text{Outside face} &= 60'4'' \times 2'6'' \times 0.5'' = 6.28 \text{ ft}^3 \\ \text{Total volume} &= 106.23 \text{ ft}^3 \end{aligned}$$

Skirting (thickness 0.75"): (Volume)

1. Main room= $(20' \times 22' \times 2) \times 10'' \times 0.75'' = 4.38$

ft^3 Deduct, Door= $4 \times 3'4'' \times 10'' \times 0.75'' = 0.69 \text{ ft}^3$

2. Verandah= $46'6'' \times 10'' \times 0.75'' = 2.42 \text{ ft}^3$

Deduct, Door= $4 \times 3'4'' \times 10'' \times 0.75'' = 0.69 \text{ ft}^3$

3. Columns= $3 \times (10'' \times 4) \times 10'' \times 0.75'' = 0.52 \text{ ft}^3$

Total volume= 5.94 ft^3

Costing of a residential building

Example:

Table 2-2: Calculation of Costing of a Residential Building

Item No.	Item Description	Quantity	Price Per Quantity	Total Cost
01	Earthwork Excavation	1784.75 cft	2.13 tk/cft	3802 tk

Total Cost= X_1 tk

Electrification= 8% of total cost= X_2

Sanitary and water supply= 8% of total cost= X_3

Estimated cost= $(X_1 + X_2 + X_3)$ tk