CE 208
Quantity Surveying

Estimation of a Residential Building

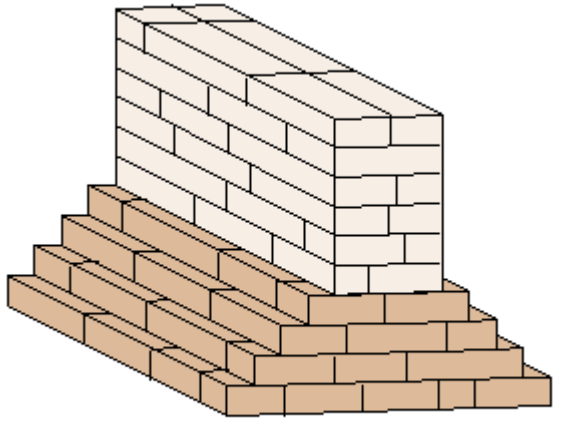


Course Teachers: Dr. Md. Shafiul Bari
Mashiat Hossain
Sumaiya Afrose Suma

DEPARTMENT OF CIVIL ENGINEERING
BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY

Brick Wall Footing

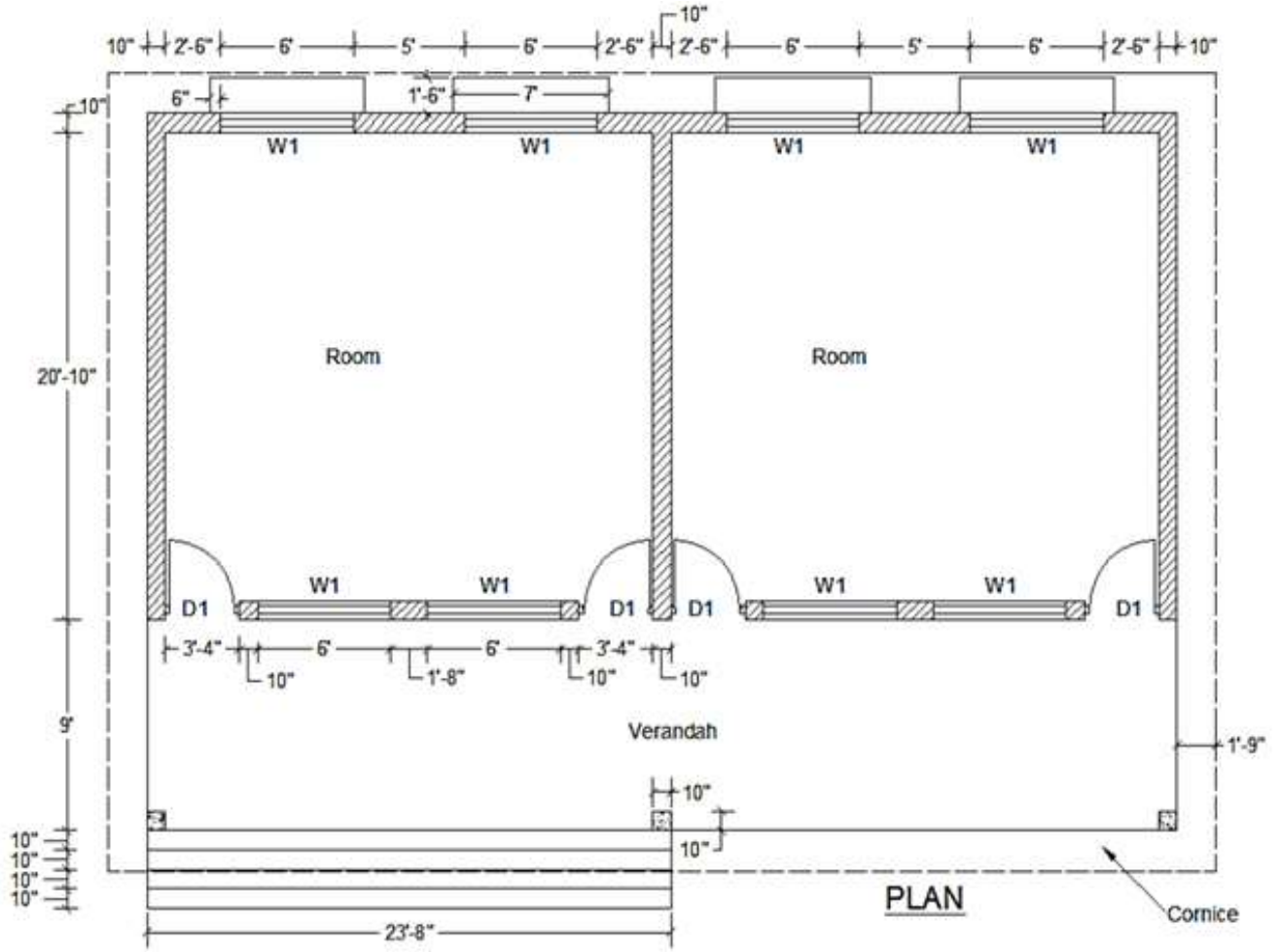
- Wall footing runs along the direction of the wall.
- The size of the footing and the thickness of the foundation wall are specified on the basis of the type of soil at the site.
- The wall footing can be constructed from stone, brick, plain concrete, or reinforced concrete.
- In the case of brick walls, the footing consists of several courses of bricks, the lowest course being usually twice the breadth of the wall above.
- The increased base width of the wall footing is obtained through the provision of 2.5 inch offsets on either side of the wall.



brick or masonry foundation or strip footing

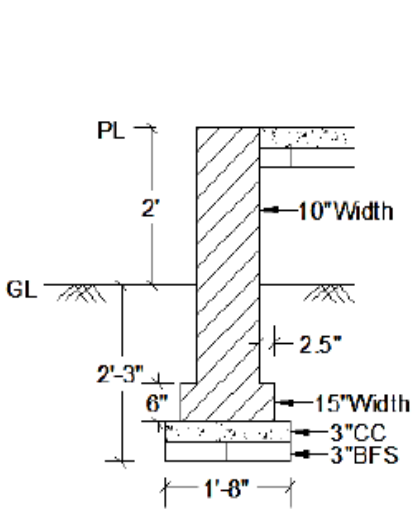


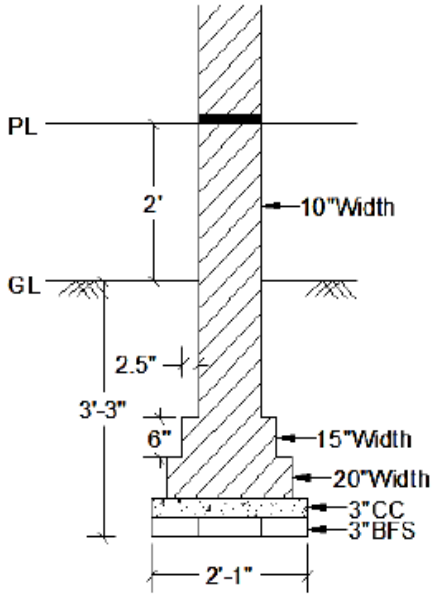
- Estimate the materials required for the following residential building (elementary information is given)

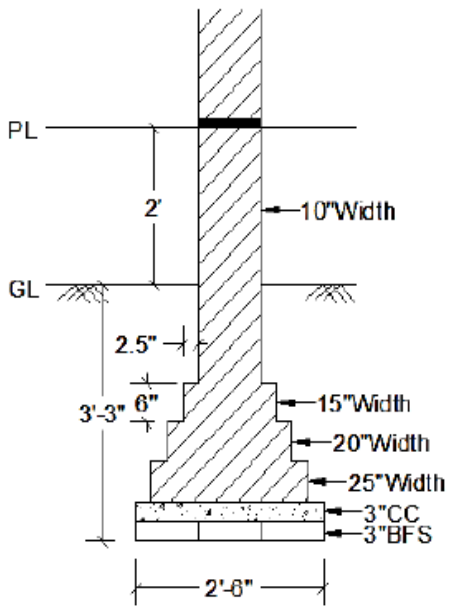


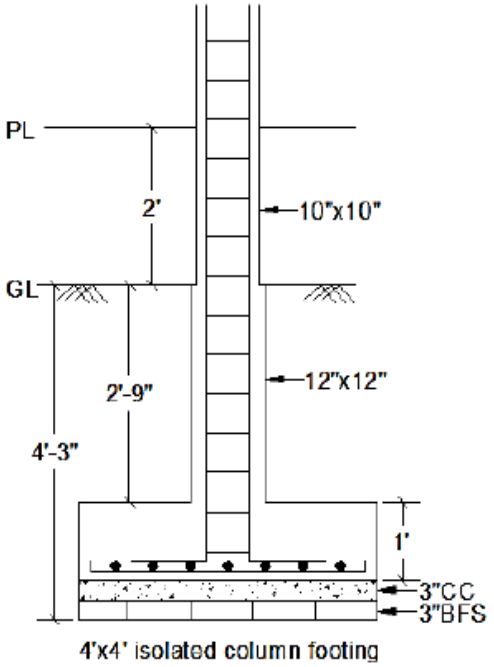
The four types of foundation used and their cross-sections are shown below -

1. 30″ wall foundation
2. 25″ wall foundation
3. 20″ wall foundation
4. Column foundation (Isolated Column Footing)

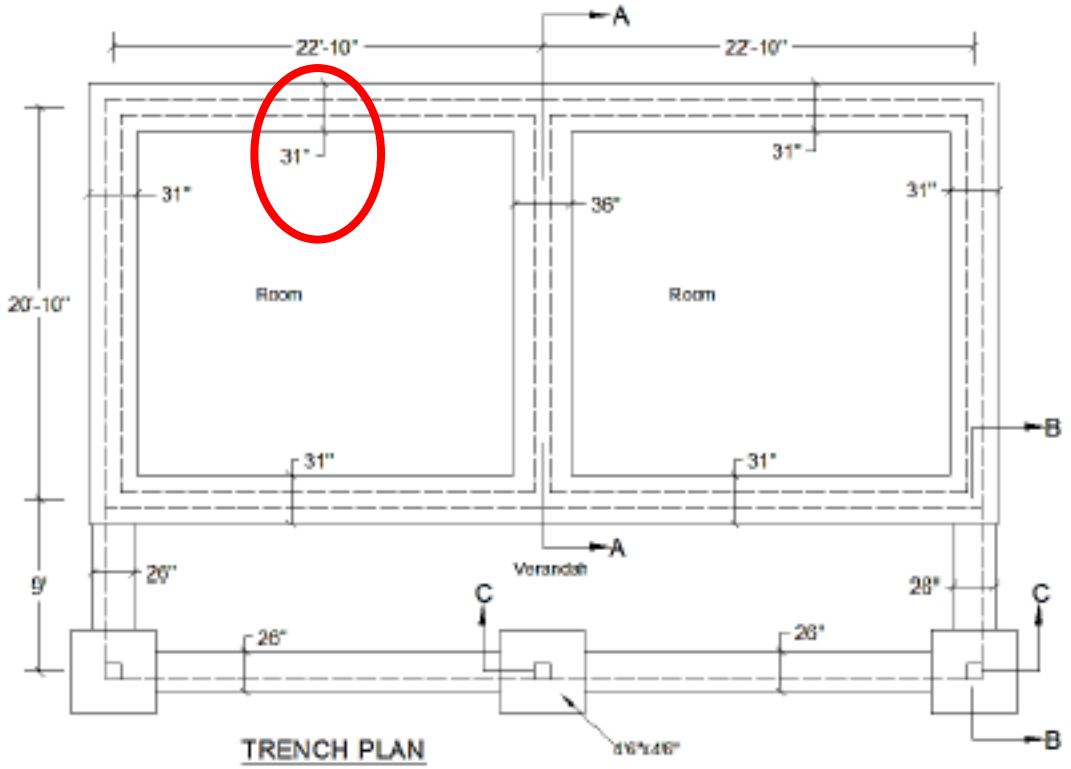


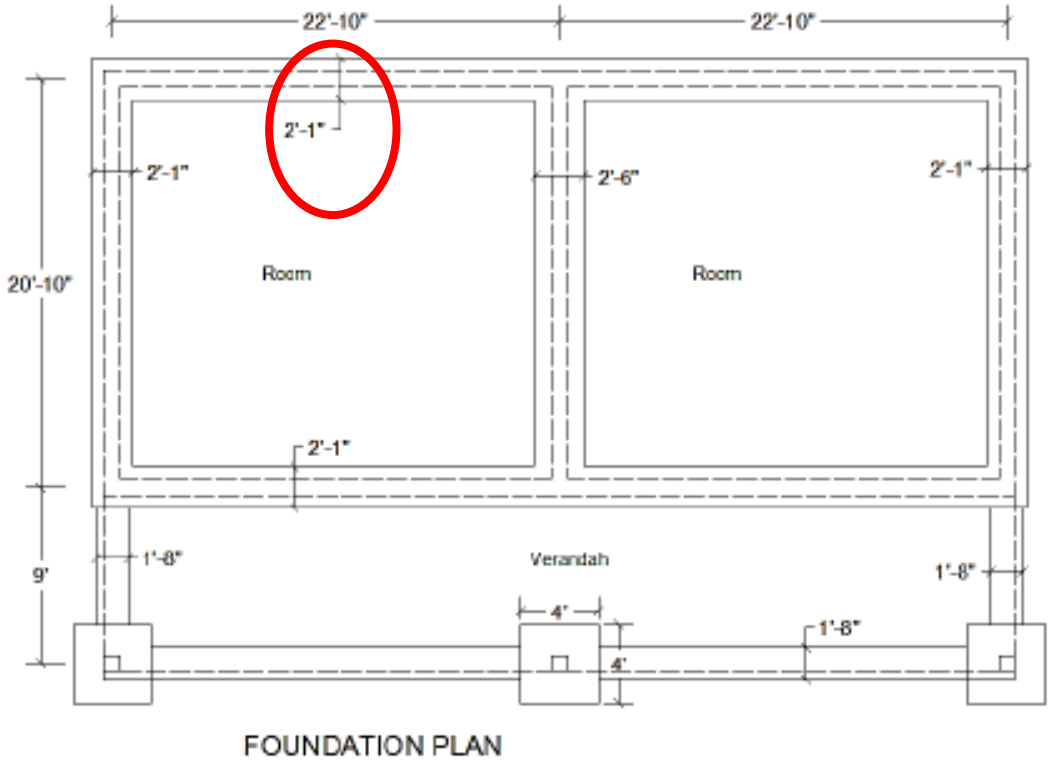






4'x4' isolated column footing



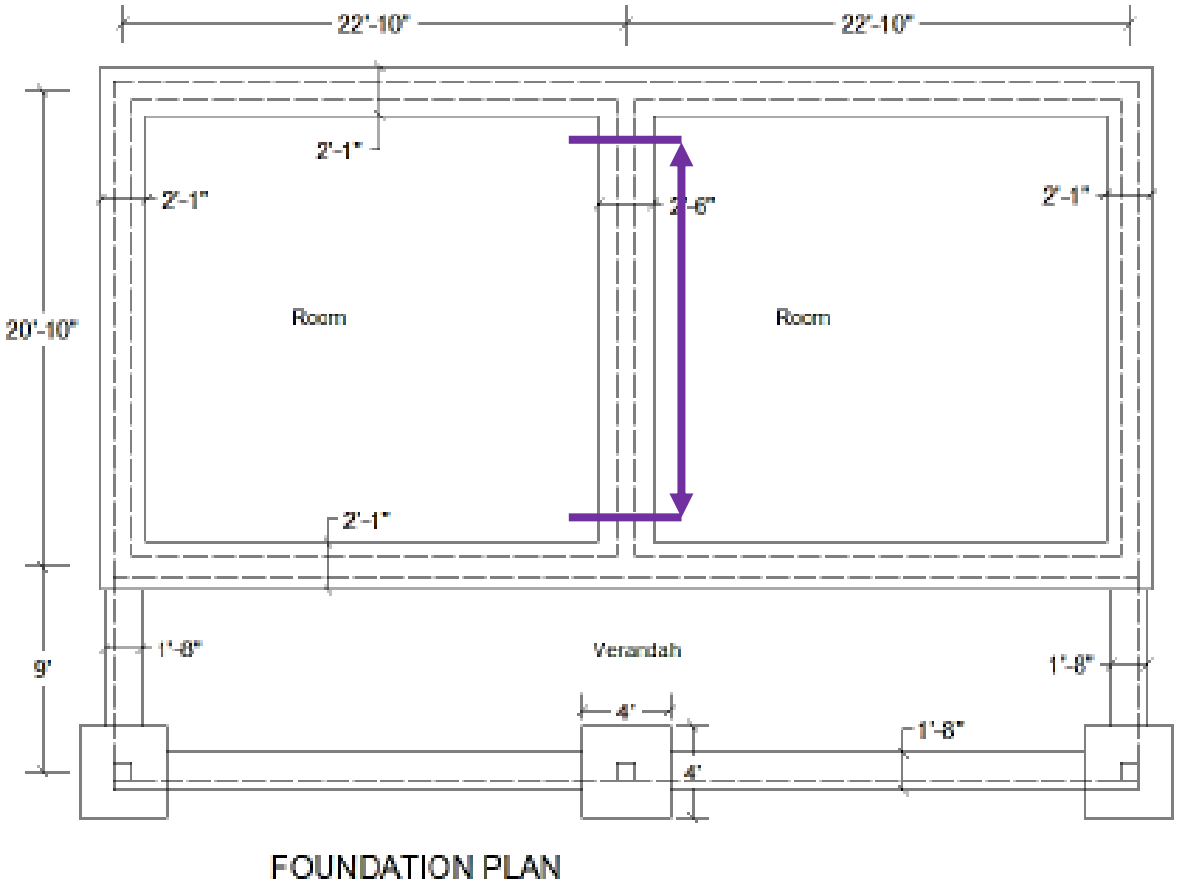




Extra width for excavation

For excavation dimensions, the actual width of foundation is offsetted by **3 inch** on **all sides** (compare the foundation plan and trench plan). If trench plan is given, you can obtain the length of excavation directly from trench plan.

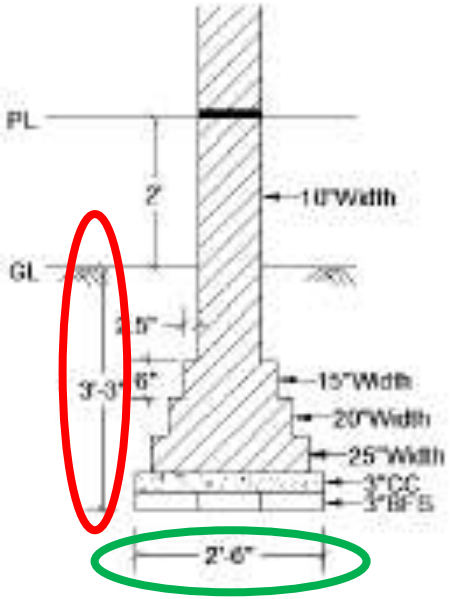
1. Estimation of Earthwork Excavation



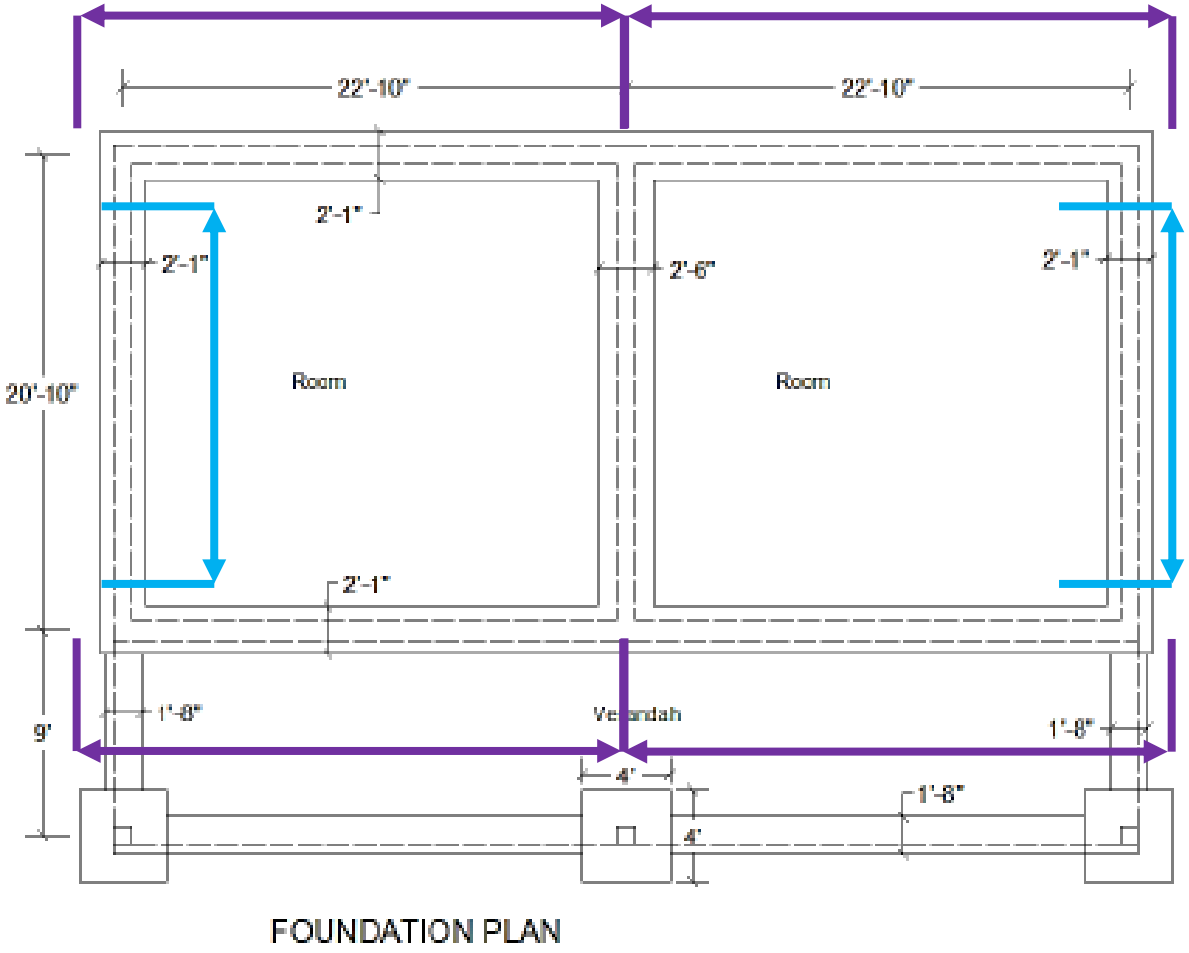
FOUNDATION PLAN

30" wall foundation:

- Height= 3'3"
- Width= (2'6")+3"+3"
- Length= 20'10"-12.5"-3"-12.5"-3"



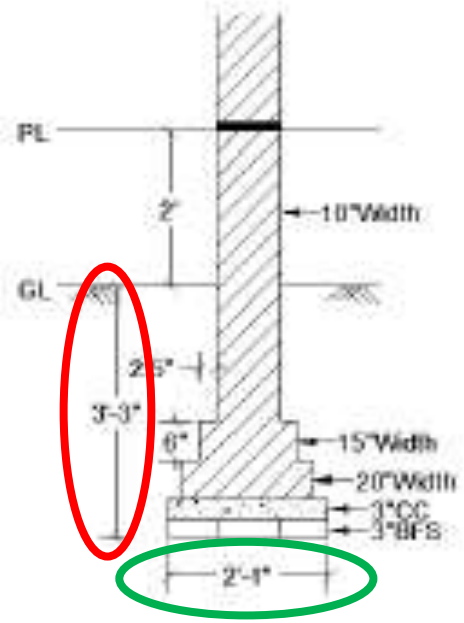
1. Estimation of Earthwork Excavation



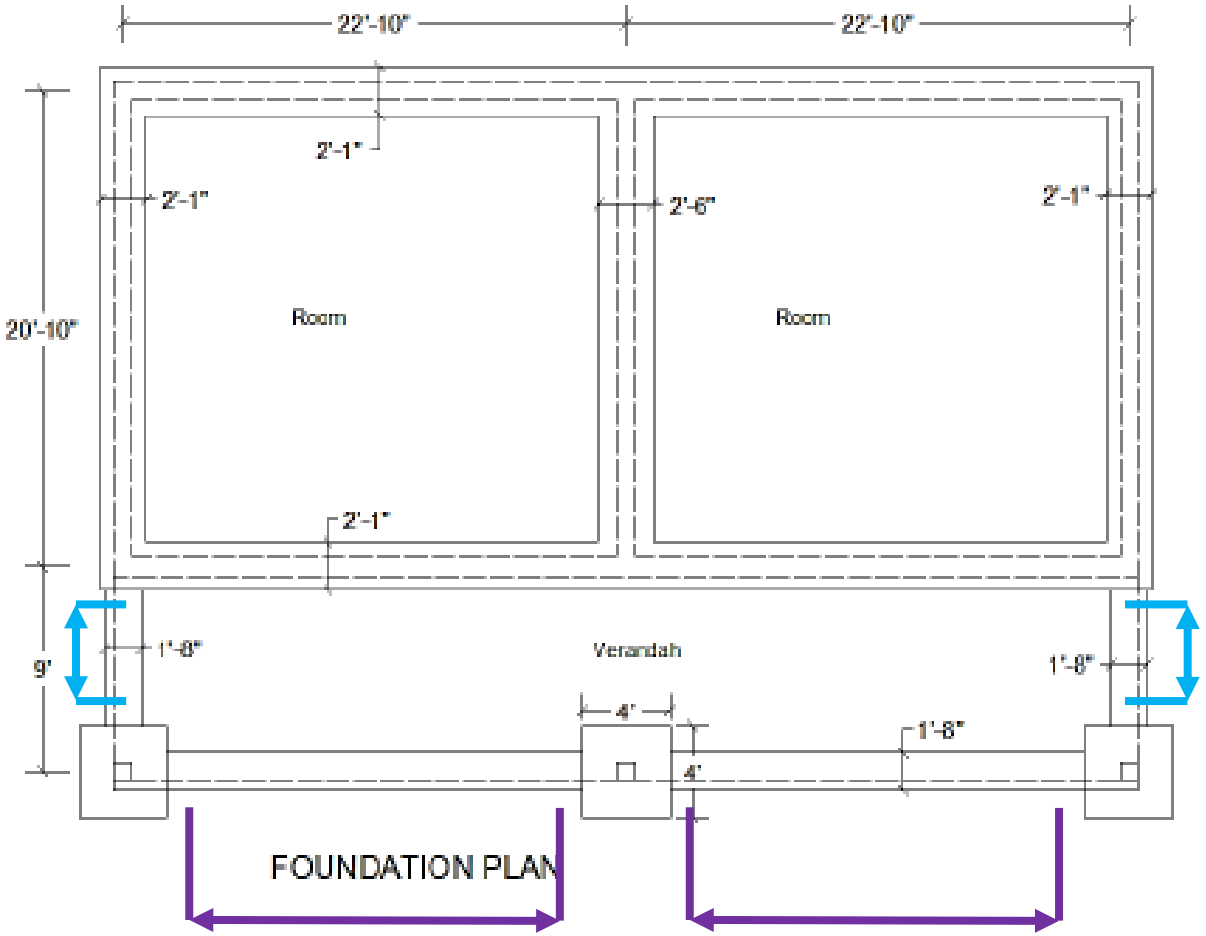
FOUNDATION PLAN

25" wall foundation:

- Height= 3'3"
- Width= (2'1")+3"+3"
- Length=((22'10"+12.5"+3")*4) +((20'10"-25"-6")*2)

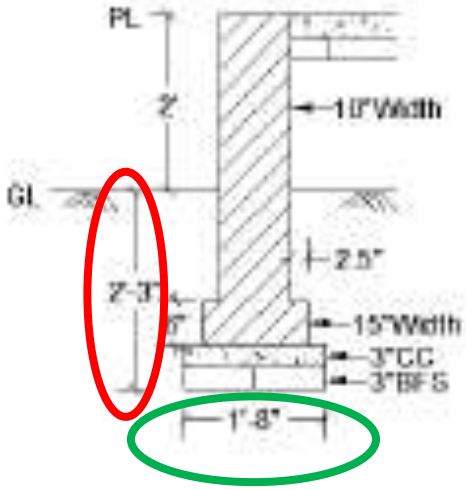


1. Estimation of Earthwork Excavation

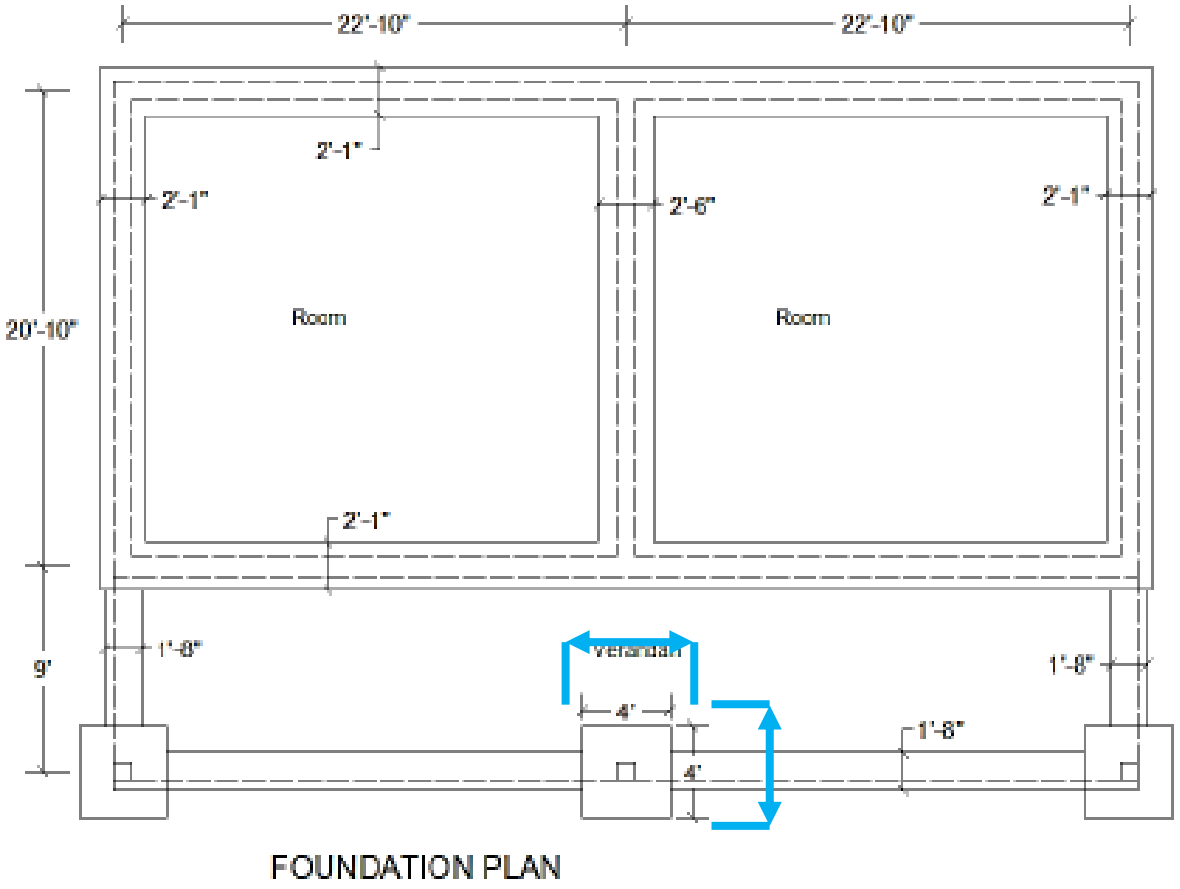


20" wall foundation:

- Height= 2'3"
- Width= (1'8")+3"+3"
- Length=((9'-2'-3"-12.5"-3")*2) + ((22'10"-4'-6")*2)



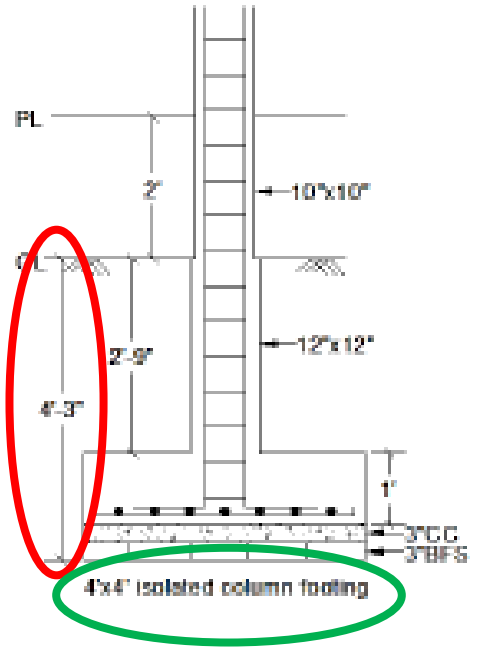
1. Estimation of Earthwork Excavation



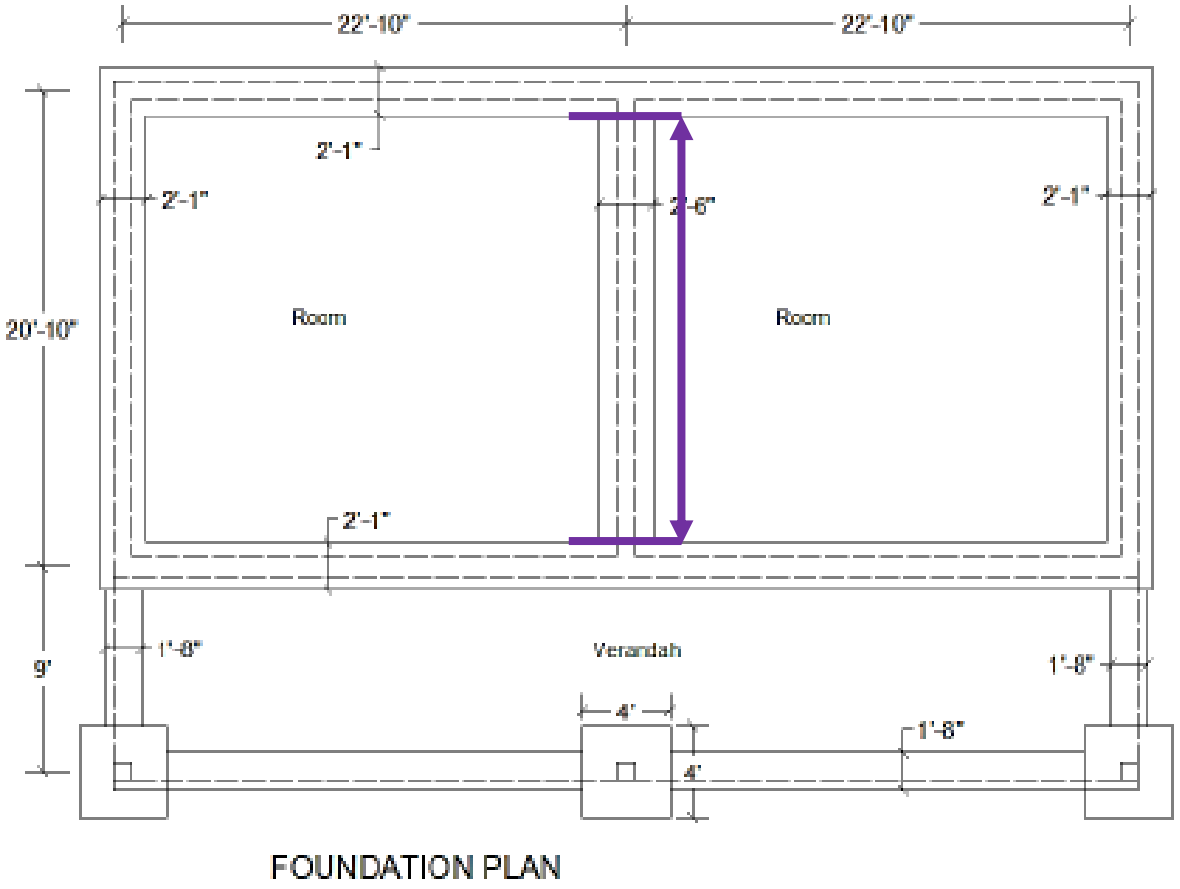
FOUNDATION PLAN

Column foundation:

- Height= 4’3”
- Width= 4’+3”+3”
- Length= 4’+3”+3”



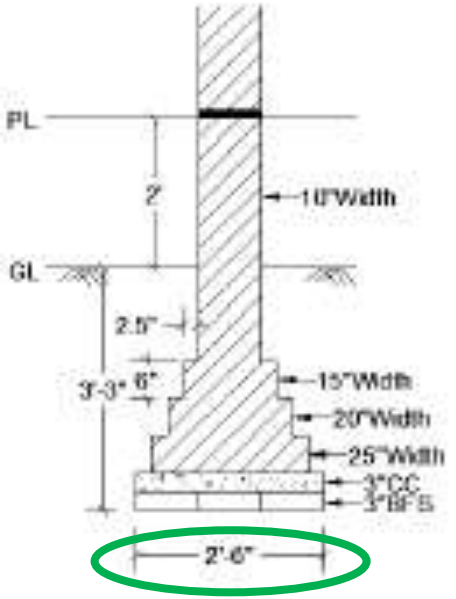
2. Estimation of Brick Flat Soling (one layer)



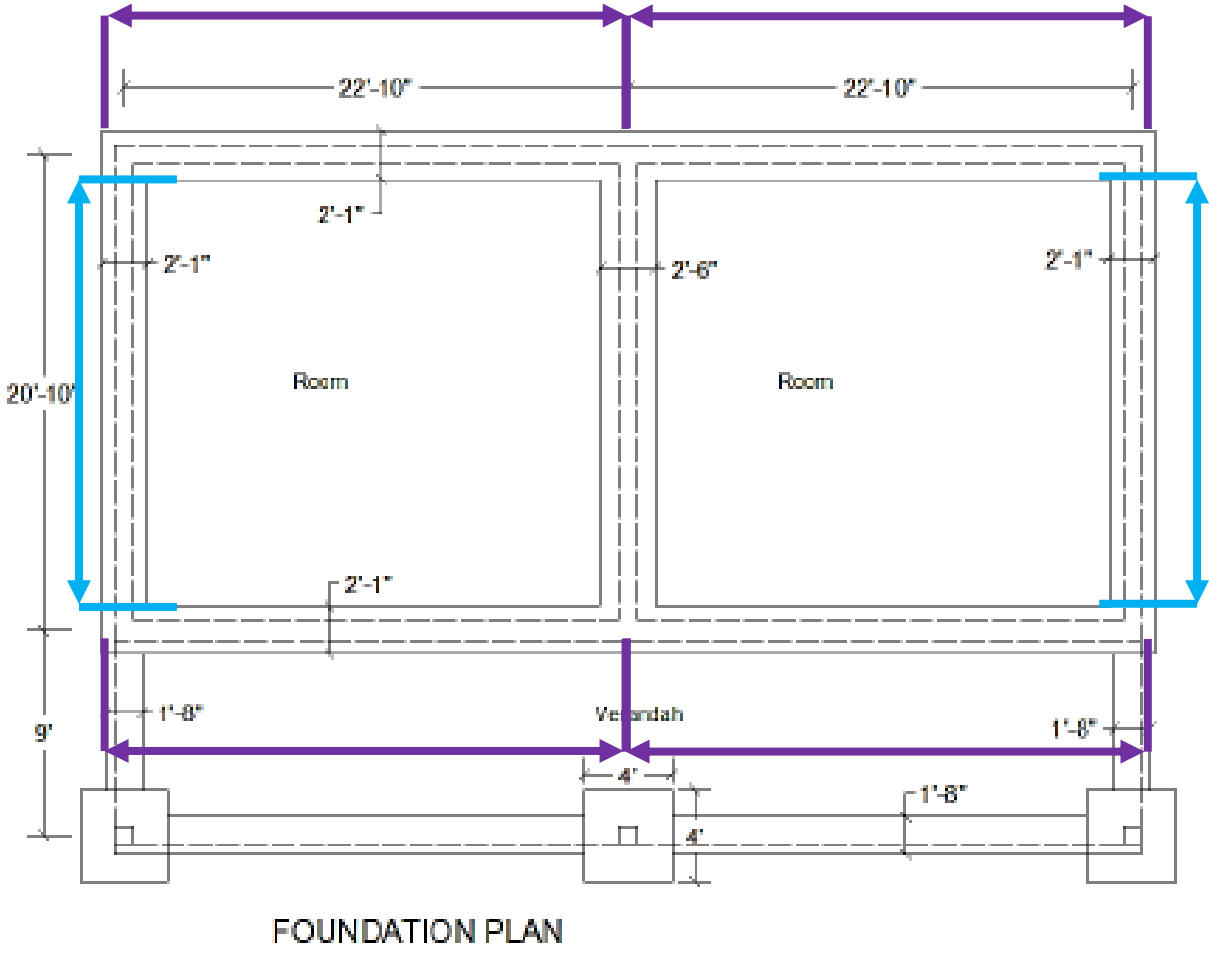
FOUNDATION PLAN

30" wall foundation:

- Width= 30"
- Length= 20'10"-25"



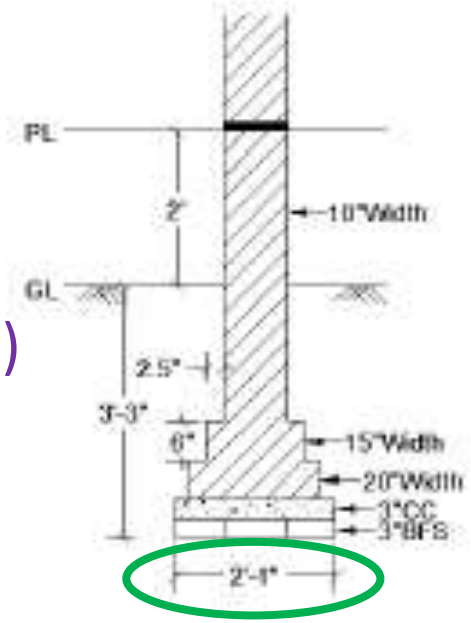
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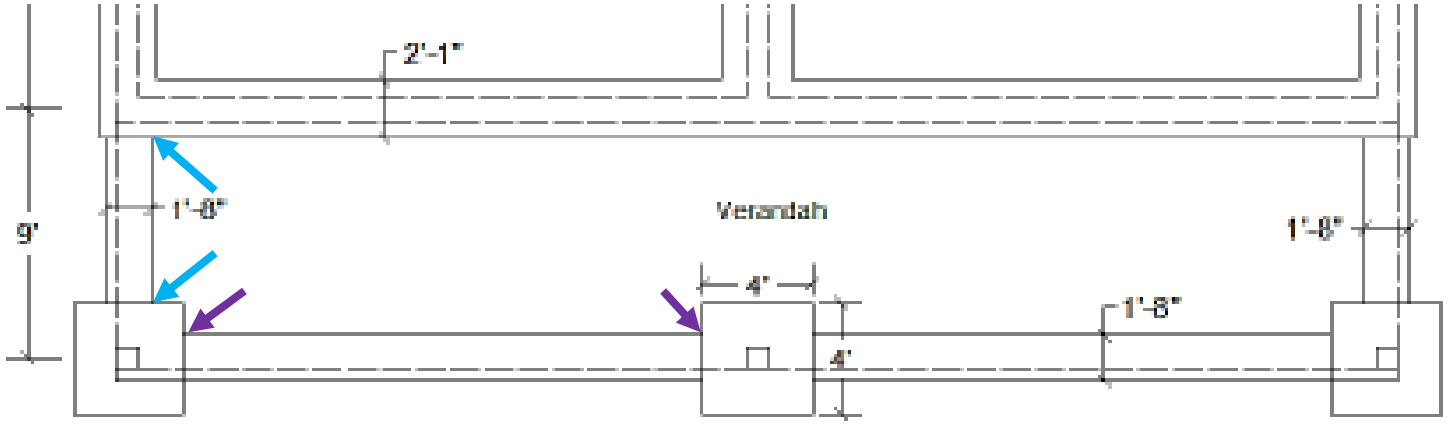
FOUNDATION PLAN

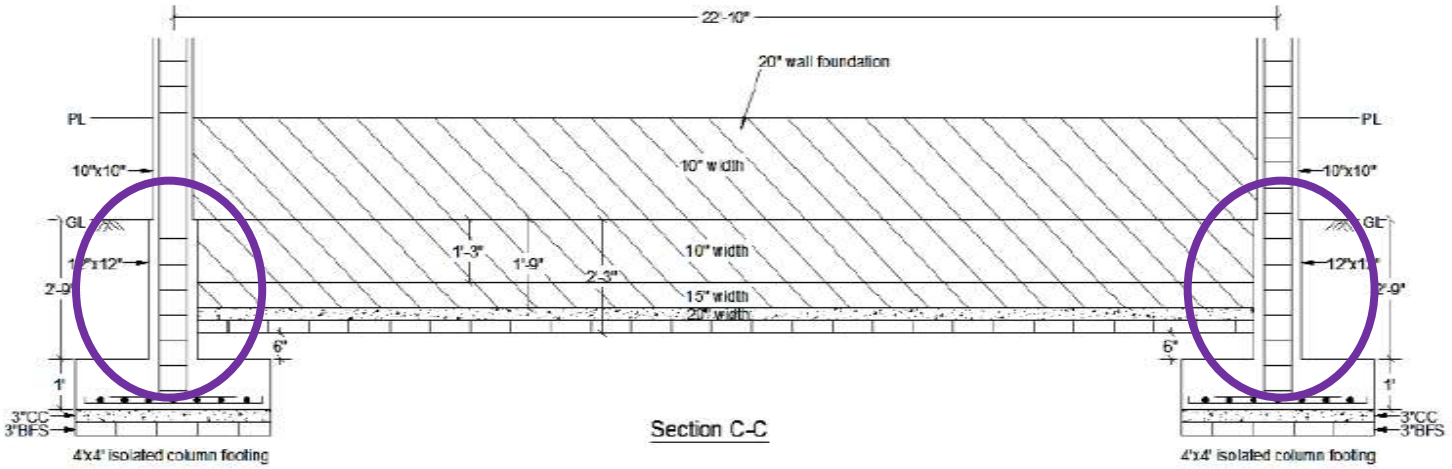
25" wall foundation:

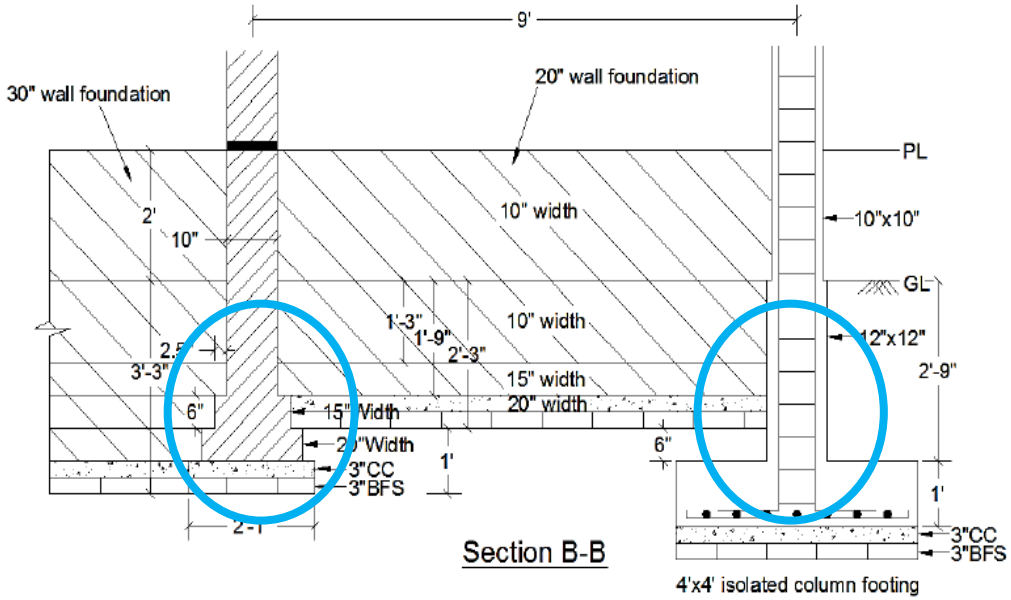
- Width= 25"
- Length=((22'10"+12.5") *4)+((20'10"-25")*2)



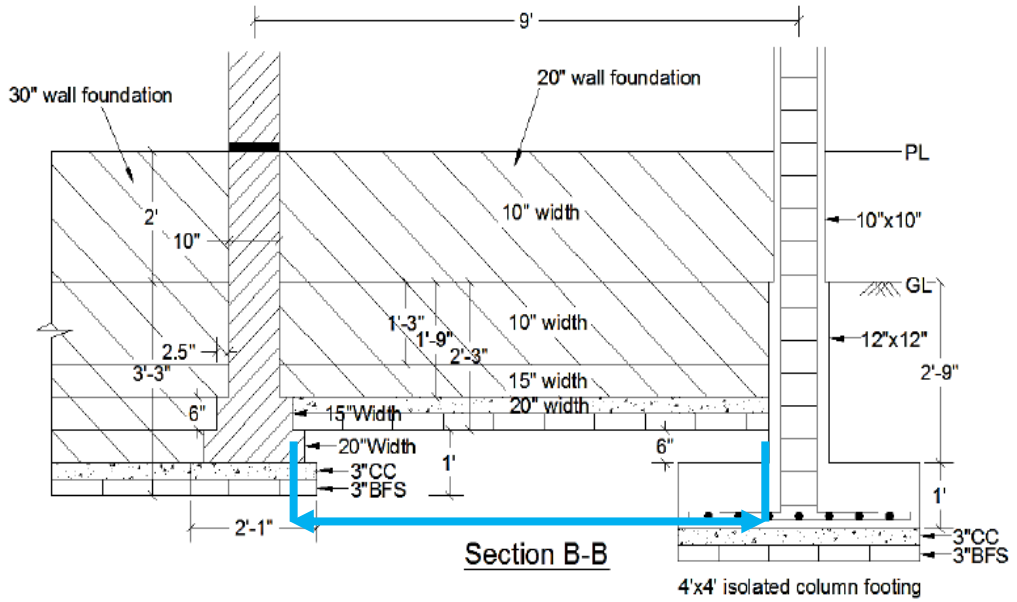
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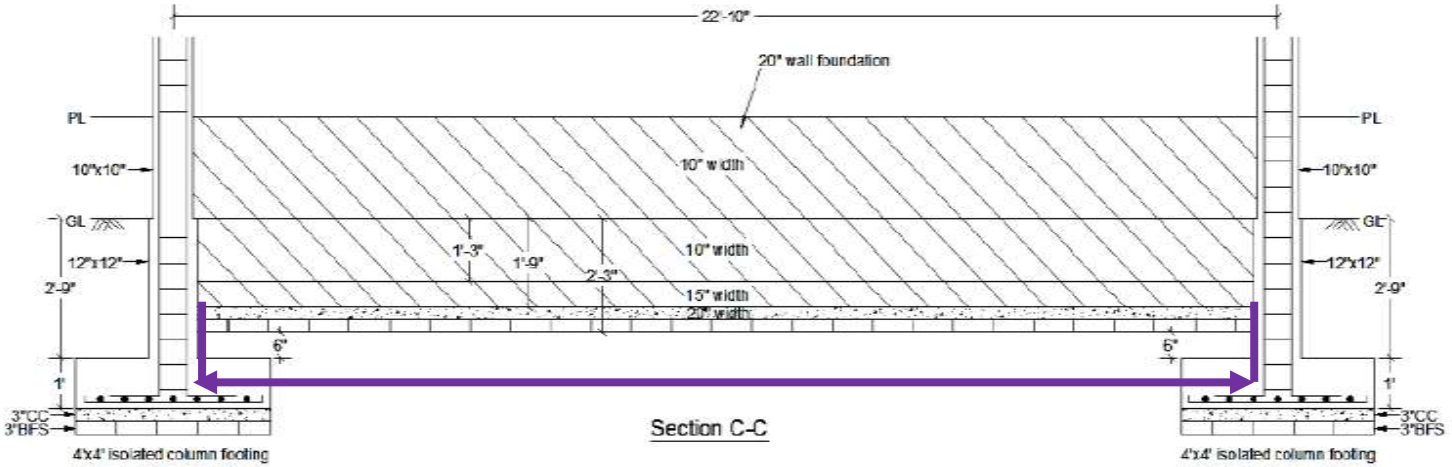






2. Estimation of Brick Flat Soling (one layer)

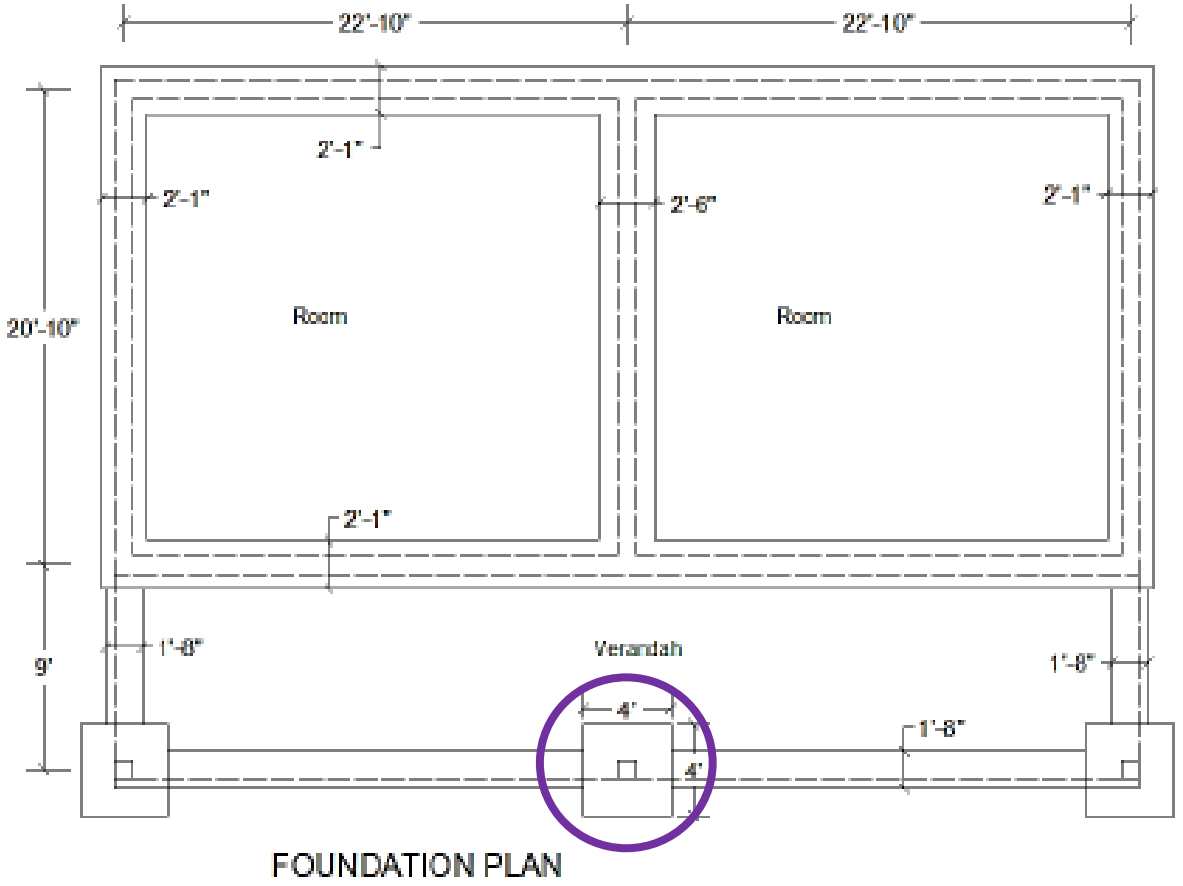




20" wall foundation:

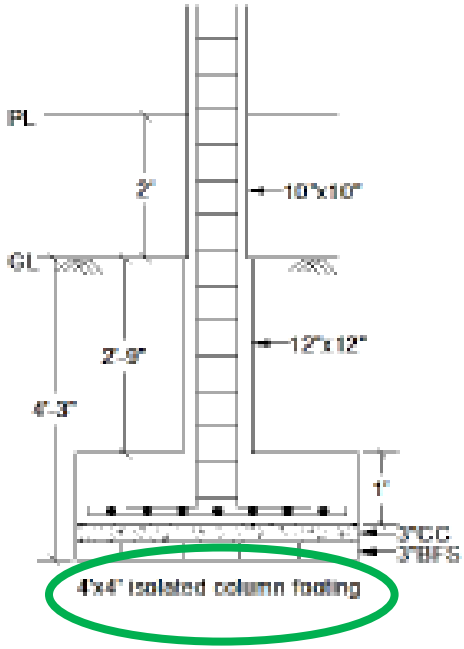
- Width= 20"
- Length=((9'-6"-7.5")*2) + ((22'10"-12")*2)

2. Estimation of Brick Flat Soling (one layer)

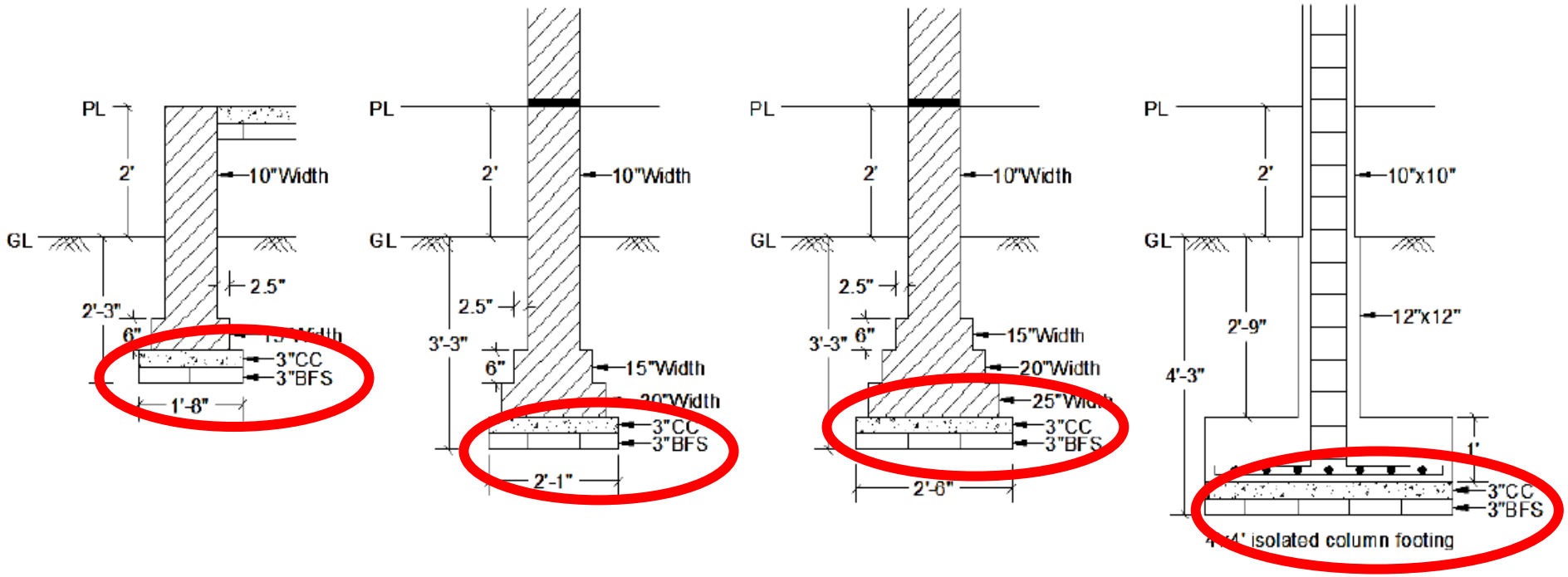


Column foundation:

- Width= 4’
- Length= 4’

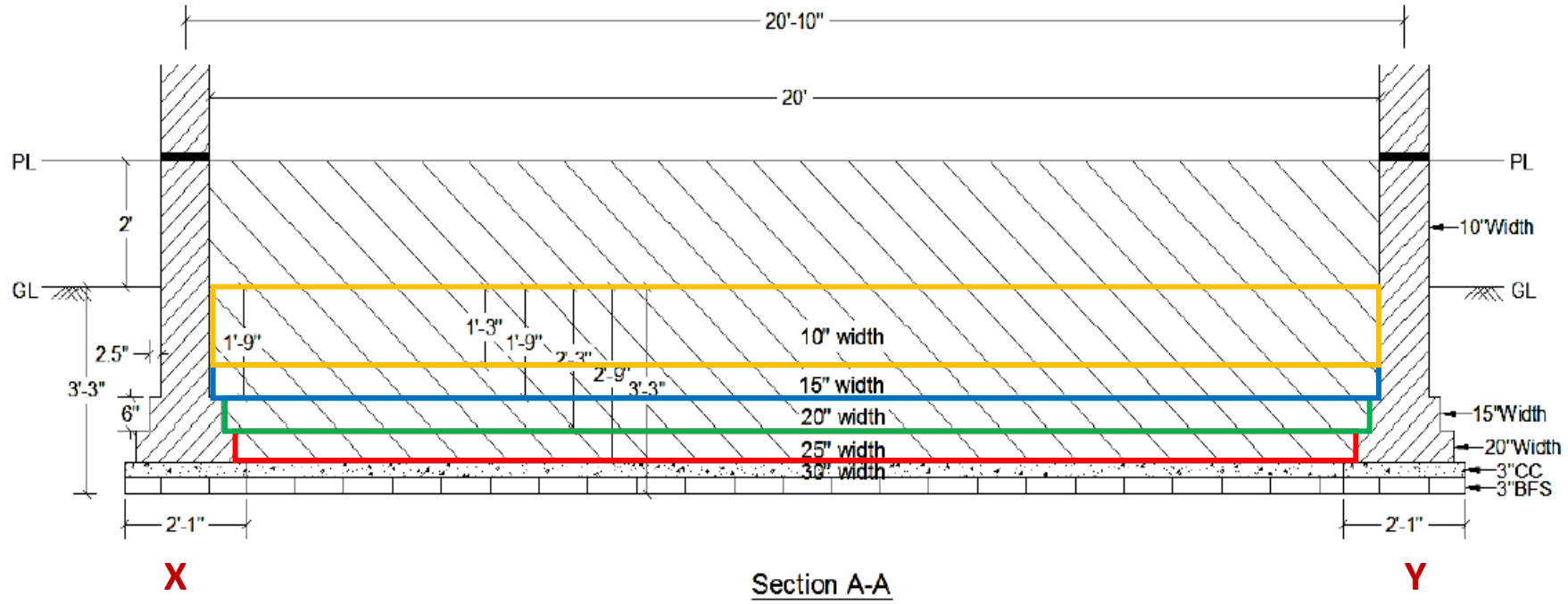


3. Estimation of Cement Concrete (1:3:6) in Foundation



- Length and width **same as BFS**!!!! For cement concrete, 3” thickness is to be considered for volume calculation

4. Estimation of Brickwork up to GL (30” wall foundation)



- The 30” wall foundation has a series of steps. At the bottom, its width is 30” and it gradually reduces to 10” decreasing by 5” in each step. The length along **XY** for each foundation width however increases by 5” as we move upwards

4. Estimation of Brickwork up to GL (30” wall foundation)

25” width:

- Height= 6”
- Width= 25”
- Length= 20’10”-25”+5”

20” width:

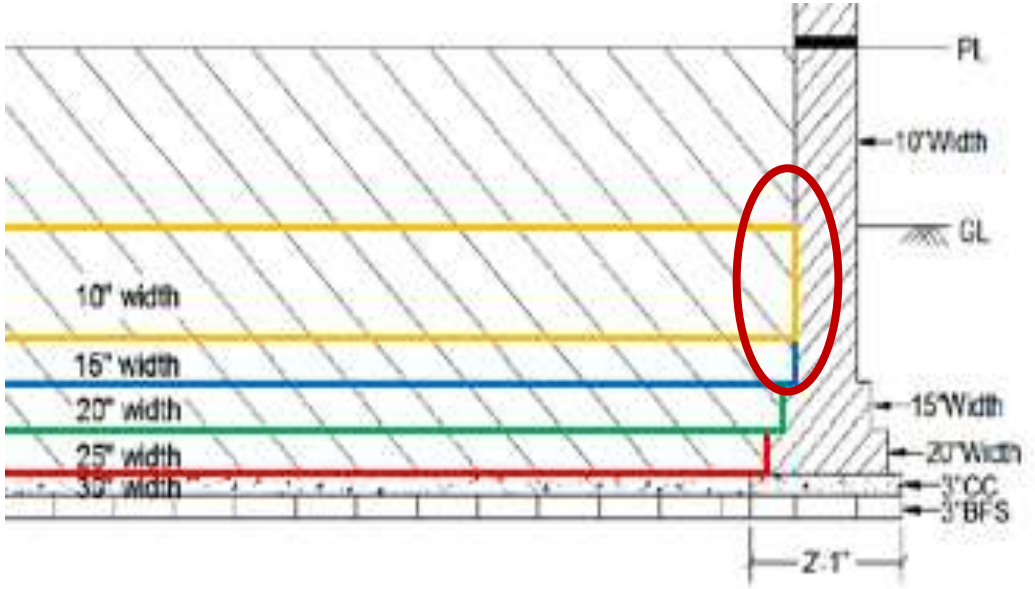
- Height= 6”
- Width= 20”
- Length= 20’10”-25”+5”+5”

15” width:

- Height= 6”
- Width= 15”
- Length= 20’10”-25”+5”+5”+5”

10” width:

- Height= 15”
- Width= 10”
- Length= 20’10”-25”+5”+5”+5”



4. Estimation of Brickwork up to GL (25” wall foundation)

Along AE, there is a **2.5”** decrease in length for 20” wall . However, along AD, there is a **5”** increase.

20” width:

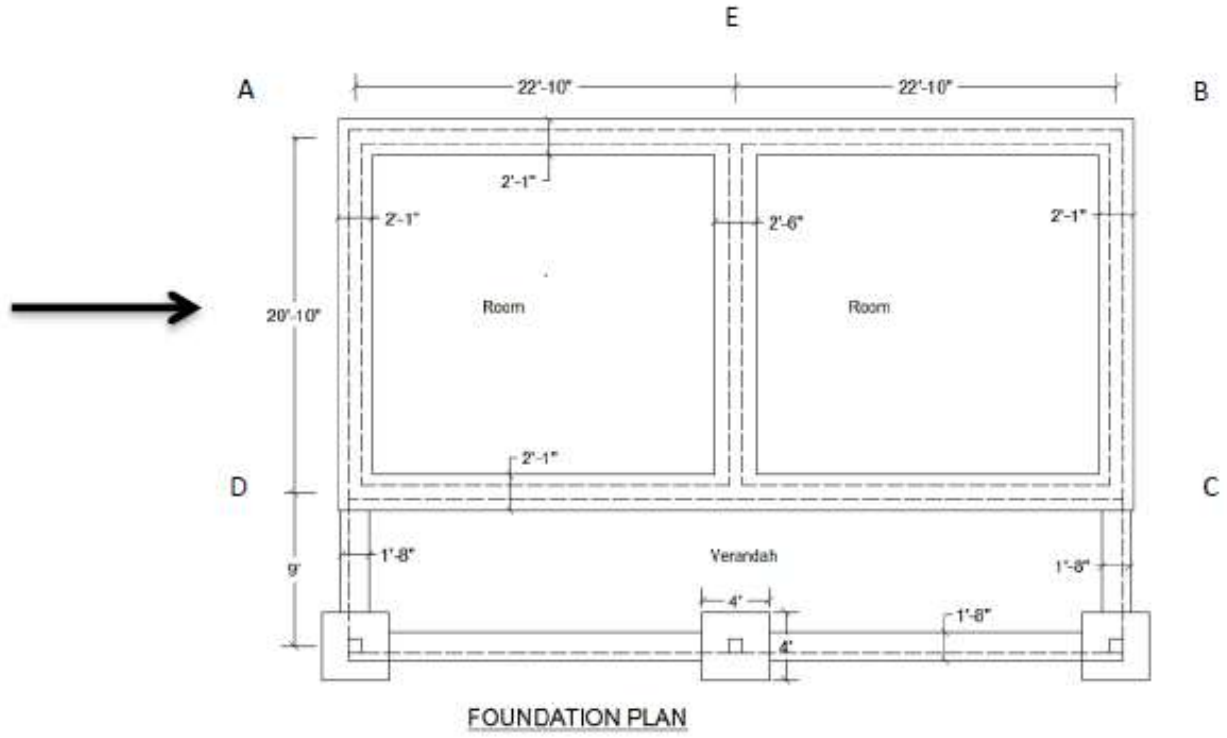
- Height= 6”
- Width= 20”
- Length= ((22’10”+12.5”-2.5”)*4) + ((20’10”-25”+5”)*2)

15” width:

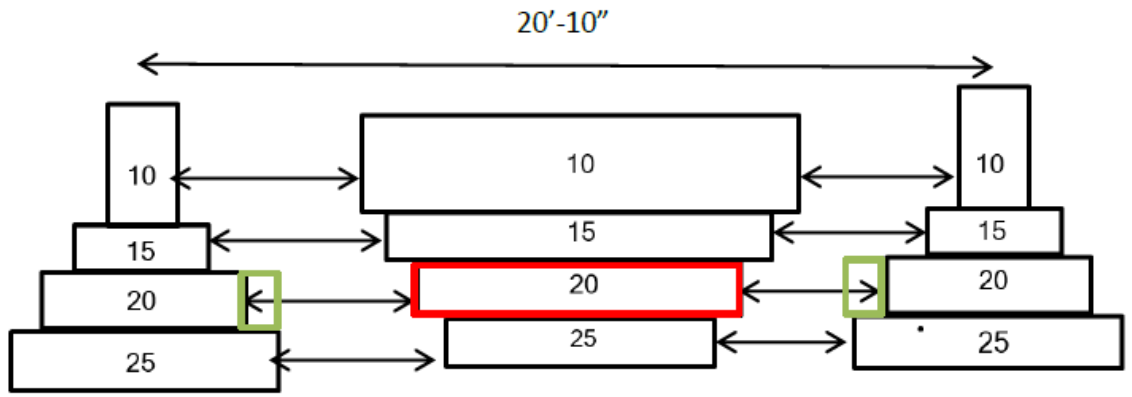
- Height= 6”
- Width= 15”
- Length= = ((22’10”+12.5”-5”)*4) + ((20’10”-25”+10”)*2)

10” width:

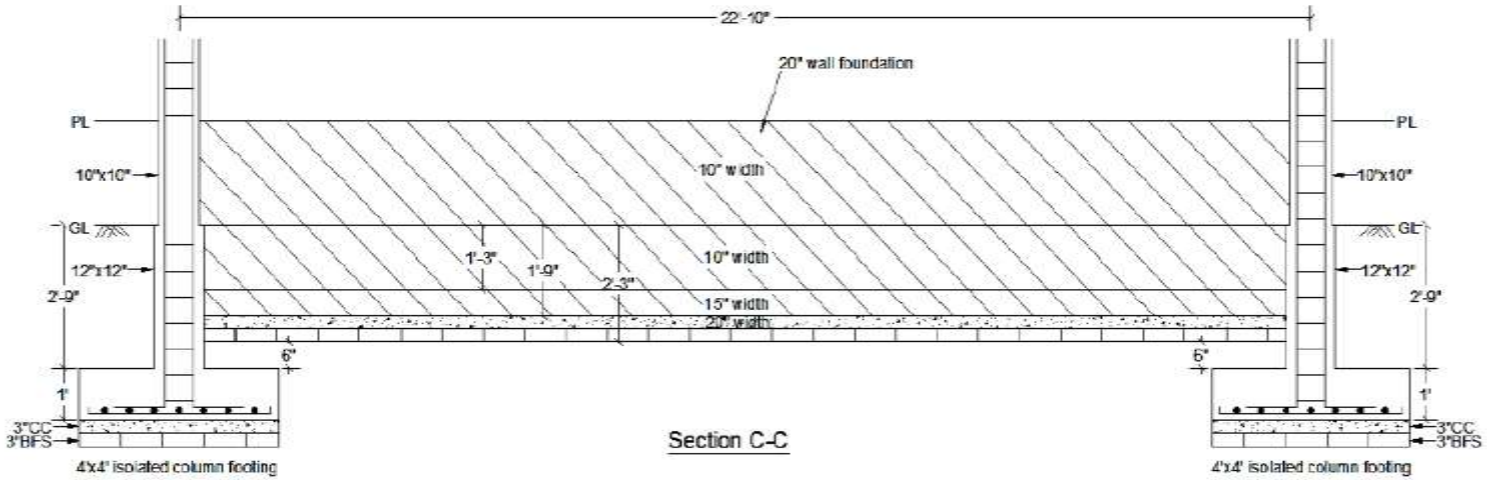
- Height= 21”
- Width= 10”
- Length= = ((22’10”+12.5”-7.5”)*4) + ((20’10”-25”+15”)*2)



FOUNDATION PLAN



4. Estimation of Brickwork up to GL (20” wall foundation)

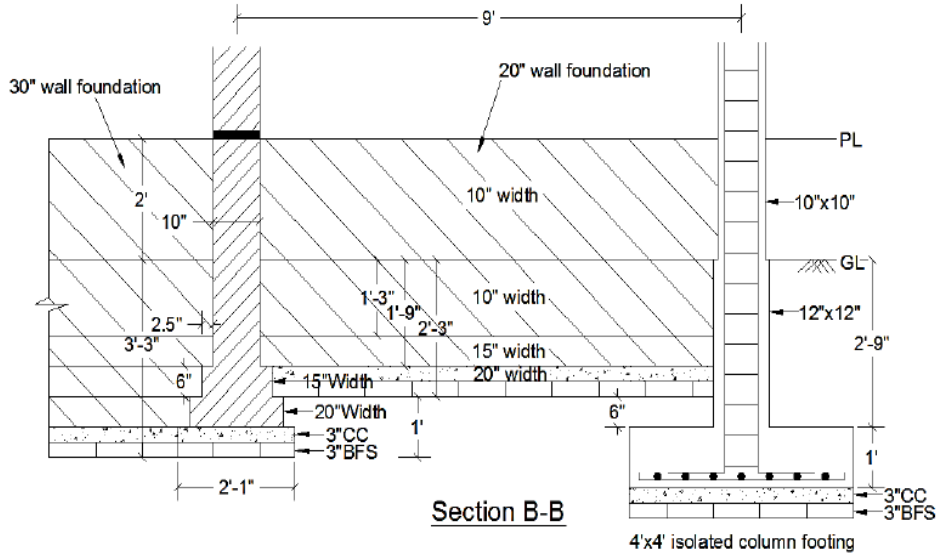


15” width:

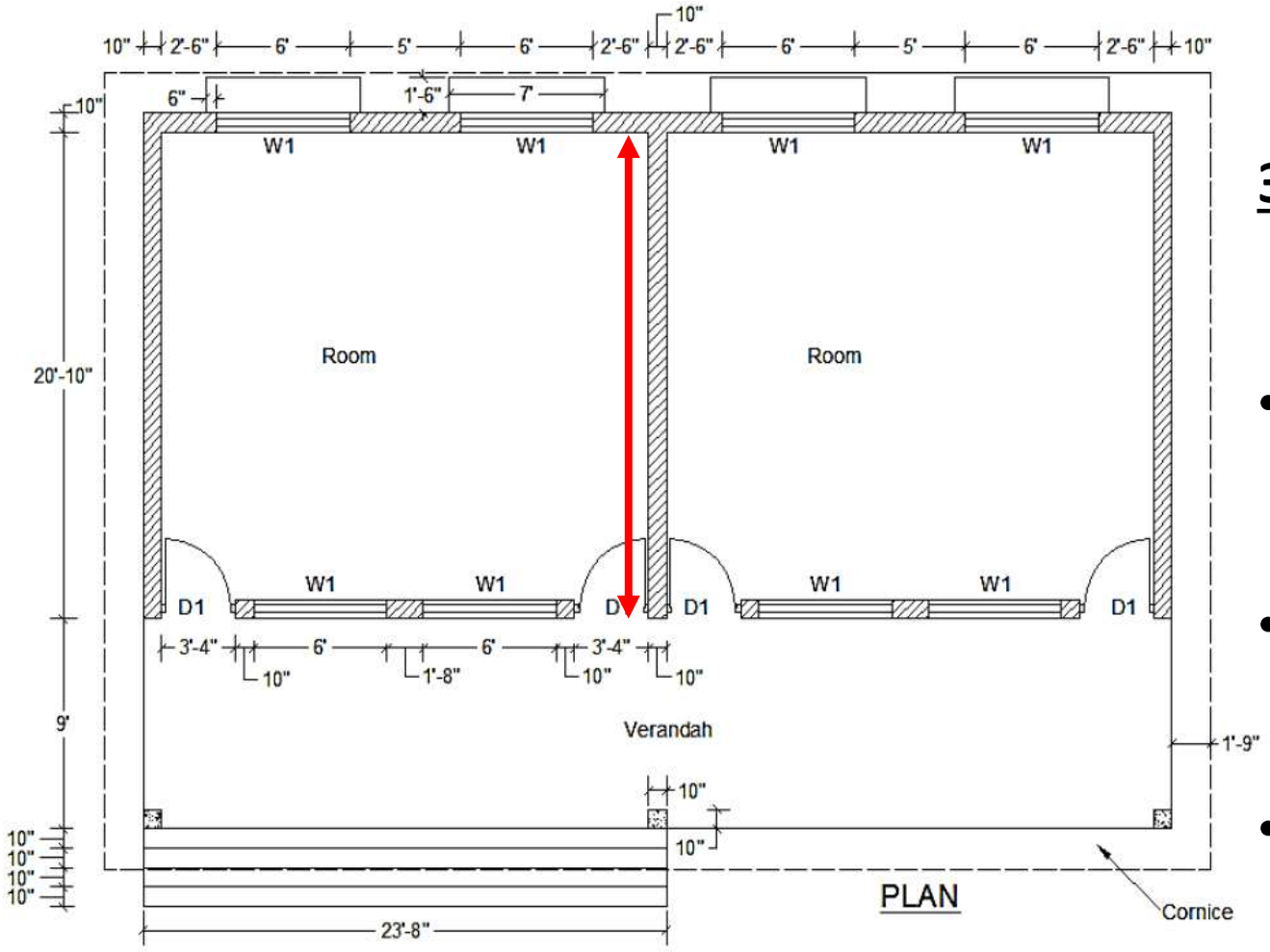
- Height= 6”
- Width= 15”
- Length= = ((9-6”-5”)*2) + ((22’10”-12”)*2)

10” width:

- Height= 15”
- Width= 10”
- Length= = ((9-6”-5”)*2) + ((22’10”-12”)*2)

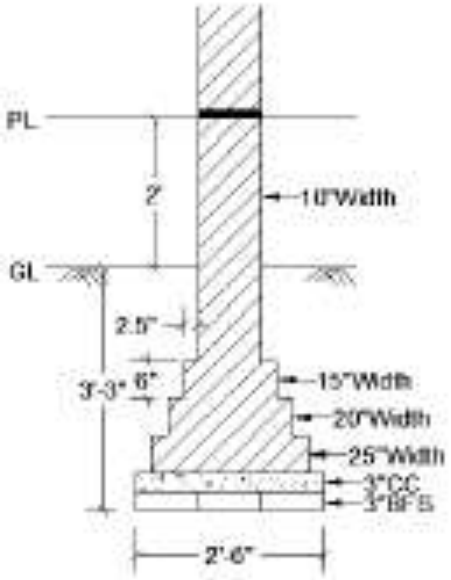


5. Estimation of Brickwork from GL to PL

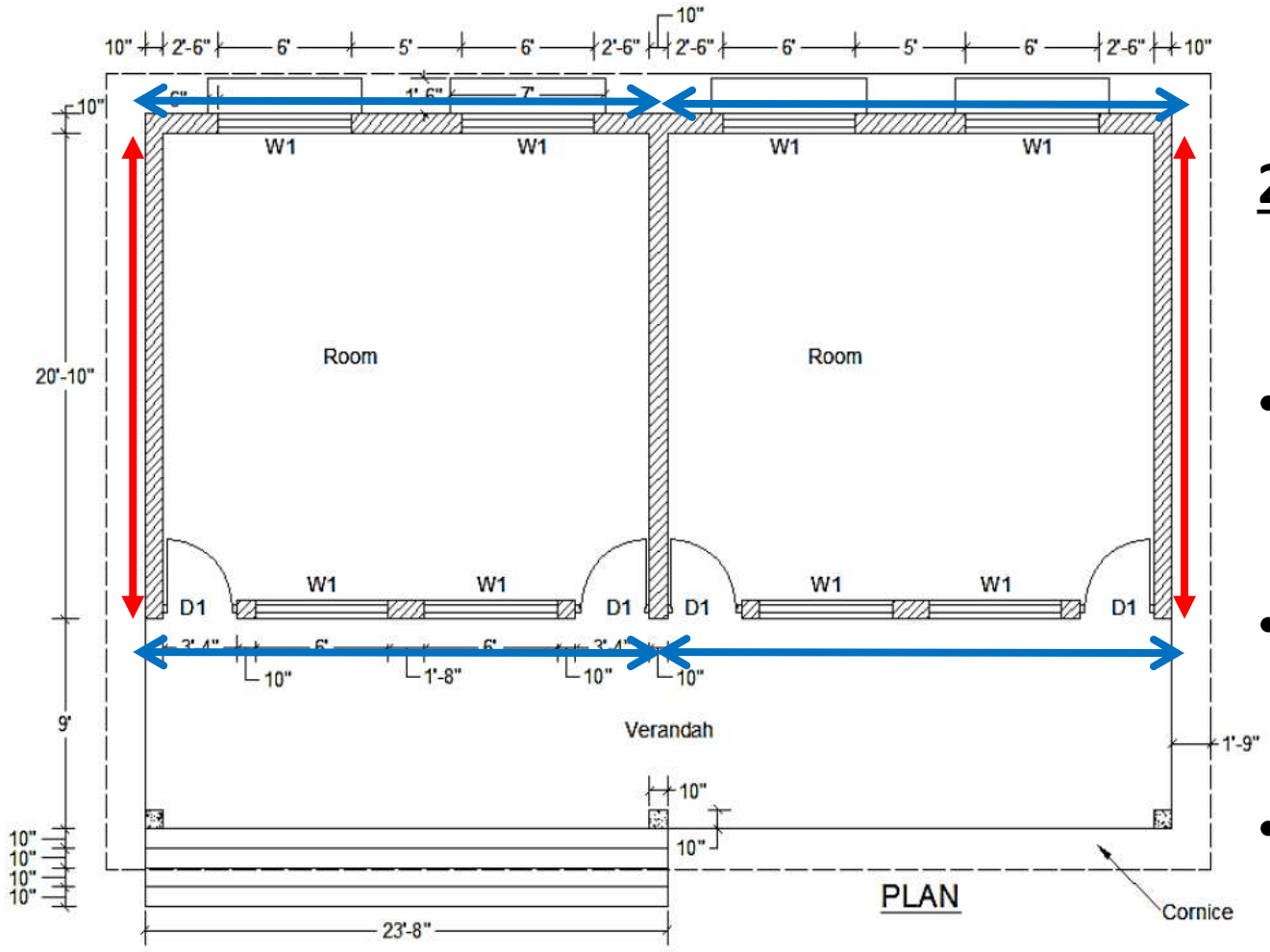


30” wall foundation:

- Height= 2’
- Width= 10”
- Length= 20’10”-5”-5”

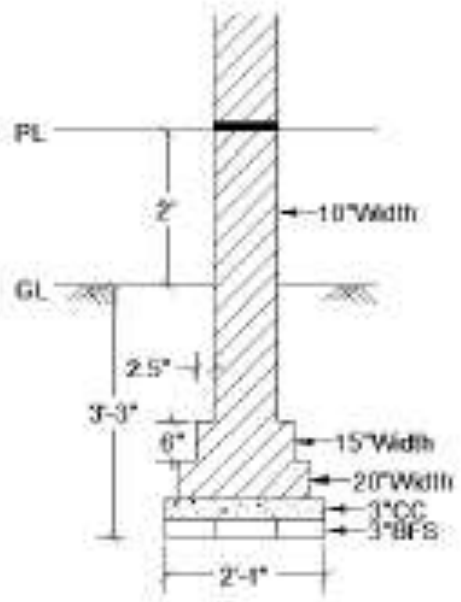


5. Estimation of Brickwork from GL to PL

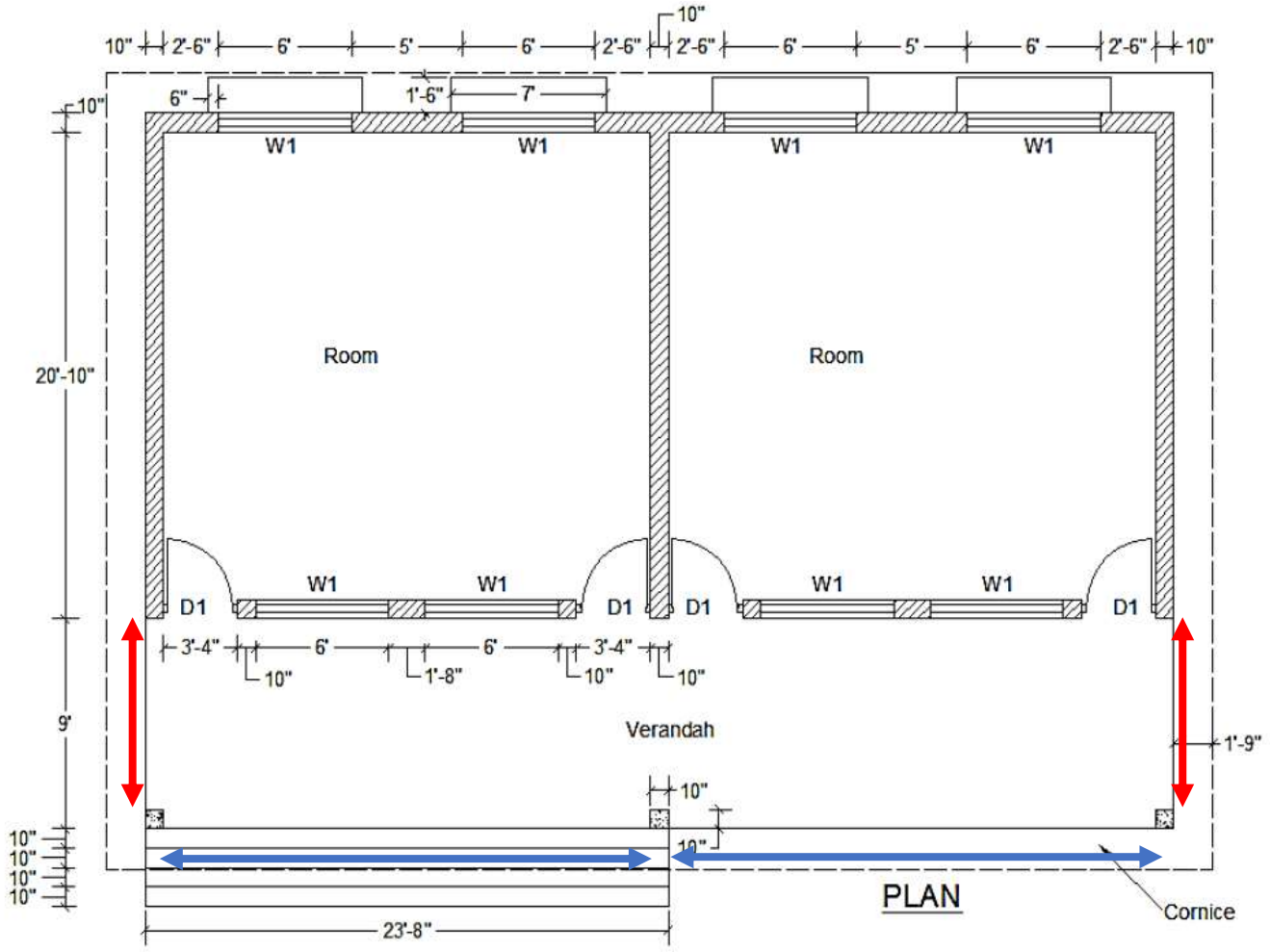


25” wall foundation:

- Height= 2’
- Width= 10”
- Length= (20’10”-5”-5”)*2 +(22’10”+5”)*4



5. Estimation of Brickwork from GL to PL

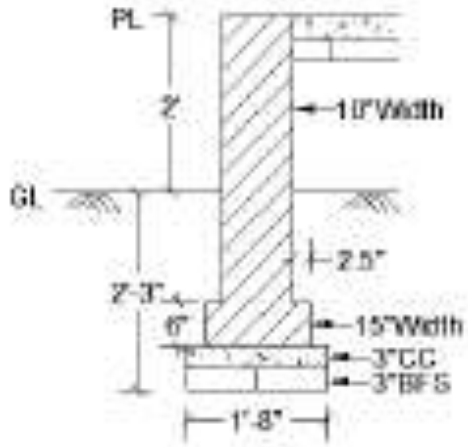


20” wall foundation:

Height= 2’

Width= 10”

Length= (9’-5”-5”)*2+(22’10”-10”)*2



6. RCC in Column (up to GL)

i) Base Slab

Volume= (4’x4’x1’)*3

i) Column

Volume= (1’x1’x1’9”)*3

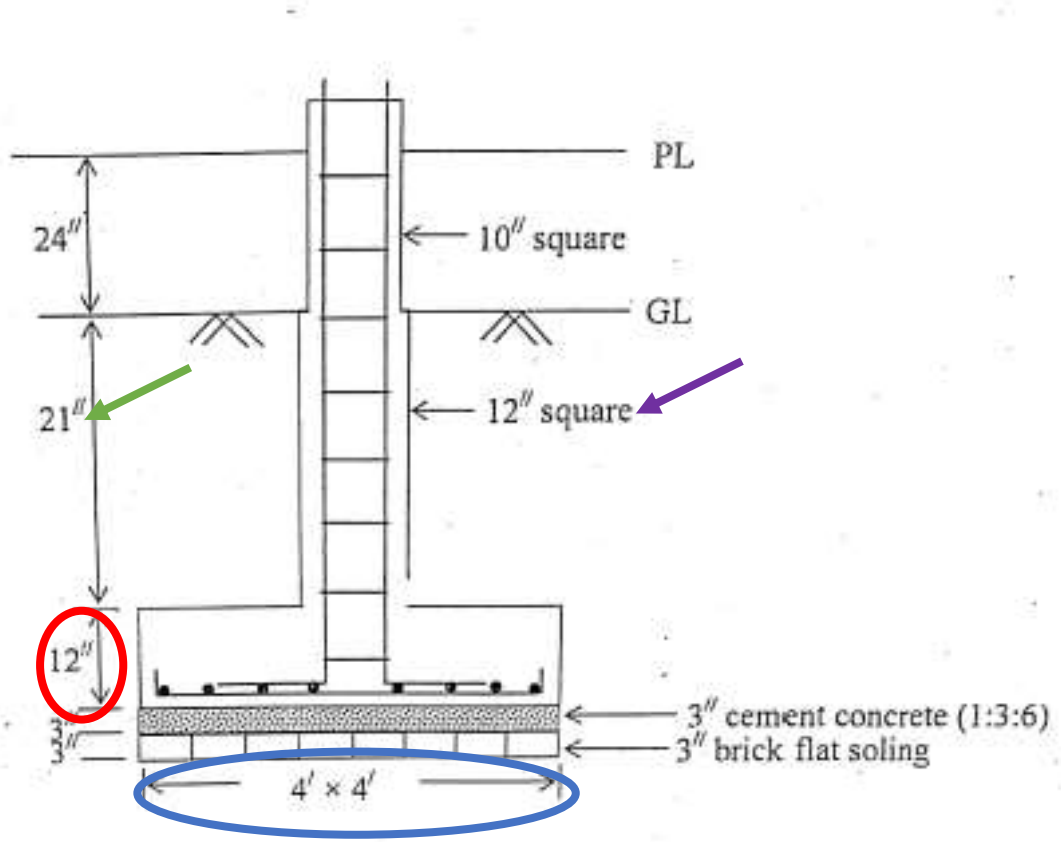


Figure: 4 ft x 4 ft isolated column footing

7. RCC in Column (GL to PL)

- Height= 2’
- Area= 10”x10”
- Volume= (2’x10”x10”)*3

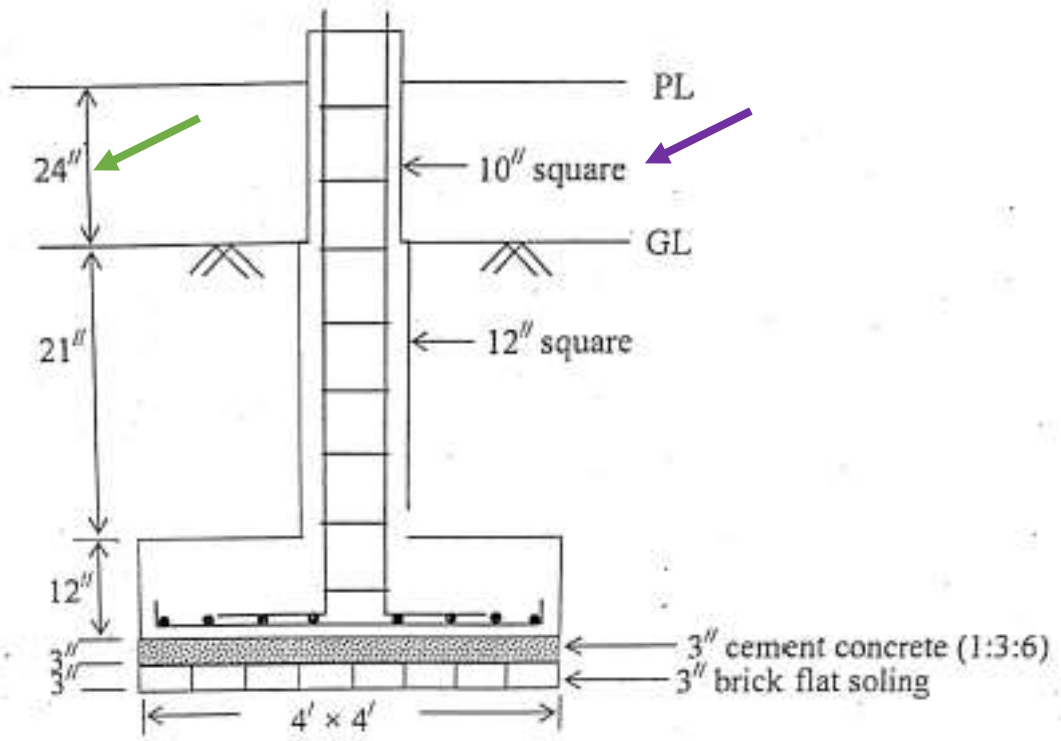


Figure: 4 ft x 4 ft isolated column footing

8. Damp Proof Course (DPC)

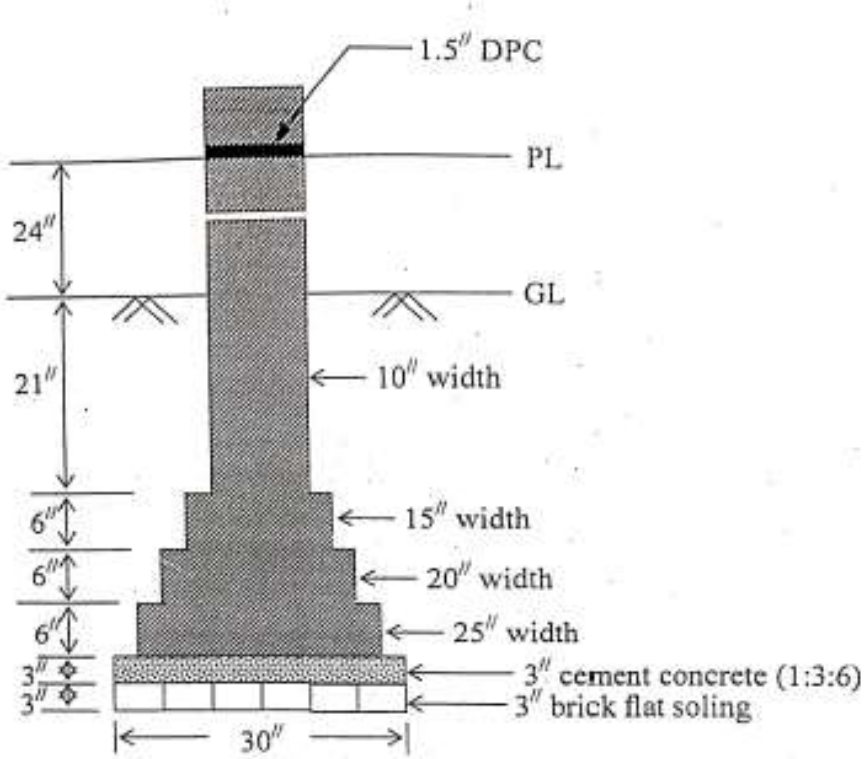


Figure: 30 inch continuous wall foundation

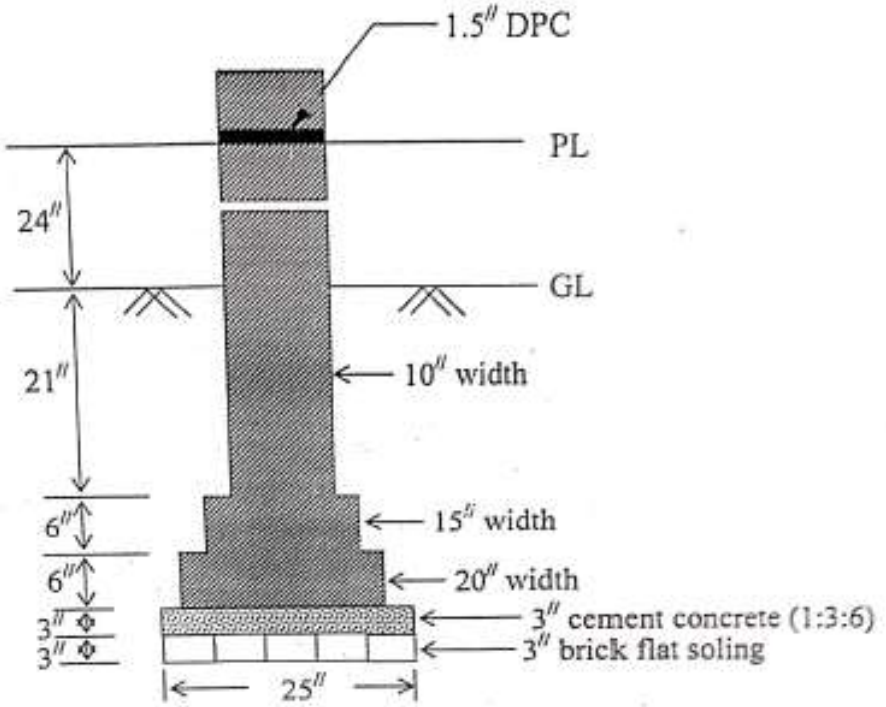


Figure: 25 inch continuous wall foundation

8. Damp Proof Course (DPC)

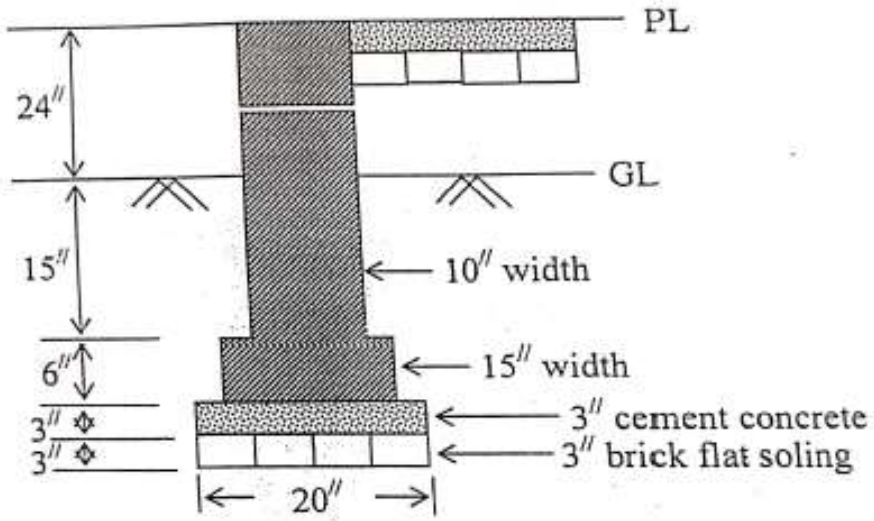


Figure: 20 inch continuous verandah wall foundation

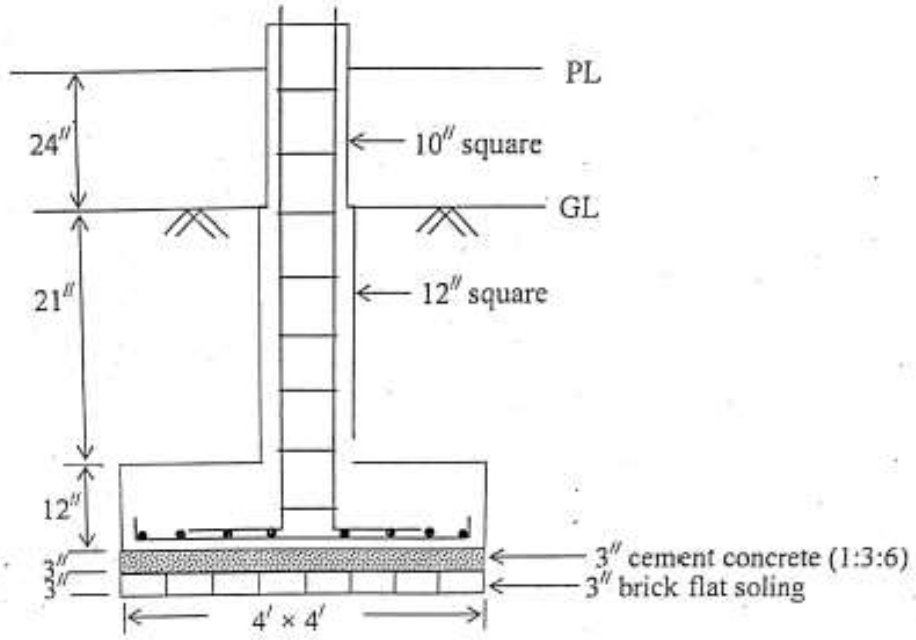
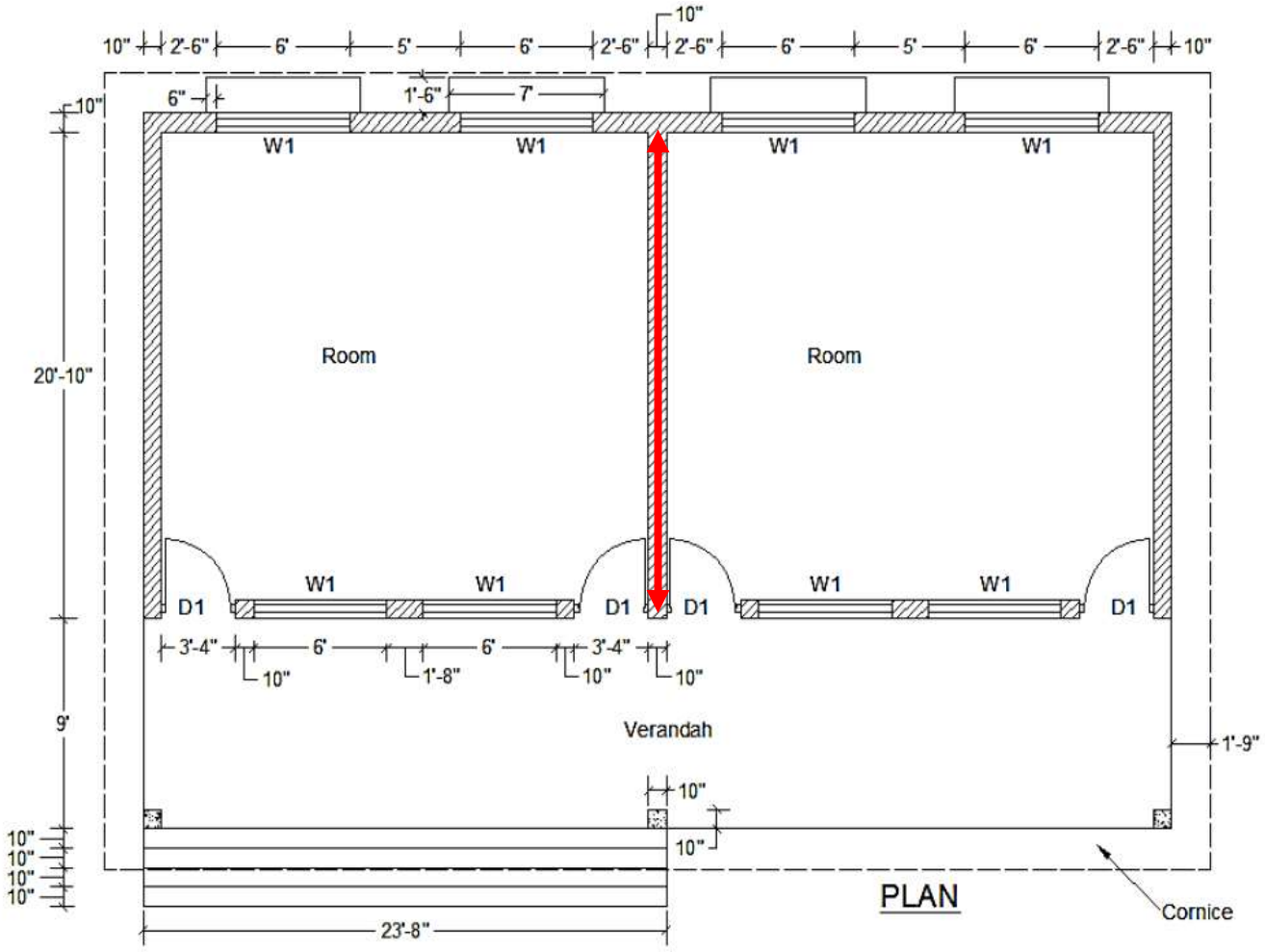


Figure: 4 ft x 4 ft isolated column footing

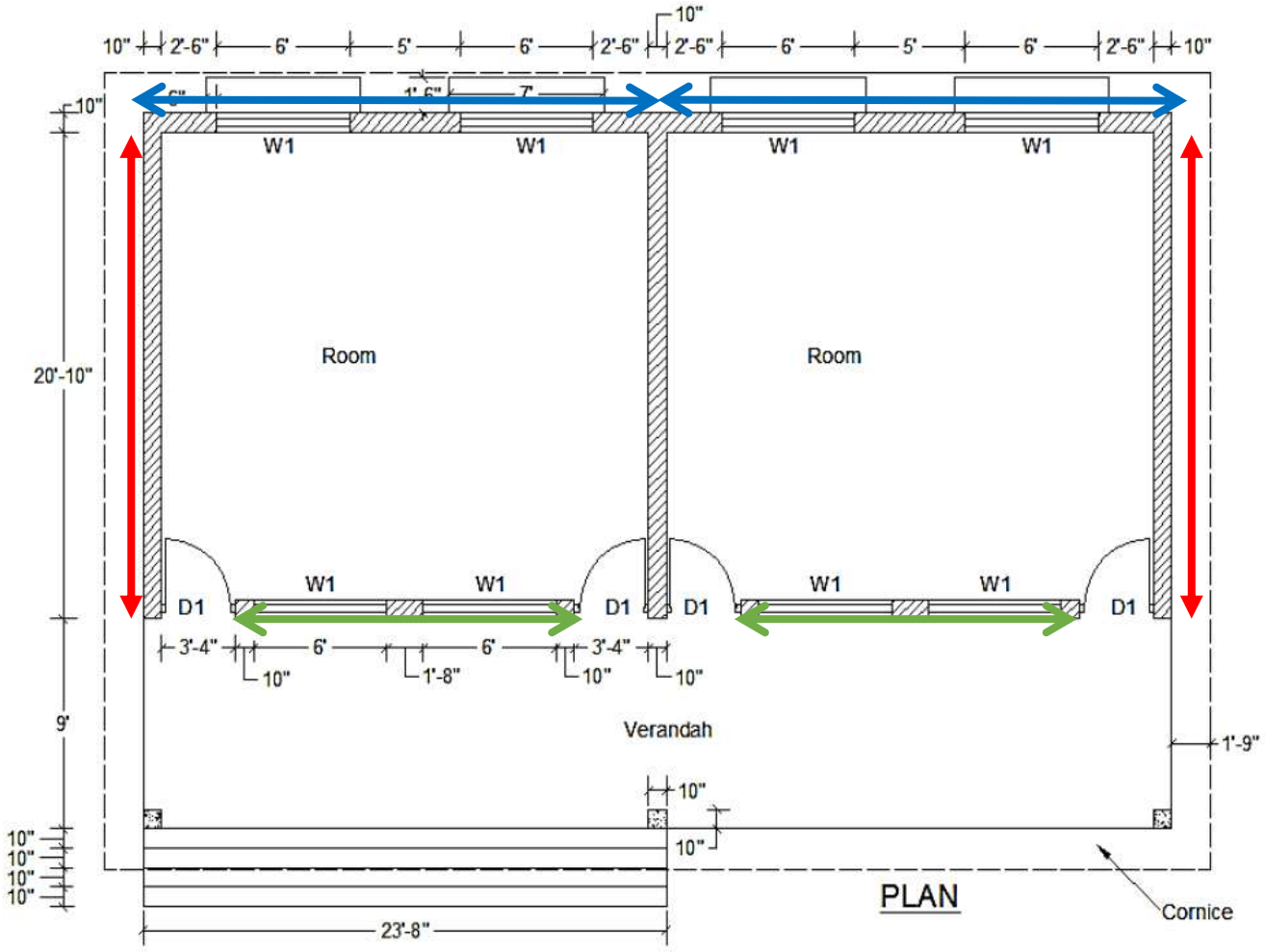
8. Damp Proof Course (DPC)



30” wall foundation:

- Thickness= 1.5”
- Width= 10”
- Length= 20’10”-10”

8. Damp Proof Course (DPC)



25" wall foundation:

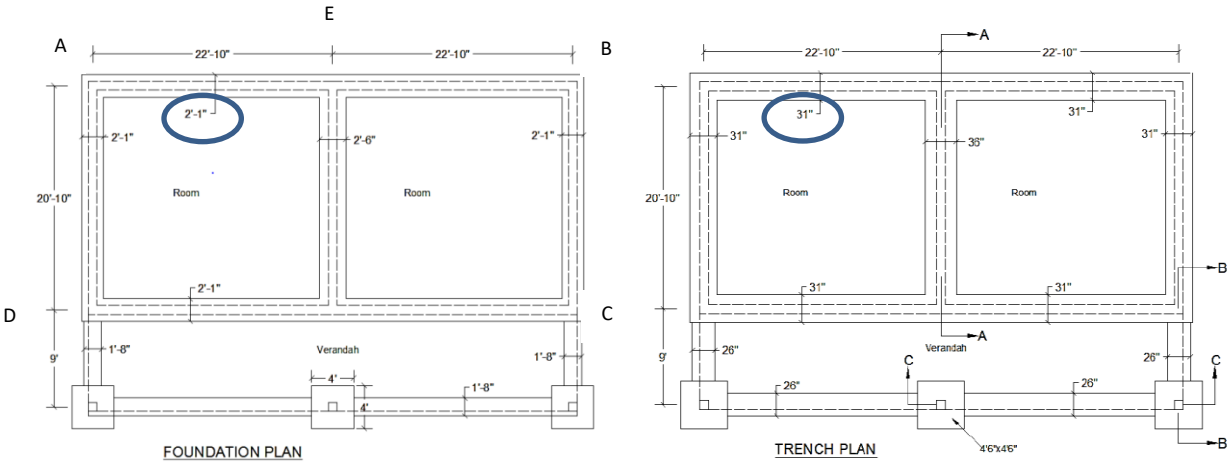
- Thickness= 1.5"
- Width= 10"
- Length= 20'*2+(22'10"+5")*2+(15'4")*2

CE 208: Building Estimation Sample Calculations

1(ii) Excavation for 25" wall foundation

Length: ((22+(10/12)+(12.5/12)+(3/12))*4)+((20+(10/12)-(25/12)- (6/12))*2)
Width: (25 + 3 + 3)/12
Height: 3 + (3/12)

For excavation dimensions, we increase the actual width of foundation by 3 inch on all sides (Compare the foundation plan and trench plan). If trench plan is given, you can obtain the dimensions directly from trench plan.



The calculation shown above is based on the foundation plan. AB and CD is taken as continuous whereas AD and BC are considered to be in between. (But you can take the opposite too)

Along AE, Length of excavation = c/c distance + Half wall width of AD + Extra excavation

$$= 22 + (10/12) + (12.5/12) + (3/12)$$

(From trench plan, 22 + (10/12) + (31/12))

Along AD

Length = c/c distance – (Half wall width of AB and DC) - (Extra excavated portion of AB and DC)

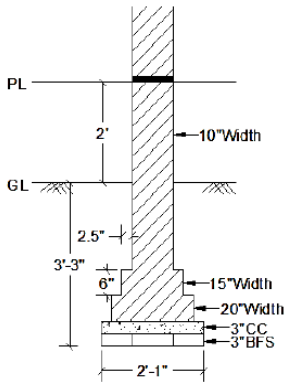
*Dimensions are subtracted as AB and DC have already been excavated

$= 22 + (10/12) – (12.5/12_{AB} + 12.5/12_{DC}) – (3/12_{AB} + 3/12_{DC})$

(From trench plan, 22 + (10/12) – (31/12))

Therefore total length: ((22+(10/12)+(12.5/12)+(3/12))*4)+((20+(10/12)-(25/12)- (6/12))*2)

Note: Dimensions used in calculation are in feet



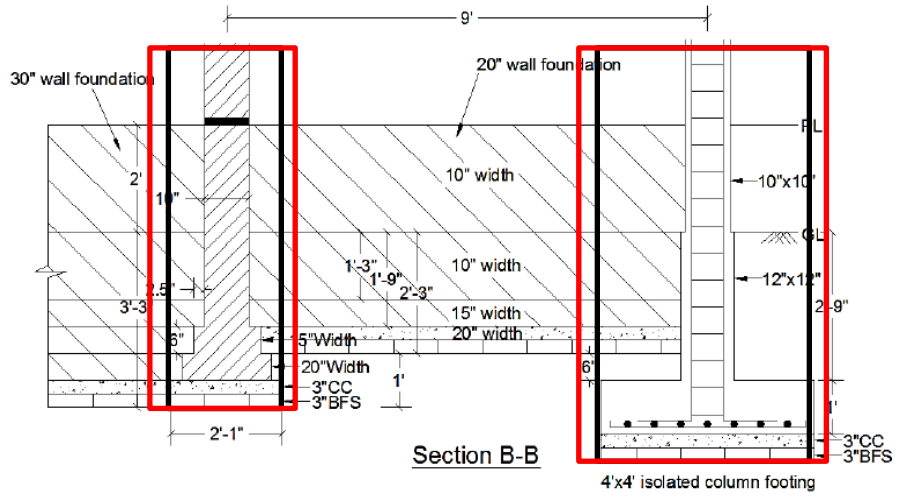
Width = $2 + (1/12) + (3/12_{Left}) + (3/12_{Right})$

Height below GL = $3 + (3/12)$

1 (iii) Excavation for 20 inch wall foundation

Length: ((9 - 2 - (3/12) - (12.5/12) - (3/12))*2) + ((22 + (10/12) - 4 - (6/12))*2)

Note: Since the depth of column footing is greater than 20" wall foundation, the former is excavated earlier.



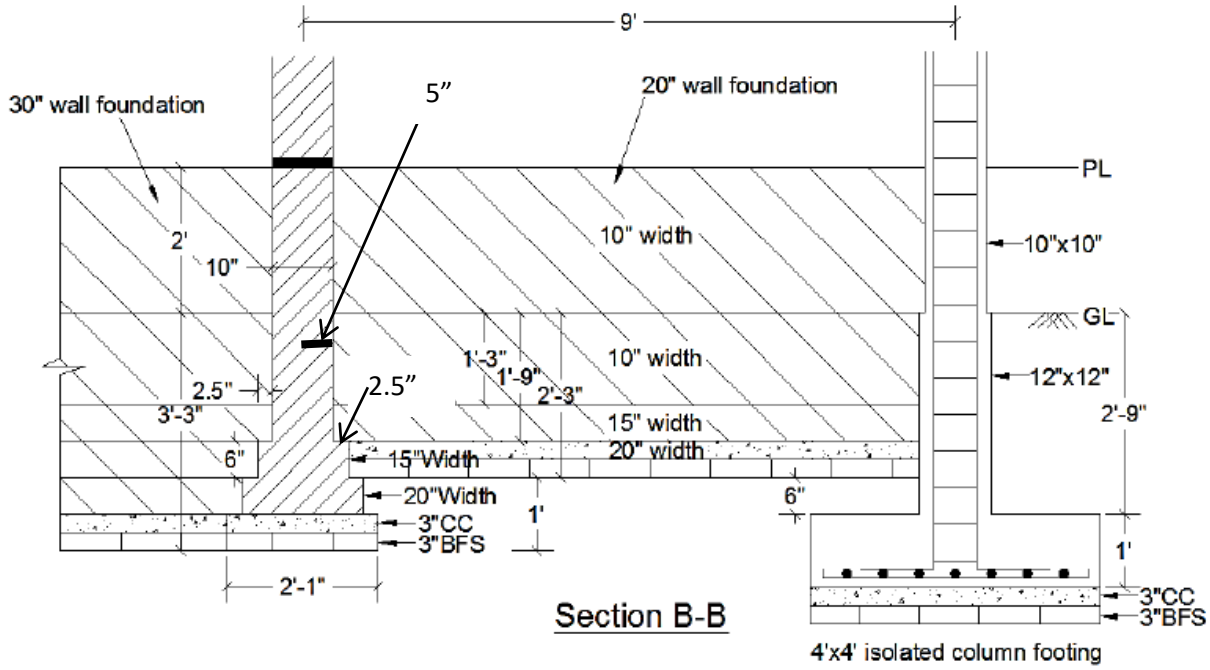
The black rectangles indicate the excavated portion if the actual width of foundation was used and the red lines indicate 3 inch portion extra excavated length on each side of foundation.

2. For brick flat soling (BFS) below foundation, we only calculate the area in order to determine the number of bricks required for covering the entire area. Cement concrete layer above BFS has the same width and length as in BFS. Only height is incoporated to determine its volume.

Note: Dimensions used in calculation are in feet

2(iii) Brick Flat Soling (BFS)

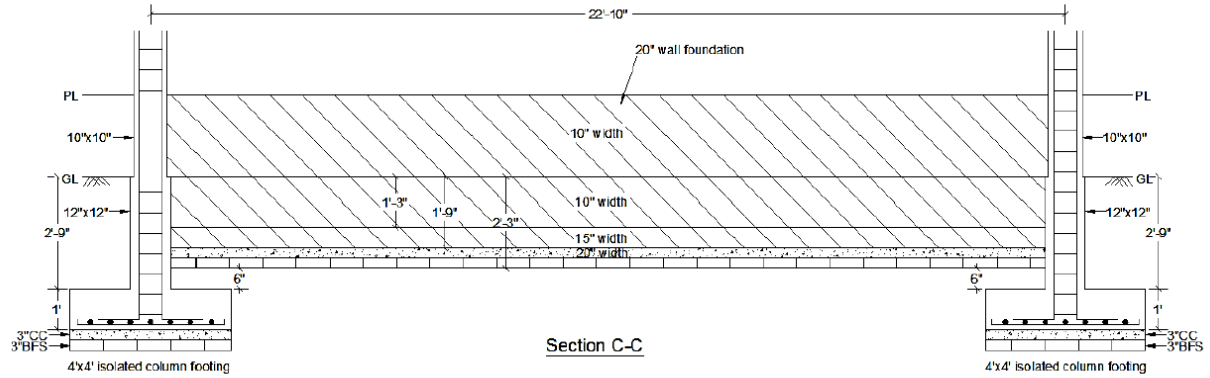
In order to find the length of **BFS**, you may consider the section view to find the relative height of foundations and obtain the lengths from the foundation plan.



9' is the center to center distance. BFS of 20" wall foundation meets the 25" wall foundation and the column footing at a depth of 2'3" below GL. At that depth, width of brick wall footing is 15" and column width is 12". So, from 9 feet you need to subtract half the wall width that is 7.5" (5" of inner portion and 2.5" extended portion) and half the column footing width that is 6"

Length: ((9 - 0.5 - (5/12)- (2.5/12))*2) + ((22 + (10/12) - 1)*2)

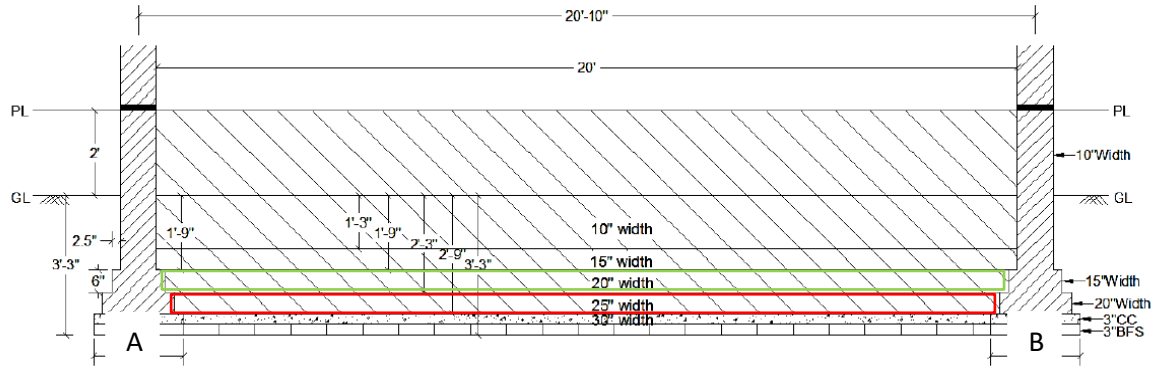
Width: (20/12)



Note: Dimensions used in calculation are in feet

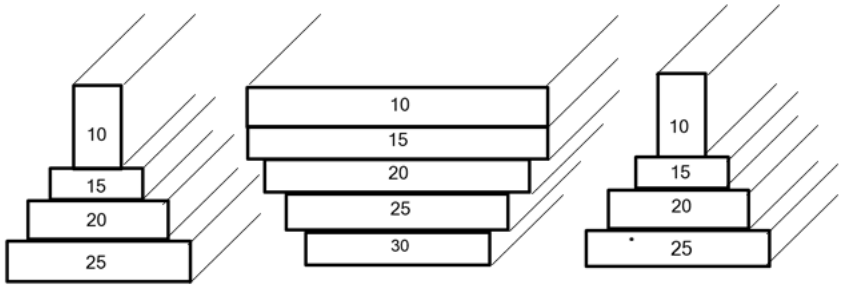
4. Brickwork in Foundation upto GL

(a) The 30 inch wall foundation has a series of steps. At the bottom, its width is 30 inch and gradually reduces to 10 inch decreasing by 5 inch in each step. The length along AB for each foundation width however increases by 5 inch as we move upwards.



Section A-A

The green block indicates the length of 20 inch width and the red block for 25 inch width.



For 10 inch width, the length can't increase by 5 inch since the width of 25 inch wall foundation is constant at that depth. The same length as for 15 inch width applies for the 10 inch width.

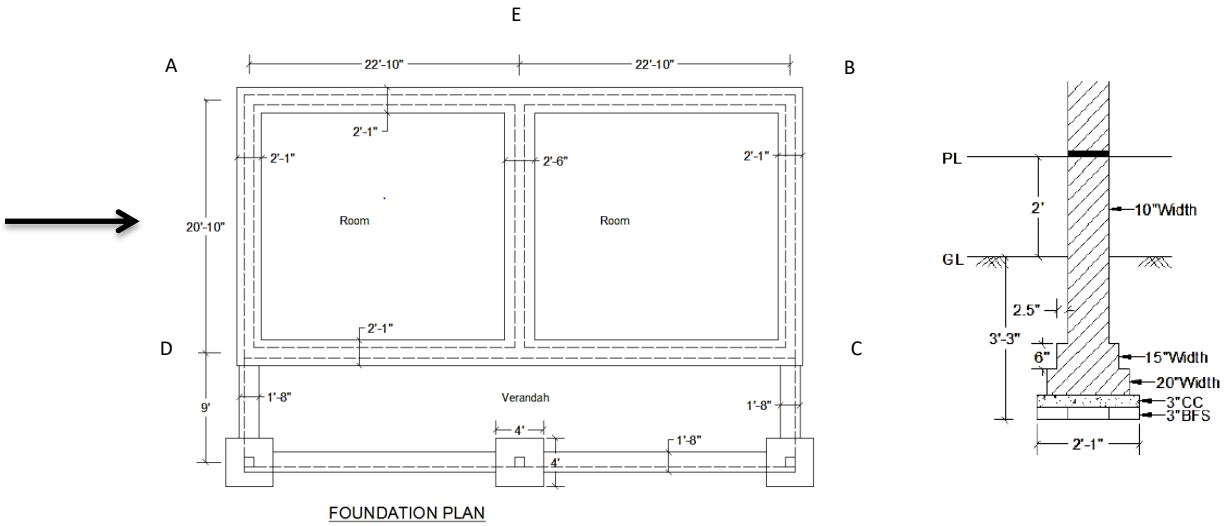
(i) 20 + (10/12) - (25/12) + (5/12)
(ii) 20 + (10/12) - (25/12) + (10/12)
(iii) 20 + (10/12) - (25/12) + (15/12)
(iv) 20 + (10/12) - (25/12) + (15/12)

Note: Dimensions used in calculation are in feet

4(b) 25 inch wall foundation

(i) 20 inch width –

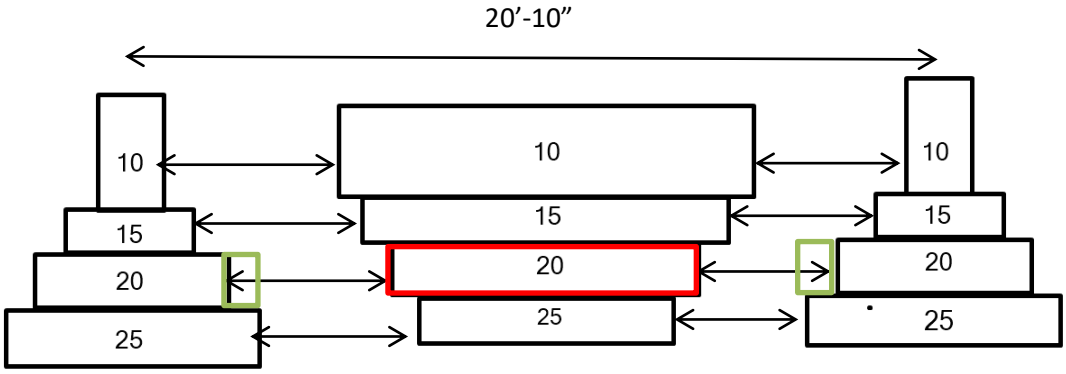
Length = ((22 + (10/12) + (10/12))*4) + ((20 + (10/12) - (25/12) + (5/12))*2)



The length of BFS for 25 inch wall foundation is as follows:

((22+(10/12)+(12.5/12))*4)+((20+(10/12)-(25/12))*2)

For the 20 inch width along AE, there is a 2.5 inch decrease in length at point A due to a reduced step size and hence ((22 + (10/12) + (10/12)). For the portion along AD, a side view (in the direction indicated by the arrow above) is shown below.



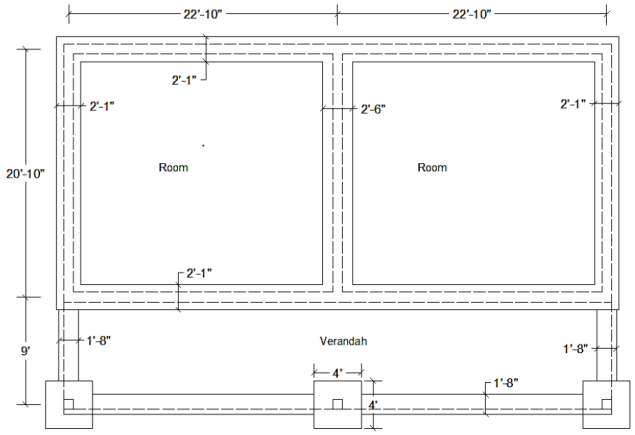
Therefore the required length = c/c distance – (2*Half width of 25 inch wall foundation) + (2*2.5 inch due to reduced step size) and hence ((20 + (10/12) - (25/12) + (5/12))

Note: Dimensions used in calculation are in feet

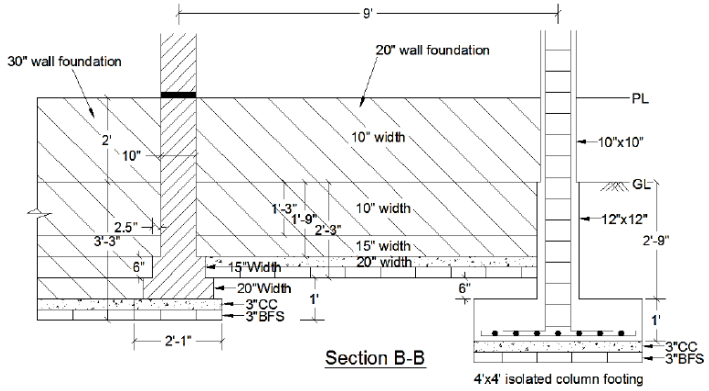
4 (c) 20 inch verandah wall foundation

(ii) **10 inch width** - ((9 - 0.5 - (5/12))*2) + ((22 + (10/12) - 1)*2)

You can use the following views to understand the sample calculation. Please keep in mind the elevation where the foundations intercept each other and calculate length accordingly.

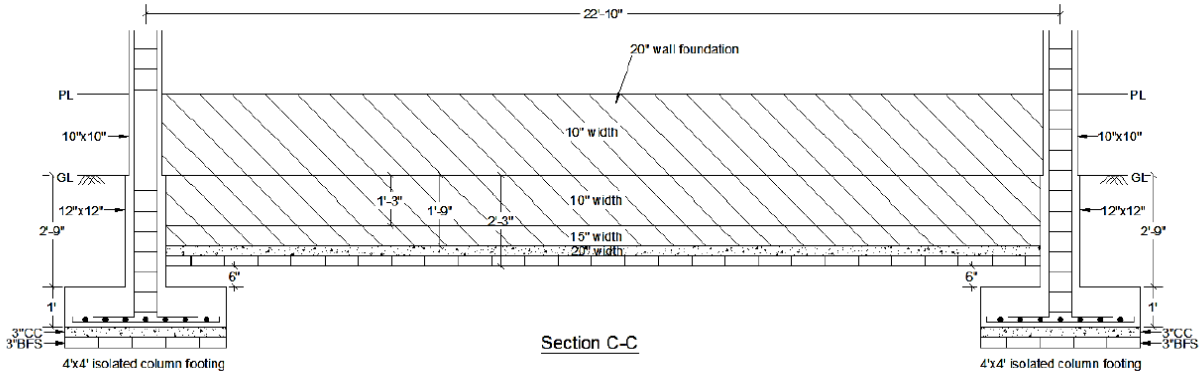


FOUNDATION PLAN



Section B-B

4'x4' isolated column footing



Section C-C

4'x4' isolated column footing

4'x4' isolated column footing

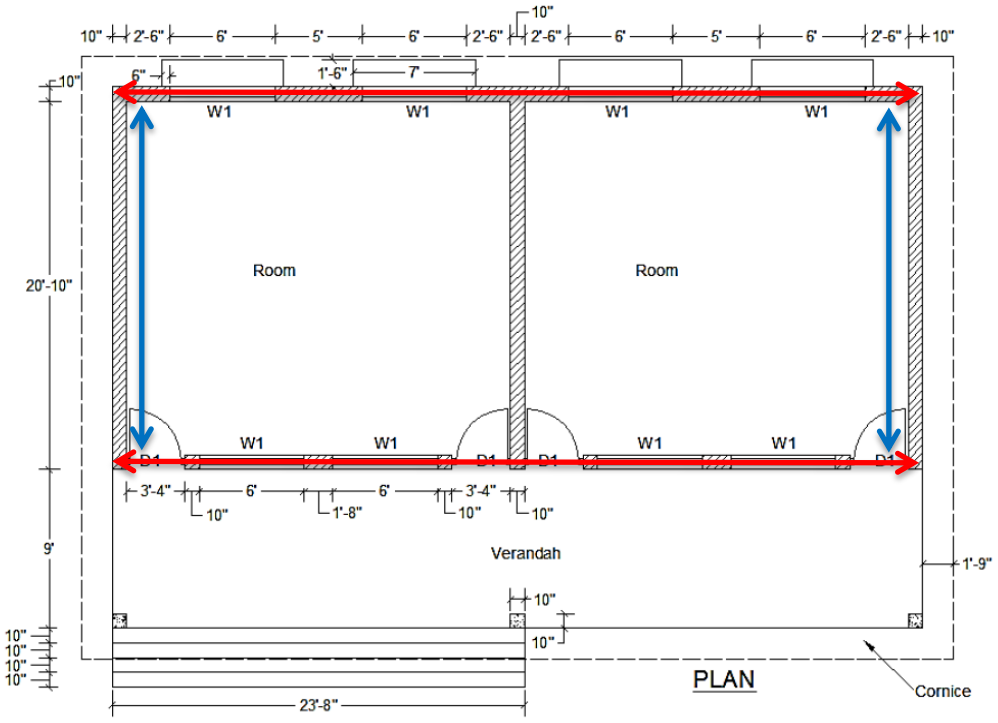
Note: Dimensions used in calculation are in feet

5. Brickwork in Foundation from GL to PL

(ii) 25 inch wall foundation –

Length = (22+ (10/12) + 22 + (10/12) + (10/12))*2 + 20 + 20

Use the plan for calculation of lengths as wall thickness is constant at 10 inch throughout. The dimensions are shown by arrows.



Note: Dimensions used in calculation are in feet

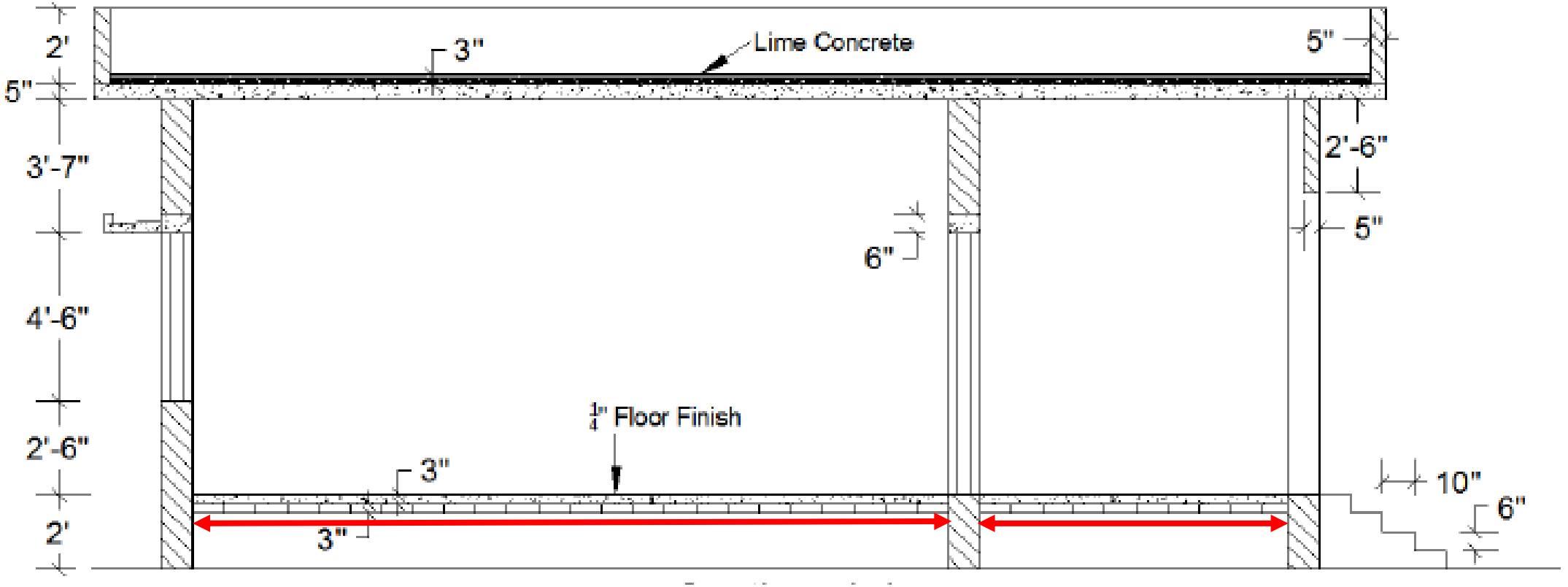
CE 208
Quantity Surveying

Estimation of a Residential Building

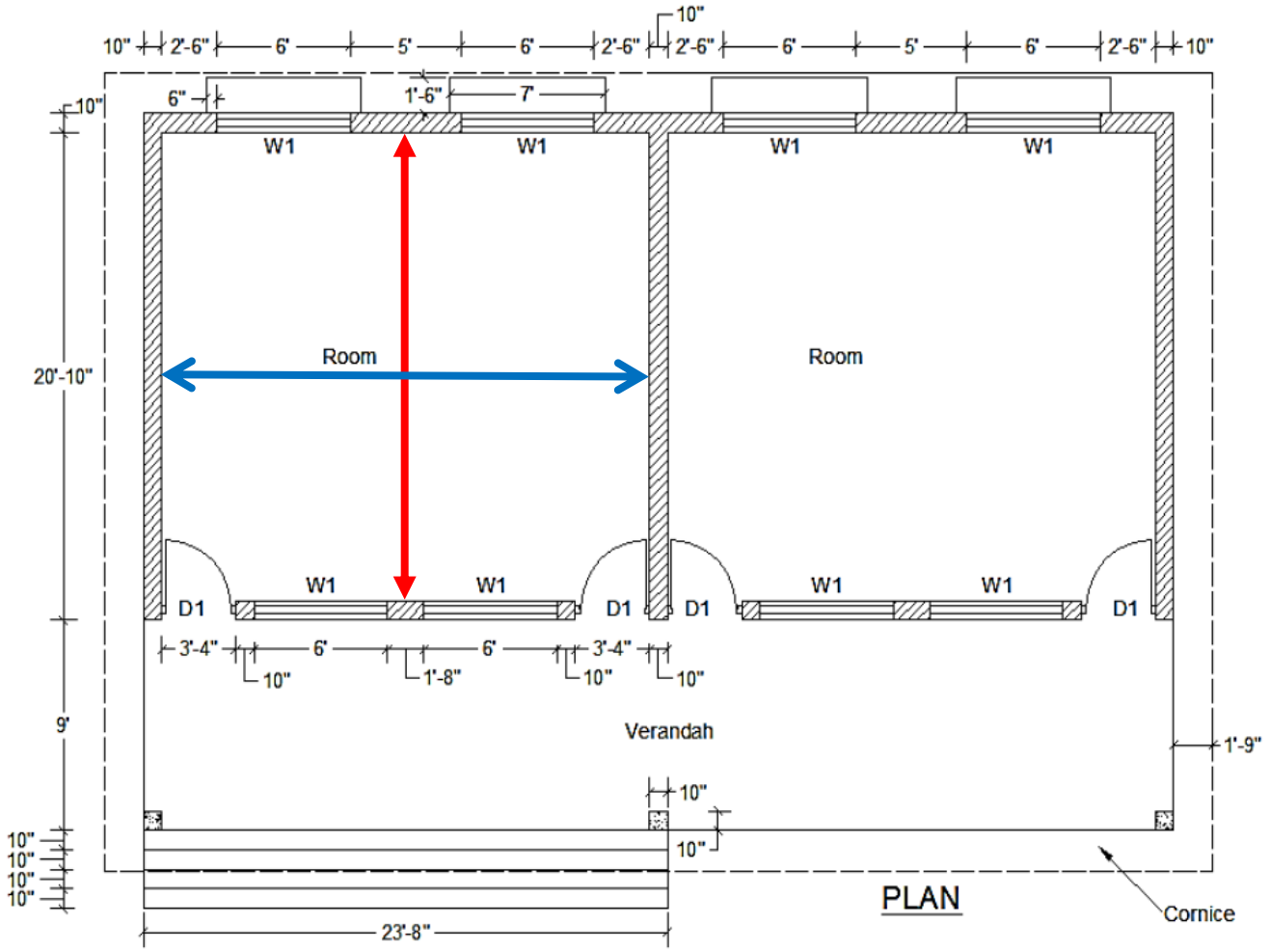


DEPARTMENT OF CIVIL ENGINEERING
BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY

9. BFS (one layer) in Floors



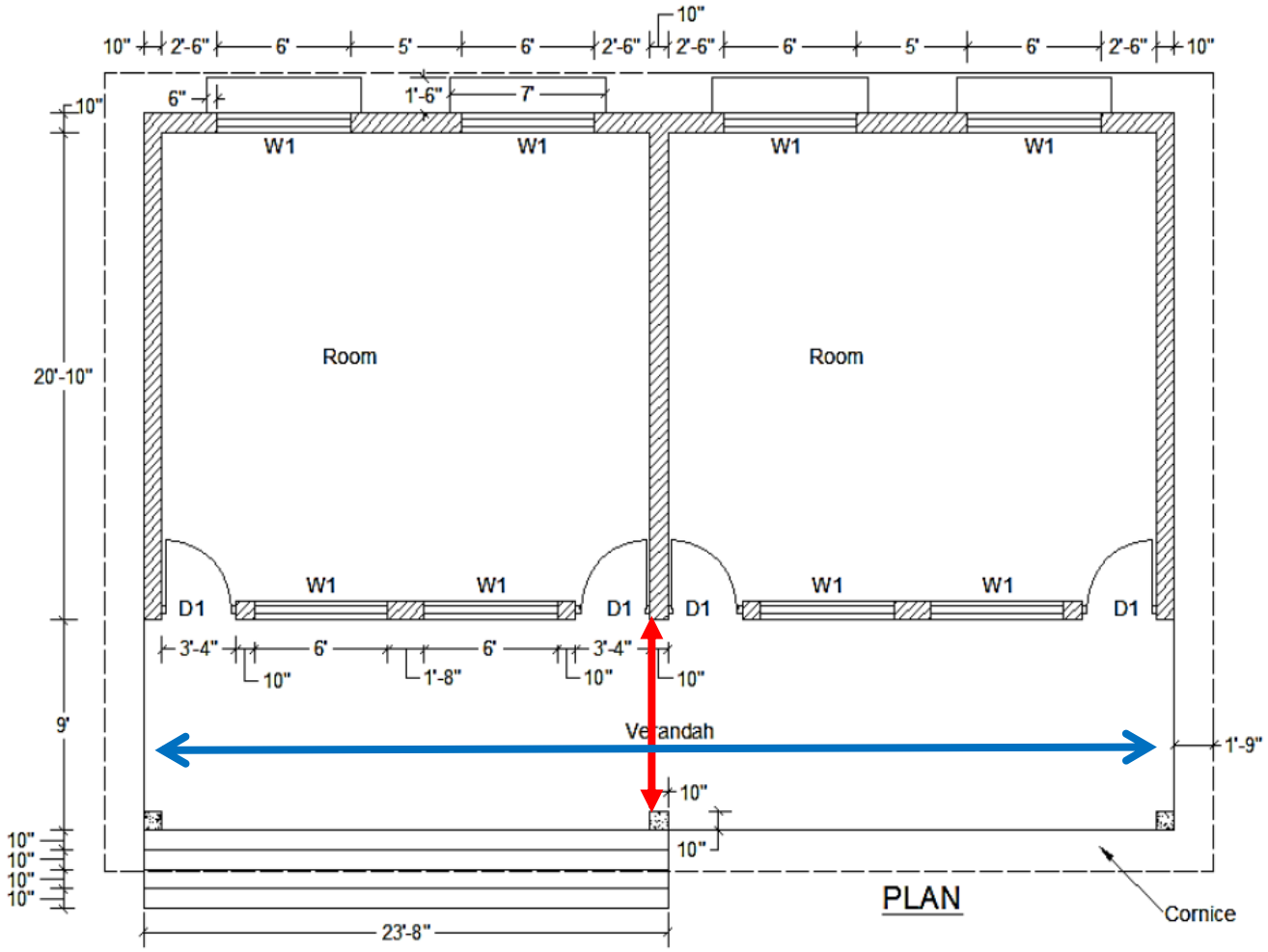
9. BFS (one layer) in Floors



Main Room:

- Length= 22’
- Width= 20’

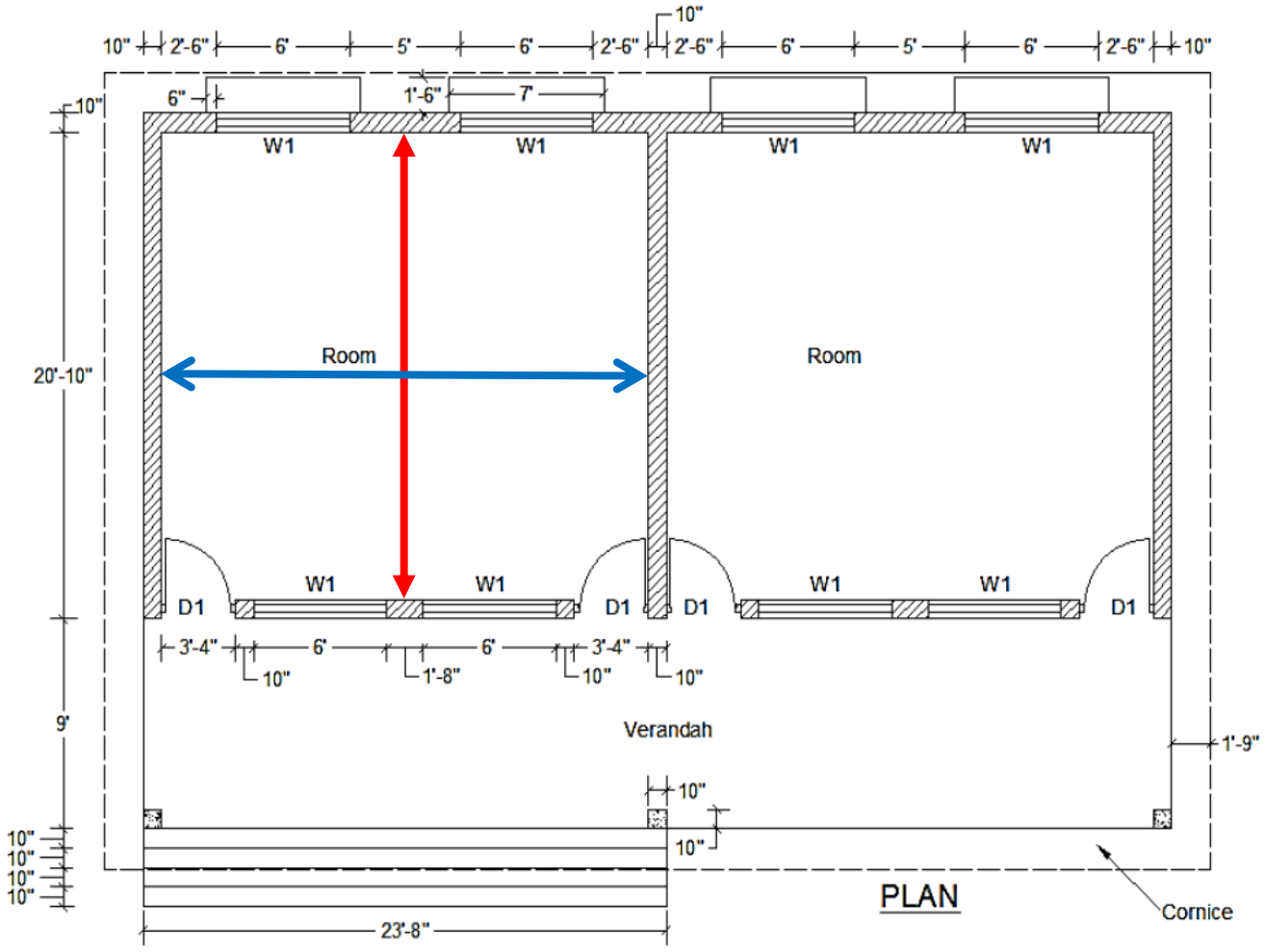
9. BFS (one layer) in Floors



Verandah:

- Length= (22’10”)*2-10”
- Width= 9’-10”

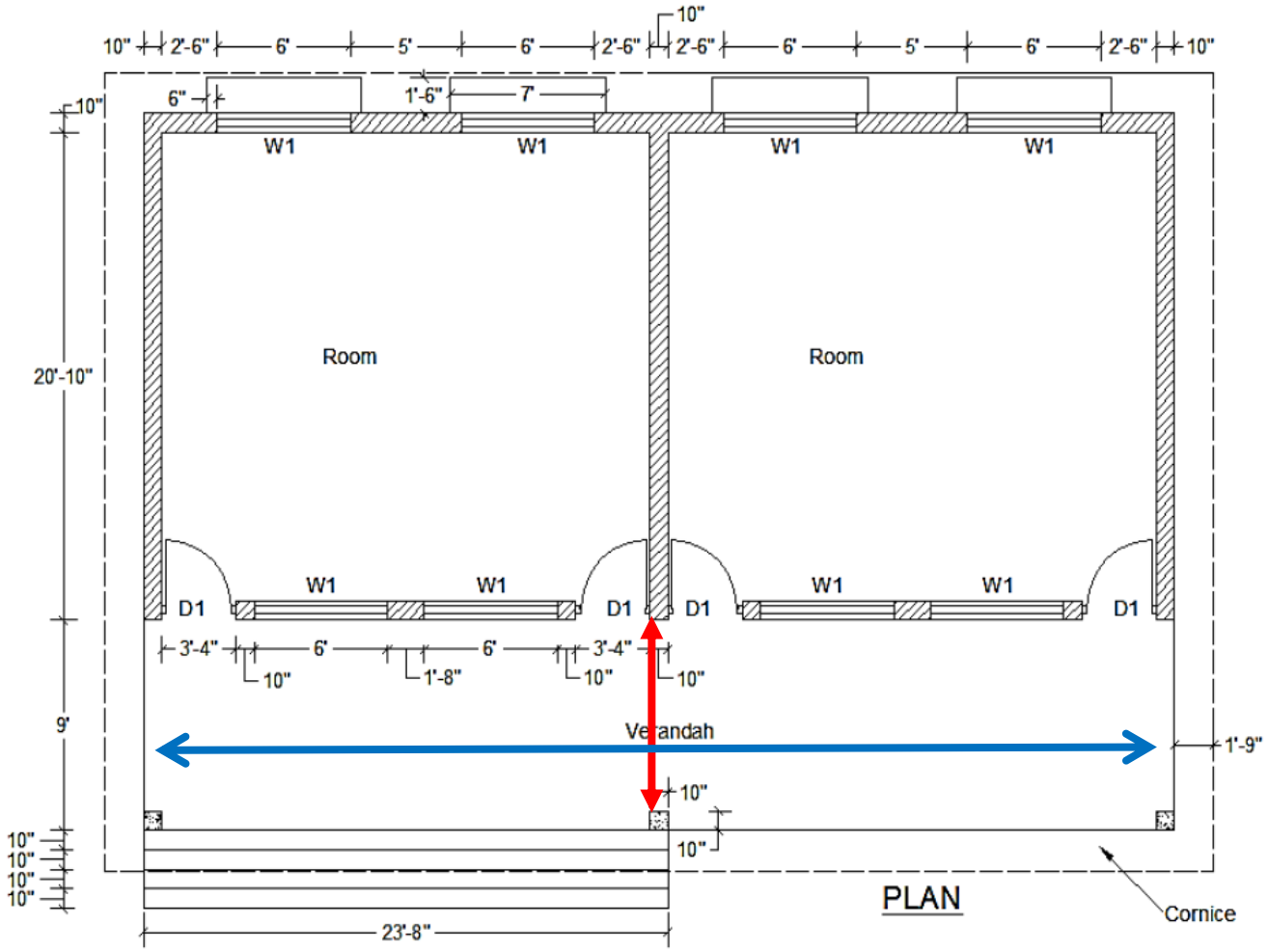
10. CC (3”) in Floors



Main Room:

- Length= 22’
- Width= 20’
- Thickness= 3”

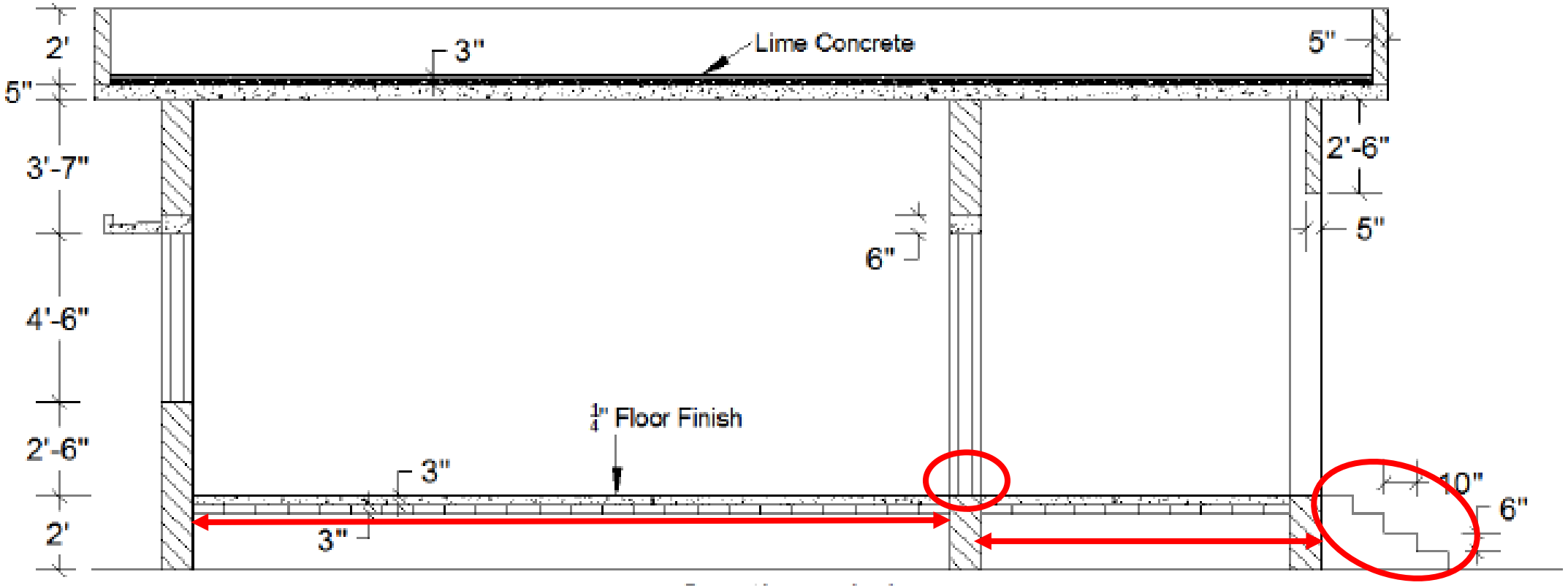
10. CC (3”) in Floors



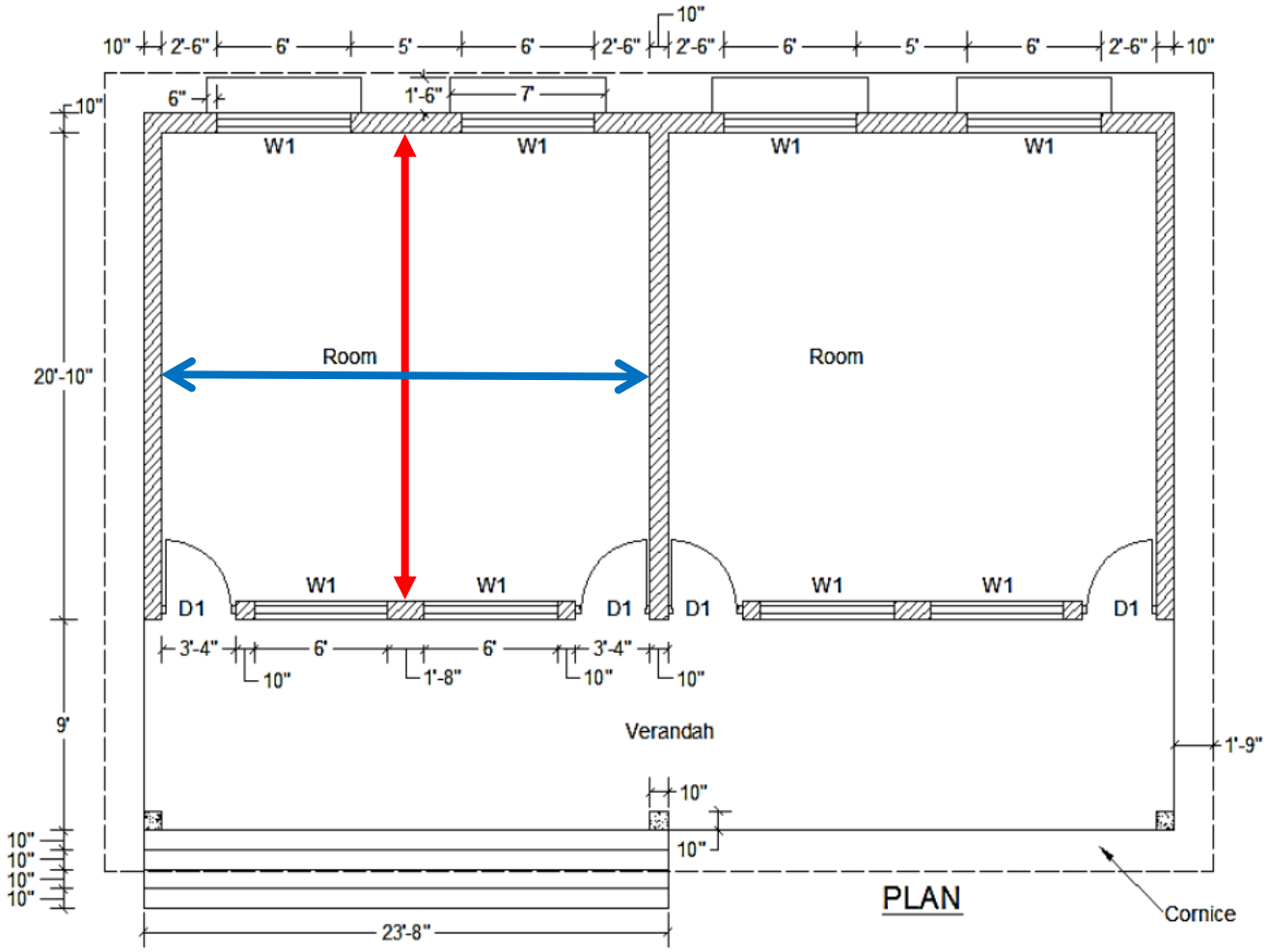
Verandah:

- Length= (22’10”)*2-10”
- Width= 9’-10”
- Thickness= 3”

11. Floor Finish, ¼” thick



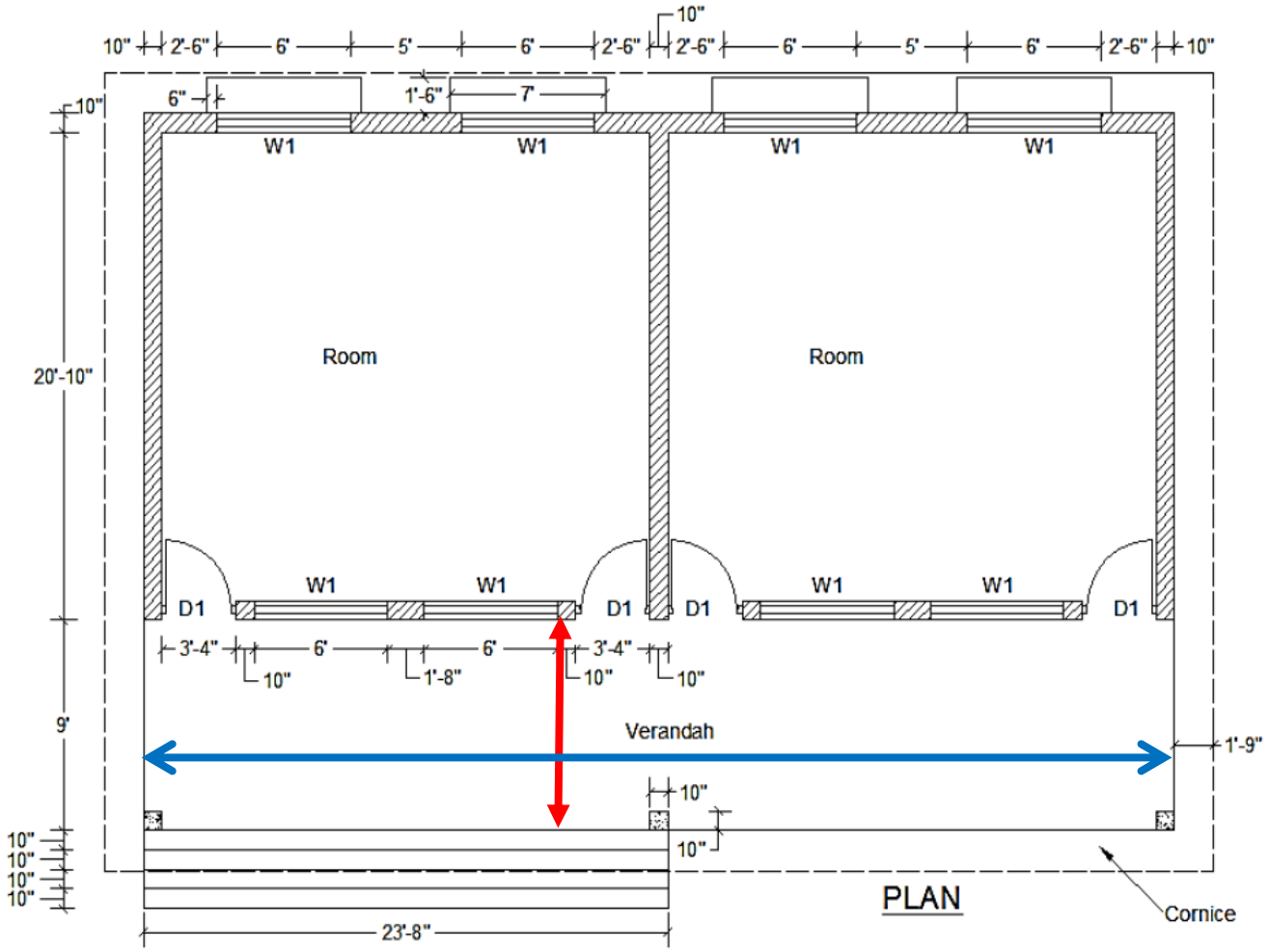
11. Floor Finish, ¼” thick



Main Floor:

- Length= 22’
- Width= 20’
- Thickness= 1/4”

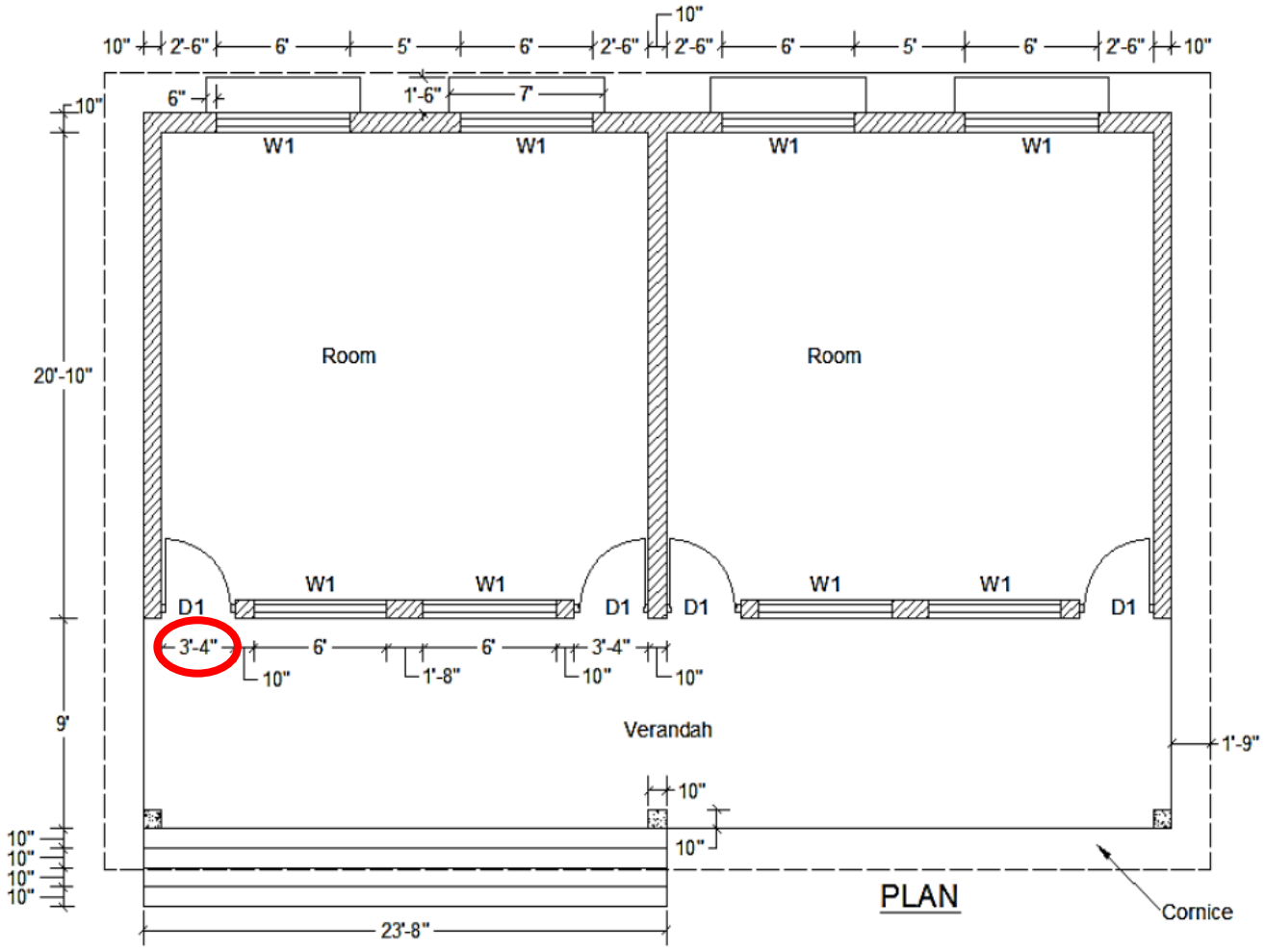
11. Floor Finish, ¼” thick



Verandah:

- Length= (22’10”)*2+10”
- Width= 9’
- Thickness= 1/4”

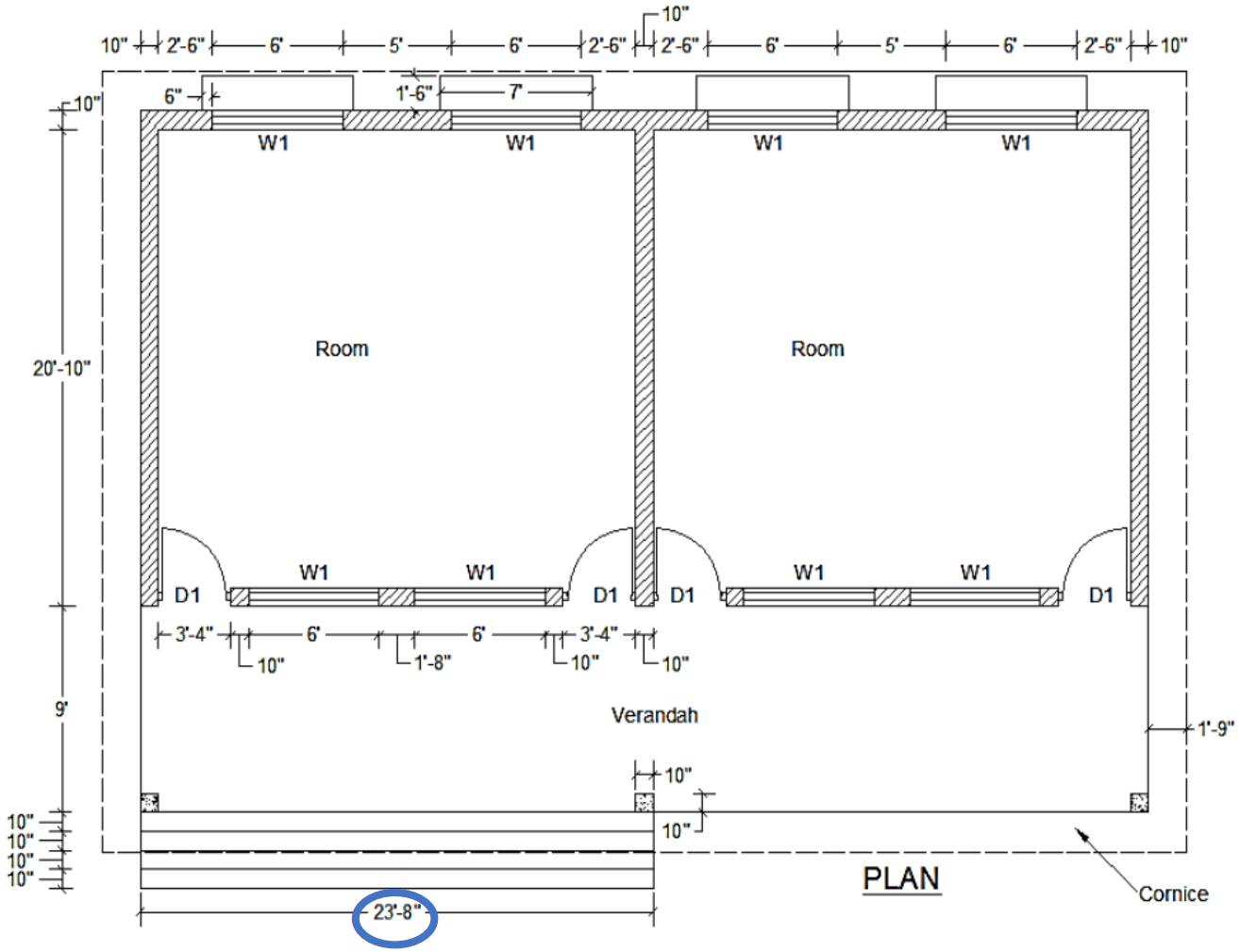
11. Floor Finish, ¼” thick



Door:

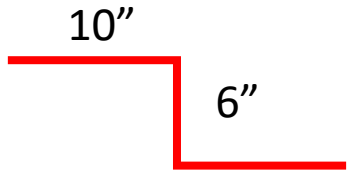
- Length= 3’4”
- Width= 10”
- Thickness= 1/4”

11. Floor Finish, ¼” thick

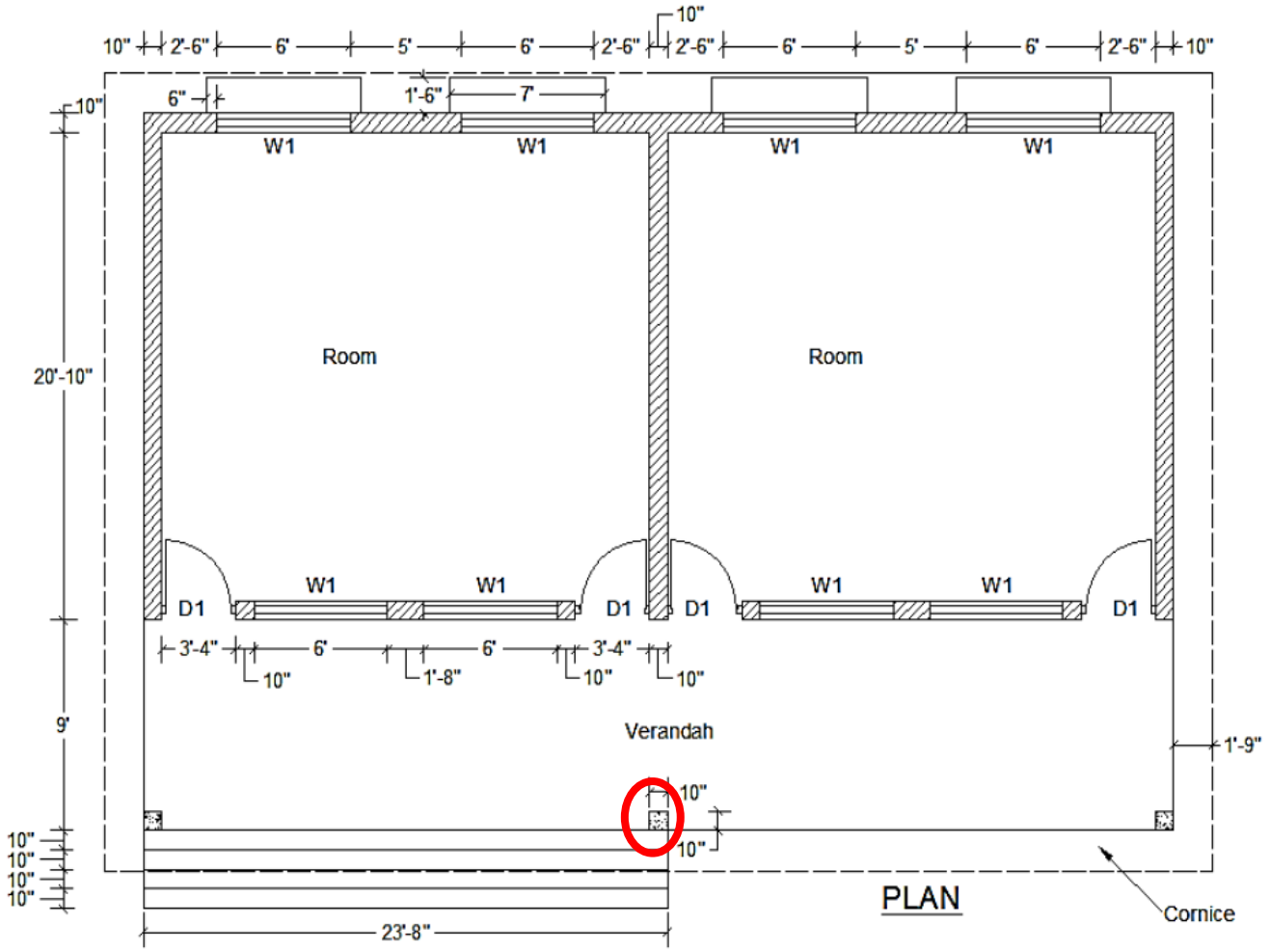


4 Steps:

- Length= 23’8”
- Width= 10”+6”
- Thickness= 1/4”



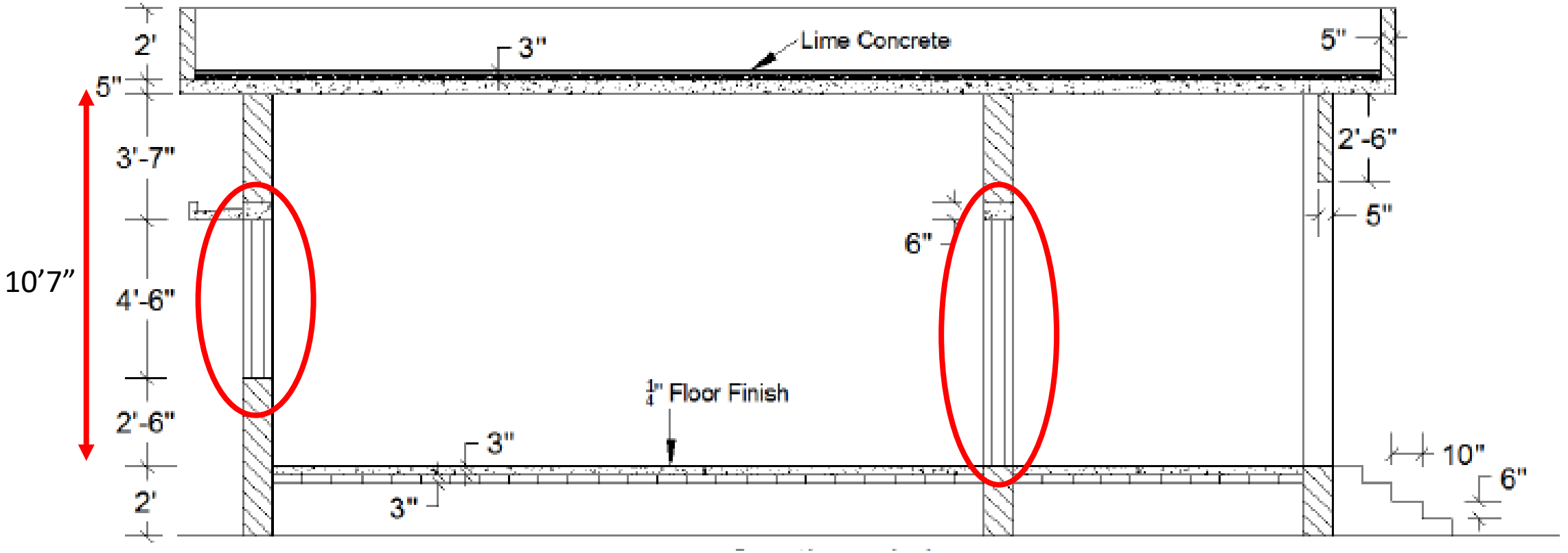
11. Floor Finish, ¼” thick



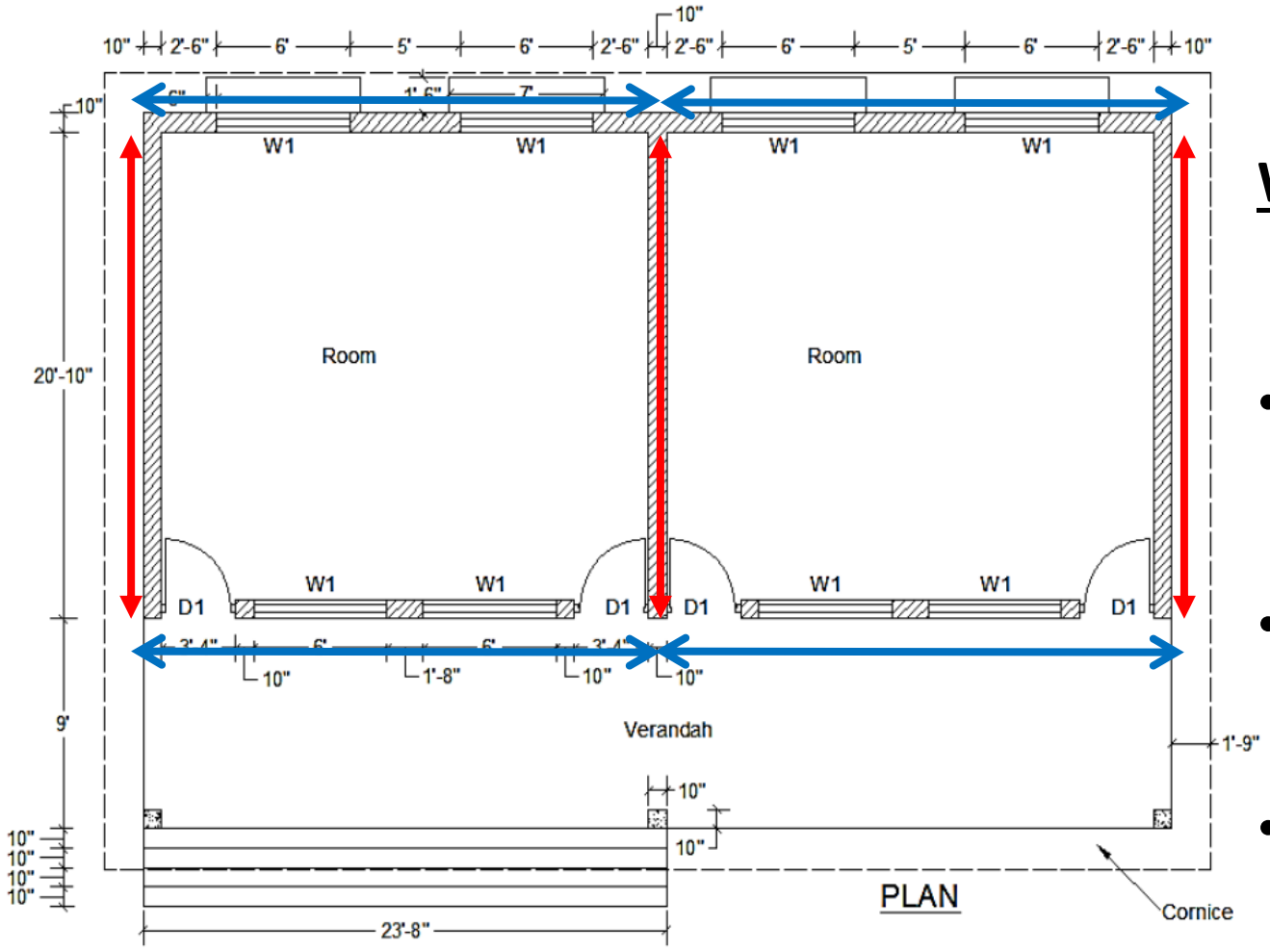
Deduct (Columns):

- Length= 10”
- Width= 10”

12. Brick walls in superstructure



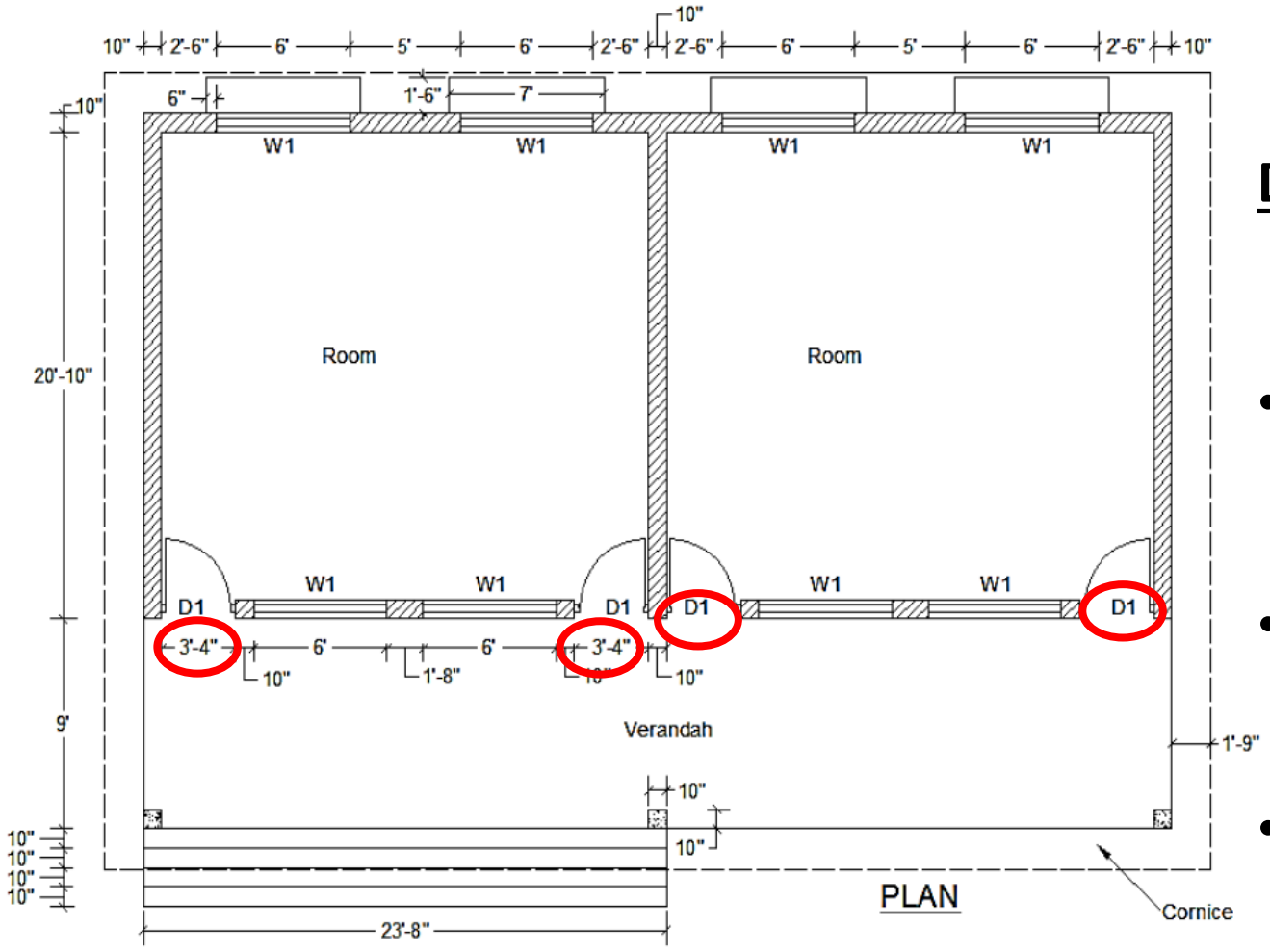
12. Brick walls in superstructure



Wall:

- Height= 10’7”
- Width= 10”
- Length= (20’10”-10”)*3 +(22’10”+5”)*4

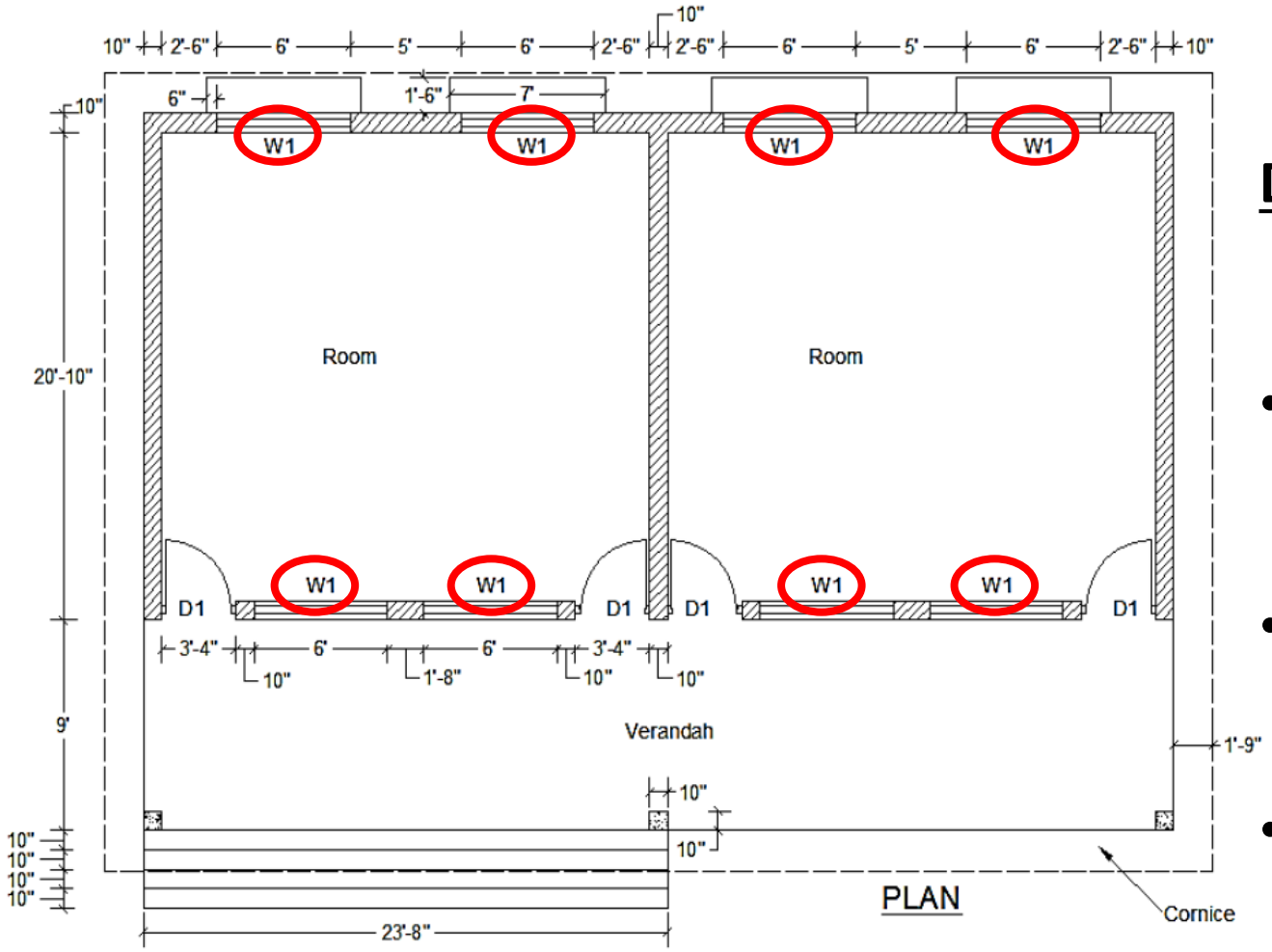
12. Brick walls in superstructure



Deduct (4 Doors):

- Height= 7’
- Width= 10”
- Length= 3’4”

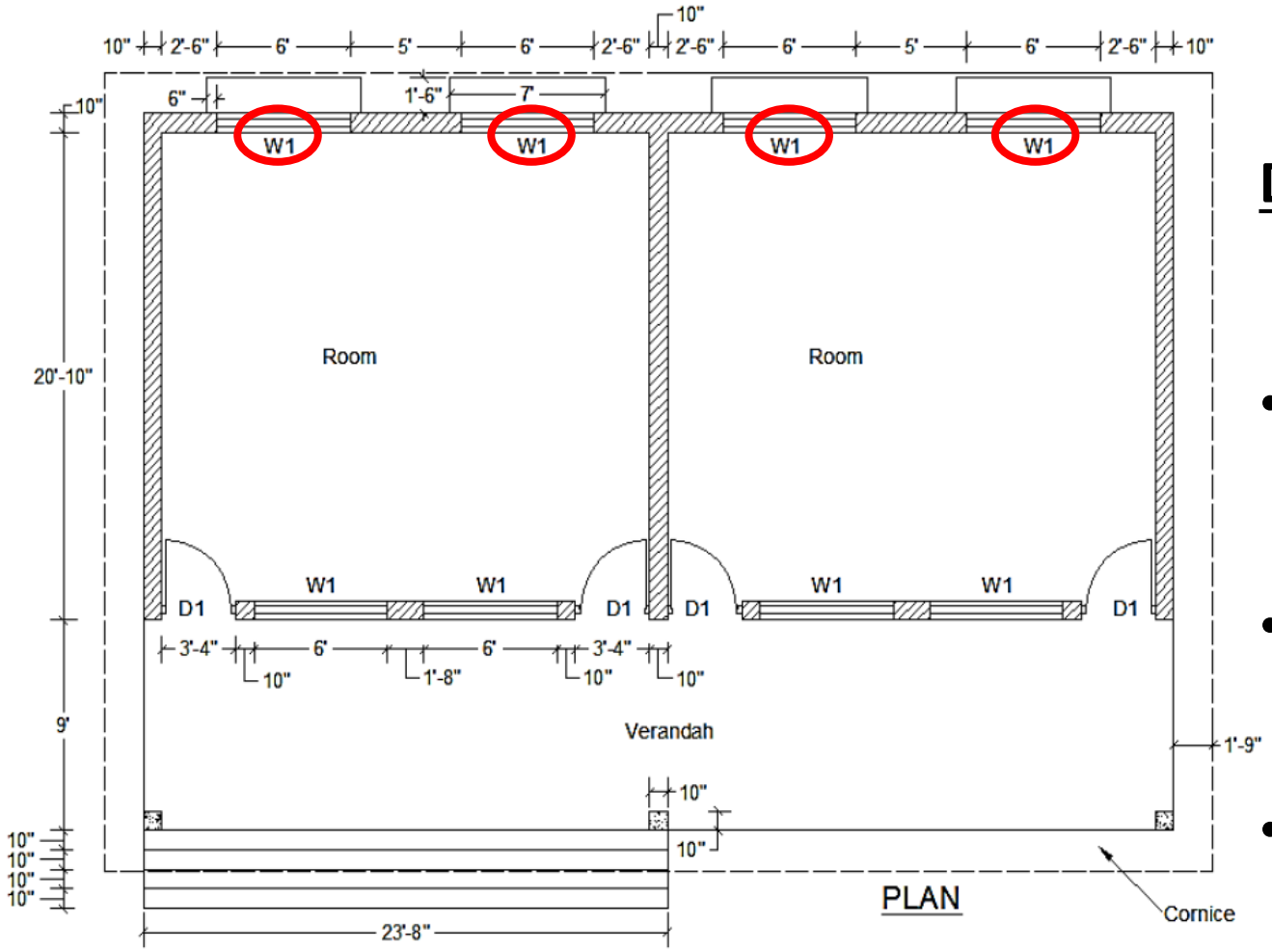
12. Brick walls in superstructure



Deduct (8 Windows):

- Height= 4’6”
- Width= 10”
- Length= 6’

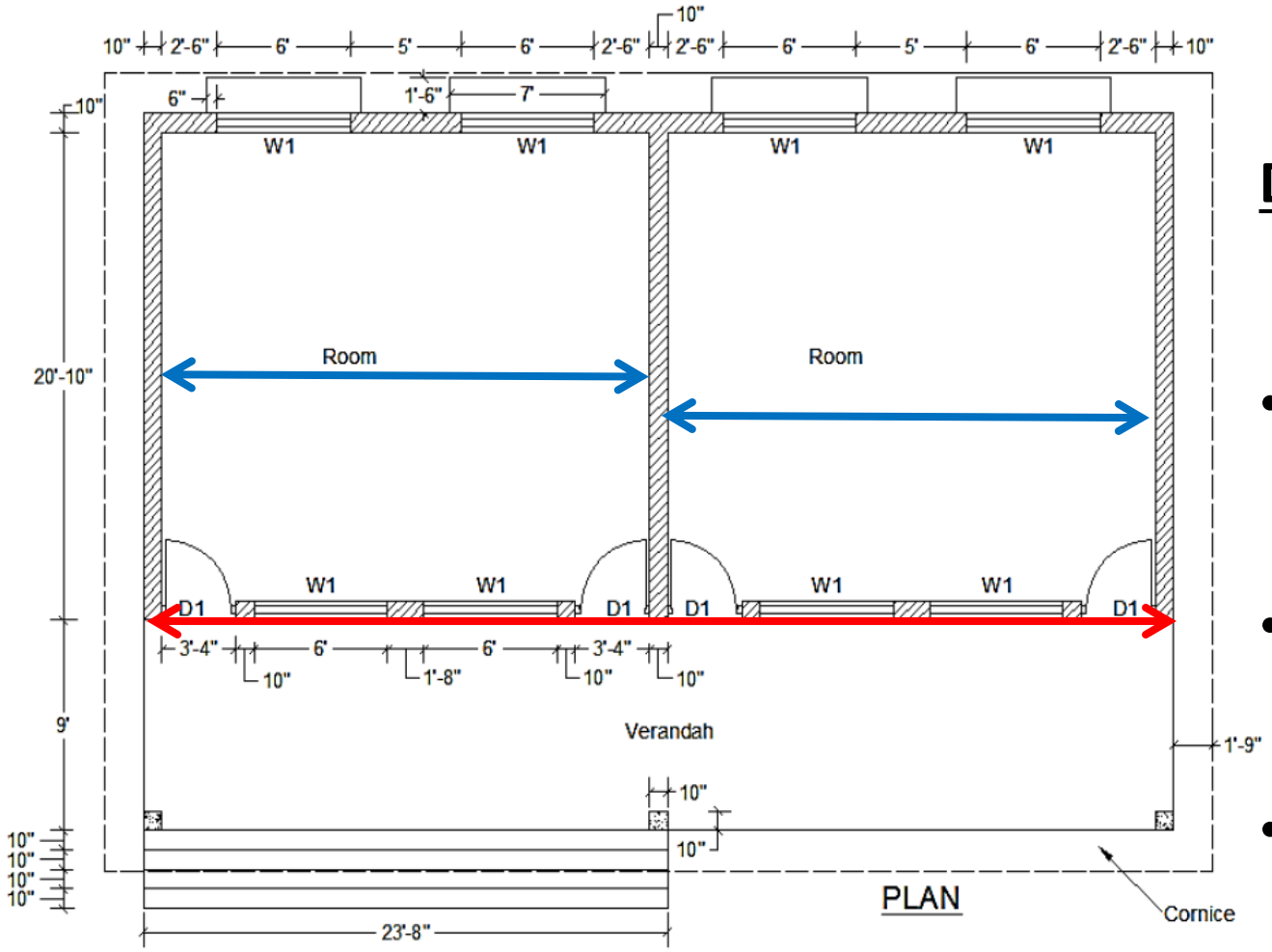
12. Brick walls in superstructure



Deduct (Lintel over Windows):

- Height= 6”
- Width= 10”
- Length= 7’

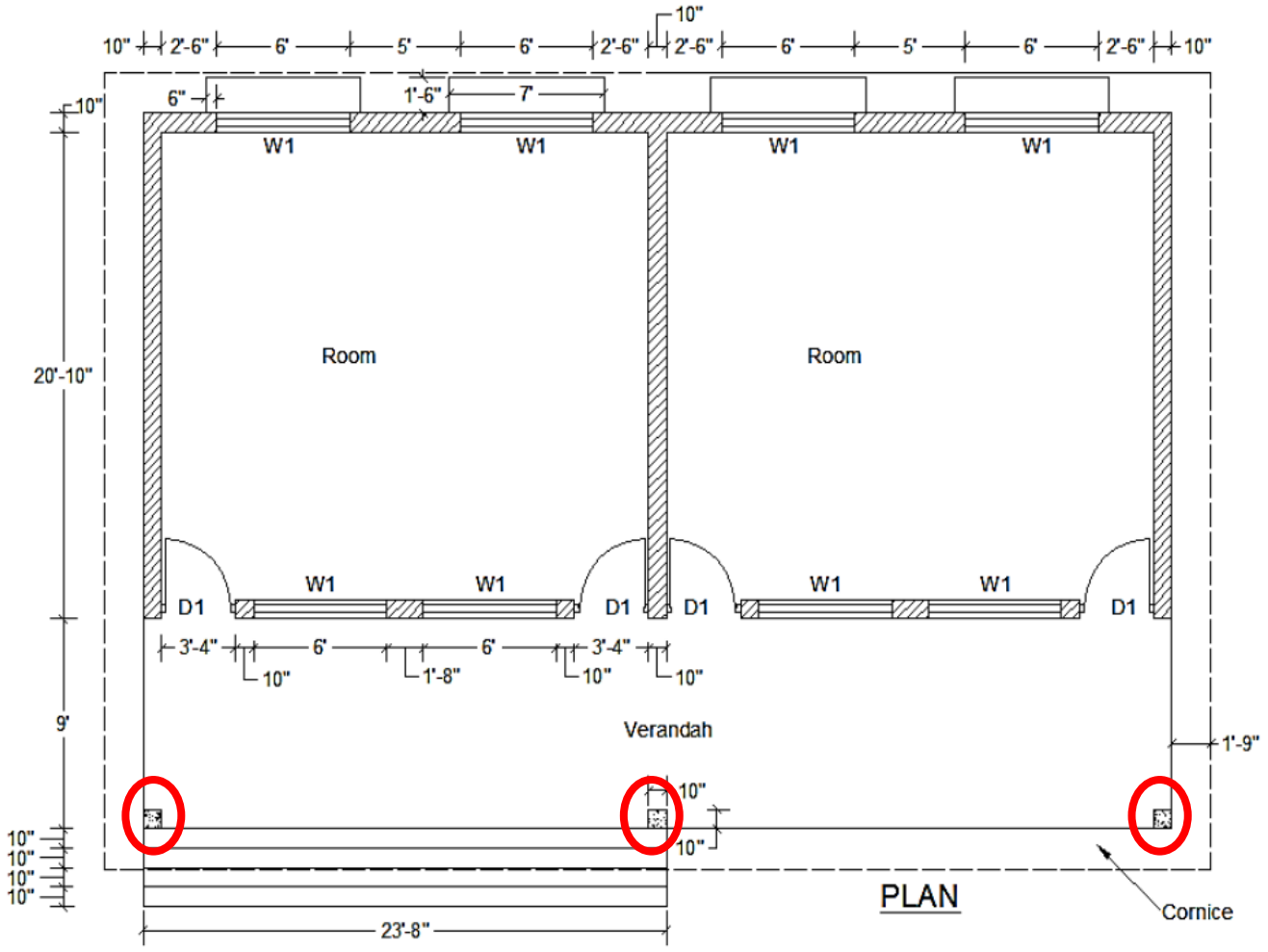
12. Brick walls in superstructure



Deduct (Lintel over W1+D1):

- Height= 6”
- Width= 10”
- Length= 2*22’+10”+2*6”

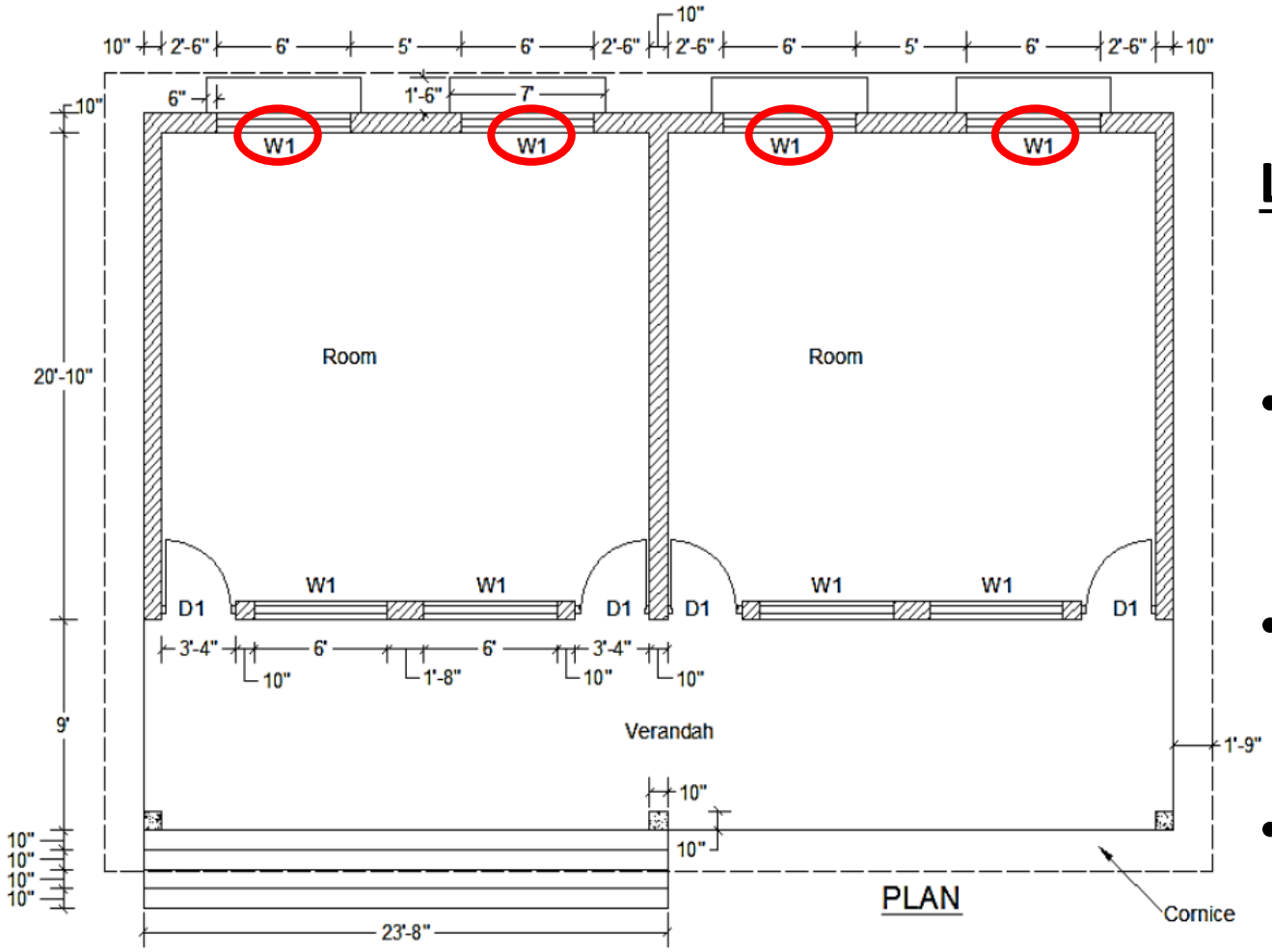
13. RCC in Columns



3 Columns:

- Length= 10”
- Width= 10”
- Height= 10’7”

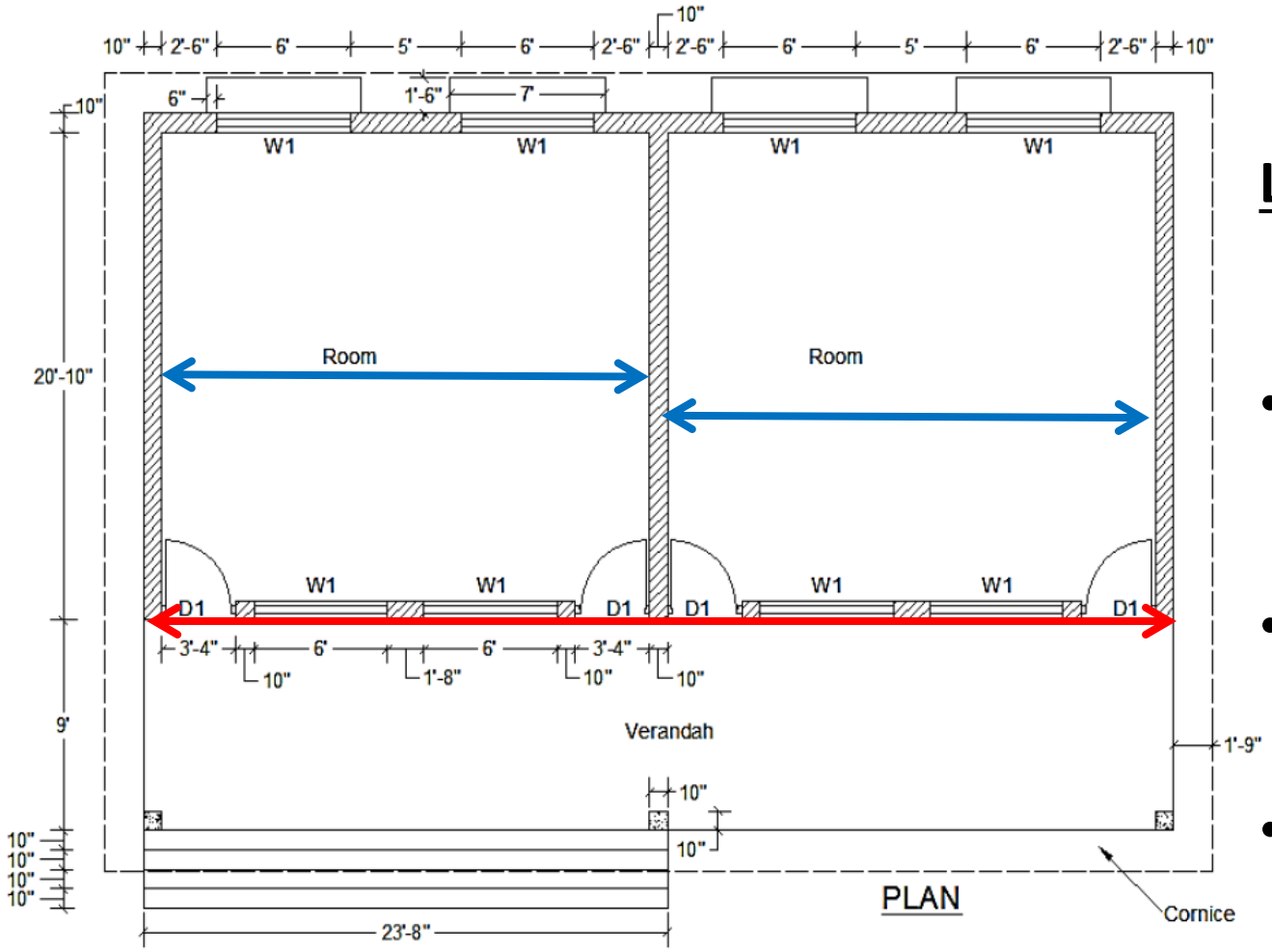
14. RCC in Lintel



Lintel over Windows:

- Height= 6”
- Width= 10”
- Length= 7’

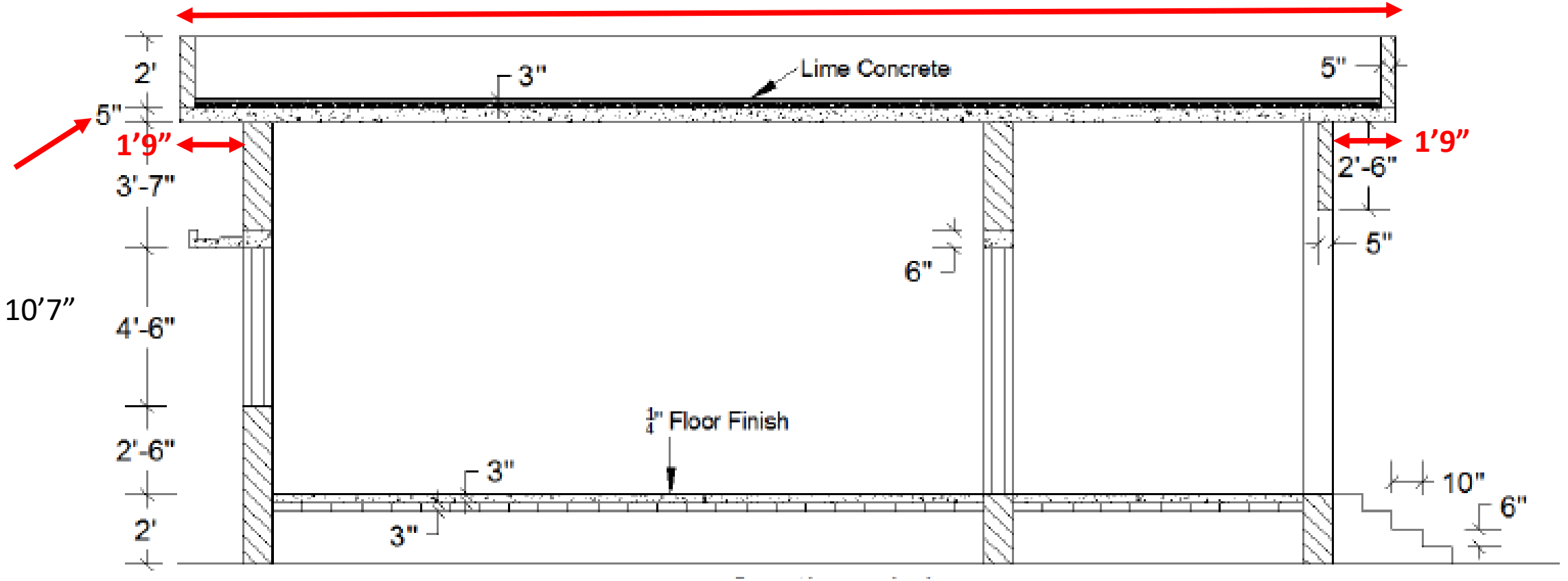
14. RCC in Lintel



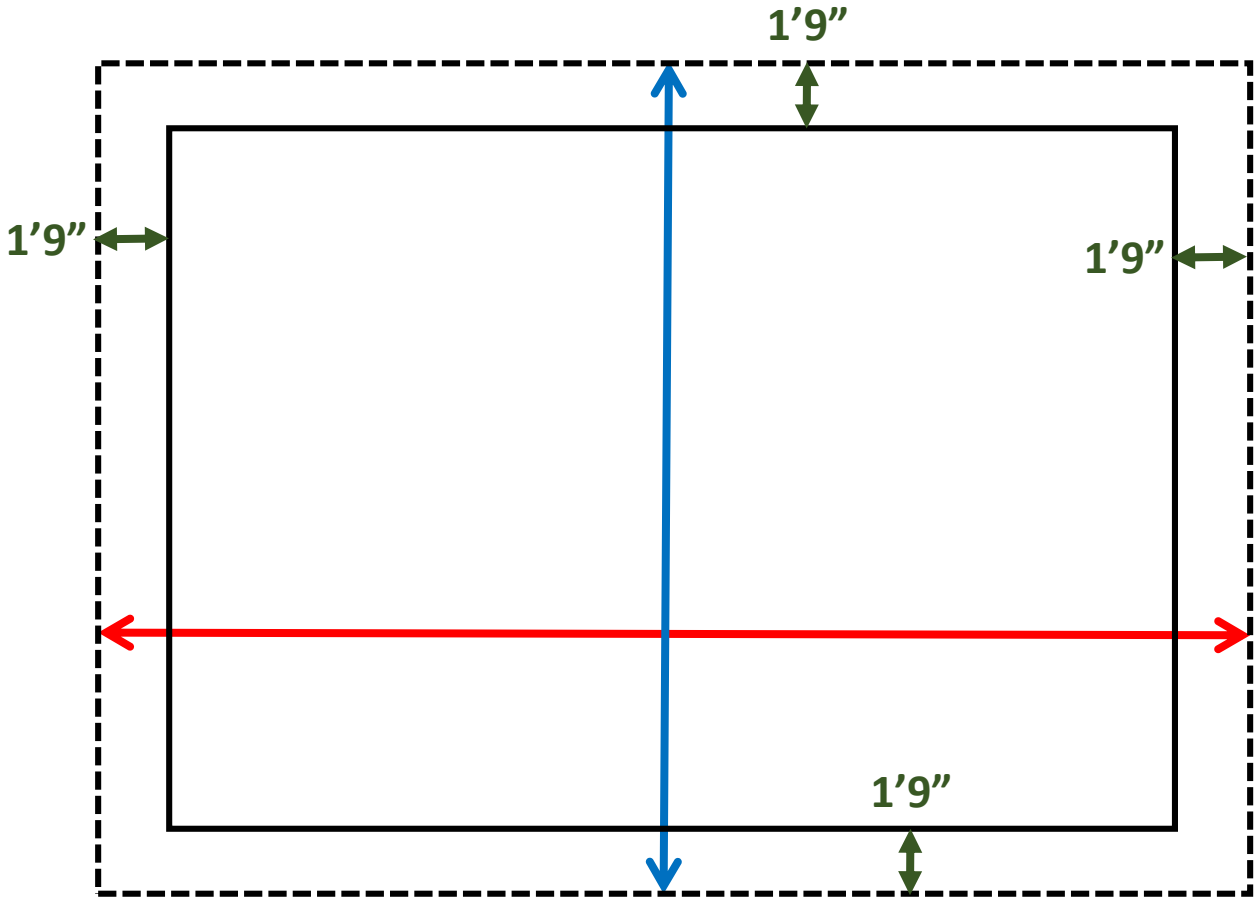
Lintel over W1+D1:

- Height= 6”
- Width= 10”
- Length= 2*22’+10”+2*6”

15. RCC in Roof



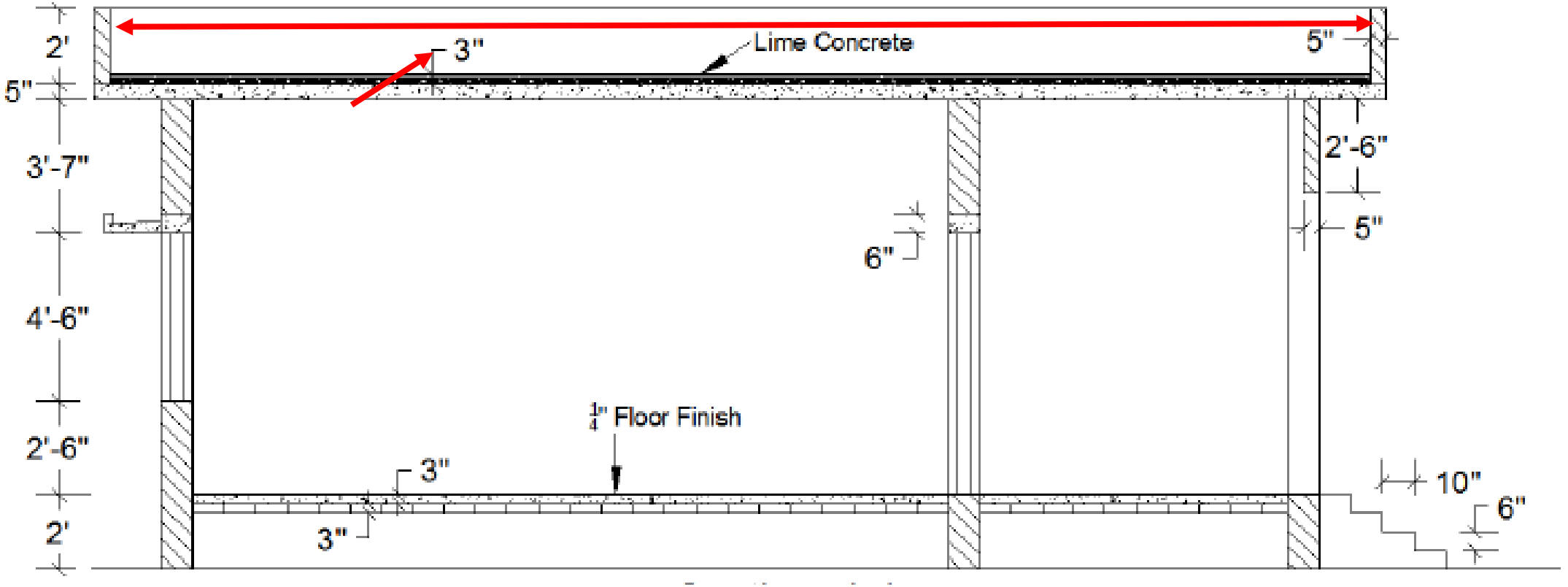
15. RCC in Roof



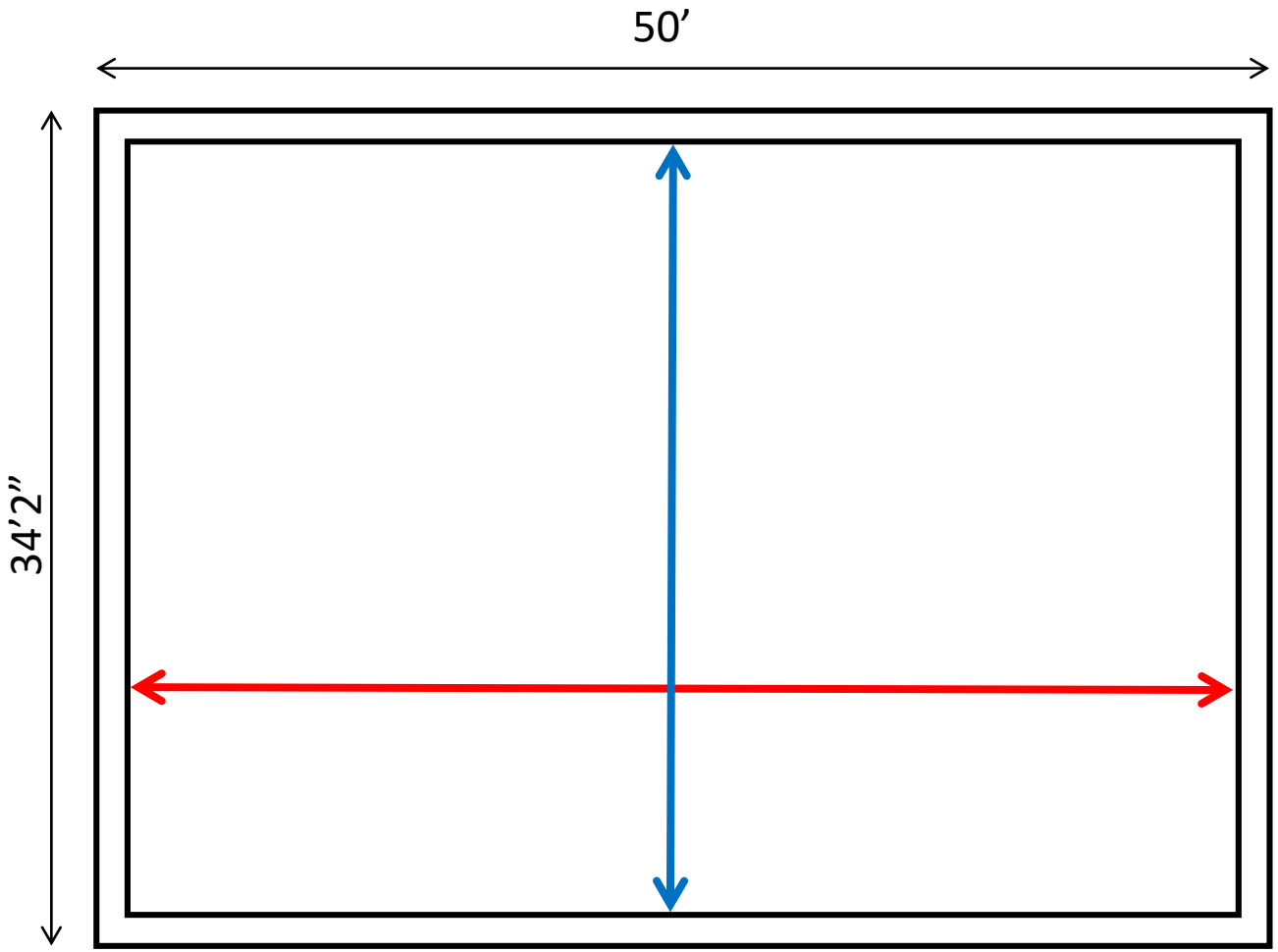
- Thickness= 5”
- Width= 30’8”+ 2*1’9”
- Length= 46’6”+2*1’9”

16. Lime Concrete in Roof

10’7”

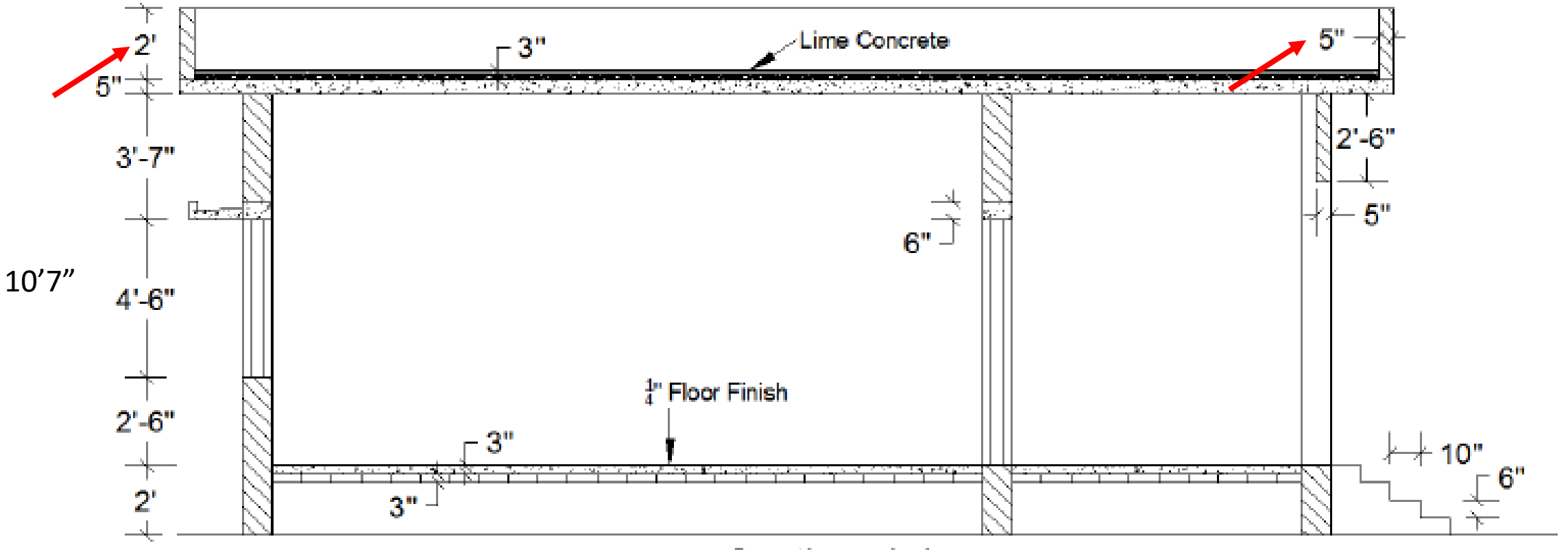


16. Lime Concrete in Roof

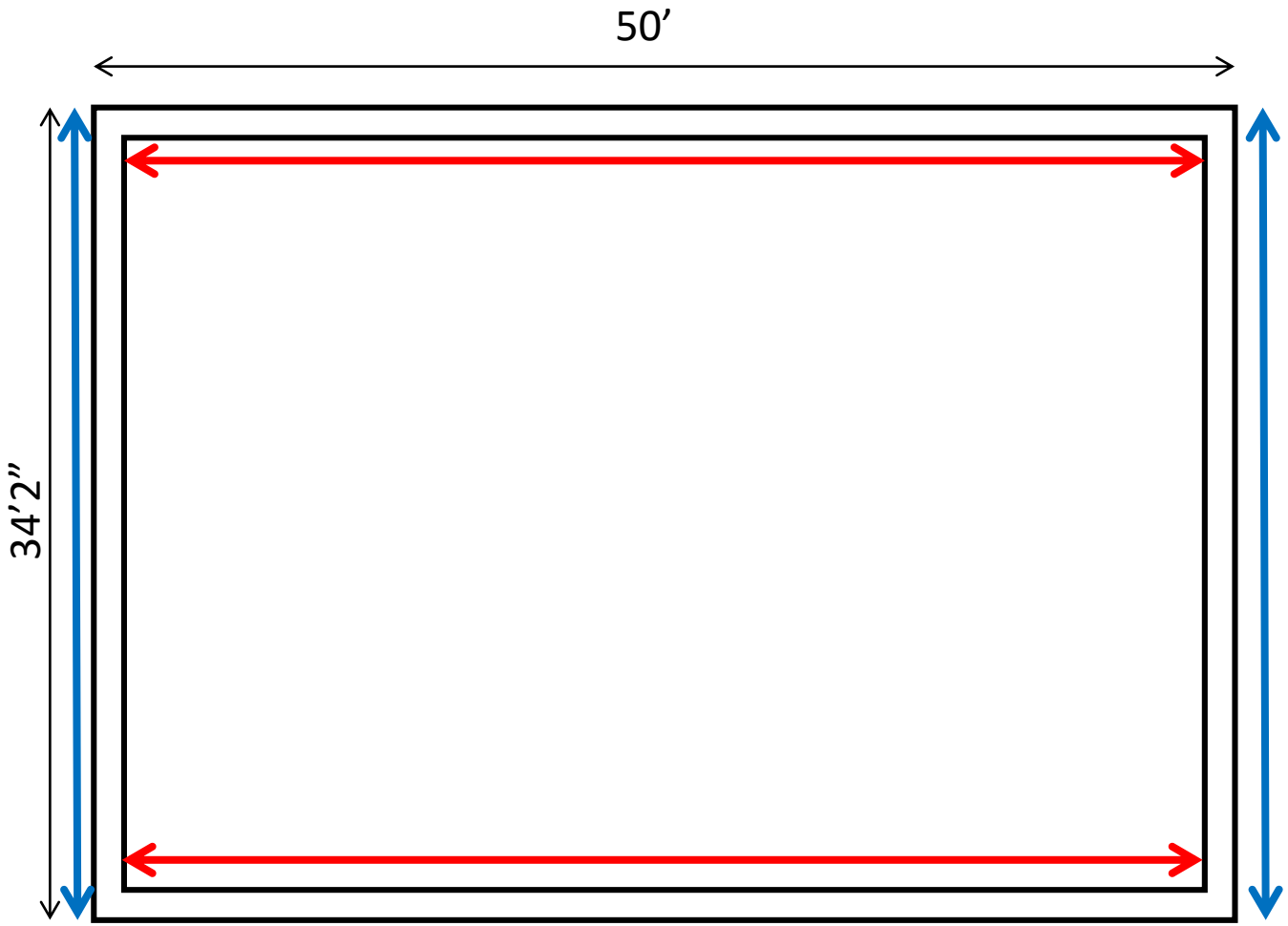


- Thickness= 3”
- Width= 34’2”-10”
- Length= 50’-10”

17. Bricks in Parapet

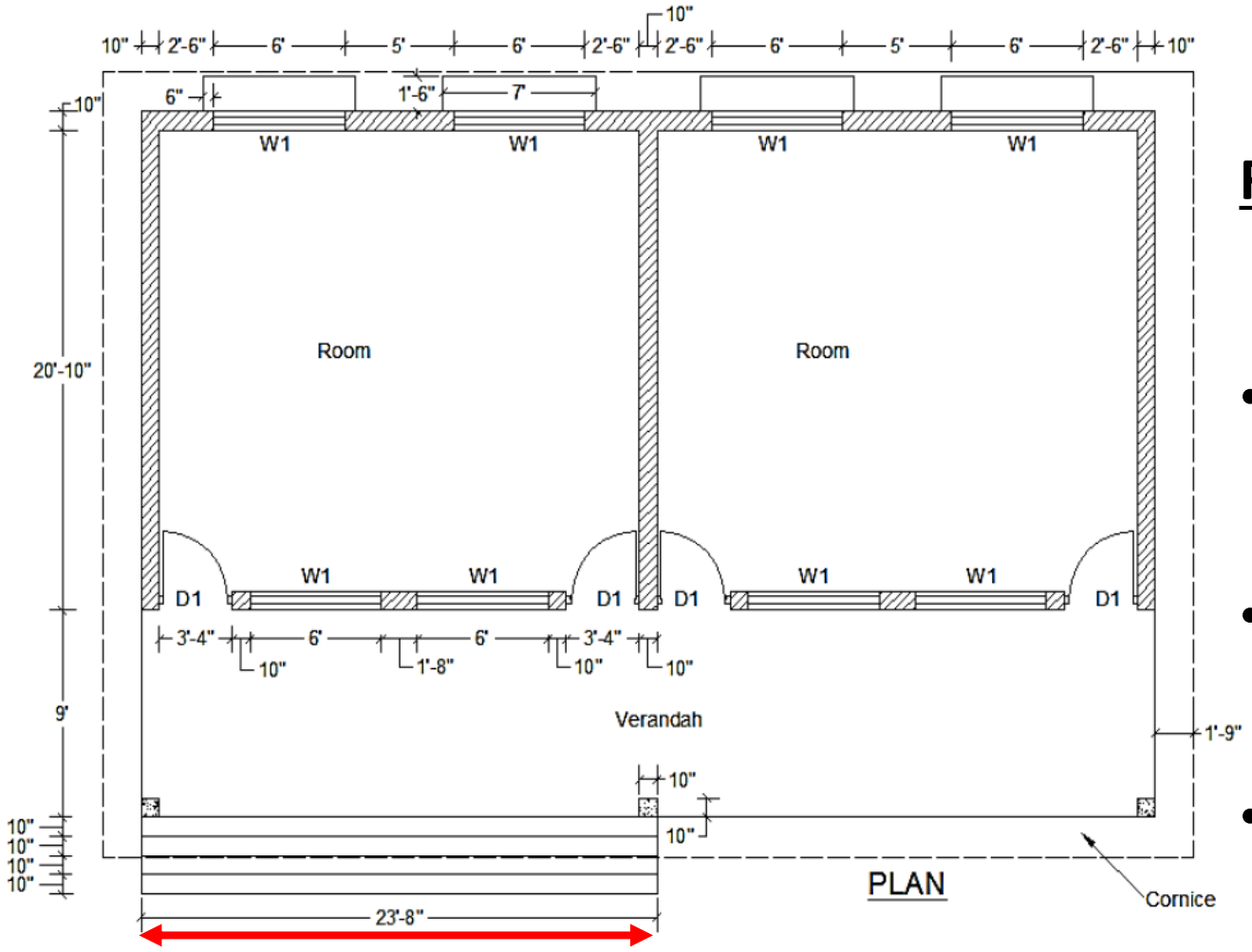


17. Bricks in Parapet



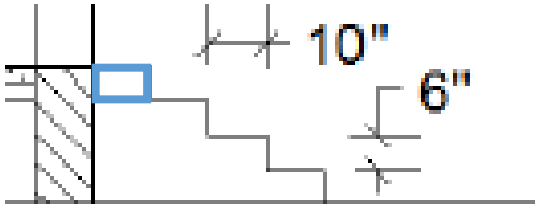
- Height= 2’
- Width= 5”
- Length= 2*((50’-10”)+34’2”)

18. Brickwork in Stairs

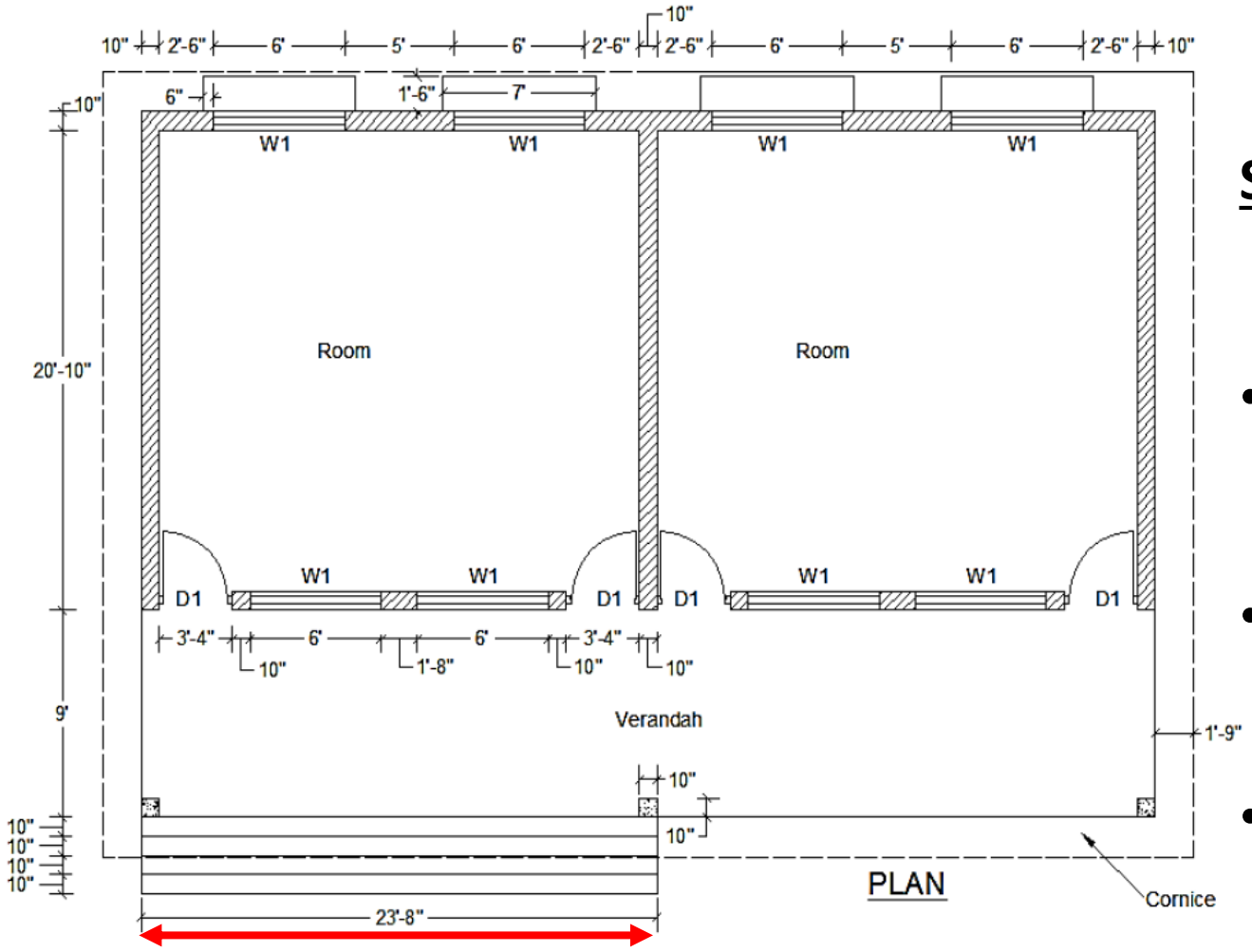


First Step:

- Height= 6”
- Width= 10”
- Length= 23’8”

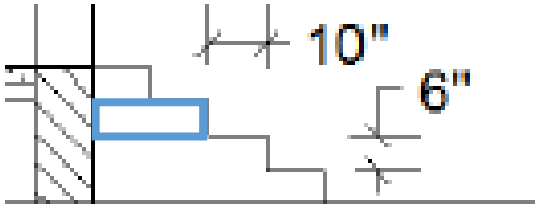


18. Brickwork in Stairs

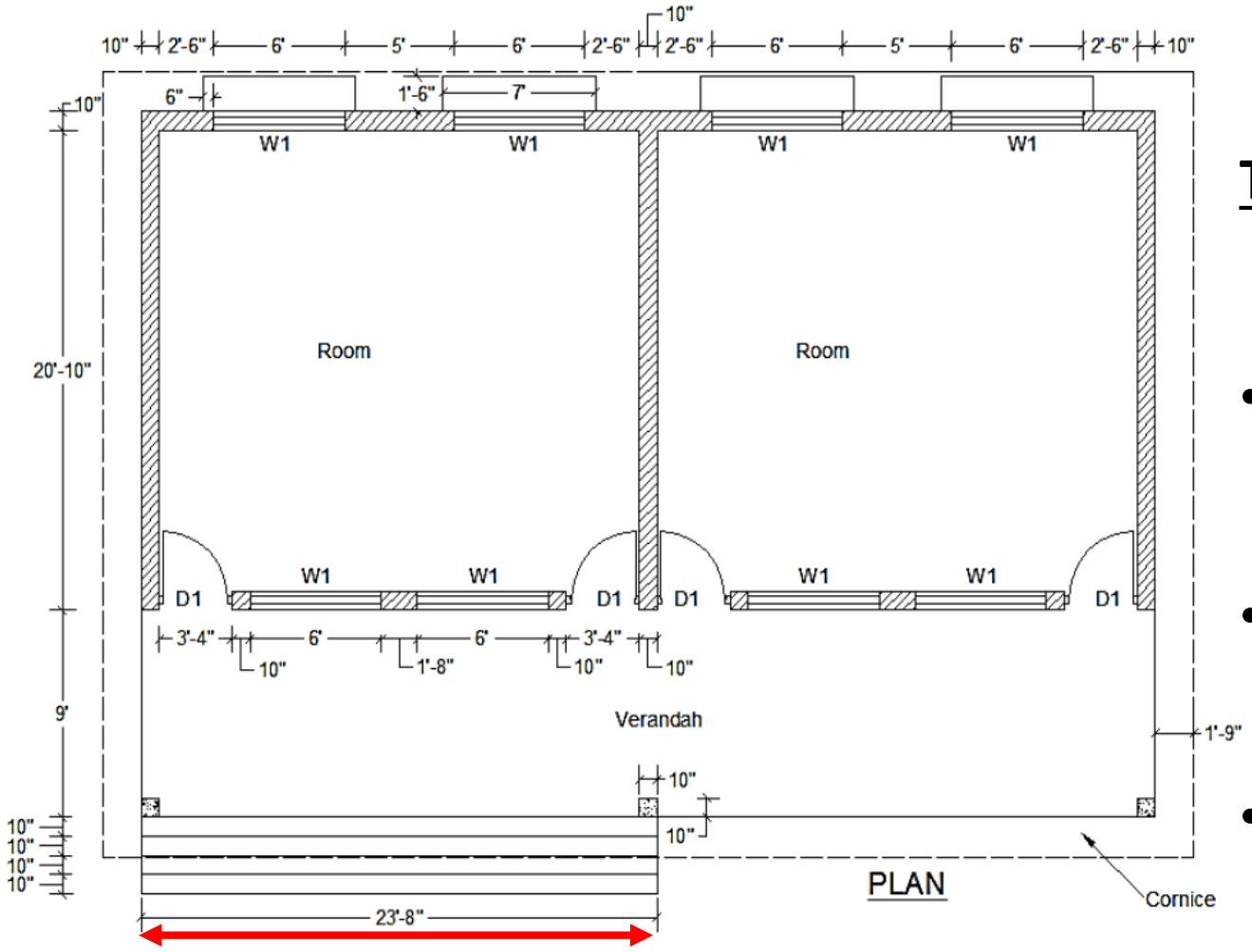


Second Step:

- Height= 6”
- Width= 20”
- Length= 23’8”

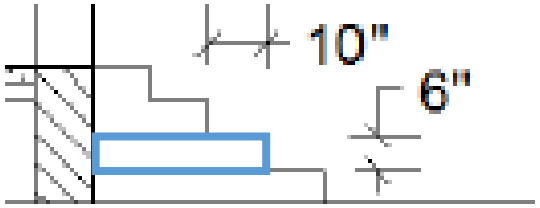


18. Brickwork in Stairs

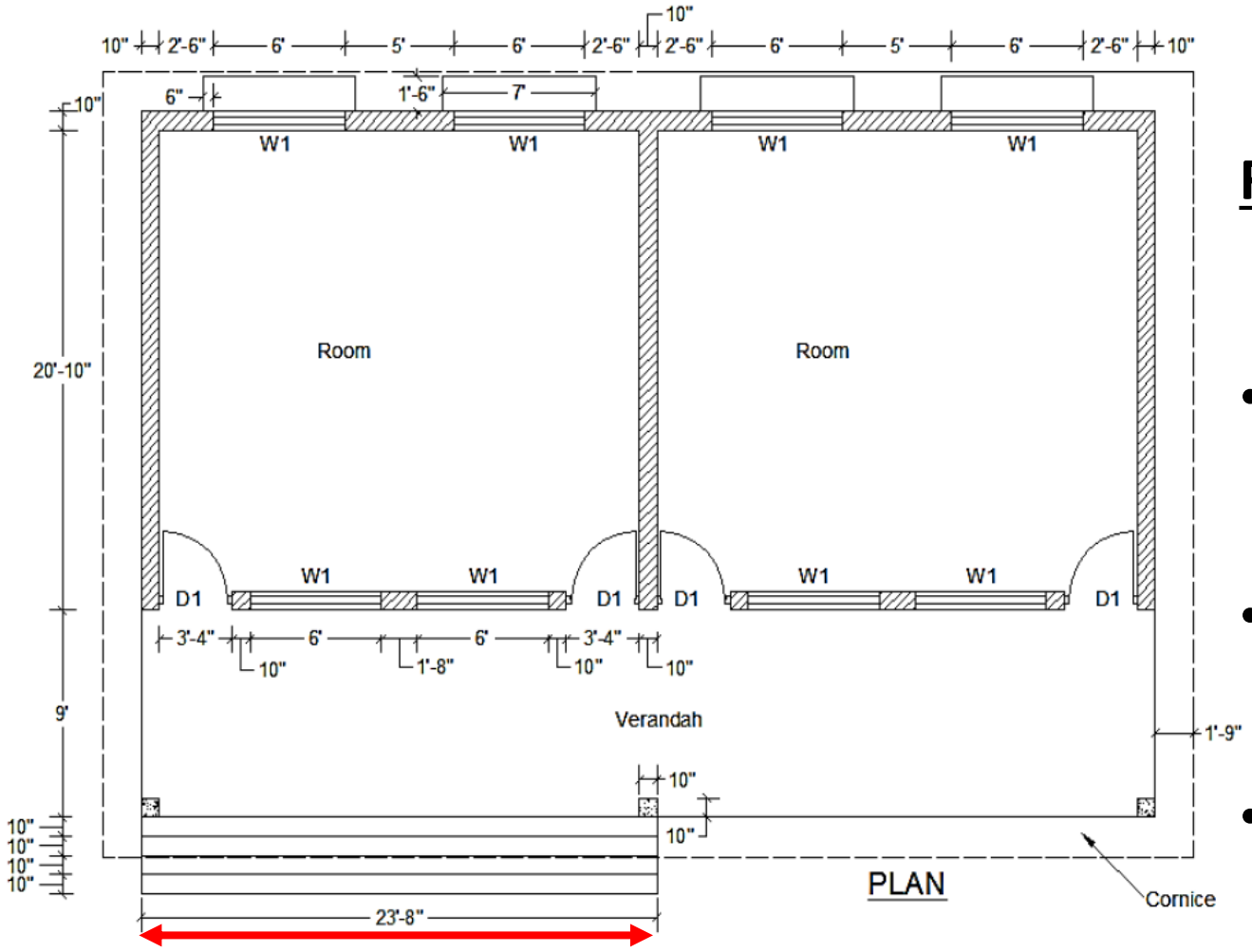


Third Step:

- Height= 6”
- Width= 30”
- Length= 23’8”

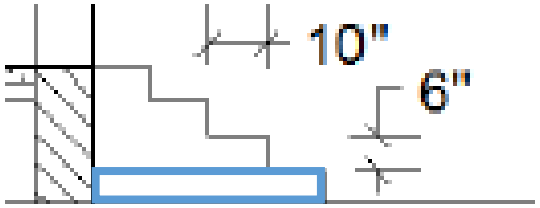


18. Brickwork in Stairs



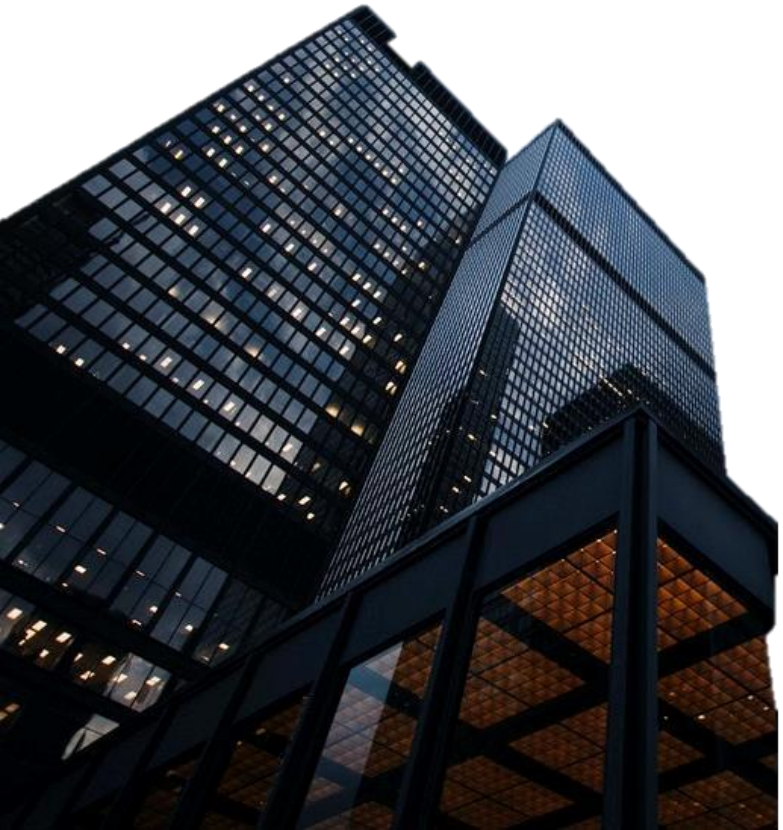
Fourth Step:

- Height= 6”
- Width= 40”
- Length= 23’8”



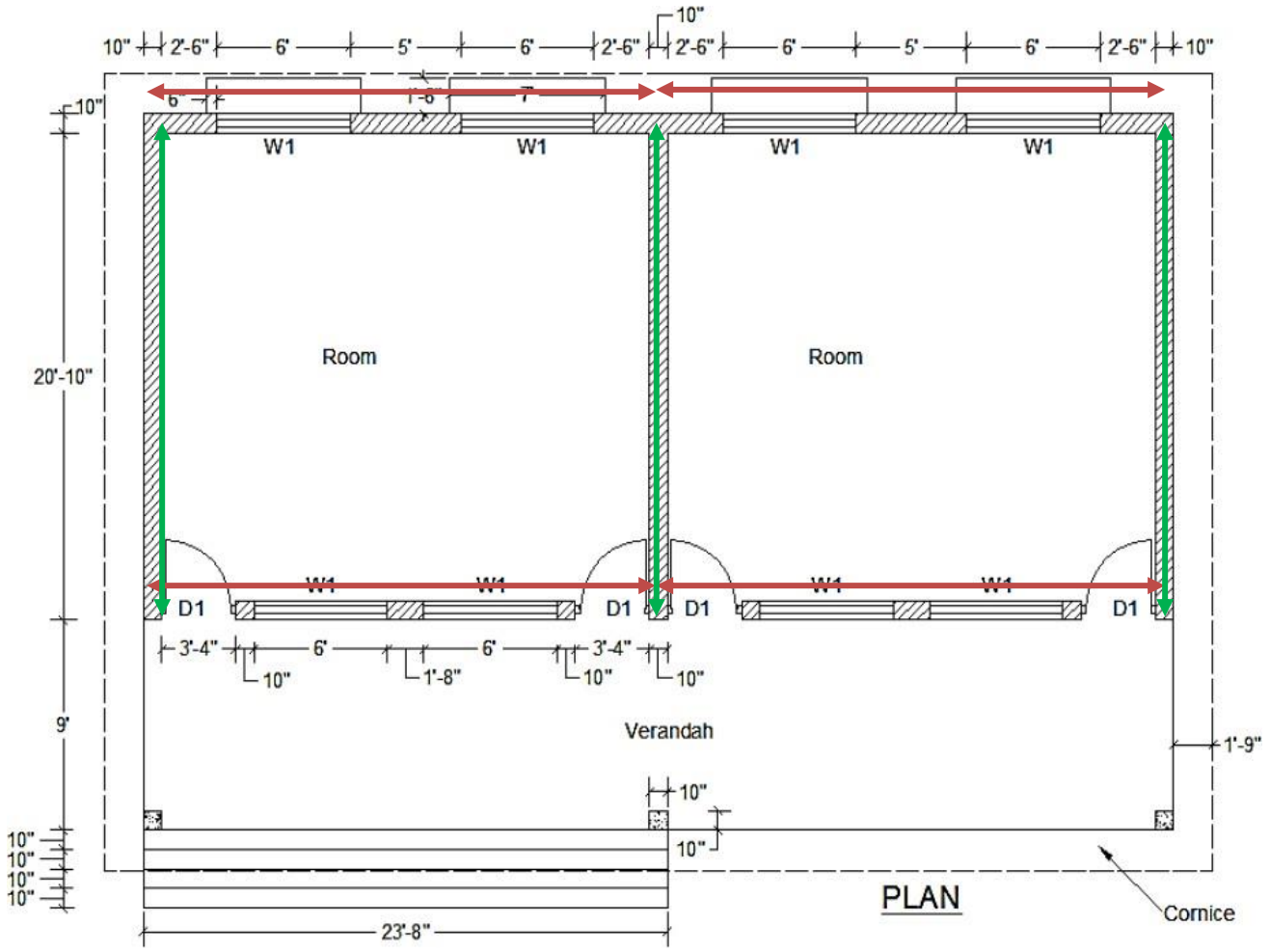
CE 208
Quantity Surveying

Estimation of a Residential Building



DEPARTMENT OF CIVIL ENGINEERING
BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY

19. Inside Plastering (Thickness-0.25”)



1) Inside wall

a) **Main room** = 2* {(22’+22’+20’+20’)* (10’7”-10” (skirting)) * 0.25”} = 34.12 cft

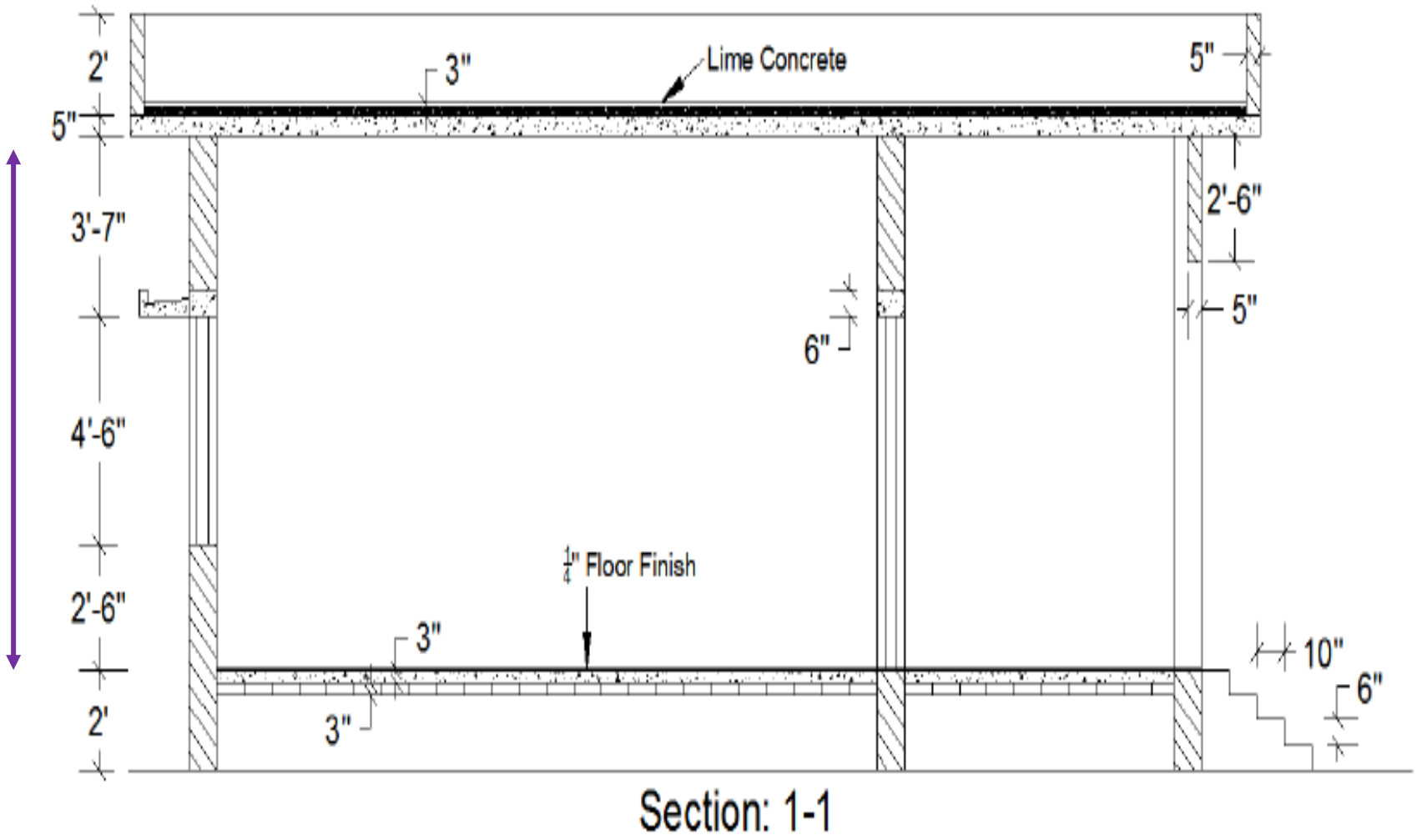
Deduction:

i. **Door** = 4 * (3’4”) * (7’-10” (skirting)) * 0.25 = 1.71 cft

ii. **Window** = 8 * 6’ * (4’6”) * 0.25” = 4.5 cft

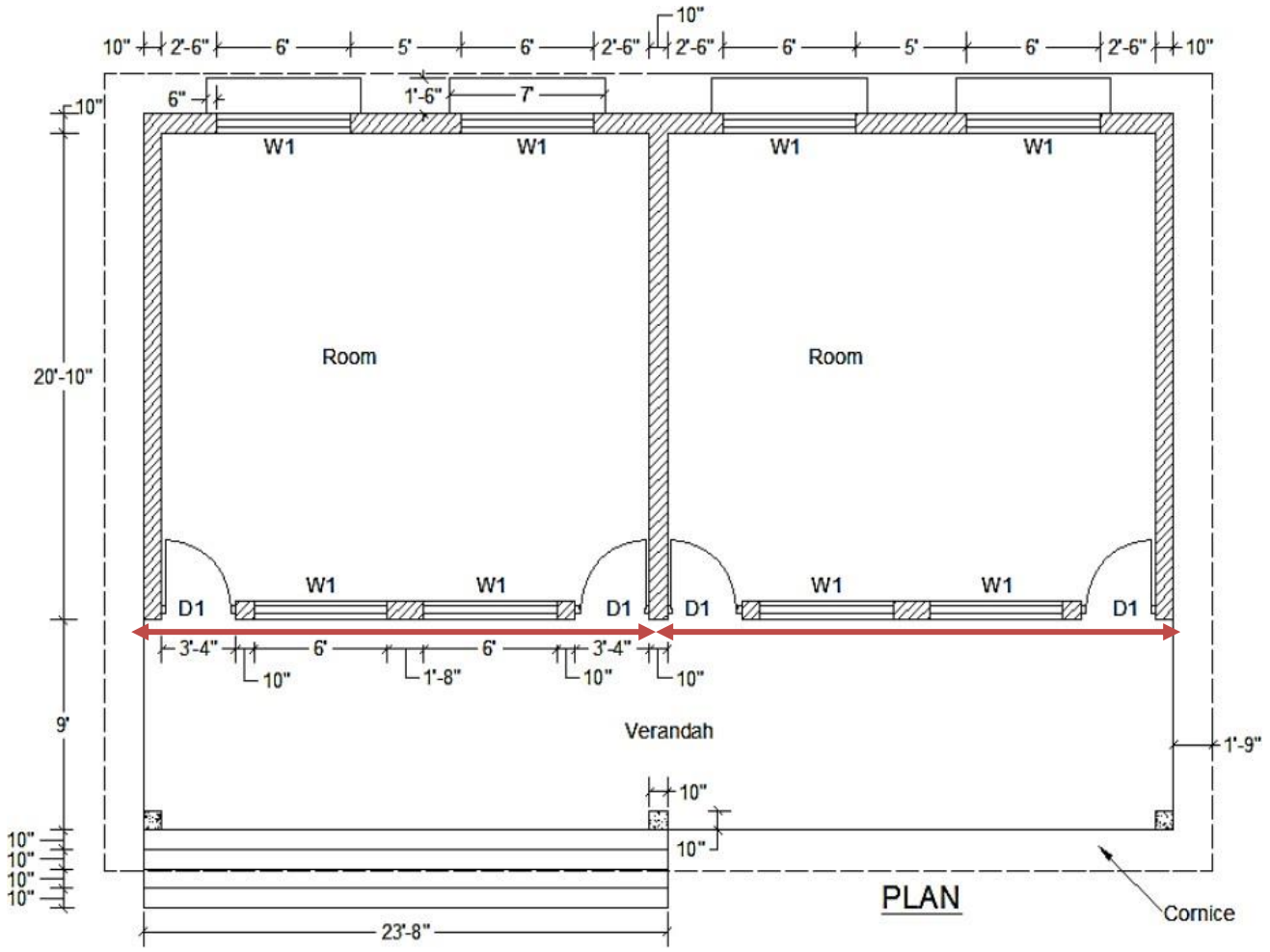
Total = (34.12 – 1.71 – 4.5) cft = 27.91 cft

19. Inside Plastering (Thickness-0.25”)



Section: 1-1

19. Inside Plastering (Thickness-0.25”)



1) Inside wall

b) Verandah= (23’3”+23’3”)* (10’7”-10” (skirting)) * 0.25”} = 9.45 cft

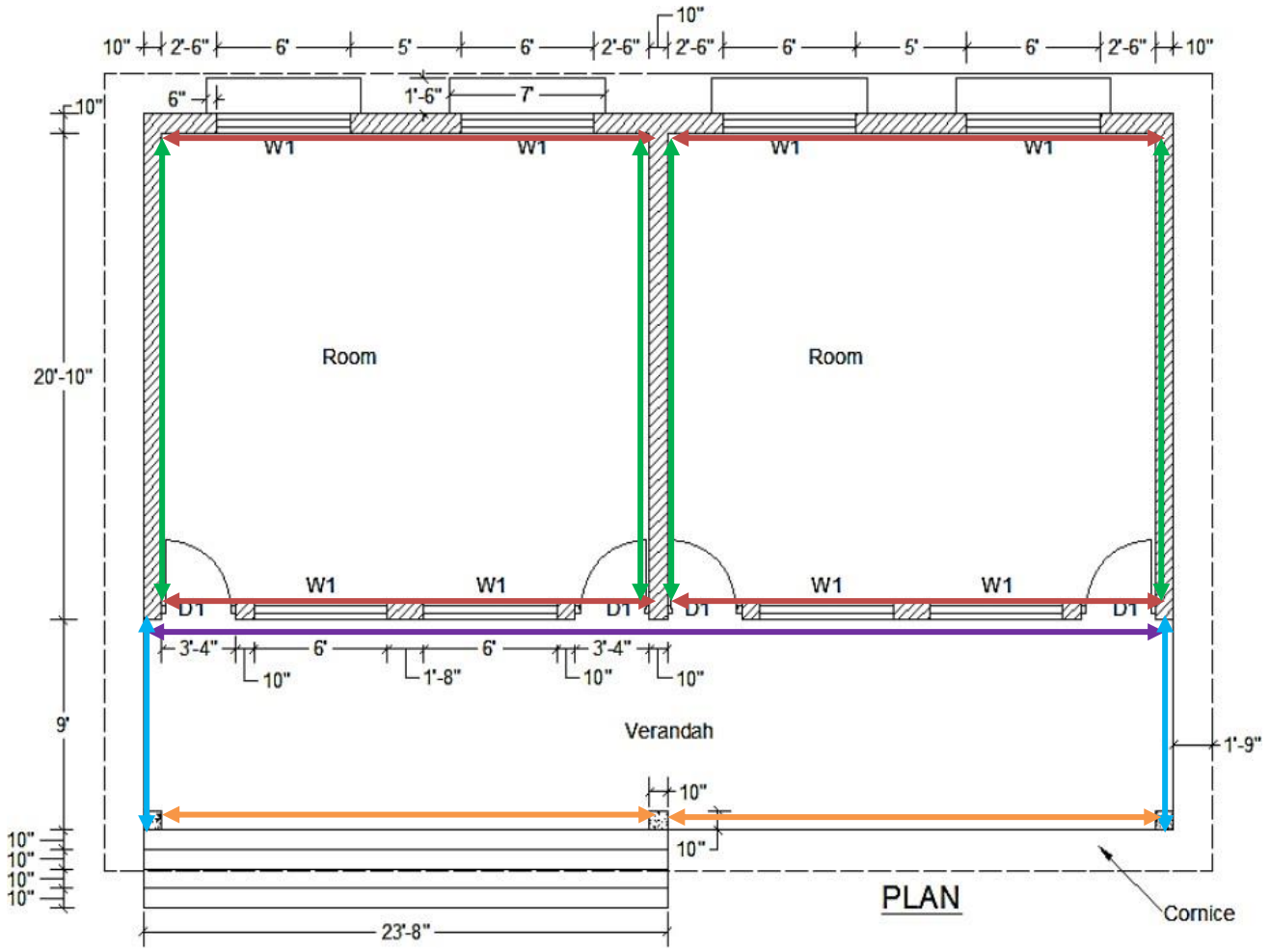
Deduction:

i. **Door** = 4 * (3’4”) * (7’-10” (skirting)) * 0.25 = 1.71 cft

ii. **Window** = 4 * 6’ * (4’6”) * 0.25” = 2.25 cft

Total = (9.45 – 1.71 – 2.25) cft = 5.49 cft

19. Inside Plastering (Thickness-0.25”)



2) Ceiling

a) Main room= 2*(22’*20’)*0.25” =

18.33 cft

b) Verandah= 46.5’*9’*0.25” = 8.72 cft

Deduction:

I. Column=

3*(10”*10”*0.25”)=0.04cft

II. Drop wall= (9’+9’+22’+22’) * 5”

*0.25” = 0.54 cft

Total = 18.33+8.72-0.04-0.54 = 26.47

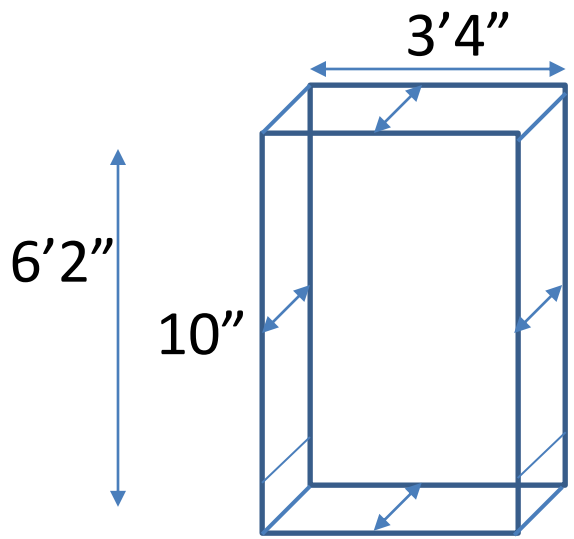
cft

19. Inside Plastering (Thickness-0.25”)

3) Edges

a) Door = 4* (6’2”+3’4”+6’2”) * 10” * 0.25” = 1.09 cft

b) Window = 8 * (4’6”*2+6’*2) * 10” * 0.25” = 2.92 cft



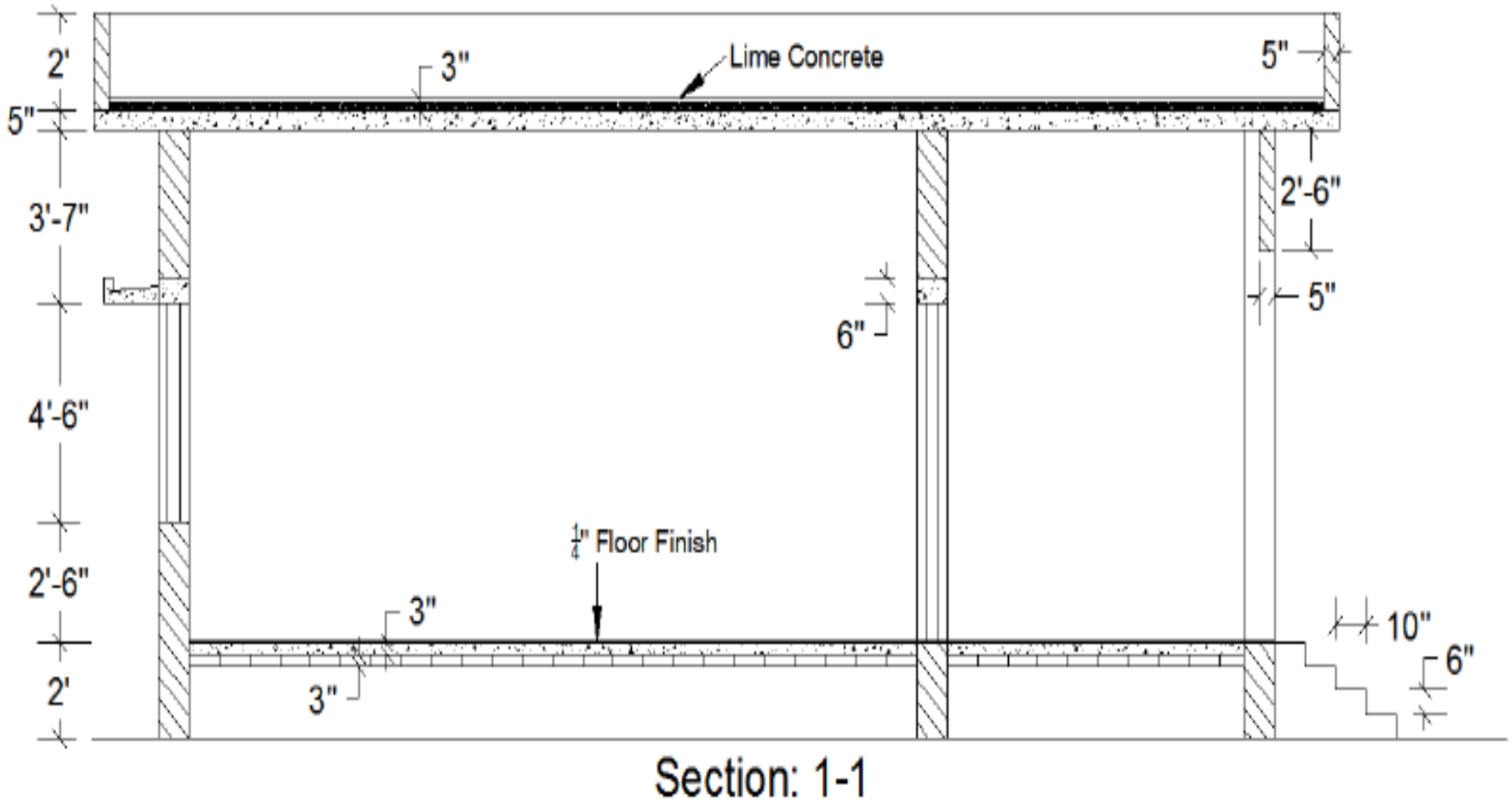
Total = 1.09+2.92 = **4.01** cft

19. Inside Plastering (Thickness-0.25”)

4) Drop wall Inside face

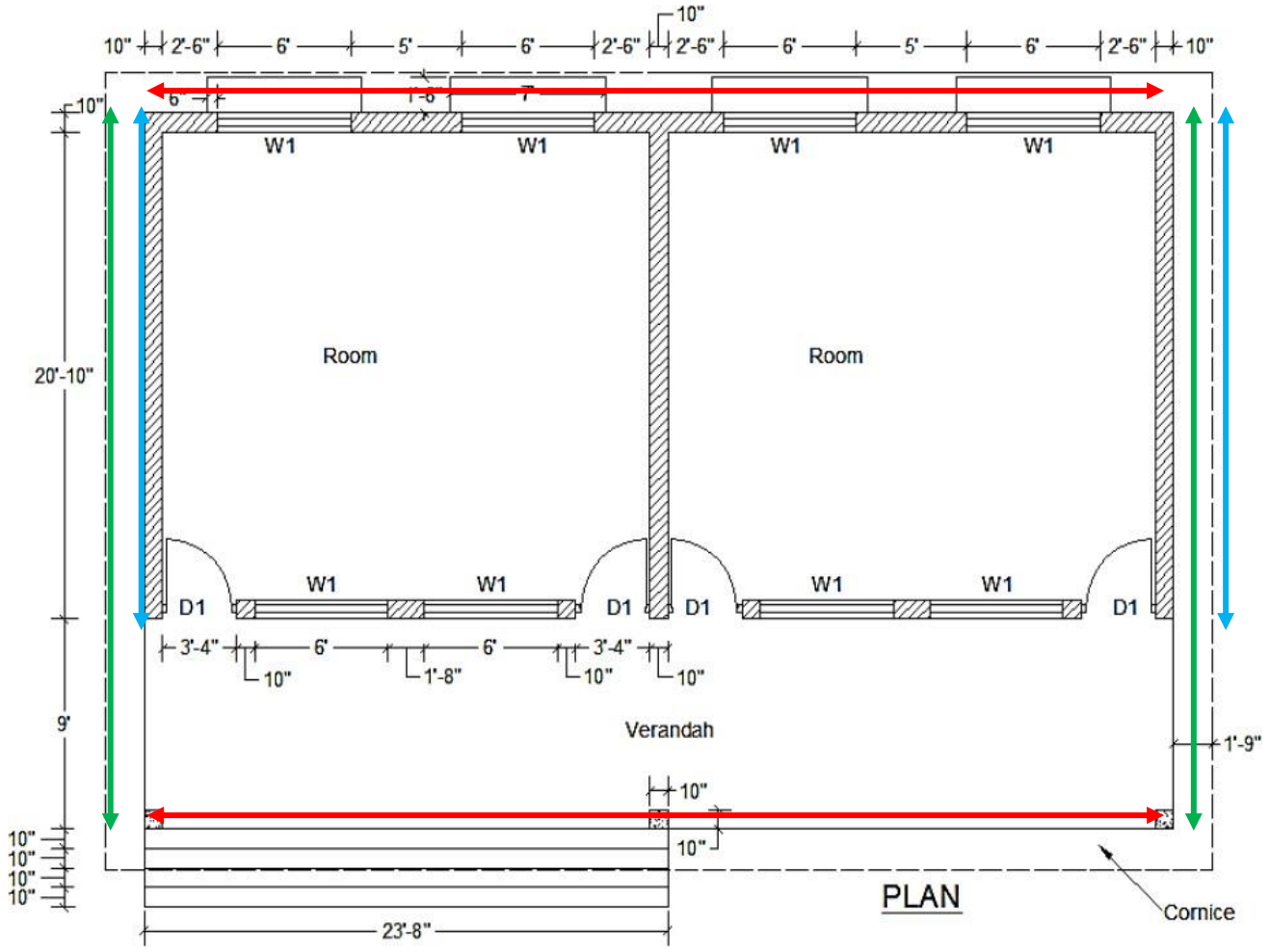
a) **Inside face =** 62’ * 2.5’ * 0.25” = 3.23 cft

b) **Bottom edge** = 62’ * 5” * 0.25” = 0.54 cft



Section: 1-1

20. Outside Plastering (Thickness-0.5”)

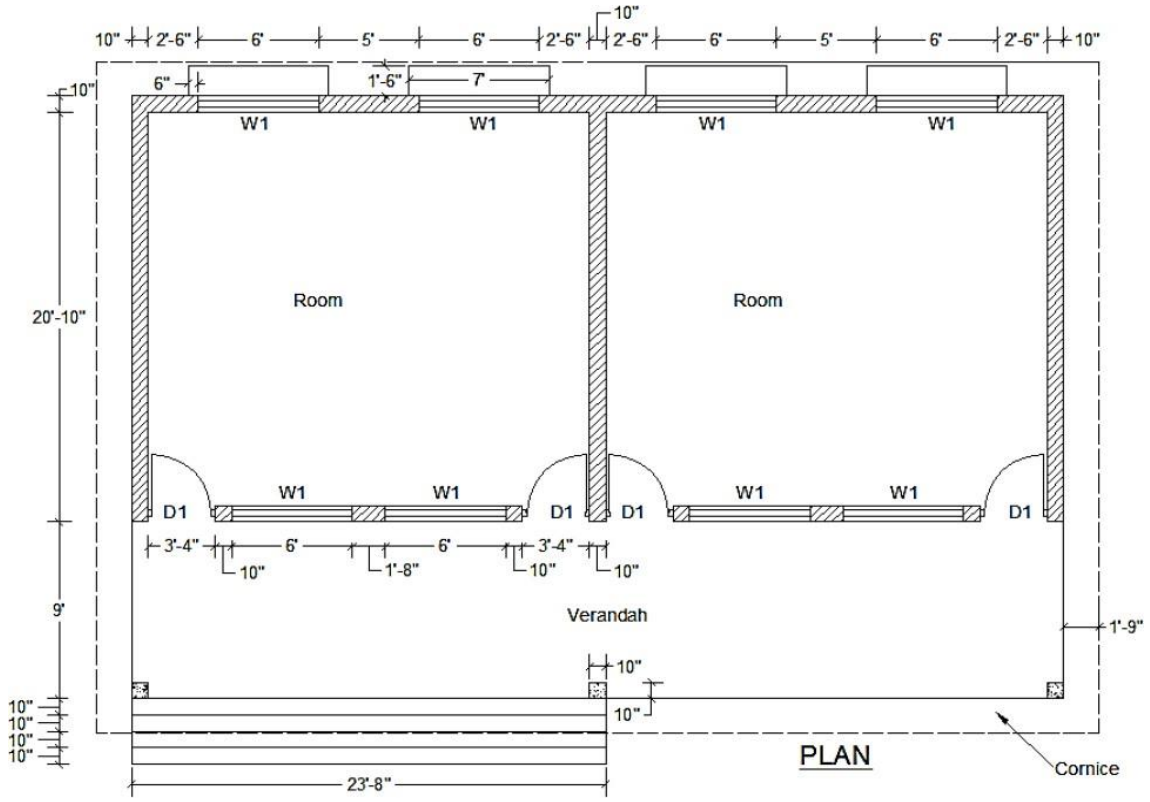


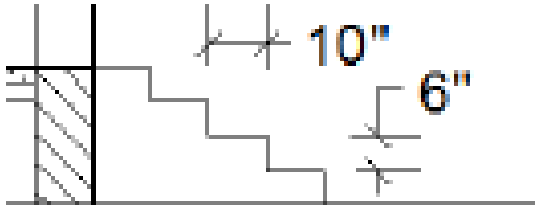
1) **GL to PL** = (46.5*2 + 30’8” *2) * 2’ * 0.5”
= 12.86 cft
Deduction:
Stair= 23’8” * 2’ * 0.5” = 1.97 cft

Total = 12.86-1.97 = 10.89 cft

2) **Outside wall** = (46.5+ 21’8”*2) * 10’
7” * 0.5” = 39.61 cft
Deduction
i. Window= 4 *4.5’* 6’*0.5”=4.5 cft
ii. Sunshade= 4 * 7’* 4”* 0.5 = 0.39 cft
Total = 34.72 cft

20. Outside Plastering (Thickness-0.5”)



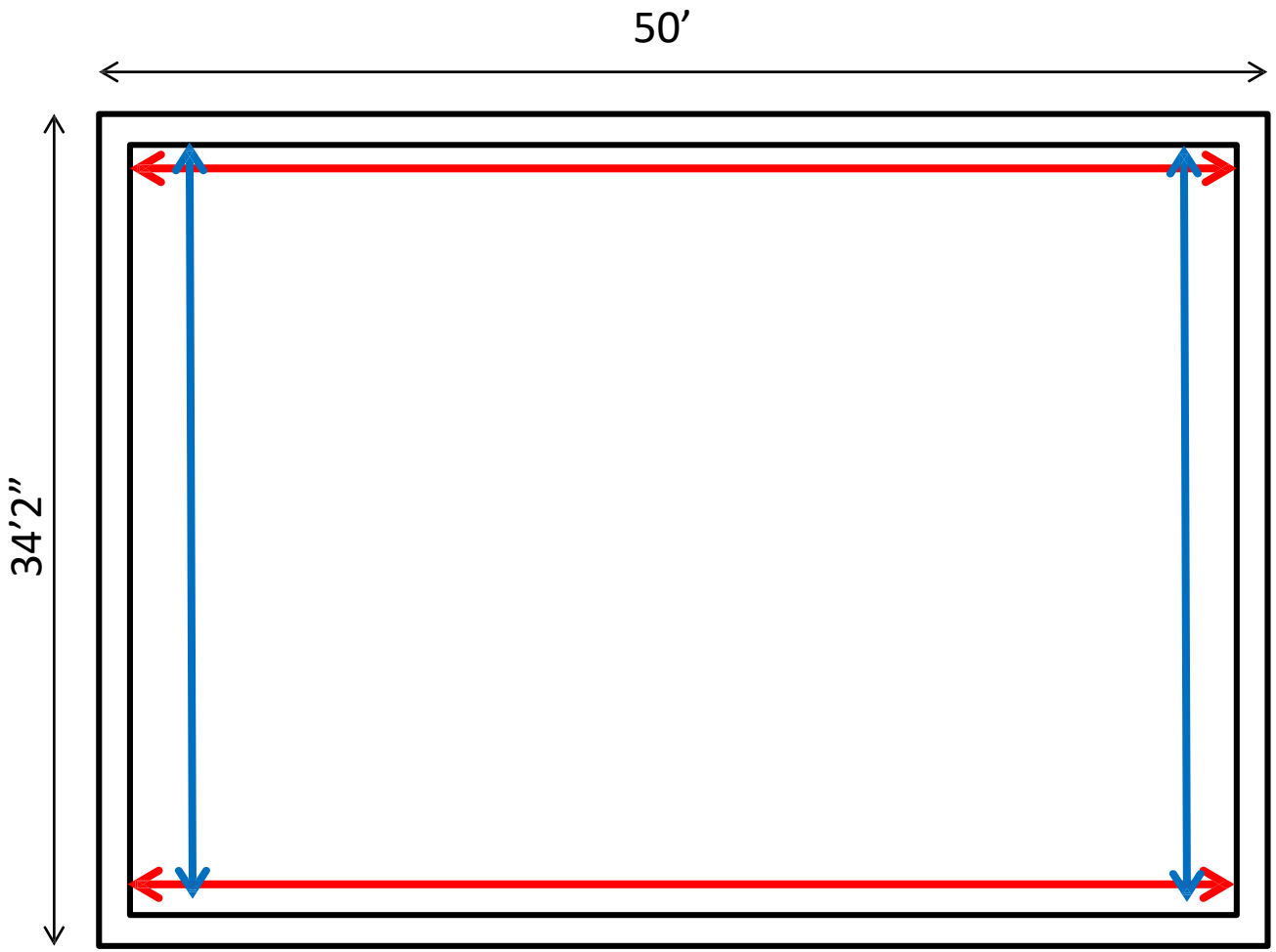


3) Column = 3* (10”*4)*(10’7”-10”) * 0.5”=
4.06 cft
Deduction:
Dropwall= 6* 2’6”*5”*0.5” = 0.26 cft
Total = 3.80 cft

4) **Stairs**

i. 1st step = 2*10”*6”*0.5” = 0.035 cft
ii. Similar for other steps.

20. Outside Plastering (Thickness-0.5”)



5) Parapet

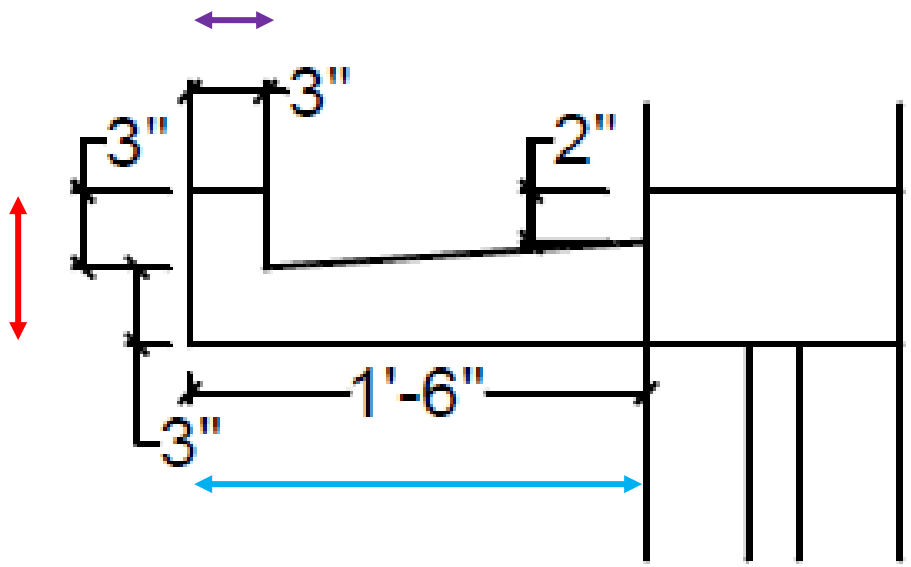
i. **Inside =** (49’2”*2+ 33’4”*2)*2’ *

0.5” = 13.75 cft

ii. **Outside = Similar**

iii. **Top =** Similar

20. Outside Plastering (Thickness-0.5”)



6) Sunshade

i. Bottom face = 4* 7’ * 1’6” * 0.5” = 1.75 cft

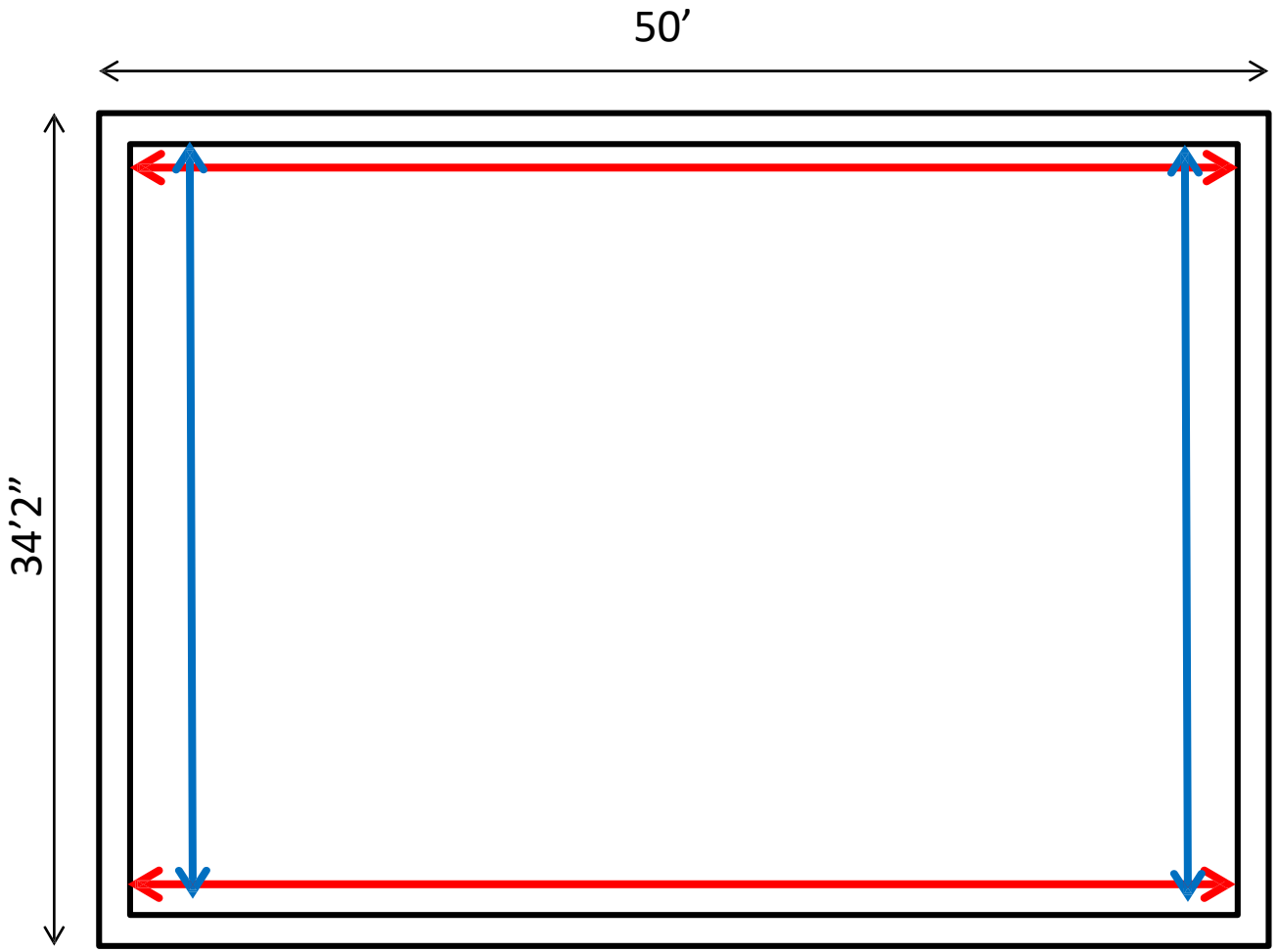
ii. Front face = 4* 7’* 6” * 0.5” = 0.58 cft

iii. Top face = 4* 7’ * 3” * 0.5” = 0.29 cft

iv. Inside face =

v. Side edge =

20. Outside Plastering (Thickness-0.5”)

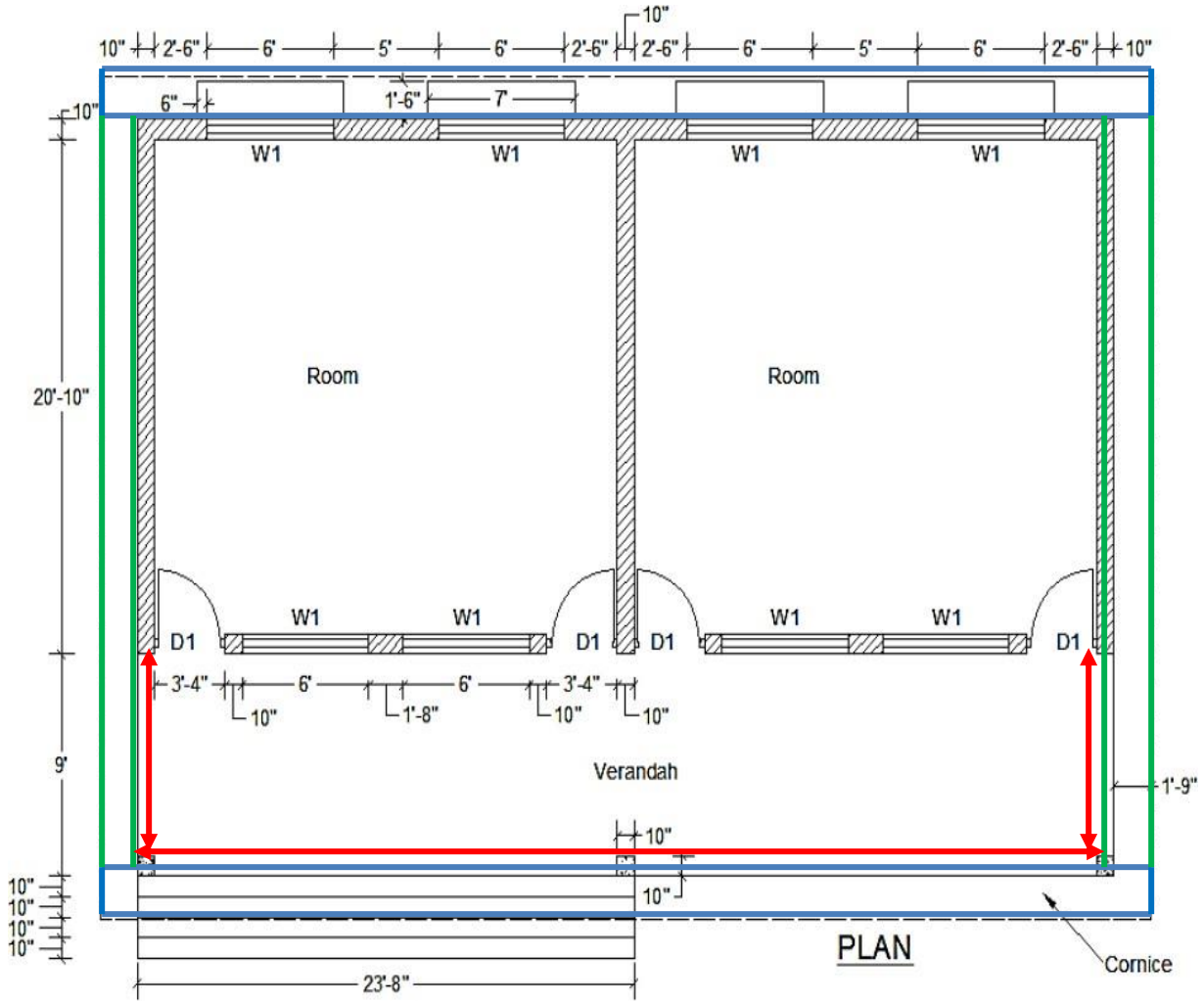


7) Cornice

i. **Side edge =**

(50’*2+34’2”*2)*0.5”*5”= 2.92 cft

20. Outside Plastering (Thickness-0.5”)



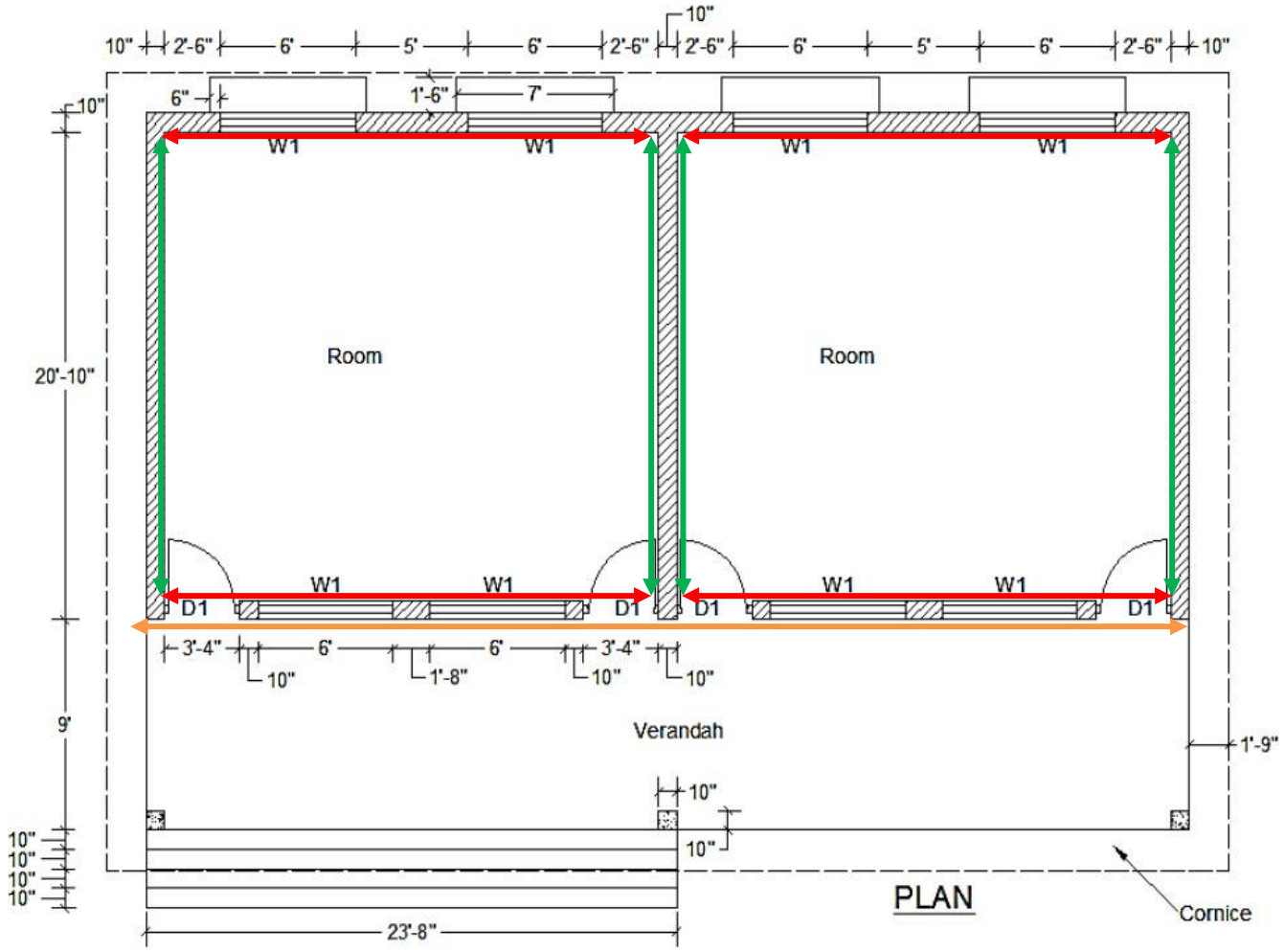
7) Cornice

i. Bottom edge = {(**46.5’+2* 1’9”)*1’9”**}*2*0.5” + {(**30’8”*1’9”)}***2*0.5” = 11.76 cft

8) Drop Wall

i. **Outside face =** 62’*2’6”*0.5” = 6.45 cft

21. Skirting (Thickness 0.75”)

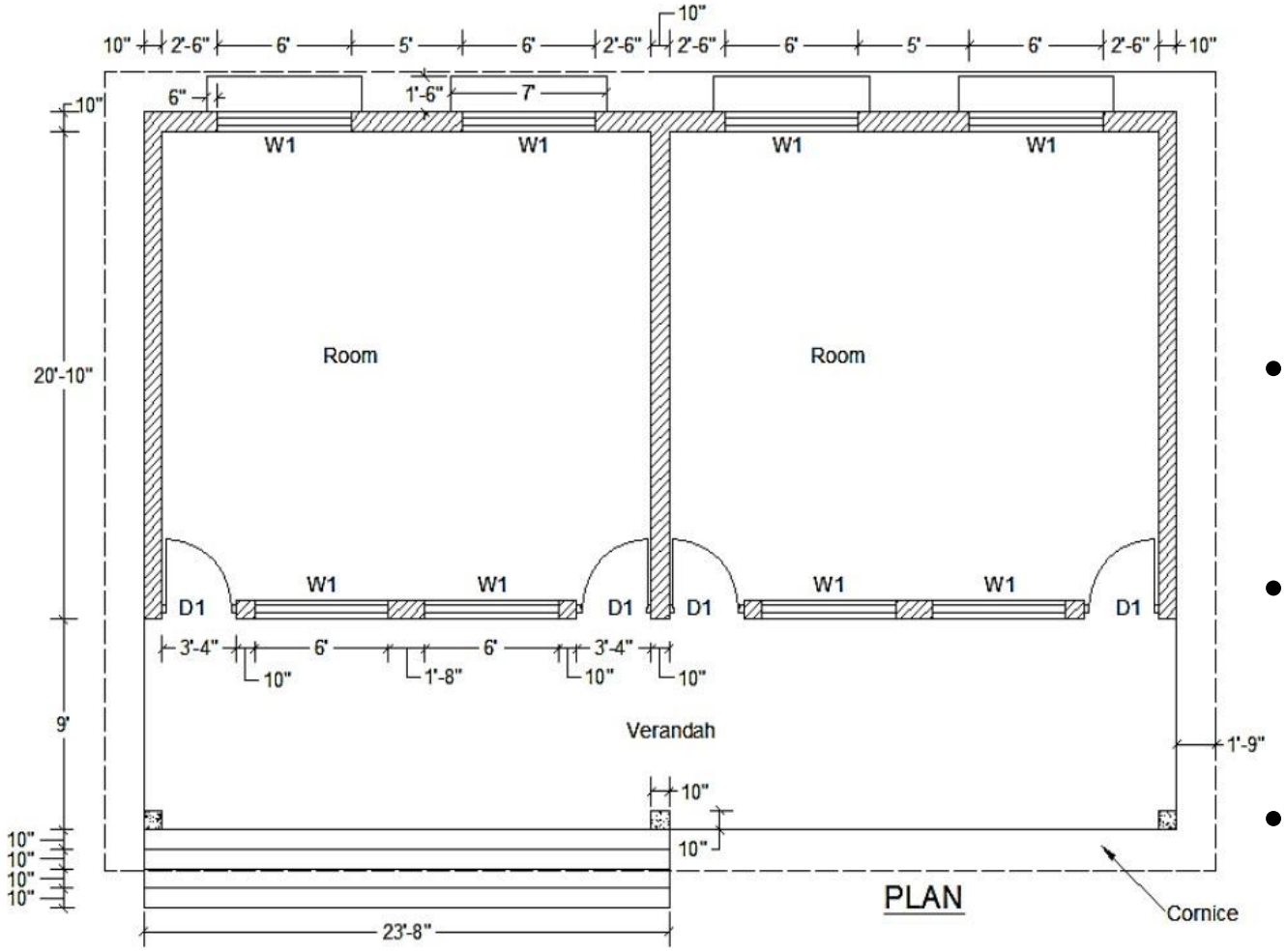


1. **Main room** = (**22’*4**+ **20’*4**)*10”*0.75”= 8.75 cft
   Deduction:
   i. Door = 4* 3’4”* 10”*0.75” = 0.69 cft

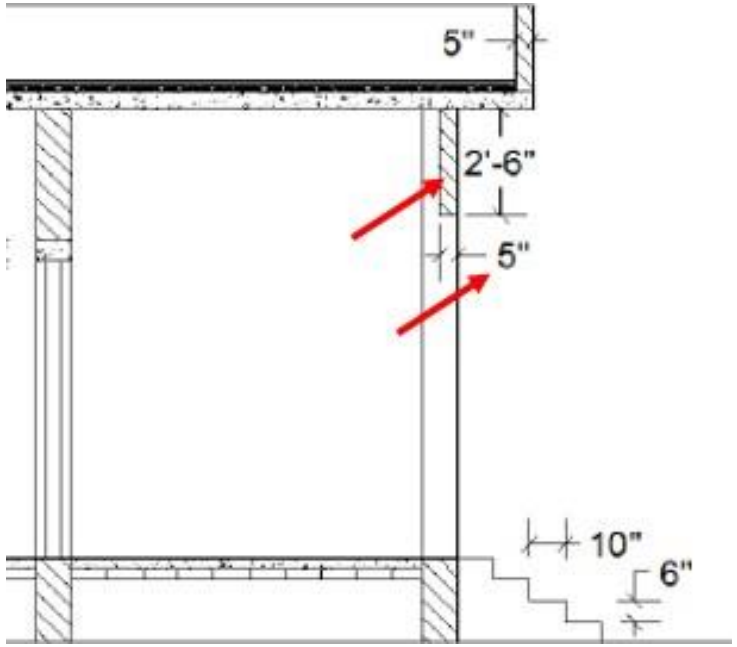
2. **Verandah** = **46’6”** * 10”* 0.75” = 2.42 cft
   Deduction:
   i. Door = 4* 3’4”* 10”*0.75” = 0.69 cft

3. **Column** = 3*(10”*4)*10”*0.75” = 0.52 cft

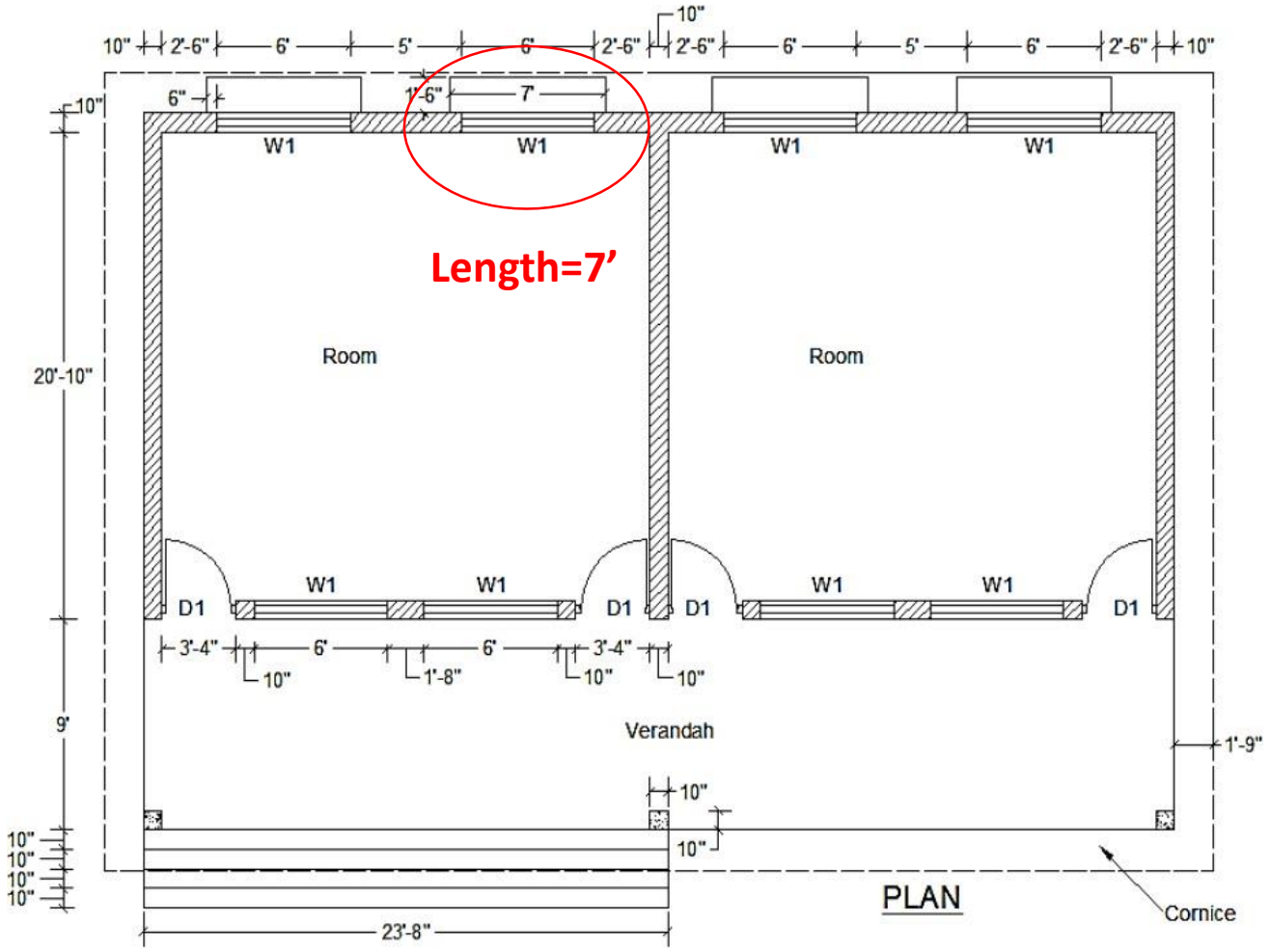
22. RCC in Drop walls



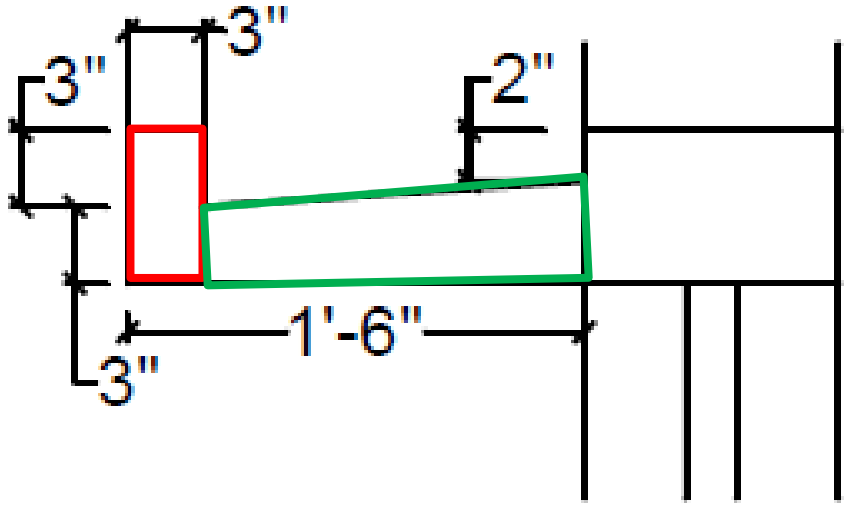
- Height= 2’6”
- Width= 5”
- Length= 62’



23. RCC in Sunshades



23. RCC in Sunshades



Volume= 4*((3”x6”) + (0.5x (3”+4”) x15”)) x7’

Lecture on
CE 208: Quantity Surveying



Material Estimation of Slab culvert

Culvert

- A small bridge used to carry water from one side to other
- Culvert may consist of one, two or three spans
- Generally, maximum span is 5-6 meter. Long span culvert may also be used

Uses of culvert

- Where natural streams intersects the roadway
- For passing surface drainage

Culvert vs Bridge

- Top- travel way
- Basis of span length (Culvert < 20 feet; Bridges > 20 feet)


Arch culvert


Box culvert


Slab culvert

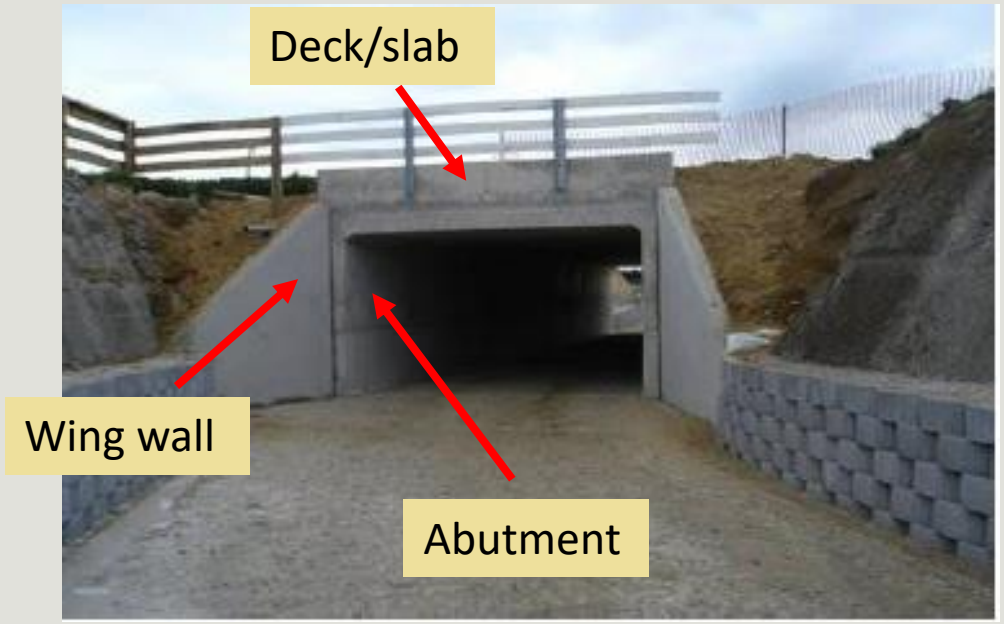

Pipe culvert

Slab Culvert

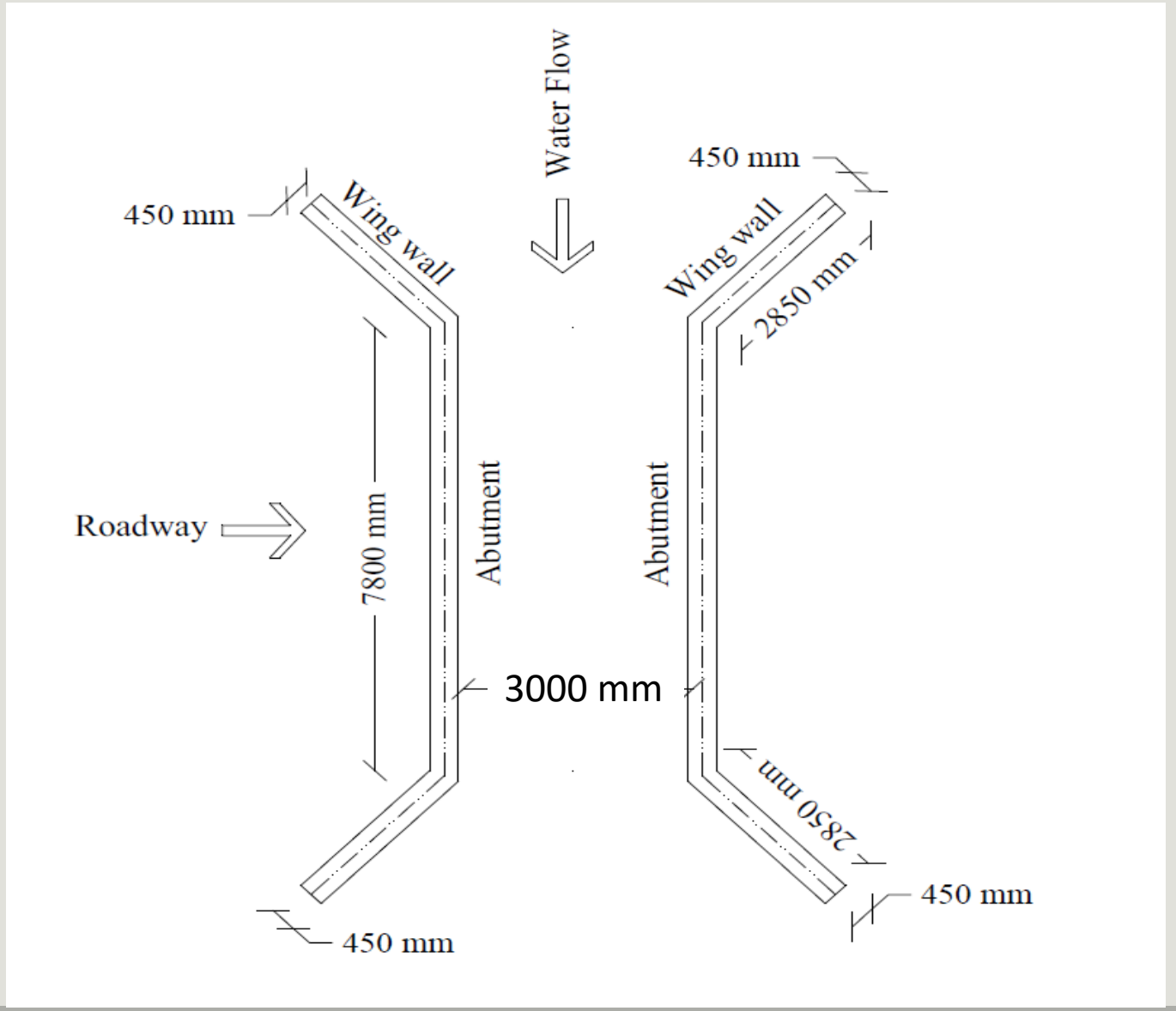
- Most commonly used in Bangladesh
- Materials- RCC

Advantages of Slab Culvert

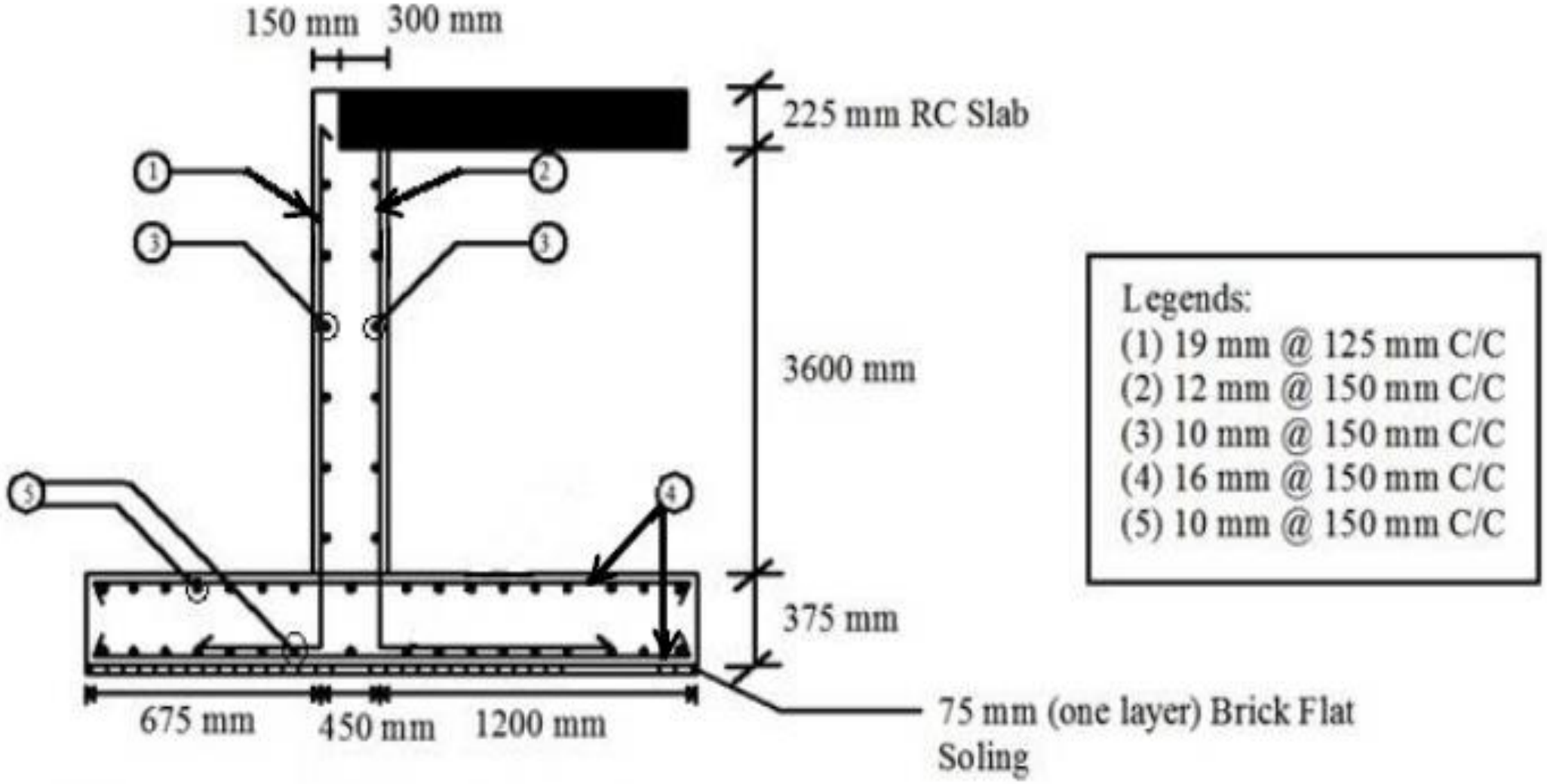
- Simple in construction
- Suitable for weak sub grade



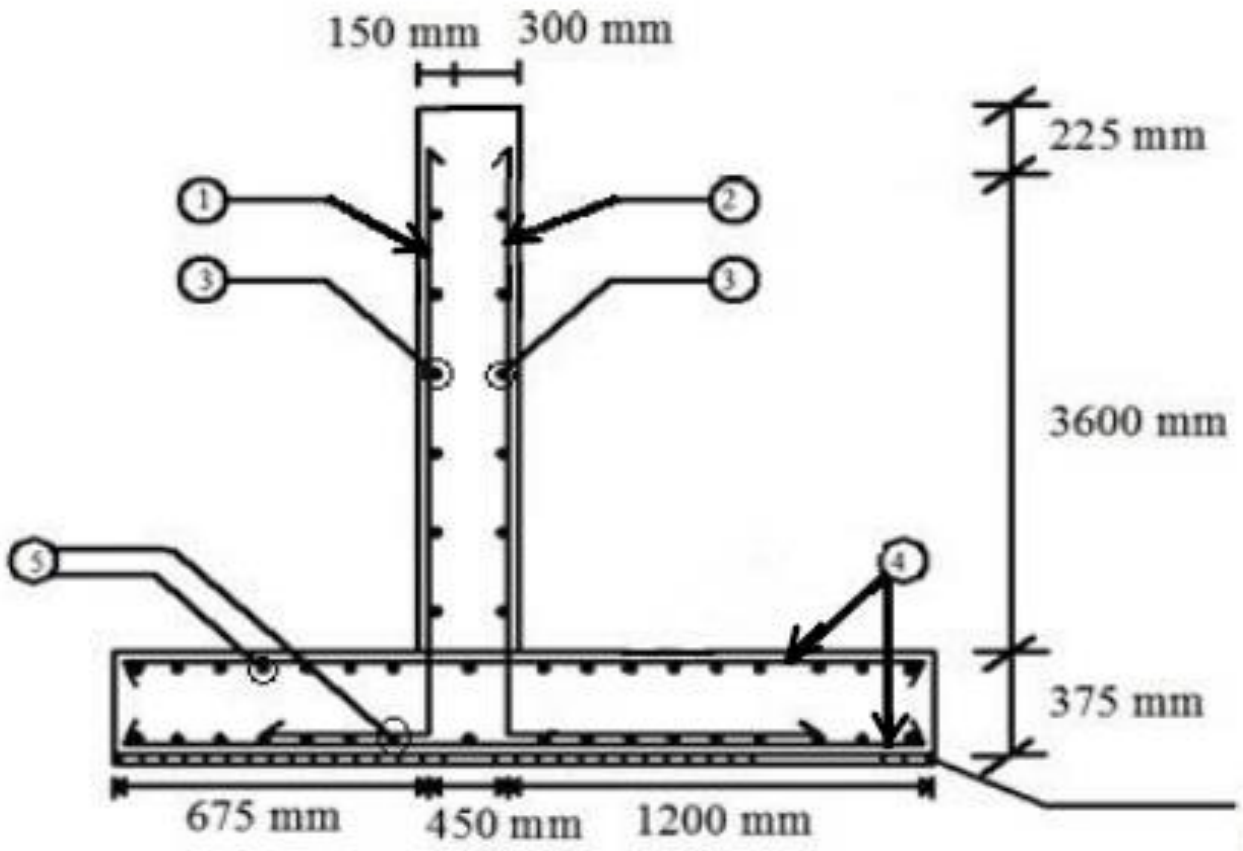
Worked out problem



Sectional Elevation through Abutment



Sectional Elevation through Wing wall

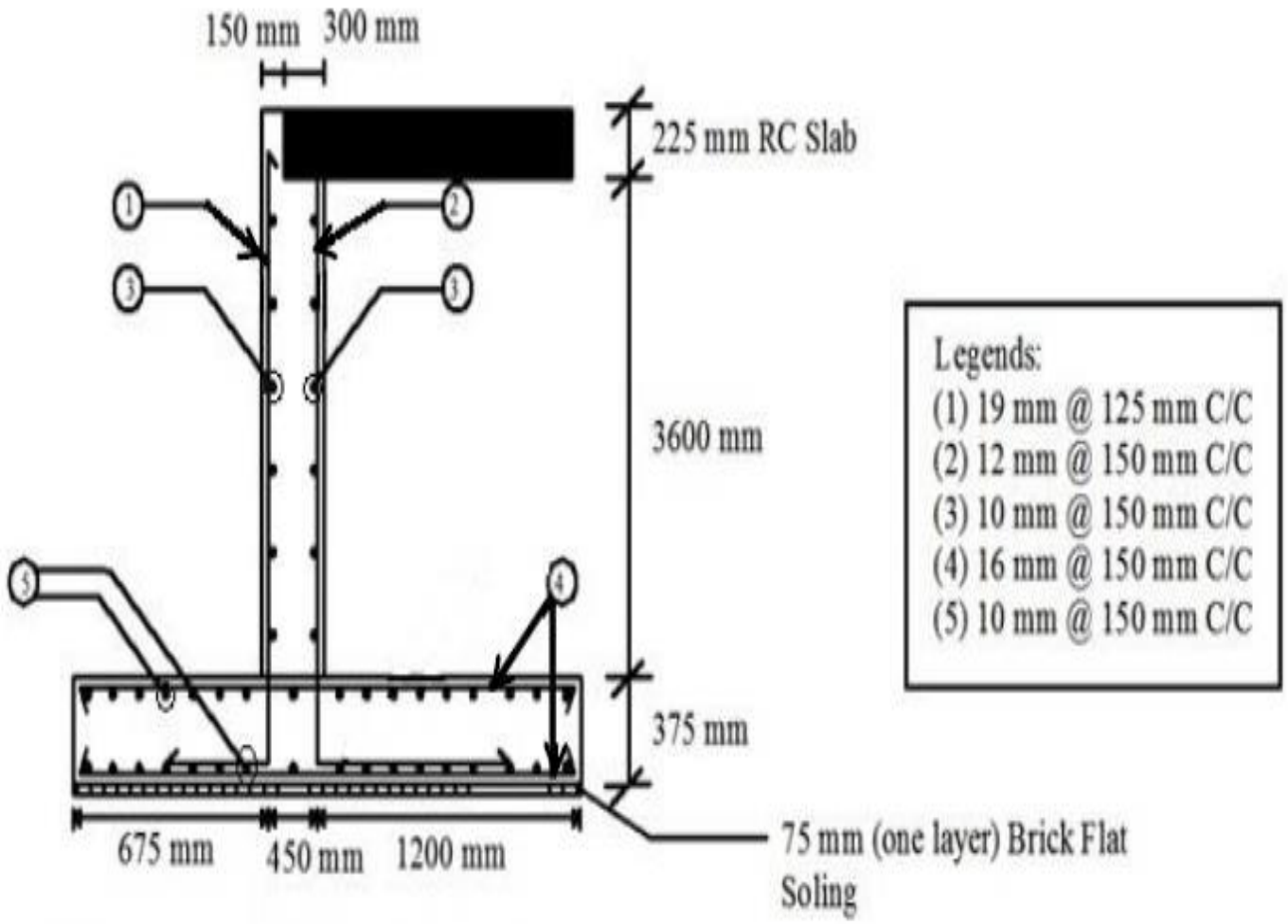


Legends:
(1) 19 mm @ 125 mm C/C
(2) 12 mm @ 150 mm C/C
(3) 10 mm @ 150 mm C/C
(4) 16 mm @ 150 mm C/C
(5) 10 mm @ 150 mm C/C

Calculation of concrete estimation

Item no.	No.	Length (m)	Width (m)	Height/ thickness (m)	Area/ volume
1. 75 mm brick flat soling					
Abutment	2	7.80	2.325	--	36.27
Wing wall	4	2.85	2.325	--	26.51
2. RCC in foundation (1:2:4)					
Abutment	2	7.80	2.325	0.375	13.60
Wing wall	4	2.85	2.325	0.375	9.94
3. RCC in superstructure (1:2:4)					
Abutment	2	7.80	0.45	3.825	26.85
Deduction due to slab bearing	2	7.80	0.30	0.225	-1.05
Wing wall	4	2.85	0.45	3.825	19.62
4. RCC in slab (1:1.5:3)					
	1	7.80	3.60	0.225	6.32

Calculation of reinforcement estimation in one Abutment



(1) Vertical rod in outside face

19 mm dia @ 125 mm c/c

$= (\frac{7800}{125} + 1) \times (3600+225+375-75-75+9dbx2+ 12x19)$

(2) Vertical rod in inside face

12 mm @150 mm c/c

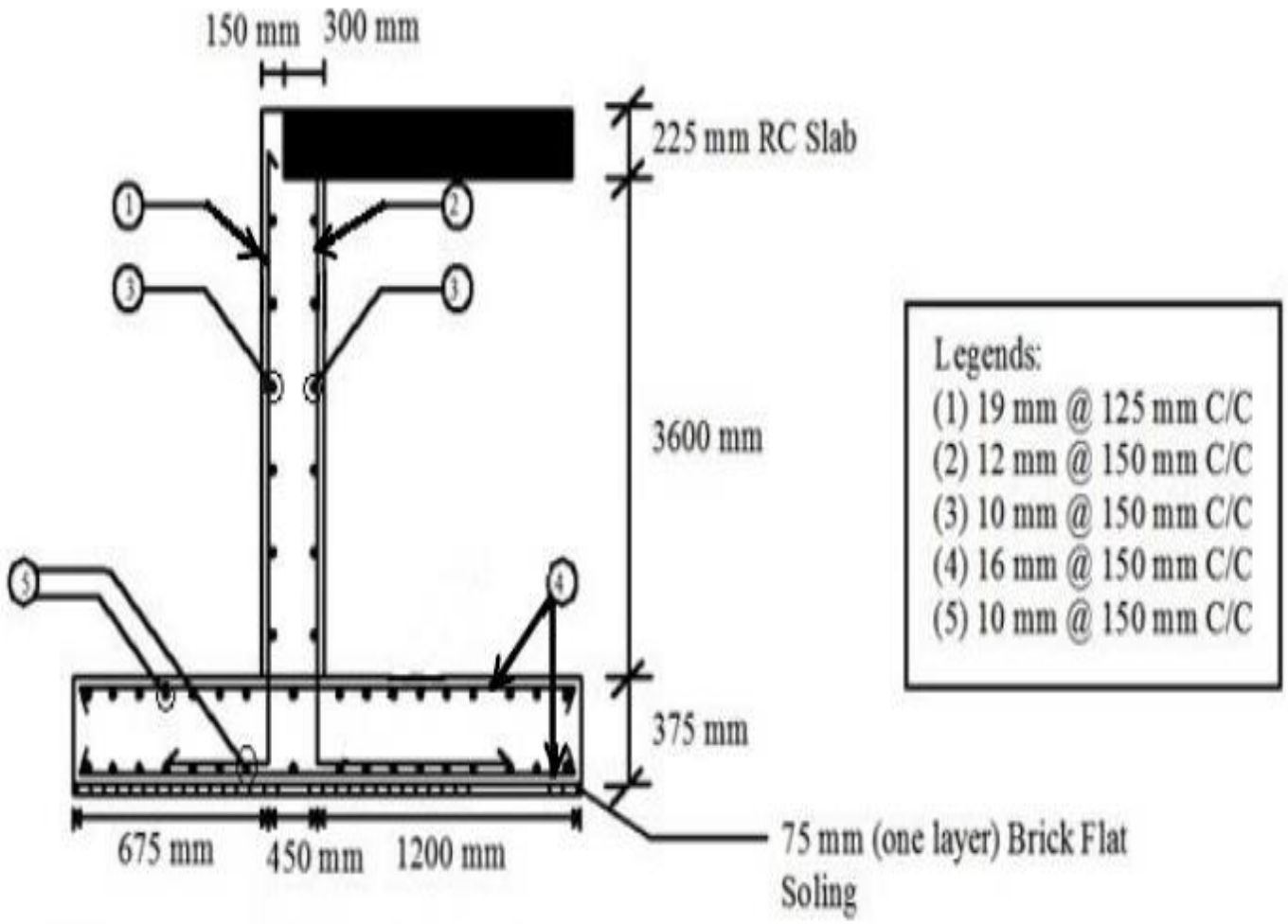
$= (\frac{7800}{150} + 1) \times (3600+375-75-75+12x12+9dbx2)$

(3) Horizontal rod in outside face

10 mm @ 150 mm c/c

$= (\frac{3600+225-75}{150} + 1) \times (7800+ 9db \times 2)$

Calculation of reinforcement estimation in Abutment



(3) Horizontal rod in inside face

10 mm dia @ 150 mm c/c

$= (\frac{3600-75}{150} + 1) \times (7800 + 9dbx2)$

(4) Horizontal rod in footing both layer

16 mm @150 mm c/c

$= (\frac{7800}{150} + 1) \times (1200+450+675-75-75-75+9db \times 2)x2$

(5) Horizontal rod in footing both face

10 mm @ 150 mm c/c

$= (\frac{1200+450+675-75-75}{150} + 1) \times (7800+9dbx2) \times 2$

Calculation of reinforcement estimation in one Wing wall

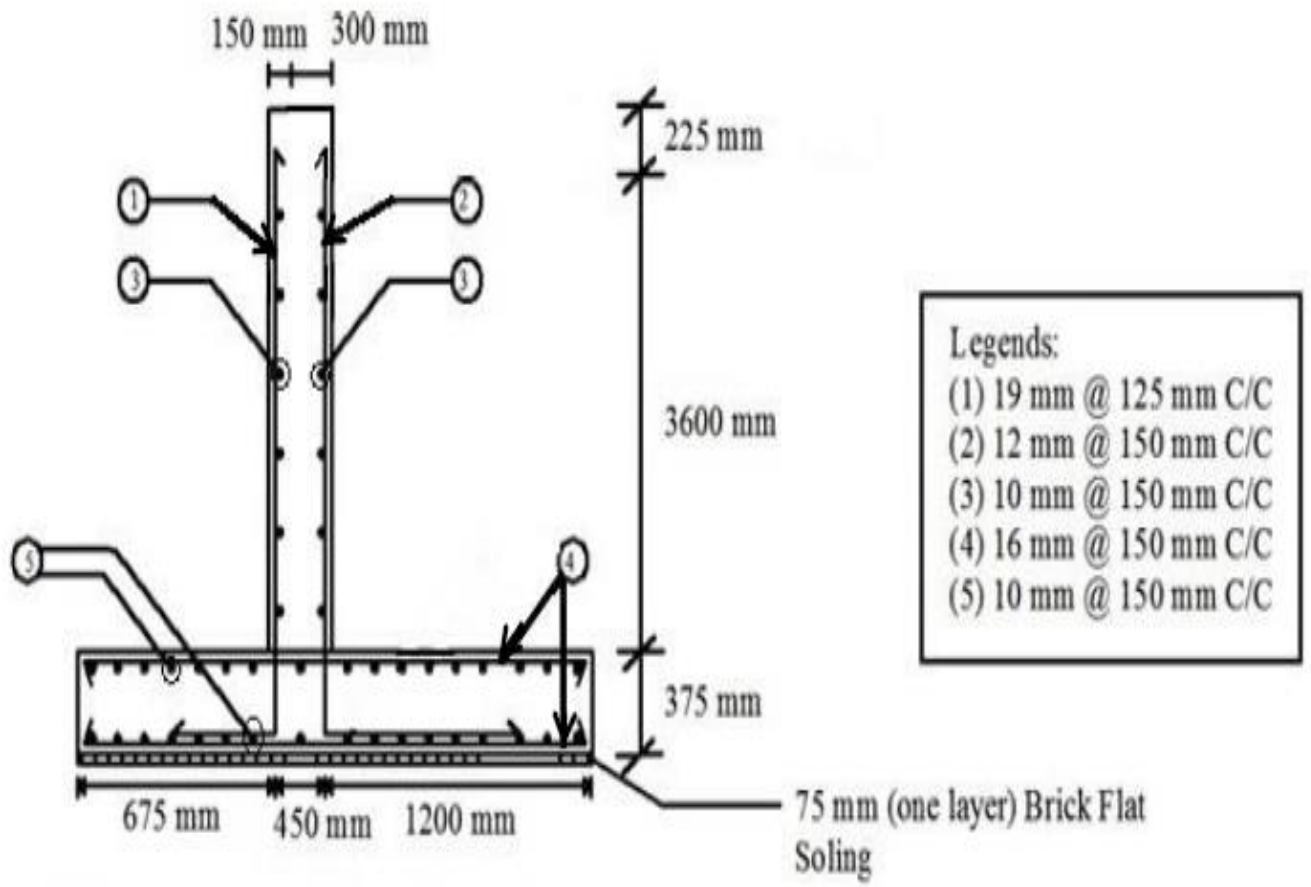


Figure 4.10: Sectional Elevation through Wing Wall

(1) Vertical rod in outside face

19 mm dia @ 125 mm c/c

$= (\frac{2850}{125} + 1)$ x (3600+225+375-75-75+9dbx2+ 12x19)

(2) Vertical rod in inside face

12 mm @150 mm c/c

$= (\frac{2850}{150} + 1)$ x (3600+225+375-75-75+12x12+9dbx2)

(3) Horizontal rod in wall both face

10 mm @ 150 mm c/c

$= (\frac{3825-75}{150} + 1)$ x (2850-75+9dbx2)x2

Calculation of reinforcement estimation in one Wing wall

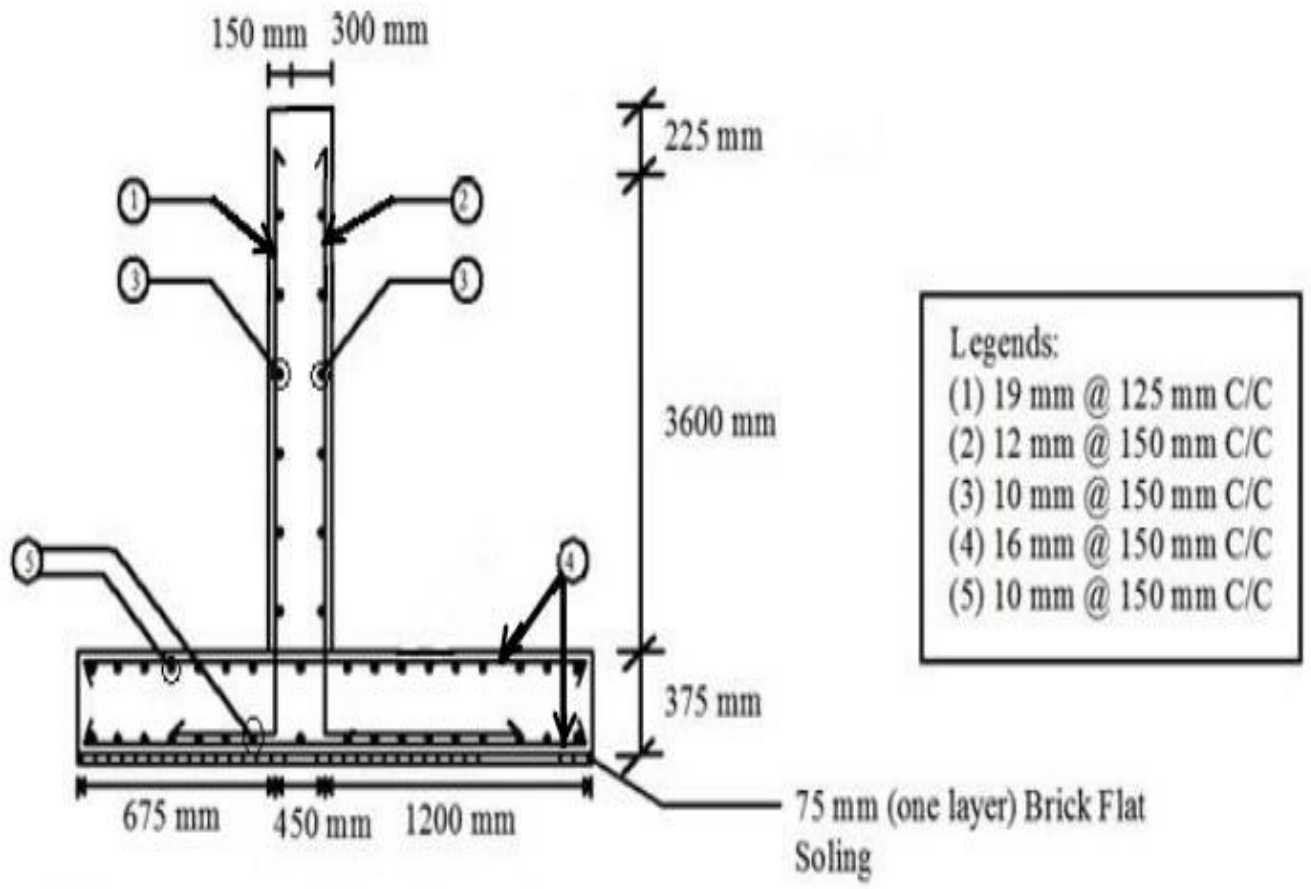


Figure 4.10: Sectional Elevation through Wing Wall

(4) Horizontal rod in footing both layer

16 mm @150 mm c/c

$= (\frac{2850}{150} + 1) \times (1200+450+675-75-75+9db \times 2) \times 2$

(5) Horizontal rod in footing both face

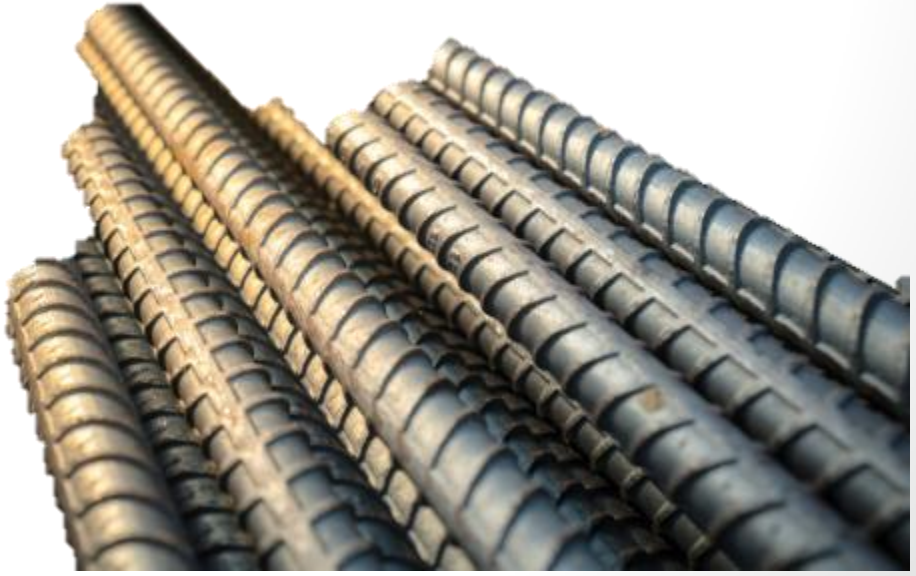
10 mm @ 150 mm c/c

$= (\frac{1200+450+675-75-75}{150} + 1) \times (2850-75+ 9db \times 2) \times 2$

THANK YOU!

CE 208
Quantity Surveying

Reinforcement Estimation: RCC Slab



Necessity for Reinforcement Estimation

- For procurement of material
- To submit or to check at site the consumption of the material
- For preparation of bill for payment

Reinforcement used in RCC Work

- Plain round mild steel bar
- Deformed bar





Properties of ASTM Standard Reinforcing Bars

Bar No.	Diameter (in)	Nominal Area (in^2)
#3	3/8	0.11
#4	4/8	0.20
#5	5/8	0.31
#6	6/8	0.44
#7	7/8	0.60
#8	8/8	0.79
#9	9/8	1.00
#10	10/8	1.27
#11	11/8	1.56

Note: Nominal dimensions of deformed bar equivalent to plain bar; same weight per feet as plain bar

Reinforcement Estimation

1. By percentage basis of concrete
2. By thumb rule &
3. Accurate estimation based on detailed drawings

(1 & 2 are crude methods)

Reinforcement estimated in units of weight in Kilogram, Pound and Quintal (1 Quintal = 100 Kilogram)

Percentage Basis of Concrete

- Footing – 0.5% to 1%
- Column – 0.8% to 8%
- Beam – 1%
- Slab - 1%
- Lintel – 0.8%
- Sunshade – 0.5% to 0.8%



- Determine the amount of reinforcement in a RCC slab (20 ft x 15 ft x 5 inch) using percentage basis of concrete.

  (Unit weight of steel = 490 pcf)

Thumb Rule

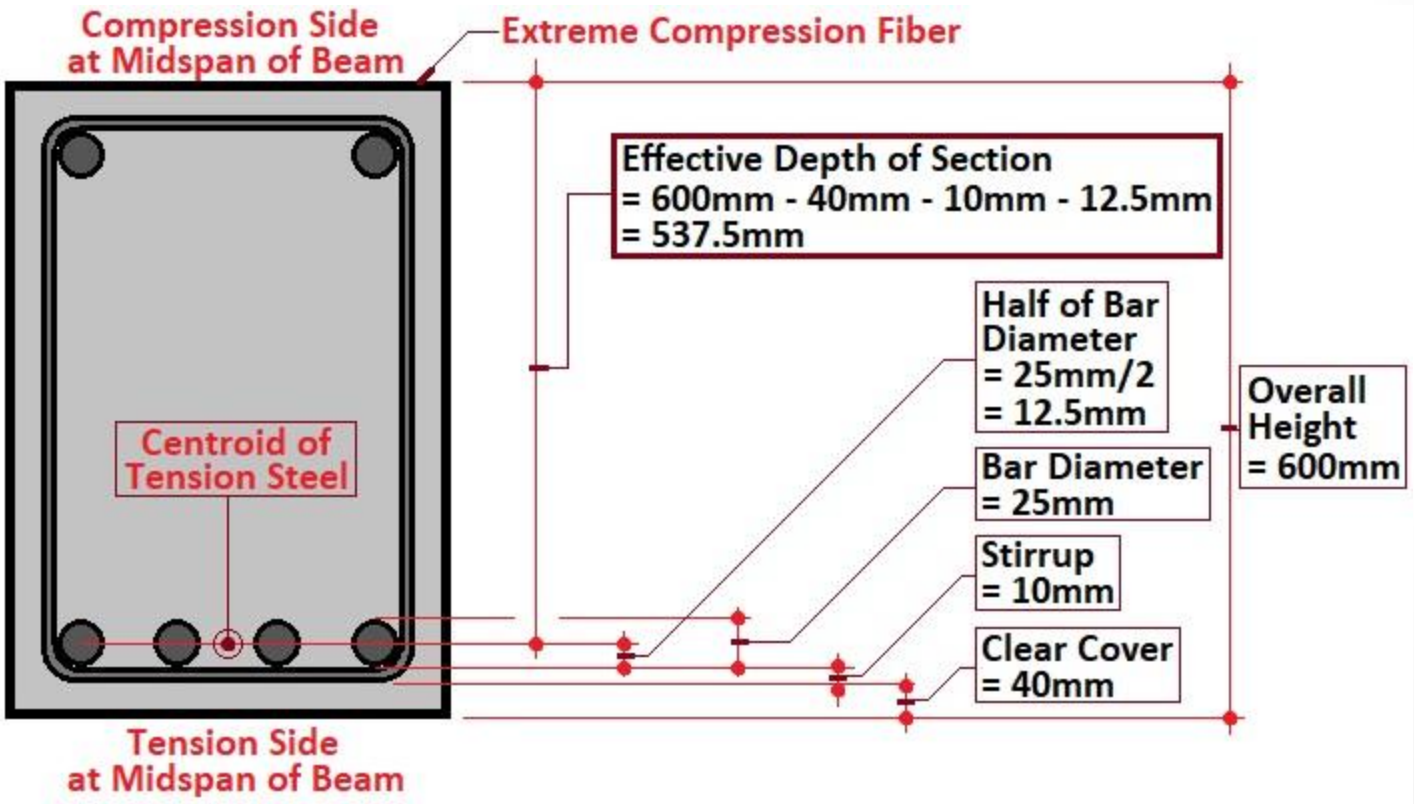
Height of Building	Quantity of Reinforcement in Kg/sq. m. of Plinth Area			Remarks
	Foundation	Floor Beams per floor	Floor Slabs per floor	
9 m to 13.5 m maximum	22 to 33	18 to 20	10 to 12	
13.5 m to 21 m maximum	50 to 65	do	do	
21 m to 36 m maximum	95 to 110	do	do	Foundation has to be raft slab. Piling will depend on soil condition.
Above 36 m	130 to 150	do	do	Concrete piling is generally required

Thumb Rule

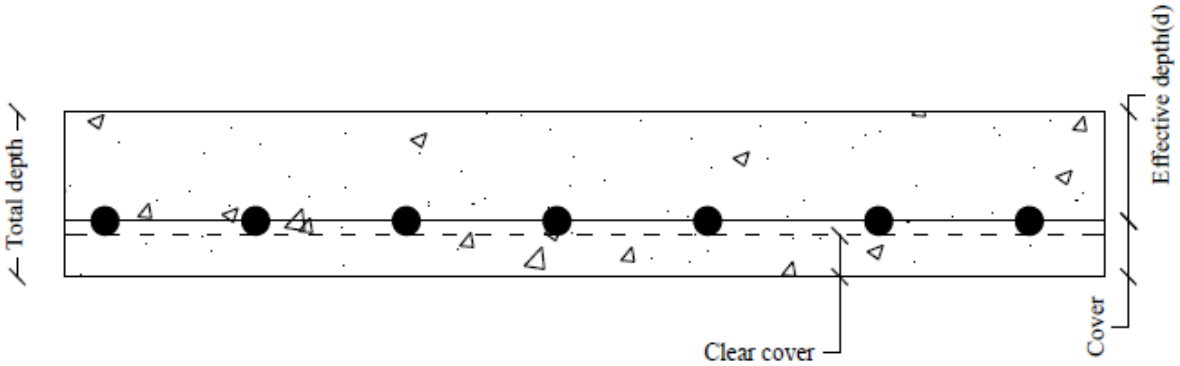
- A three storied building (each story being 10 feet) having a plinth area of 60 feet x 45 feet & height of 30 feet. Estimate the quantity of reinforcement in each floor & total reinforcement in the floors using thumb rule.

➢ Plinth Area, Quantity of Reinforcement in kg/sq. m. of plinth area, Number of floors

Accurate Estimate Based on Detailed Drawings



Accurate Estimate Based on Detailed Drawings



Total Depth (t) = Face to face distance
Effective Depth (d) = Distance from compression face of concrete to the center of gravity (C.G.) of steels
Cover = Distance of outer fiber from C.G. of steel
Clear Cover = Distance of outer fiber from face of steel
Total Depth (t) = Effective Depth (d) + Cover

Reinforcement Covering

- To protect reinforcement/steel from weathering effect i.e. corrosion
- To protect from fire.
- The need for adequate adhesion between the steel and concrete.

For normal exposure of concrete according to ACI Code (American Concrete Institute)

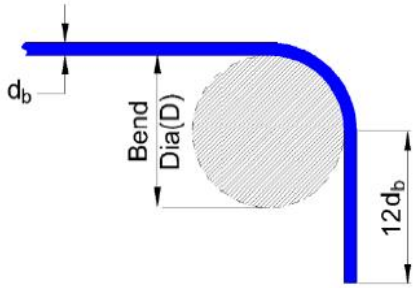
	Beam/Column	Slab
Clear cover	1.5 inch (minimum)	0.75 inch (minimum)
Cover	2.5 inch	1 inch

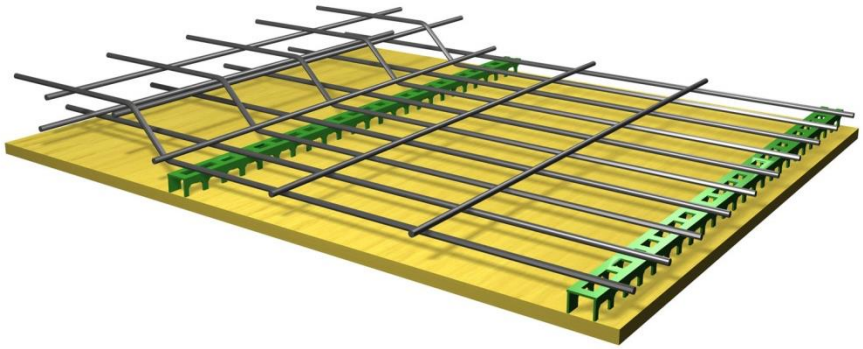
Reinforcement in Slab

- Straight bar : lies at bottom
- Cranked bar: lies at top & at bottom (both location, depending upon cracking)
- Extra top: lies at top

These three types of reinforcement occurs in both direction (both long and short direction).

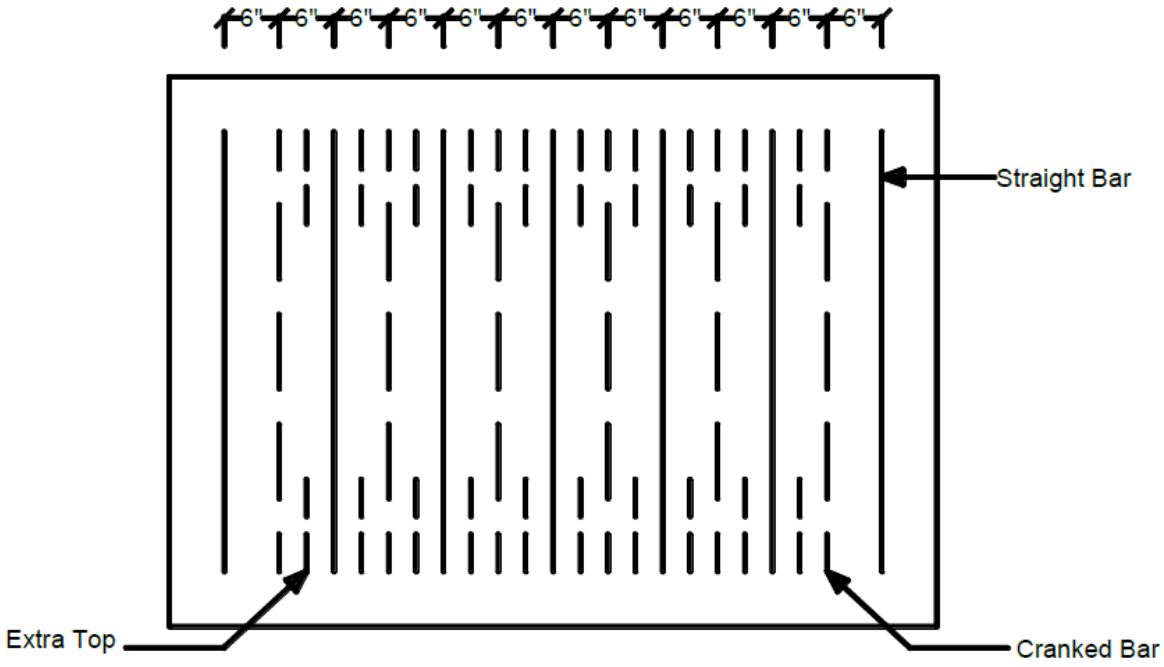
Each bar is hooked at each end if plain bar is used.





Slab Reinforcement Distribution

- Start with a straight bar and end with a straight bar
- Cranked bars are in between straight bars.
- Extra tops are in between cranked bar.



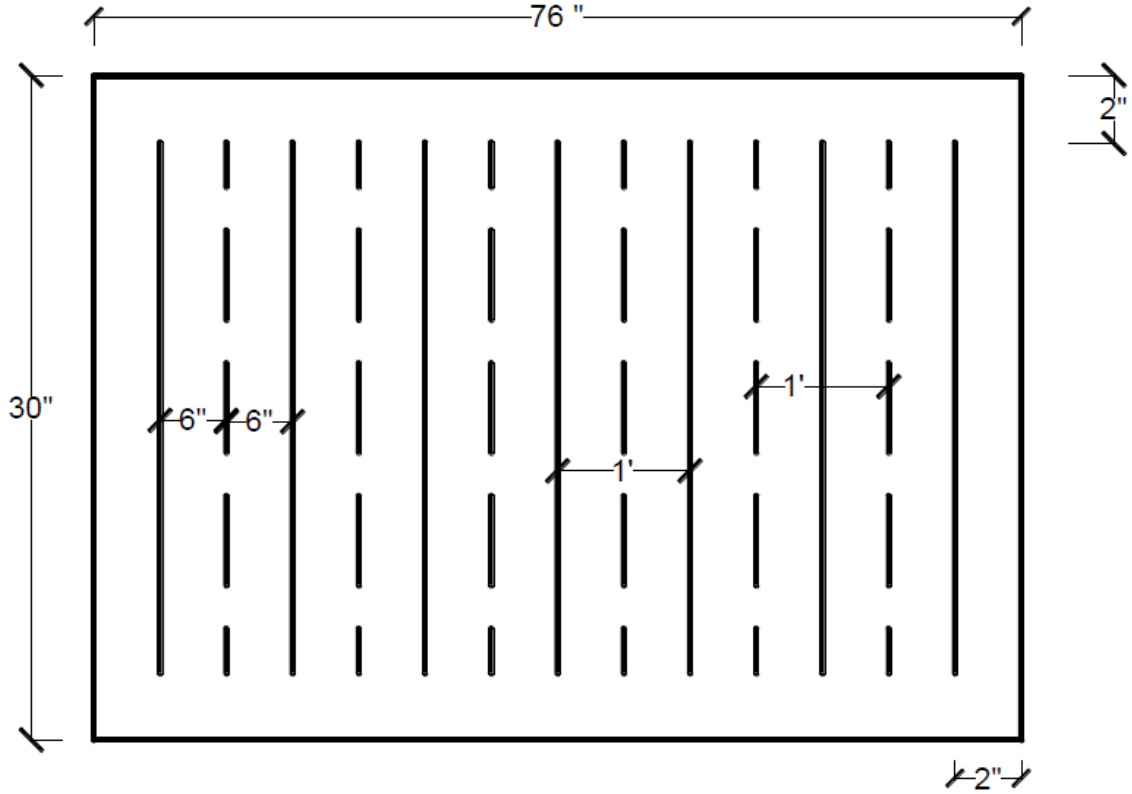
Slab Reinforcement Distribution

- Number of straight bar $= \frac{Distance - 2" \ (from \ each \ side)}{spacing \ of \ straight \ bars} + 1$

  = Next higher integer

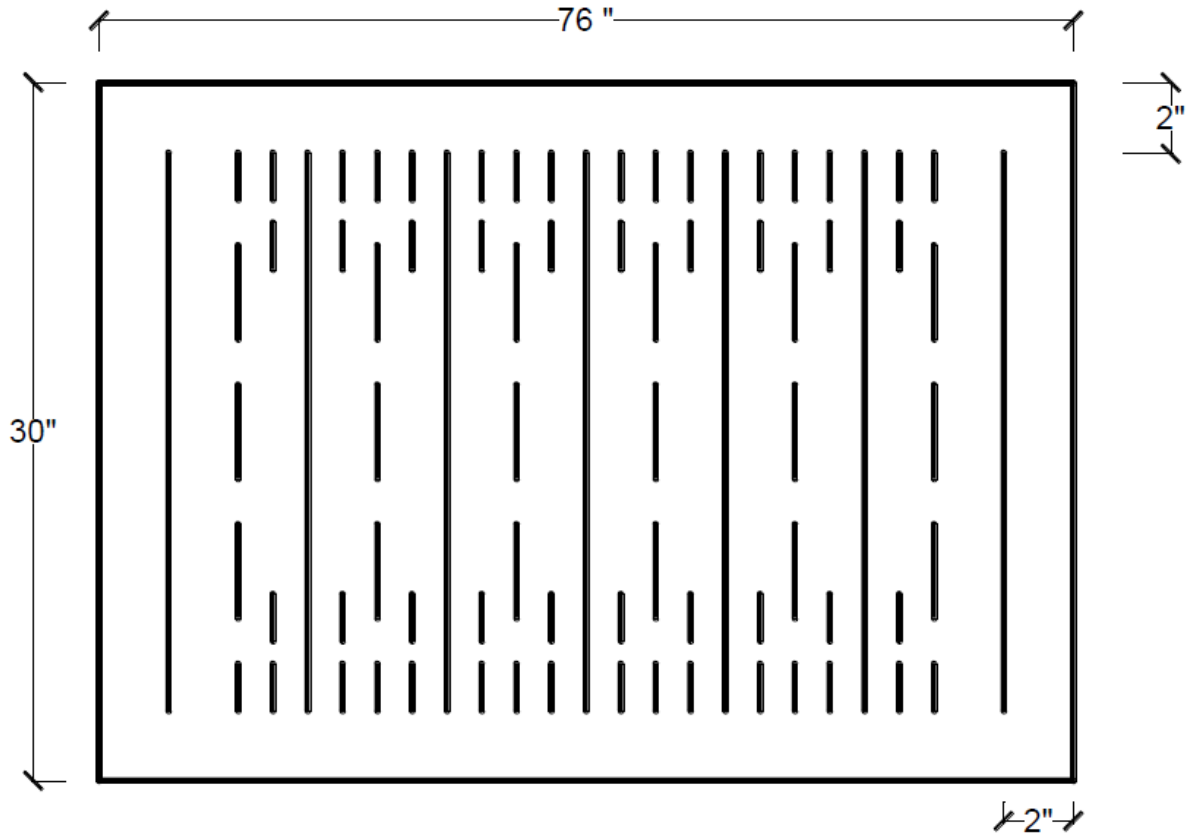
(distance is perpendicular to bar length)

- Between N number of straight bars, there will be (N-1) number of gaps. So, *No. of cranked bar = No. of straight bar -1*
- Between (N-1) number of cranked bars, there will be (N-2) number of gaps. So, *No. of extra top = No. of cranked bar – 1* (if one extra top in between cranked bars)
- No. of extra top = *n x (No. of cranked bar -1)* (if n extra tops in between cranked bars)



#3@6" c/c alt. ckd.

No. of straight bars = (76"- 2" - 2")/12 + 1 = 6.16 = 7 Nos.
No. of cranked bars = No. of straight bars - 1 = 7 – 1 = 6 Nos.



2#3 extra top in between cranked

No of extra top (one side) = (No. of cranked bar – 1) x 2

= (6 – 1) x 2

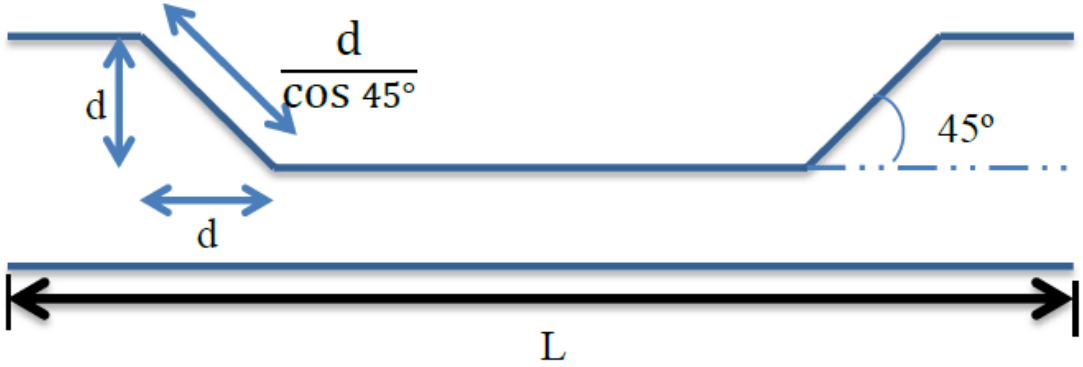
= 10

Length of bar

- Length of straight bar = Length of slab (L) – 2 inch (from each side)
- Length of cranked bar $= (L - d - d) + \frac{d}{\cos 45} + \frac{d}{\cos 45}$

$= (L - d - d) + 1.42d + 1.42d$

$= L + 0.42d + 0.42d$



Length of cranked bar = Length of straight bar + n (0.42d)

Where n is number of bends, d is effective depth of slab

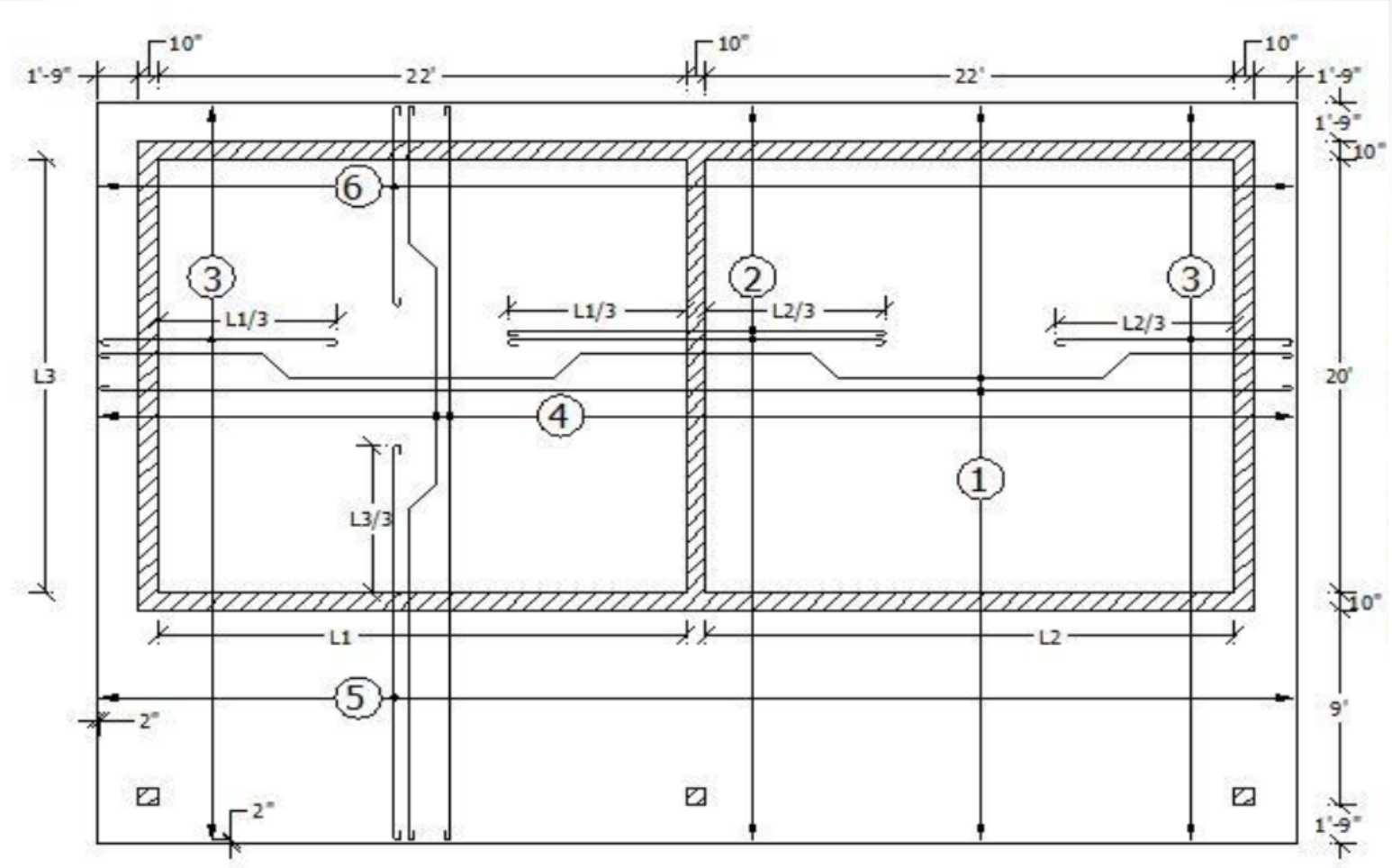
Length of hook

- The standard hook length for each end of plain rods vary from 9 to 12.5 times diameter of the rods generally used

- If plain bar is used, each bar must be hooked at both ends.
- If deformed bar is used, no hooks required.

Procedure for reinforcement estimation in slab

- Step 1: Determine the number of straight bars
- Step 2: Determine the number of cranked bar
- Step 3: Determine the number of extra top
- Step 4: Determine the number of hook
- Step 5: Determine the length of one straight bar
- Step 6: Determine the length of one cranked bar
- Step 7: Determine the length of extra top(s)
- Step 8: Determine the length of hook(s)
- Step 9: Determine the total length of straight bars
- Step 10: Determine the total length of cranked bars
- Step 11: Determine the total length of extra top(s)
- Step 12: Determine the total length of hook(s)
- Step 13: Repeat step 1 to step 12 for other direction
- Step 14: Volume of bar = Area of bar x Length of bar
- Step 15: Weight of bar = Unit weight of steel (490 pcf) x Volume



Legends:

(1) #4 @ 6" c/c alt. ckd

(2) 2#4 extra top in between ckd. bars

(3) 1#3 extra top in between ckd. Bars

(4) #3 @ 4" c/c alt. ckd

(5) 1#4 extra top in between ckd. bars

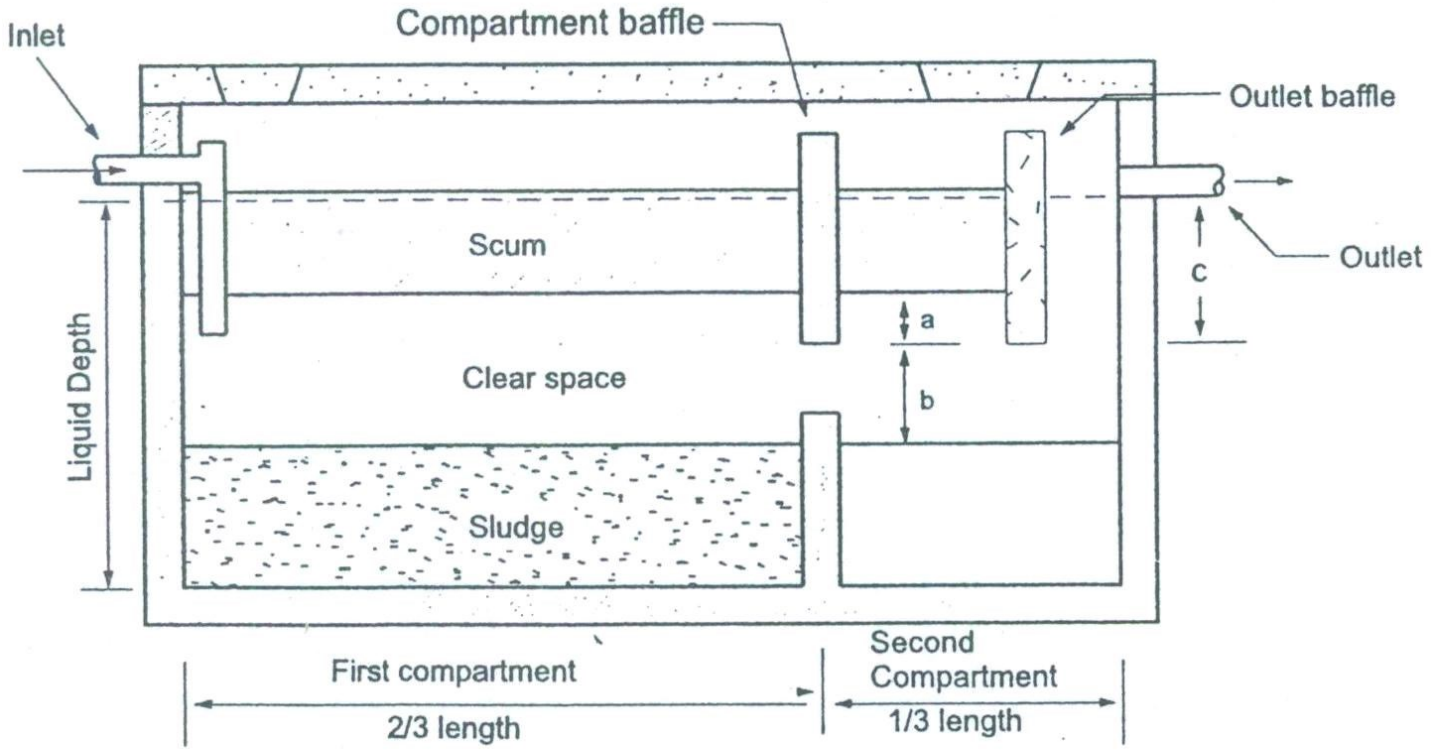
(6) 1#3 extra top in between ckd. bars

Material Estimation for Septic Tank

Septic Tank

- On-site sewage disposal system
- A buried, watertight receptacle designed and constructed to receive wastewater from a home
- Combined sedimentation cum digestion tank
- Purposes-
  - separate the solids from liquids
  - provide limited digestion of organic matter
  - store solids and to allow the clarified liquid to discharge for further treatment and disposal

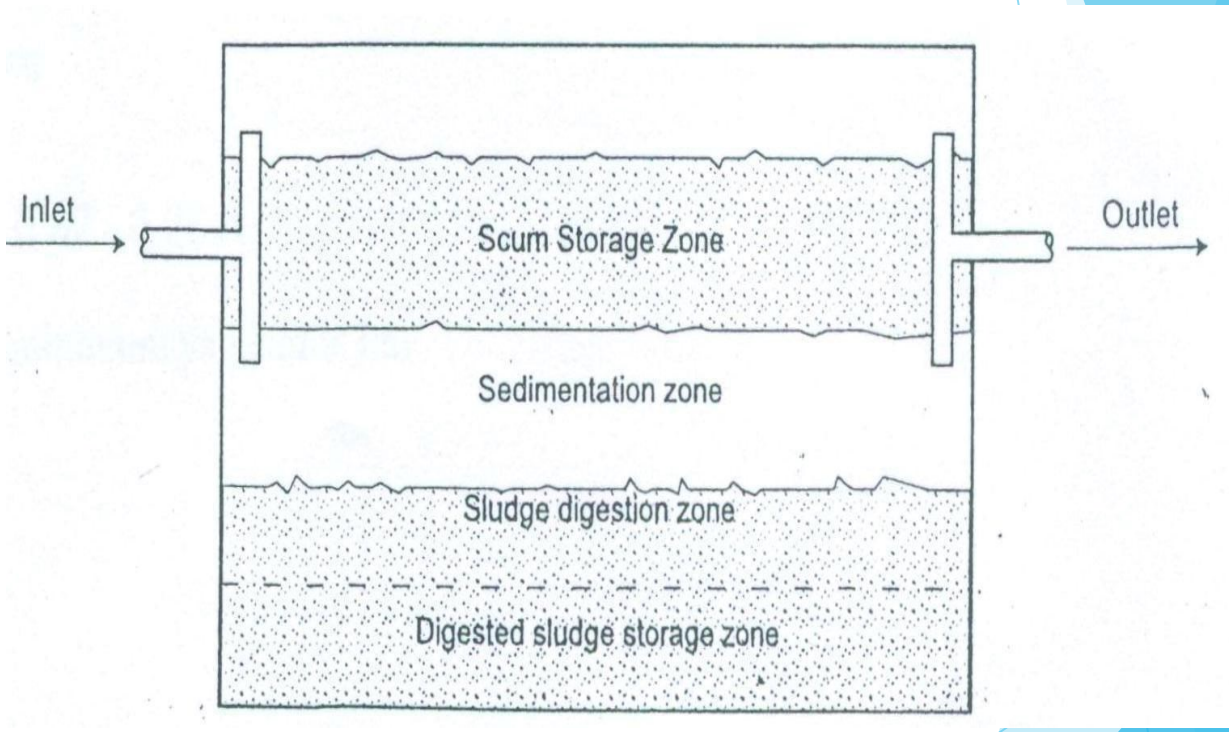
Septic Tank



Components of a septic tank system

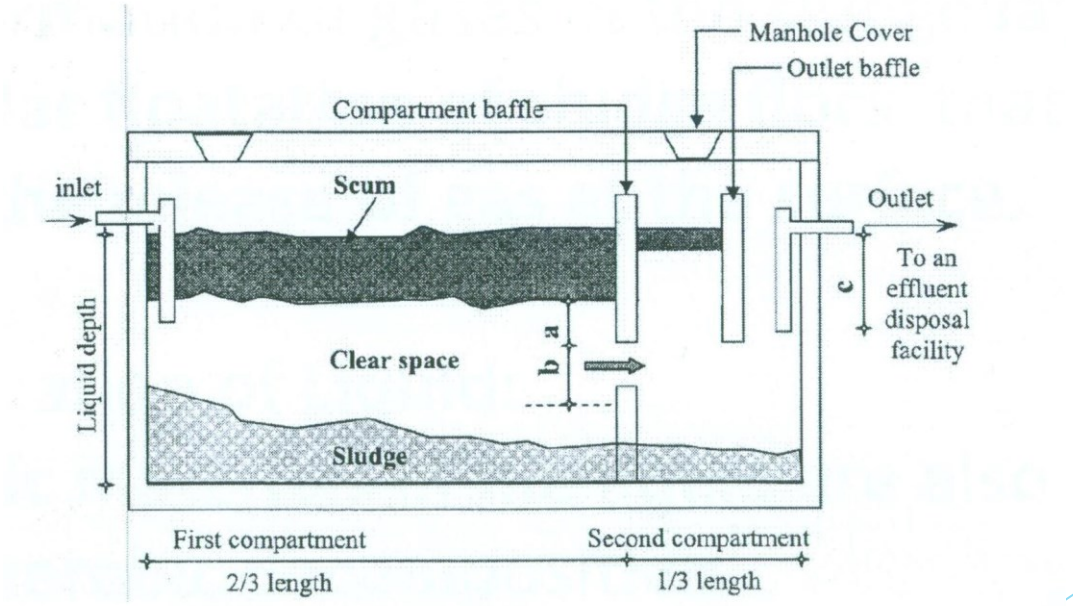
Septic Tank

- Processes in a Septic tank
  - Separation of suspended solids
  - Digestion of sludge and scum
  - Stabilization of the liquids
  - Growth of micro organisms



Processes in Septic Tank

1. Separation of suspended solids and scum: Results in the formation of
   - A sludge layer at the bottom
   - A floating layer of scum at the top
   - A relatively clear layer of liquid in the middle



Processes in Septic Tank

2. Digestion/decomposition of sludge and scum:

Anaerobic bacteria decomposes organic matter in sludge and scum and produces volatile acids, methane. Decomposition helps to reduce volume of the sludge by releasing various gases.

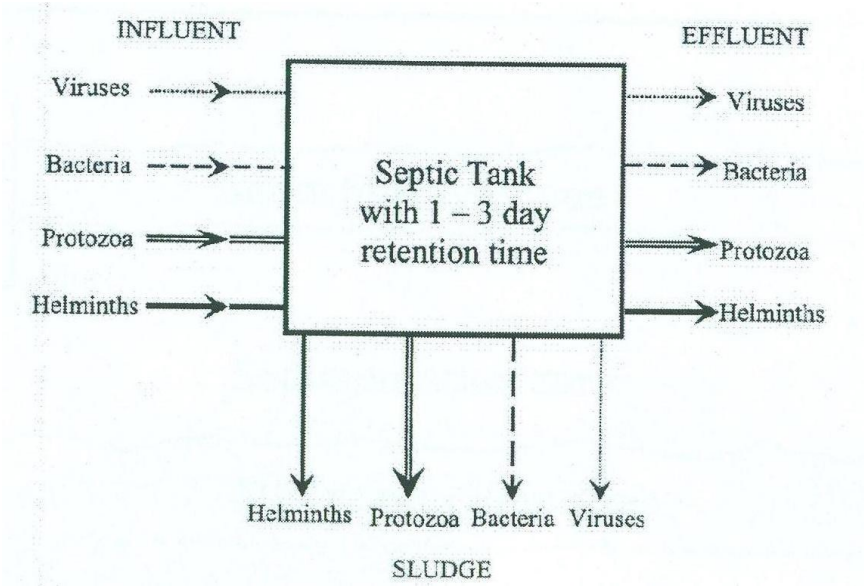
3. Stabilization of liquid:

Organic materials in the liquid are also stabilized by anaerobic decomposition

Processes in Septic Tank

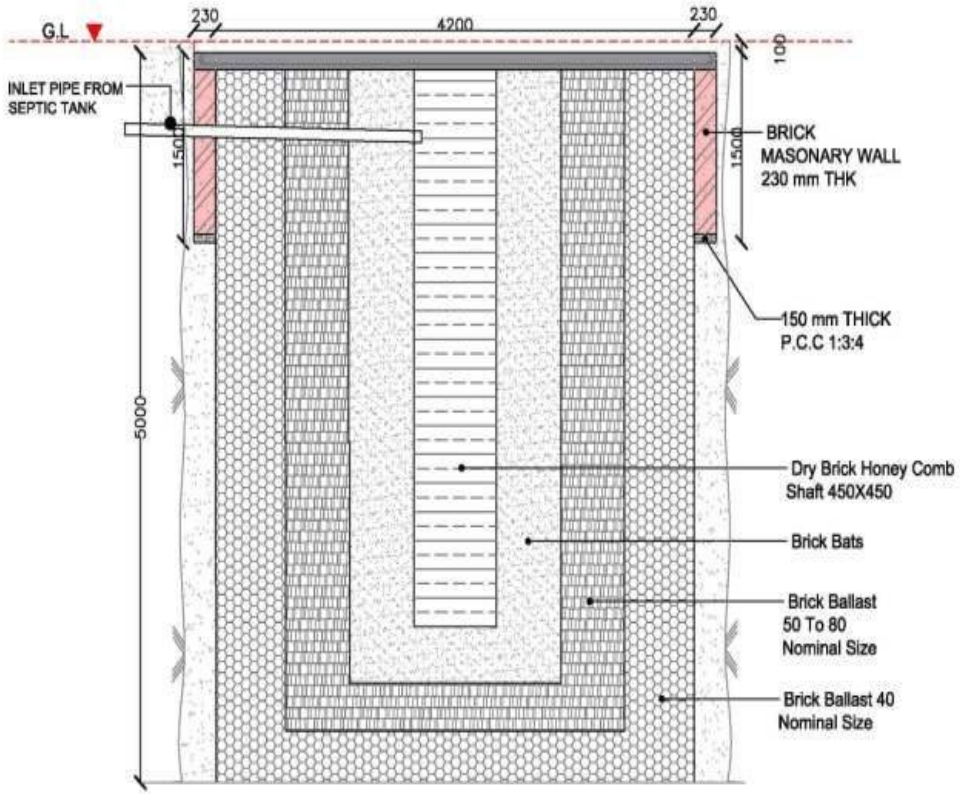
4. Growth of Micro organism

A large variety of microorganisms grow, reproduce and die during biodegradation processes in the tank. Most of them are separated out (by settling) with solids. However a large number of microorganisms (bacteria, viruses, protozoa, helminthis) survive the processes in the tank and remain in the effluent, the sludge and scum.

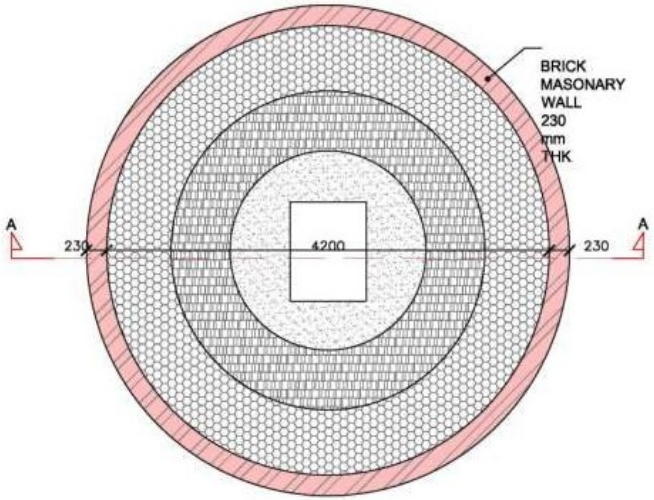


Soak Pit

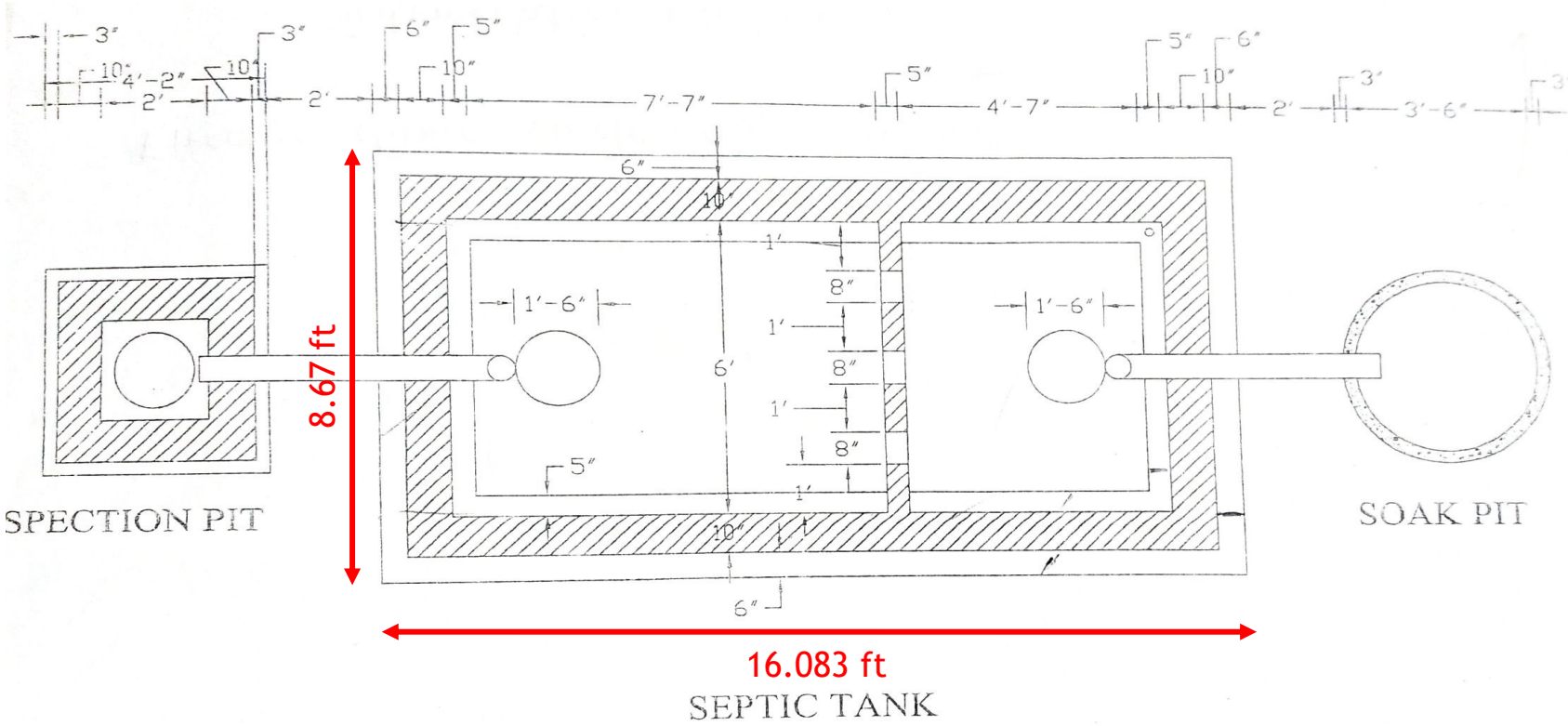
- The pits may be of any regular shape, circular or square being more common.
- The pit may be lined with stone, brick or concentrated blocks with dry open joints. The pit is generally filled with layer of loose stones, bricks bats and brick ballast. The pit may be covered with a RCC slab.
- The Soak pit is a pit through which effluent is allowed to seep or leach in to surrounding soil. The effluent may be disposed of in a soak pit.
- It should be minimum 10 m and preferably 30m away from any source of drinking water, such as well, even bore well to mitigate the possibility of bacterial pollution of water supply.



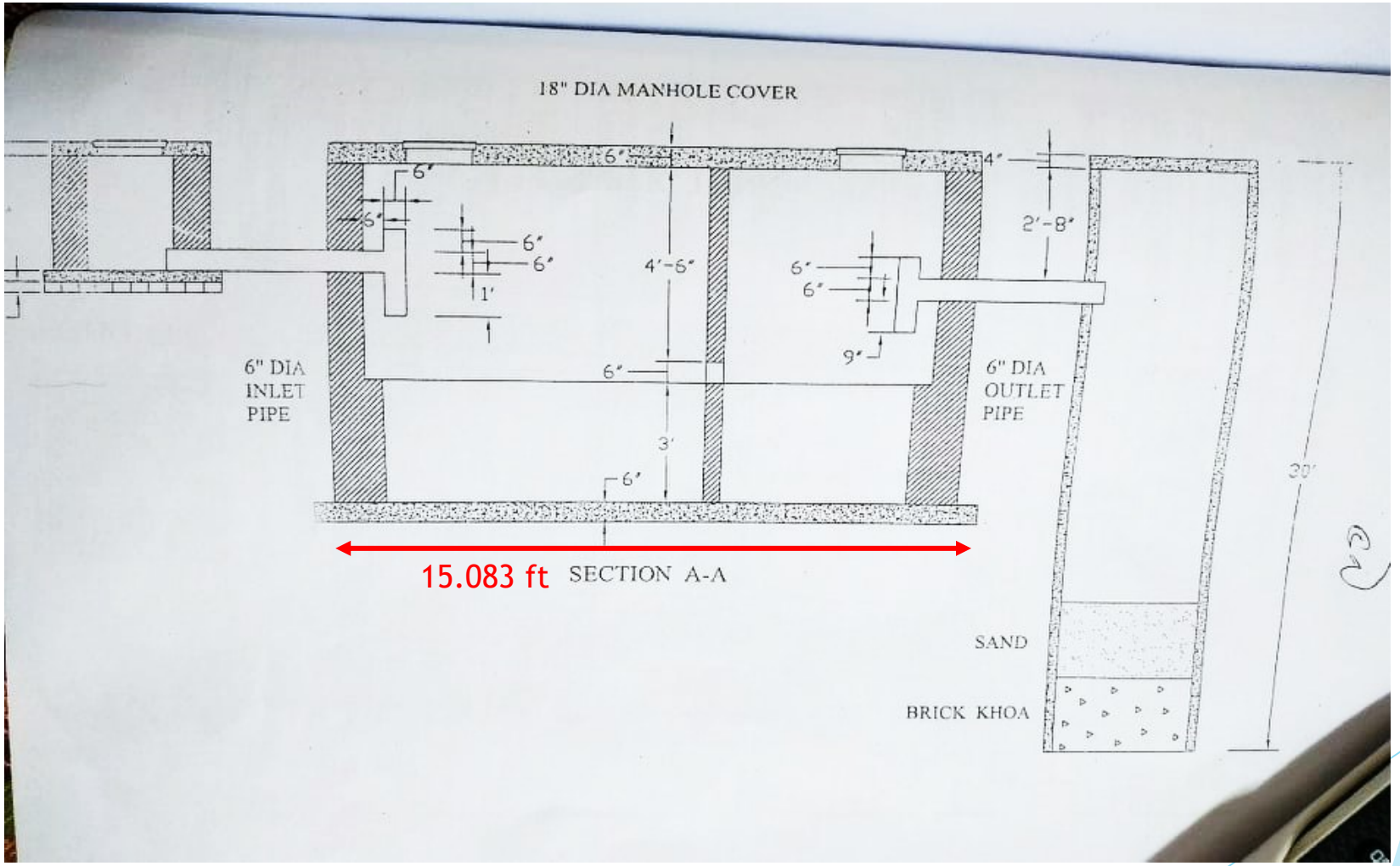
SECTION"A-A"



PLAN
SOAK PIT DETAIL


3″
3″
6″
5″
10″
4′-2″
10″
2′
2′
7′-7″
5″
4′-7″
5″
6″
10″
2′
3″
3′-6″
3″
6″
10″
1′
8″
1′-6″
1′
8″
1′-6″
6′
1′
8″
5″
1′
10″
6″
8.67 ft
SPECTION PIT
SOAK PIT
16.083 ft
SEPTIC TANK

Plan View


18" DIA MANHOLE COVER
6"
6"
6"
6"
6"
1'
4'-6"
6"
6"
9"
4"
2'-8"
6" DIA
INLET
PIPE
6"
3'
6"
6" DIA
OUTLET
PIPE
30"
15.083 ft SECTION A-A
SAND
BRICK KHOA

Earthwork Excavation:

Septic Tank:

Length= 16.083 ft

Width= 8.67 ft

Height= 9 ft

Volume= L X W X H = 1254.54 cft

Soak Pit:

Area= πr^2 sft

= $\pi(2)^2$ sft =12.57 sft

Height= 30 ft

Volume= A X H = 377 cft

Cement Concrete Floor:

Length= 16.083 ft

Width= 8.67 ft

Height= 0.5 ft

Volume= L X W X H = 69.72 cft

Precast RC Work

Roof Cover Slab of Septic Tank:

Length= 15.083 ft

Width= 7.67 ft

Height= 0.5 ft

Volume= L X W X H = 57.84 cft

Roof Cover Slab of Soak Pit:

Area= πr^2 sft

= $\pi(2)^2$ sft =12.57 sft

Height= 4 in = 0.33 ft

Volume= A X H = 4.2 cft

Side Wall of Soak Pit:

Area= $\pi(R^2 - r^2)$ sft

= $\pi(2^2 - 1.75^2)$sft = 2.94 sft

Height= 29.67 ft

Volume= A X H = 87.22 cft

1st Class Brick with 1:4 Cement Mortar in septic tank

- (a) Long Wall
- 1st step:

  Length= 15.083 ft

  Width= 1.25 ft

  Height= 3 ft

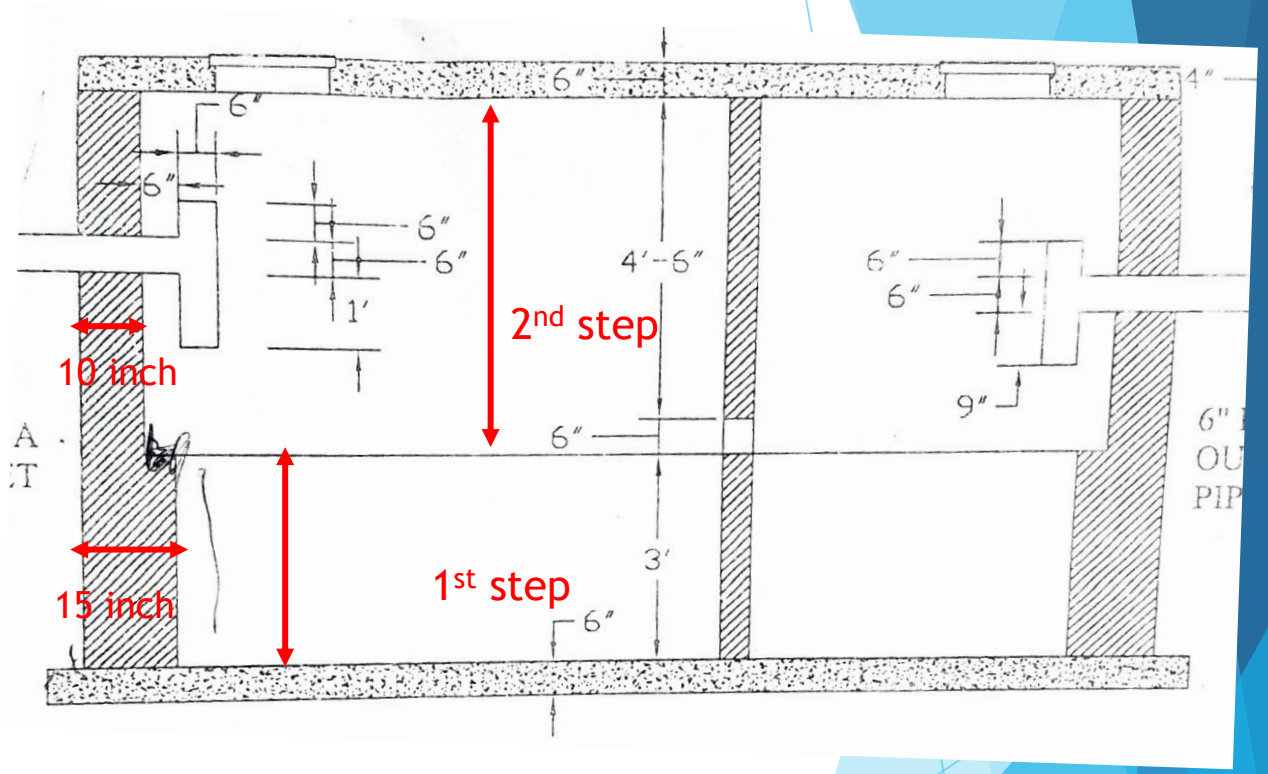
  Volume= 2 X L X W X H
- 2nd step:

  Length= 15.083 ft

  Width= 0.833 ft

  Height= 5 ft

  Volume= 2 X L X W X H



1st Class Brick with 1:4 Cement Mortar in septic tank

- (b) Short Wall
- 1st step:

  Length= 5.167 ft

  Width= 1.25 ft

  Height= 3 ft

  Volume=2 X L X W X H = 38.75 cft

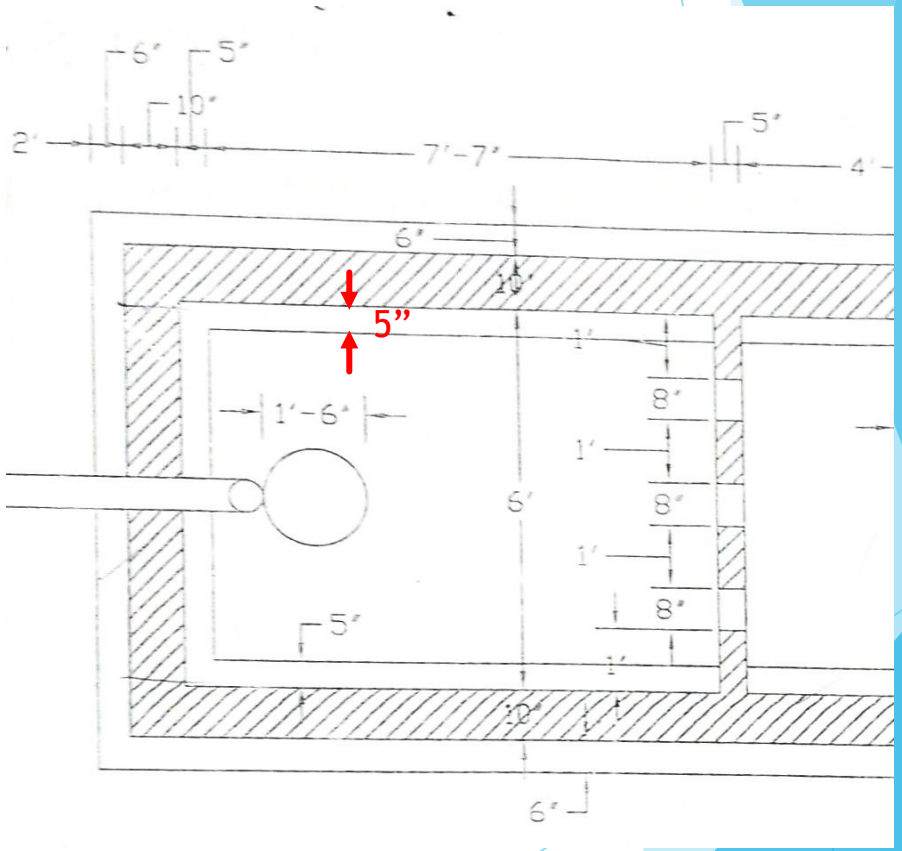
- 2nd step:

  Length= 6 ft

  Width= 0.833 ft

  Height= 5 ft

  Volume=2 X L X W X H = 50 cft



1st Class Brick with 1:4 Cement Mortar in septic tank

- (c) Partition Wall
- 1st step:

  Length= 5.167 ft

  Width= 0.417 ft

  Height= 3 ft

  Volume= L X W X H = 6.46 cft

- 2nd step:

  Length= 6 ft

  Width= 0.417 ft

  Height= 5 ft

  Volume=L X W X H = 12.51 cft

½ inch Cement Plaster 1:3 in wall of septic tank

- (a) Long Wall
- 1st step:

  Length= 15.083 – (30/12)= 12.583 ft

  Height= 3 ft

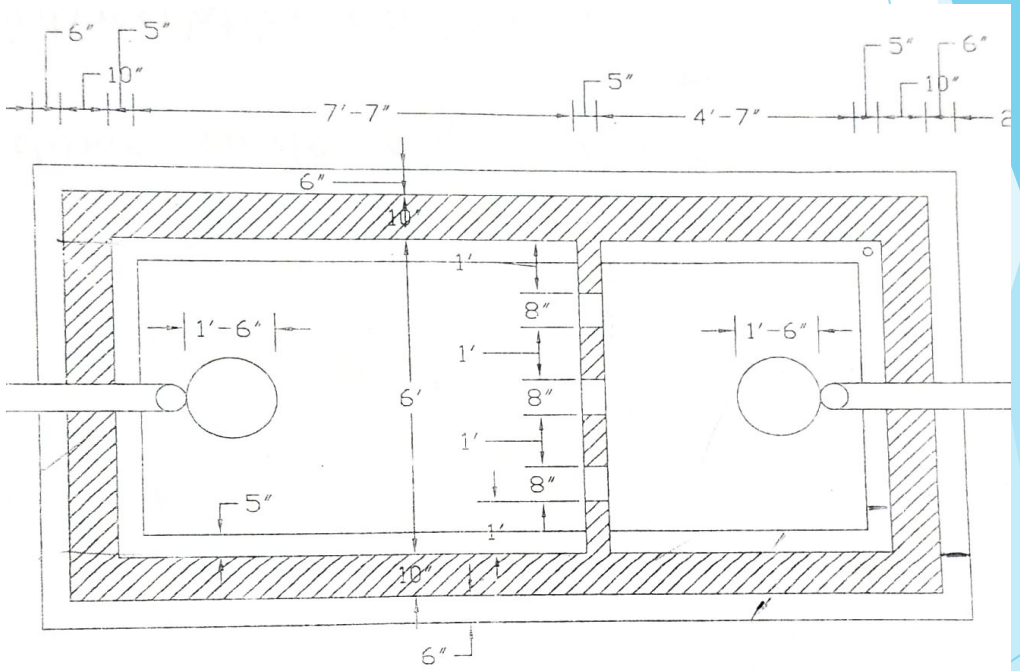
  Area= 2 X L X H

- 2nd step:

  Length= 15.083 – (20/12) = 13.417 ft

  Height= 5 ft

  Area= 2 X L X H



- ¾ inch Cement Plaster 1:3 in floor of septic tank

  Length= 12.583 ft

  Width= 5.167 ft

  Area= L X W = 65.02 sft

- 2 inch size Brick Aggregates at Bottom of Soak Pit

  Area= $\pi(1.75)^2$ sft

  Height= 1 ft

  Volume= 9.62 cft

- Course Sand at Bottom of Soak Pit

  Area= $\pi(1.75)^2$ sft

  Height= 1.5 ft

  Volume= 14.43 cft