CE 208
Quantity Surveying

Estimation of a Residential Building

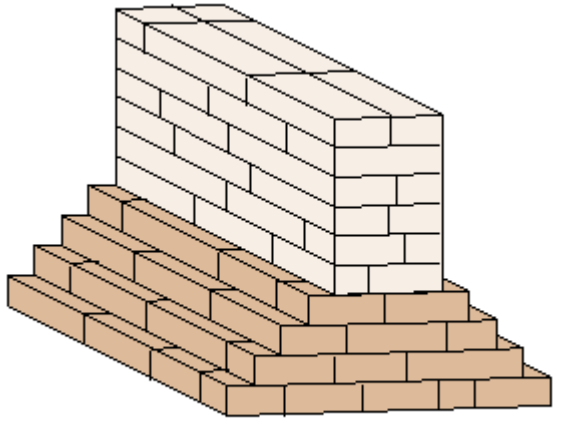


Course Teachers: Dr. Md. Shafiul Bari
Mashiat Hossain
Sumaiya Afrose Suma

DEPARTMENT OF CIVIL ENGINEERING
BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY

Brick Wall Footing

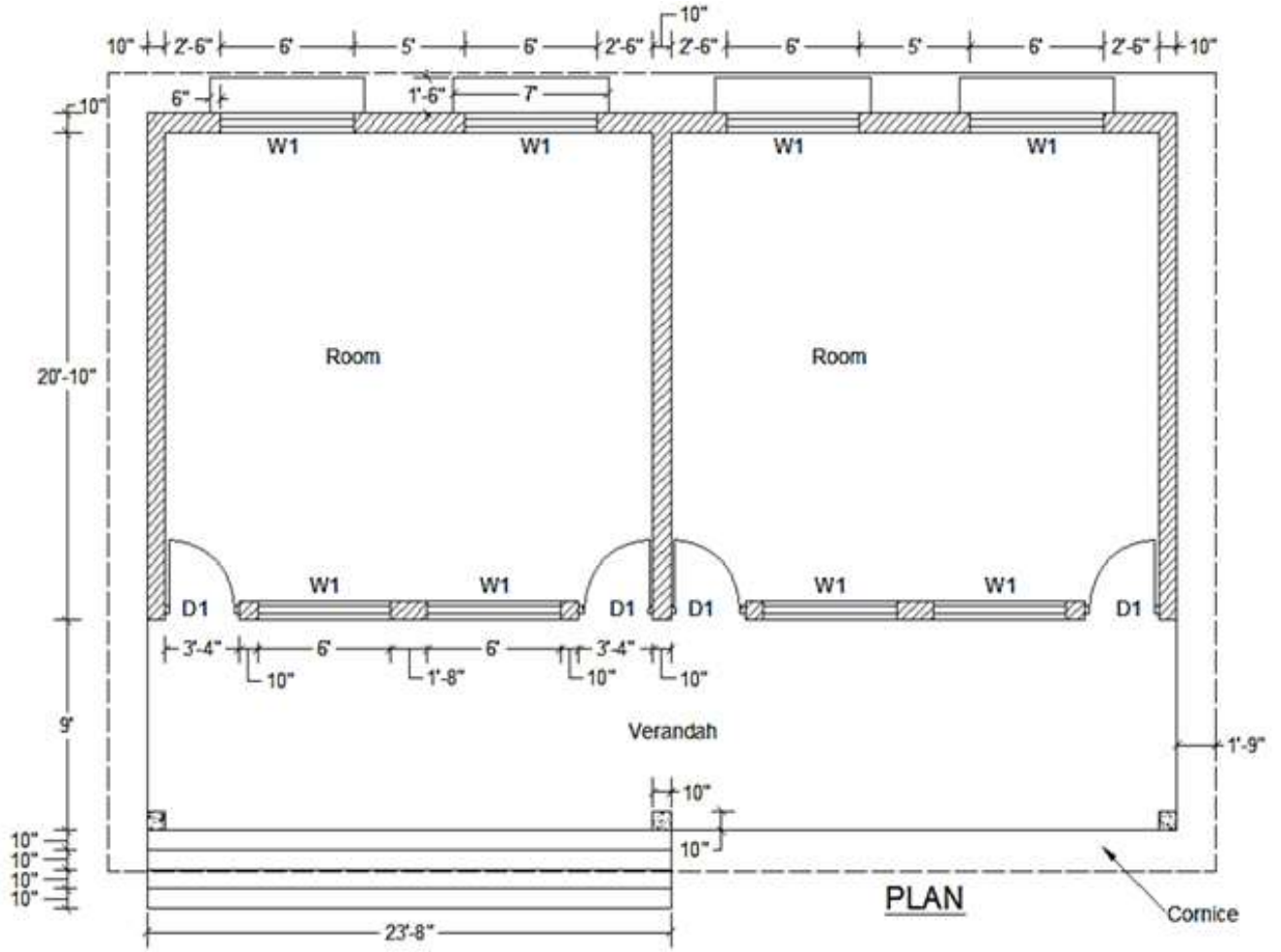
- Wall footing runs along the direction of the wall.
- The size of the footing and the thickness of the foundation wall are specified on the basis of the type of soil at the site.
- The wall footing can be constructed from stone, brick, plain concrete, or reinforced concrete.
- In the case of brick walls, 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

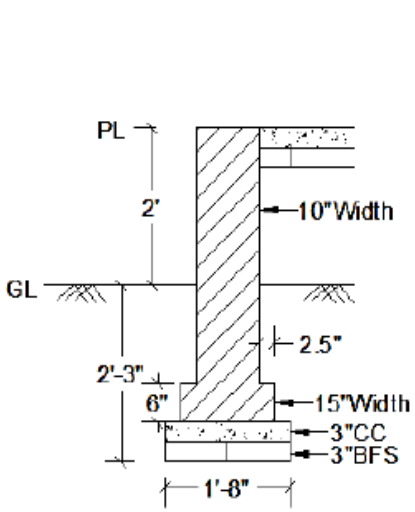


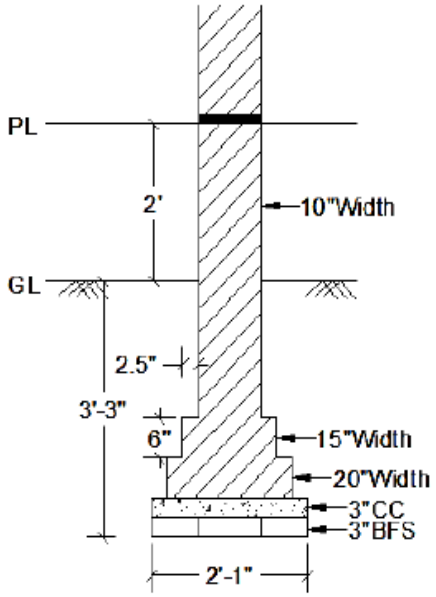
- Estimate the materials required for the following residential building (elementary information is given)

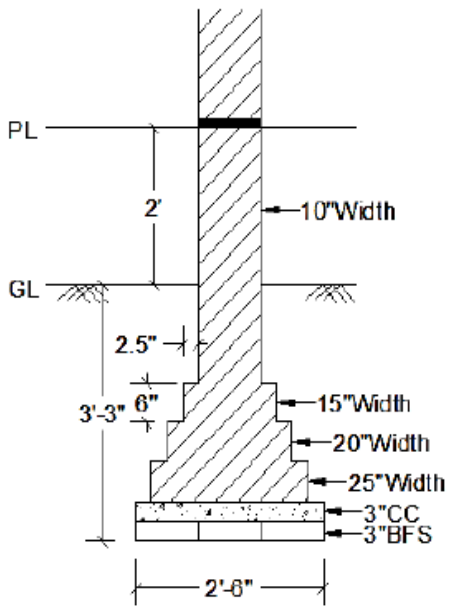


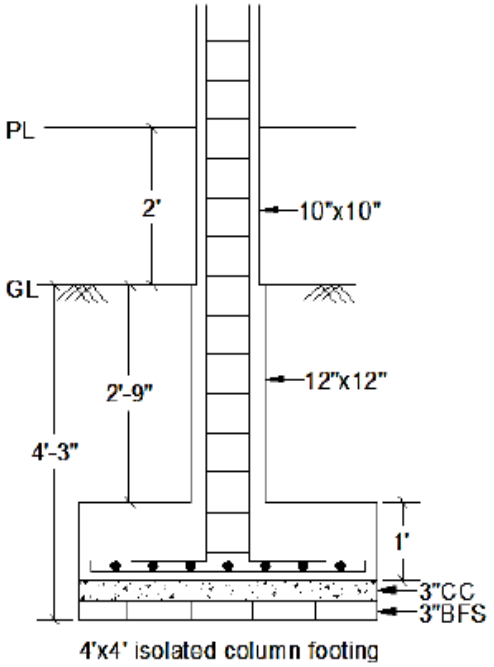
The four types of foundation used and their cross-sections are shown below -

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

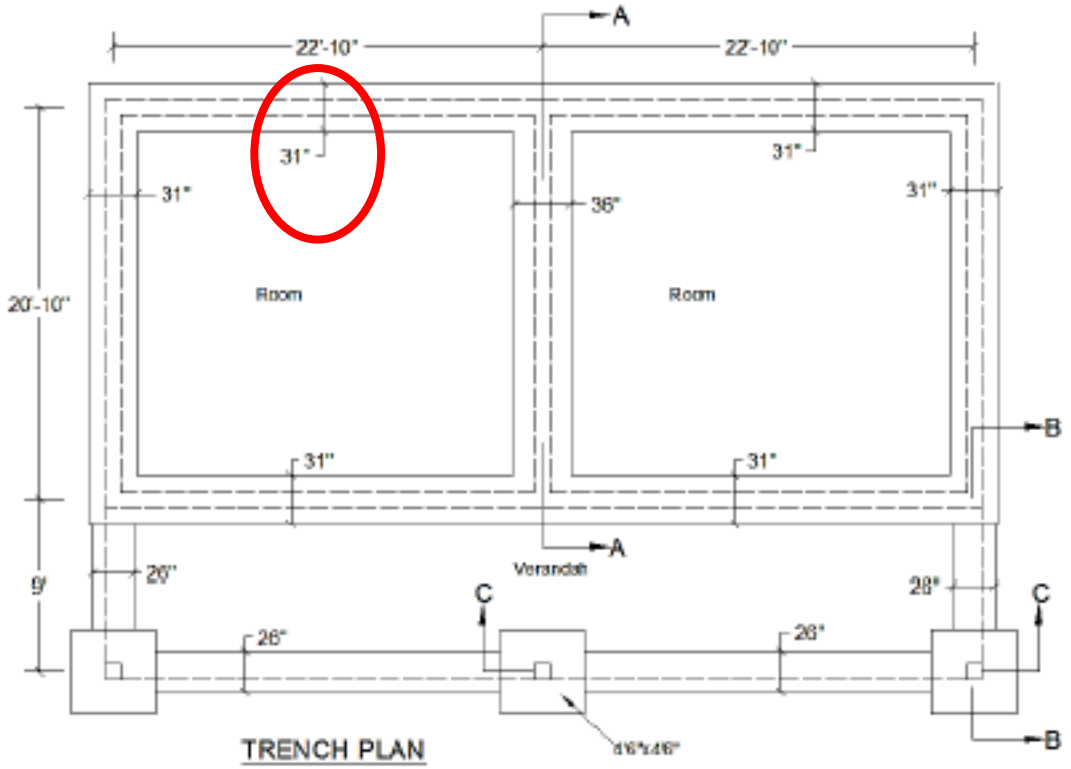


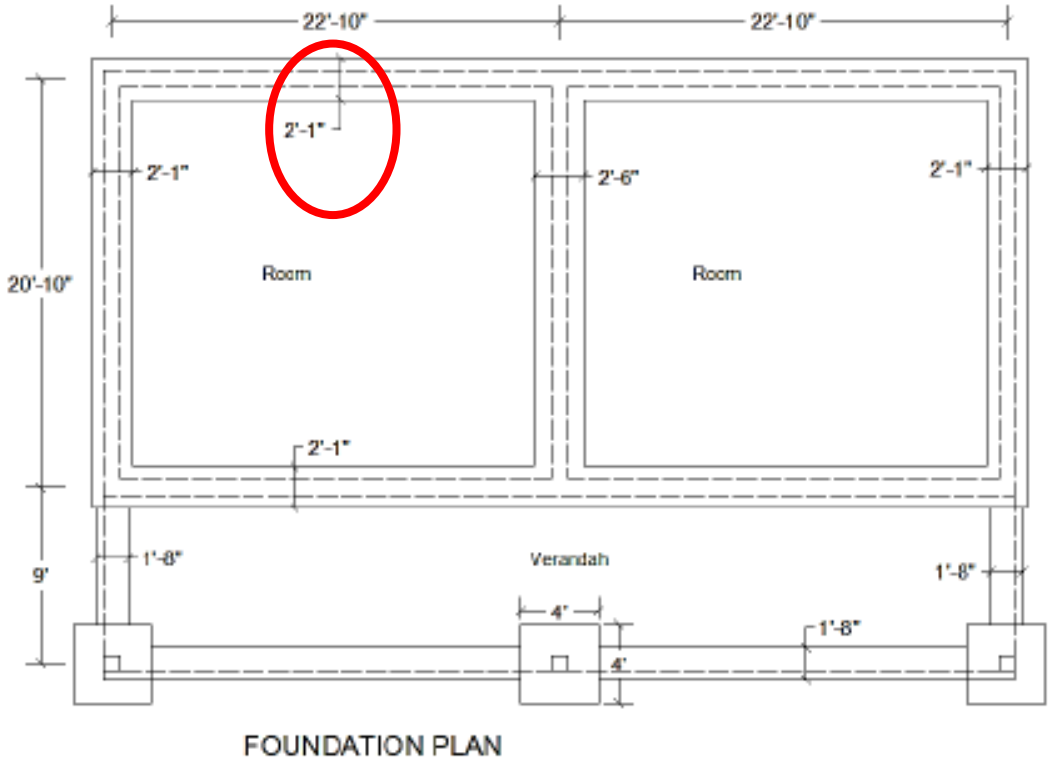






4'x4' isolated column footing



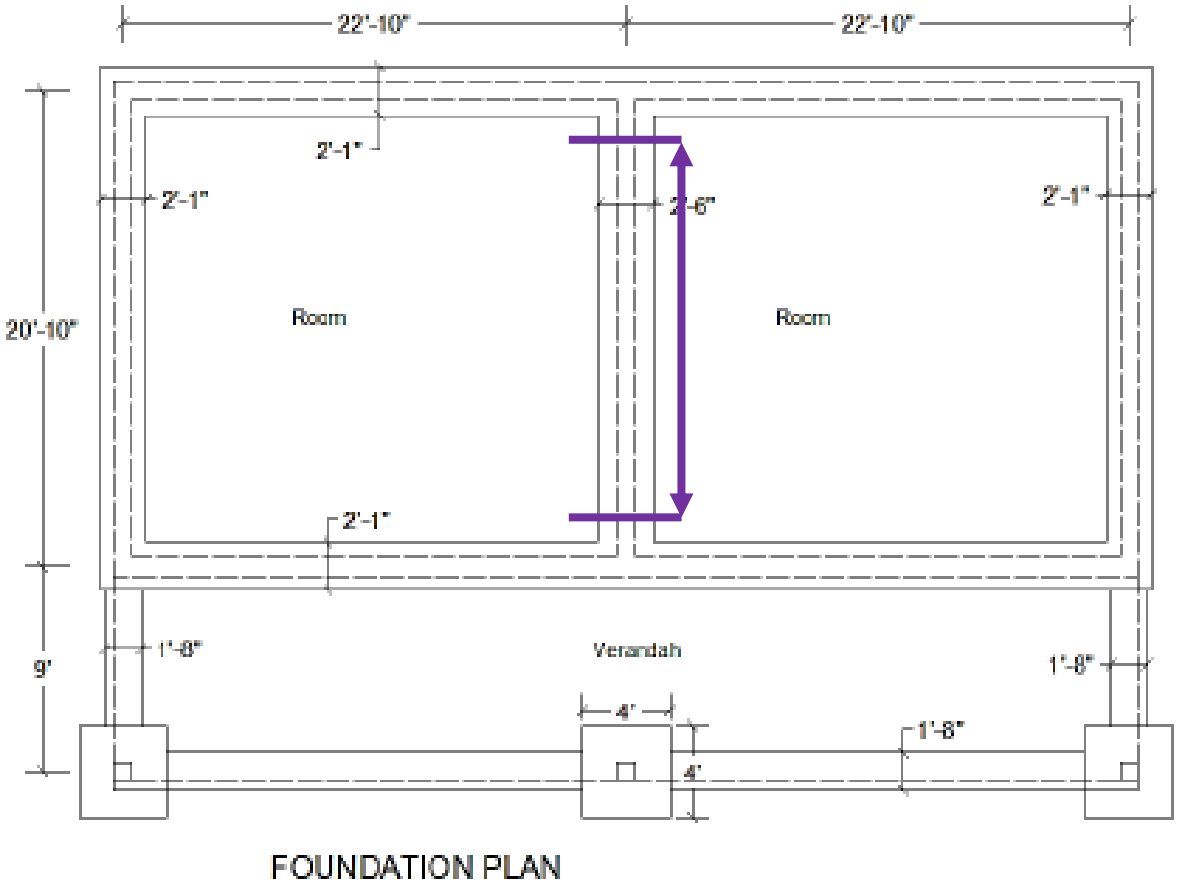




Extra width for excavation

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.

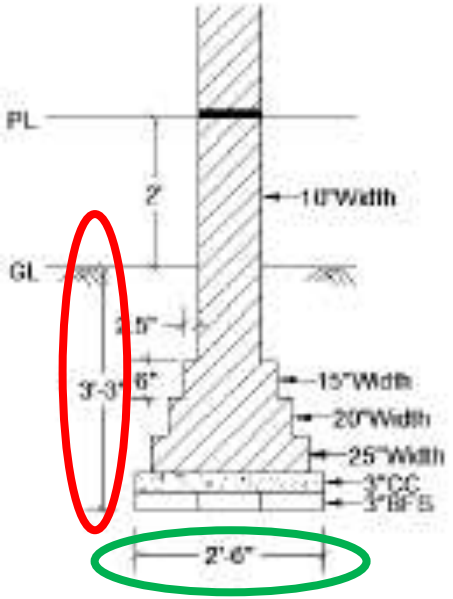
1. Estimation of Earthwork Excavation



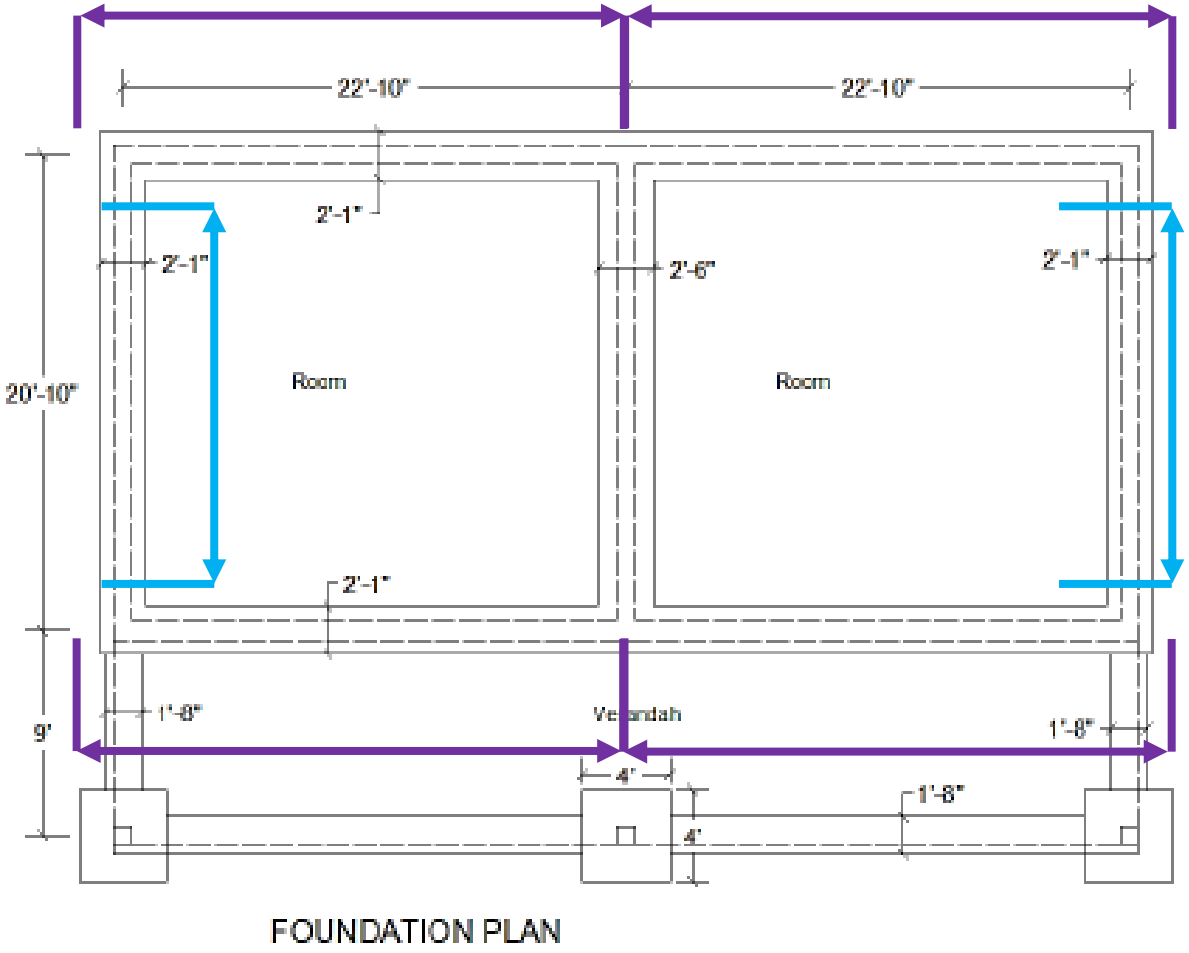
FOUNDATION PLAN

30" wall foundation:

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



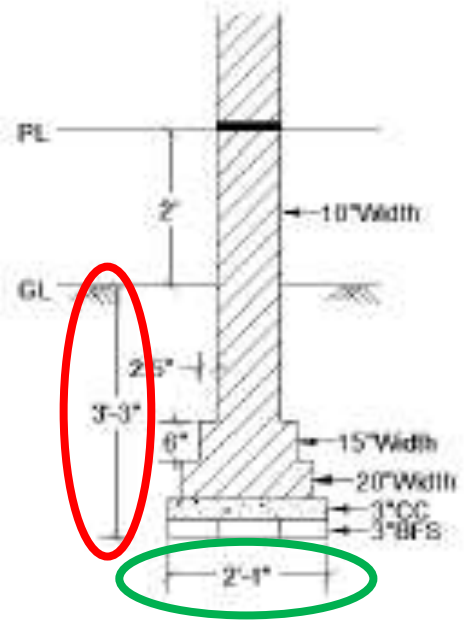
1. Estimation of Earthwork Excavation



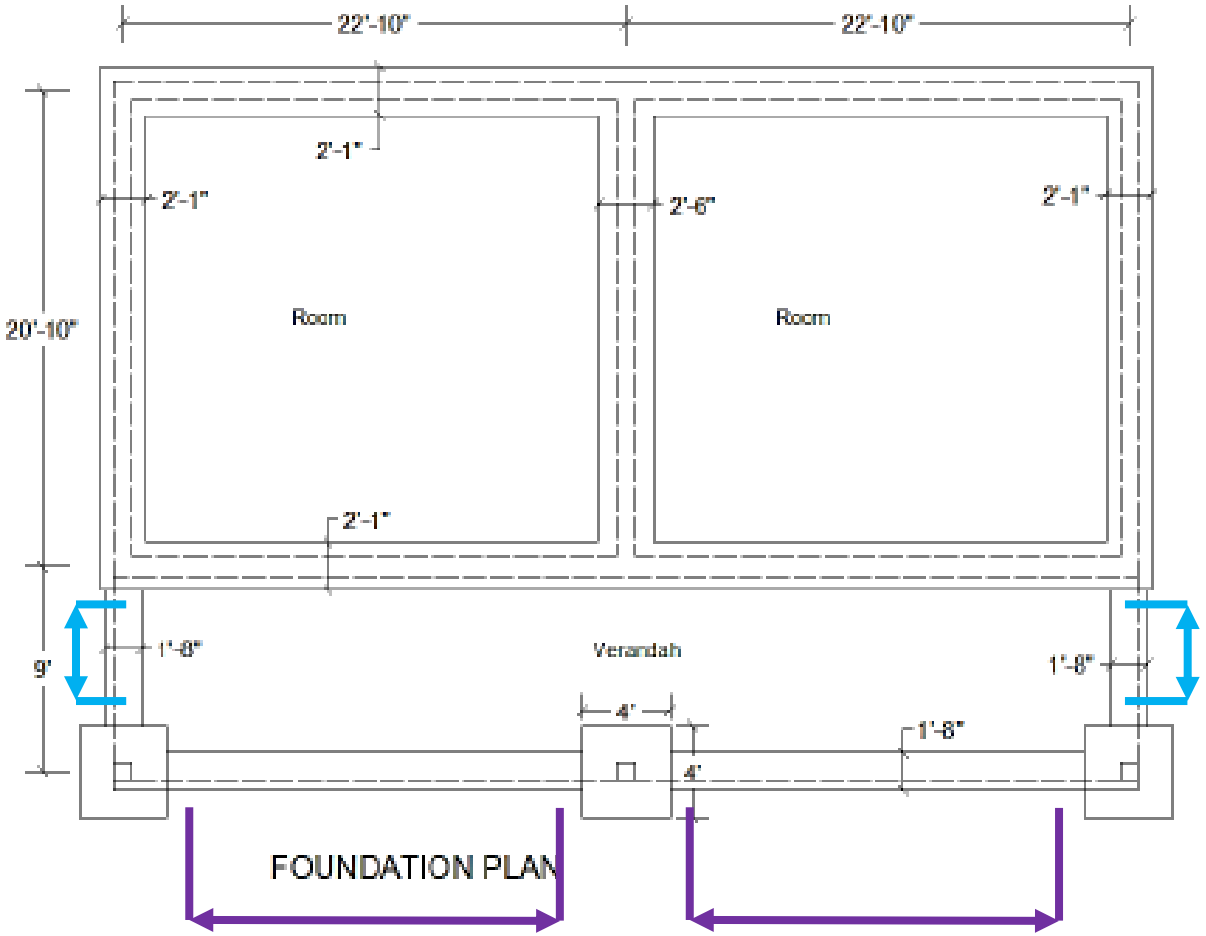
FOUNDATION PLAN

25" wall foundation:

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

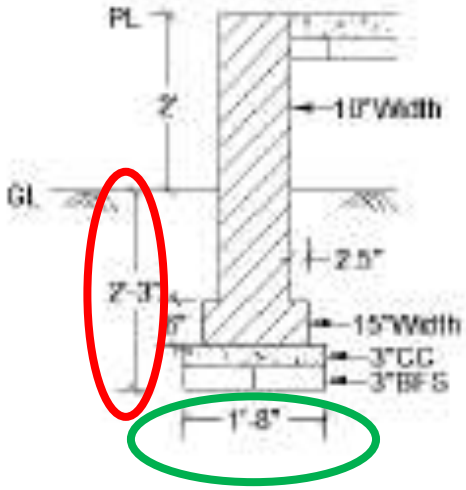


1. Estimation of Earthwork Excavation

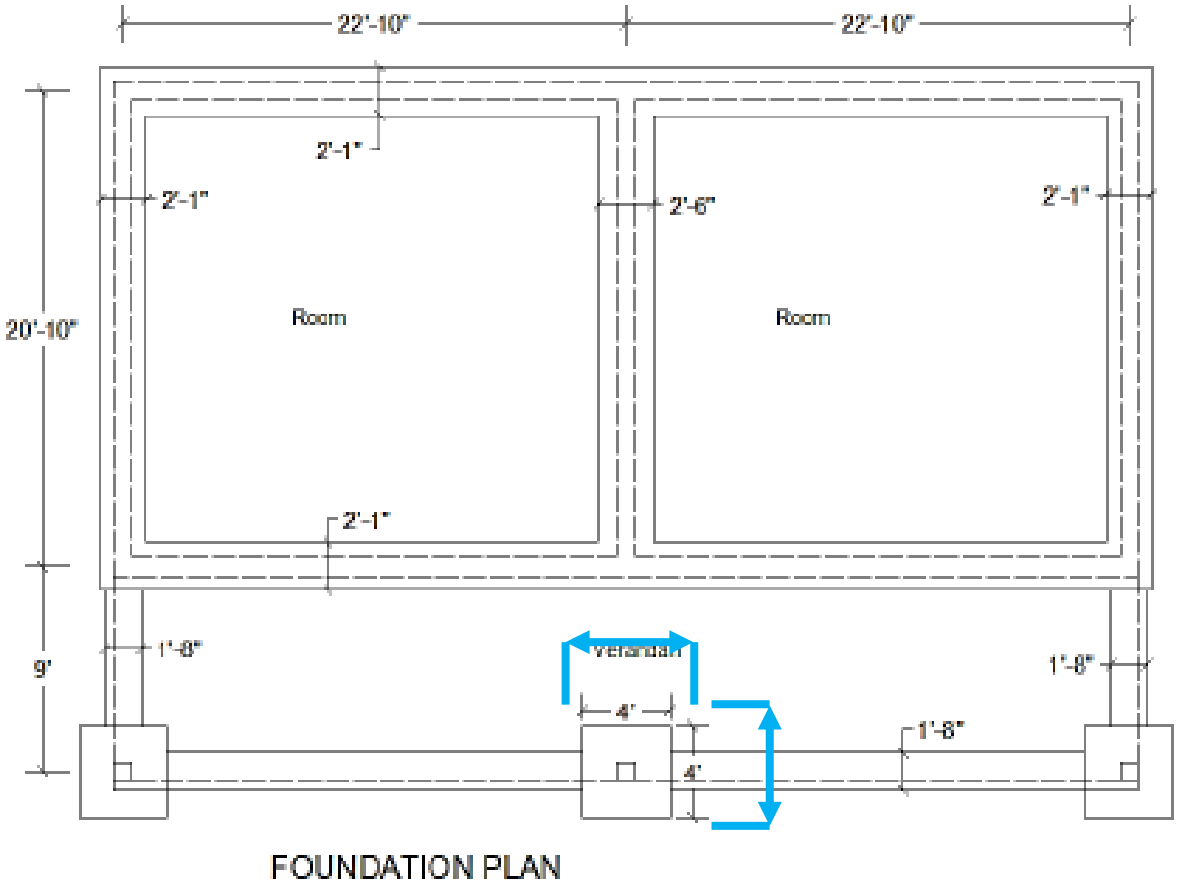


20" wall foundation:

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



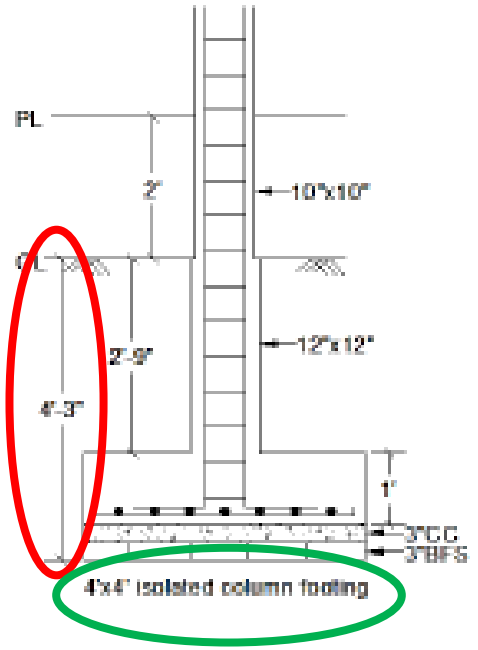
1. Estimation of Earthwork Excavation



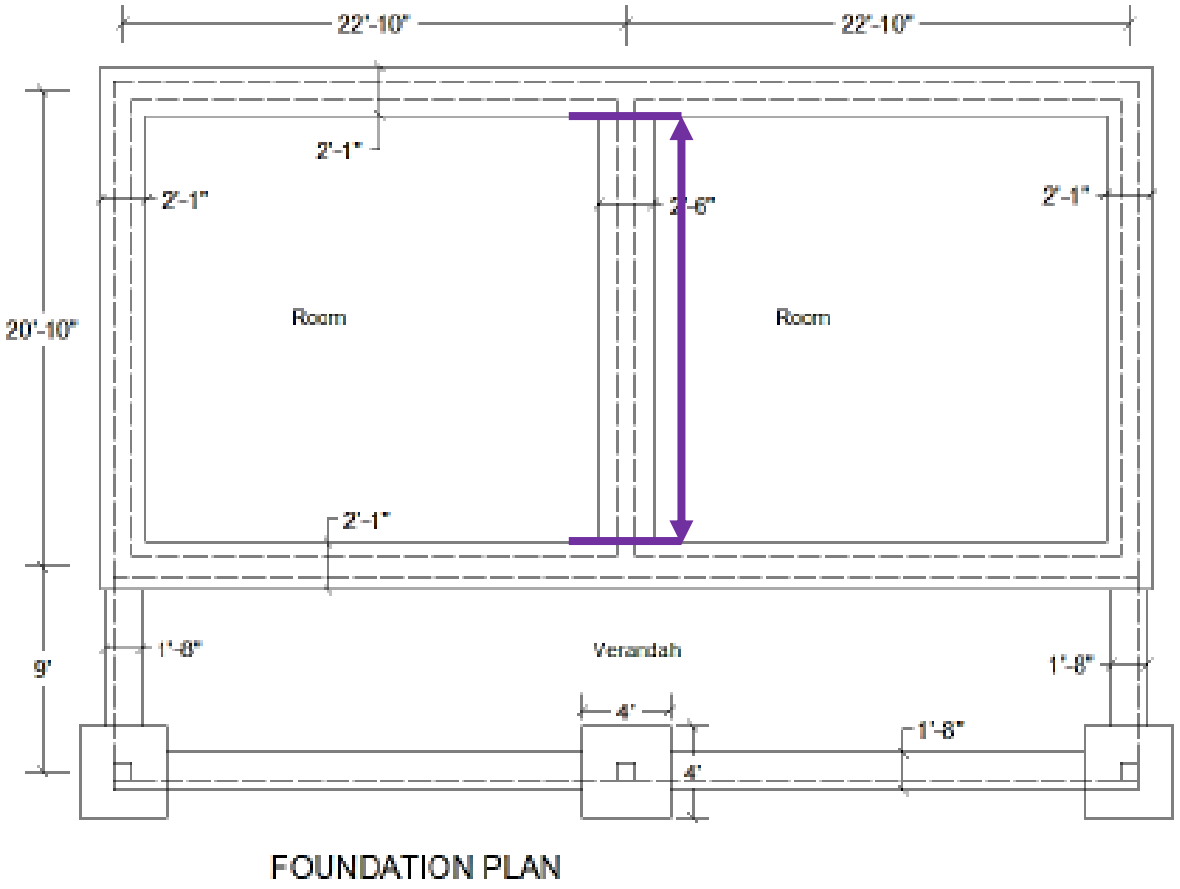
FOUNDATION PLAN

Column foundation:

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



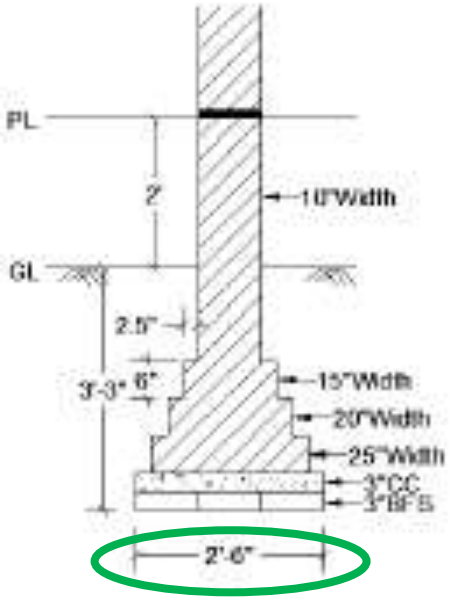
2. Estimation of Brick Flat Soling (one layer)



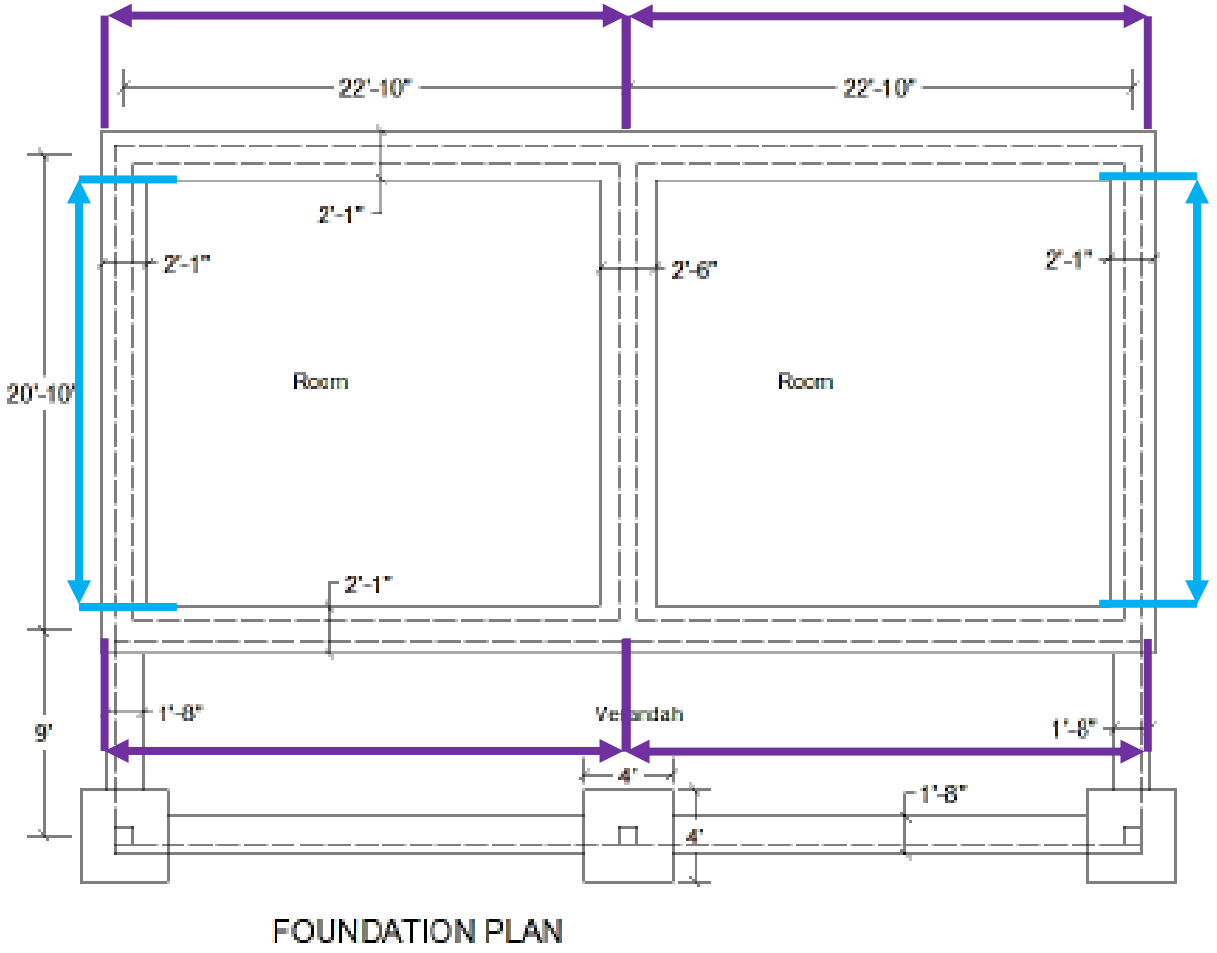
FOUNDATION PLAN

30" wall foundation:

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



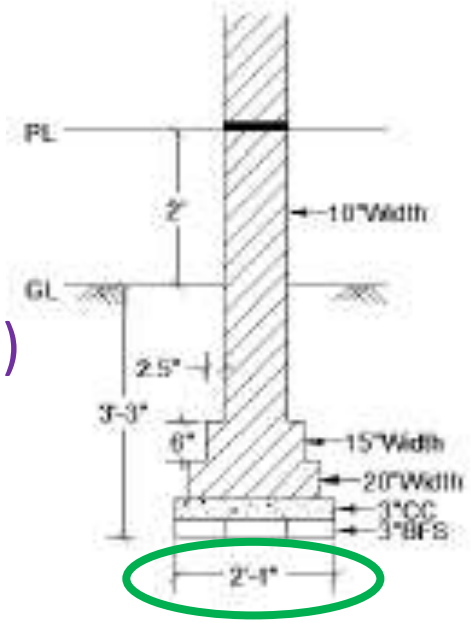
2. Estimation of Brick Flat Soling (one layer)



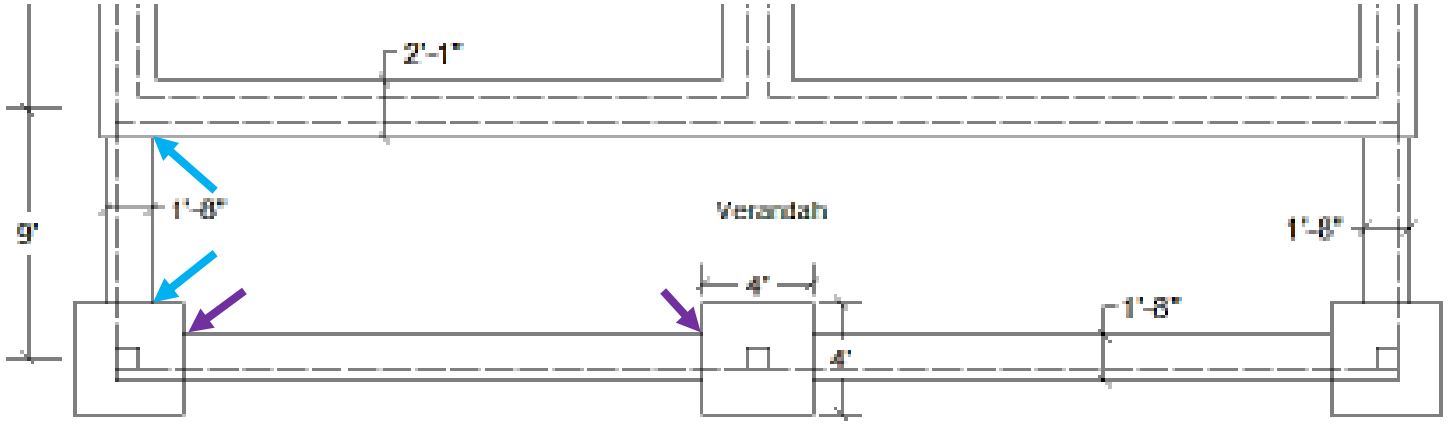
FOUNDATION PLAN

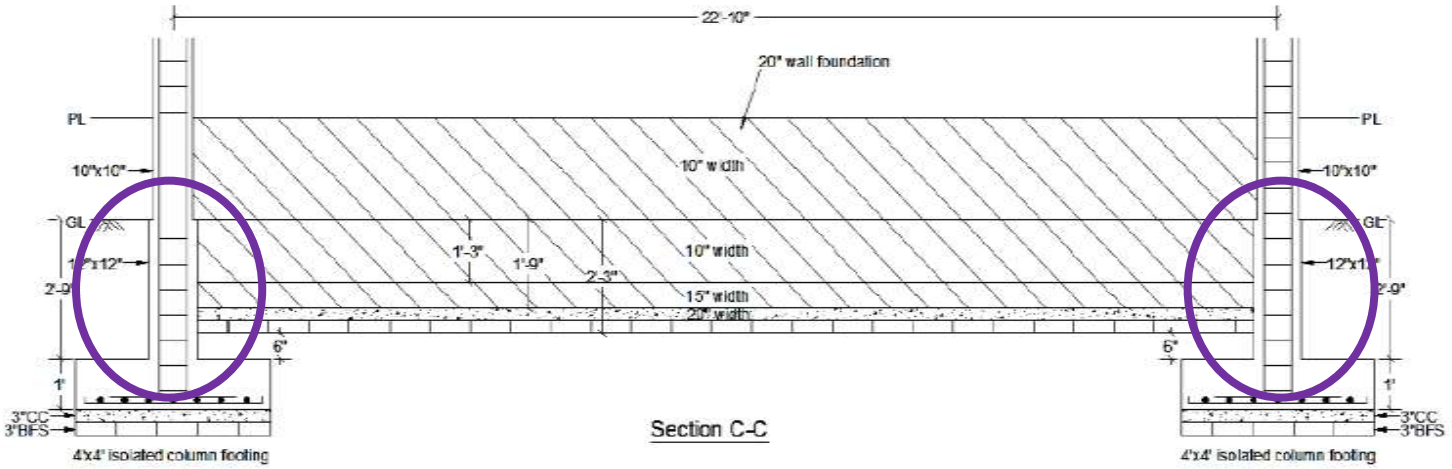
25" wall foundation:

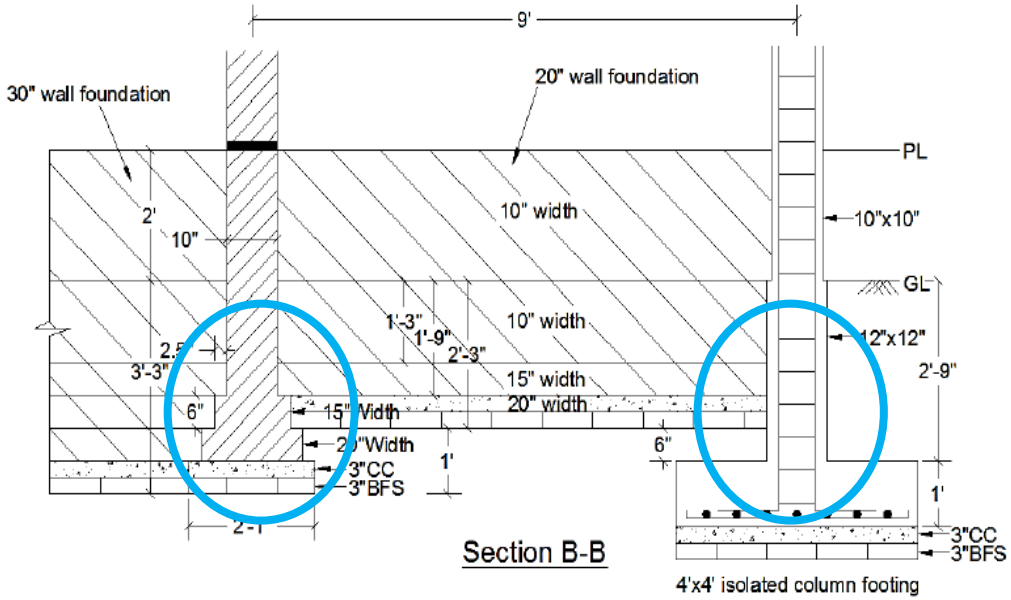
- Width= 25"
- Length=((22'10"+12.5") *4)+((20'10"-25")*2)



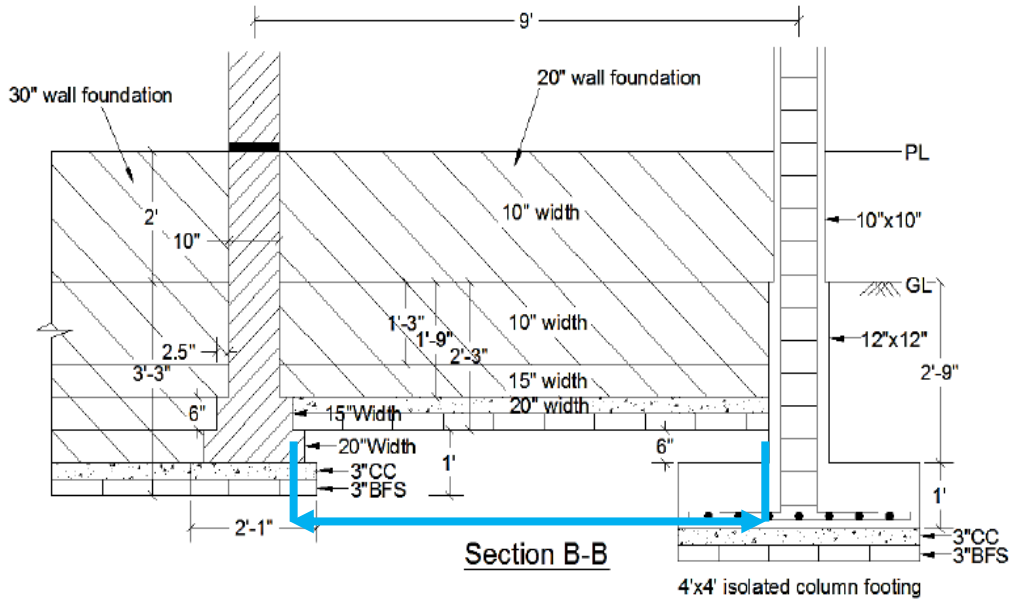
2. Estimation of Brick Flat Soling (one layer)

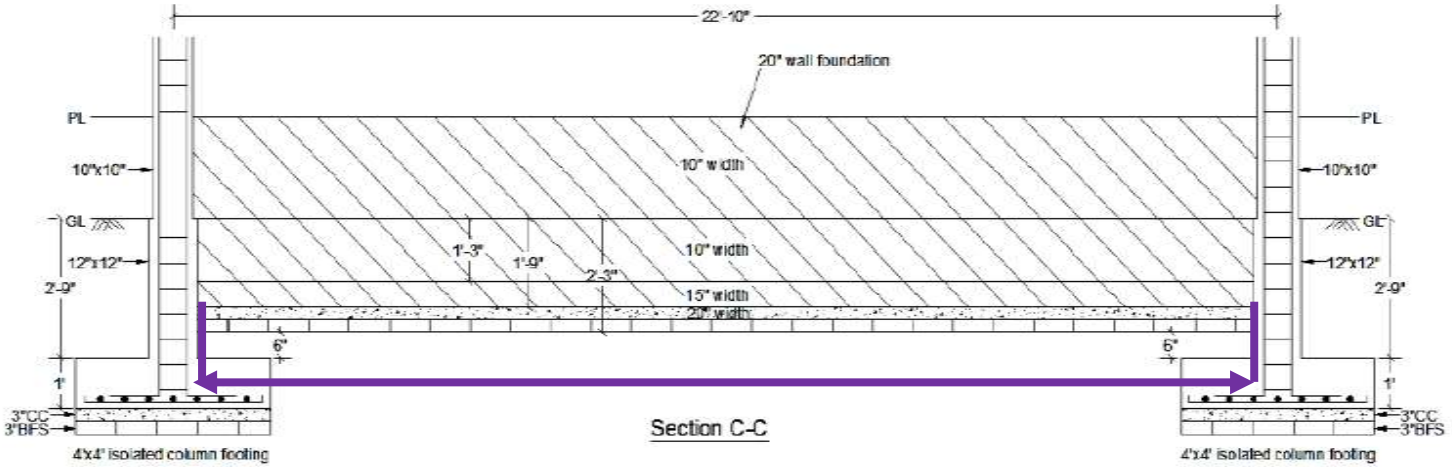






2. Estimation of Brick Flat Soling (one layer)

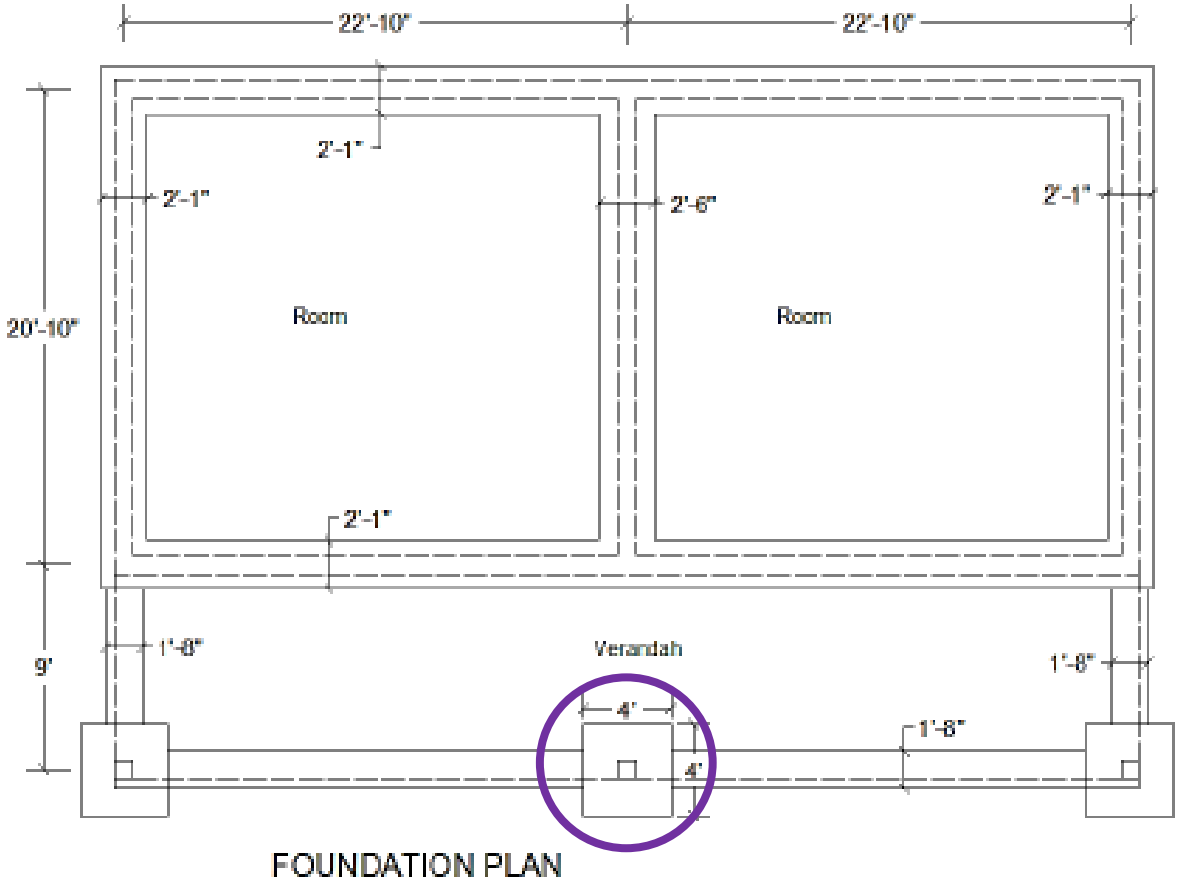




20" wall foundation:

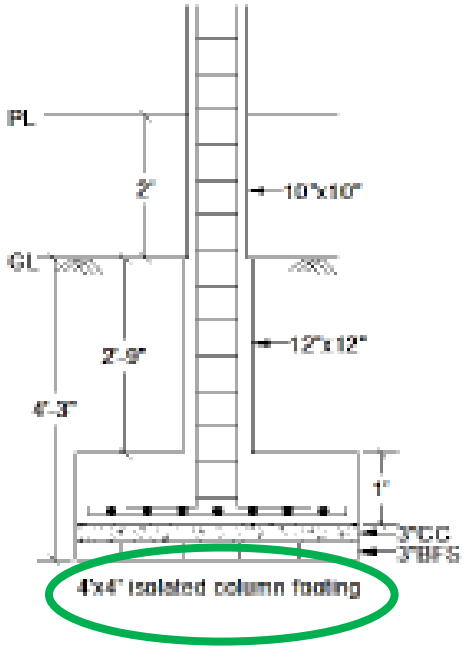
- Width= 20"
- Length=((9'-6"-7.5")*2) + ((22'10"-12")*2)

2. Estimation of Brick Flat Soling (one layer)

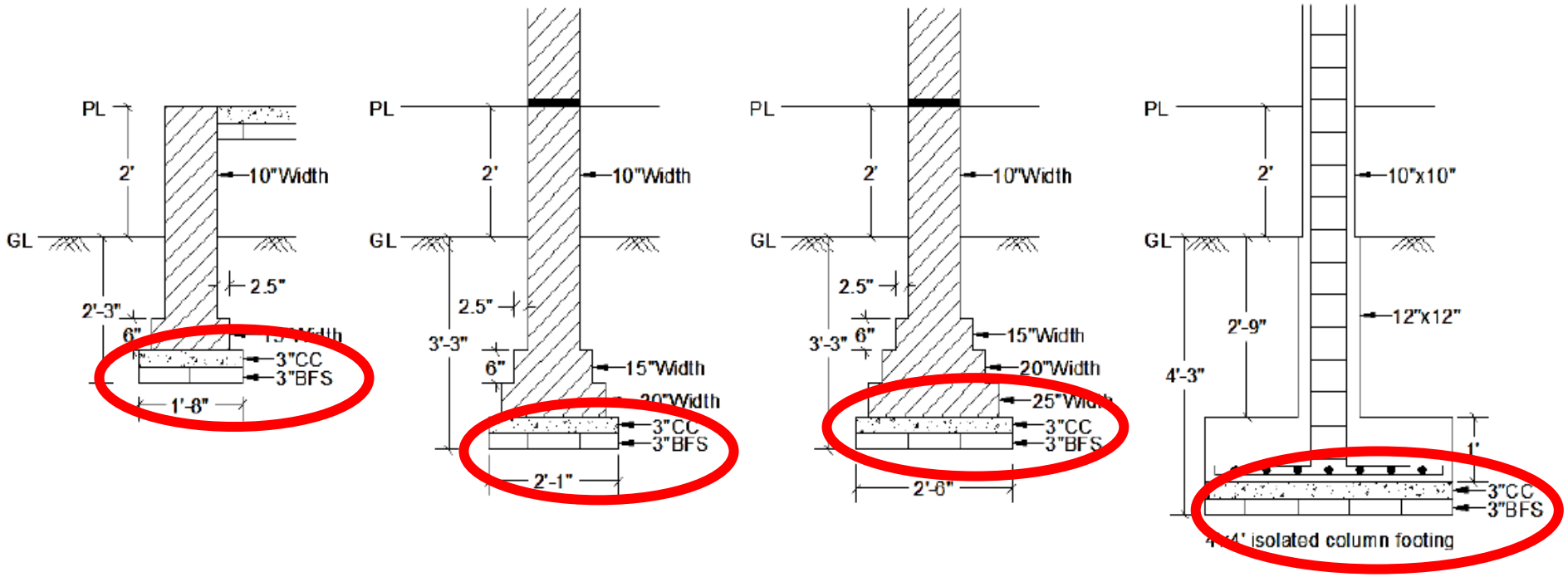


Column foundation:

- Width= 4’
- Length= 4’

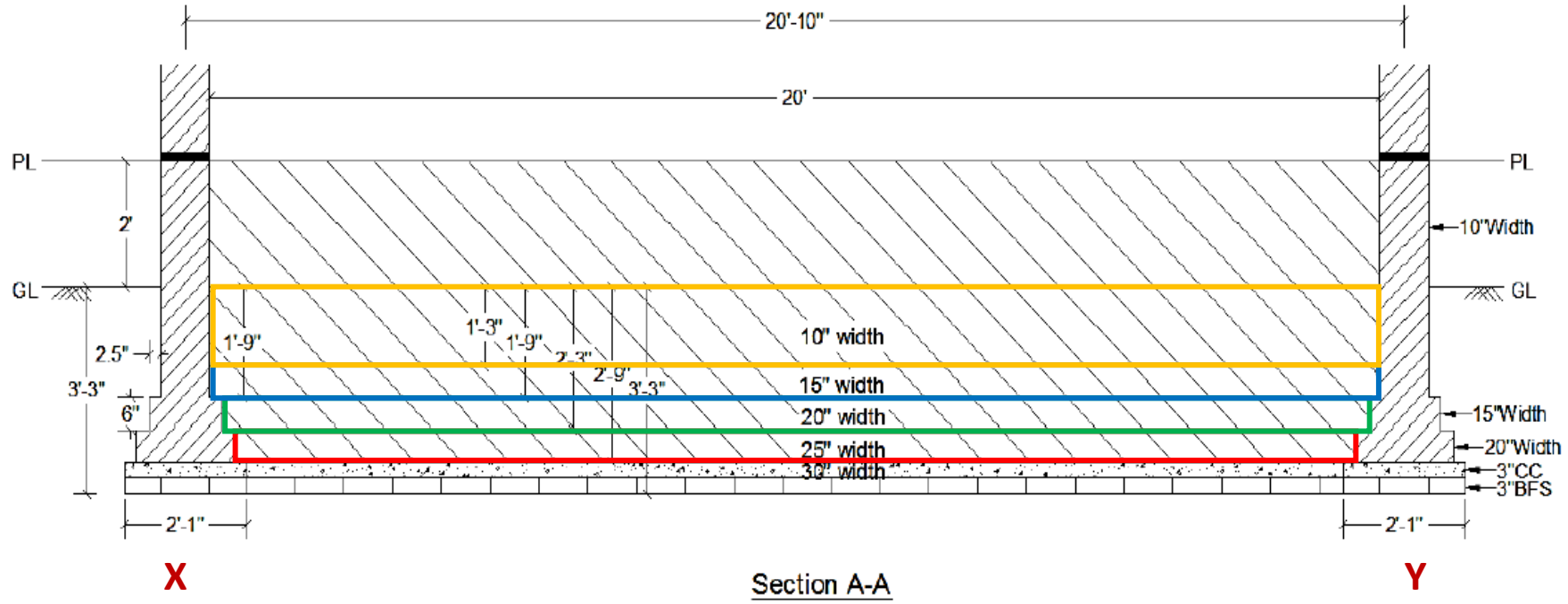


3. Estimation of Cement Concrete (1:3:6) in Foundation



- 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:

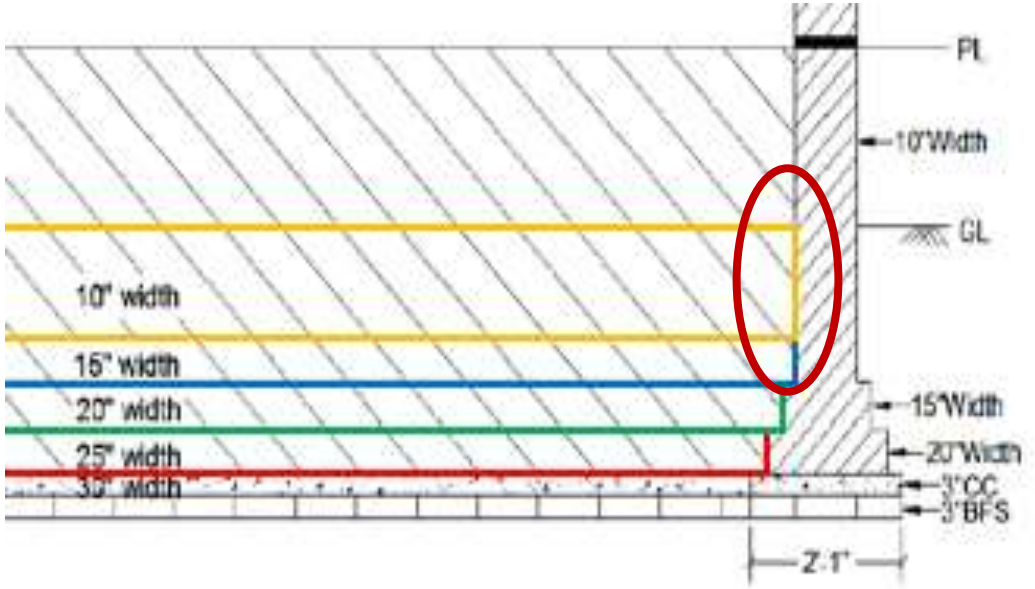
- Height= 6”
- Width= 20”
- Length= 20’10”-25”+5”+5”

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:

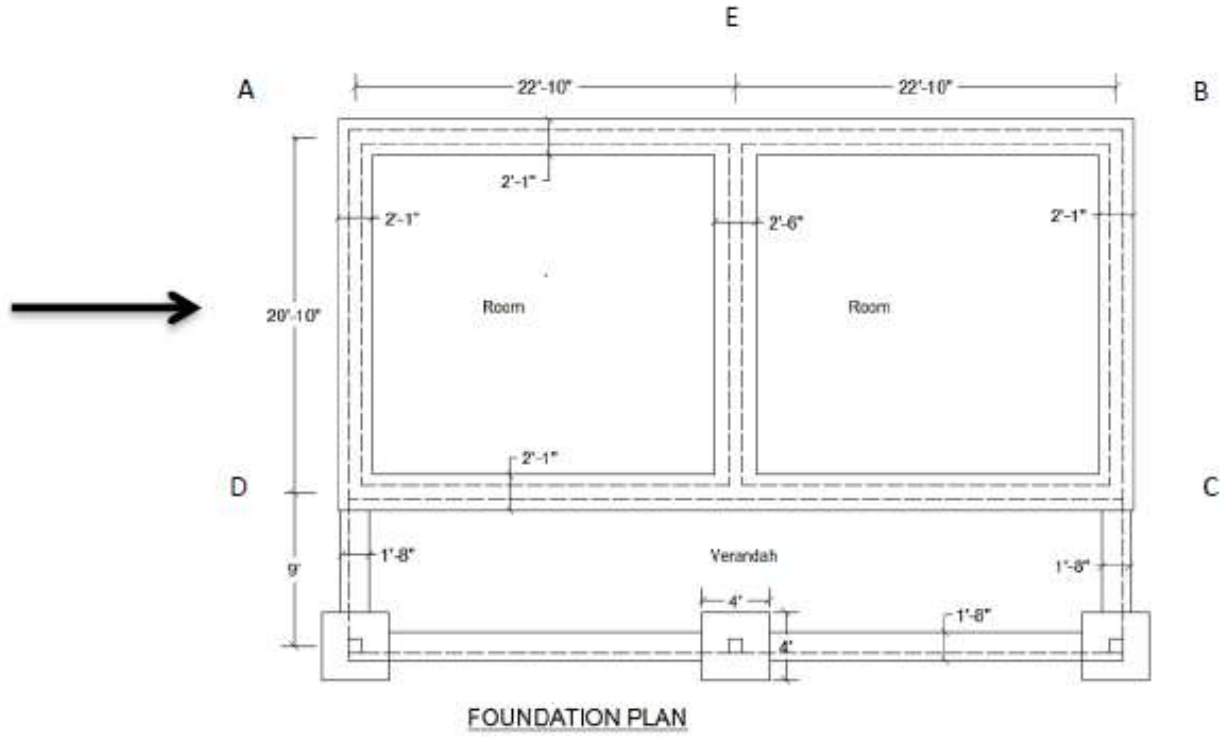
- Height= 6”
- Width= 20”
- Length= ((22’10”+12.5”-2.5”)*4) + ((20’10”-25”+5”)*2)

15” width:

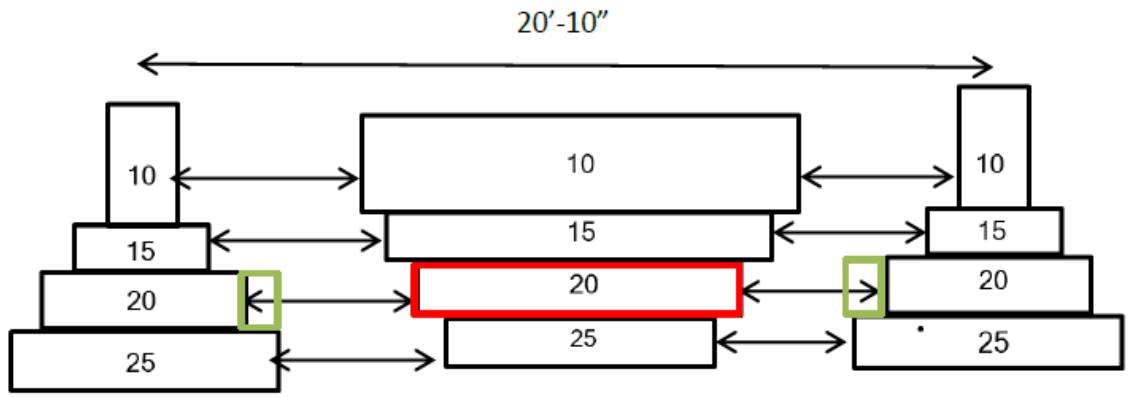
- Height= 6”
- Width= 15”
- Length= = ((22’10”+12.5”-5”)*4) + ((20’10”-25”+10”)*2)

10” width:

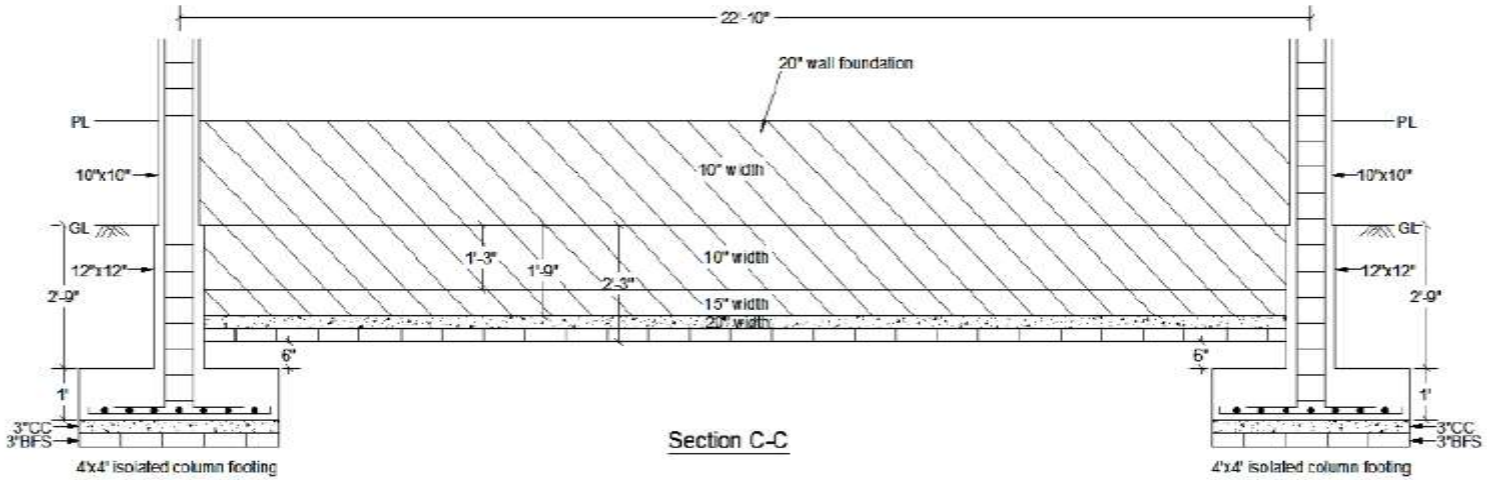
- Height= 21”
- Width= 10”
- Length= = ((22’10”+12.5”-7.5”)*4) + ((20’10”-25”+15”)*2)



FOUNDATION PLAN



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

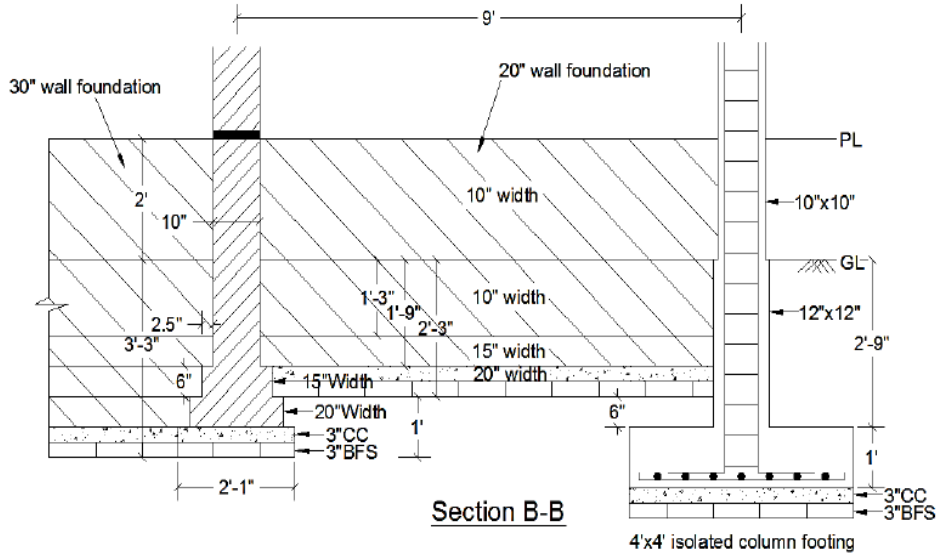


15” width:

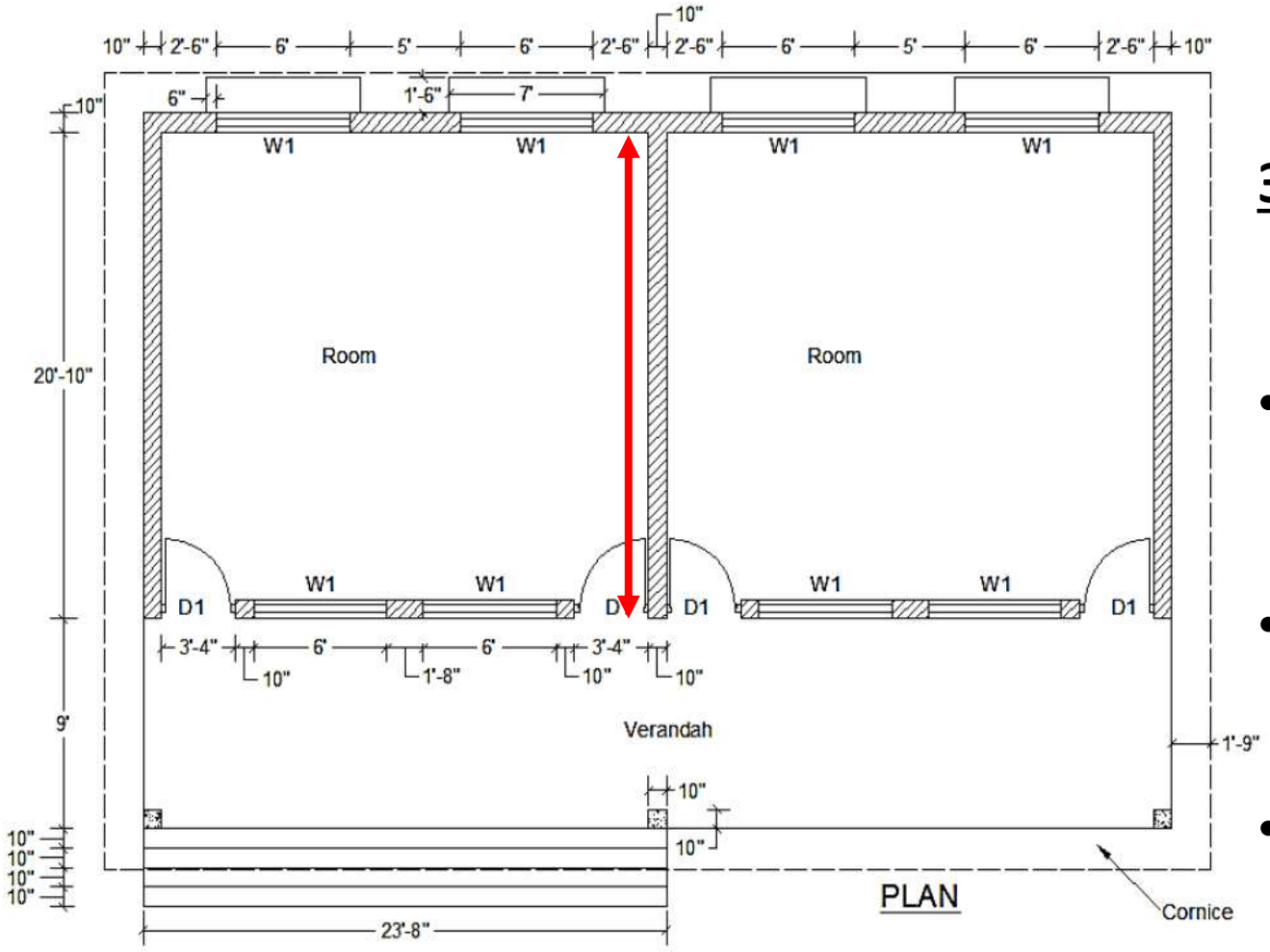
- Height= 6”
- Width= 15”
- Length= = ((9-6”-5”)*2) + ((22’10”-12”)*2)

10” width:

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

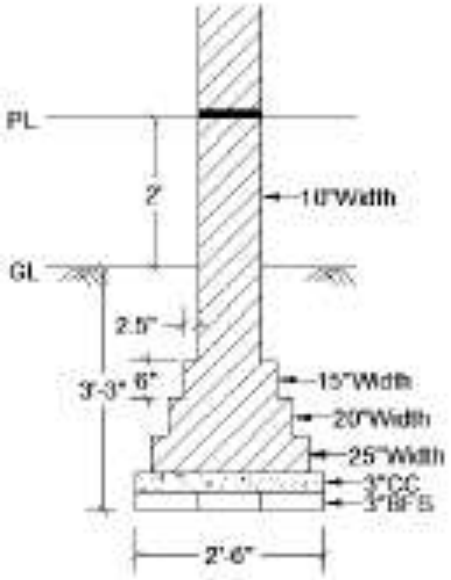


5. Estimation of Brickwork from GL to PL

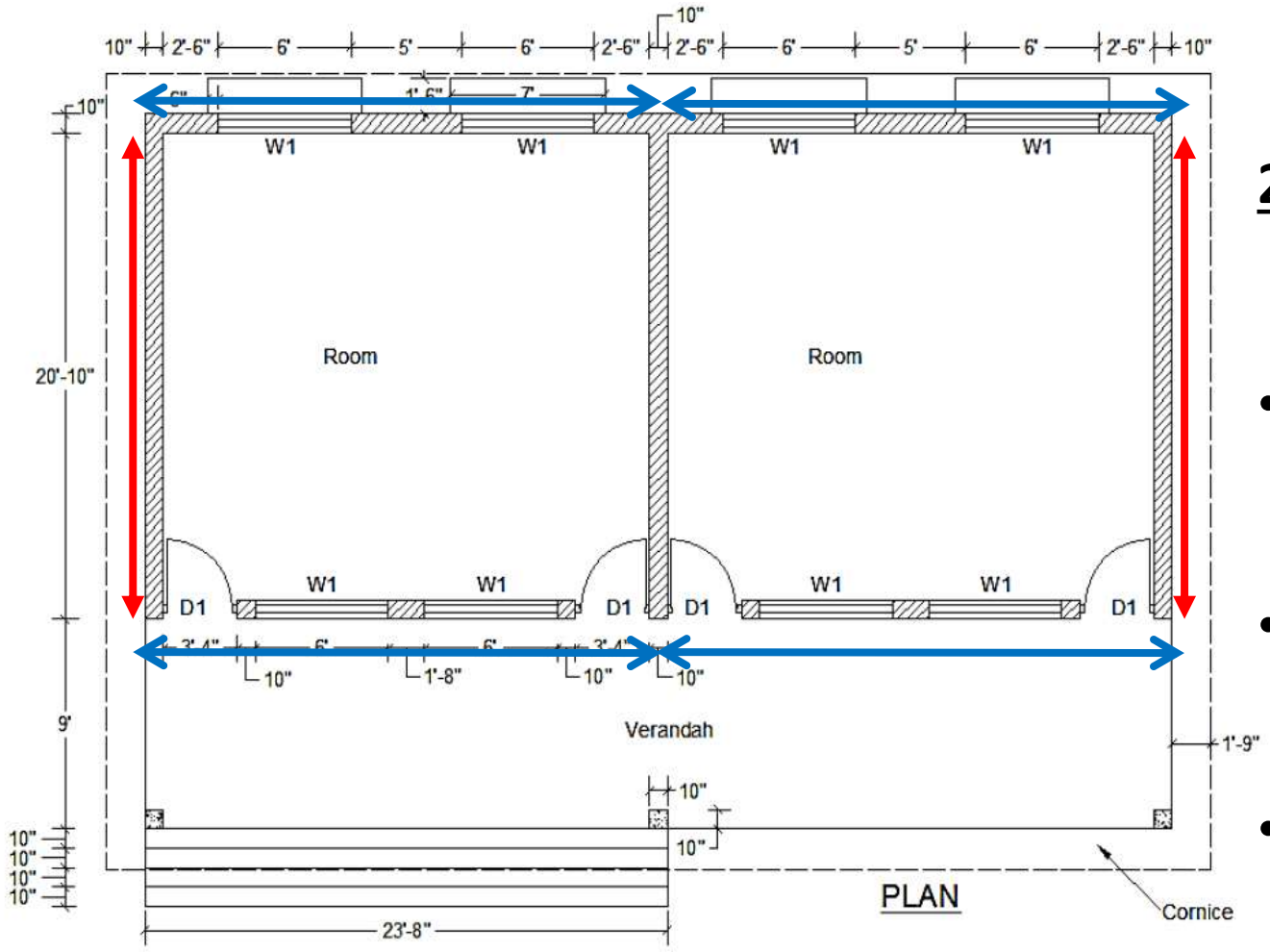


30” wall foundation:

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

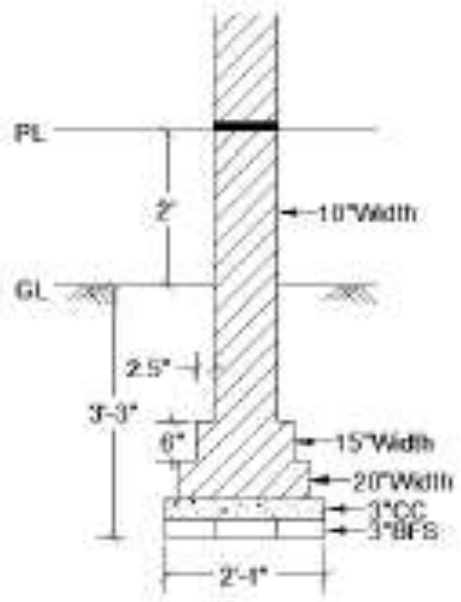


5. Estimation of Brickwork from GL to PL

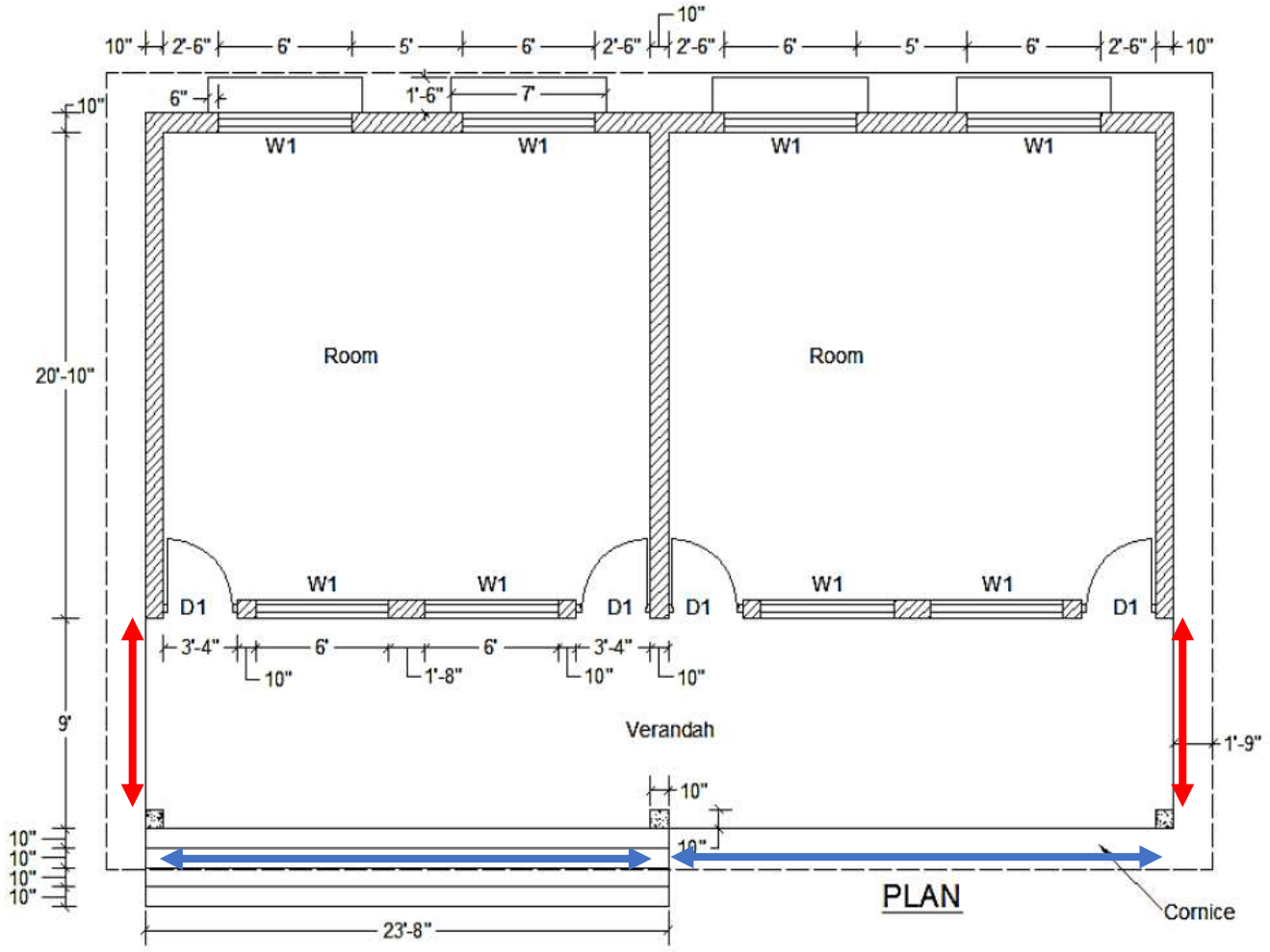


25” wall foundation:

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



5. Estimation of Brickwork from GL to PL

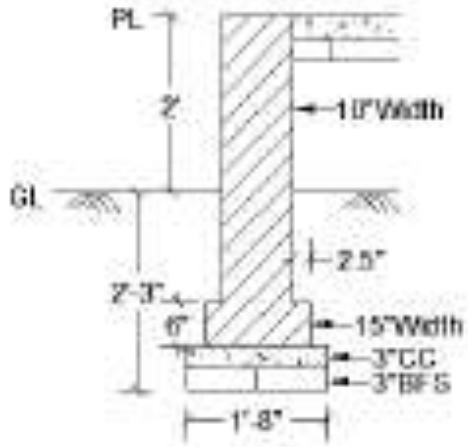


20” wall foundation:

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

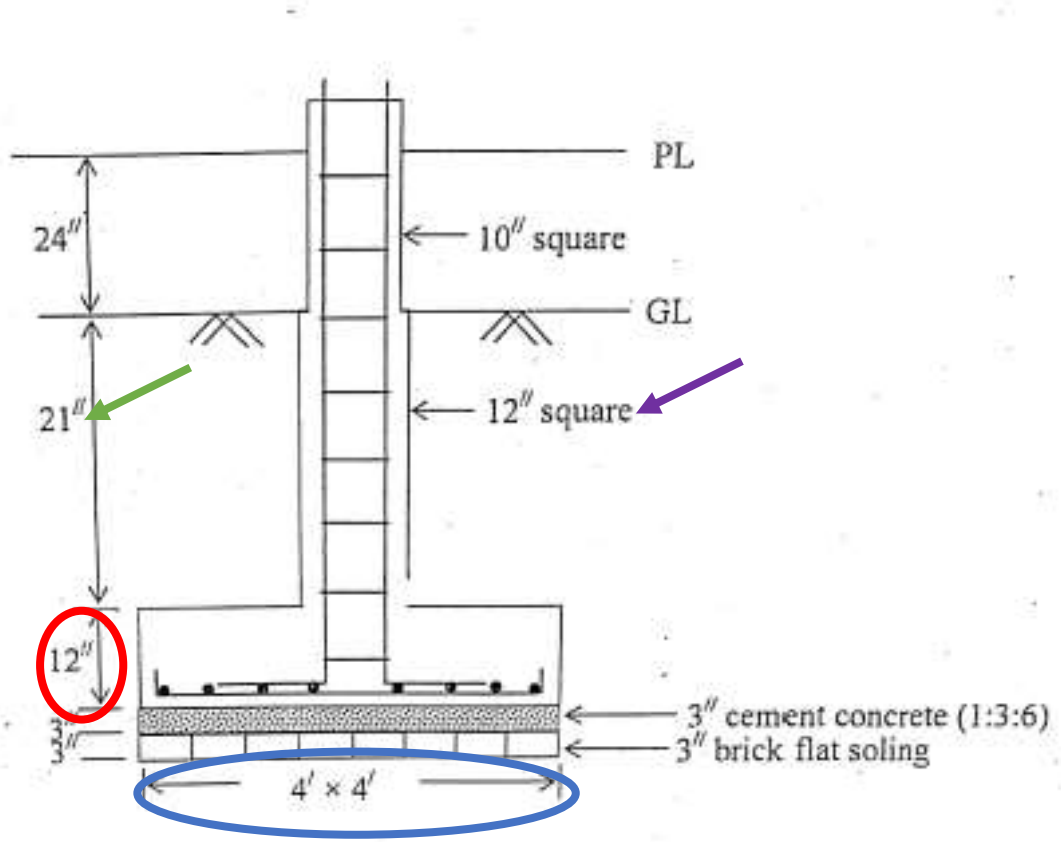


Figure: 4 ft x 4 ft isolated column footing

7. RCC in Column (GL to PL)

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

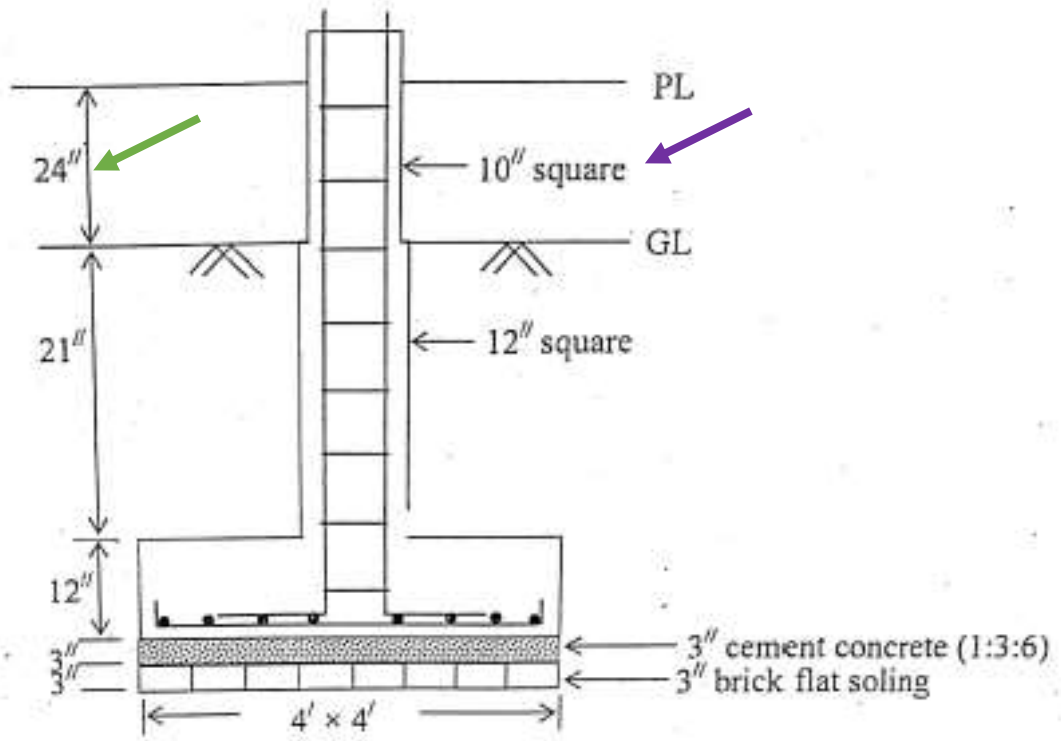


Figure: 4 ft x 4 ft isolated column footing

8. Damp Proof Course (DPC)

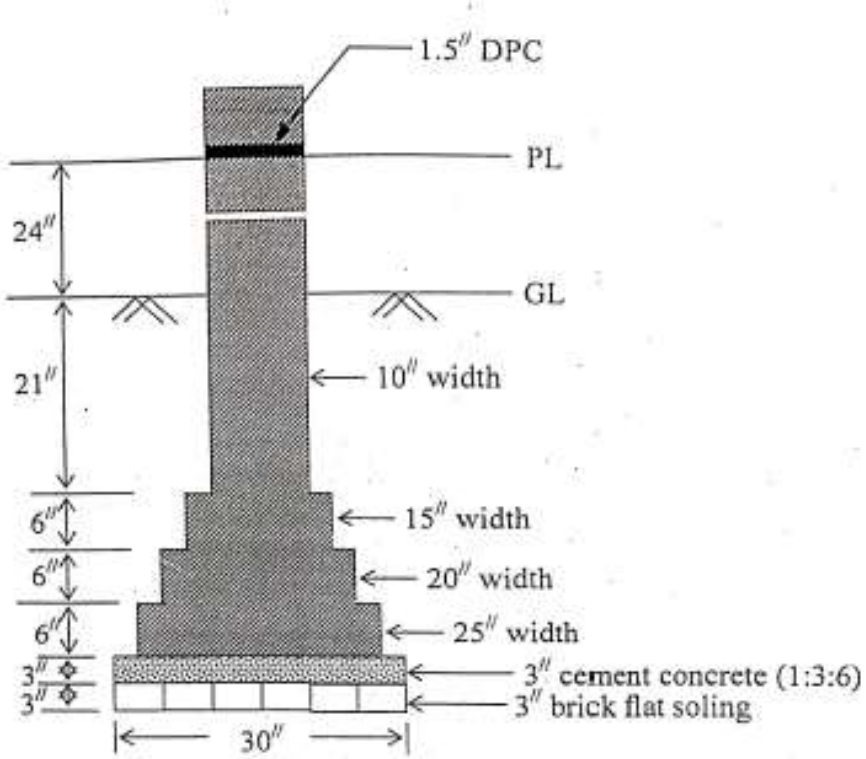


Figure: 30 inch continuous wall foundation

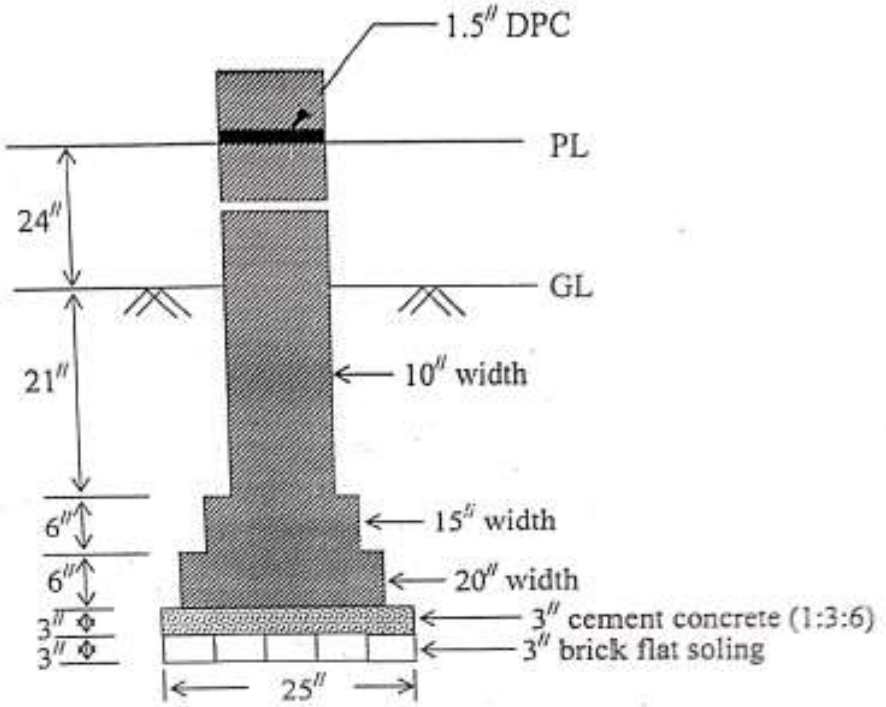


Figure: 25 inch continuous wall foundation

8. Damp Proof Course (DPC)

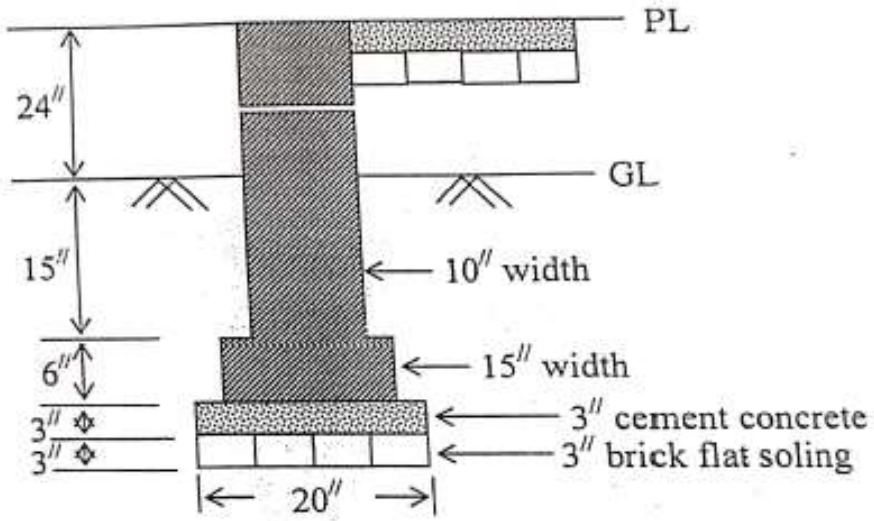


Figure: 20 inch continuous verandah wall foundation

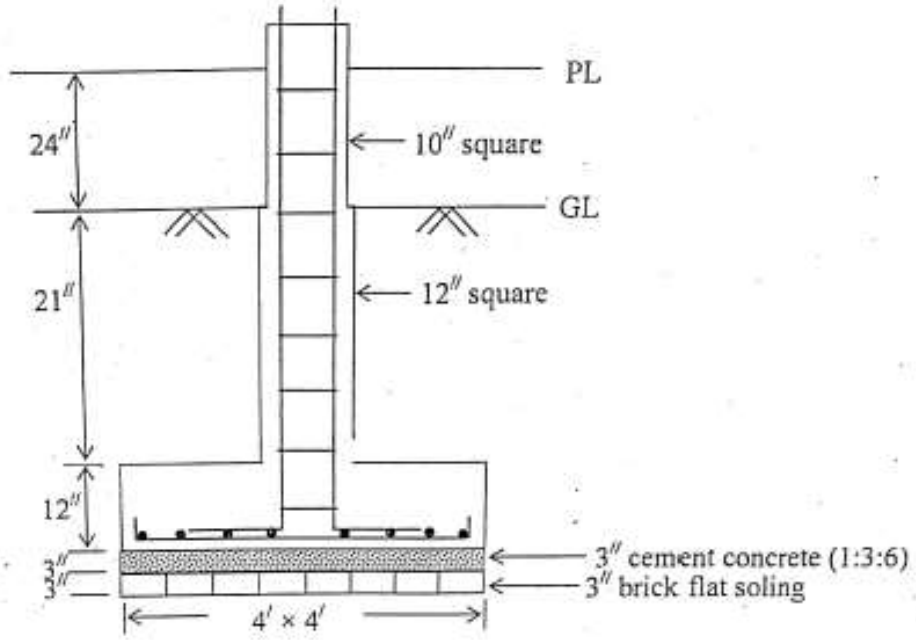
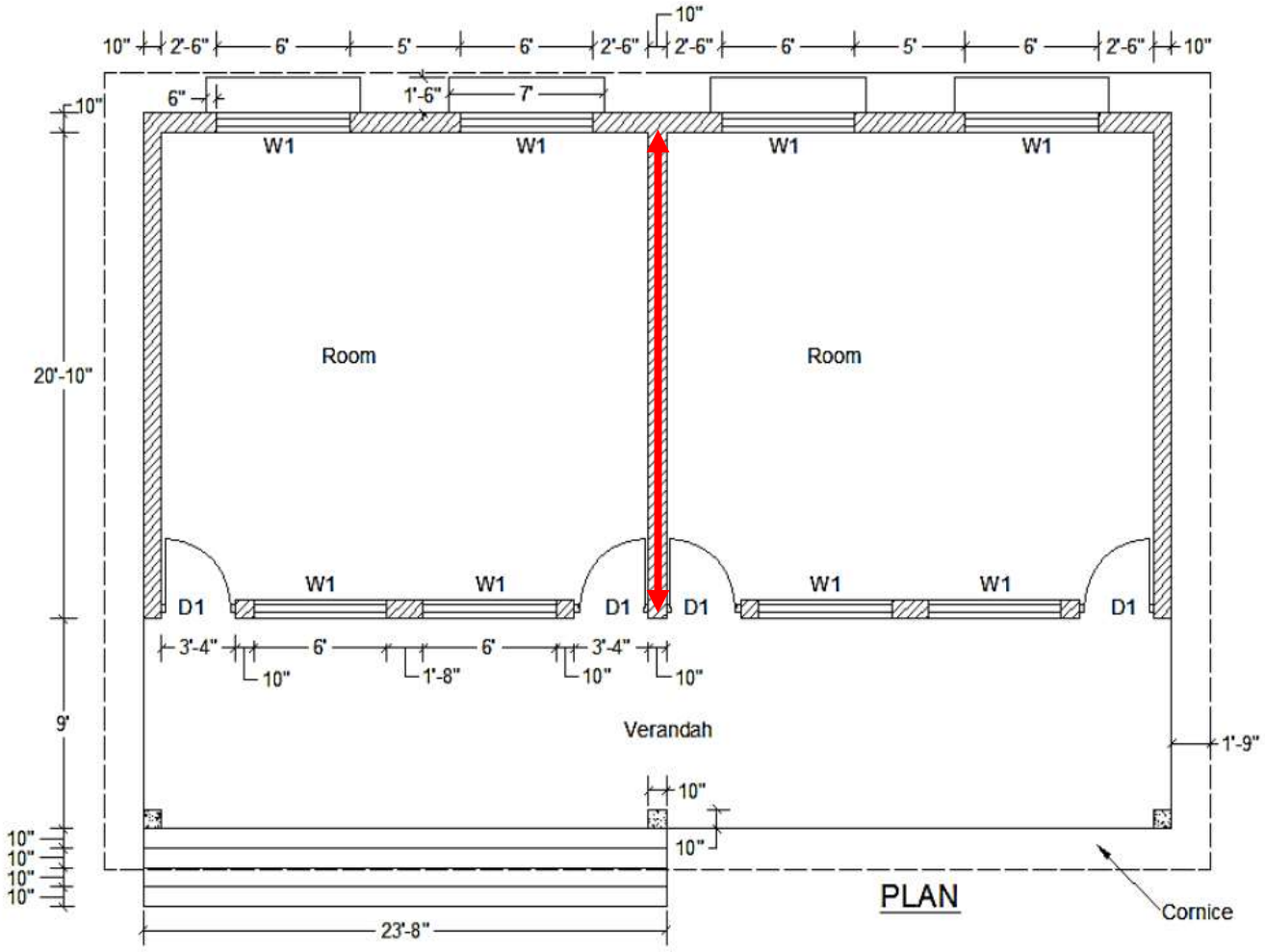


Figure: 4 ft x 4 ft isolated column footing

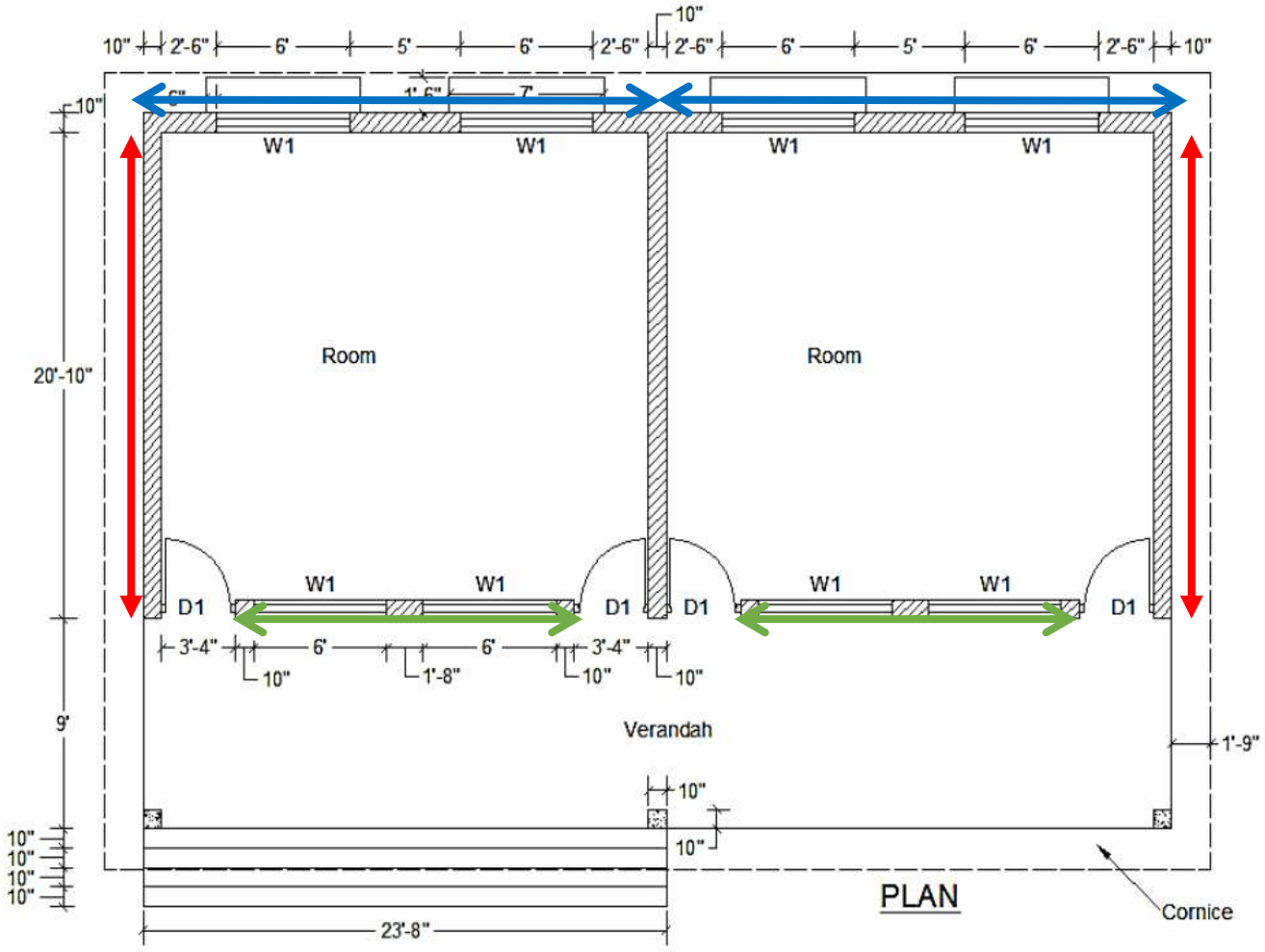
8. Damp Proof Course (DPC)



30” wall foundation:

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

8. Damp Proof Course (DPC)



25" wall foundation:

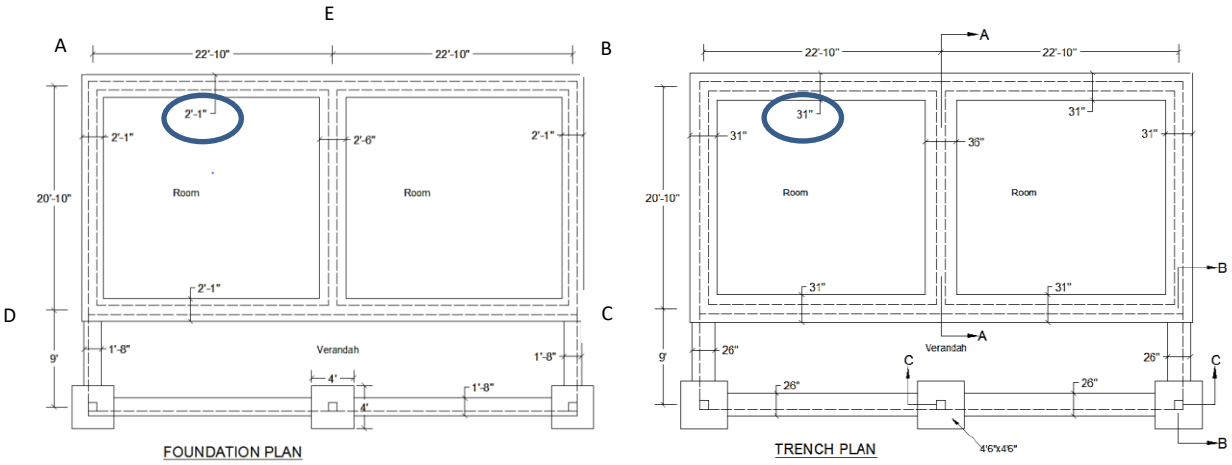
- Thickness= 1.5"
- Width= 10"
- Length= 20'*2+(22'10"+5")*2+(15'4")*2

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)

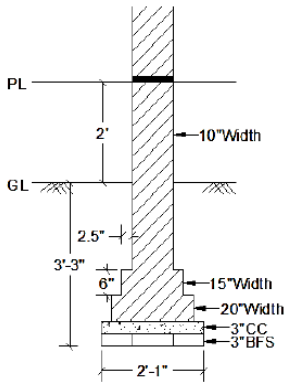
*Dimensions are subtracted as AB and DC have already been excavated

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

(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



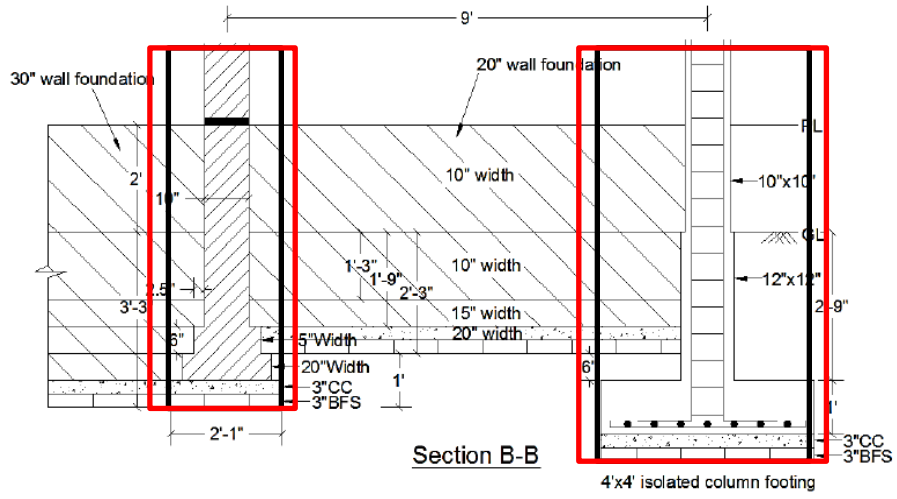
Width = $2 + (1/12) + (3/12_{Left}) + (3/12_{Right})$

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.



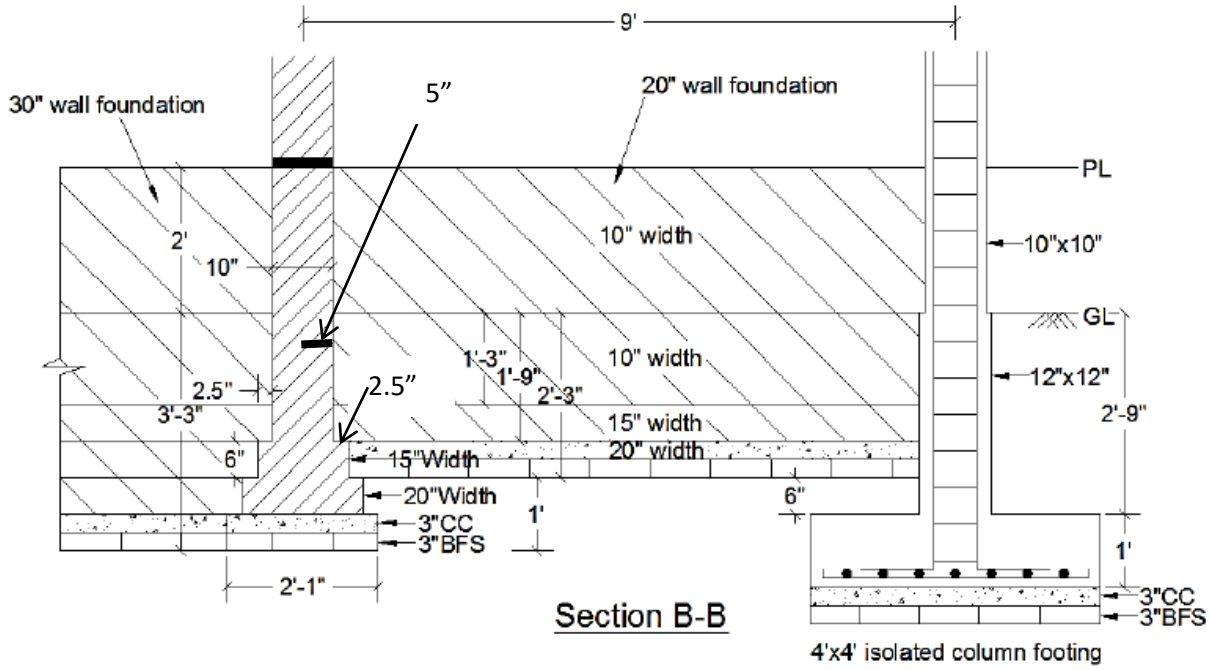
The black rectangles indicate the excavated portion if the actual width of foundation was used and the red lines indicate 3 inch portion extra excavated length on each side of foundation.

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)

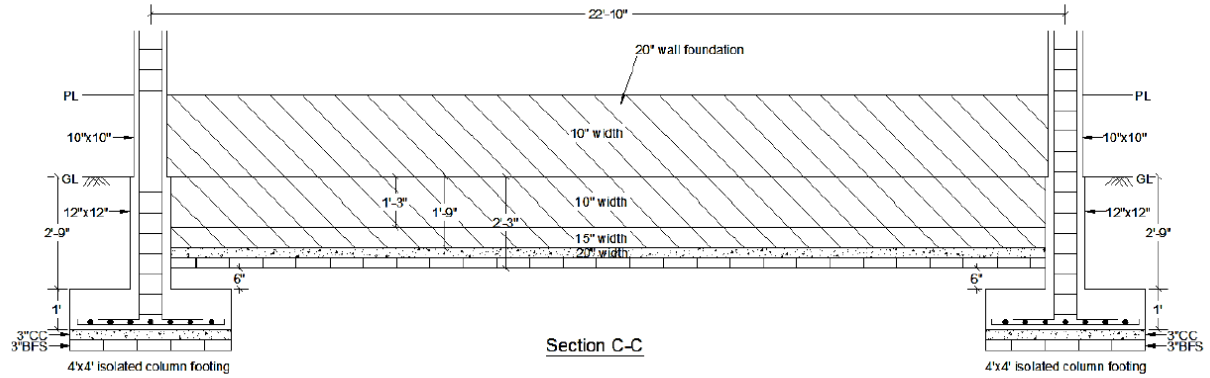
In order to find the length of **BFS**, you may consider the section view to find the relative height of foundations and obtain the lengths from the foundation plan.



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)

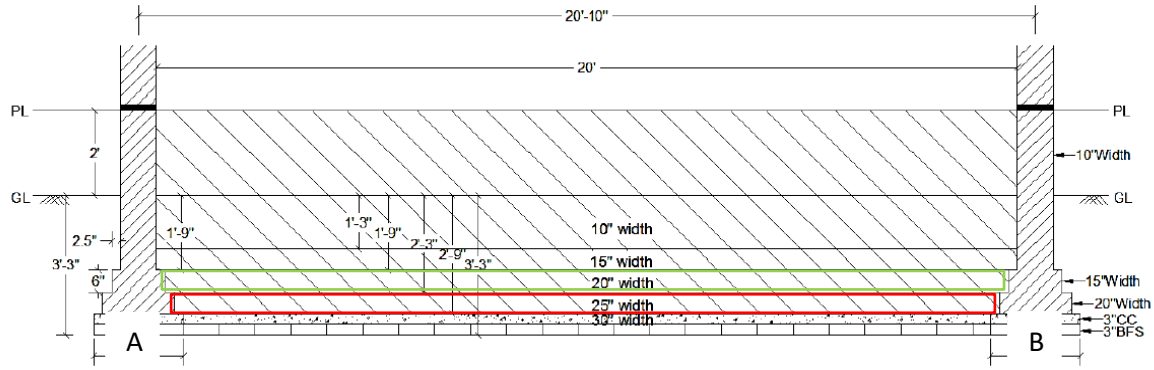
Width: (20/12)



Note: Dimensions used in calculation are in feet

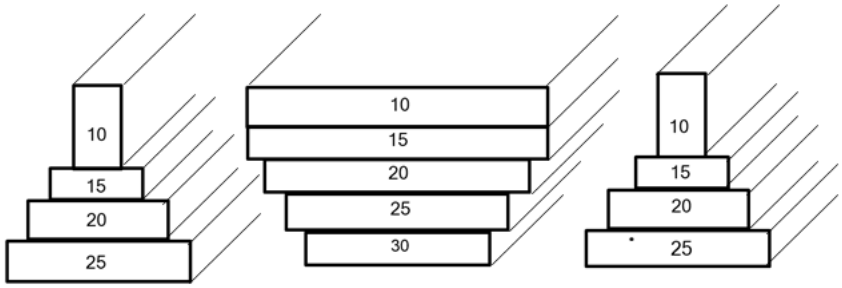
4. Brickwork in Foundation upto GL

(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.

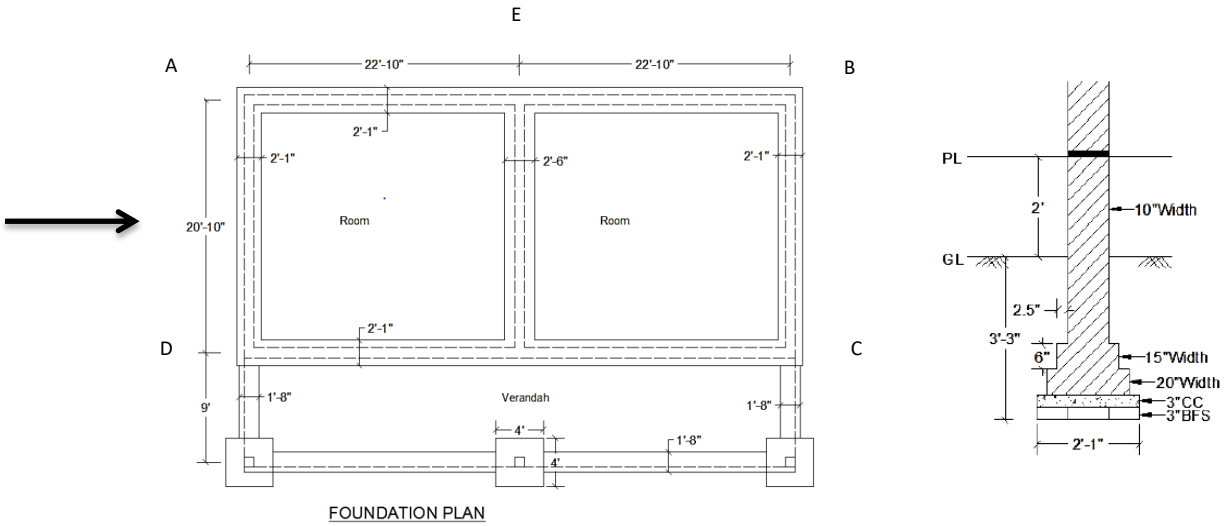
(i) 20 + (10/12) - (25/12) + (5/12)
(ii) 20 + (10/12) - (25/12) + (10/12)
(iii) 20 + (10/12) - (25/12) + (15/12)
(iv) 20 + (10/12) - (25/12) + (15/12)

Note: Dimensions used in calculation are in feet

4(b) 25 inch wall foundation

(i) 20 inch width –

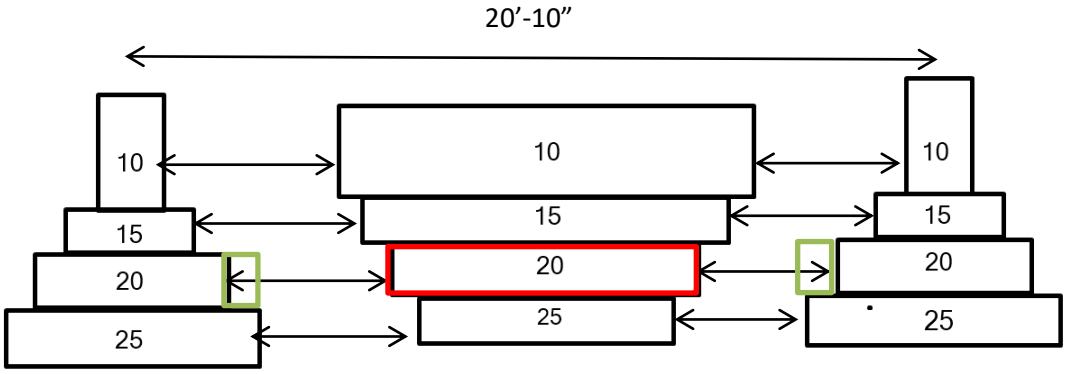
Length = ((22 + (10/12) + (10/12))*4) + ((20 + (10/12) - (25/12) + (5/12))*2)



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.



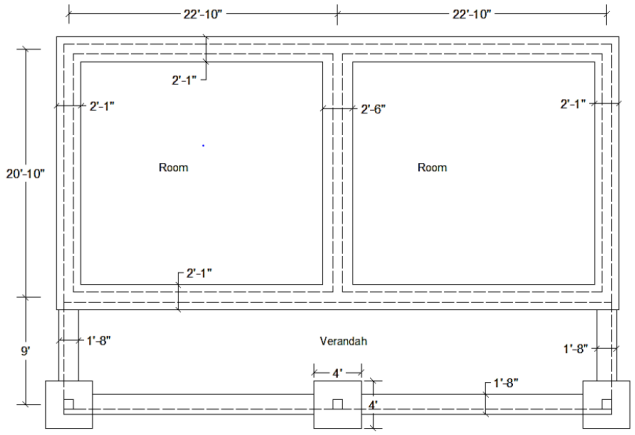
Therefore the required length = c/c distance – (2*Half width of 25 inch wall foundation) + (2*2.5 inch due to reduced step size) and hence ((20 + (10/12) - (25/12) + (5/12))

Note: Dimensions used in calculation are in feet

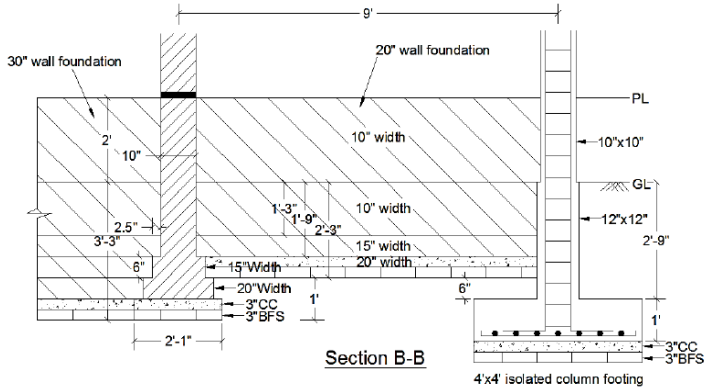
4 (c) 20 inch verandah wall foundation

(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.

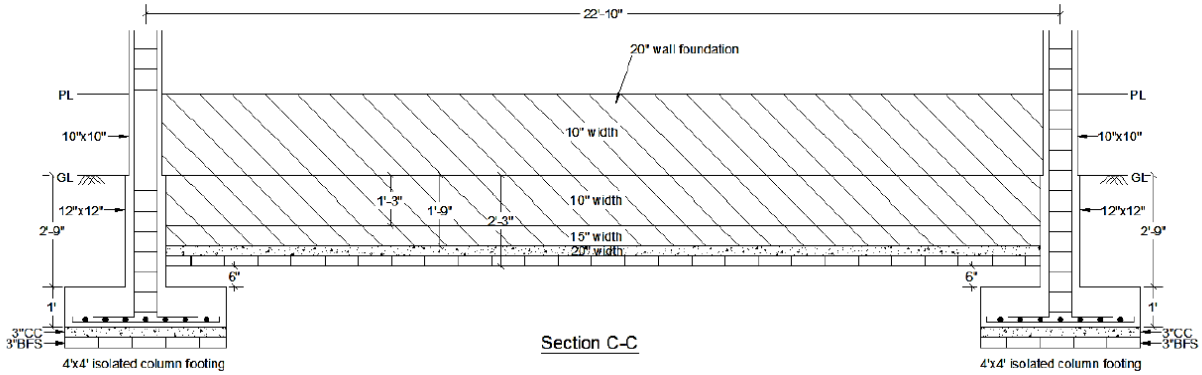


FOUNDATION PLAN



Section B-B

4'x4' isolated column footing



Section C-C

4'x4' isolated column footing

4'x4' isolated column footing

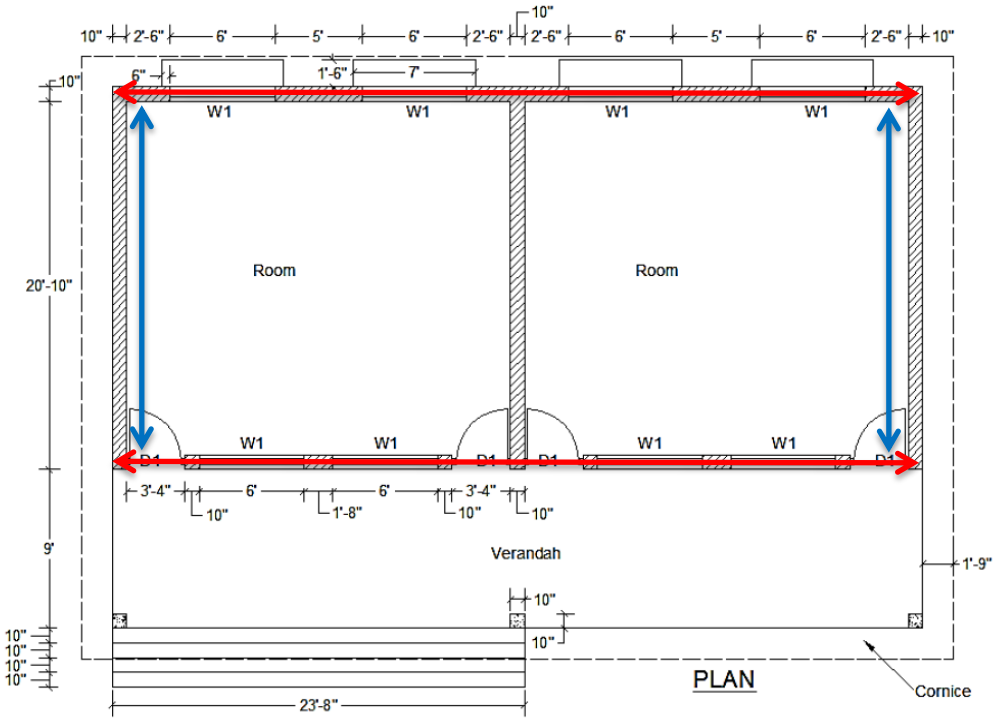
Note: Dimensions used in calculation are in feet

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

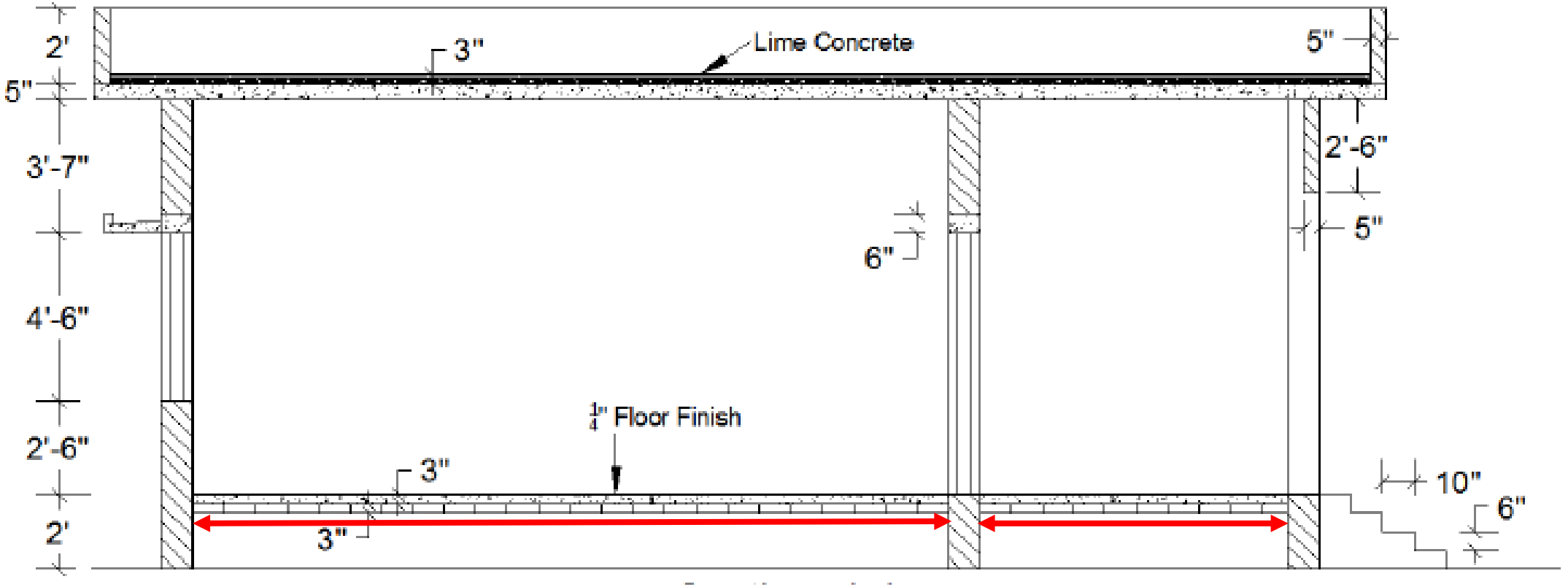
CE 208
Quantity Surveying

Estimation of a Residential Building

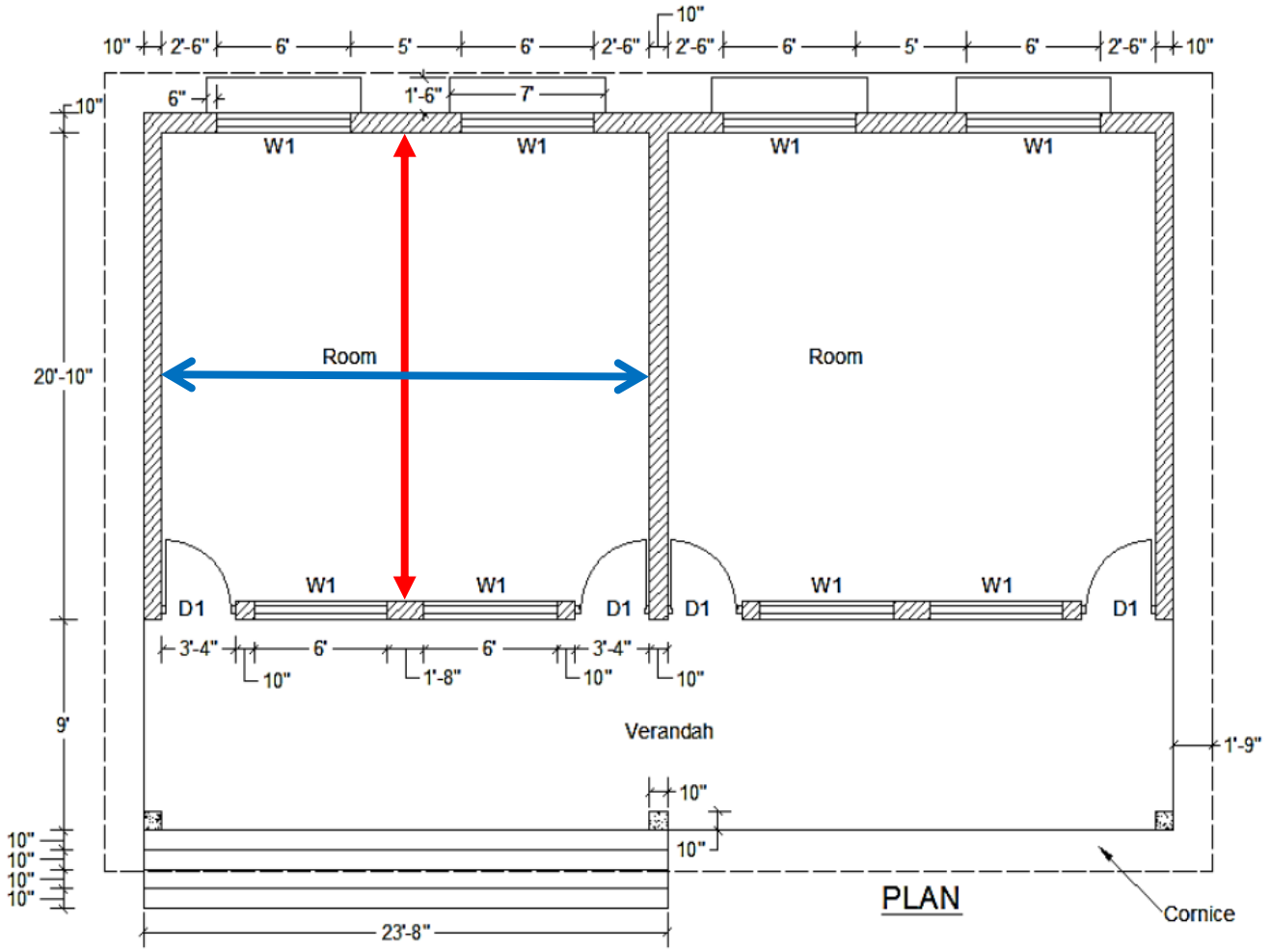


DEPARTMENT OF CIVIL ENGINEERING
BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY

9. BFS (one layer) in Floors



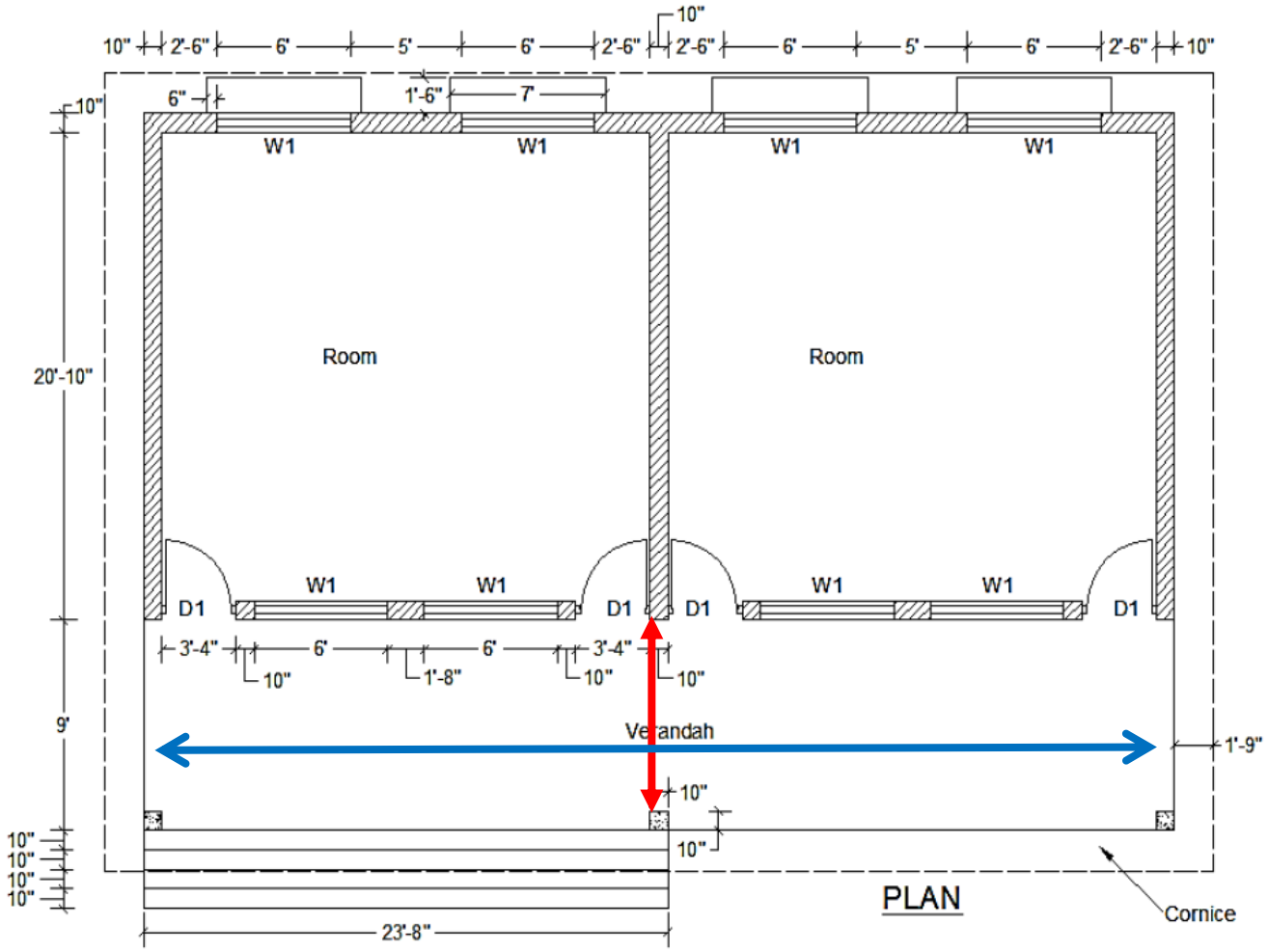
9. BFS (one layer) in Floors



Main Room:

- Length= 22’
- Width= 20’

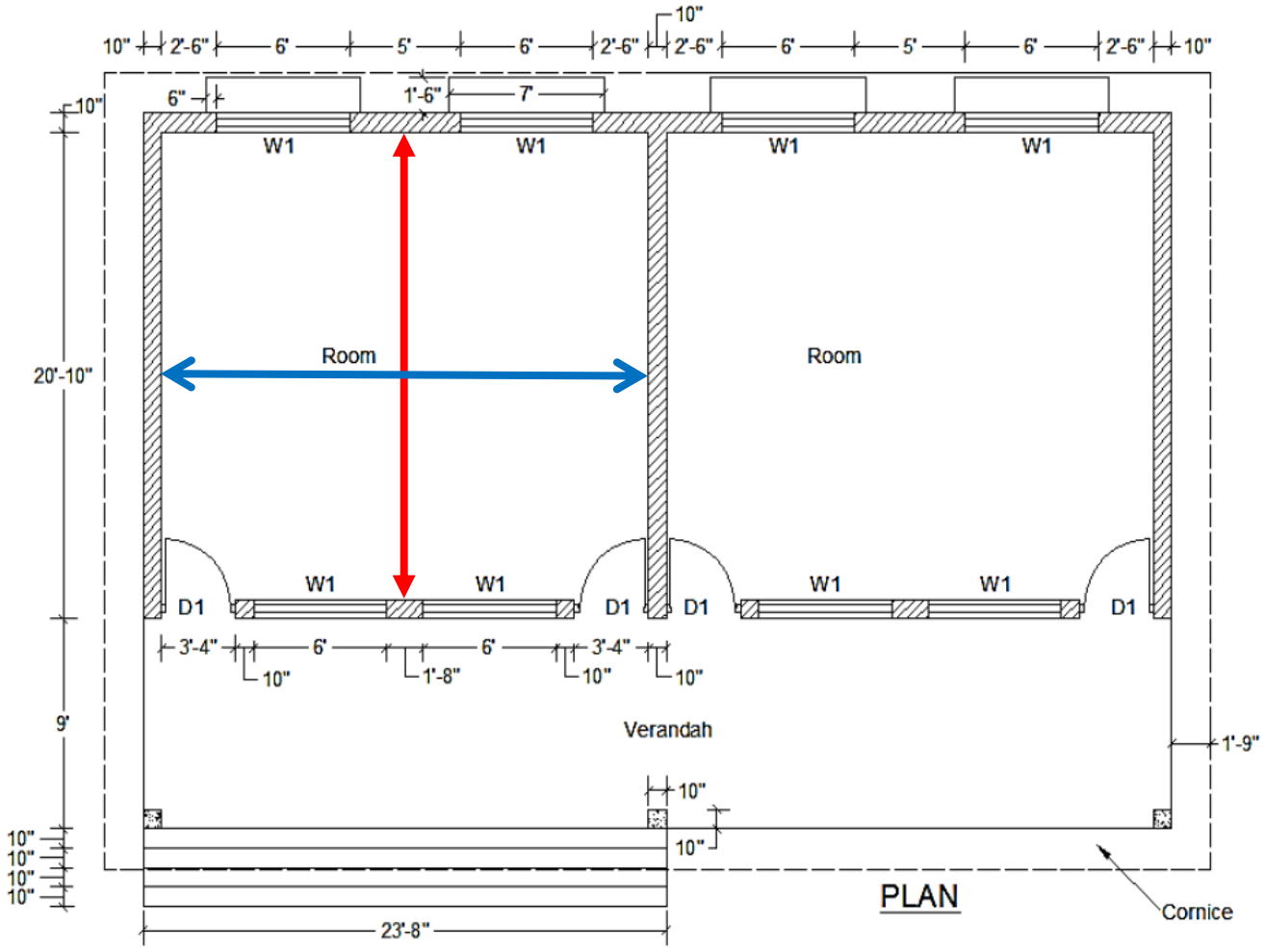
9. BFS (one layer) in Floors



Verandah:

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

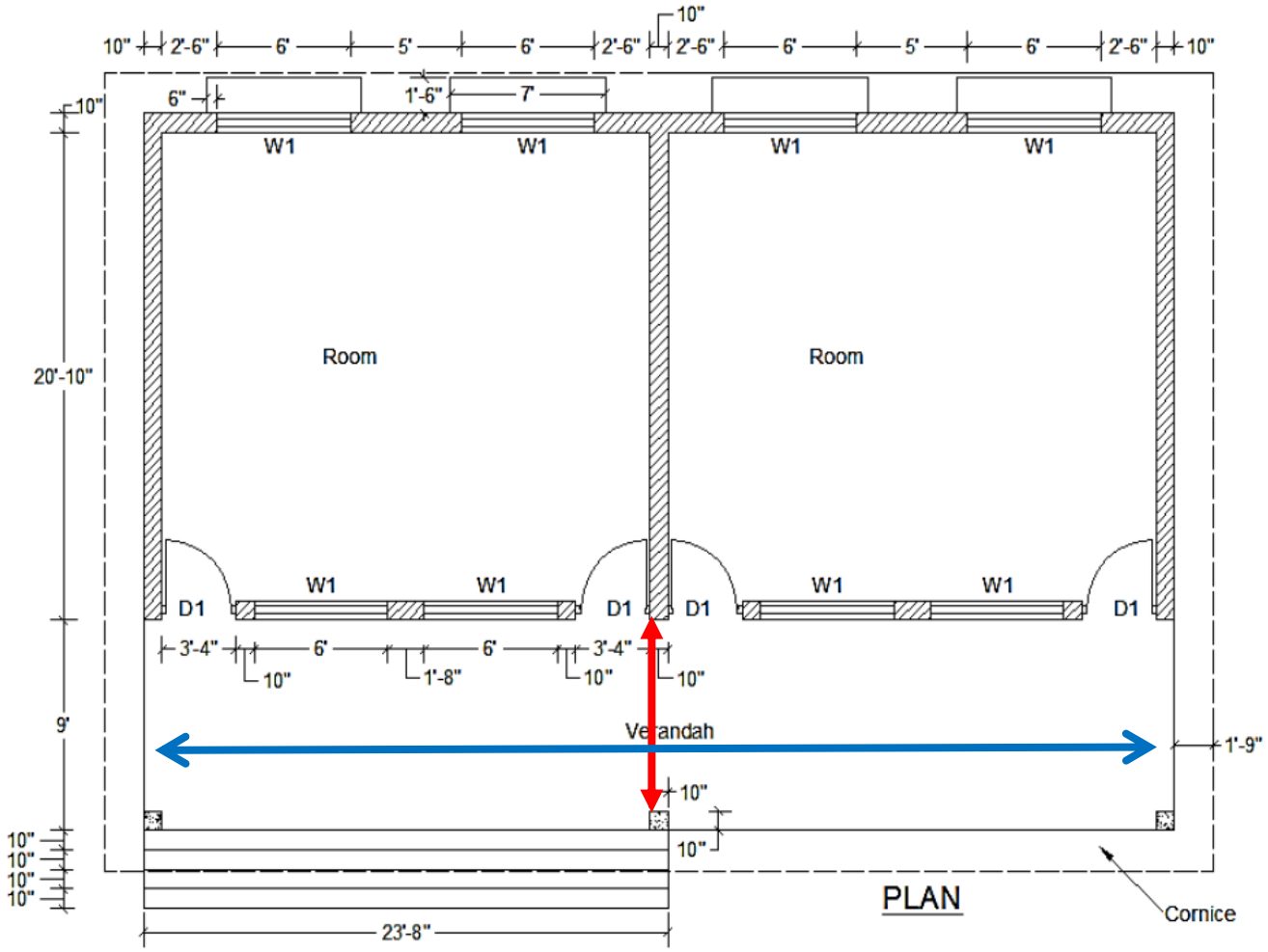
10. CC (3”) in Floors



Main Room:

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

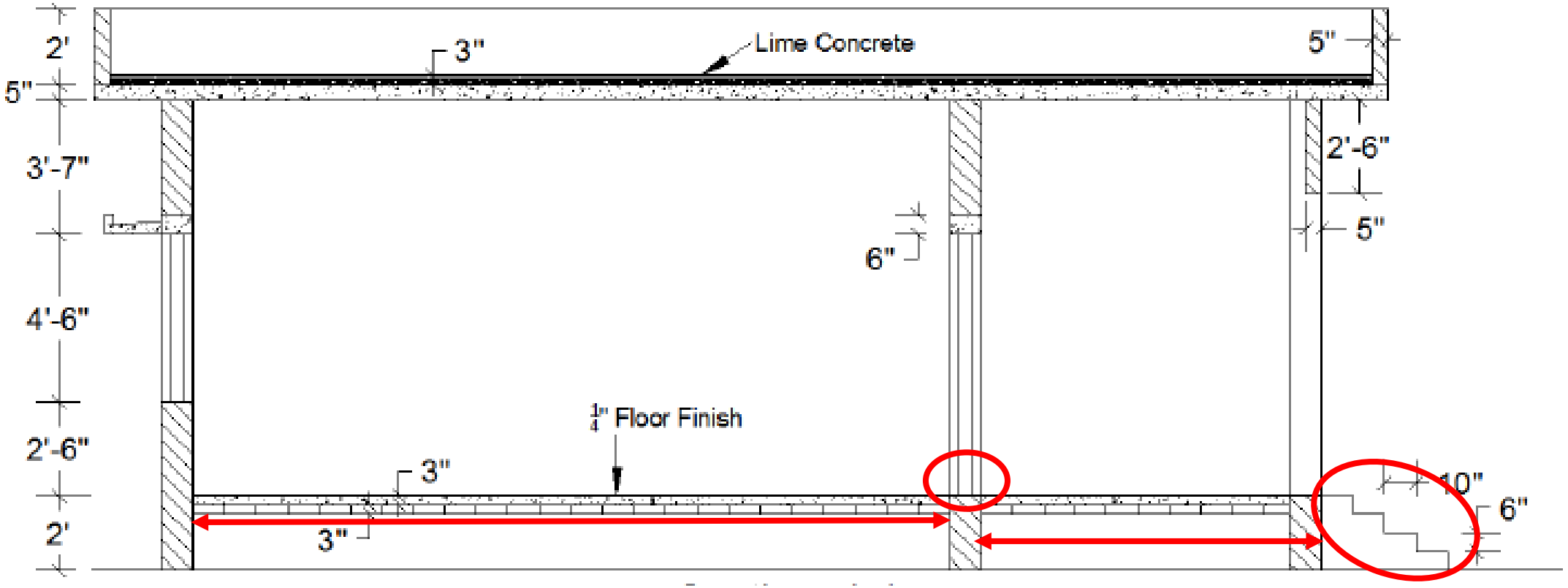
10. CC (3”) in Floors



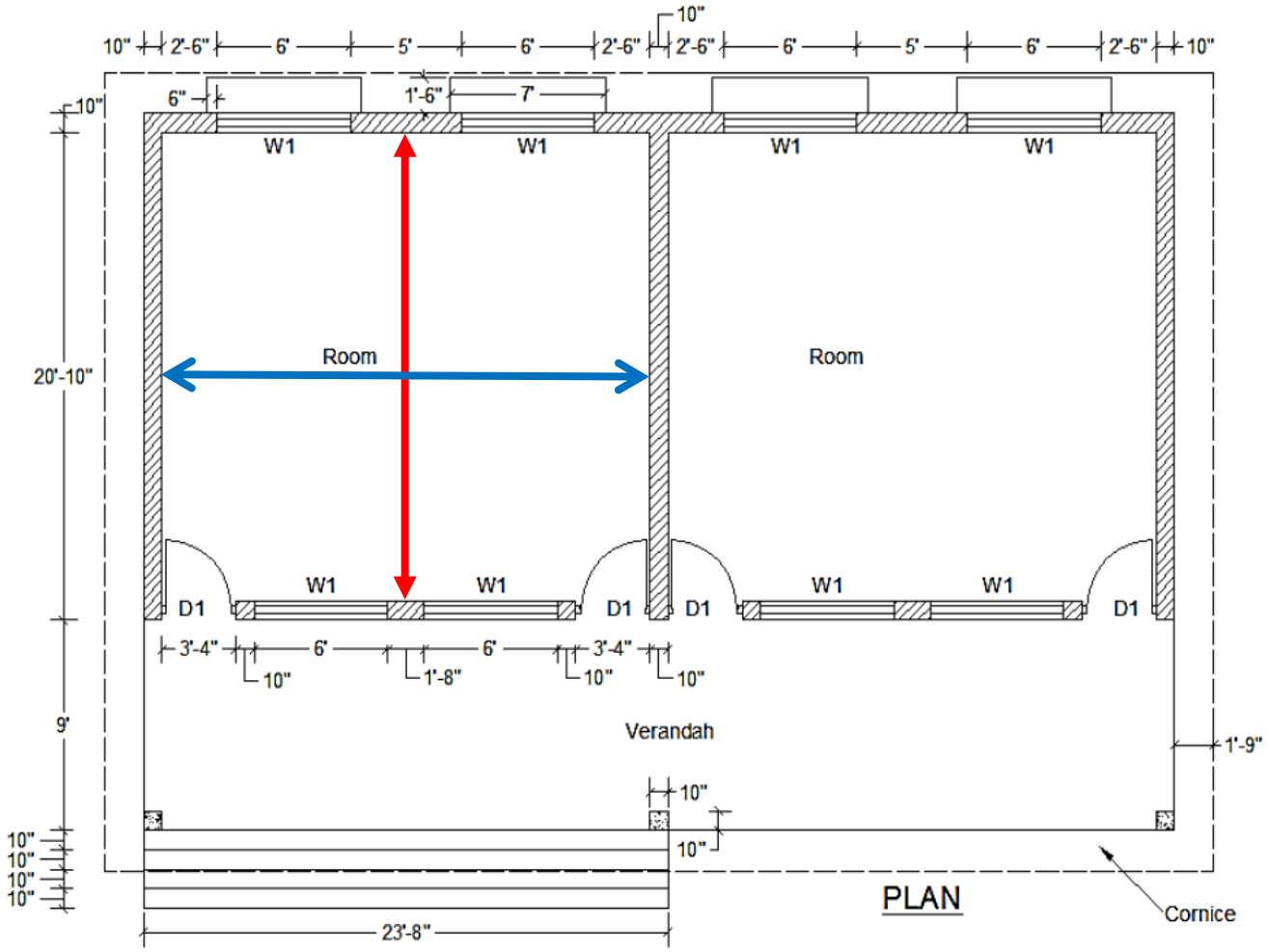
Verandah:

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

11. Floor Finish, ¼” thick



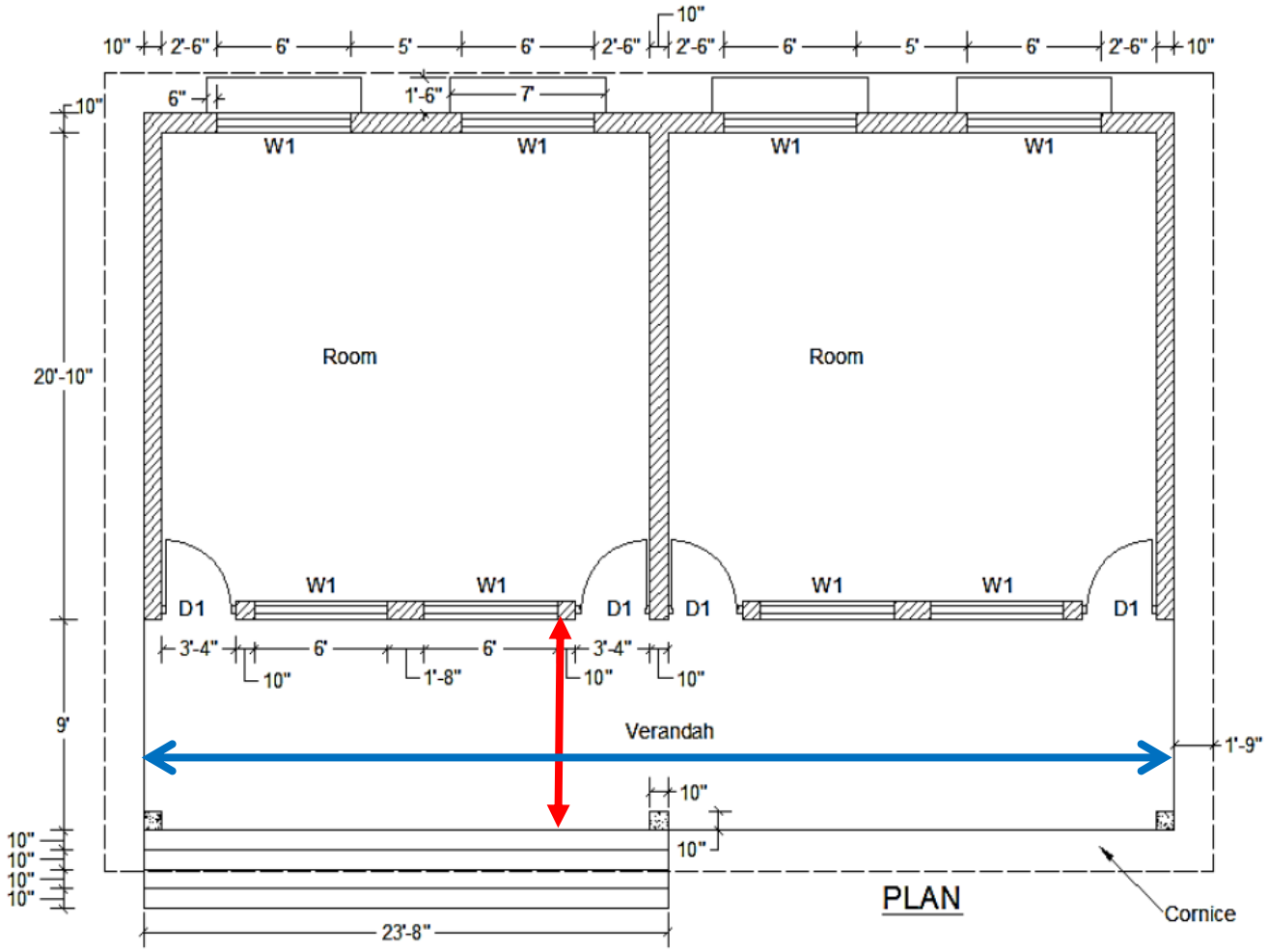
11. Floor Finish, ¼” thick



Main Floor:

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

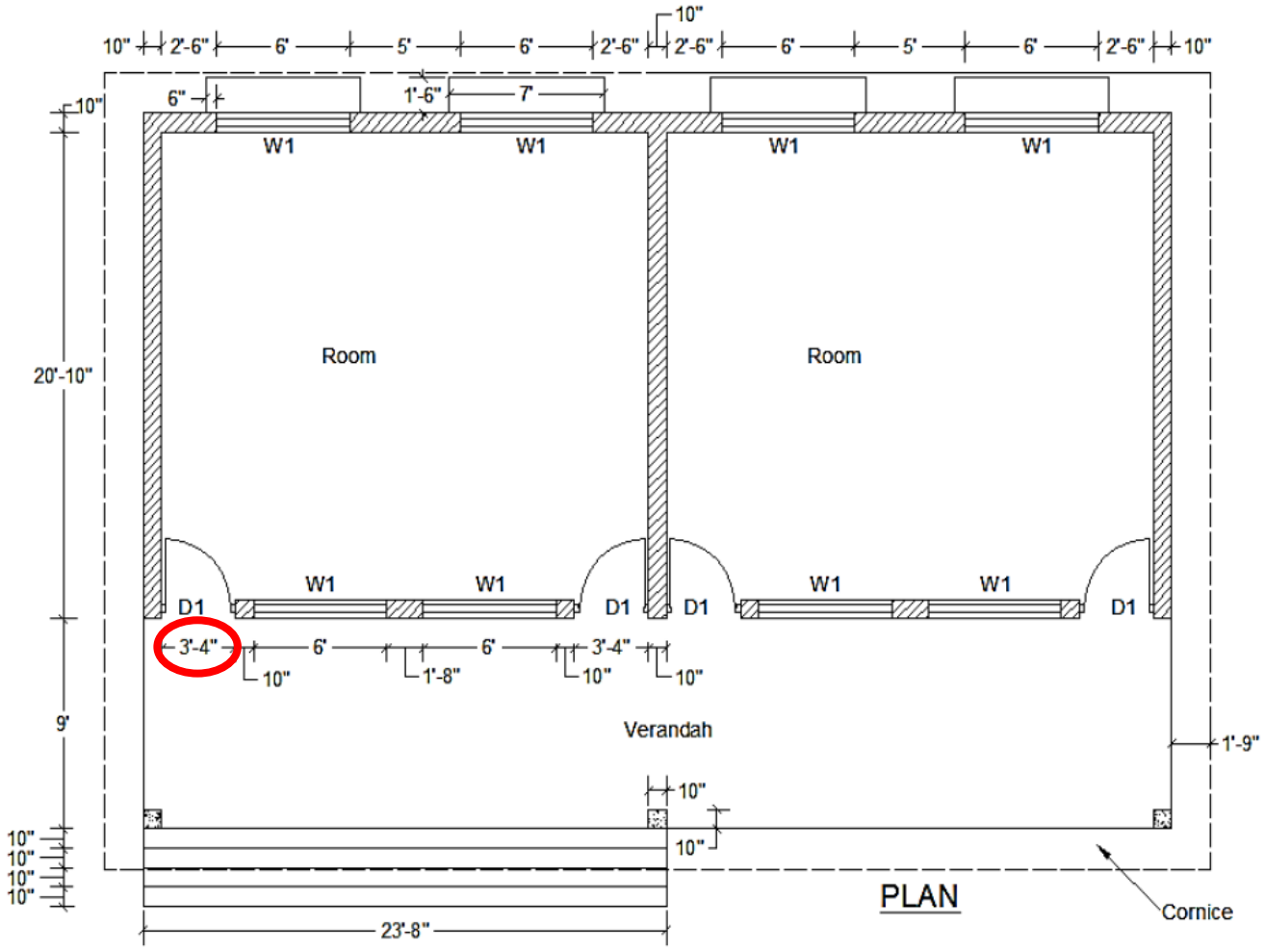
11. Floor Finish, ¼” thick



Verandah:

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

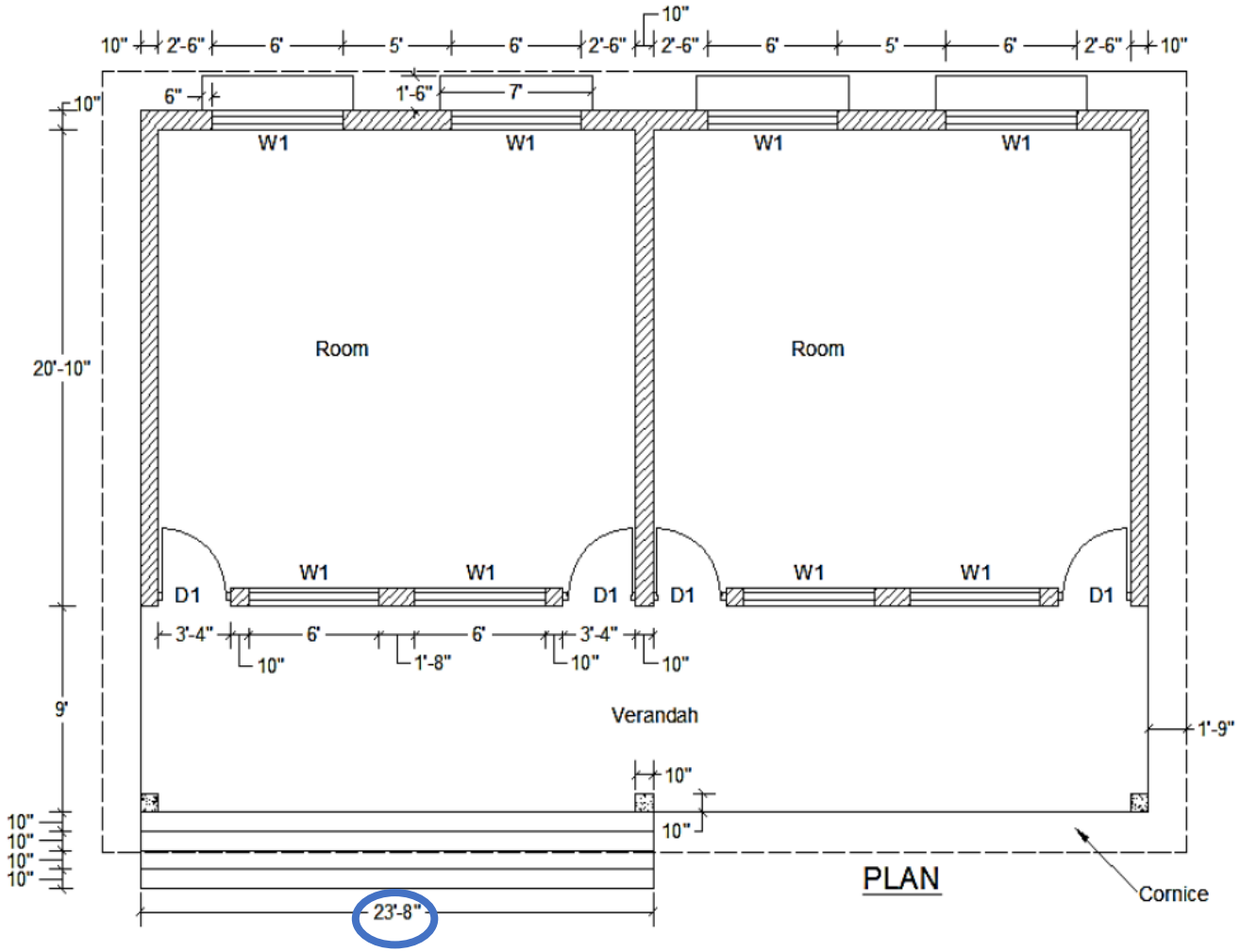
11. Floor Finish, ¼” thick



Door:

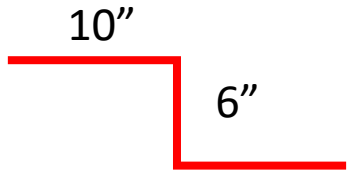
- Length= 3’4”
- Width= 10”
- Thickness= 1/4”

11. Floor Finish, ¼” thick

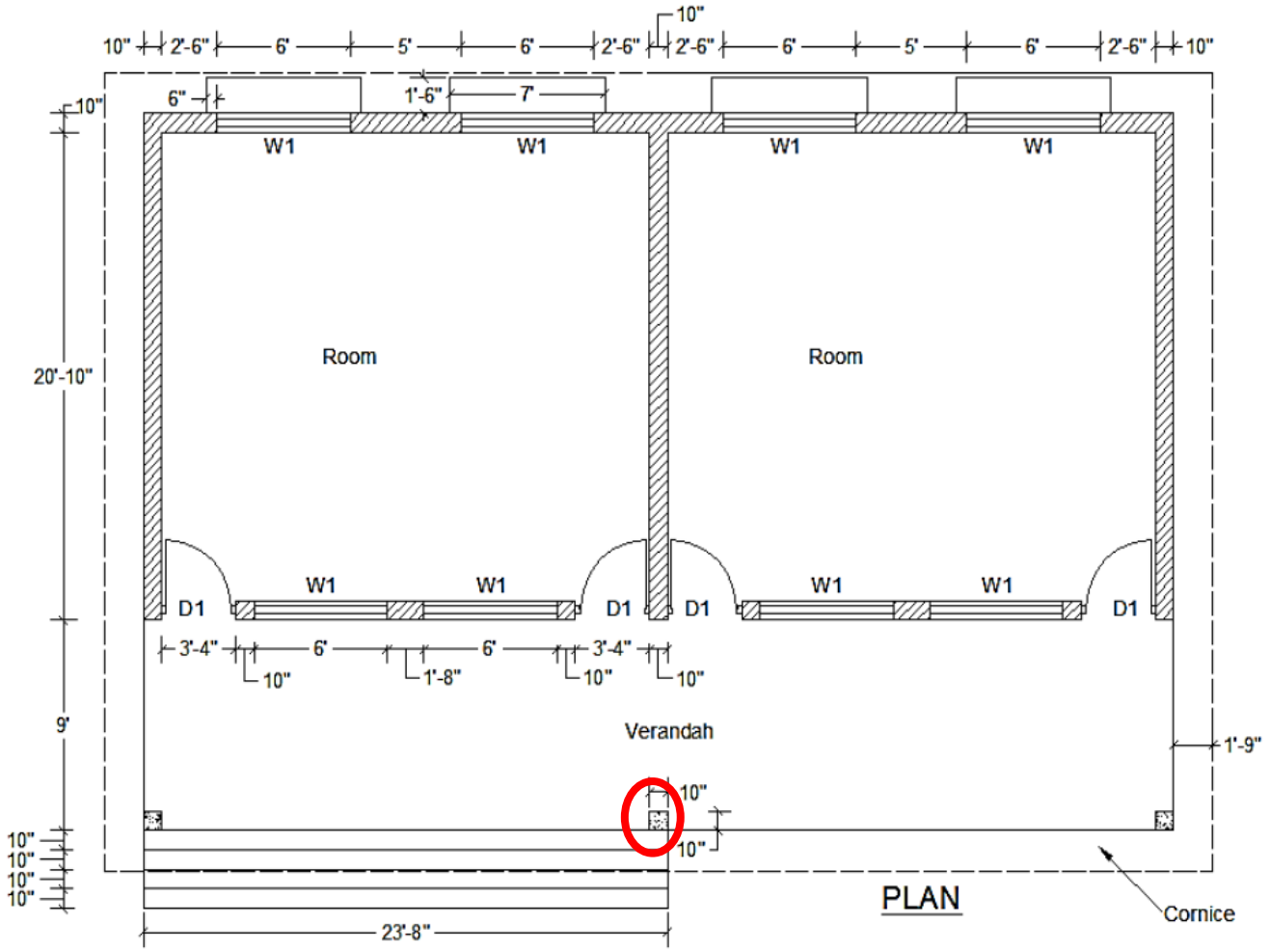


4 Steps:

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



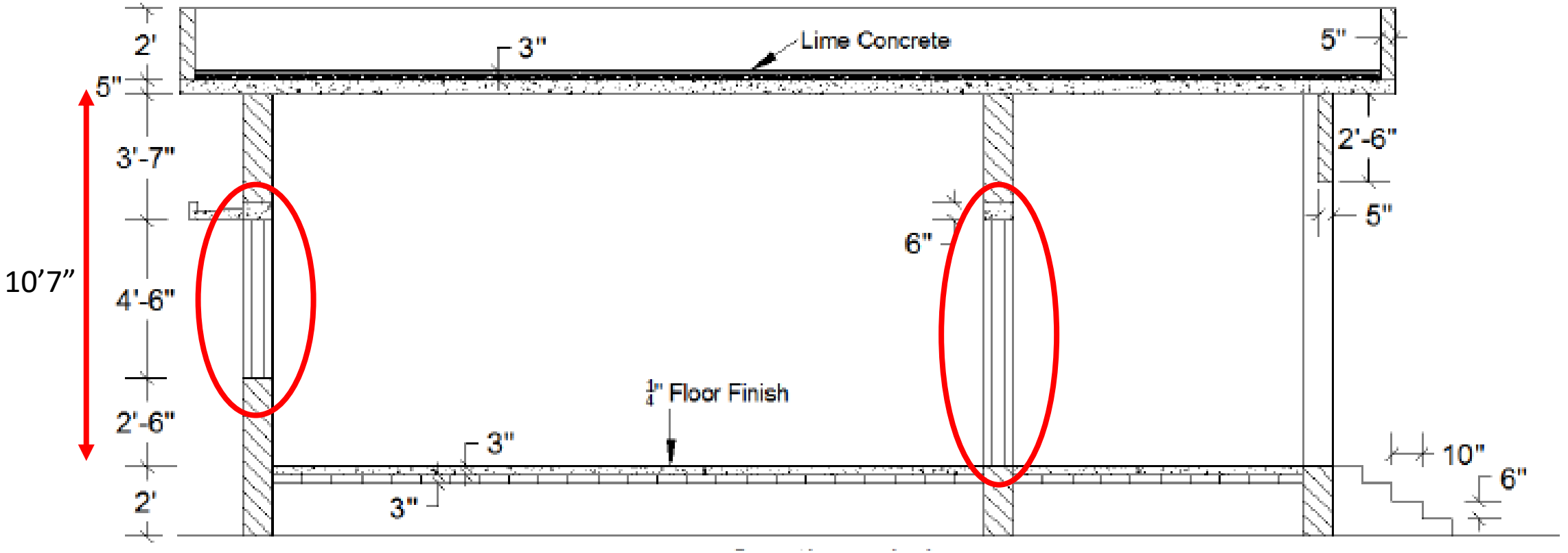
11. Floor Finish, ¼” thick



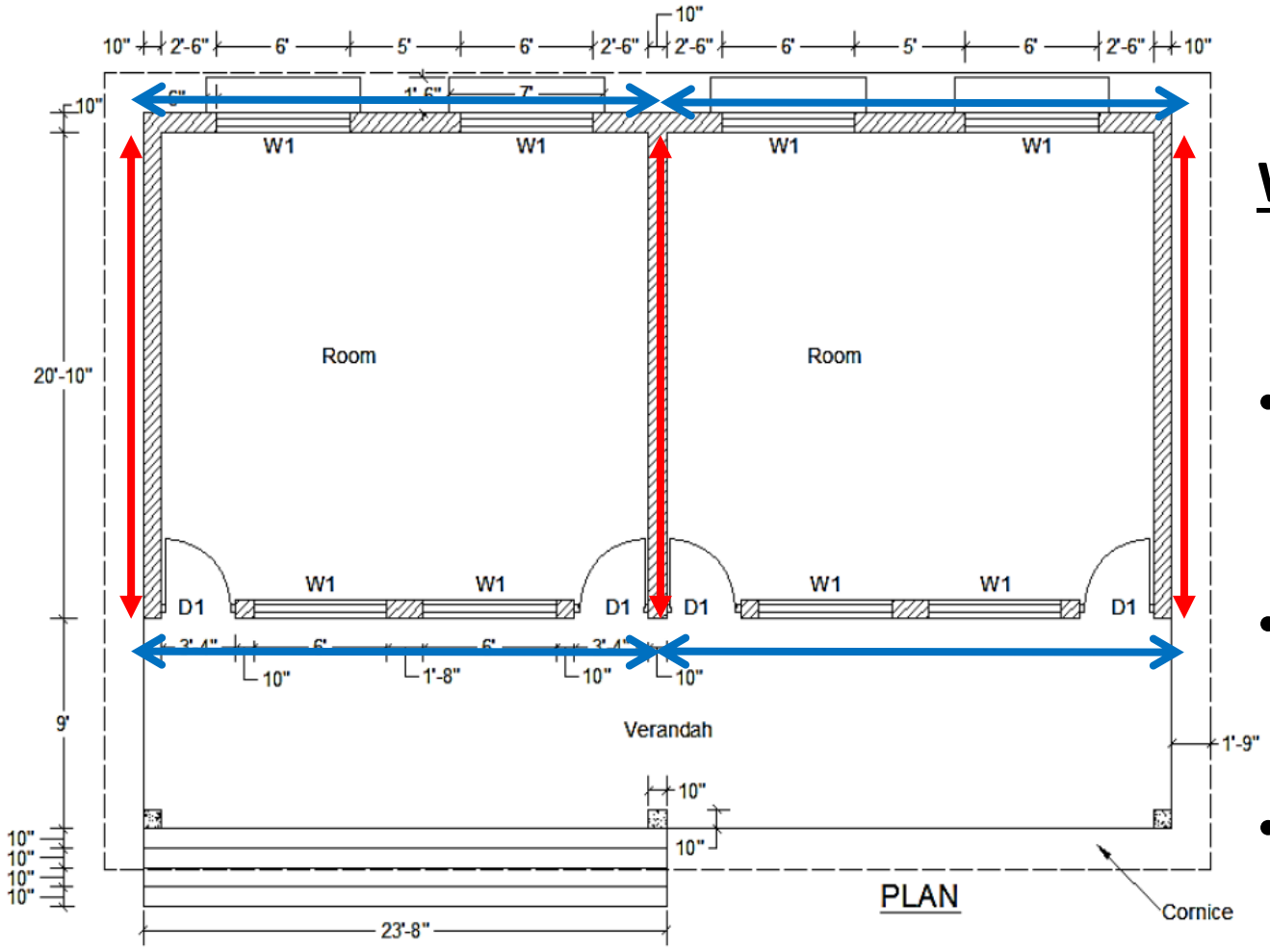
Deduct (Columns):

- Length= 10”
- Width= 10”

12. Brick walls in superstructure



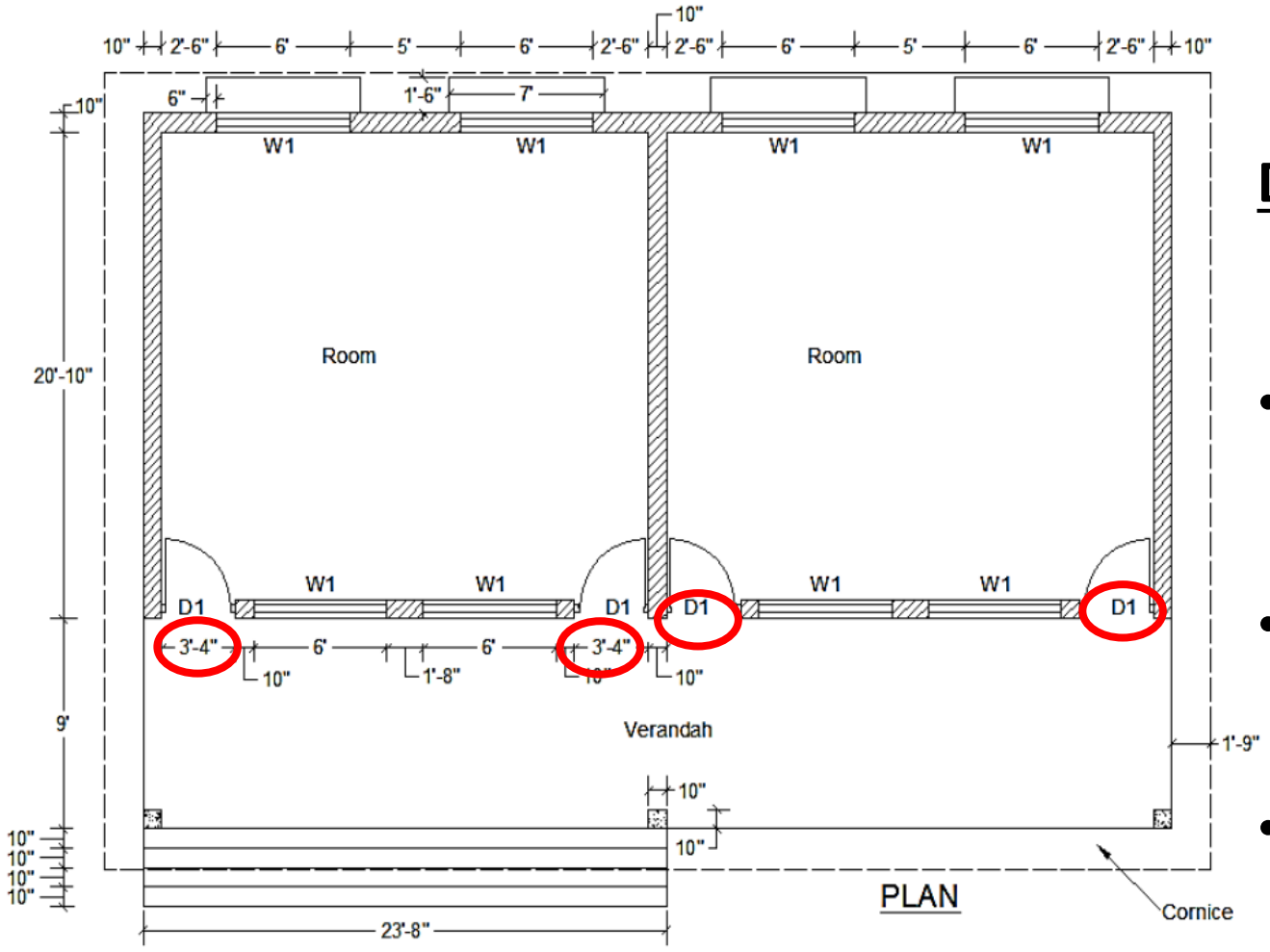
12. Brick walls in superstructure



Wall:

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

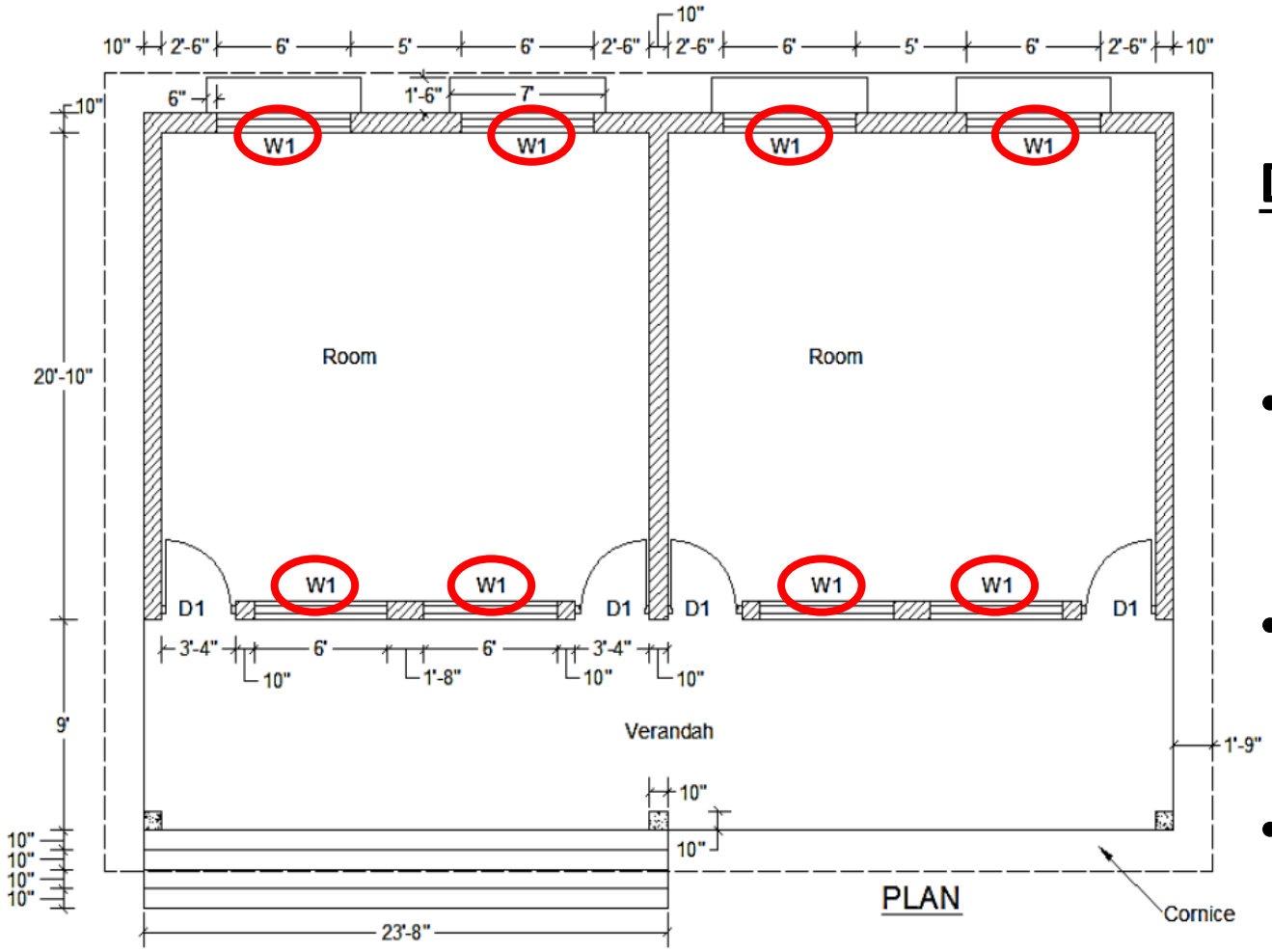
12. Brick walls in superstructure



Deduct (4 Doors):

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

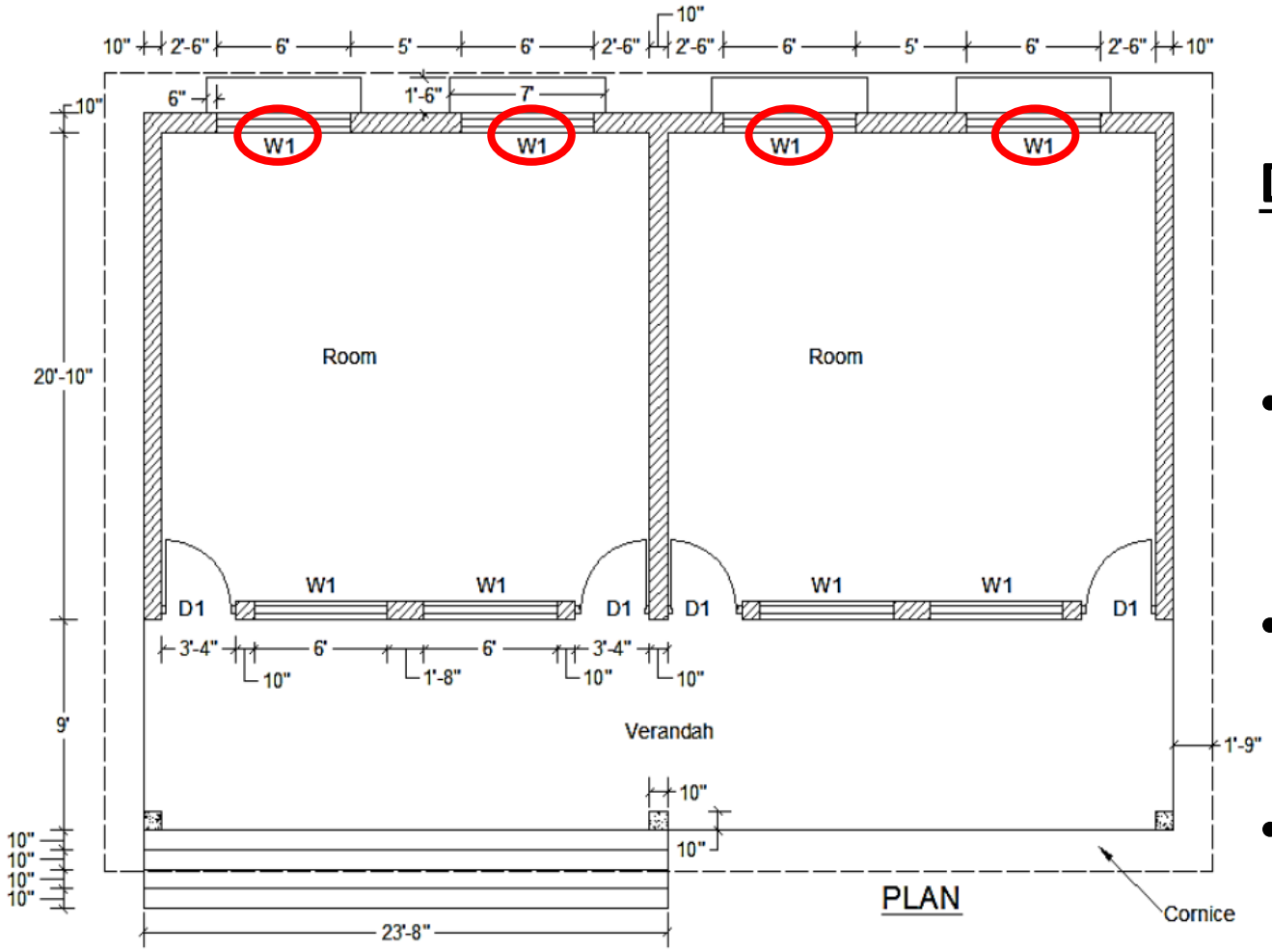
12. Brick walls in superstructure



Deduct (8 Windows):

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

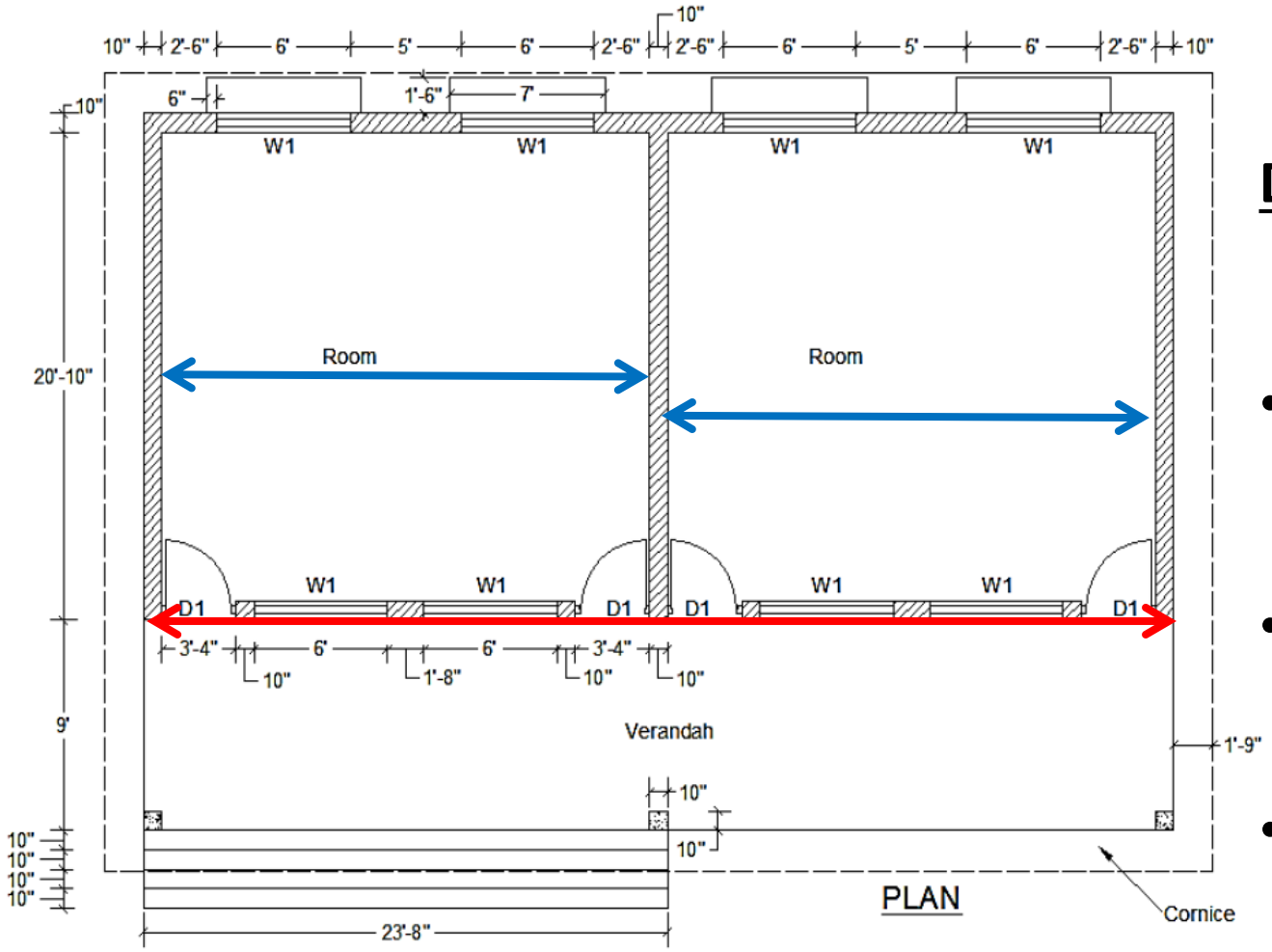
12. Brick walls in superstructure



Deduct (Lintel over Windows):

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

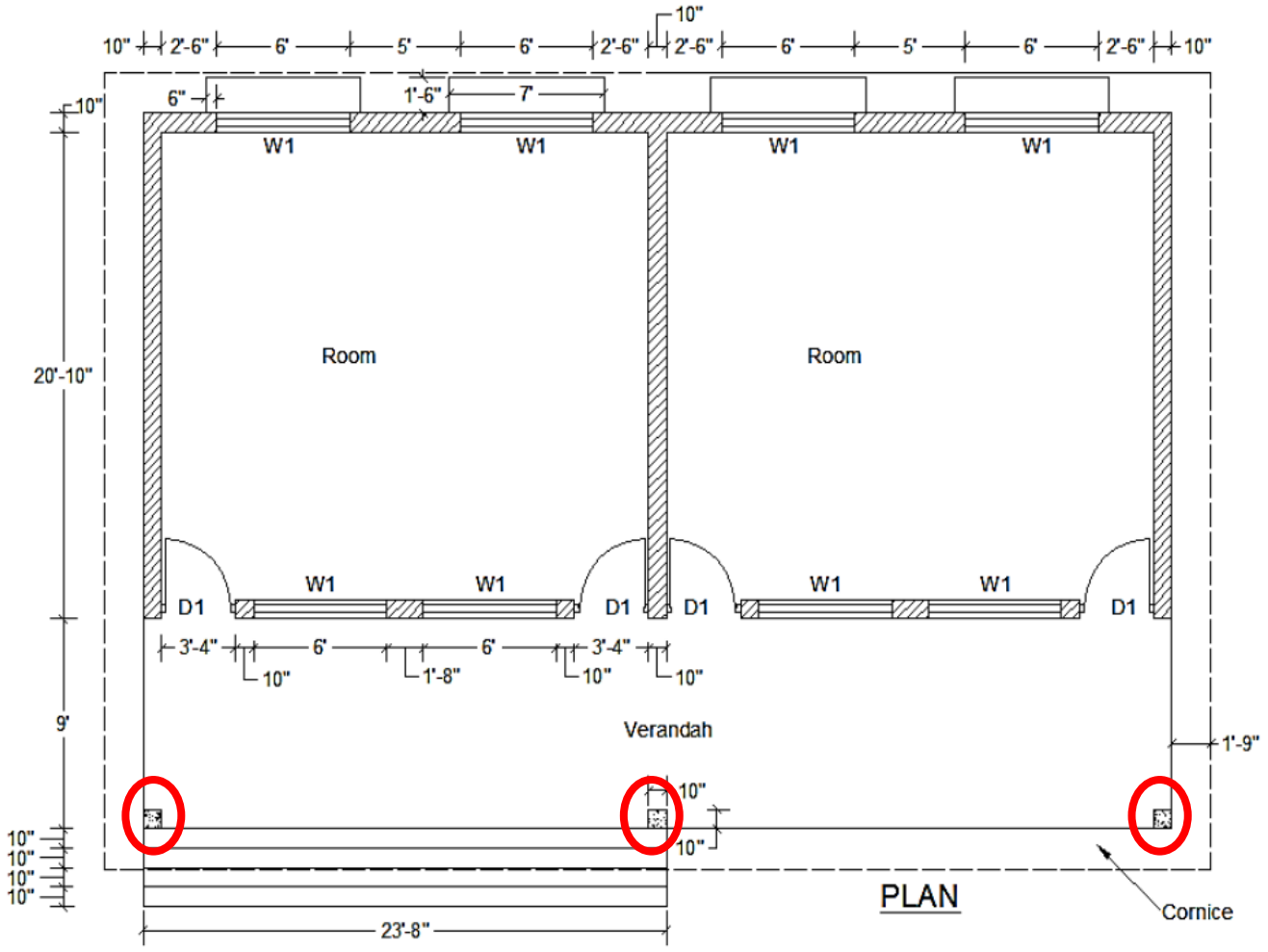
12. Brick walls in superstructure



Deduct (Lintel over W1+D1):

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

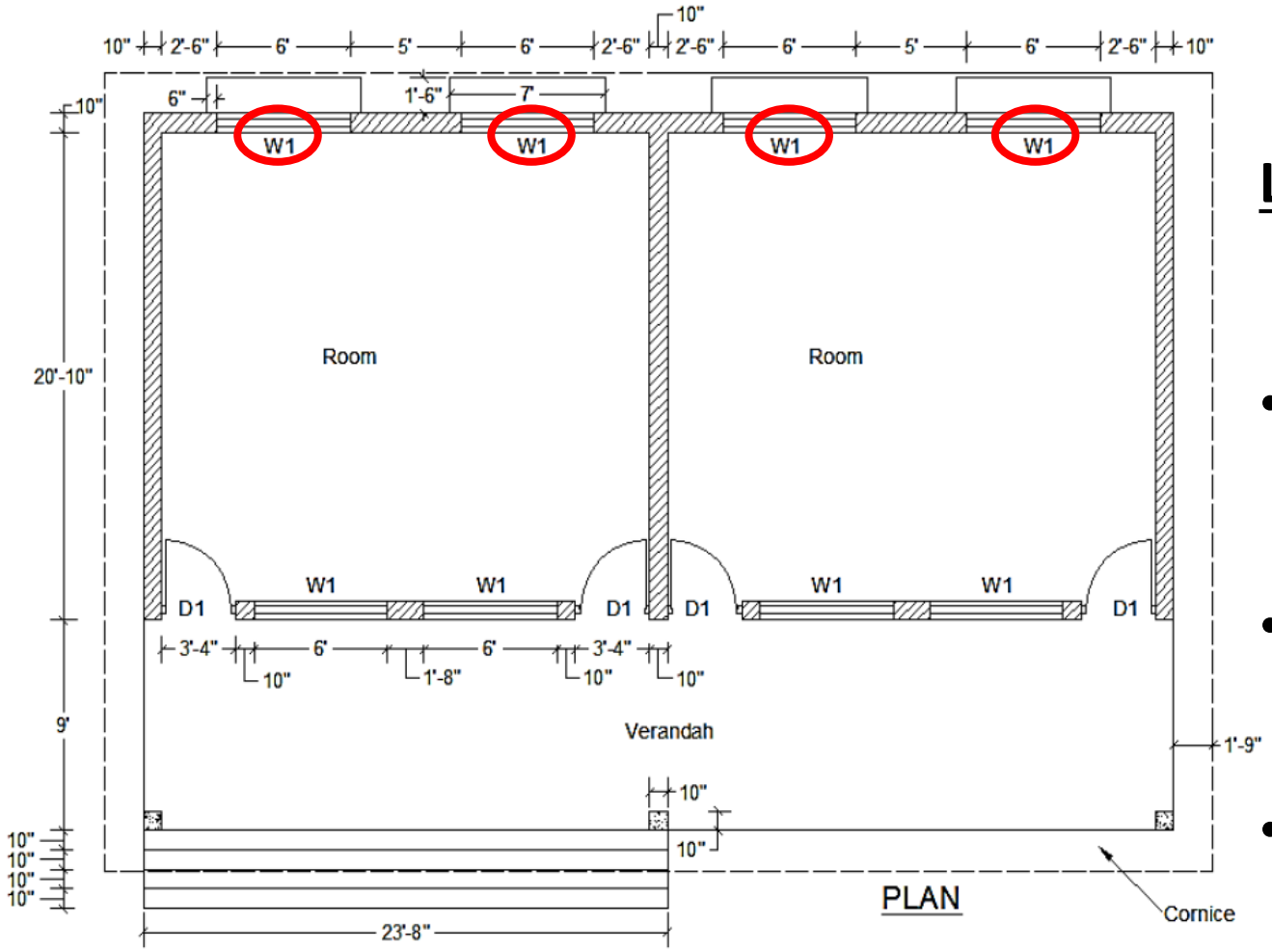
13. RCC in Columns



3 Columns:

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

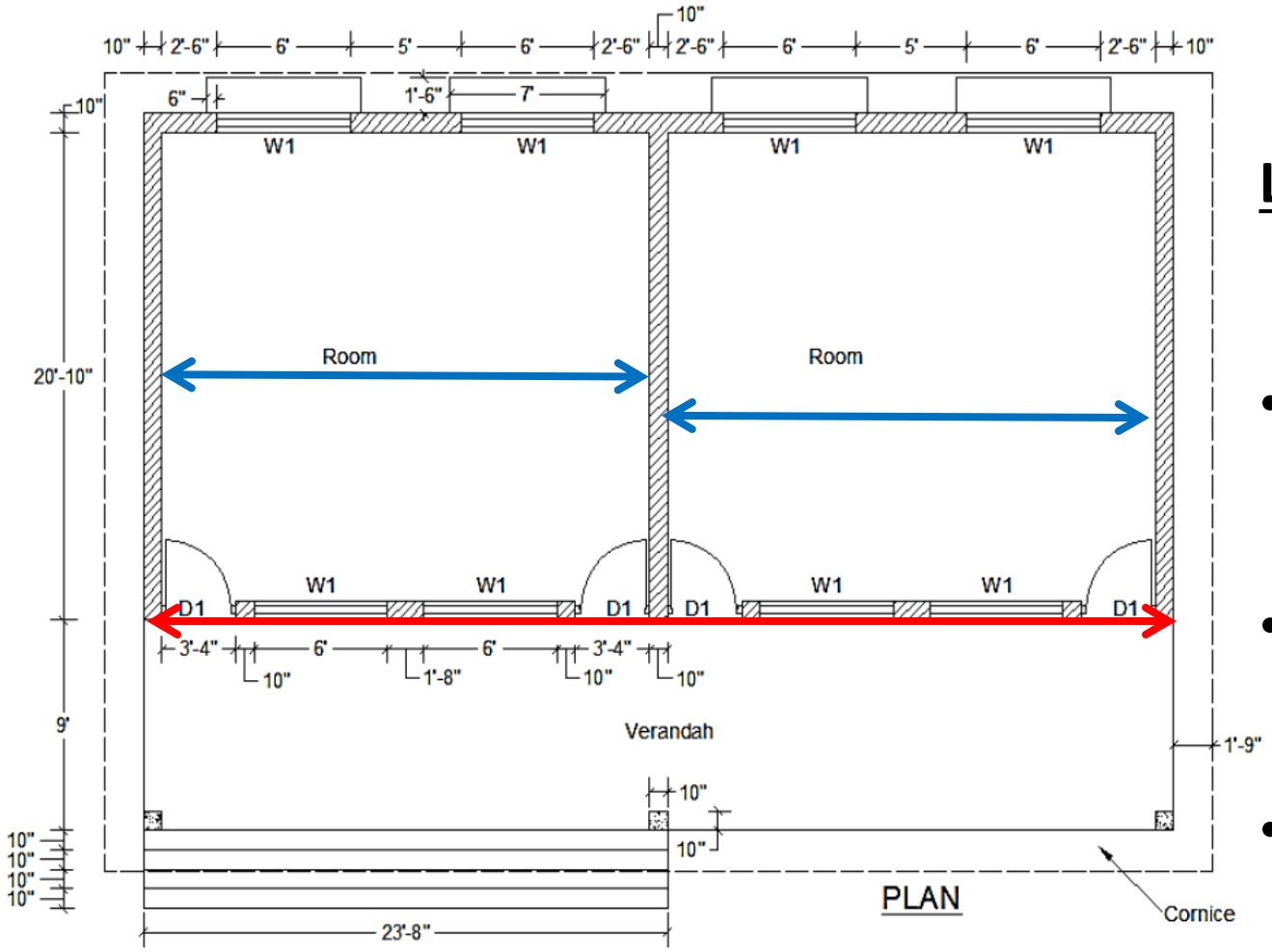
14. RCC in Lintel



Lintel over Windows:

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

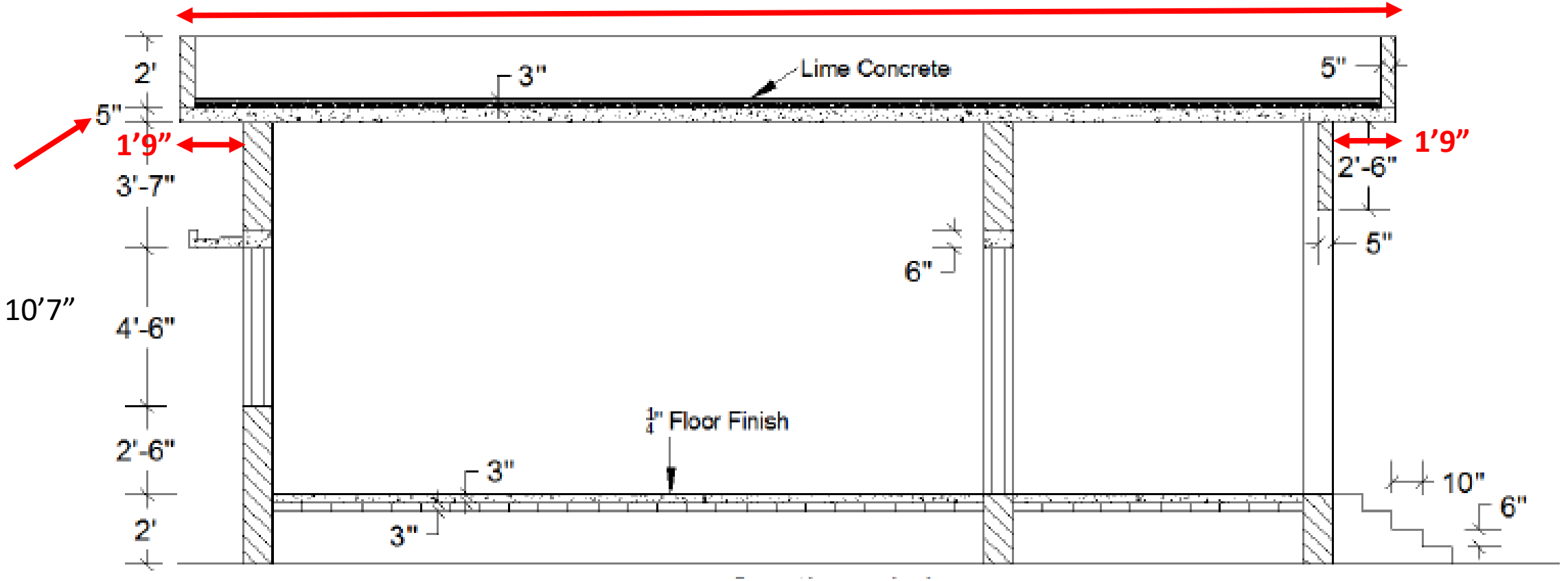
14. RCC in Lintel



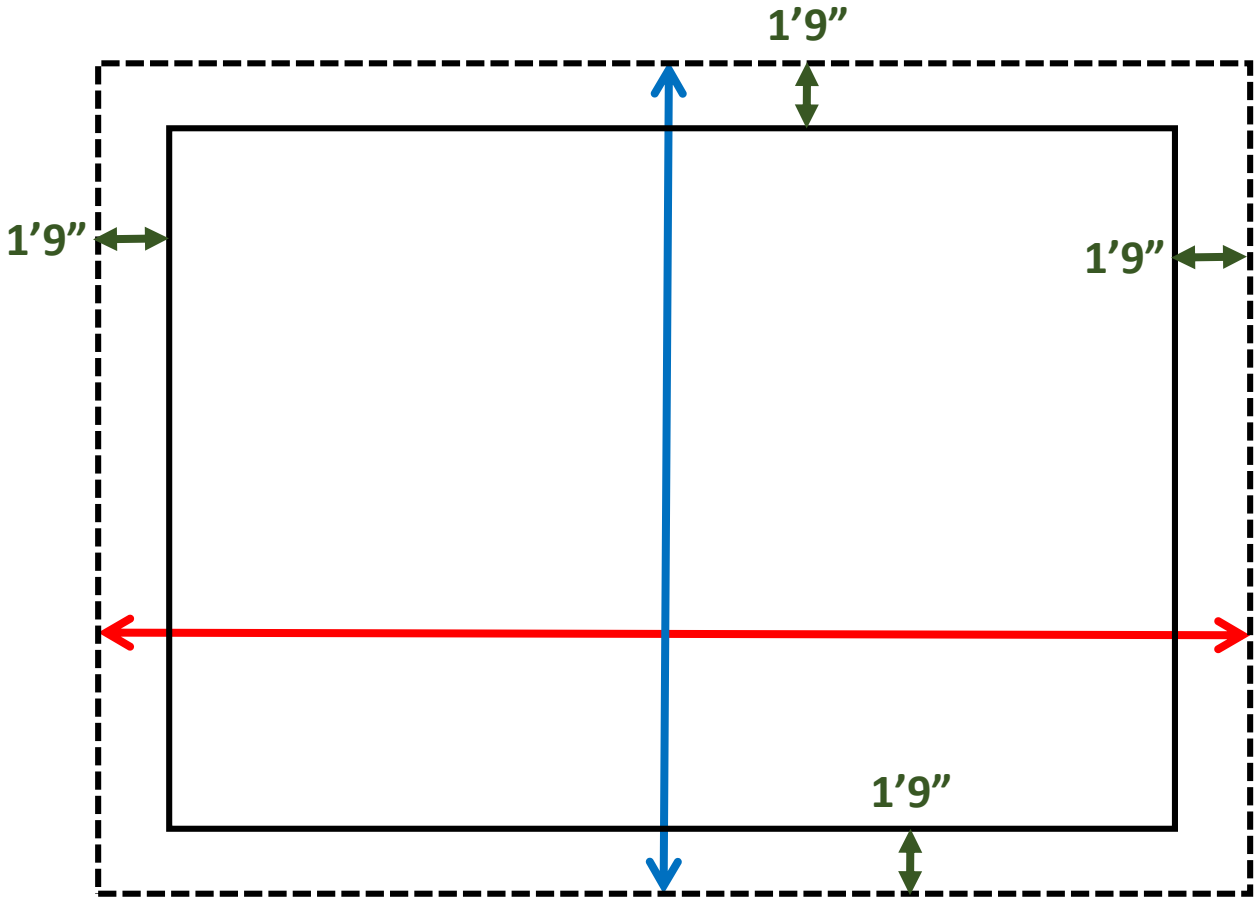
Lintel over W1+D1:

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

15. RCC in Roof



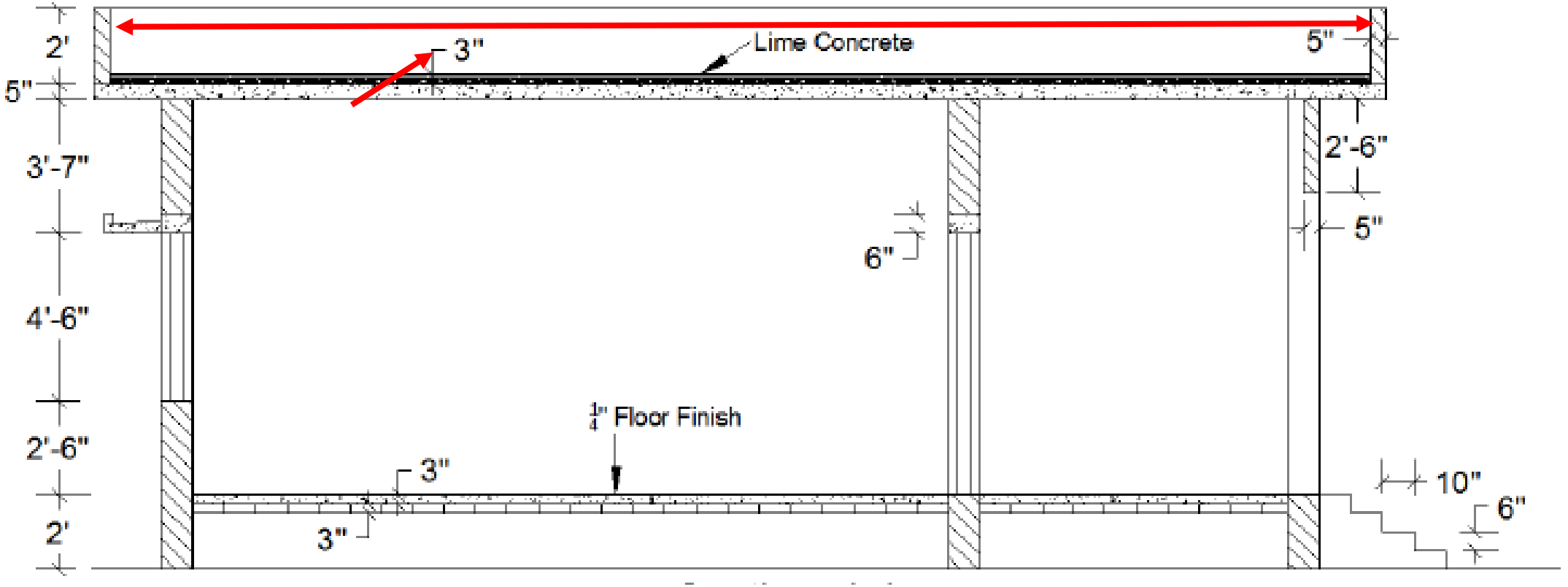
15. RCC in Roof



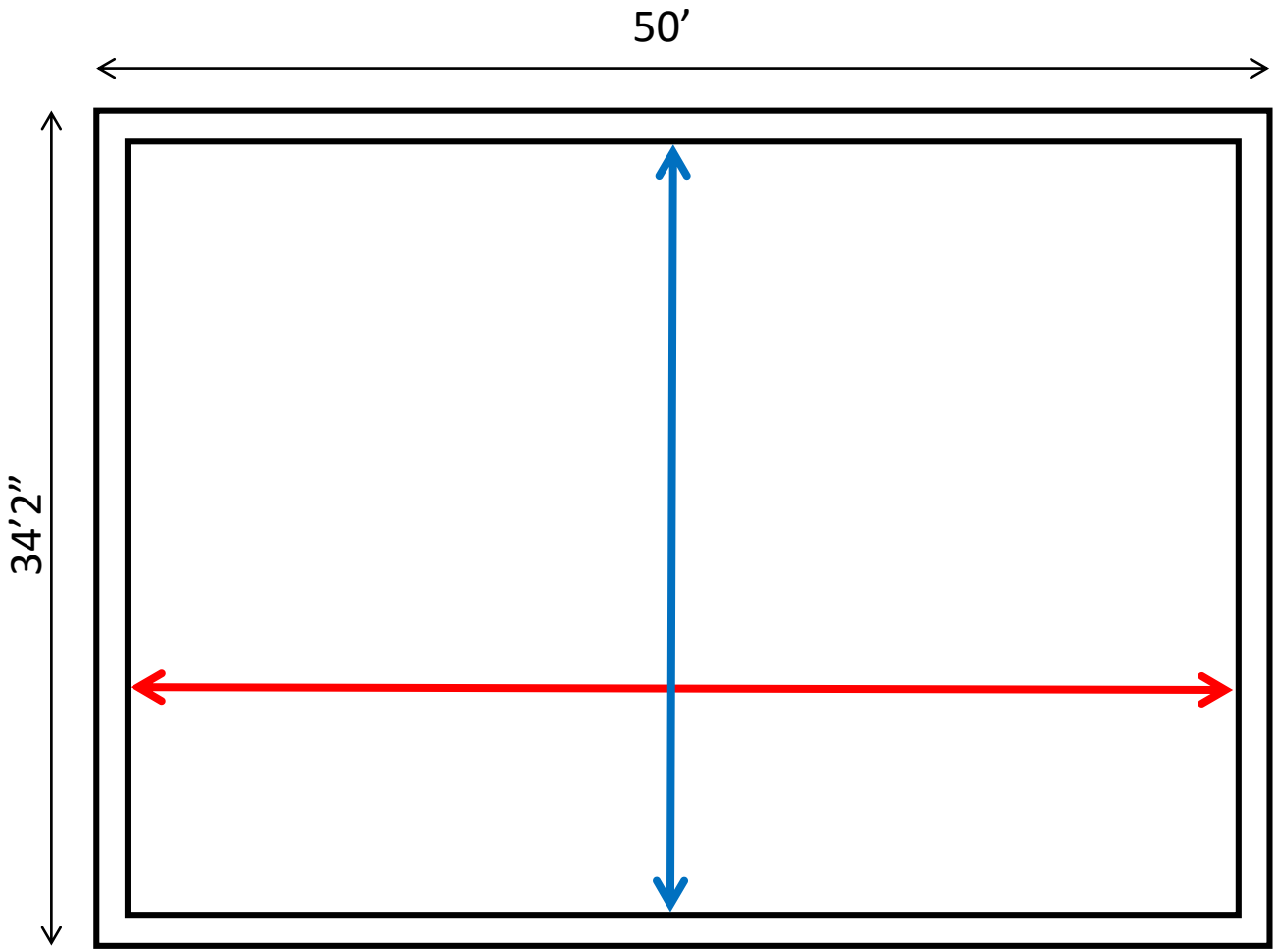
- Thickness= 5”
- Width= 30’8”+ 2*1’9”
- Length= 46’6”+2*1’9”

16. Lime Concrete in Roof

10’7”

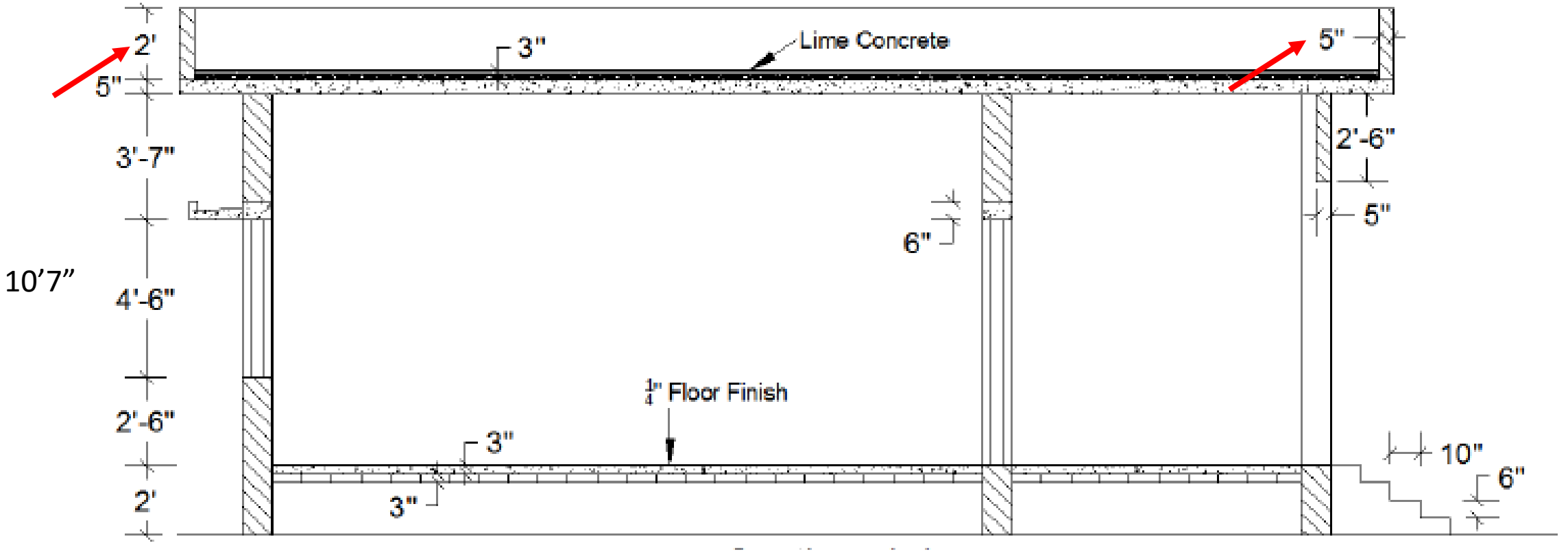


16. Lime Concrete in Roof

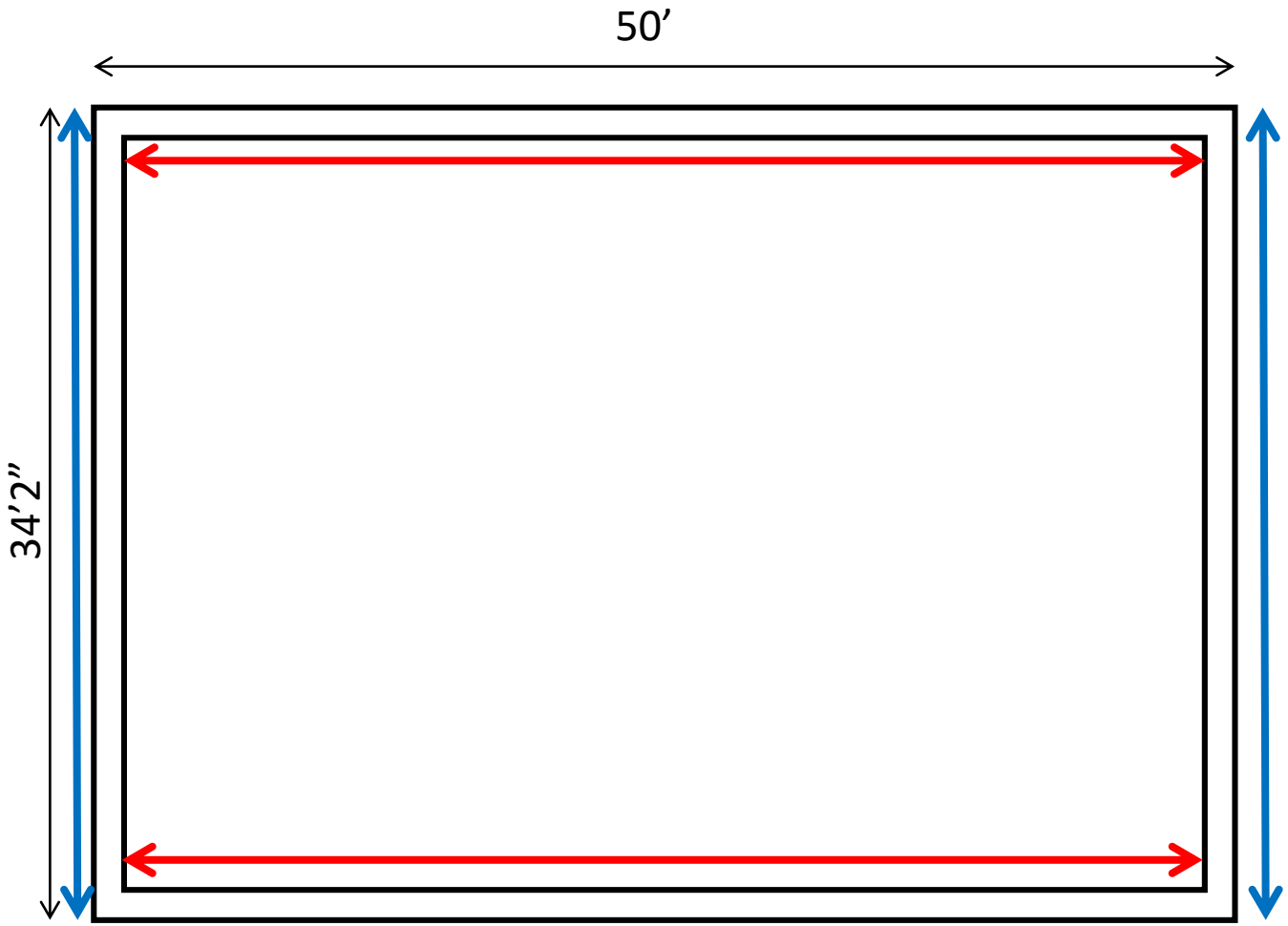


- Thickness= 3”
- Width= 34’2”-10”
- Length= 50’-10”

17. Bricks in Parapet

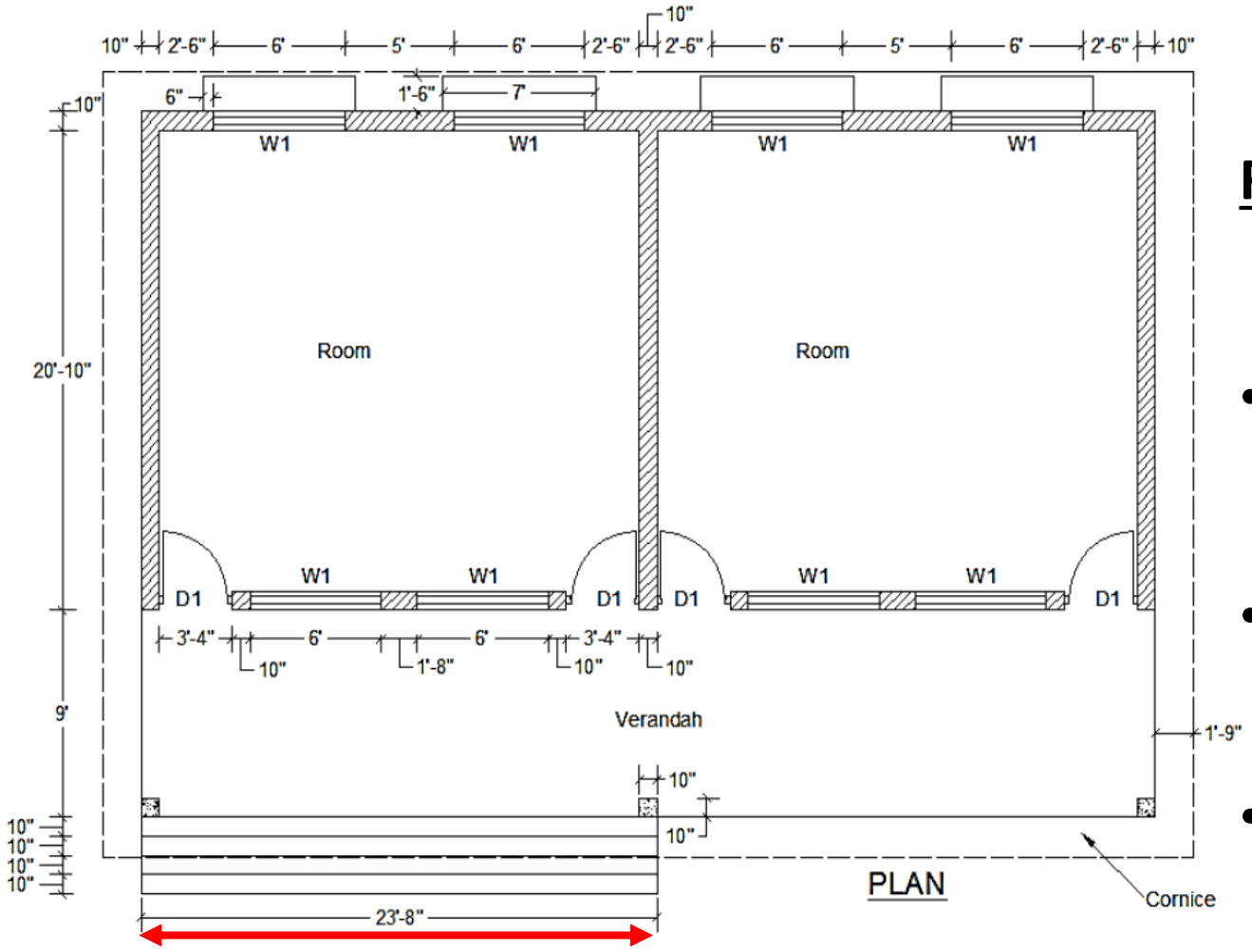


17. Bricks in Parapet



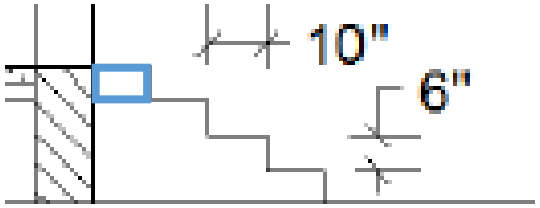
- Height= 2’
- Width= 5”
- Length= 2*((50’-10”)+34’2”)

18. Brickwork in Stairs

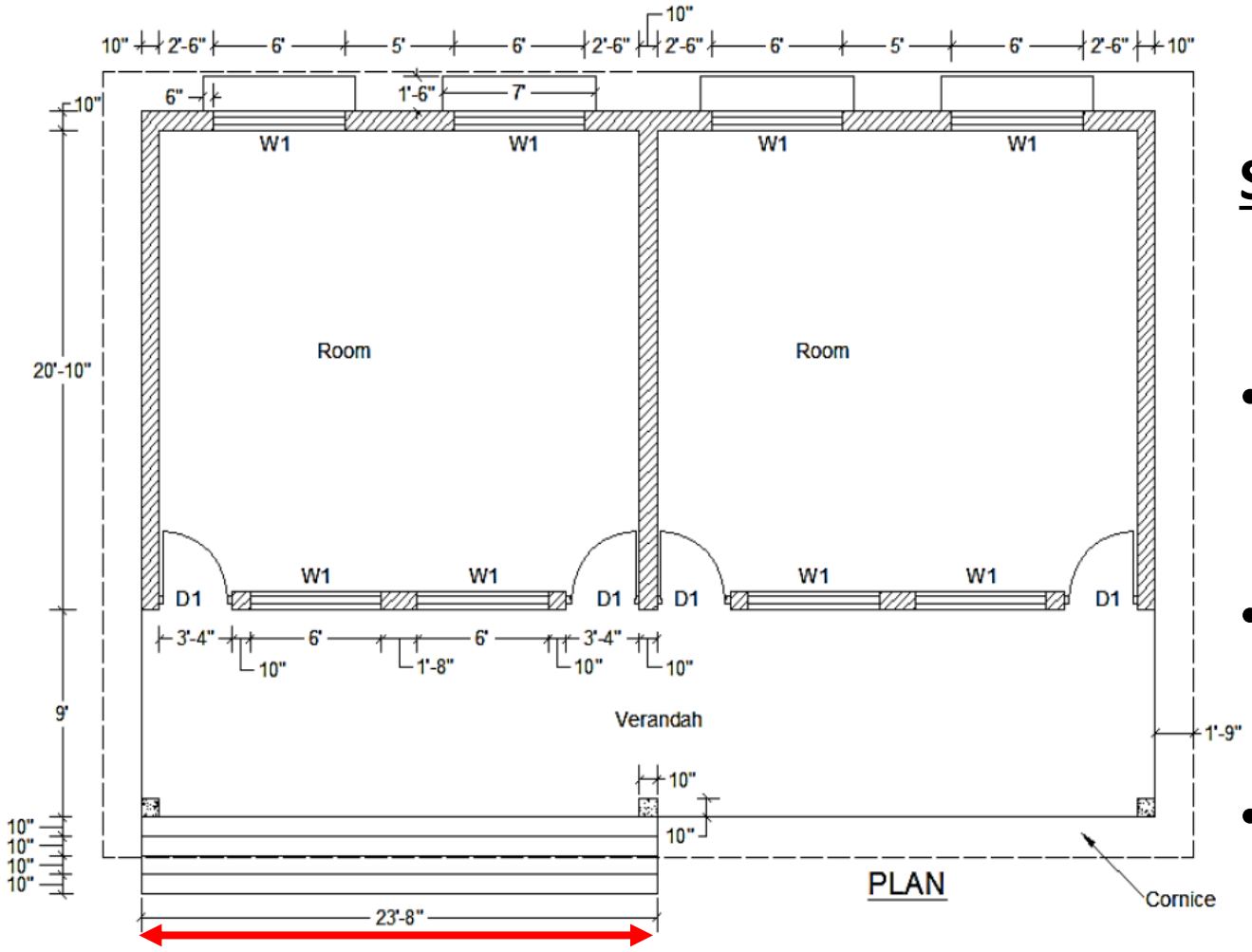


First Step:

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

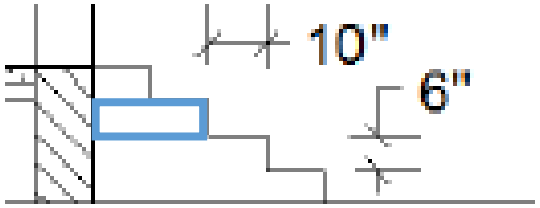


18. Brickwork in Stairs

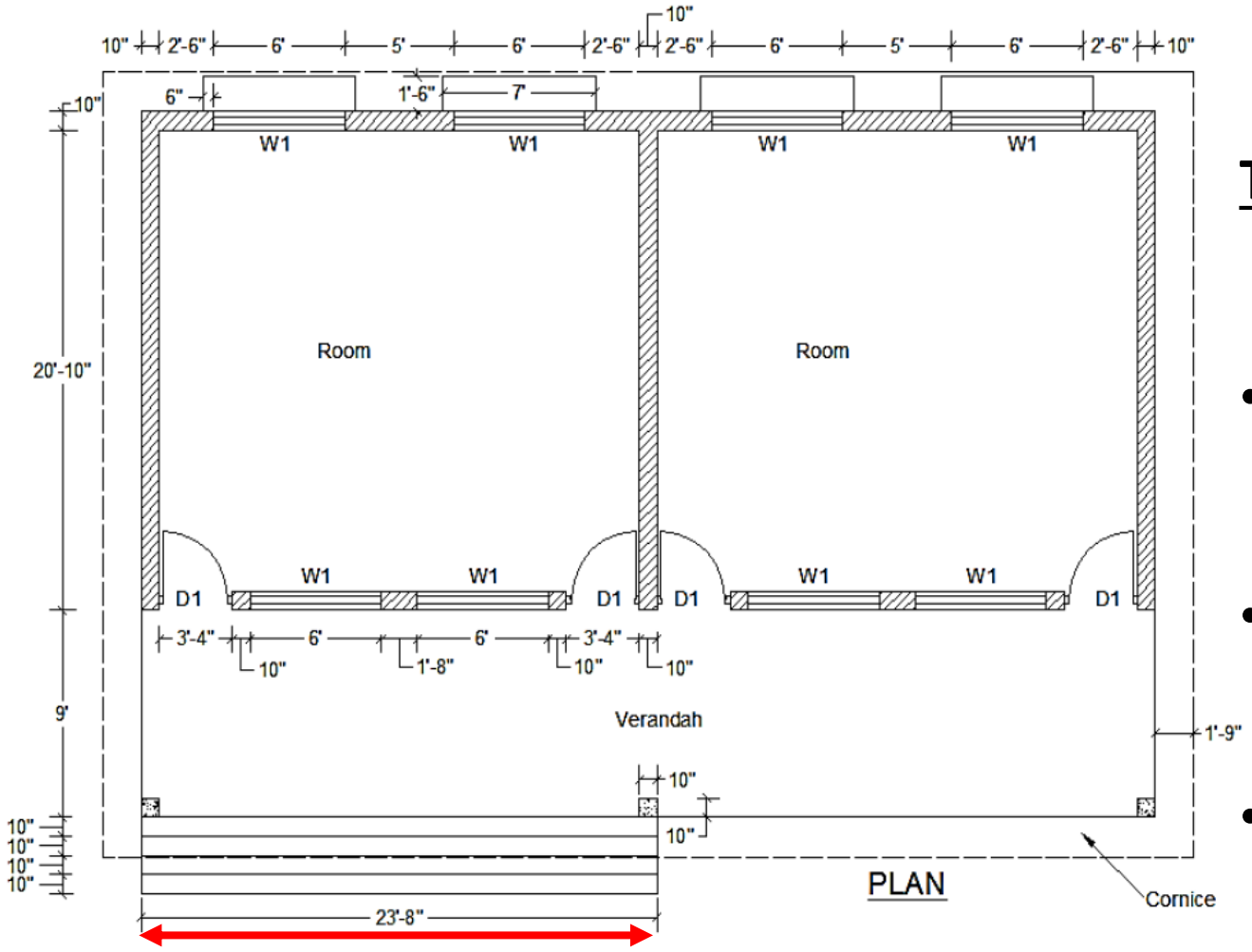


Second Step:

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

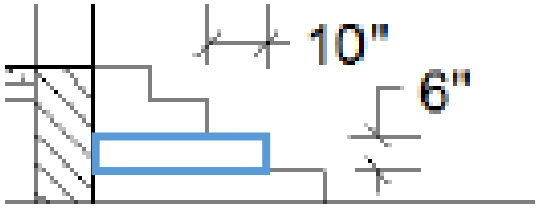


18. Brickwork in Stairs

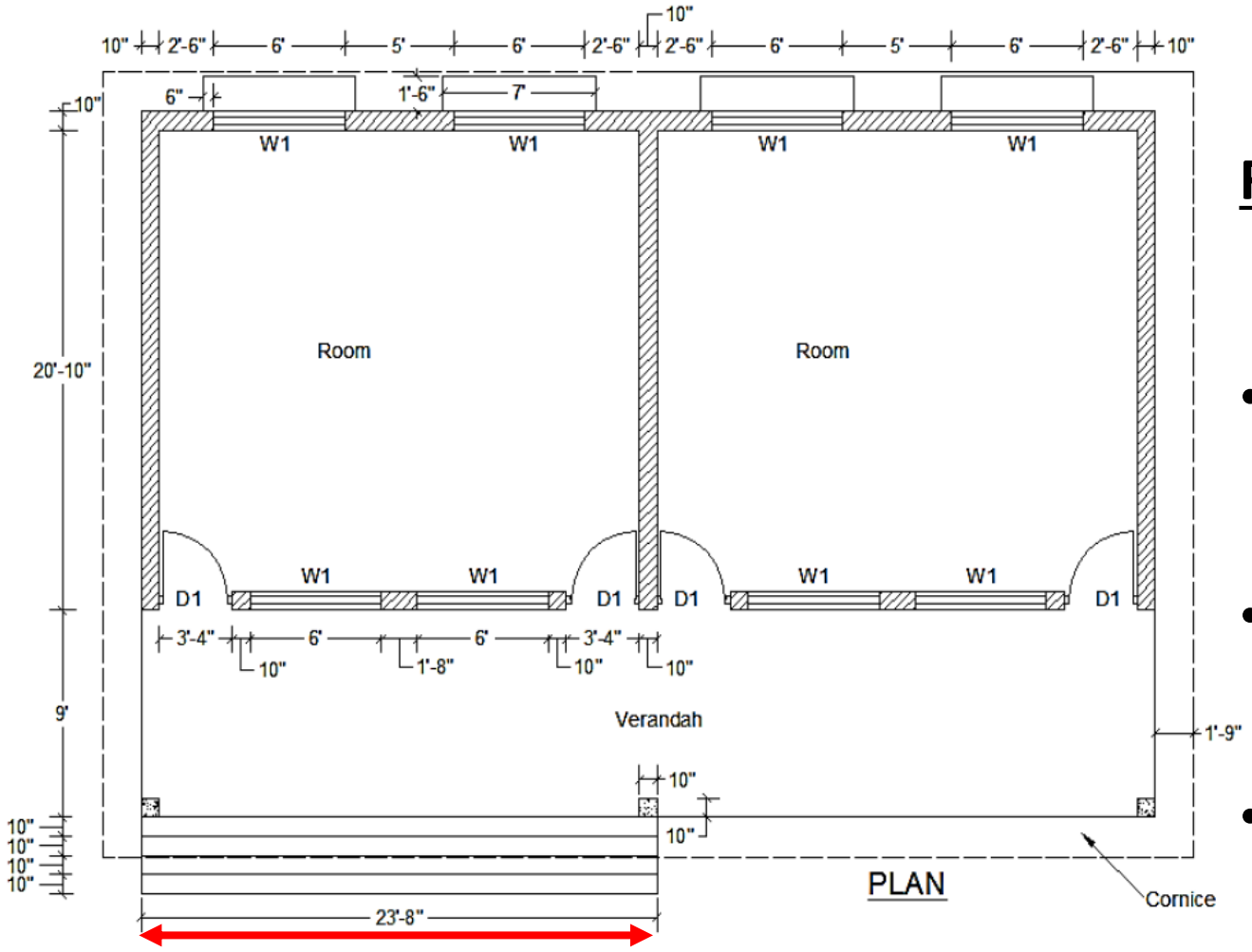


Third Step:

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

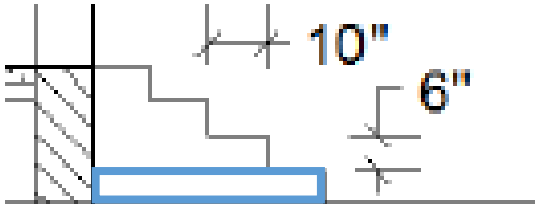


18. Brickwork in Stairs



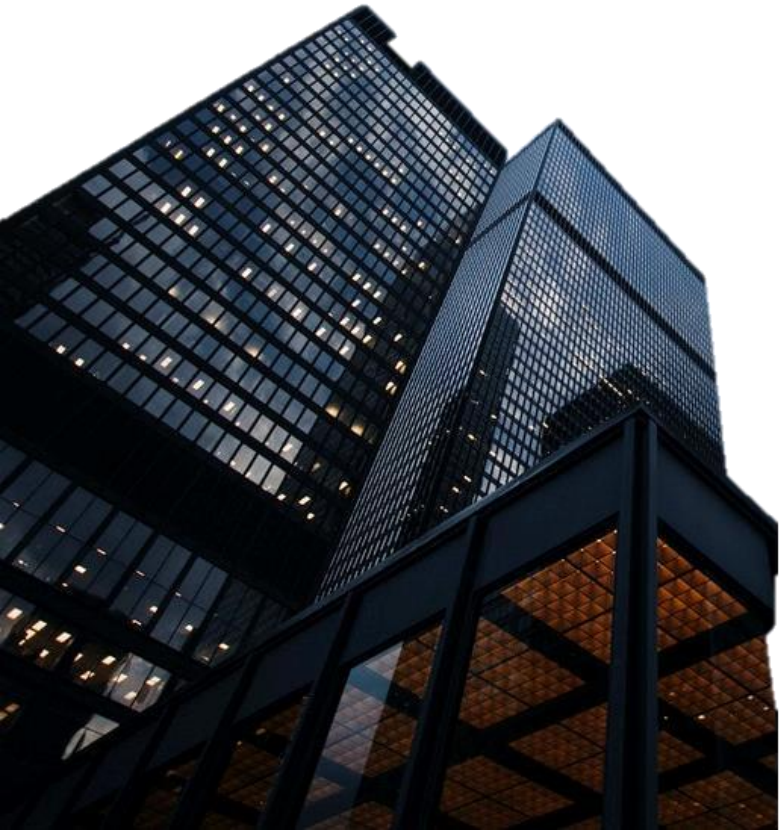
Fourth Step:

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



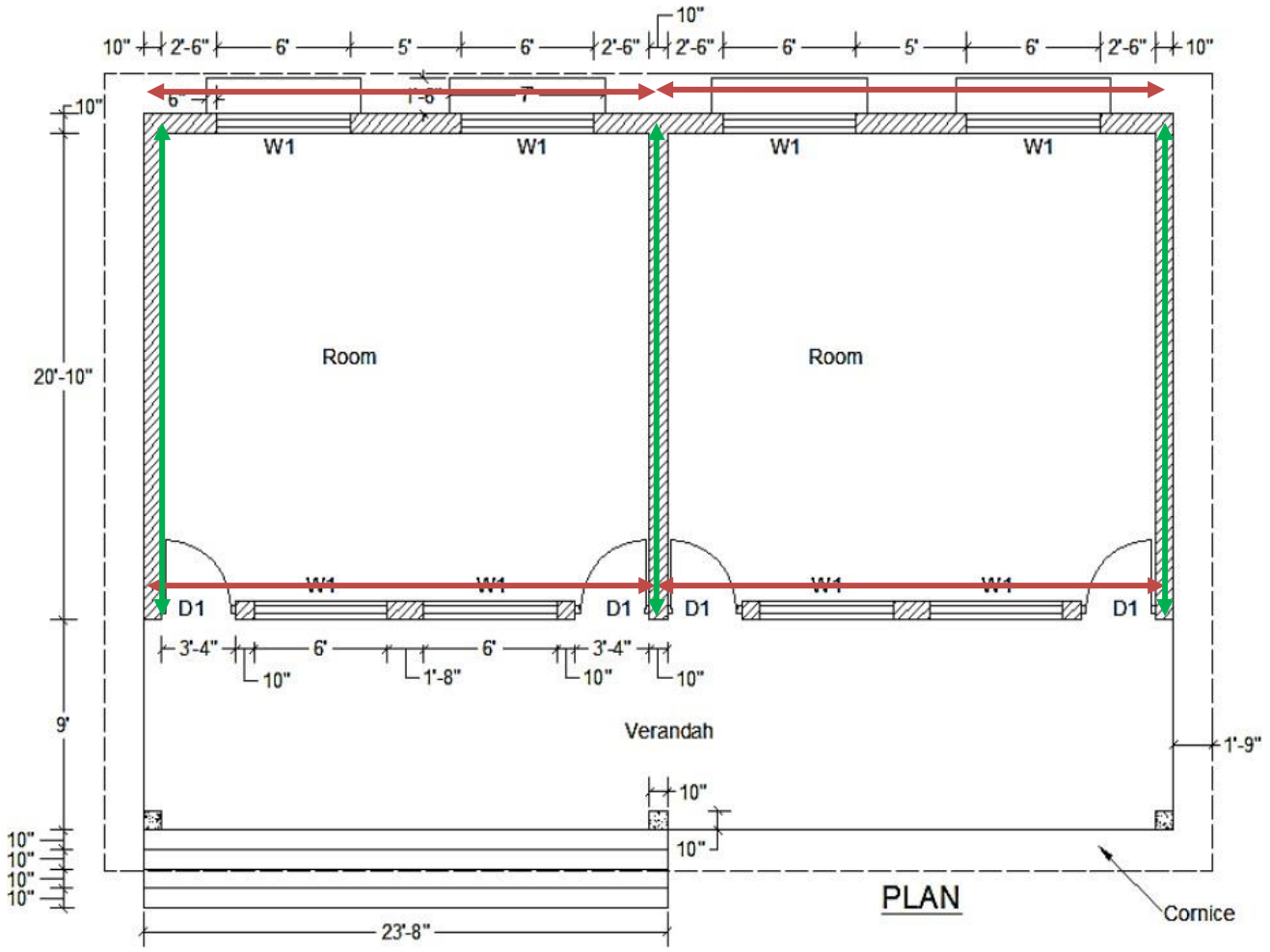
CE 208
Quantity Surveying

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

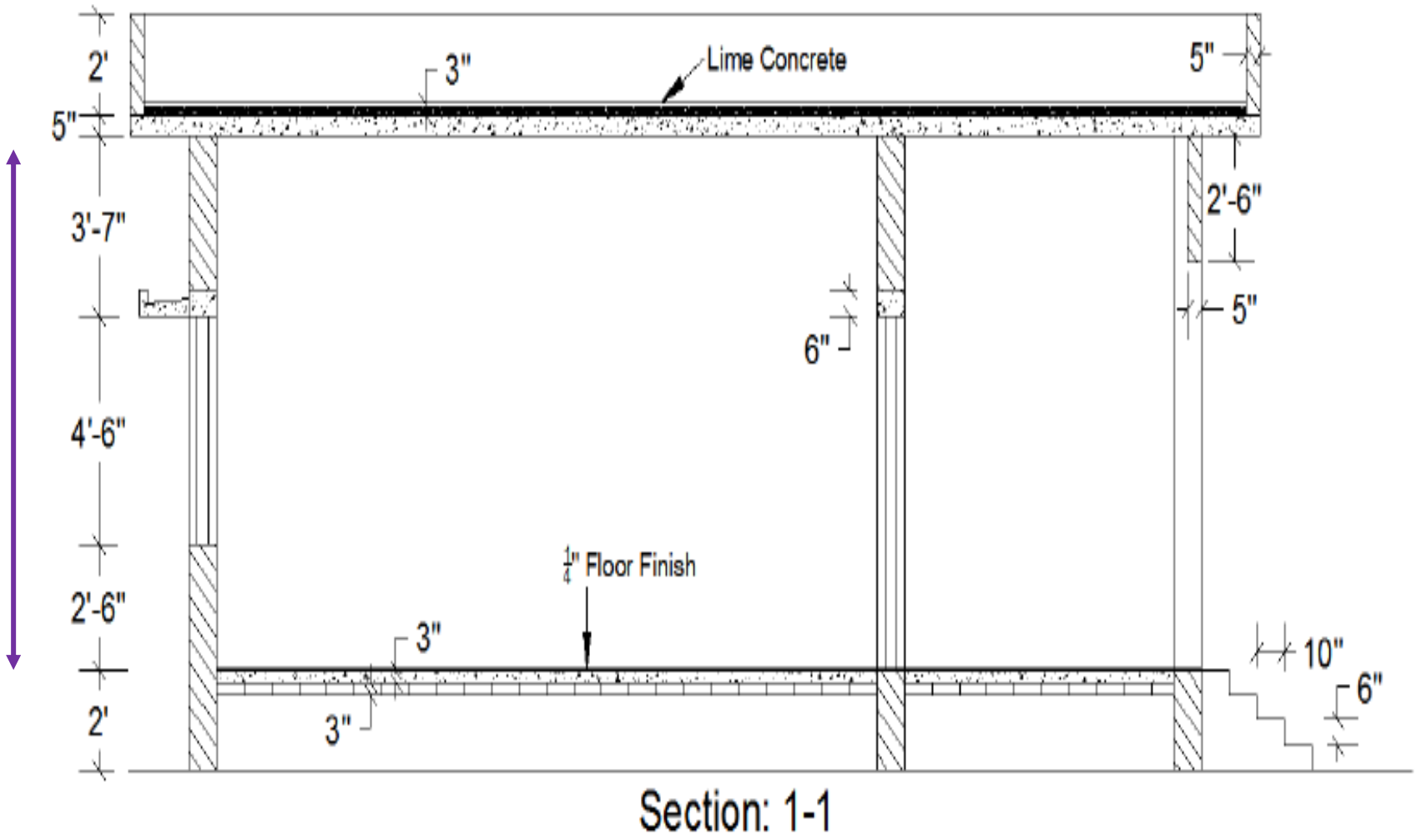
Deduction:

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

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

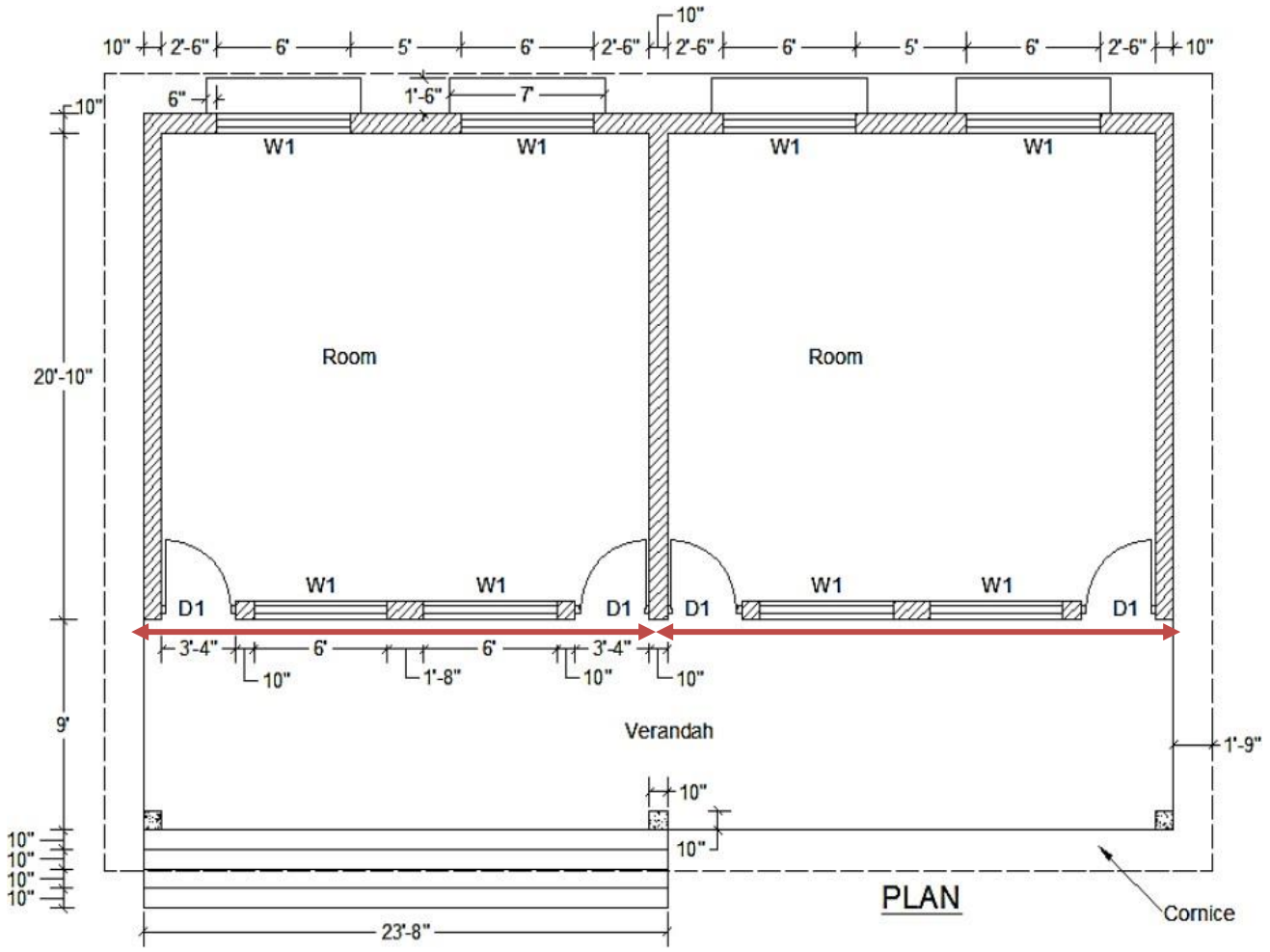
Total = (34.12 – 1.71 – 4.5) cft = 27.91 cft

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

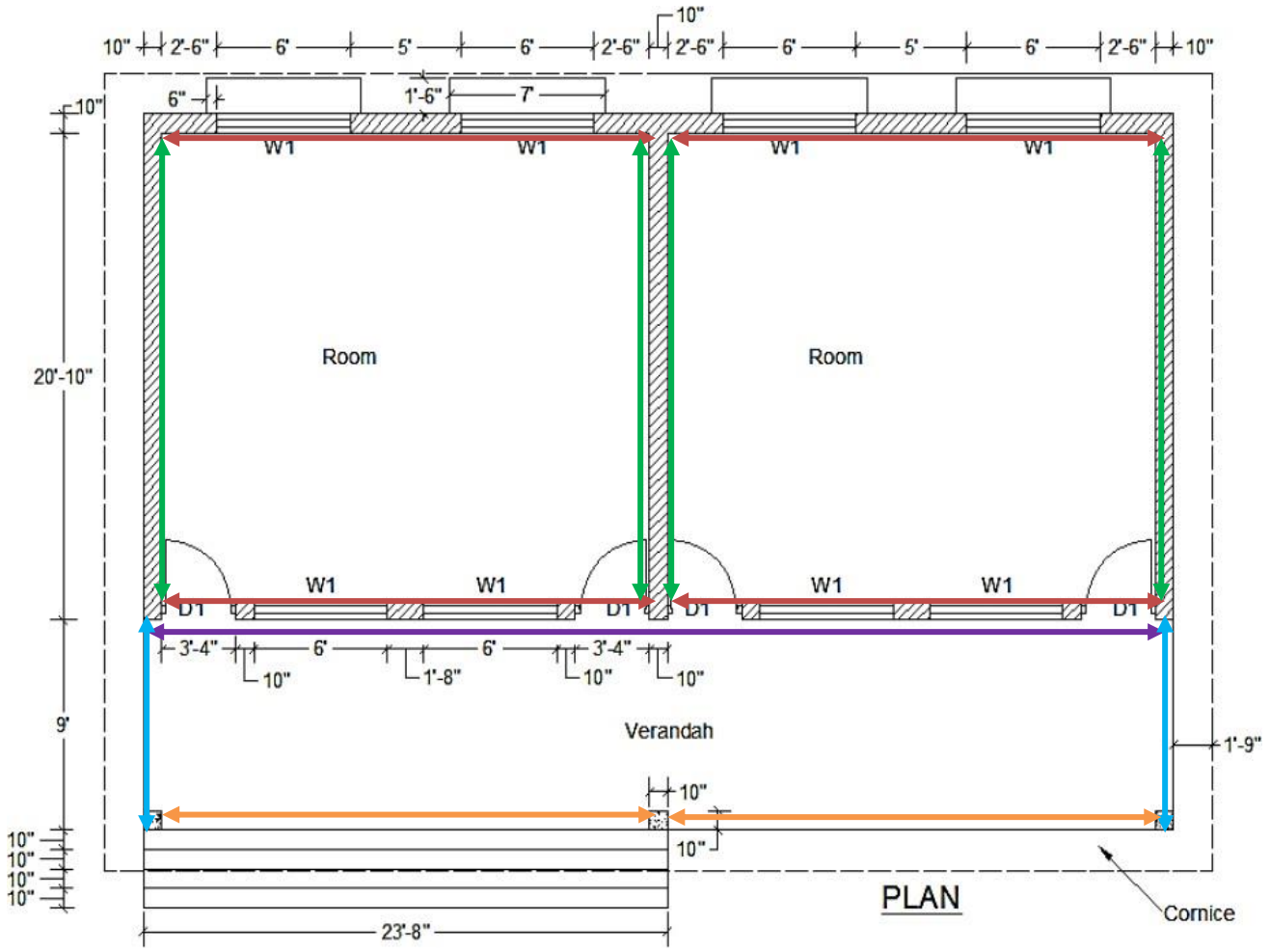
Deduction:

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

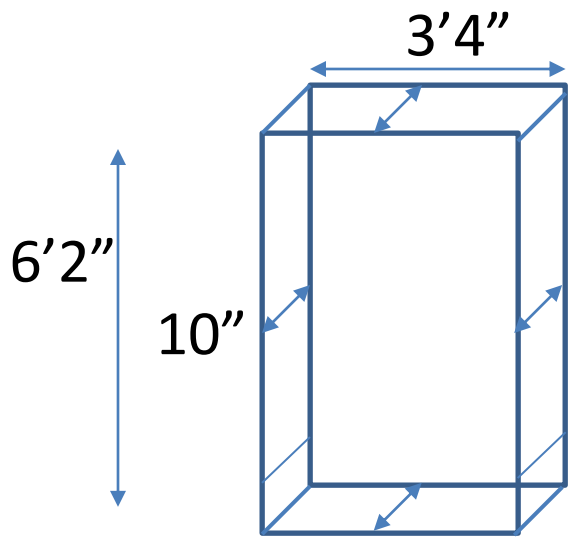
cft

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



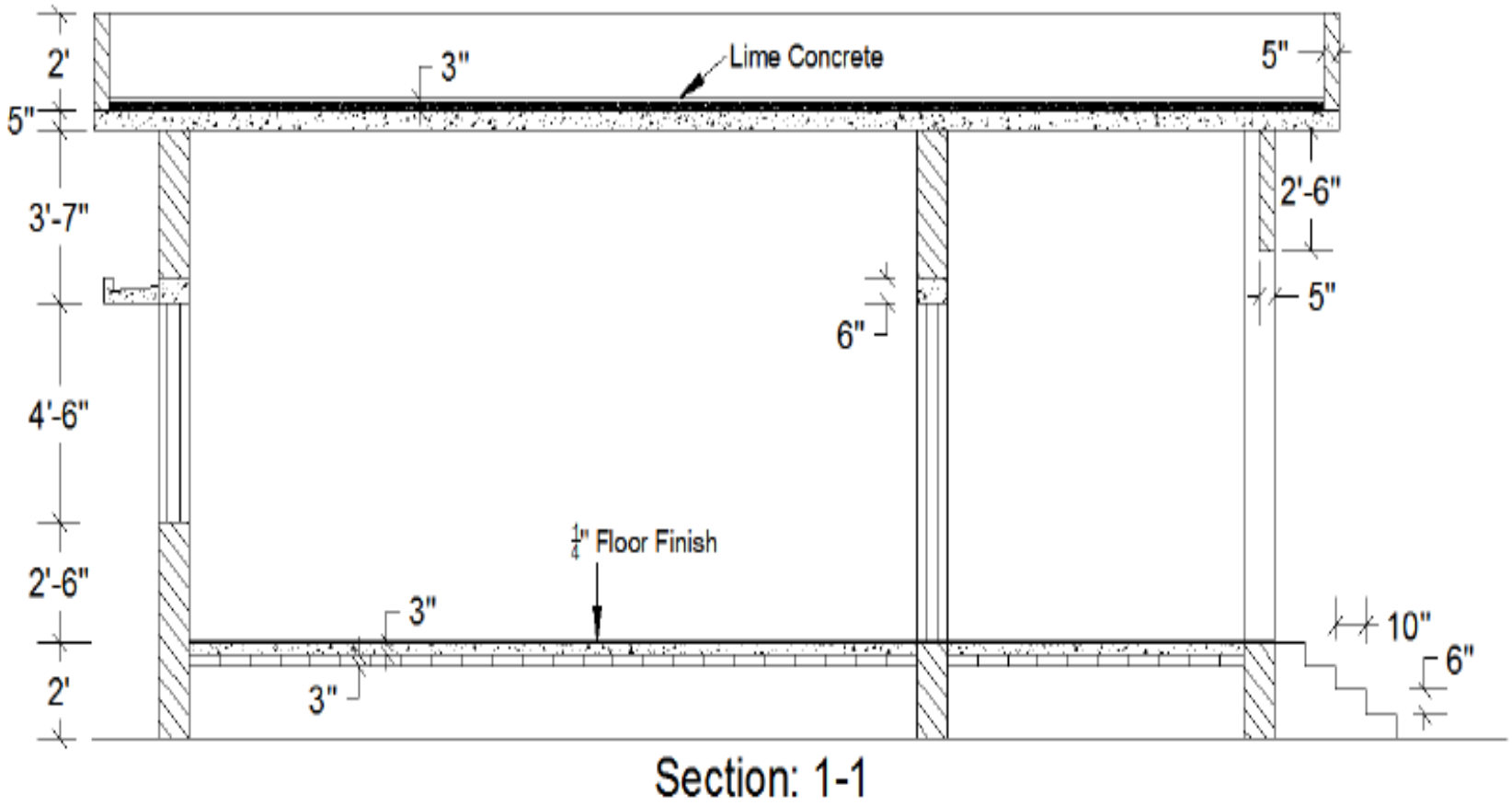
Total = 1.09+2.92 = **4.01** cft

19. Inside Plastering (Thickness-0.25”)

4) Drop wall Inside face

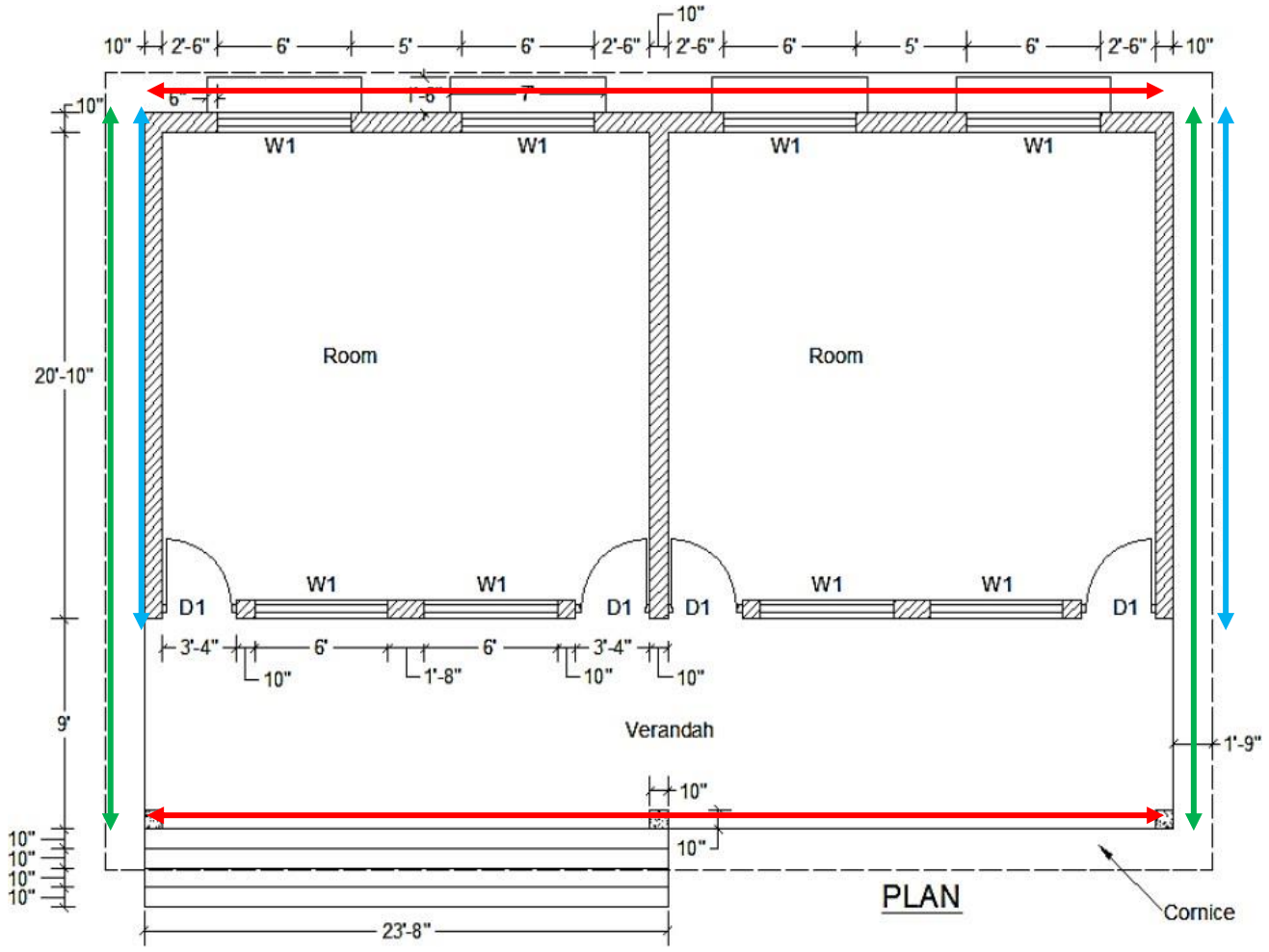
a) **Inside face =** 62’ * 2.5’ * 0.25” = 3.23 cft

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



Section: 1-1

20. Outside Plastering (Thickness-0.5”)

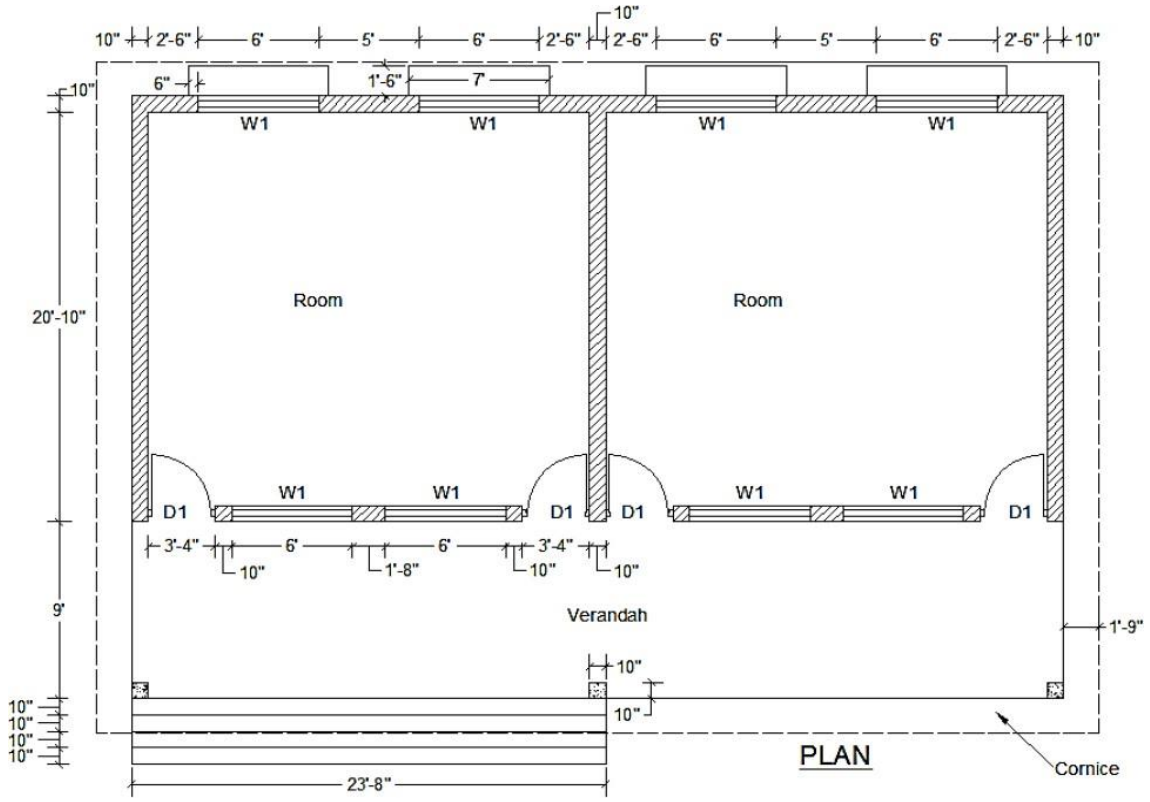


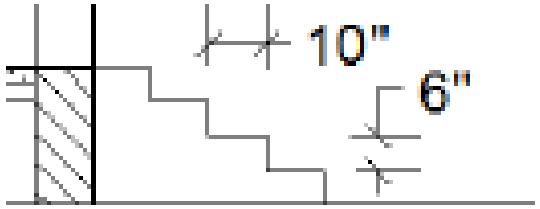
1) **GL to PL** = (46.5*2 + 30’8” *2) * 2’ * 0.5”
= 12.86 cft
Deduction:
Stair= 23’8” * 2’ * 0.5” = 1.97 cft

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”)



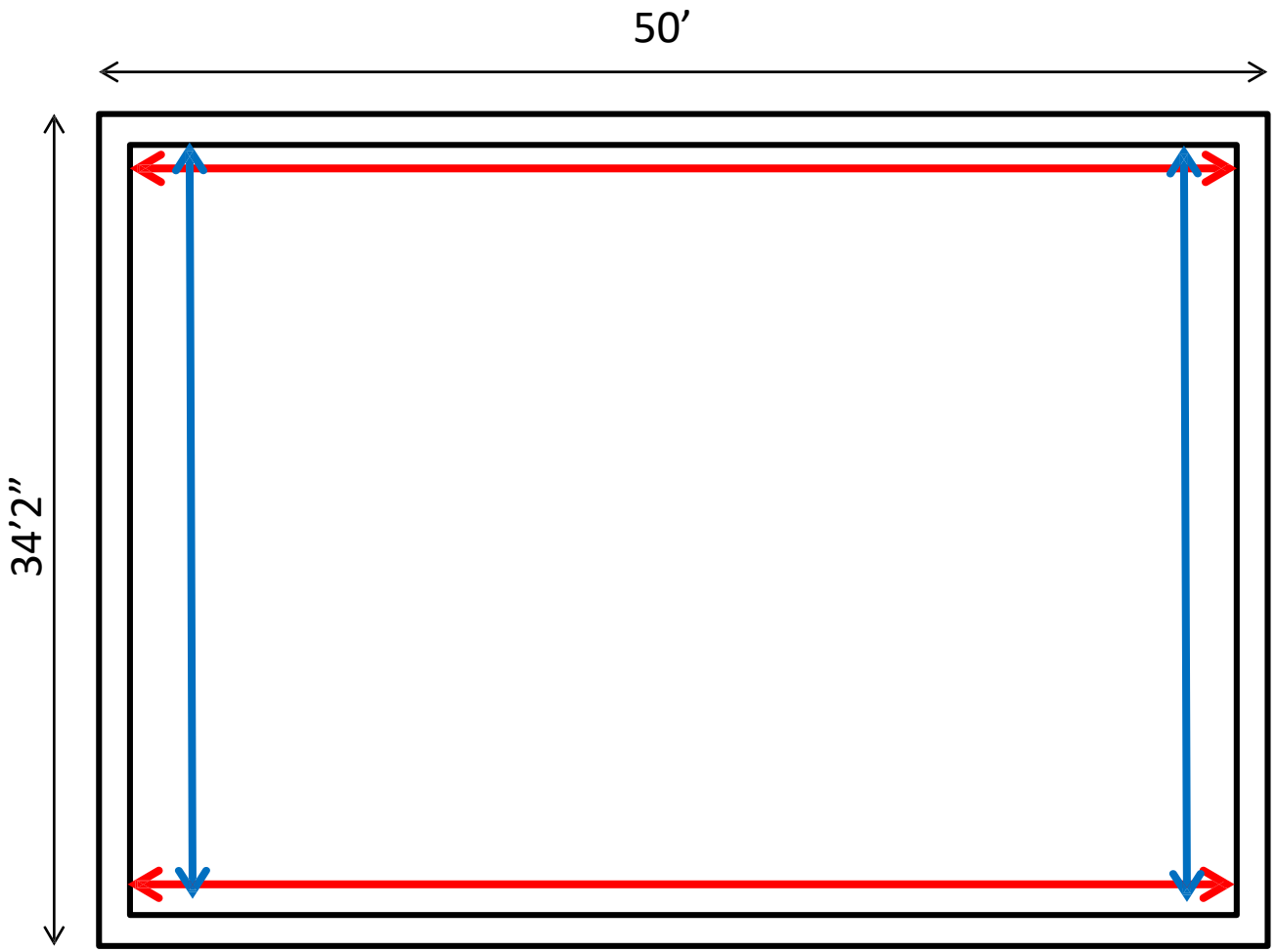


3) Column = 3* (10”*4)*(10’7”-10”) * 0.5”=
4.06 cft
Deduction:
Dropwall= 6* 2’6”*5”*0.5” = 0.26 cft
Total = 3.80 cft

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

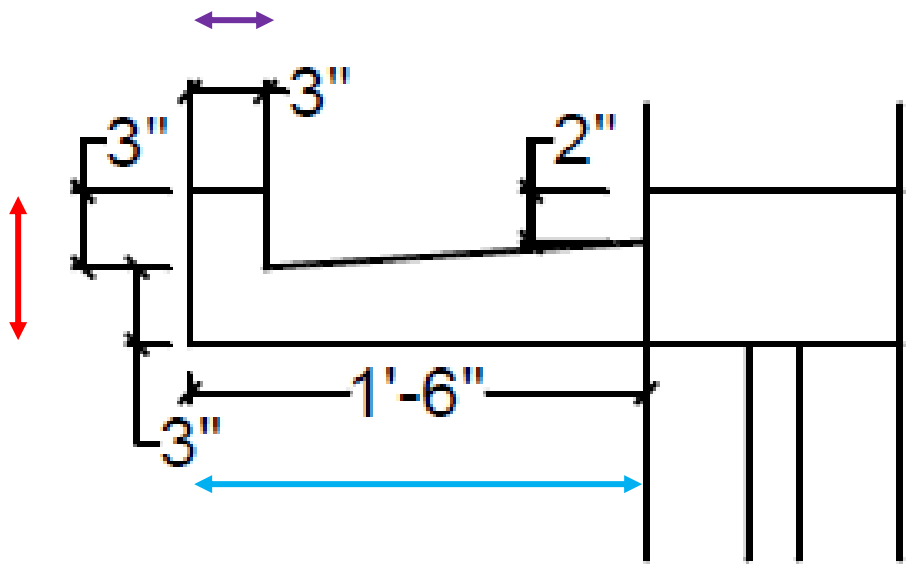
i. **Inside =** (49’2”*2+ 33’4”*2)*2’ *

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

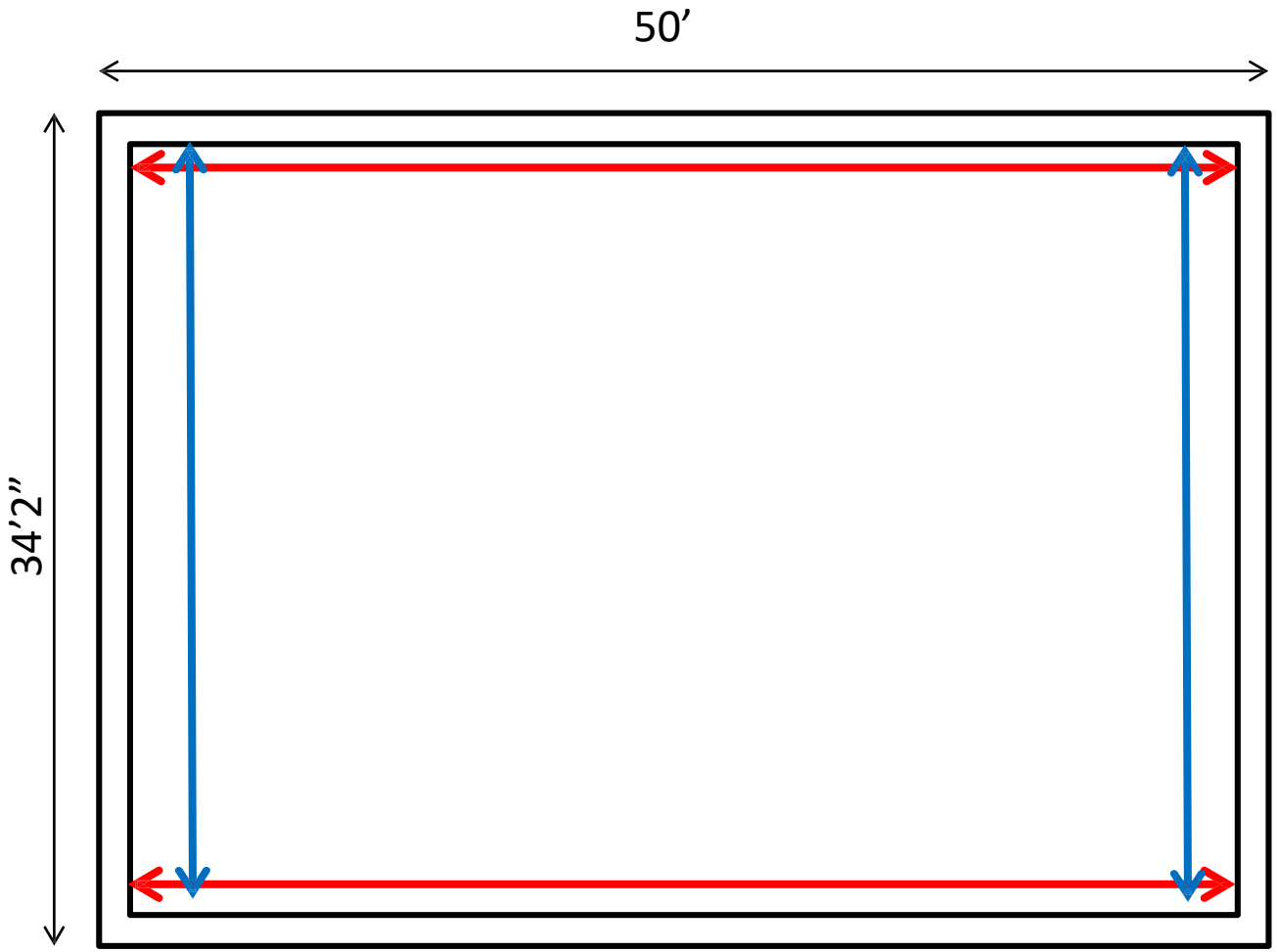
ii. Front face = 4* 7’* 6” * 0.5” = 0.58 cft

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

iv. Inside face =

v. Side edge =

20. Outside Plastering (Thickness-0.5”)

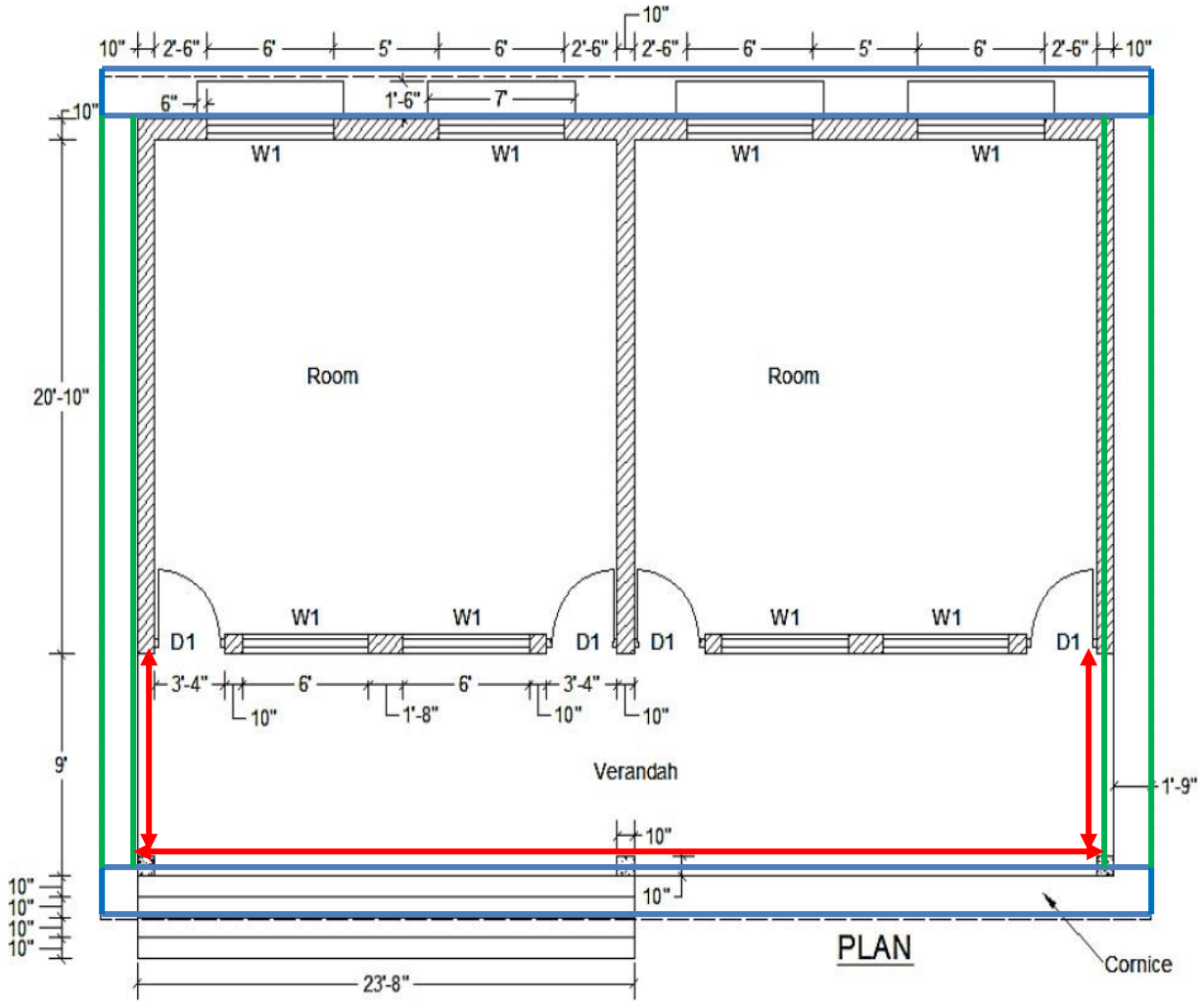


7) Cornice

i. **Side edge =**

(50’*2+34’2”*2)*0.5”*5”= 2.92 cft

20. Outside Plastering (Thickness-0.5”)



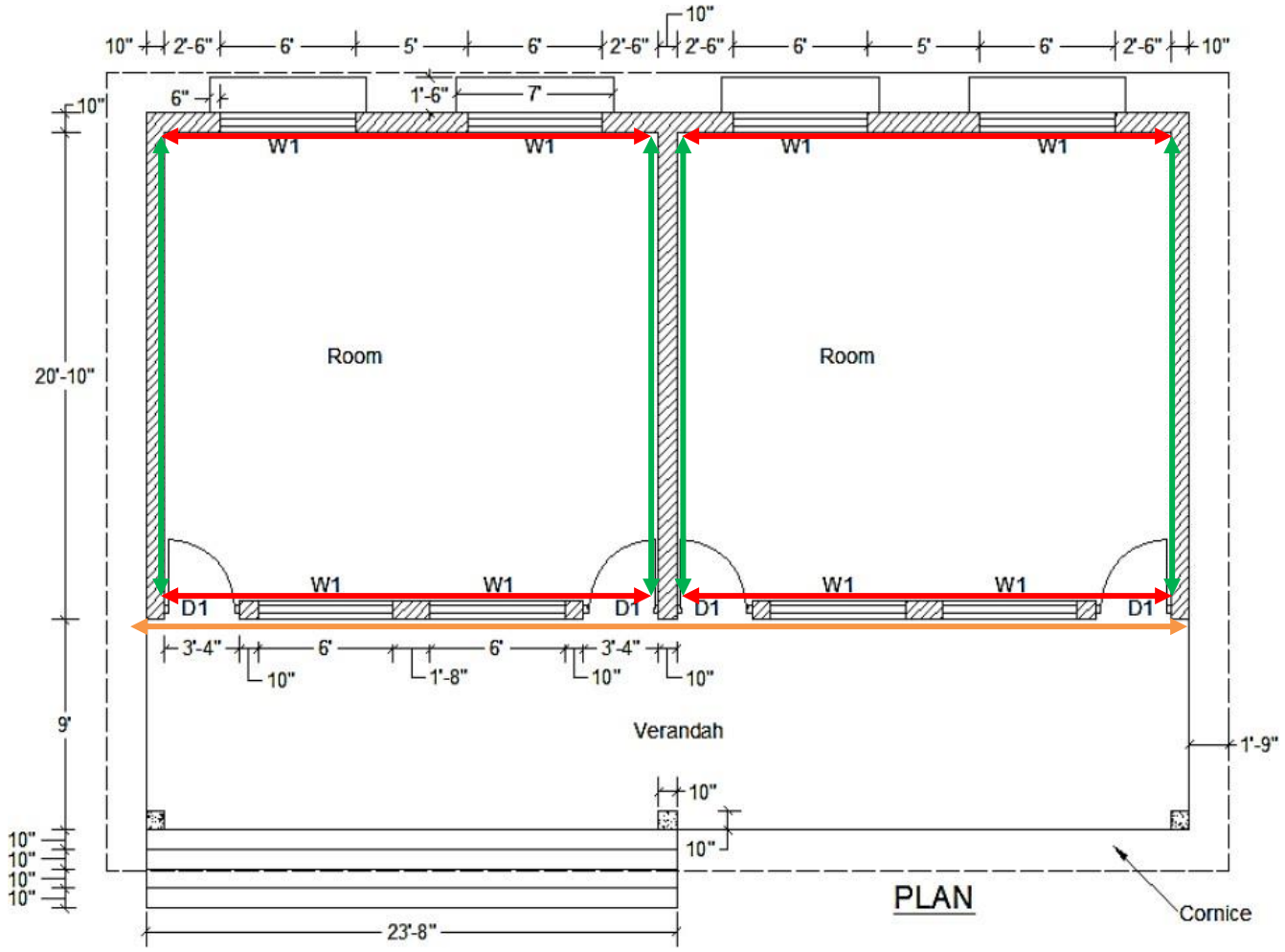
7) Cornice

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”)

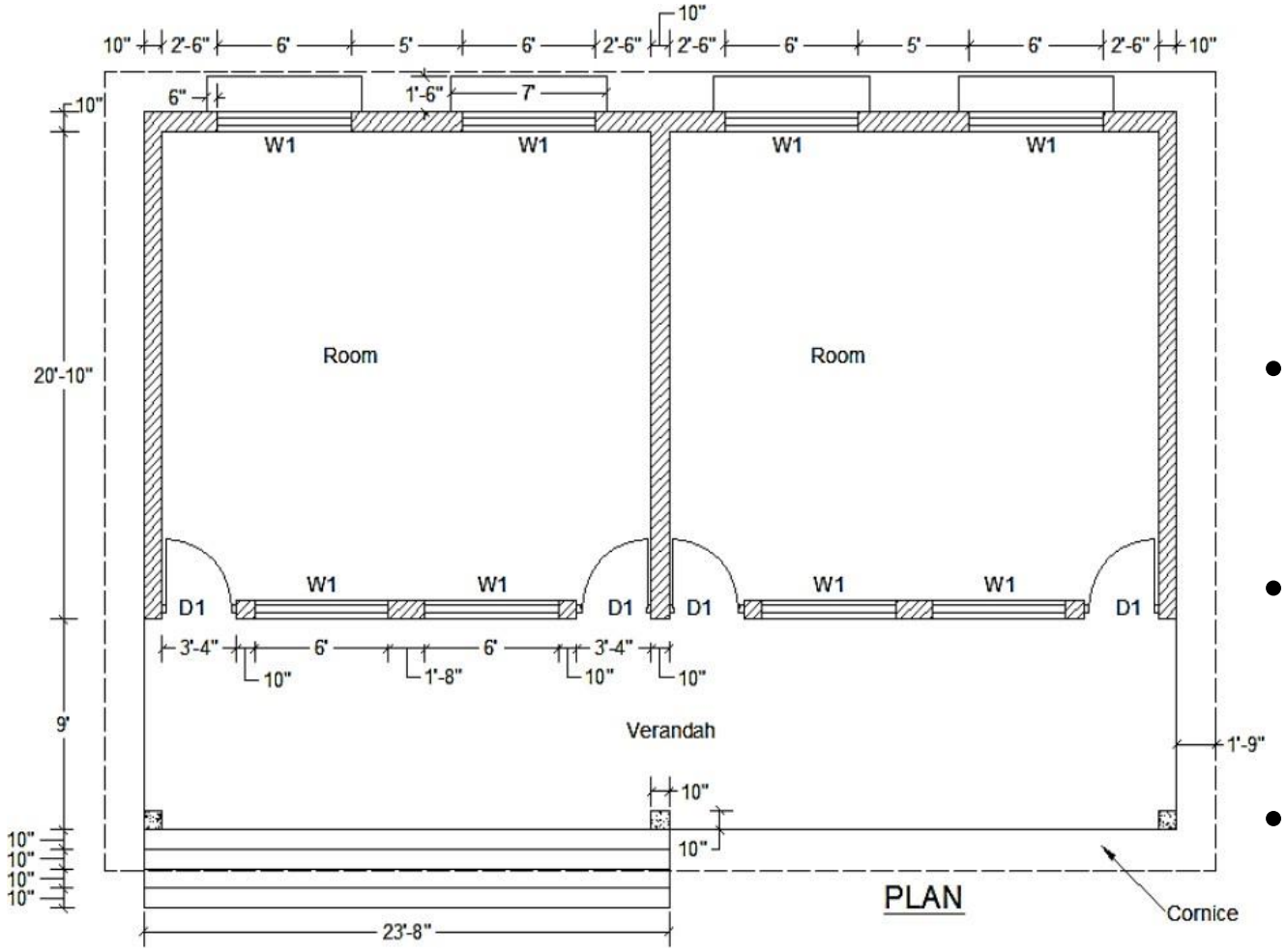


1. **Main room** = (**22’*4**+ **20’*4**)*10”*0.75”= 8.75 cft
   Deduction:
   i. Door = 4* 3’4”* 10”*0.75” = 0.69 cft

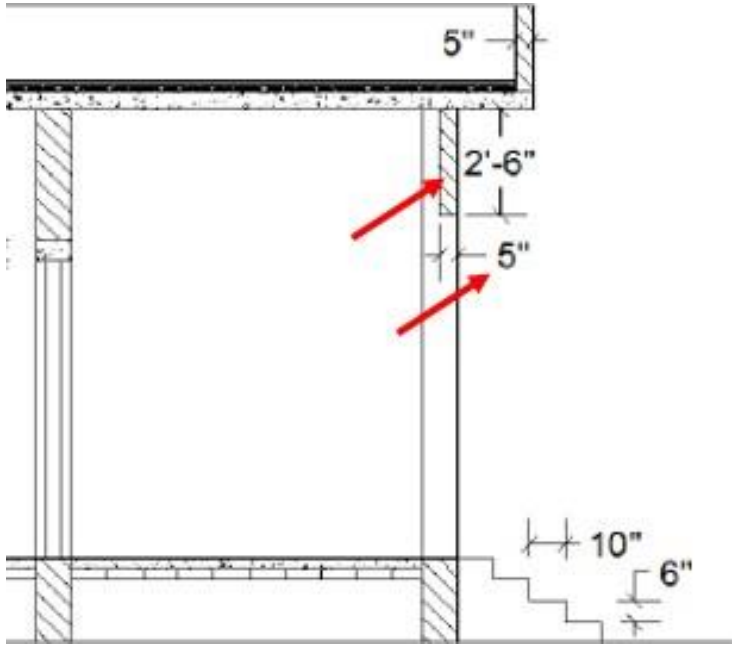
2. **Verandah** = **46’6”** * 10”* 0.75” = 2.42 cft
   Deduction:
   i. Door = 4* 3’4”* 10”*0.75” = 0.69 cft

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

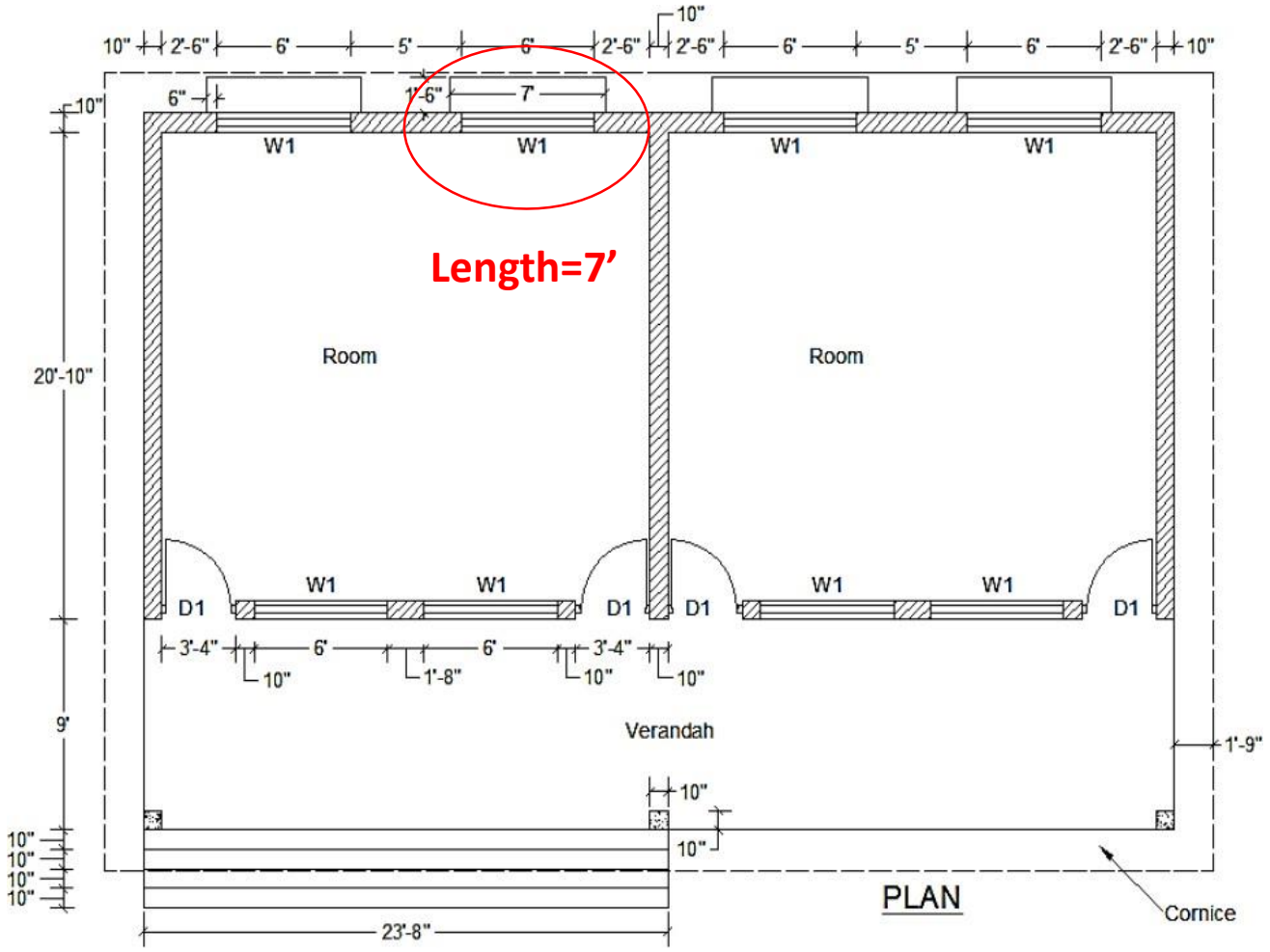
22. RCC in Drop walls



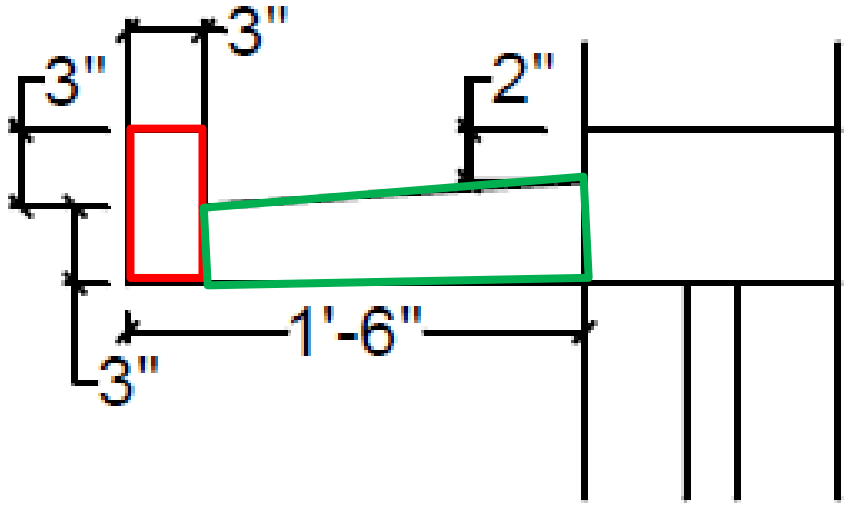
- Height= 2’6”
- Width= 5”
- Length= 62’



23. RCC in Sunshades



23. RCC in Sunshades



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