CE 316
CONCRETE STRUCTURES DESIGN SESSIONAL-1

Design of a Brick Masonry Building for Gravity Loading

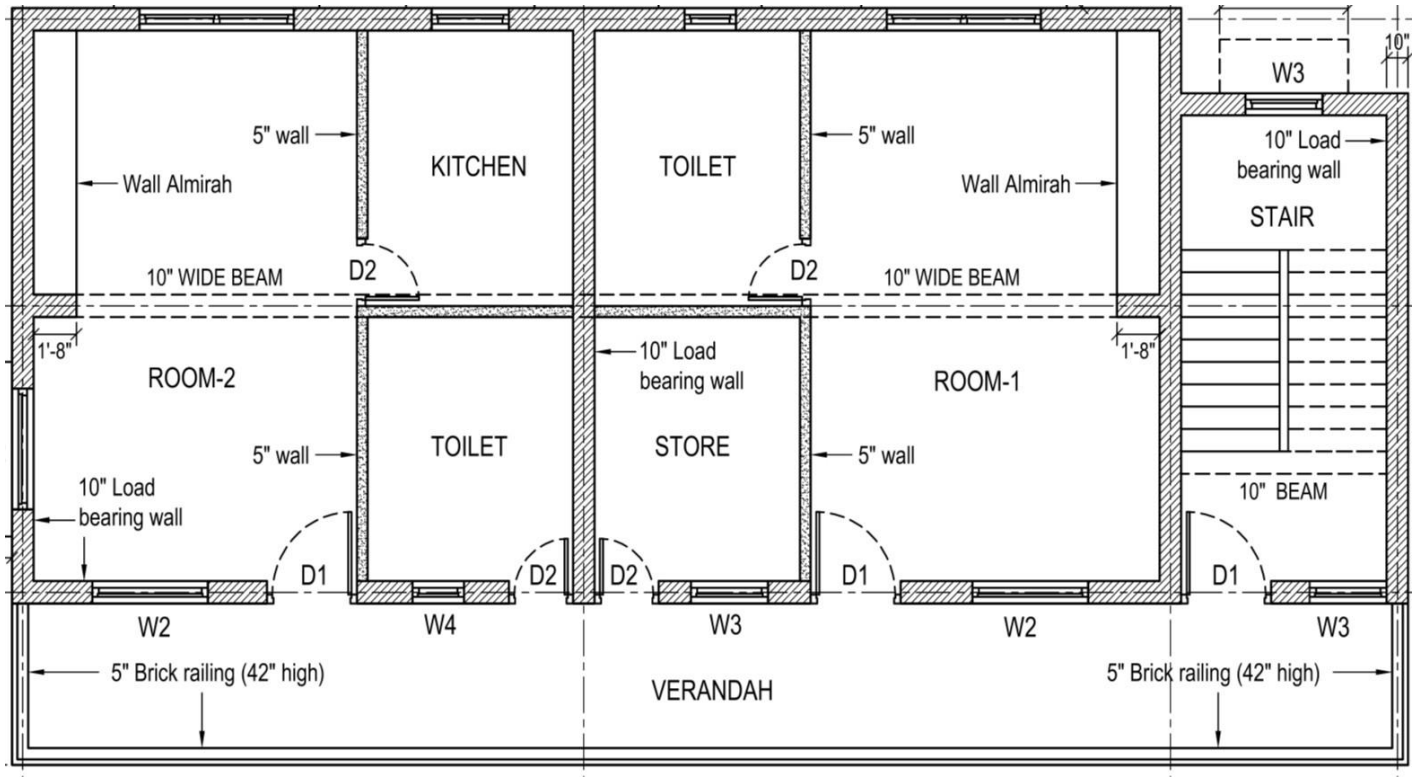
Lecture-5

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Outline of the lecture

1. Design of Brick walls
2. Design of wall foundations



Plan View

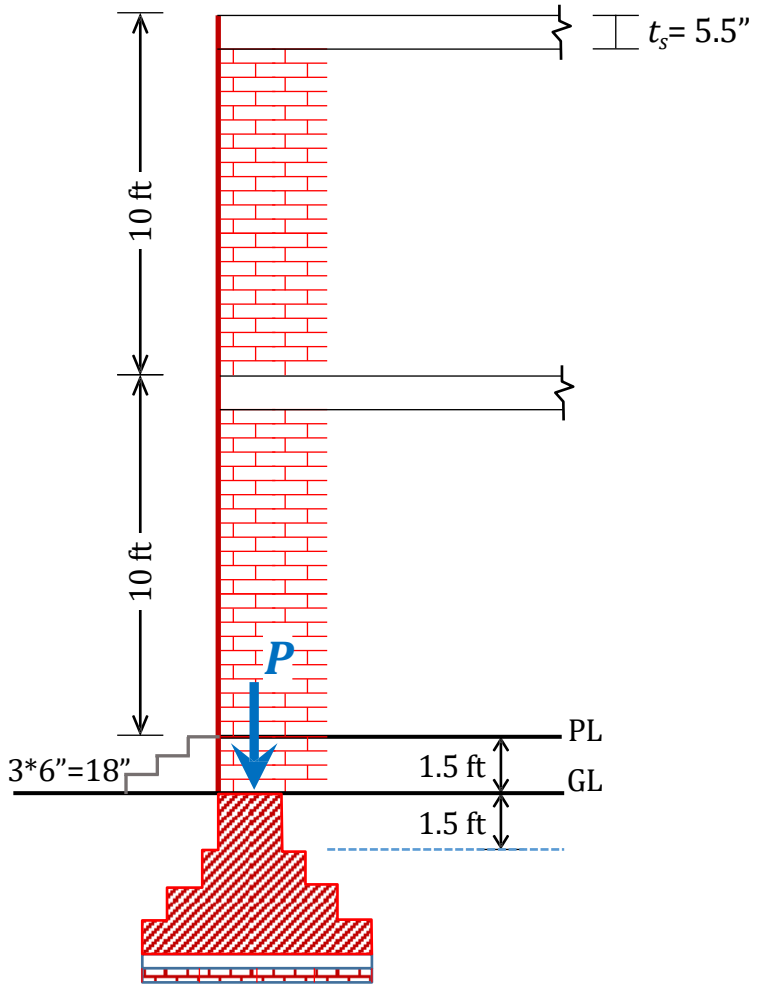
2. Check Compressive stress:

Unfactored loads will be used for calculating load on brick walls

****Let for this calculation, no. of stories of the building = 2****

UDL on brick wall AB comes from:

1. Floor Slab
2. Sunshade
3. Lintel
4. Wall self-weight
5. Brick work (GL to PL)

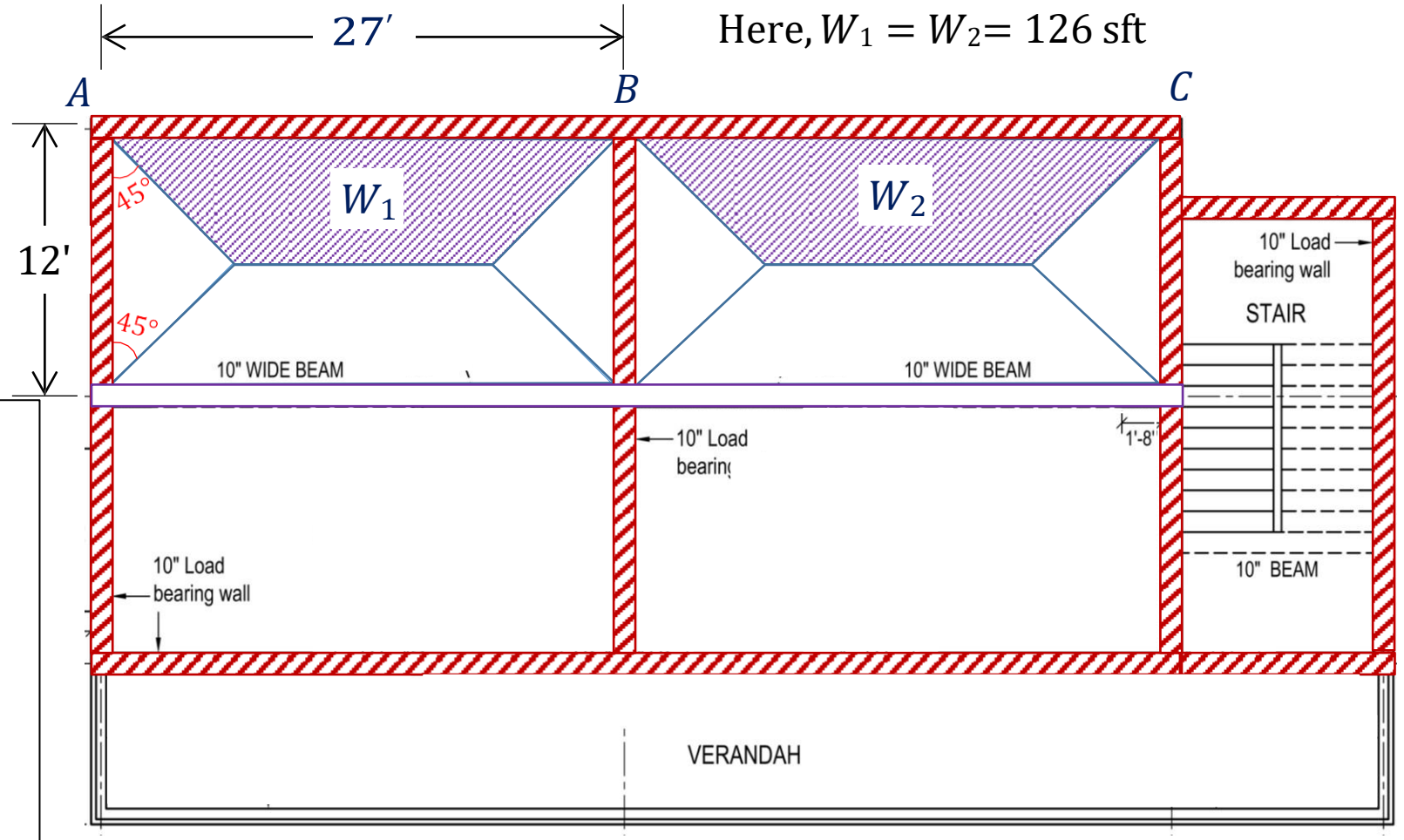


1. UDL on brick wall from Floor Slab:

Load on wall from slab per unit length of the wall is

$$= \frac{\text{Tributary area} \times \text{Total load from slab (psf)}}{\text{Total wall length (ft)}} \text{ lb/ft}$$

∗ Dimensions are assumed for demonstration of example ∗



Example

- Slab (t_s=5.5 in.) : 68.75 psf
- FF : 25 psf
- LL : 40 psf

= 133.75 psf

$$w = \frac{W_1 \times 133.75 \text{ psf}}{\text{Total Wall length (ft)}} \text{ lb/ft}$$

= 624.17 lb/ft **from one floor slab**

Load bearing Walls

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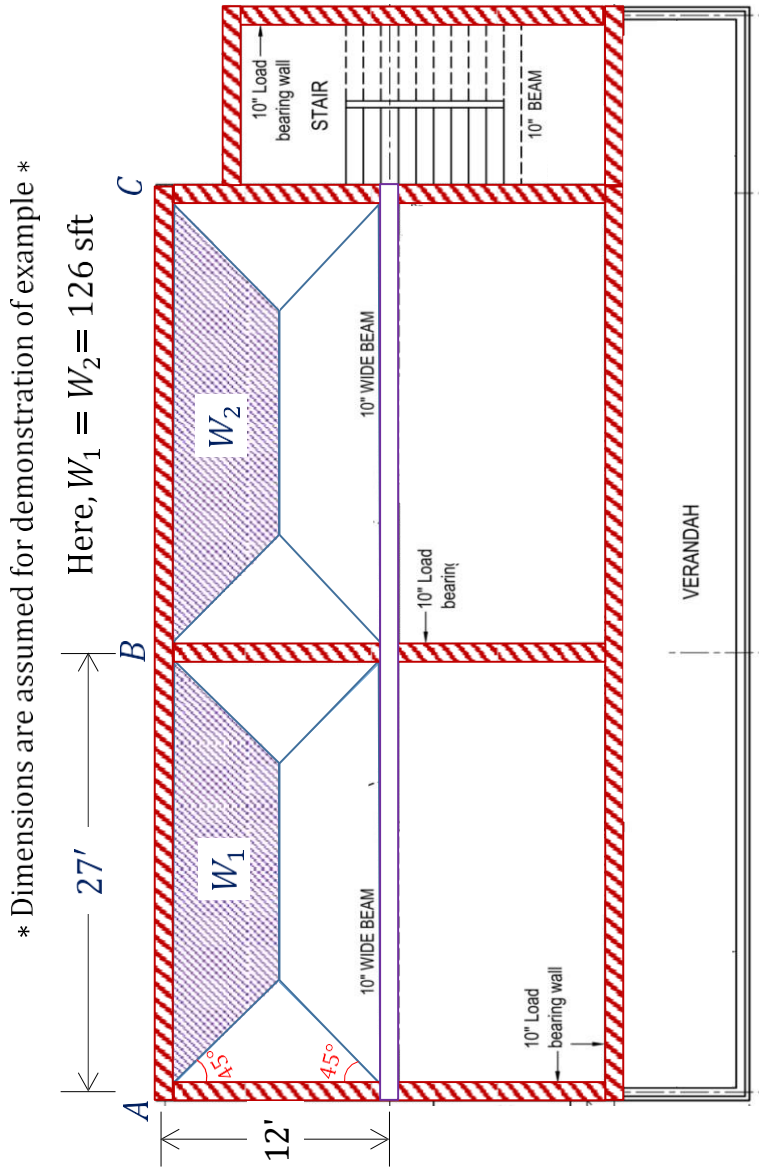
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UDL on brick wall AB comes from:

1. **Floor Slab**
2. Sunshade
3. Lintel
4. Wall self-weight
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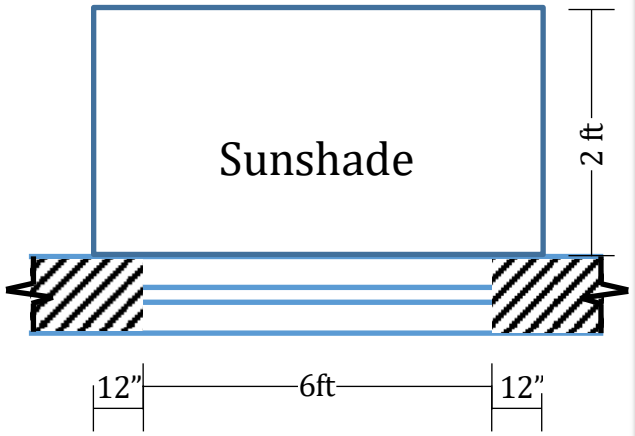
2. From Sunshade:

a) DL: Self wt.: $8' \times 2' \times \frac{3.5"}{12} \times 150 = 700$ lb

b) LL: 10 psf$\times 8' \times 2' = 160$ lb

$= 860$ lb

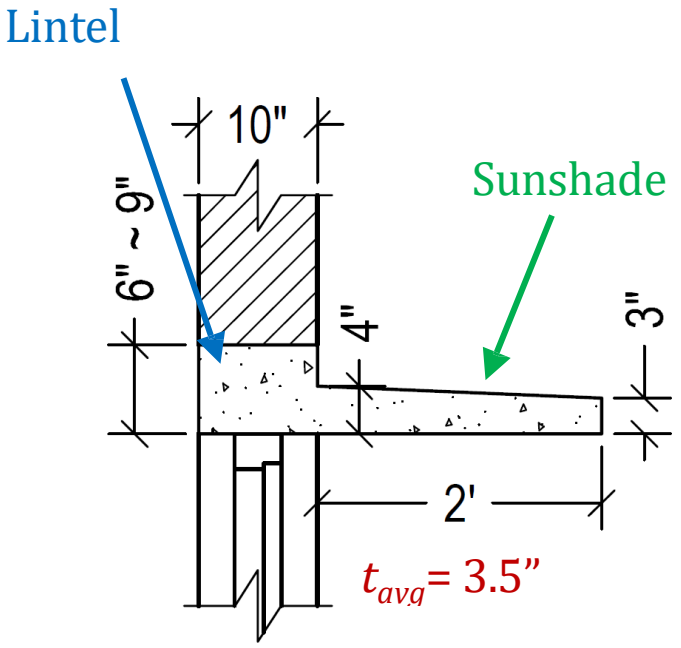
Plan View



$$\therefore \text{UDL on Wall } 'AB' = \frac{\text{Sunshade weight}}{\text{Wall length}}$$

$$= \frac{860 \text{ lb}}{27'}$$

$= 31.85$ lb/ft of the wall length



UDL on brick wall AB comes from:

1. Floor Slab
2. **Sunshade**
3. Lintel
4. Wall self-weight
5. Brick work (GL to PL)

3. From Lintel:

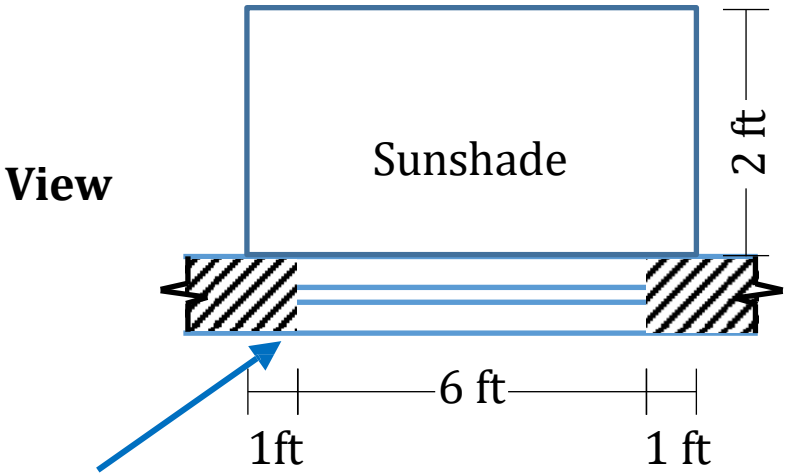
$$\text{Lintel weight} = \left[\frac{6"}{12} \times \frac{10"}{12} \times 8'\right] \times 150$$
$$= 500 \text{ lb}$$

$$\text{UDL on Wall } 'AB' = \frac{\text{Lintel weight}}{\text{Wall length}}$$

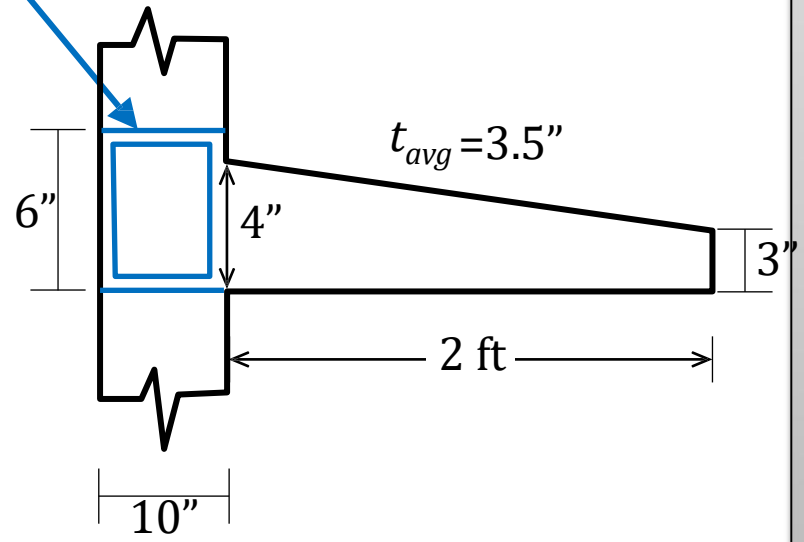
$$= \frac{500 \text{ lb}}{27'}$$

$$= 18.52 \text{ lb/ft of the wall}$$

Plan View



Section



UDL on brick wall AB comes from:

1. Floor Slab
2. Sunshade
3. **Lintel**
4. Wall self-weight
5. Brick work (GL to PL)

4. From Wall self weight:

Self weight of wall of one floor

= (Thickness × Height

× Unit wt.) per ft of wall length

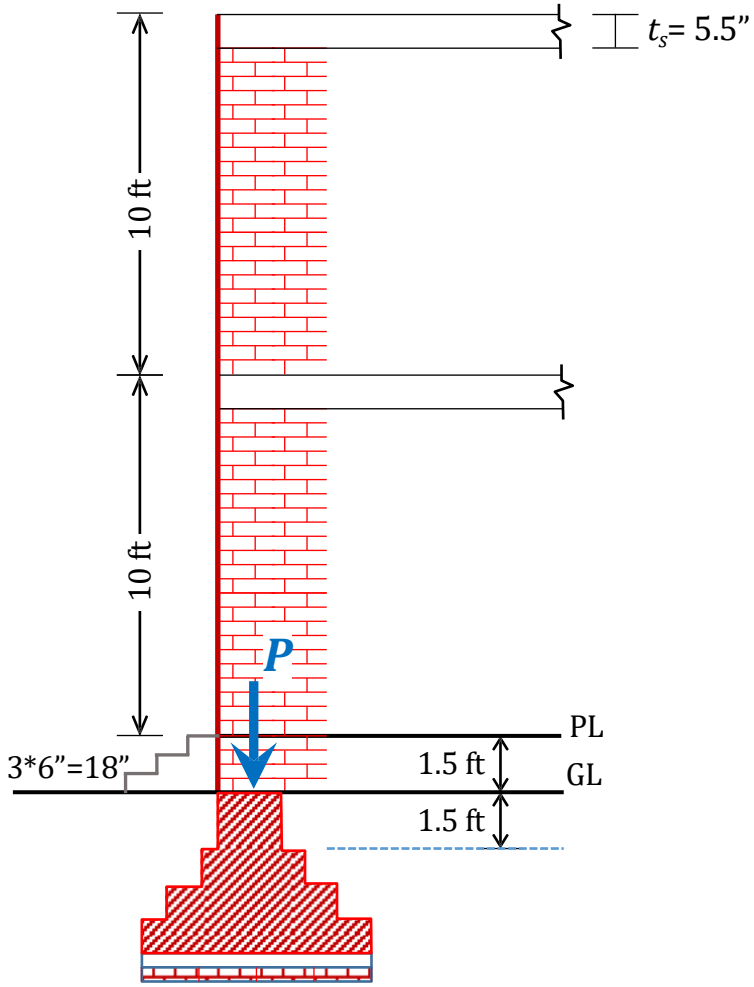
$$= \frac{10"}{12} \times 10' \times 1' \times 120$$

= 1000 lb/ft of wall length

5. From Brick work of GL to PL:

$$= \frac{10"}{12} \times 1.5' \times 1' \times 120$$

= 150 lb/ft of wall length



UDL on brick wall AB comes from:

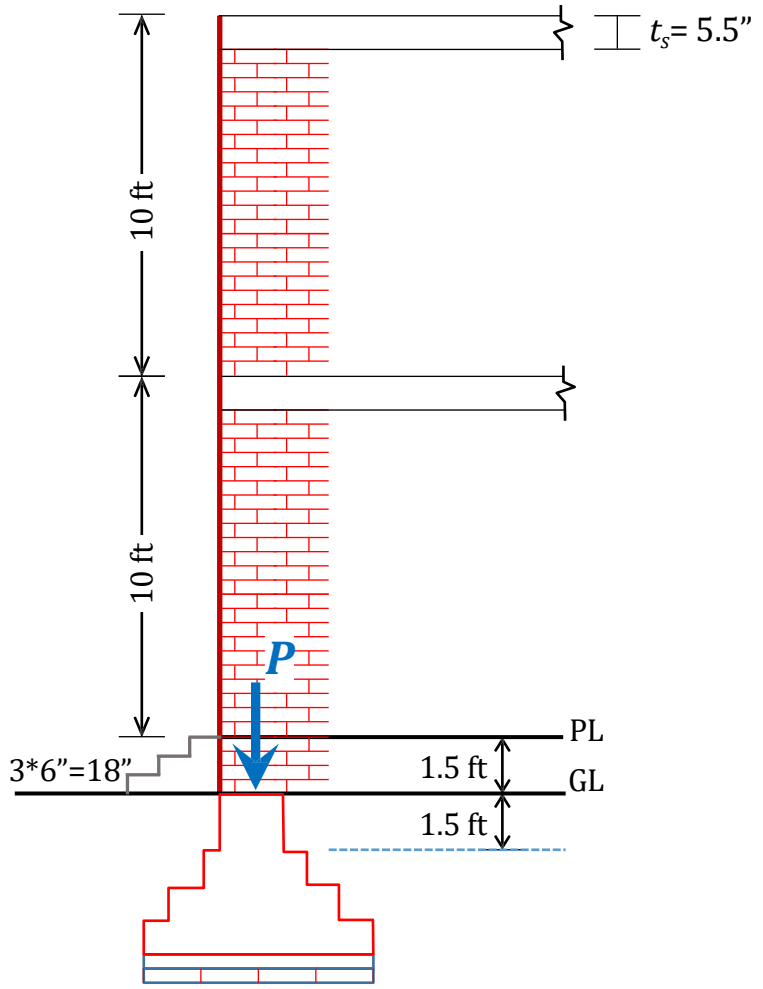
1. Floor Slab
2. Sunshade
3. Lintel
4. **Wall self-weight**
5. **Brick work (GL to PL)**

Let for this calculation, no. of stories of the building = 2

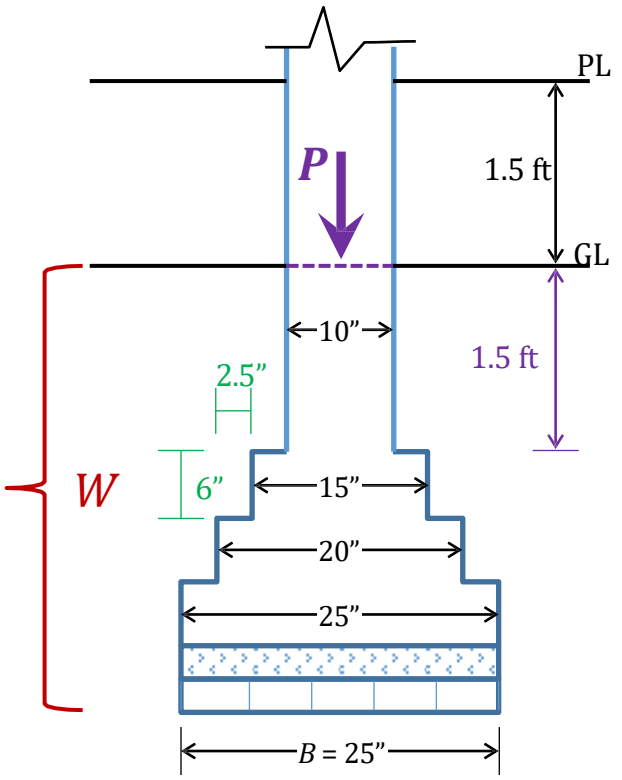
UDL on brick wall AB comes from:

1. Floor Slab = 624.167 lb/ft * 2 (No of stories)
2. Sunshade = 31.85 lb/ft * 2
3. Lintel = 18.52 lb/ft * 2
4. Wall self-weight = 1000 lb/ft * 2
5. Brick work (GL to PL) = 150 lb/ft

Sum at 'GL', → P = 3500 lb/ft of the wall length



Foundation Design



Load on the soil is = Load at GL, *P* + Foundation weight, *W*

$$\text{Required width of the wall foundation is} = \frac{\text{Load at GL } (P) + \text{ Foundation weight } (W)}{q_{allowable}}$$

$q_{allowable}$ = Allowable bearing capacity of soil = 1.15 tsf = 2300 psf

$$\text{Required width of the wall foundation is} = \frac{(P+W)\ \text{lb/ft}}{2300\ \text{lb/ft}^2}$$

(At this point the foundation geometry and width is not known.

So, foundation weight, *W* is unknown. Let *W* =10% of *P*)

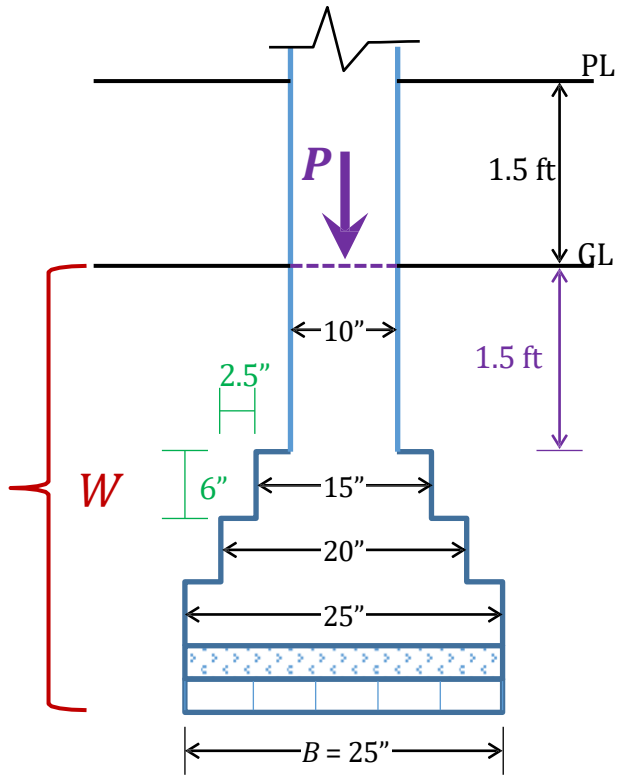
$$\text{So, required width, } B_{required} = \frac{(3500+350)\ \text{lb/ft}}{2300\ \text{lb/ft}^2} = 1.67' = 20.08" \cong 25"$$

Foundation Design

Load on the soil = Load at GL + Foundation weight

Required width of the wall foundation is $= \dfrac{\text{Load at GL} + \text{Foundation weight}}{q_{allowable}}$

$q_{allowable}$ = Allowable bearing capacity of soil = 1.15 tsf = 2300 psf



Foundation self weight, $W = \left[\left(\frac{10"}{12} \times 1.5'\right) + \left(\frac{15"}{12} \times \frac{6"}{12}\right) + \left(\frac{20"}{12} \times \frac{6"}{12}\right) + \left(\frac{25"}{12} \times \frac{6"}{12}\right)\right] \times 1' \times$

$120\ \text{lb/ft}^3 + \left[\frac{25"\times 3"}{12\times 12}\right] \times 1' \times 145\ \text{lb/ft}^3 + \left[\frac{25"\times 3"}{12\times 12}\right] \times 1' \times 120\ \text{lb/ft}^3 =$ **588 lb/ft**

Required width of the wall foundation is $= \frac{(3500+588)\ \text{lb/ft}}{2300\ \text{lb/ft}^2} = 1.78' = 21.34"$ which is less than the determined width (25" → ok)

So, the final foundation width is ***B* = 25”.**

End of Lecture 5

THANK YOU!

Any Question?