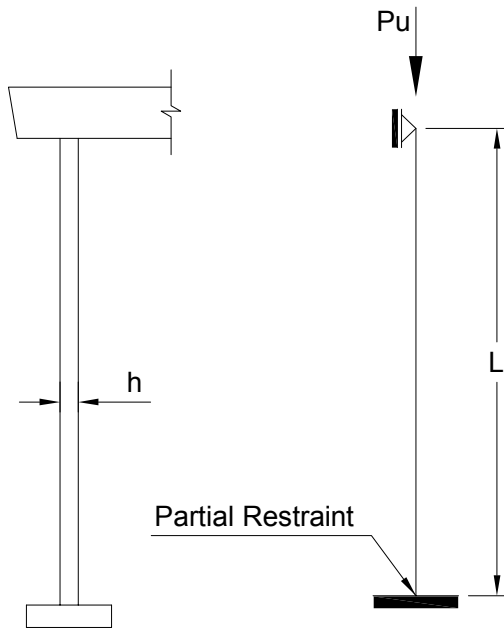




**Design of Bearing Wall by Empirical Method as per ACI 318-11 Chapters 10 & 14**



**System**

Height of Wall, $L=$		15 ft
Spacing of Wall Panels, $s_p=$		8 ft
Width of Stem for Bearing Wall, $b_w=$		7 in

**Load**

Service Dead Load, $P_D=$		28 kips
Service Live Load, $P_L=$		14 kips
Ultimate Load, $P_u=$	$1,2 * P_D + 1,6 * P_L$	$= 56$ kips

**Material Properties**

Concrete Strength, $f'_c=$		4000 psi
Bearing Strength Reduction Factor (According to Cl.9.3.2 of ACI318), $\Phi=$		0.65
Modification Factor for Lightweight Concrete, $\lambda=$		1.00

**Determine Wall Thickness**

Assume Wall Thickness, $h=$		7.5 in
Minimum Wall Thickness, $h_{min}= \text{MAX}(L * 12 / 25 ; 4)$		$= 7.2$ in
Check Validation =	$\text{IF}( h > h_{min}; \text{"O.K."}; \text{"Increase Thickness"} )$	$= \text{O.K.}$

**Check Concrete Bearing Strength**

Loaded Area, $A_1=$	$h * b_w$	$= 52.50$ in <sup>2</sup>
Nominal Concrete Bearing Capacity (According to Cl.10.14.1 of ACI318),		
$\Phi V_b=$	$\Phi * 0.85 * f'_c * A_1 / 1000$	$= 116$ kips
Check Validation =	$\text{IF}( \Phi V_b > P_u; \text{"Valid."}; \text{"Invalid"} )$	$= \text{Valid.}$



**Calculate Design Strength of Wall**

Effective Width of Wall,  $w = \text{MIN}(b_w + 4 * h ; s_p * 12) = 37 \text{ in}$

Wall Resistant Type,

Type-1 : Restrained Rotation - One or Both Ends (T/B/Both)

Type-2 : Unrestrained Rotation at Both Ends

Type-3 : For Walls not Braced Against Lateral Translation

Type=  $\text{SEL}(\text{"ACI/K"} ; \text{Type} ; ) = \text{Type-1}$

Effective Length Factor,  $K = \text{TAB}(\text{"ACI/K"} ; K ; \text{Type} = \text{Type} ) = 0.80$

Nominal Strength of Wall (According to Eq.14-1 of ACI 318),

$$\Phi P_n = 0,55 * \Phi * f_c * w * h * \frac{1 - \left( \frac{K * L * 12}{32 * h} \right)^2}{1000} = 254 \text{ kips}$$

Check Validity=  $\text{IF}(\Phi P_n > P_u ; \text{"Valid"} ; \text{"Invalid"} ) = \text{Valid}$

**Determine Single Layer of Reinforcement**

Vertical Area of Reinforcement for Wall (According to Cl.14.3.2 of ACI318),

$A_{sv} = 0.0012 * 12 * h = 0.108 \text{ in}^2 / \text{ft}$

Provided Reinforcement, Bar=  $\text{SEL}(\text{"ACI/Bar"} ; \text{Bar} ; ) = \text{No.4}$

Provided Reinforcement,  $A_{sb} = \text{TAB}(\text{"ACI/Bar"} ; \text{Asb} ; \text{Bar} = \text{Bar} ) = 0.20 \text{ in}^2$

Bar Spacing,  $s = 18 \text{ in}$

$A_{sv\_Prov} = A_{sb} * 12 / s = 0.13 \text{ in}^2$

Check Validity=  $\text{IF}(A_{sv\_Prov} > A_{sv} ; \text{"Valid"} ; \text{"Invalid"} ) = \text{Valid}$

Horizontal Area of Reinforcement for Wall (According to Cl.14.3.3 of ACI318),

$A_{sh} = 0.0020 * 12 * h = 0.180 \text{ in}^2 / \text{ft}$

Provided Reinforcement, Bar=  $\text{SEL}(\text{"ACI/Bar"} ; \text{Bar} ; ) = \text{No.4}$

Provided Reinforcement,  $A_{sb} = \text{TAB}(\text{"ACI/Bar"} ; \text{Asb} ; \text{Bar} = \text{Bar} ) = 0.20 \text{ in}^2$

Bar Spacing,  $s = 12 \text{ in}$

$A_{sh\_Prov} = A_{sb} * 12 / s = 0.20 \text{ in}^2$

Check Validity=  $\text{IF}(A_{sh\_Prov} > A_{sh} ; \text{"Valid"} ; \text{"Invalid"} ) = \text{Valid}$

**Design Summary**

Wall Thickness,  $h = h = 8 \text{ in}$

Length of Footing,  $L = L = 15 \text{ ft}$

Vertical Area of Reinforcement for Wall,  $A_{sv\_Prov} = A_{sv\_Prov} = 0.13 \text{ in}^2$

Horizontal Area of Reinforcement for Wall,  $A_{sh\_Prov} = A_{sh\_Prov} = 0.20 \text{ in}^2$