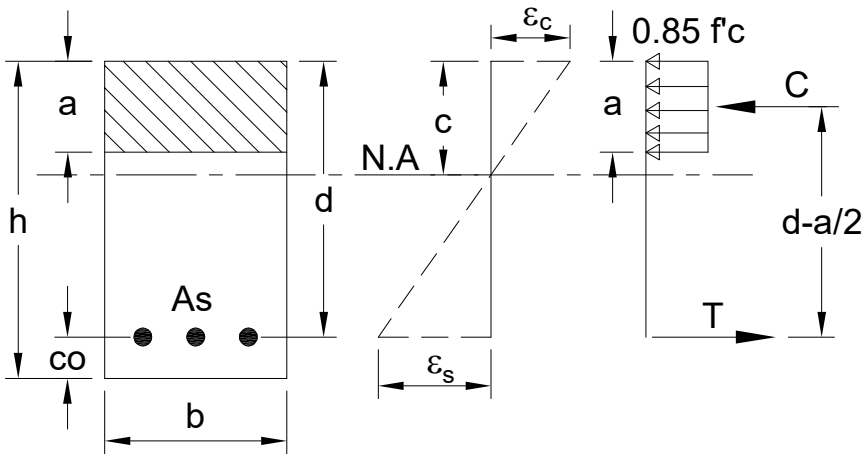
Design of Rectangular Section with Tension Reinforcement only as per ACI 318-11 Chapters 9 & 10



System

Width of Concrete Section, b=		12.0 in
Depth of Concrete Section, h=		16.0 in
Concrete Cover, co=		2.5 in
Effective Depth of Concrete Section, d= h - co	= 16.0 - 2.5	= 13.5 in

Load

Bending Moment due to Dead Load, M_D=		56.0 kip*ft
Bending Moment due to Live Load, M_L=		35.0 kip*ft
Ultimate Bending Moment, M_U=	$(1.2*M_D)+(1.6*M_L)$	= 123.2 kip*ft

Material Properties

Concrete Strength, f'_c=		4000 psi
Yield Strength of Reinforcement, f_y=		60000 psi
Tension Strength Reduction Factor (According to Cl.9.3.2 of ACI318), Φ=		0.90

Factor for Rectangular Compressive Stress Block (According to Cl.10.2.7.3),

β_1=	IF(f'_c≤4000;0.85;IF(f'_c≥8000;0.65;1.05-0.00005*f'_c))	= 0.85

Area of Reinforcement

R_n=	$\frac{M_U*12000}{\Phi*b*d^2}$	= 751.1 psi
ρ=	$0.85*\frac{f'_c}{f_y}*\left(1-\sqrt{1-\frac{2*R_n}{0.85*f'_c}}\right)$	= 0.0143
Area of Reinforcement, A_s=	ρ*b*d	= 2.32 in^2

Minimum Area of Reinforcement (According to Cl.10.5 of ACI318),

A_{s_min1}=	$\frac{3*\sqrt{f'_c}*b*d}{f_y}$	= 0.51 in^2

$A_{s\_min2}=$	$\frac{200*b*d}{f_y}$	=	0.54 in^2
$A_{s\_min}=$	$MAX(A_{s\_min1}; A_{s\_min2})$	=	0.54 in^2
Required Area of Reinforcement, $A_{sc\_Req}=$	$MAX(A_s; A_{s\_min})$	=	2.32 in^2
Provided Reinforcement, Bar=	SEL("ACI/Bar"; Bar;)	=	No.10
Provided Reinforcement, $A_{sb}=$	TAB("ACI/Bar"; Asb; Bar=Bar)	=	1.27 in^2
Number of Bars, n=			2
Vertical Reinforcement, $A_{sc\_Prov}=$	$A_{sb} * n$	=	2.54 in^2
Check Validity=	$IF(A_{sc\_Prov} \geq A_{sc\_Req}$; "Valid"; "Invalid")	=	Valid

Check Tension Controlled

Depth of Rectangular Stress Block, a=	$\frac{A_{sc\_Prov} * f_y}{0.85 * f'_c * b}$	=	3.74 in
Distance from Extreme Compression Fiber to Neutral Axis, $c= a/\beta_1$		=	4.40 in
c/d =	c / d = 4.40 / 13.5	=	0.326
IF(c/d>0.375; "Add Com. RFT"; "Tension Controlled") =			Tension Controlled

Design Summary

Required Area of Reinforcement, $A_{sc}=$	A_{sc_Prov}	=	2.54 in^2