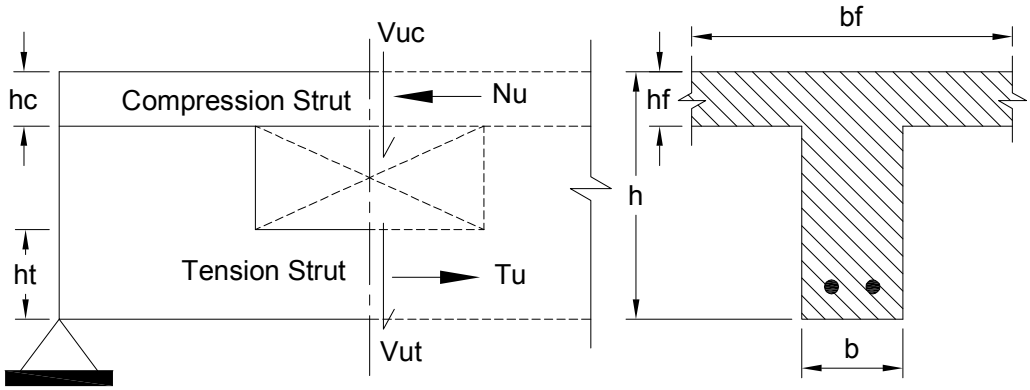
Check Shear Reinforcement at Opening as per ACI 318-11 Chapter 11



System

Width of Beam, b=	4.3 in
Width of Top Flange, b_f=	48.0 in
Height of Beam, h=	26.0 in
Height of Compression Strut, h_c=	4.0 in
Height of Tension Strut, h_t=	12.0 in

Load

Ultimate Shear Force at Center of Opening, V_u=	7.2 kips
Ultimate Axial Tension Force in Tension Strut, T_u=	-10.8 kips
Ultimate Axial Compression Force in Compression Strut, N_u=	60.0 kips
Ultimate Shear Force in Tension Strut, V_{ut}=	6.0 kips
Ultimate Shear Force in Compression Strut, V_{uc}=	5.4 kips

Material Properties

Concrete Strength for Beam, f'_{c1}=	6000 psi
Concrete Strength for Topping, f'_{c2}=	3000 psi
Yield Strength of Reinforcement, f_y=	60000 psi
Shear Strength Reduction Factor (According to Cl.9.3.2 of ACI318), Φ=	0.75
Modification Factor for Lightweight Concrete, λ=	1.00

Calculation of Required Shear Reinforcement

Required Shear RFT, A_{v_Req}=	$\frac{V_u}{\Phi * fy / 1000}$	=	0.16 in^2
Identification of, Bar=	SEL("ACI/Bar" ;Bar;)	=	No.3
Provided Reinforcement, A_{sb}=	TAB("ACI/Bar"; Asb; Bar=Bar)	=	0.11 in^2
Number of Bars, n=			2
Provided Shear Reinforcement, A_{v_Prov}=	n * A_{sb}	=	0.22 in^2
Check Validity=	IF($A_{v\_Prov} \geq A_{v\_Req}$; "Valid"; "Invalid")	=	Valid

Calculation of Shear Reinforcement of Tensile Strut

Strut Depth, d_t=	$0.8 * h_t$	=	9.6 in

Concrete Shear Strength for Tensile Strut (According to Eq.11-8 of ACI318),

V_{ct}=	$2*\left(1+\frac{T_u*1000}{500*b*h_t}\right)*\lambda*\frac{\sqrt{f'_{c1}}}{1000}*b*d_t$	=	3.72 kips
Shear Reinforcement for Ten. Strut=IF($V_{ut}\leq\Phi*V_{ct}$;"Not Required";"Required")		=	Required

Spacing between Stirrups (According to Cl.11.4.5.1 of ACI318),

s=	$0.75 * h_t$	=	9.00 in
Required RFT Area, A_{vt_Req}=	$\frac{(V_{ut}-\Phi*V_{ct})*s}{\Phi*f_y*d_t/1000}$	=	0.07 in^2
Identification of, Bar=	SEL("ACI/Bar" ;Bar;)	=	No.3
Provided Reinforcement, A_{sb}=	TAB("ACI/Bar"; Asb; Bar=Bar)	=	0.11 in^2
Number of Bars, n=			1
Provided Shear Reinforcement, A_{vt_Prov}= n * A_{sb}		=	0.11 in^2
Check Validity=	IF($A_{vt\_Prov}\geq A_{vt\_Req}$; "Valid"; "Invalid")	=	Valid

Calculation of Shear Reinforcement of Compression Strut

Strut Depth, d_c=	$0.8 * h_c$	=	3.2 in

Concrete Shear Strength for Tensile Strut (According to Eq.11-8 of ACI318),

V_{cc}=	$2*\left(1+\frac{N_u*1000}{2000*b_f*h_c}\right)*\lambda*\frac{\sqrt{f'_{c2}}}{1000}*b_f*d_c$	=	19.46 kips
Shear Reinforcement for Comp. Strut=IF($V_{uc}\leq\Phi*V_{cc}$;"Not Required";"Required")		=	Not Required

Spacing between Stirrups (According to Cl.11.4.5.1 of ACI318),

s=	$0.75 * h_c$	=	3.00 in
Required RFT Area, A_{vc_Req}=	$\frac{(V_{uc}-\Phi*V_{cc})*s}{\Phi*f_y*d_c/1000}$	=	-0.19 in^2
Identification of, Bar=	SEL("ACI/Bar" ;Bar;)	=	No.3
Provided Reinforcement, A_{sb}=	TAB("ACI/Bar"; Asb; Bar=Bar)	=	0.11 in^2
Number of Bars, n=			1
Provided Shear Reinforcement, A_{vc_Prov}= n * A_{sb}		=	0.11 in^2
Check Validity=	IF($A_{vc\_Prov}\geq A_{vc\_Req}$; "Valid"; "Invalid")	=	Valid

Design Summary

Shear Reinforcement for Beam, A_{v_Prov}=	A_{v_Prov}	=	0.22 in
Shear Reinforcement for Ten. Strut, A_{vt_Prov}=	IF($V_{ut}\leq\Phi*V_{ct}$;"Zero" ; A_{vt_Prov})	=	0.11 in^2
Shear Reinforcement for Com. Strut, A_{vc_Prov}=	IF($V_{uc}\leq\Phi*V_{cc}$;"Zero" ; A_{vc_Prov})	=	Zero