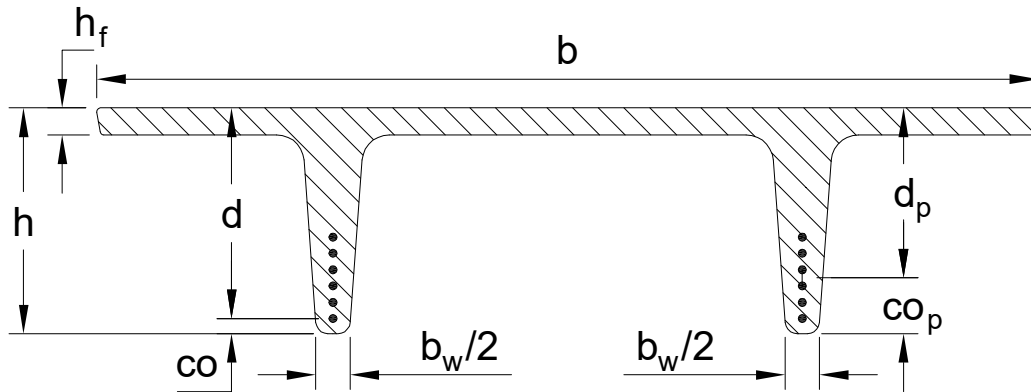




Tension Controlled Limit for Prestressed Flexural Member as per ACI 318-11 Chapters 10 & 18



System

Width of Concrete Double Tee Section, b=		84.0 in
Width of Web of Concrete Double Tee Section, b _w =		15.5 in
Depth of Concrete Double Tee Section, h=		32.0 in
Thickness of Concrete Top Slab, h _f =		2.0 in
Concrete Cover, co=		2.0 in
Concrete Cover to CG of Prestressed Steel, co _p =		4.5 in
Effective Depth of Concrete Section, d=	h - co	= 30.0 in
Effective Depth of Concrete Section, d _p =	h - co _p	= 27.5 in
Number of Strands, n=		22.0
Area of One Strand, A _s =		0.153 in ²

Material Properties

Concrete Strength, f' _c =		5000 psi
Tensile Strength of Prestressed Steel, f _{pu} =		270000 psi
Yield Strength of Prestressed Steel, f _{py} =	0.9 * f _{pu}	= 243000 psi
Factor for Type of Prestressing Steel (According to Cl.18.7.2 of ACI318), γ _p =		0.28
Factor for Rectangular Compressive Stress Block (According to Cl.10.2.7.3 of ACI318),		
β ₁ =	IF(f' _c ≤ 4000; 0.85; IF(f' _c ≥ 8000; 0.65; 1.05 - 0.00005 * f' _c))	= 0.80

Calculation of Stress in Prestressed Reinforcement

$$\omega_{pu} = \frac{(n * A_s) * f_{pu}}{(b * d_p * f_c)} = 0.079$$

Prestressing Force (According to Eq.18-1 of ACI318),

$$f_{ps} = f_{pu} * \left(1 - \frac{\gamma_p}{\beta_1} * \omega_{pu} \right) = 262535 \text{ psi}$$

Area of Reinforcement for Compression in Flange,

$$A_{pf} = \frac{0.85 * h_f * f_c * (b - b_w)}{f_{pu}} = 2.16 \text{ in}^2$$

Calculation of Depth of Concrete Stress Block



$$a_i = \frac{(n * A_s) * f_{ps}}{(0.85 * b * f_c)} = 2.48 \text{ in}$$

For $a_i > h_f$:

$$a_1 = \frac{(n * A_s - A_{pt}) * f_{ps}}{(0.85 * b_w * f_c)} = 4.81 \text{ in}$$

For $a_i \leq h_f$:

$$a_2 = a_i = 2.48 \text{ in}$$

$$a = \text{IF}(a_i > h_f; a_1; a_2) = 4.81 \text{ in}$$

$$c = a / \beta_1 = 6.01 \text{ in}$$

Check Tension Controlled

$$c/d = c / d = 0.200$$

$$\text{IF}(c/d > 0.375; \text{"Compression Controlled"}; \text{"Tension Controlled"}) = \text{Tension Controlled}$$

Calculation Summary

Type of Section:

$$\text{IF}(c/d > 0.375; \text{"Compression Controlled"}; \text{"Tension Controlled"}) = \text{Tension Controlled}$$