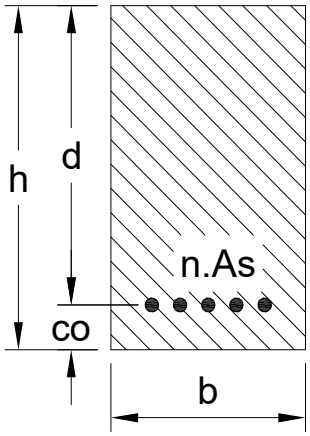
Flexural Strength of Prestressed Member Using Approximate Value of f_{ps}

As per ACI 318-11 Chapters 10 & 18



System

Width of Concrete Section, b=		12.0 in
Depth of Concrete Section, h=		24.0 in
Concrete Cover, co=		2.0 in
Effective Depth of Concrete Section, d= h - co = 24.0 - 2.0	=	22.0 in
Number of Strands, n=		6
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($f'_c \le 4000$;0.85;IF($f'_c \ge 8000$;0.65;1.05-0.00005*f'_c))	=	0.80

Calculation of Stress for Prestressed Reinforcement

Prestressed Reinforcement Ratio, ρ_p= n * A_s / (b * d)		=0.00348
Prestressing Force (According to Eq. 18-1 of ACI318),		
f_{ps}= $\frac{f_{pu}}{1000} * \left(1 - \frac{\gamma_p}{\beta_1} * \rho_p * \frac{f_{pu}}{f'_c}\right)$	=	252 ksi

Calculation of Nominal Moment Strength

Distance of Compression Block, a= $\frac{n * A_s * f_{ps}}{0.85 * b * f'_c / 1000}$	=	4.54 in
Nominal Moment Strength, M_n= $\frac{n * A_s * f_{ps}}{12} * \left(d - \frac{a}{2}\right)$	=	380.4 kip*ft

Calculation Summary

Nominal Moment Strength, M_n= M_n = 380.4 kip*ft