



# Transmission of Prestress Formulas

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Conversions!

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### **List of 15 Transmission of Prestress Formulas**

#### **Transmission of Prestress**

#### Post-Tensioned Members

1) Allowable Bearing Stress in Local Zone

$$\mathbf{F}_{\mathrm{p}} = 0.48 \cdot \mathrm{f_{ci}} \cdot \sqrt{rac{\mathrm{A_{b}}}{\mathrm{A_{pun}}}}$$

Open Calculator 🗗

$$0.455605 ext{MPa} = 0.48 \cdot 15.5 ext{N/mm}^2 \cdot \sqrt{rac{30 ext{mm}^2}{0.008 ext{m}^2}}$$

2) Allowable Stress given End Zone Reinforcement

$$\sigma_{al} = rac{2.5 \cdot M_t}{A_{st} \cdot h}$$

Open Calculator

ex 
$$0.013718 \mathrm{N/m^2} = rac{2.5 \cdot 0.03 \mathrm{N^*m}}{0.272 \mathrm{m^2} \cdot 20.1 \mathrm{cm}}$$



#### 3) Bearing Stress in Local Zone

$$f_{
m br} = rac{F}{A_{
m pun}}$$

Open Calculator 🗗

$$= \frac{400 kN}{0.008 m^2}$$

#### 4) Bursting Force for Square End Zone

$$\mathbf{F}_{\mathrm{bst}} = \mathrm{F} \cdot \left(0.32 - 0.3 \cdot \left(rac{\mathrm{Y}_{\mathrm{po}}}{\mathrm{Y}_{\mathrm{o}}}
ight)
ight)$$

Open Calculator

$$\texttt{ex} \ 68 \text{kN} = 400 \text{kN} \cdot \left(0.32 - 0.3 \cdot \left(\frac{5.0 \text{cm}}{10 \text{cm}}\right)\right)$$

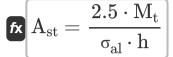
#### 5) Cube Strength at Transfer given Allowable Bearing Stress

$$\mathbf{f_{ci}} = rac{\mathbf{F_p}}{0.48 \cdot \sqrt{rac{\mathbf{A_b}}{\mathbf{A_{pun}}}}}$$

ex 
$$16.67014 \mathrm{N/mm^2} = rac{0.49 \mathrm{MPa}}{0.48 \cdot \sqrt{rac{30 \mathrm{mm^2}}{0.008 \mathrm{m^2}}}}$$



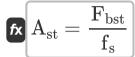
#### 6) End Zone Reinforcement along Transmission Length



Open Calculator 🗗

$$= \frac{2.5 \cdot 0.03 N^* m}{27 N/m^2 \cdot 20.1 cm}$$

#### 7) End Zone Reinforcement in each Direction 🖸



Open Calculator

$$m ex = 0.272m^2 = rac{68kN}{250N/mm^2}$$

# 8) Length of Side of Bearing Plate given Bursting Force for Square End Zone

$$\mathbf{Y}_{\mathrm{po}} = - \left(rac{\left(rac{\mathrm{F}_{\mathrm{bst}}}{\mathrm{F}}
ight) - 0.32}{0.3}
ight) \cdot \mathrm{Y}_{\mathrm{o}}$$

Open Calculator

$$\mathbf{ex} \left[ 5 \mathrm{cm} = - \left( rac{\left( rac{68 \mathrm{kN}}{400 \mathrm{kN}} 
ight) - 0.32}{0.3} 
ight) \cdot 10 \mathrm{cm} 
ight]$$



#### 9) Prestress in Tendon given Bearing Stress

## $\mathbf{f}_{\mathbf{x}} \mathbf{F} = \mathbf{f}_{\mathrm{br}} \cdot \mathbf{A}_{\mathrm{pun}}$

Open Calculator 2

 $400 \mathrm{kN} = 50 \mathrm{N/mm^2 \cdot 0.008m^2}$ 



Open Calculator 2

Open Calculator

 $\mathrm{F} = rac{\mathrm{F}_{\mathrm{bst}}}{0.32 - 0.3 \cdot \left(rac{\mathrm{Y}_{\mathrm{po}}}{\mathrm{Y}_{\mathrm{o}}}
ight)}$ 

ex  $400 \mathrm{kN} = \frac{68 \mathrm{kN}}{0.32 - 0.3 \cdot (\frac{5.0 \mathrm{cm}}{10 \mathrm{cm}})}$ 

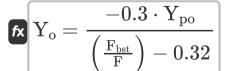
# 11) Stress in Transverse Reinforcement given End Zone Reinforcement



 $f_{
m s} = rac{F_{
m bst}}{\Lambda}$ 

=  $250 \text{N/mm}^2 = \frac{68 \text{kN}}{0.272 \text{m}^2}$ 

#### 12) Transverse Dimension of End Zone given Bursting Force for Square End Zone

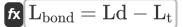


ex 
$$10 ext{cm} = rac{-0.3 \cdot 5.0 ext{cm}}{\left(rac{68 ext{kN}}{400 ext{kN}}
ight) - 0.32}$$



#### Pre-Tensioned Members

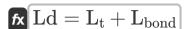
13) Bond Length given Development Length of Section 🗗



Open Calculator

4.9 cm = 550 mm - 50.1 cm

14) Development Length of Section



Open Calculator

551 mm = 50.1 cm + 5 cm

15) Transmission Length given Development Length of Section

fx  $m L_t = Ld - L_{bond}$ 

Open Calculator 🚰



#### Variables Used

- A<sub>b</sub> Bearing Area Between Screw and Nut (Square Millimeter)
- Apun Punching Area (Square Meter)
- Ast End Zone Reinforcement (Square Meter)
- **F** Prestressing Force (Kilonewton)
- f<sub>br</sub> Bearing Stress (Newton per Square Millimeter)
- **F**<sub>bst</sub> Prestress Bursting force (*Kilonewton*)
- fci Cube Strength (Newton per Square Millimeter)
- F<sub>p</sub> Allowable Bearing Stress in Members (Megapascal)
- **f**<sub>s</sub> Stress in Transverse Reinforcement (Newton per Square Millimeter)
- **h** Total Depth (Centimeter)
- Lbond Bond Length (Centimeter)
- Lt Transmission Length (Centimeter)
- Ld Prestress Development Length (Millimeter)
- M<sub>t</sub> Moment in Structures (Newton Meter)
- Yo Traverse Dimension of End Zone (Centimeter)
- Ypo Side Length of Bearing Plate (Centimeter)
- σ<sub>al</sub> Allowable Stress (Newton per Square Meter)





#### Constants, Functions, Measurements used

- Function: sqrt, sqrt(Number) Square root function
- Measurement: Length in Centimeter (cm), Millimeter (mm)
  Length Unit Conversion
- Measurement: Area in Square Millimeter (mm²), Square Meter (m²)

  Area Unit Conversion
- Measurement: Pressure in Megapascal (MPa), Newton per Square Millimeter (N/mm²), Newton per Square Meter (N/m²)
   Pressure Unit Conversion
- Measurement: Energy in Newton Meter (N\*m)

  Energy Unit Conversion
- Measurement: Force in Kilonewton (kN)

  Force Unit Conversion





#### **Check other formula lists**

- Analysis of Prestressing and Bending Stresses Formulas
- Crack Width and Deflection of Prestress Concrete Members
   Formulas
- General Principles of Prestressed Concrete Formulas
- Transmission of Prestress
   Formulas

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