

Important Transmission of Prestress Formulas PDF



Formulas
Examples
with Units

List of 15 Important Transmission of Prestress Formulas

1) Post-Tensioned Members Formulas

1.1) Allowable Bearing Stress in Local Zone Formula

Formula

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

Example with Units

$$0.4556 \text{ MPa} = 0.48 \cdot 15.5 \text{ N/mm}^2 \cdot \sqrt{\frac{30 \text{ mm}^2}{0.008 \text{ m}^2}}$$

Evaluate Formula

1.2) Allowable Stress given End Zone Reinforcement Formula

Formula

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

Example with Units

$$0.0137 \text{ N/mm}^2 = \frac{2.5 \cdot 0.03 \text{ N} \cdot \text{m}}{0.272 \text{ m}^2 \cdot 20.1 \text{ cm}}$$

Evaluate Formula

1.3) Bearing Stress in Local Zone Formula

Formula

$$f_{br} = \frac{F}{A_{pun}}$$

Example with Units

$$50 \text{ N/mm}^2 = \frac{400 \text{ kN}}{0.008 \text{ m}^2}$$

Evaluate Formula

1.4) Bursting Force for Square End Zone Formula

Formula

$$F_{bst} = F \cdot \left(0.32 - 0.3 \cdot \left(\frac{Y_{po}}{Y_o} \right) \right)$$

Example with Units

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

Evaluate Formula

1.5) Cube Strength at Transfer given Allowable Bearing Stress Formula

Formula

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

Example with Units

$$16.6701 \text{ N/mm}^2 = \frac{0.49 \text{ MPa}}{0.48 \cdot \sqrt{\frac{30 \text{ mm}^2}{0.008 \text{ m}^2}}}$$

Evaluate Formula



1.6) End Zone Reinforcement along Transmission Length Formula

Formula

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

Example with Units

$$0.0001 \text{ m}^2 = \frac{2.5 \cdot 0.03 \text{ N}^*\text{m}}{27 \text{ N/mm}^2 \cdot 20.1 \text{ cm}}$$

Evaluate Formula 

1.7) End Zone Reinforcement in each Direction Formula

Formula

$$A_{st} = \frac{F_{bst}}{f_s}$$

Example with Units

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

Evaluate Formula 

1.8) Length of Side of Bearing Plate given Bursting Force for Square End Zone Formula

Formula

$$Y_{po} = - \left(\frac{\left(\frac{F_{bst}}{F} \right) - 0.32}{0.3} \right) \cdot Y_o$$

Example with Units

$$5 \text{ cm} = - \left(\frac{\left(\frac{68 \text{ kN}}{400 \text{ kN}} \right) - 0.32}{0.3} \right) \cdot 10 \text{ cm}$$

Evaluate Formula 

1.9) Prestress in Tendon given Bearing Stress Formula

Formula

$$F = f_{br} \cdot A_{pun}$$

Example with Units

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

Evaluate Formula 

1.10) Prestress in Tendon given Bursting Force for Square End Zone Formula

Formula

$$F = \frac{F_{bst}}{0.32 - 0.3 \cdot \left(\frac{Y_{po}}{Y_o} \right)}$$

Example with Units

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

Evaluate Formula 

1.11) Stress in Transverse Reinforcement given End Zone Reinforcement Formula

Formula

$$f_s = \frac{F_{bst}}{A_{st}}$$

Example with Units

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

Evaluate Formula 

1.12) Transverse Dimension of End Zone given Bursting Force for Square End Zone Formula

Formula

$$Y_o = \frac{-0.3 \cdot Y_{po}}{\left(\frac{F_{bst}}{F} \right) - 0.32}$$

Example with Units

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

Evaluate Formula 



2) Pre-Tensioned Members Formulas

2.1) Bond Length given Development Length of Section Formula

Formula

$$L_{\text{bond}} = L_d - L_t$$

Example with Units

$$4.9 \text{ cm} = 550 \text{ mm} - 50.1 \text{ cm}$$

Evaluate Formula 

2.2) Development Length of Section Formula

Formula

$$L_d = L_t + L_{\text{bond}}$$

Example with Units

$$551 \text{ mm} = 50.1 \text{ cm} + 5 \text{ cm}$$

Evaluate Formula 

2.3) Transmission Length given Development Length of Section Formula

Formula

$$L_t = L_d - L_{\text{bond}}$$

Example with Units

$$50 \text{ cm} = 550 \text{ mm} - 5 \text{ cm}$$

Evaluate Formula 



Variables used in list of Transmission of Prestress Formulas above

- **A_b** Bearing Area Between Screw and Nut
(Square Millimeter)
- **A_{pun}** Punching Area (Square Meter)
- **A_{st}** End Zone Reinforcement (Square Meter)
- **F** Prestressing Force (Kilonewton)
- **f_{br}** Bearing Stress (Newton per Square Millimeter)
- **F_{bst}** Prestress Bursting force (Kilonewton)
- **f_{ci}** Cube Strength (Newton per Square Millimeter)
- **F_p** Allowable Bearing Stress in Members
(Megapascal)
- **f_s** Stress in Transverse Reinforcement (Newton per Square Millimeter)
- **h** Total Depth (Centimeter)
- **L_{bond}** Bond Length (Centimeter)
- **L_t** Transmission Length (Centimeter)
- **L_d** Prestress Development Length (Millimeter)
- **M_t** Moment in Structures (Newton Meter)
- **Y_o** Traverse Dimension of End Zone (Centimeter)
- **Y_{po}** Side Length of Bearing Plate (Centimeter)
- **σ_{al}** Allowable Stress (Newton per Square Meter)

Constants, Functions, Measurements used in list of Transmission of Prestress Formulas above

- **Functions:** **sqrt**, sqrt(Number)
A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- **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 



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