Important Estimation of Effective Length of Columns Formulas PDF

Formulas
Examples
with Units

List of 18
Important Estimation of Effective Length of Columns Formulas

1) Actual Length given Slenderness Ratio Formula

Evaluate Formula

Formula

$$L = \lambda \cdot r$$

Example with Units

$$5000\,\text{mm} = 100 \cdot 50\,\text{mm}$$

2) Actual Length of Column given Effective Length if Both Ends of Column are Fixed Formula

Evaluate Formula

Formula

$$L = 2 \cdot L_e$$

Example with Units

$$5000\,\text{mm} = 2 \cdot 2500\,\text{mm}$$

3) Actual Length of Column given Effective Length if One End is Fixed Other is Free Formula

Evaluate Formula

Formula

$$L = \frac{L_e}{2}$$

Example with Units

$$1250\,\text{mm} = \frac{2500\,\text{mm}}{2}$$

4) Actual Length of Column given Effective Length if One End is Fixed Other is Hinged Formula

Evaluate Formula

Formula

$$L = \sqrt{2} \cdot L_e$$

Example with Units

$$3535.5339\,\text{mm} = \sqrt{2} \cdot 2500\,\text{mm}$$

5) Effective Length of Column given Actual Length if Both Ends of Column are Fixed Formula

Evaluate Formula

Formula

$$L_e = \frac{L}{2}$$

Example with Units

$$2500\,\text{mm} = \frac{5000\,\text{mm}}{2}$$

6) Effective Length of Column given Actual Length if One End is Fixed Other is Free Formula

Evaluate Formula

Formula

$$L_e = 2 \cdot L$$

Example with Units

$$10000\,\text{mm} = 2 \cdot 5000\,\text{mm}$$

7) Effective Length of Column given Actual Length if One End is Fixed Other is Hinged Formula

Evaluate Formula

Formula

$$L_e = \frac{L}{\sqrt{2}}$$

Example with Units

$$3535.5339\,\text{mm} = \frac{5000\,\text{mm}}{\sqrt{2}}$$

8) Effective Length of Column given Crippling Load for any type of End Condition Formula

Evaluate Formula

Formula

$$L_e = \sqrt{\frac{\pi^2 \cdot \varepsilon_c \cdot I}{P_{cr}}}$$

Example with Units

$$2500.6762\,\text{mm} = \sqrt{\frac{3.1416^2 \cdot 10.56\,\text{MPa} \cdot 60000\,\text{cm}^4}{10000\,\text{N}}}$$

9) Effective Length of Column given Crippling Stress Formula

Evaluate Formula

Formula

$$L_e = \sqrt{\frac{\pi^2 \cdot \varepsilon_c \cdot r^2}{\sigma_{crippling}}}$$

Example with Units

$$3609.4152\,\text{mm} = \sqrt{\frac{3.1416^2 \cdot 10.56\,\text{MPa} \cdot 50\,\text{mm}^2}{0.02\,\text{MPa}}}$$

10) Least Radius of Gyration given Slenderness Ratio Formula

Evaluate Formula

Formula

$$r = \frac{L}{\lambda}$$

Example with Units

$$50\,\text{mm} = \frac{5000\,\text{mm}}{100}$$

11) Modulus of Elasticity given Crippling Load for any type of End Condition Formula

Evaluate Formula

Formula

$$\varepsilon_c = \frac{P_{cr} \cdot L_e^2}{\pi^2 \cdot I}$$

Example with Units

$$10.5543\,\text{MPa} = \frac{10000\,\text{N} \cdot 2500\,\text{mm}^2}{3.1416^2 \cdot 60000\,\text{cm}^4}$$

12) Modulus of Elasticity of Column given Crippling Stress Formula

Evaluate Formula

Formula

$$\varepsilon_c = \frac{\sigma_{crippling} \cdot L_e^2}{\pi^2 \cdot r^2}$$

Example with Units

$$5.0661\,\text{MPa} = \frac{0.02\,\text{MPa} \cdot 2500\,\text{mm}^2}{3.1416^2 \cdot 50\,\text{mm}^2}$$

13) Moment of Inertia given Crippling Load for any type of End Condition Formula

Evaluate Formula

Formula

$$I = \frac{P_{cr} \cdot L_e^2}{\pi^2 \cdot \varepsilon_c}$$

Example with Units

$$59967.5566\,\text{cm}^4 = \frac{10000\,\text{N} \cdot 2500\,\text{mm}^2}{3.1416^2 \cdot 10.56\,\text{MPa}}$$

14) Radius of Gyration given Effective Length and Crippling Load Formula

Evaluate Formula

Formula

$$r = \sqrt{\frac{P_{cr} \cdot L_e^2}{\pi^2 \cdot \varepsilon_c \cdot A}}$$

Example with Units

$$9.7953\,\text{mm} = \sqrt{\frac{10000\,\text{N} \cdot 2500\,\text{mm}^2}{3.1416^2 \cdot 10.56\,\text{MPa} \cdot 6.25\,\text{m}^2}}$$

15) Crippling Load Formulas

15.1) Crippling Load for any type of End Condition Formula

Evaluate Formula

Formula

$$P_{cr} = \frac{\pi^2 \cdot \varepsilon_c \cdot I}{L_e^2}$$

Example with Units

$$10005.4102\,\text{N} = \frac{3.1416^2 \cdot 10.56\,\text{MPa} \cdot 60000\,\text{cm}^4}{2500\,\text{mm}^2}$$

15.2) Crippling Load given Effective Length and Radius of Gyration Formula

Evaluate Formula

Formula

$$P_{cr} = \frac{\pi^2 \cdot \varepsilon_c \cdot A \cdot r^2}{L_e^2}$$

Example with Units

$$260557.5562\,\text{N} = \frac{3.1416^2 \cdot 10.56\,\text{MPa} \cdot 6.25\,\text{m}^2 \cdot 50\,\text{mm}^2}{2500\,\text{mm}^2}$$

15.3) Crippling Stress Formula

Evaluate Formula

Formula

$$\sigma_{crippling} = \frac{\pi^2 \cdot \varepsilon_c \cdot r^2}{L_e^2}$$

Example with Units

$$0.0417\,\text{MPa} = \frac{3.1416^2 \cdot 10.56\,\text{MPa} \cdot 50\,\text{mm}^2}{2500\,\text{mm}^2}$$

15.4) Crippling Stress given Crippling Load Formula

Evaluate Formula

Formula

$$\sigma_{crippling} = \frac{P_{cr}}{A}$$

Example with Units

$$0.0016\,\text{MPa} = \frac{10000\,\text{N}}{6.25\,\text{m}^2}$$

Variables used in list of Estimation of Effective Length of Columns Formulas above

- **A** Column Cross-Sectional Area *(Square Meter)*
- **I** Moment of Inertia Column *(Centimeter⁴)*
- **L** Length of Column *(Millimeter)*
- L_e Effective Length of Column *(Millimeter)*
- P_{cr} Column Crippling Load *(Newton)*
- **r** Least Radius of Gyration of Column *(Millimeter)*
- ε_c Modulus of Elasticity of Column *(Megapascal)*
- **λ** Slenderness Ratio
- $\sigma_{crippling}$ Crippling Stress *(Megapascal)*

Constants, Functions, Measurements used in list of Estimation of Effective Length of Columns Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- 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 Millimeter (mm) *Length Unit Conversion*
- Measurement: **Area** in Square Meter (m²) *Area Unit Conversion*
- Measurement: **Pressure** in Megapascal (MPa) *Pressure Unit Conversion*
- Measurement: **Force** in Newton (N) *Force Unit Conversion*
- Measurement: **Second Moment of Area** in Centimeter⁴ (cm⁴) *Second Moment of Area Unit Conversion*

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