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Number of Connectors in Bridges Formulas

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List of 29 Number of Connectors in Bridges Formulas

Number of Connectors in Bridges

1) 28-day Compressive Strength of Concrete given Force in Slab

Open Calculator

fx $$f_c = \frac{P_{on\ slab}}{0.85 \cdot A_{concrete}}$$

ex $$15\text{MPa} = \frac{245\text{kN}}{0.85 \cdot 19215.69\text{mm}^2}$$

2) Area of Longitudinal Reinforcing given Force in Slab at Maximum Negative Moments

Open Calculator

fx $$A_{st} = \frac{P_{on\ slab}}{f_y}$$

ex $$980\text{mm}^2 = \frac{245\text{kN}}{250\text{MPa}}$$

3) Effective Concrete Area given Force in Slab

Open Calculator

fx $$A_{concrete} = \frac{P_{on\ slab}}{0.85 \cdot f_c}$$

ex $$19215.69\text{mm}^2 = \frac{245\text{kN}}{0.85 \cdot 15\text{MPa}}$$

4) Force in Slab at Maximum Negative Moments given Minimum Number of Connectors for Bridges

Open Calculator

fx $$P_3 = N \cdot \Phi \cdot S_{ultimate} - P_{on\ slab}$$

ex $$10\text{kN} = 15.0 \cdot 0.85 \cdot 20.0\text{kN} - 245\text{kN}$$

5) Force in Slab at Maximum Negative Moments given Reinforcing Steel Yield Strength

Open Calculator

fx $$P_{on\ slab} = A_{st} \cdot f_y$$

ex $$245\text{kN} = 980\text{mm}^2 \cdot 250\text{MPa}$$

6) Force in Slab at Maximum Positive Moments given Minimum Number of Connectors for Bridges

Open Calculator

$$P_{\text{on slab}} = N \cdot \Phi \cdot S_{\text{ultimate}} - P_3$$

$$245\text{kN} = 15.0 \cdot 0.85 \cdot 20.0\text{kN} - 10\text{kN}$$

7) Force in Slab given Effective Concrete Area

Open Calculator

$$P_{\text{on slab}} = 0.85 \cdot A_{\text{concrete}} \cdot f_c$$

$$245\text{kN} = 0.85 \cdot 19215.69\text{mm}^2 \cdot 15\text{MPa}$$

8) Force in Slab given Number of Connectors in Bridges

Open Calculator

$$P_{\text{on slab}} = N \cdot \Phi \cdot S_{\text{ultimate}}$$

$$255\text{kN} = 15.0 \cdot 0.85 \cdot 20.0\text{kN}$$

9) Force in Slab given Total Area of Steel Section

Open Calculator

$$P_{\text{on slab}} = A_{\text{st}} \cdot f_y$$

$$245\text{kN} = 980\text{mm}^2 \cdot 250\text{MPa}$$

10) Minimum Number of Connectors for Bridges

Open Calculator

$$N = \frac{P_{\text{on slab}} + P_3}{\Phi \cdot S_{\text{ultimate}}}$$

$$15 = \frac{245\text{kN} + 10\text{kN}}{0.85 \cdot 20.0\text{kN}}$$

11) Number of Connectors in Bridges

Open Calculator

$$N = \frac{P_{\text{on slab}}}{\Phi \cdot S_{\text{ultimate}}}$$

$$14.41176 = \frac{245\text{kN}}{0.85 \cdot 20.0\text{kN}}$$

12) Reduction Factor given Minimum Number of Connectors in Bridges

Open Calculator

$$\Phi = \frac{P_{\text{on slab}} + P_3}{S_{\text{ultimate}} \cdot N}$$

$$0.85 = \frac{245\text{kN} + 10\text{kN}}{20.0\text{kN} \cdot 15.0}$$

13) Reduction Factor given Number of Connectors in Bridges

Open Calculator

$$\Phi = \frac{P_{\text{on slab}}}{N \cdot S_{\text{ultimate}}}$$

$$0.816667 = \frac{245\text{kN}}{15.0 \cdot 20.0\text{kN}}$$

14) Reinforcing Steel Yield Strength given Force in Slab at Maximum Negative Moments

Open Calculator

$$f_y = \frac{P_{\text{on slab}}}{A_{st}}$$

$$250\text{MPa} = \frac{245\text{kN}}{980\text{mm}^2}$$

15) Steel Yield Strength given Total Area of Steel Section

Open Calculator

$$f_y = \frac{P_{\text{on slab}}}{A_{st}}$$

$$250\text{MPa} = \frac{245\text{kN}}{980\text{mm}^2}$$

16) Total Area of Steel Section given Force in Slab

Open Calculator

$$A_{st} = \frac{P_{\text{on slab}}}{f_y}$$

$$980\text{mm}^2 = \frac{245\text{kN}}{250\text{MPa}}$$

17) Ultimate Shear Connector Strength given Minimum Number of Connectors in Bridges

Open Calculator

$$S_{ultimate} = \frac{P_{on\ slab} + P_3}{\Phi \cdot N}$$

$$20\text{kN} = \frac{245\text{kN} + 10\text{kN}}{0.85 \cdot 15.0}$$

18) Ultimate Shear Connector Strength given Number of Connectors in Bridges

Open Calculator

$$S_{ultimate} = \frac{P_{on\ slab}}{N \cdot \Phi}$$

$$19.21569\text{kN} = \frac{245\text{kN}}{15.0 \cdot 0.85}$$

Shear Strength Design for Bridges

19) Shear Capacity for Flexural Members

Open Calculator

$$V_u = 0.58 \cdot f_y \cdot d \cdot bw \cdot C$$

$$7830\text{kN} = 0.58 \cdot 250\text{MPa} \cdot 200\text{mm} \cdot 300\text{mm} \cdot 0.90$$

20) Shear Capacity for Girders with Transverse Stiffeners

Open Calculator

$$V_u = 0.58 \cdot f_y \cdot d \cdot bw \cdot \left(C + \left(\frac{1 - C}{\left(1.15 \cdot \left(1 + \left(\frac{a}{H} \right)^2 \right)^{0.5} \right)} \right) \right)$$

ex

$$8364.942\text{kN} = 0.58 \cdot 250\text{MPa} \cdot 200\text{mm} \cdot 300\text{mm} \cdot \left(0.90 + \left(\frac{1 - 0.90}{\left(1.15 \cdot \left(1 + \left(\frac{5\text{m}}{5.0\text{m}} \right)^2 \right)^{0.5} \right)} \right) \right)$$

Ultimate Shear Strength of Connectors in Bridges

21) 28-day Compressive Strength given Ultimate Shear Connector Strength for Welded Studs

Open Calculator

$$f_c = \frac{\left(\frac{S_{ultimate}}{0.4 \cdot d_{stud} \cdot d_{stud}}\right)^2}{E}$$

$$14.90116\text{MPa} = \frac{\left(\frac{20.0\text{kN}}{0.4 \cdot 64\text{mm} \cdot 64\text{mm}}\right)^2}{10.0\text{MPa}}$$

22) 28-day Compressive Strength of Concrete given Ultimate Shear Connector Strength for Channels

Open Calculator

$$f_c = \left(\frac{S_{ultimate}}{17.4 \cdot w \cdot \left(h + \frac{t_w}{2}\right)}\right)^2$$

$$15.44222\text{MPa} = \left(\frac{20.0\text{kN}}{17.4 \cdot 1500\text{mm} \cdot \left(150\text{mm} + \frac{90\text{mm}}{2}\right)}\right)^2$$

23) Average Channel Flange Thickness given Ultimate Shear Connector Strength for Channels

Open Calculator

$$h = \frac{S_{ultimate}}{17.4 \cdot w \cdot \left((f_c)^{0.5}\right)} - \frac{t_w}{2}$$

$$152.8536\text{mm} = \frac{20.0\text{kN}}{17.4 \cdot 1500\text{mm} \cdot \left((15\text{MPa})^{0.5}\right)} - \frac{90\text{mm}}{2}$$

24) Channel Length given Ultimate Shear Connector Strength for Channels

Open Calculator

$$w = \frac{S_{ultimate}}{17.4 \cdot \sqrt{f_c} \cdot \left(h + \frac{t_w}{2}\right)}$$

$$1521.95\text{mm} = \frac{20.0\text{kN}}{17.4 \cdot \sqrt{15\text{MPa}} \cdot \left(150\text{mm} + \frac{90\text{mm}}{2}\right)}$$

25) Channel Web Thickness given Ultimate Shear Connector Strength for Channels

Open Calculator

$$t_w = \left(\left(\frac{S_{ultimate}}{17.4 \cdot w \cdot \sqrt{f_c}}\right) - h\right) \cdot 2$$

$$95.70711\text{mm} = \left(\left(\frac{20.0\text{kN}}{17.4 \cdot 1500\text{mm} \cdot \sqrt{15\text{MPa}}}\right) - 150\text{mm}\right) \cdot 2$$

26) Diameter of connector given Ultimate Shear Connector Strength for Welded Studs

Open Calculator

$$d_{stud} = \sqrt{\frac{S_{ultimate}}{0.4 \cdot \sqrt{E \cdot f_c}}}$$

$$63.89431\text{mm} = \sqrt{\frac{20.0\text{kN}}{0.4 \cdot \sqrt{10.0\text{MPa} \cdot 15\text{MPa}}}}$$

27) Elastic Modulus of Concrete given Ultimate Shear Connector Strength for Welded Studs

Open Calculator

$$E = \left(\frac{\left(\frac{S_{ultimate}}{0.4 \cdot d_{stud} \cdot d_{stud}}\right)^2}{f_c}\right)$$

$$9.934107\text{MPa} = \left(\frac{\left(\frac{20.0\text{kN}}{0.4 \cdot 64\text{mm} \cdot 64\text{mm}}\right)^2}{15\text{MPa}}\right)$$

28) Ultimate Shear Connector Strength for Channels

Open Calculator

$$S_{ultimate} = 17.4 \cdot w \cdot \left((f_c)^{0.5}\right) \cdot \left(h + \frac{t_w}{2}\right)$$

$$19.71155\text{kN} = 17.4 \cdot 1500\text{mm} \cdot \left((15\text{MPa})^{0.5}\right) \cdot \left(150\text{mm} + \frac{90\text{mm}}{2}\right)$$

29) Ultimate Shear Strength for Welded Studs

Open Calculator

fx $S_{ultimate} = 0.4 \cdot d_{stud} \cdot d_{stud} \cdot \sqrt{E \cdot f_c}$

ex $20.06622\text{kN} = 0.4 \cdot 64\text{mm} \cdot 64\text{mm} \cdot \sqrt{10.0\text{MPa} \cdot 15\text{MPa}}$

Variables Used

- **a** Clear Distance between Transverse Stiffeners *(Meter)*
- **$A_{concrete}$** Effective Concrete Area *(Square Millimeter)*
- **A_{st}** Area of Steel Reinforcement *(Square Millimeter)*
- **bw** Breadth of Web *(Millimeter)*
- **C** Shear Buckling Coefficient C
- **d** Depth of Cross Section *(Millimeter)*
- **d_{stud}** Stud Diameter *(Millimeter)*
- **E** Modulus Elasticity of Concrete *(Megapascal)*
- **f_c** 28 Day Compressive Strength of Concrete *(Megapascal)*
- **f_y** Yield Strength of Steel *(Megapascal)*
- **h** Average Flange Thickness *(Millimeter)*
- **H** Cross Section's Height *(Meter)*
- **N** No of Connector in Bridge
- **P_3** Force in Slab at Negative Moment Point *(Kilonewton)*
- **$P_{on\ slab}$** Slab Force *(Kilonewton)*
- **$S_{ultimate}$** Ultimate Shear Connector Stress *(Kilonewton)*
- **t_w** Web Thickness *(Millimeter)*
- **V_u** Shear Capacity *(Kilonewton)*
- **w** Channel Length *(Millimeter)*
- **Φ** Reduction Factor

Constants, Functions, Measurements used

- Function: **sqrt**, sqrt(Number)
  Square root function
- Measurement: **Length** in Millimeter (mm), Meter (m)
  Length Unit Conversion
- Measurement: **Area** in Square Millimeter (mm²)
  Area Unit Conversion
- Measurement: **Pressure** in Megapascal (MPa)
  Pressure Unit Conversion
- Measurement: **Force** in Kilonewton (kN)
  Force Unit Conversion
- Measurement: **Stress** in Megapascal (MPa)
  Stress Unit Conversion

Check other formula lists

- Additional Bridge Column Formulas
- Allowable Stress Design for Bridges Formulas
- Bearing on Milled Surfaces and Bridge Fasteners Formulas
- Composite Construction in Highway Bridges Formulas
- Load Factor Design (LFD) Formulas
- Number of Connectors in Bridges Formulas
- Stiffeners on Bridge Girders Formulas
- Suspension Cables Formulas

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