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# Design of Two Way Slab System and Footing Formulas

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# List of 12 Design of Two Way Slab System and Footing Formulas

## Design of Two Way Slab System and Footing

## Design of Two Way Slab System

### 1) Concrete Shear Strength at Critical Sections

Open Calculator

fx $$V = \left(2 \cdot (f_c)^{\frac{1}{2}}\right) \cdot d' \cdot b_o$$

ex $$41.82822\text{Pa} = \left(2 \cdot (15\text{MPa})^{\frac{1}{2}}\right) \cdot 10\text{mm} \cdot 0.54\text{m}$$

### 2) Equation for Punching Shear Design

Open Calculator

fx $$\phi V_n = \varphi \cdot (V_c + V_s)$$

ex $$161.5\text{MPa} = 0.85 \cdot (90\text{MPa} + 100\text{MPa})$$

### 3) Maximum Slab thickness

Open Calculator

fx $$h = \left(\frac{l_n}{36}\right) \cdot \left(0.8 + \frac{fy_{steel}}{200000}\right)$$

ex $$3509.189\text{mm} = \left(\frac{101\text{mm}}{36}\right) \cdot \left(0.8 + \frac{250\text{MPa}}{200000}\right)$$

# Footing

## 4) Maximum Moment for Symmetrical Concrete Wall Footing

Open Calculator

fx $$M'max = \left(\frac{P}{8}\right) \cdot (b - t)^2$$

ex $$85.64106N*m = \left(\frac{11.76855Pa}{8}\right) \cdot (0.2m - 7.83m)^2$$

## 5) Tensile Bending Stress at Bottom when Footing is Deep

Open Calculator

fx $$B = \left(6 \cdot \frac{M}{D^2}\right)$$

ex $$12997.75N*mm = \left(6 \cdot \frac{500.5N}{(15.2m)^2}\right)$$

## 6) Uniform Pressure on Soil given Maximum Moment

Open Calculator

fx $$P = \frac{8 \cdot M'max}{(b - t)^2}$$

ex $$6.872231Pa = \frac{8 \cdot 50.01N*m}{(0.2m - 7.83m)^2}$$

# Partial Safety Factors for Loads

## 7) Basic Load Effect given Ultimate Strength for Applied Wind Loads

Open Calculator

$$\mathrm{DL} = \frac{\mathrm{U} - (1.3 \cdot \mathrm{W})}{0.9}$$

$$12.11111\mathrm{kN/m^2} = \frac{20\mathrm{kN/m^2} - (1.3 \cdot 7\mathrm{kN/m^2})}{0.9}$$

## 8) Basic Load Effect given Ultimate Strength for Unapplied Wind and Earthquake Loads

Open Calculator

$$\mathrm{DL} = \frac{\mathrm{U} - (1.7 \cdot \mathrm{LL})}{1.4}$$

$$8.214286\mathrm{kN/m^2} = \frac{20\mathrm{kN/m^2} - (1.7 \cdot 5\mathrm{kN/m^2})}{1.4}$$

## 9) Live Load Effect given Ultimate Strength for Unapplied Wind and Earthquake Loads

Open Calculator

$$\mathrm{LL} = \frac{\mathrm{U} - (1.4 \cdot \mathrm{DL})}{1.7}$$

$$3.521176\mathrm{kN/m^2} = \frac{20\mathrm{kN/m^2} - (1.4 \cdot 10.01\mathrm{kN/m^2})}{1.7}$$

## 10) Ultimate Strength when Wind and Earthquake Loads are not Applied

Open Calculator

$$U = (1.4 \cdot DL) + (1.7 \cdot LL)$$

$$22.514\text{kN/m}^2 = (1.4 \cdot 10.01\text{kN/m}^2) + (1.7 \cdot 5\text{kN/m}^2)$$

## 11) Ultimate Strength when Wind Loads are Applied

Open Calculator

$$U = (0.9 \cdot DL) + (1.3 \cdot W)$$

$$18.109\text{kN/m}^2 = (0.9 \cdot 10.01\text{kN/m}^2) + (1.3 \cdot 7\text{kN/m}^2)$$

## 12) Wind Load Effect given Ultimate Strength for Applied Wind Loads

Open Calculator

$$W = \frac{U - (0.9 \cdot DL)}{1.3}$$

$$8.454615\text{kN/m}^2 = \frac{20\text{kN/m}^2 - (0.9 \cdot 10.01\text{kN/m}^2)}{1.3}$$

## Variables Used

- **b** Width of Footing *(Meter)*
- **B** Tensile Bending Stress *(Newton Millimeter)*
- $b_o$ Perimeter of Critical Section *(Meter)*
- **d'** Distance from Compression to Centroid Reinforcment *(Millimeter)*
- **D** Depth of Footing *(Meter)*
- **DL** Dead Load *(Kilonewton per Square Meter)*
- $f_c$ 28 Day Compressive Strength of Concrete *(Megapascal)*
- $fy_{steel}$ Yield Strength of Steel *(Megapascal)*
- **h** Maximum Slab Thickness *(Millimeter)*
- $l_n$ Length of Clear Span in Long Direction *(Millimeter)*
- **LL** Live Load *(Kilonewton per Square Meter)*
- **M** Factored Moment *(Newton)*
- **M'max** Maximum Moment *(Newton Meter)*
- **P** Uniform Pressure on Soil *(Pascal)*
- **t** Wall Thickness *(Meter)*
- **U** Ultimate Strength *(Kilonewton per Square Meter)*
- **V** Shear Strength of Concrete at Critical Section *(Pascal)*
- $V_c$ Nominal Shear Strength of Concrete *(Megapascal)*
- $V_s$ Nominal Shear Strength by Reinforcement *(Megapascal)*
- **W** Wind Load *(Kilonewton per Square Meter)*
- **φ** Capacity Reduction Factor
- $\phi V_n$ Punching Shear *(Megapascal)*

## Constants, Functions, Measurements used

- Measurement: **Length** in Millimeter (mm), Meter (m)
  *Length Unit Conversion*
- Measurement: **Pressure** in Pascal (Pa), Megapascal (MPa), Kilonewton per Square Meter (kN/m²)
  *Pressure Unit Conversion*
- Measurement: **Force** in Newton (N)
  *Force Unit Conversion*
- Measurement: **Moment of Force** in Newton Meter (N*m)
  *Moment of Force Unit Conversion*
- Measurement: **Bending Moment** in Newton Millimeter (N*mm)
  *Bending Moment Unit Conversion*
- Measurement: **Stress** in Megapascal (MPa)
  *Stress Unit Conversion*

## Check other formula lists

- **Properties of Basic Material of Concrete Structures Formulas**
- **Design for Beams and Ultimate Strength for Rectangular Beams with Tension Reinforcement Formulas**
- **Design of Compression Members Formulas**
- **Design of Retaining Walls Formulas**
- **Design of Two Way Slab System and Footing Formulas**

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