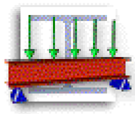
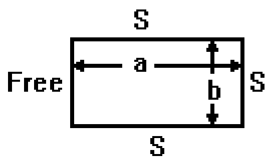
Table 26 Formulas for maximum deflection and maximum stress in flat plates with straight boundaries and constant thickness



# Case 2a Rectangular plate, three edges simply supported, one edge (b) free; uniform load over entire plate

**Rectangular plate, three edges simply supported, one edge (b) free**




**Notation file** Provides a description of Table 26 and the notation used.

**Enter dimensions, properties and loading**

Plate dimensions:

length: $a \equiv 15 \cdot in$

width: $b \equiv 12 \cdot in$

thickness: $t \equiv 0.25 \cdot in$

Uniformly distributed load: $q \equiv 100 \cdot \frac{lbf}{in^2}$

Modulus of elasticity: $E \equiv 30 \cdot 10^6 \cdot \frac{lbf}{in^2}$

Poisson's ratio: $\nu \equiv 0.3$

**Calculation procedure**

For a plate material with ν approximately = 0.3, the maximum stress (σ) and deflection (y) are functions of α and β which are defined after these calculations.

$\sigma_{max} := \frac{\beta \cdot q \cdot b^2}{t^2}$  $\sigma_{max} = 1.659 \times 10^5 \frac{lbf}{in^2}$

$y_{max} := \frac{-\alpha \cdot q \cdot b^4}{E \cdot t^3}$  $y_{max} = -0.664\ in$

**Interpolate data values**

$$\text{Table} \equiv \begin{pmatrix} 0.5 & 0.36 & 0.08 \\ 0.667 & 0.45 & 0.106 \\ 1 & 0.67 & 0.14 \\ 1.5 & 0.77 & 0.16 \\ 2 & 0.79 & 0.165 \\ 4 & 0.8 & 0.167 \end{pmatrix}$$

The transpose of this data can be found in the file "d02a.prn".

$$\text{Table}^T = \begin{pmatrix} 0.5 & 0.667 & 1 & 1.5 & 2 & 4 \\ 0.36 & 0.45 & 0.67 & 0.77 & 0.79 & 0.8 \\ 0.08 & 0.106 & 0.14 & 0.16 & 0.165 & 0.167 \end{pmatrix}$$

$\alpha$ and $\beta$ are interpolated from the above data table.

$$\frac{a}{b} = 1.25$$

$$\alpha \equiv \text{linterp}\left(\text{Table}^{\langle 0 \rangle}, \text{Table}^{\langle 2 \rangle}, \frac{a}{b}\right) \qquad \alpha = 0.15$$

$$\beta \equiv \text{linterp}\left(\text{Table}^{\langle 0 \rangle}, \text{Table}^{\langle 1 \rangle}, \frac{a}{b}\right) \qquad \beta = 0.72$$

**Large deflection condition check**

Check to verify that the absolute value of the maximum deflection is less than one-half the plate thickness (an assumption stated in the notation file which must hold true):

$$\frac{t}{2} = 0.125 \text{ in} \qquad \left|y_{max}\right| = 0.664 \text{ in}$$

**Table 26a**

**Notation file**

If $y_{max}$ is greater than t/2 (large deflection), the equations in this table are subject to large errors. For large deflections, use the equations provided in Table 26a. Read the Notation file for more specific information.

**References**


Ref. 8. Wojtaszak, I. A.: Stress and Deflection of Rectangular Plates, *ASME Paper* A-71, *J. Appl. Mech.*, vol. 3, no. 2, 1936.