## LANDING PLATE SPAN ANALYSIS

$t_{plate} := 0.125 \cdot in$ Thickness of the plate

$F_y := 36 \cdot ksi$ Yield strength of the plate

$B_a := B_S$ Plate length in the long direction

$b_a := 0$ Flange width of the long direction support

$B_b := trib_{cb}$ Plate length in the short direction

$b_b := b_f = 2 \cdot in$ Flange width of the short direction support

$E := 29000 \cdot ksi$ Modulus of elasticity of the steel

$\Omega := 1.67$ ASD safety factor for bending

**Member Marks:**
tr5

$a := B_a - b_a = 54 \cdot in$ Long dimension of plate

$b := B_b - b_b = 14.875 \cdot in$ Short dimension of plate

$\sigma_a := \frac{F_y}{\Omega} = 21.6 \cdot ksi$ Allowable bending stress

$\Delta := \frac{a}{360} = 0.15 \cdot in$ Allowable deflection

$q := LL = 100 \cdot psf$ Uniform plate load

### 4 Edges Simply Supported

$a/b := (1 \quad 1.2 \quad 1.4 \quad 1.6 \quad 1.8 \quad 2 \quad 3 \quad 4 \quad 5 \quad \infty)^T$

$\beta_v := (0.2874 \quad 0.3762 \quad 0.4530 \quad 0.5172 \quad 0.5688 \quad 0.6102 \quad 0.7134 \quad 0.7410 \quad 0.7476 \quad 0.750)^T$

$\alpha_v := (0.0444 \quad 0.0616 \quad 0.0770 \quad 0.0906 \quad 0.1017 \quad 0.1110 \quad 0.1335 \quad 0.1400 \quad 0.1417 \quad 0.1421)^T$

$\alpha := linterp\left(a/b, \alpha_v, \frac{a}{b}\right)$ $\alpha = 0.138$

$\beta := linterp\left(a/b, \beta_v, \frac{a}{b}\right)$ $\beta = 0.731$

$\delta_1 := \frac{\alpha \cdot q \cdot b^4}{E \cdot t_{plate}^3}$ $\delta_1 = 0.083 \cdot in$ **Actual Deflection**

$\sigma_1 := \frac{\beta \cdot q \cdot b^2}{t_{plate}^2}$ $\sigma_1 = 7.187 \cdot ksi$ **Actual Stress**

## 2 Short Edges Fixed, 2 Long Edges Simply Supported

$a/b := (1 \quad 1.2 \quad 1.4 \quad 1.6 \quad 1.8 \quad 2 \quad \infty)^T$

$\beta_v := (0.4182 \quad 0.5208 \quad 0.5988 \quad 0.6540 \quad 0.6912 \quad 0.7146 \quad 0.750)^T$

$\alpha_v := (0.0210 \quad 0.0349 \quad 0.0502 \quad 0.0658 \quad 0.0800 \quad 0.0922 \quad 0.1560)^T$

$\alpha := \text{linterp}\left(a/b, \alpha_v, \frac{a}{b}\right) \qquad \alpha = 0.092$

$\beta := \text{linterp}\left(a/b, \beta_v, \frac{a}{b}\right) \qquad \beta = 0.715$

$\delta_2 := \frac{\alpha \cdot q \cdot b^4}{E \cdot t_{plate}^3}$ $\qquad \boxed{\delta_2 = 0.055 \cdot in}$ **Actual Deflection**

$\sigma_2 := \frac{\beta \cdot q \cdot b^2}{t_{plate}^2}$ $\qquad \boxed{\sigma_2 = 7.027 \cdot ksi}$ **Actual Stress**

## 2 Long Edges Fixed, 2 Short Edges Simply Supported

$a/b := (1 \quad 1.2 \quad 1.4 \quad 1.6 \quad 1.8 \quad 2 \quad \infty)^T$

$\beta_v := (0.4182 \quad 0.4626 \quad 0.4860 \quad 0.4968 \quad 0.4971 \quad 0.4973 \quad 0.5)^T$

$\alpha_v := (0.0210 \quad 0.0243 \quad 0.0262 \quad 0.0273 \quad 0.0280 \quad 0.0283 \quad 0.0285)^T$

$\alpha := \text{linterp}\left(a/b, \alpha_v, \frac{a}{b}\right) \qquad \alpha = 0.028$

$\beta := \text{linterp}\left(a/b, \beta_v, \frac{a}{b}\right) \qquad \beta = 0.497$

$\delta_3 := \frac{\alpha \cdot q \cdot b^4}{E \cdot t_{plate}^3}$ $\qquad \boxed{\delta_3 = 0.017 \cdot in}$ **Actual Deflection**

$\sigma_3 := \frac{\beta \cdot q \cdot b^2}{t_{plate}^2}$ $\qquad \boxed{\sigma_3 = 4.890 \cdot ksi}$ **Actual Stress**

## 4 Edges Fixed

$a/b := (1 \quad 1.2 \quad 1.4 \quad 1.6 \quad 1.8 \quad 2 \quad \infty)^T$

$\beta_v := (0.3078 \quad 0.3834 \quad 0.4356 \quad 0.4680 \quad 0.4872 \quad 0.4974 \quad 0.5)^T$

$\alpha_v := (0.0138 \quad 0.0188 \quad 0.0226 \quad 0.0251 \quad 0.0267 \quad 0.0277 \quad 0.0284)^T$

$\alpha := \text{linterp}\left(a/b, \alpha_v, \frac{a}{b}\right) \qquad \alpha = 0.028$

$\beta := \text{linterp}\left(a/b, \beta_v, \frac{a}{b}\right) \qquad \beta = 0.497$

$\delta_4 := \frac{\alpha \cdot q \cdot b^4}{E \cdot t_{plate}^3}$ $\qquad \boxed{\delta_4 = 0.017 \cdot in}$ **Actual Deflection**

$\sigma_4 := \frac{\beta \cdot q \cdot b^2}{t_{plate}^2}$ $\qquad \boxed{\sigma_4 = 4.891 \cdot ksi}$ **Actual Stress**

## Summary of Support Conditions

| (4) Edges Simple Support | (2) Short Edges Fixed | (2) Long Edges Fixed | (4) Edges Fixed | Allowed |
|---|---|---|---|---|
| $\delta_1 = 0.083 \cdot in$ | $\delta_2 = 0.055 \cdot in$ | $\delta_3 = 0.017 \cdot in$ | $\delta_4 = 0.017 \cdot in$ | $\Delta = 0.150 \cdot in$ |
| $\sigma_1 = 7.19 \cdot ksi$ | $\sigma_2 = 7.03 \cdot ksi$ | $\sigma_3 = 4.89 \cdot ksi$ | $\sigma_4 = 4.89 \cdot ksi$ | $\sigma_a = 21.56 \cdot ksi$ |
| | $\frac{\sigma_2}{\sigma_a} = 32.6 \cdot \%$ | $\frac{\sigma_3}{\sigma_a} = 22.7 \cdot \%$ | $\frac{\sigma_4}{\sigma_a} = 22.7 \cdot \%$ | <-- Required percentage of stitch weld required to consider fixed |