Important Taxiway Design Formulas PDF

Formulas
Examples
with Units

List of 44
Important Taxiway Design Formulas

1) Braking Distance Formulas

1.1) Assumed Brake Application Speed given Distance for Deceleration in Normal Braking Mode Formula

Evaluate Formula

Formula

$$V_{ba} = \sqrt{S_3 \cdot 2 \cdot d + V_{ex}^2}$$

Example with Units

$$101.548\,\text{m/s} = \sqrt{60\,\text{m} \cdot 2 \cdot 32.6\,\text{m²/s} + 80\,\text{m/s}^2}$$

1.2) Deceleration Rate when Distance for Deceleration in Normal Braking Mode Formula

Evaluate Formula

Formula

$$d = \frac{V_{ba}^2 - V_{ex}^2}{2 \cdot S_3}$$

Example with Units

$$25.075\,\text{m²/s} = \frac{97\,\text{m/s}^2 - 80\,\text{m/s}^2}{2 \cdot 60\,\text{m}}$$

1.3) Deceleration Rate when Distance for Deceleration in Normal Braking Mode is considered Formula

Evaluate Formula

Formula

$$d = \frac{\left(V_t - 15\right)^2 - \left(V_{ex}^2\right)}{8 \cdot S_3}$$

Example with Units

$$24.6917\,\text{m²/s} = \frac{\left(150.1\,\text{m/s} - 15\right)^2 - \left(80\,\text{m/s}^2\right)}{8 \cdot 60\,\text{m}}$$

1.4) Distance for Transition from Main gear Touchdown to create Stabilized Braking Configuration Formula

Evaluate Formula

Formula

$$S_2 = 10 \cdot V$$

Example with Units

$$450\,\text{m} = 10 \cdot 45\,\text{m/s}$$

1.5) Distance required for Deceleration in normal Braking mode Formula

Evaluate Formula

Formula

$$S_3 = \frac{V_{ba}^2 - V_{ex}^2}{2 \cdot d}$$

Example with Units

$$46.1503\,\text{m} = \frac{97\,\text{m/s}^2 - 80\,\text{m/s}^2}{2 \cdot 32.6\,\text{m²/s}}$$

1.6) Distance required for Deceleration in Normal Braking Mode to Nominal Takeoff Speed Formula

Evaluate Formula

Formula

$$S_3 = \frac{\left(V_t - 15\right)^2 - V_{ex}^2}{8 \cdot d}$$

Example with Units

$$45.4448\,\text{m} = \frac{\left(150.1\,\text{m/s} - 15\right)^2 - 80\,\text{m/s}^2}{8 \cdot 32.6\,\text{m}^2\text{/s}}$$

1.7) Distance required for Transition from Maingear Touchdown to create Stabilized Braking Configuration Formula

Evaluate Formula

Formula

$$S_2 = 5 \cdot \left(V_{th} - 10\right)$$

Example with Units

$$50\,\text{m} = 5 \cdot \left(20\,\text{m/s} - 10\right)$$

1.8) Nominal Turn-Off Speed given Distance for Deceleration in Normal Braking Mode Formula

Evaluate Formula

Formula

$$V_{ex} = \sqrt{\left(V_{ba}^2\right) - \left(S_3 \cdot 2 \cdot d\right)}$$

Example with Units

$$74.1418\,\text{m/s} = \sqrt{\left(97\,\text{m/s}^2\right) - \left(60\,\text{m} \cdot 2 \cdot 32.6\,\text{m}^2\text{/s}\right)}$$

1.9) Nominal Turn-off Speed given Distance required for Deceleration in normal Braking mode Formula

Evaluate Formula

Formula

$$V_{ex} = \sqrt{\left(\left(V_t - 15\right)^2\right) - \left(8 \cdot d \cdot S_3\right)}$$

Example with Units

$$51.0295\,\text{m/s} = \sqrt{\left(\left(150.1\,\text{m/s} - 15\right)^2\right) - \left(8 \cdot 32.6\,\text{m}^2\text{/s} \cdot 60\,\text{m}\right)}$$

1.10) Threshold Speed given Distance for Deceleration in Normal Braking Mode Formula

Evaluate Formula

Formula

$$V_t = \left(8 \cdot S_3 \cdot d + V_{ex}^2\right)^{0.5} + 15$$

Example with Units

$$163.4857\,\text{m/s} = \left(8 \cdot 60\,\text{m} \cdot 32.6\,\text{m}^2\text{/s} + 80\,\text{m/s}^2\right)^{0.5} + 15$$

1.11) Threshold Speed given Distance required for Transition from Maingear Touchdown Formula

Evaluate Formula

Formula

$$V_{th} = \left(\frac{S_2}{5}\right) + 10$$

Example with Units

$$20.2\,\text{m/s} = \left(\frac{51\,\text{m}}{5}\right) + 10$$

1.12) Vehicle Speed given Distance required for Transition from Maingear Touchdown Formula

Evaluate Formula

Formula

$$V = \frac{S_2}{10}$$

Example with Units

$$5.1\,\text{m/s} = \frac{51\,\text{m}}{10}$$

2) Design of Fillets Formulas

2.1) Aircraft Datum Length given Length of each Wedge-shaped End of Fillet Formula

Evaluate Formula

Formula

$$D_L = F - L$$

Example with Units

$$131.9\,\text{m} = 135\,\text{m} - 3.1\,\text{m}$$

2.2) Distance along Straight Taxiway Center line given Length of each End of Fillet Formula

Evaluate Formula

Formula

$$F = L + D_L$$

Example with Units

$$135.1\,\text{m} = 3.1\,\text{m} + 132\,\text{m}$$

2.3) Length of each Wedge-Shaped end of Fillet Formula

Evaluate Formula

Formula

$$L = F - D_L$$

Example with Units

$$3\,\text{m} = 135\,\text{m} - 132\,\text{m}$$

2.4) Maximum Deviation permissible without Filleting Formula

Evaluate Formula

Formula

$$\lambda = \left(\frac{T_{Width}}{2}\right) - \left(M + \frac{T}{2}\right)$$

Example with Units

$$4.05 = \left(\frac{45.1\,\text{m}}{2}\right) - \left(15 + \frac{7}{2}\right)$$

2.5) Maximum value of Deviation of main Undercarriage given Radius of Fillet Formula

Evaluate Formula

Formula

$$\gamma = -\left(r - R + M + \left(\frac{T}{2}\right)\right)$$

Example with Units

$$104 = -\left(27.5\,\text{m} - 150\,\text{m} + 15 + \left(\frac{7}{2}\right)\right)$$

2.6) Minimum Safety Margin given Maximum Deviation permissible without Filleting Formula

Evaluate Formula

Formula

$$M = \left(\frac{T_{Width}}{2}\right) - \lambda - \left(\frac{T}{2}\right)$$

Example with Units

$$14.95 = \left(\frac{45.1\,\text{m}}{2}\right) - 4.1 - \left(\frac{7}{2}\right)$$

2.7) Minimum Safety Margin given Radius of Fillet Formula

Evaluate Formula

Formula

$$M = -\left(r - R + \gamma + \left(\frac{T}{2}\right)\right)$$

Example with Units

$$24 = -\left(27.5\,\text{m} - 150\,\text{m} + 95 + \left(\frac{7}{2}\right)\right)$$

2.8) Radius of Fillet Formula

Evaluate Formula

Formula

$$r = R - \left(\gamma + M + \left(\frac{T}{2}\right)\right)$$

Example with Units

$$36.5\,\text{m} = 150\,\text{m} - \left(95 + 15 + \left(\frac{7}{2}\right)\right)$$

2.9) Radius of Taxiway Centerline given Radius of Fillet Formula

Evaluate Formula

Formula

$$R = r + \left(\gamma + M + \frac{T}{2}\right)$$

Example with Units

$$141\,\text{m} = 27.5\,\text{m} + \left(95 + 15 + \frac{7}{2}\right)$$

2.10) Taxiway Width given Maximum Deviation permissible without Filleting Formula

Evaluate Formula

Formula

$$T_{Width} = 2 \cdot \left(\lambda + \left(M + \frac{T}{2}\right)\right)$$

Example with Units

$$45.2\,\text{m} = 2 \cdot \left(4.1 + \left(15 + \frac{7}{2}\right)\right)$$

2.11) Track of Main Undercarriage given Maximum Deviation permissible without Filleting Formula

Evaluate Formula

Formula

$$T = 2 \cdot \left(\left(\frac{T_{Width}}{2}\right) - \lambda - M\right)$$

Example with Units

$$6.9 = 2 \cdot \left(\left(\frac{45.1\,\text{m}}{2}\right) - 4.1 - 15\right)$$

2.12) Track of main Undercarriage given Radius of Fillet Formula

Evaluate Formula

Formula

$$T = -2 \cdot \left(r - R + \gamma + M\right)$$

Example with Units

$$25 = -2 \cdot \left(27.5\,\text{m} - 150\,\text{m} + 95 + 15\right)$$

3) Path followed by the main Undercarriage of Taxiing Aircraft Formulas

3.1) Datum Length of Aircraft given Deviation of main Undercarriage Formula

Evaluate Formula

Formula

$$D_L = \frac{\gamma}{\sin\left(\beta\right)}$$

Example with Units

$$132.0655\,\text{m} = \frac{95}{\sin\left(46^\circ\right)}$$

3.2) Deviation of Main Undercarriage Formula

Evaluate Formula

Formula

$$\gamma = D_L \cdot \sin(\beta)$$

Example with Units

$$94.9529\,\text{m} = 132\,\text{m} \cdot \sin(46°)$$

4) Taxiway Width Formulas

4.1) Clearance between Outer Main Gear Wheel and Taxiway Edge given Taxiway Width Formula

Evaluate Formula

Formula

$$C = \frac{T_{Width} - T_M}{2}$$

Example with Units

$$14.95\,\text{m} = \frac{45.1\,\text{m} - 15.2\,\text{m}}{2}$$

4.2) Clearance between Outer Main Gear Wheel and Taxiway Edge given Wing Tip Clearance Formula

Evaluate Formula

Formula

$$C = S - WS - Z$$

Example with Units

$$14\,\text{m} = 64\,\text{m} - 45\,\text{m} - 5\,\text{m}$$

4.3) Clearance given Separation Distance between Taxiway and Object Formula

Evaluate Formula

Formula

$$C = S - \left(0.5 \cdot W_{Span}\right) - Z$$

Example with Units

$$16.5\,\text{m} = 64\,\text{m} - \left(0.5 \cdot 85\,\text{m}\right) - 5\,\text{m}$$

4.4) Lateral Deviation given Separation Distance between Aircraft Stand Taxi lane-to-object Formula

Evaluate Formula

Formula

$$d_L = S - \left(0.5 \cdot W_{Span}\right) - Z$$

Example with Units

$$16.5 = 64\,\text{m} - \left(0.5 \cdot 85\,\text{m}\right) - 5\,\text{m}$$

4.5) Maximum Outer Main Gear Wheel Span given Taxiway Width Formula

Evaluate Formula

Formula

$$T_M = T_{Width} - \left(2 \cdot C\right)$$

Example with Units

$$14.9\,\text{m} = 45.1\,\text{m} - \left(2 \cdot 15.1\,\text{m}\right)$$

4.6) Separation Distance between Aircraft Stand Taxi lane-to-object Formula

Evaluate Formula

Formula

$$S = \left(\frac{W_{Span}}{2}\right) + d_L + Z$$

Example with Units

$$65\,\text{m} = \left(\frac{85\,\text{m}}{2}\right) + 17.5 + 5\,\text{m}$$

4.7) Separation Distance between Runway and Parallel Taxiway Formula

Evaluate Formula

Formula

$$S = 0.5 \cdot \left(SW + WS\right)$$

Example with Units

$$64\,\text{m} = 0.5 \cdot \left(83\,\text{m} + 45\,\text{m}\right)$$

4.8) Separation Distance between Taxiway and Object Formula

Evaluate Formula

Formula

$$S = \left(\frac{W_{Span}}{2}\right) + C + Z$$

Example with Units

$$62.6\,\text{m} = \left(\frac{85\,\text{m}}{2}\right) + 15.1\,\text{m} + 5\,\text{m}$$

4.9) Separation Distance given Wing Tip Clearance Formula

Evaluate Formula

Formula

$$S = WS + C + Z$$

Example with Units

$$65.1\,\text{m} = 45\,\text{m} + 15.1\,\text{m} + 5\,\text{m}$$

4.10) Strip Width given Separation Distance between Runway and Parallel Taxiway Formula

Evaluate Formula

Formula

$$SW = \left(\frac{S}{0.5}\right) - WS$$

Example with Units

$$83\,\text{m} = \left(\frac{64\,\text{m}}{0.5}\right) - 45\,\text{m}$$

4.11) Taxiway Width Formula

Evaluate Formula

Formula

$$T_{Width} = T_M + 2 \cdot C$$

Example with Units

$$45.4\,\text{m} = 15.2\,\text{m} + 2 \cdot 15.1\,\text{m}$$

4.12) Wing Span given Separation Distance between Aircraft Stand Taxi lane-to-object Formula

Evaluate Formula

Formula

$$W_{Span} = 2 \cdot \left(S - d_L - Z\right)$$

Example with Units

$$83\,\text{m} = 2 \cdot \left(64\,\text{m} - 17.5 - 5\,\text{m}\right)$$

4.13) Wing Span given Separation Distance between Runway and Parallel Taxiway Formula

Evaluate Formula

Formula

$$WS = \left(\frac{S}{0.5}\right) - SW$$

Example with Units

$$45\,\text{m} = \left(\frac{64\,\text{m}}{0.5}\right) - 83\,\text{m}$$

4.14) Wing Span given Separation Distance between Taxiway and Object Formula

Evaluate Formula

Formula

$$W_{Span} = \frac{S - C - Z}{0.5}$$

Example with Units

$$87.8\,\text{m} = \frac{64\,\text{m} - 15.1\,\text{m} - 5\,\text{m}}{0.5}$$

4.15) Wing Span given Wing Tip Clearance Formula

Evaluate Formula

Formula

$$WS = S - C - Z$$

Example with Units

$$43.9\,\text{m} = 64\,\text{m} - 15.1\,\text{m} - 5\,\text{m}$$

4.16) Wing Tip Clearance given Separation Distance between Aircraft Stand Taxi lane-to-object Formula

Evaluate Formula

Formula

$$Z = S - \left(0.5 \cdot W_{Span}\right) - d_L$$

Example with Units

$$4\,\text{m} = 64\,\text{m} - \left(0.5 \cdot 85\,\text{m}\right) - 17.5$$

4.17) Wing Tip Clearance given Separation Distance between Runway and parallel Taxiway Formula

Evaluate Formula

Formula

$$Z = S - WS - C$$

Example with Units

$$3.9\,\text{m} = 64\,\text{m} - 45\,\text{m} - 15.1\,\text{m}$$

4.18) Wing Tip Clearance given Separation Distance between Taxiway and Object Formula

Evaluate Formula

Formula

$$Z = S - \left(0.5 \cdot W_{Span}\right) - C$$

Example with Units

$$6.4\,\text{m} = 64\,\text{m} - \left(0.5 \cdot 85\,\text{m}\right) - 15.1\,\text{m}$$

Variables used in list of Taxiway Design Formulas above

- **C** Clearance Distance *(Meter)*
- **d** Deceleration *(Square Meter per Second)*
- d_L Lateral Deviation
- D_L Datum Length of Aircraft *(Meter)*
- **F** Distance along Straight Taxiway Centerline *(Meter)*
- **L** Length of each Wedge-shaped end of Fillet *(Meter)*
- **M** Minimum Safety Margin
- **r** Radius of Fillet *(Meter)*
- **R** Radius of Taxiway Centerline *(Meter)*
- **S** Separation Distance *(Meter)*
- S_2 Distance for Transition from Main gear Touchdown *(Meter)*
- S_3 Distance for Deceleration in Normal Breaking Mode *(Meter)*
- **SW** Strip Width *(Meter)*
- **T** Track of Main Undercarriage
- T_M Maximum Outer Main Gear Wheel Span *(Meter)*
- T_{Width} Taxiway Width *(Meter)*
- **V** Vehicle Speed *(Meter per Second)*
- V_{ba} Assumed Speed Brake Application Speed *(Meter per Second)*
- V_{ex} Nominal Turn-off Speed *(Meter per Second)*
- V_t Threshold Speed for Transition *(Meter per Second)*
- V_{th} Threshold Speed under Normal Braking Mode *(Meter per Second)*
- W_{Span} Span of Wing *(Meter)*
- **WS** Wing Span *(Meter)*
- **Z** Wing Tip Clearance *(Meter)*
- **β** Steering Angle *(Degree)*
- **γ** Deviation of Main Undercarriage
- **λ** Maximum Deviation without Filleting

Constants, Functions, Measurements used in list of Taxiway Design Formulas above

- Functions: **sin**, sin(Angle)
  Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.
- 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 Meter (m)
  Length Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Kinematic Viscosity** in Square Meter per Second (m²/s)
  Kinematic Viscosity Unit Conversion

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7/8/2024 | 9:17:00 AM UTC