Wheel Toe: Millimetres to Angle and Tyre Scrub

Toe angle per wheel and total toe in degrees and minutes from a toe measurement in millimetres at a reference diameter, with the sideways scrub per kilometre.

Method: Toe geometry

Input parameters

Unit system: SI

Parameter	Value	Unit
Total toe (front minus rear distance between rims)	2.0000	mm
Reference diameter of measurement	381.00	mm

Calculated results

Parameter	Value	Unit
Total toe angle	0.30077	°
Toe angle per wheel	0.15038	°
Toe per wheel in minutes of arc	9.0230	
Sideways scrub per wheel per km	2.6247	m

Notes for this case

• Toe measured as the difference in distance between the front and rear of the rims (positive toe-in) across a diameter D gives a total angle of about Δ/D, half on each wheel: δ = asin(Δ/2D). Each wheel then runs at that angle to the direction of travel, scrubbing sideways about tan δ metres per kilometre and wearing the tyre edges. Quote the reference diameter (rim or tyre) with any mm specification.

Formula and method

$$\delta = \sin^{-1}\frac{\Delta}{2D}, \quad \delta_{total} = 2\delta, \quad s = 1000\tan\delta$$

Variables

Δ	Total toe (front minus rear distance between rims)	m
D	Reference diameter of measurement	m
δ_{total}	Total toe angle	rad
δ	Toe angle per wheel	rad
\delta'	Toe per wheel in minutes of arc	-
s	Sideways scrub per wheel per km	m

Method and standards

Toe conversion.

Assumptions and limits

- Small angles; symmetric toe.

References

Toe geometry

Report details

Report reference	FCC-KDGE-FJ98 (the same inputs always give the same reference)
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Calculator	Wheel Toe: Millimetres to Angle and Tyre Scrub
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Software release	FireCAD Calc, release of 22 November 2026
Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/automotive/vehicle-dynamics/toe-angle-conversion

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.