Traction-Limited Acceleration for FWD, RWD and AWD

Maximum acceleration a vehicle's tyres can transmit for front, rear or all-wheel drive, with weight transfer from CG height, and the 0–100 km/h time limit.

Method: Traction limits with longitudinal load transfer

Input parameters

Unit system: SI

Parameter	Value	Unit
Driven axle	Rear-wheel drive	
Vehicle mass	1,500.0	kg
Static front axle load share	55.000	%
Wheelbase	2,700.0	mm
Centre-of-gravity height	550.00	mm
Tyre-road friction coefficient	1.0000	

Calculated results

Parameter	Value	Unit
Maximum acceleration	0.56512	g
Maximum tractive force	8.3128	kN
Load on the driven axle(s) while accelerating	8.3128	kN
0–100 km/h time if traction-limited throughout	5.0123	s

Notes for this case

• Weight shifts rearwards by mah/L: FWD a = μgf/(1 + μh/L), RWD a = μg(1 − f)/(1 − μh/L), AWD a = μg. Rolling and aerodynamic resistance and engine power limits are ignored.

Formula and method

$$a_{FWD} = \frac{\mu g f}{1 + \mu h/L}, \quad a_{RWD} = \frac{\mu g (1 - f)}{1 - \mu h/L}, \quad a_{AWD} = \mu g$$

Variables

drive	Driven axle	-
m	Vehicle mass	kg
f	Static front axle load share	-
L	Wheelbase	m
h	Centre-of-gravity height	m
μ	Tyre-road friction coefficient	-
a_{max}	Maximum acceleration	m/s²
F_x	Maximum tractive force	N
W_d	Load on the driven axle(s) while accelerating	N
t_{0-100}	0–100 km/h time if traction-limited throughout	s

Method and standards

Traction limits.

Assumptions and limits

- Rigid vehicle; constant friction; no aerodynamic load.

References

Traction limits with longitudinal load transfer

Report details

Report reference	FCC-18Y2-9HG9 (the same inputs always give the same reference)
Generated	23 November 2026, 17:51 UTC
Calculator	Traction-Limited Acceleration for FWD, RWD and AWD
Method last reviewed	17 November 2026
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/traction-limited-acceleration

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.