Vehicle Stopping Distance with Reaction Time and Grade

Reaction distance, braking distance and total stopping distance of a vehicle from speed, tyre-road friction, road grade and driver reaction time.

Method: Uniform-deceleration stopping distance; Kinematics of braking on a grade

Input parameters

Unit system: SI

Parameter	Value	Unit
Initial speed	80.000	km/h
Tyre-road friction coefficient (dry about 0.7, wet 0.4)	0.70000	
Road grade (positive uphill)	0	%
Reaction time	1.5000	s

Calculated results

Parameter	Value	Unit
Reaction distance	33.333	m
Braking distance	35.969	m
Total stopping distance	69.302	m
Deceleration	6.8647	m/s²
Braking time	3.2372	s

Notes for this case

• d = vt_r + v²/[2g(μ cos θ + sin θ)] with θ = atan(grade). Assumes full friction used throughout (ABS near the peak); worn tyres, wet or icy roads and loaded vehicles brake much longer.

Formula and method

$$d = v t_r + \frac{v^2}{2g(\mu \cos\theta + \sin\theta)}$$

Variables

v	Initial speed	m/s
μ	Tyre-road friction coefficient (dry about 0.7, wet 0.4)	-
G	Road grade (positive uphill)	-
t_r	Reaction time	s
d_r	Reaction distance	m
d_b	Braking distance	m
d	Total stopping distance	m
a	Deceleration	m/s²
t_b	Braking time	s

Method and standards

Stopping distance.

Assumptions and limits

- Constant friction; no brake fade.

References

Uniform-deceleration stopping distance, Kinematics of braking on a grade

Report details

Report reference	FCC-PRQ1-58BA (the same inputs always give the same reference)
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Calculator	Vehicle Stopping Distance with Reaction Time and Grade
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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/vehicle-braking-distance

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.