Maximum Cornering Speed on a Banked Curve

Maximum speed before skidding on a curve of given radius, friction and bank angle, the no-friction design speed and the lateral acceleration felt.

Method: Point-mass vehicle on a banked curve; Newton's laws on a banked curve

Input parameters

Unit system: SI

Parameter	Value	Unit
Curve radius	150.00	m
Side friction coefficient	0.60000	
Bank (superelevation) angle	5.0000	°

Calculated results

Parameter	Value	Unit
Maximum speed before sliding	117.61	km/h
Speed needing no side friction	40.840	km/h
Lateral acceleration at v_max	7.1155	m/s²
Lateral acceleration in g	0.72558	

Notes for this case

• Point-mass limit v² = gR(sin θ + μ cos θ)/(cos θ − μ sin θ); rollover, load transfer and tyre load sensitivity can lower it. Road design uses much smaller side friction factors for comfort and margin.

Formula and method

$$v_{max} = \sqrt{gR\frac{\sin\theta + \mu\cos\theta}{\cos\theta - \mu\sin\theta}}, \quad v_0 = \sqrt{gR\tan\theta}$$

Variables

R	Curve radius	m
μ	Side friction coefficient	-
θ	Bank (superelevation) angle	rad
v_{max}	Maximum speed before sliding	m/s
v_0	Speed needing no side friction	m/s
a_y	Lateral acceleration at v_max	m/s²
a_y/g	Lateral acceleration in g	-

Method and standards

Curve speed limits.

Assumptions and limits

- Point mass; steady cornering.

References

Point-mass vehicle on a banked curve, Newton's laws on a banked curve

Report details

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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/cornering-speed-banking

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.