Centre of Gravity Height by Axle Lifting

Height of a vehicle's centre of gravity from the change in front axle load when the rear axle is raised a known height, with wheelbase and wheel radius.

Method: Axle-lift method of CG height

Input parameters

Unit system: SI

Parameter	Value	Unit
Total vehicle weight	14.700	kN
Front axle load, level	8.4000	kN
Front axle load, rear raised	8.9600	kN
Wheelbase	2.7000	m
Height the rear axle is raised	0.60000	m
Loaded wheel radius (axle height)	300.00	mm

Calculated results

Parameter	Value	Unit
Tilt angle	12.840	°
CG distance behind front axle	1.1571	m
CG height above ground	751.28	mm

Notes for this case

• Raising one axle tilts the vehicle; the CG's height above the axle line shifts load to the lower axle in proportion to tanθ: h = r + L(W_f′ − W_f)/(W·tanθ), sinθ = Δh/L. Lock the suspension (or block it) so it does not move during the lift, drain or fill fuel consistently, and use a tilt of at least 10–15° for accuracy.

Formula and method

$$h_{cg} = r_l + \frac{L(W_f{}' - W_f)}{W \tan\theta}, \quad \sin\theta = \frac{\Delta h}{L}$$

Variables

W	Total vehicle weight	N
W_f	Front axle load, level	N
$W_f{}'$	Front axle load, rear raised	N
L	Wheelbase	m
Δh	Height the rear axle is raised	m
r_l	Loaded wheel radius (axle height)	m
θ	Tilt angle	rad
b	CG distance behind front axle	m
h_{cg}	CG height above ground	m

Method and standards

CG height.

Assumptions and limits

- Rigid vehicle during the lift; weights measured accurately.

References

Axle-lift method of CG height

Report details

Report reference	FCC-6HWY-YG5Y (the same inputs always give the same reference)
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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/cg-height-axle-lift

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.