Rotating Mass Factor and Equivalent Mass by Gear

Equivalent translational mass of a vehicle in a gear from wheel, driveline and engine inertias, gear ratios and efficiency, and the rotating mass factor.

Method: Reflected inertia through gearing

Input parameters

Unit system: SI

Parameter	Value	Unit
Vehicle mass	1,500.0	kg
Tyre dynamic radius	310.00	mm
All road wheels and brakes	4.0000	kg·m²
Driveline after the gearbox	0.050000	kg·m²
Engine, flywheel and clutch	0.20000	kg·m²
Gear ratio	3.5000	
Final drive ratio	4.1000	
Driveline efficiency	92.000	%

Calculated results

Parameter	Value	Unit
Equivalent mass	1,944.6	kg
Rotating mass factor	1.2964	
Engine share of rotating mass	88.672	%

Notes for this case

• m_eq = m + [J_w + J_di_f² + J_ei_g²i_f²η]/r²: each inertia is seen at the wheels multiplied by the square of its gear ratio. In first gear the engine's inertia can add 20–40 % to a car's mass; in top gear the factor falls to about 1.05. Use δ in acceleration and braking calculations.

Formula and method

$$m_{eq} = m + \frac{J_w + J_d i_f^2 + J_e i_g^2 i_f^2 \eta}{r_d^2}, \quad \delta = \frac{m_{eq}}{m}$$

Variables

m	Vehicle mass	kg
r_d	Tyre dynamic radius	m
J_w	All road wheels and brakes	kg·m²
J_d	Driveline after the gearbox	kg·m²
J_e	Engine, flywheel and clutch	kg·m²
i_g	Gear ratio	-
i_f	Final drive ratio	-
η	Driveline efficiency	-
m_{eq}	Equivalent mass	kg
δ	Rotating mass factor	-
$\Delta m_e / \Delta m$	Engine share of rotating mass	-

Method and standards

Rotating mass.

Assumptions and limits

- Rigid driveline; ratios constant.

References

Reflected inertia through gearing

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/transmission/rotating-mass-factor

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.