Fuel Consumption from Road Load and BSFC

Steady-speed fuel consumption of a vehicle from rolling, aerodynamic and grade resistance, driveline efficiency and the engine's BSFC, in L/100 km and km/L.

Method: Road-load and BSFC fuel model

Input parameters

Unit system: SI

Parameter	Value	Unit
Vehicle mass	1,500.0	kg
Rolling resistance coefficient	0.010000	
Drag area	0.65000	m²
Air density	1.2000	kg/m³
Speed	100.00	km/h
Road grade	0	%
Driveline efficiency	92.000	%
Engine BSFC at that operating point	260.00	g/kWh
Fuel density	745.00	kg/m³

Calculated results

Parameter	Value	Unit
Power at the wheels	12.445	kW
Engine power	13.527	kW
Fuel mass flow	3.5171	kg/h
Fuel consumption (L/100 km)	4.7210	
Fuel economy (km/L)	21.182	

Notes for this case

• Road load F = C_rrmg·cosθ + ½ρC_DAv² + mg·sinθ; engine power = F·v/η_d; fuel = BSFC × P_e. At steady speed the engine runs at light load, where BSFC is much worse than its best figure (often 300–400 g/kWh for petrol at 100 km/h), so use the BSFC map value at that speed and gear.

Formula and method

$$F = C_{rr} m g \cos\theta + \frac{1}{2}\rho C_D A v^2 + m g \sin\theta, \quad \dot{m}_f = BSFC\frac{F v}{\eta_d}, \quad FC = \frac{\dot{m}_f/\rho_f}{v}$$

Variables

m	Vehicle mass	kg
C_{rr}	Rolling resistance coefficient	-
$C_D A$	Drag area	m²
ρ	Air density	kg/m³
v	Speed	m/s
s	Road grade	-
η_d	Driveline efficiency	-
$BSFC$	Engine BSFC at that operating point	kg/J
ρ_f	Fuel density	kg/m³

P_w	Power at the wheels	W
P_e	Engine power	W
$\dot{m}_f$	Fuel mass flow	kg/s
FC	Fuel consumption (L/100 km)	-
FE	Fuel economy (km/L)	-

Method and standards

Fuel use.

Assumptions and limits

- Steady speed; no accessory loads.

References

Road-load and BSFC fuel model

Report details

Report reference	FCC-VR6R-Q1WY (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/fuel-consumption-road-load

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.