Tractor Wheel Slip, Drawbar Power and Tractive Efficiency

Wheel slip from theoretical and actual travel speeds, drawbar power from pull and speed, and the tractive efficiency against axle (or PTO) power.

Method: Wheel slip and tractive efficiency

Input parameters

Unit system: SI

Parameter	Value	Unit
Theoretical speed (from wheel rotation, no slip)	7.0000	km/h
Actual travel speed	6.0000	km/h
Drawbar pull	15.000	kN
Axle or PTO power	40.000	kW

Calculated results

Parameter	Value	Unit
Wheel slip	14.286	%
Drawbar power	25.000	kW
Tractive efficiency	62.500	%

Notes for this case

• A driven wheel travels less than its rolling circumference per turn under load; the shortfall is slip, s = 1 − v_a/v_t. Drawbar power is pull times actual speed, and tractive efficiency compares it with the power at the axle. Efficiency peaks at about 10–15 % slip on firm soil (8–10 % on concrete, 15 % on tilled soil); much higher slip wastes fuel and damages soil, lower slip means the tractor is over-ballasted.

Formula and method

$$s = 1 - \frac{v_a}{v_t}, \quad P_{db} = F v_a, \quad \eta_t = \frac{P_{db}}{P_a}$$

Variables

v_t	Theoretical speed (from wheel rotation, no slip)	m/s
v_a	Actual travel speed	m/s
F	Drawbar pull	N
P_a	Axle or PTO power	W
s	Wheel slip	-
P_{db}	Drawbar power	W
η_t	Tractive efficiency	-

Method and standards

Tractor slip.

Assumptions and limits

- Steady pull and speed.

References

Wheel slip and tractive efficiency

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/civil/irrigation-farm/tractor-wheel-slip-drawbar-power

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.