

Towing Science Cheat Sheet

Capacity ratings, tongue weight, hitches and trailer sway

ENGINEERING
CHEAT SHEET

Key equations

Quantity	Equation	Notes
Towing capacity	Capacity = GCWR – curb weight	GCWR = max combined weight of tow vehicle and trailer
SAE J2807 rating	TWR = GCWR – TVTW	TVTW = tow vehicle total weight (loaded for the trip)
Tongue weight	$W_t = 0.10 \text{ to } 0.15 \times W_{\text{trailer}}$	Below 10%: sway. Above 15%: front axle goes light, poor steering and braking
Loaded-weight check	curb + trailer + people + cargo + hitch + accessories $\leq$ GCWR	Confirm on a public scale with everything loaded
Safety margin	Load $\leq 0.9 \times$ rated capacity	Stay at least 10% under the limit for load shifts and hard stops
Trailer load split	About 60% of cargo weight ahead of the trailer axle	Keep it even side to side and tied down
J2807 sway metric	0.10 at 100 km/h	Standardized trailer sway response target
J2807 understeer window	0.1 g to 0.3 g lateral acceleration	Handling is checked with the trailer under load

Key takeaways

- **GVWR is not towing capacity.** GVWR is the most the vehicle can carry (people, cargo, fuel, tongue weight). Capacity comes from GCWR minus curb weight.
- Do not exceed GAWR-RR (rear axle rating) once tongue weight is added. Set the weight-distributing hitch only after checking it.
- A weight-distributing hitch uses spring bars to move part of the tongue weight forward to the front axle and back to the trailer axles, leveling the ride.
- If the trailer sways: **ease off the throttle, do not brake, hold the wheel steady**, and let it settle.
- Sway causes: bad weight distribution, speed, crosswinds, wrong tire pressures. Sway control devices stiffen the hitch connection.
- J2807 testing covers 12% grade launch, hot-weather gradeability, braking, parking brake and stability, so ratings are comparable across brands.

Hitch classes (max trailer weight)

Class	I	II	III	IV	V
Up to (lb)	2,000	3,500	5,000	10,000	20,000