

Vehicle Inertial Parameters Cheat Sheet

SAE 1999-01-1336: C.G., inertias, SSF, CSV, accuracy

ENGINEERING
CHEAT SHEET

Key equations

Quantity	Equation	Notes
Normalized roll inertia	$I_{xx} / [m (T/2)^2]$	T = track width
Normalized pitch, yaw inertia	$I / [m (L/2)^2]$	L = wheelbase
Normalized roll/yaw product	$I_{xz} / [m T L / 4]$	Negative for unladen trucks (front heavy)
Longitudinal C.G. ratio	a / L	Distance C.G. to front axle over wheelbase
Static stability factor	$SSF = T / (2 h)$	Textbook form (not in post); h = C.G. height
SSF vs CSV, 32 vehicles	slope 0.070, $r^2 = 0.91$	Strong correlation
SSF vs TTR, 12 vehicles	slope 1.09, $r^2 = 0.90$	SSF vs CSV $r^2 = 0.85$

Key takeaways

- Database of NHTSA light-vehicle inertial parameters: 496 entries, 82 added in this update. Data gap from Sept 1992 to Sept 1996.
- Tools: NHTSA IPMD (upgraded since 1987), S.E.A. Inc. VIMF, and a Tilt Table. TT means tilt-table-only test.
- Stated error bounds: IPMD v5 about 3% (pitch, roll, yaw); VIMF 1% pitch and yaw, 2% roll, 6.8 kg·m² roll/yaw product.
- 1998 set: 32 vehicles, roughly 1050 to 2700 kg; 20 also tested at GVWR. Cars have the highest SSF and CSV, SUVs the lowest.
- Loading to GVWR: car SSF changed little; light truck, van and SUV SSF dropped by 0.02 to 0.15.
- Loading to GVWR raises a/L, so the C.G. moves rearward. Vans have the highest normalized roll inertia.
- Data is from 1990s vehicles. See the attached SAE PDF for the full tables.