



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35.



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Approved by AICTE, New Delhi & Affiliated to Anna University,
Chennai.

DEPARTMENT OF AUTOMOBILE ENGINEERING

COURSE NAME : 23AUT101 – ELEMENTS OF AUTOMOTIVE SYSTEM

I YEAR /II SEMESTER

Unit 2 Steering System
Topic : Wheel Alignment

Need of Wheel Alignment

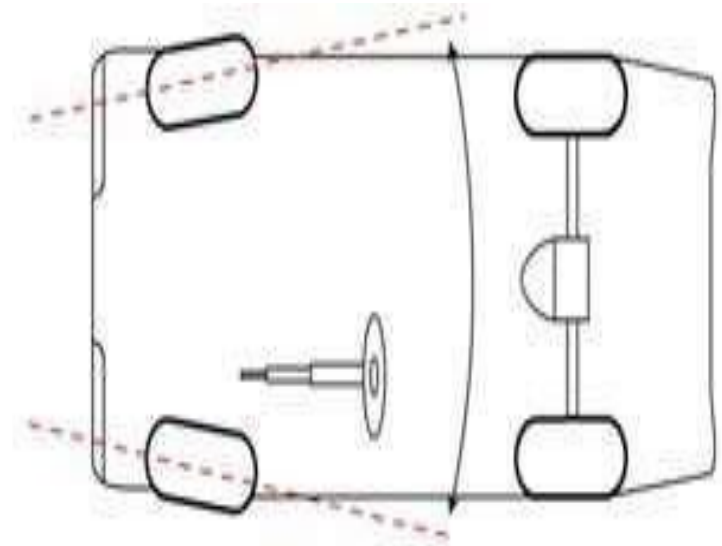
- The vehicle's wheels to roll straight down the highway with little steering effort.
- To minimize scuffing, slipping, or dragging of the tires under all operating conditions.
- Proper steering response and vehicle handling, and long tire life.
- For a vehicle's steering and suspension systems to operate as designed, the wheel alignment settings must be within their specified range and the vehicle must be capable of retaining the settings.

Five essential wheel alignment angles:

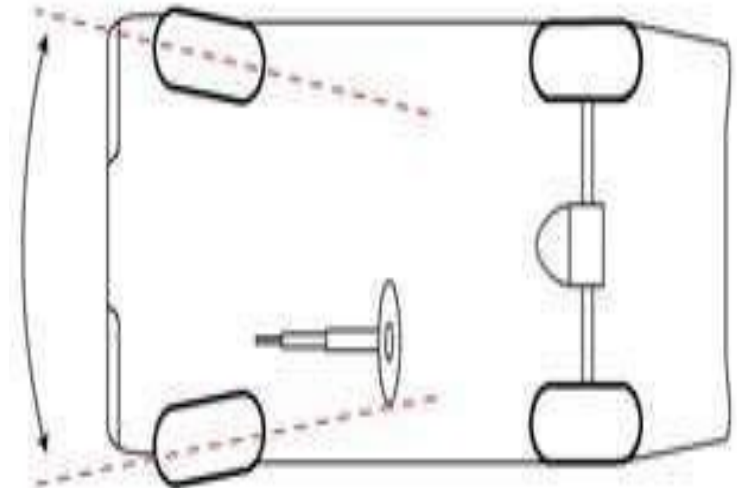
- Toe
- Camber
- Caster
- Steering axis inclination (SAI)
- Scrub Radius

Toe

- The difference in distance between the front and rear of the tires. When the tires are closer together at the front than at the rear, the wheels are said to be **toed in**, and if they are farther apart at the front, they are **toed out**.
- Toe-in is also called **positive** and toe-out **negative**.
- The **most critical** tire wearing angle, because if toe is outside of specs, excessive tire wear will quickly result, due to scuffing, as the tire tends to be dragged sideways on the road while it rolls.



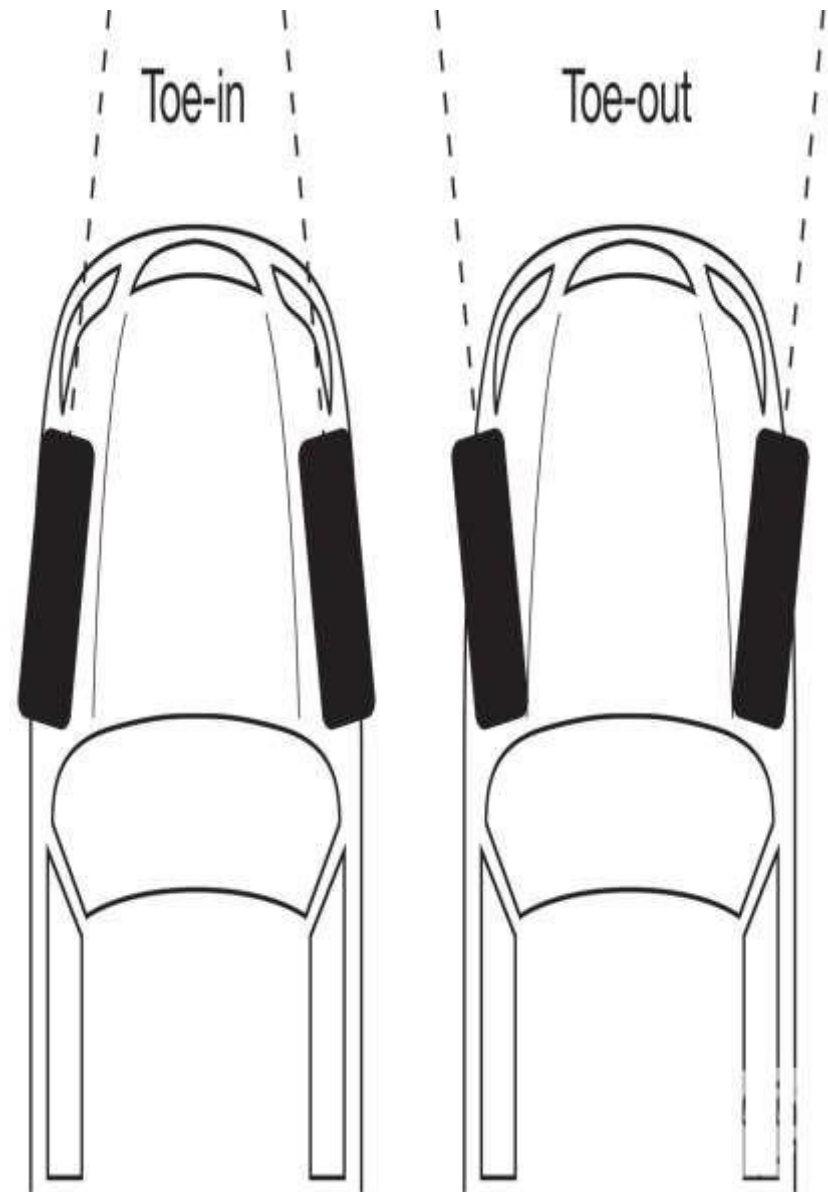
TOE-IN



TOE-OUT

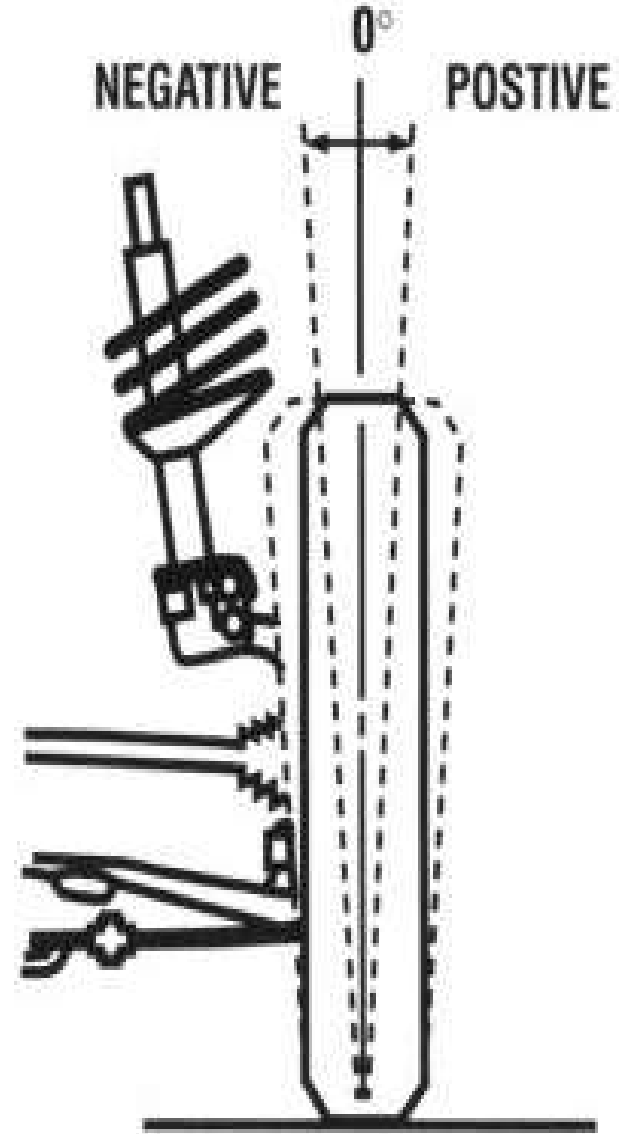
Toe

- When **rear-wheel-drive vehicles** are driven, the front wheels tend to toe out, as the rolling resistance of the tires acts upon the steering and suspension systems. Higher speeds produce **more toe-out action**. For this reason, they are usually set to have a **small amount of toe-in on the alignment rack** to compensate. A typical setting might be 1/16 to 1/8 of an inch (0.06” to 0.13” or 1.6mm to 3.2mm).
- On **front-wheel-drive vehicles**, engine torque tends to **cause toe-in** at road speed, and toe may change depending on whether the vehicle is accelerating or decelerating. They are commonly set to have a **small amount of toe-out, or zero toe on the alignment rack**.

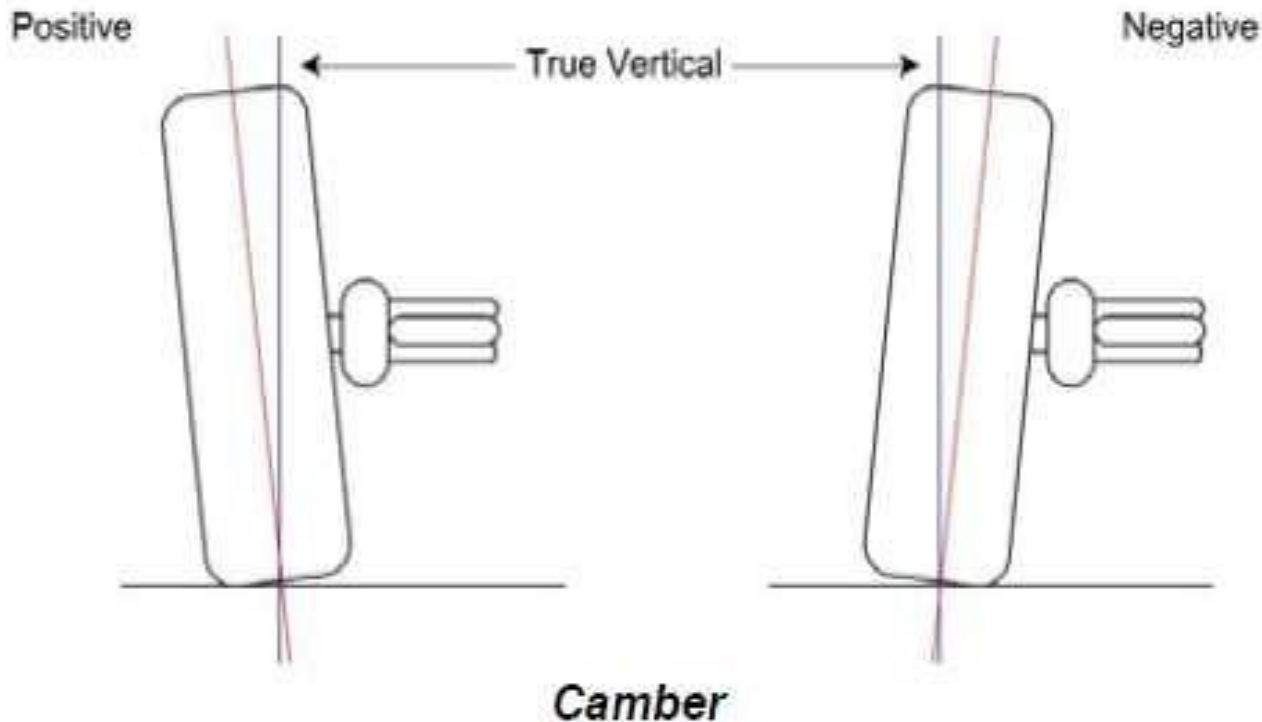


Camber

- The inward or outward lean of the top of the wheel. If the top of the wheel tilts outward from true vertical, it has **positive camber**, and if it tilts inward at the top, it has **negative camber**.
- Tire wearing angle – wear occurs on the side to which the wheel leans (on the outer or the inner area of the tread). The proper camber setting will correctly load the suspension and minimize tire wear.
- Measured in degrees of a circle, with zero degrees at true vertical

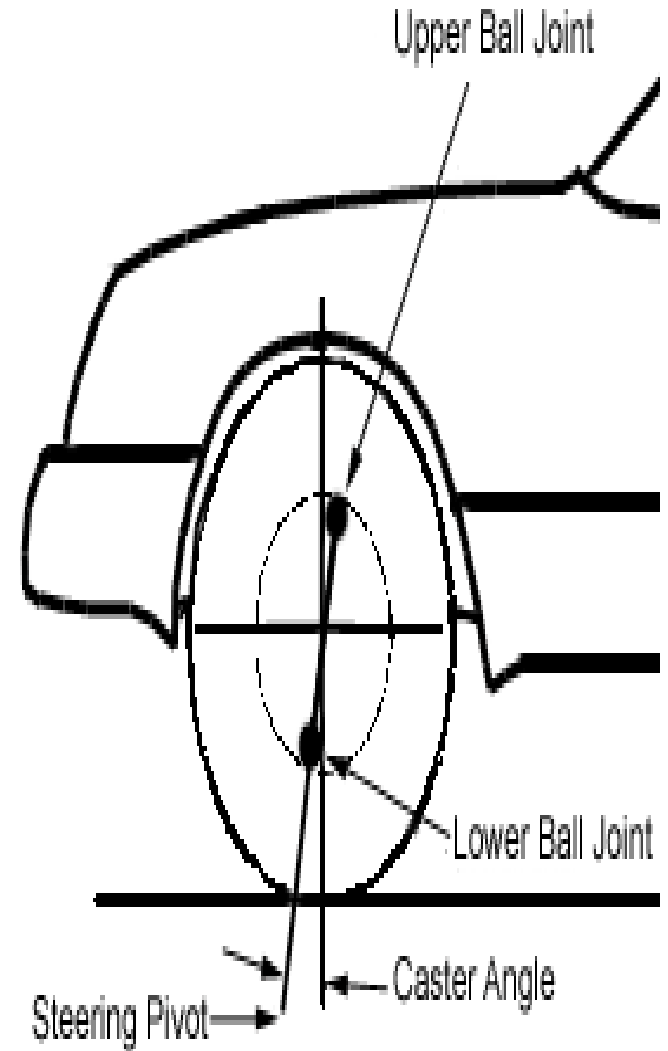


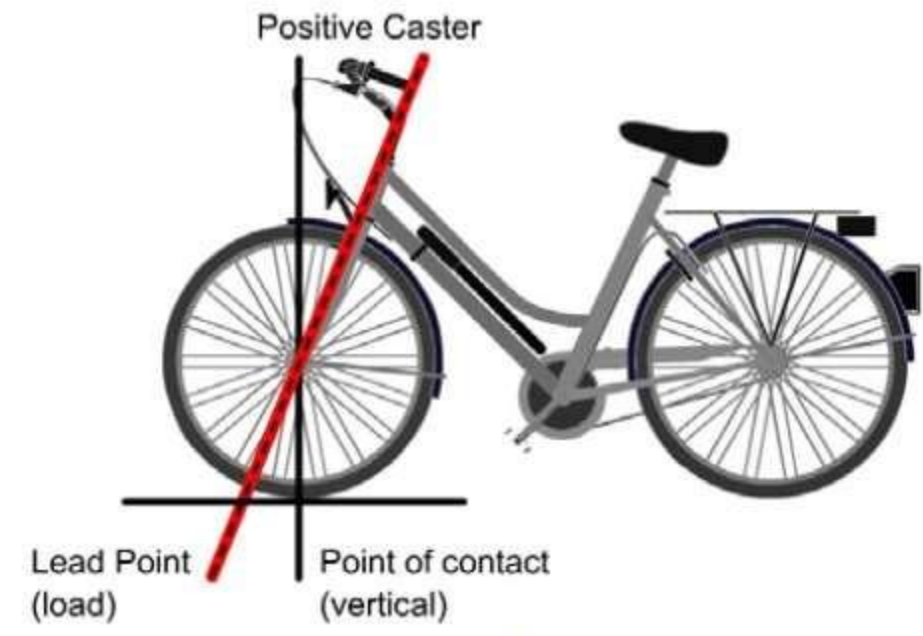
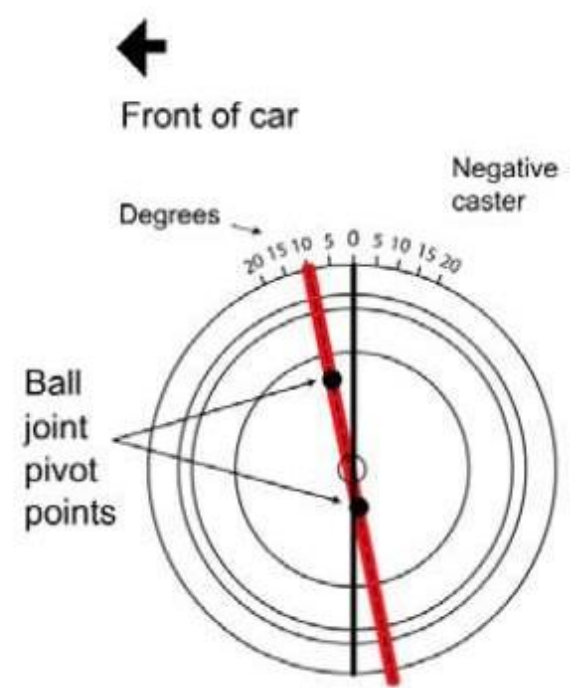
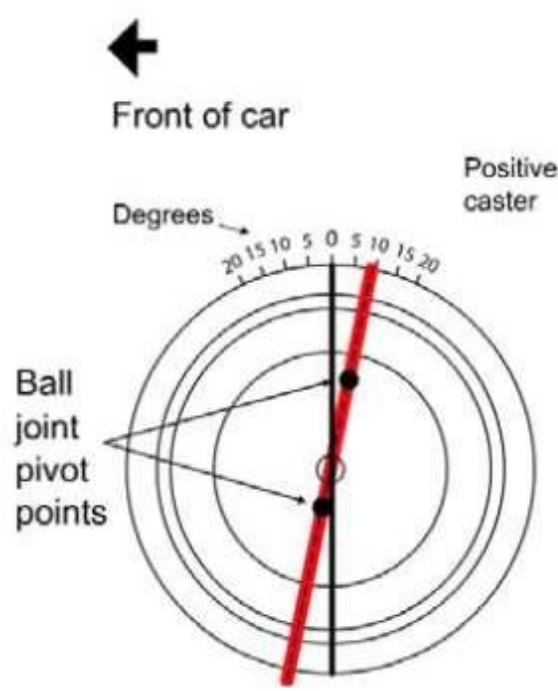
- To properly load the larger inner wheel bearing and spindle assembly, SLA suspensions are usually set with a small amount of positive camber, typically about $\frac{1}{4}$ to $\frac{1}{2}$ degree (0.25° to 0.5°). Some MacPherson strut front suspensions call for a small amount of positive camber, but many have a preferred setting of zero degrees



Caster

- Caster is the angle that identifies the forward or backward slope of a line that is drawn through the upper and lower steering pivot points. It does not affect tire wear, but caster does have an influence on the directional control of the steering.
- The caster is a line through the upper strut mount and lower ball joint. If such a line tilts rearward at the top, the caster is **positive**, and if the line tilts forward at the top, the caster is **negative**.
- it's the angle of your steering axis when viewed from the side of your vehicle. If you have positive caster, the steering axis will tilt toward the driver. Negative caster, on the other hand, means the steering axis tilts toward the front of your vehicle.

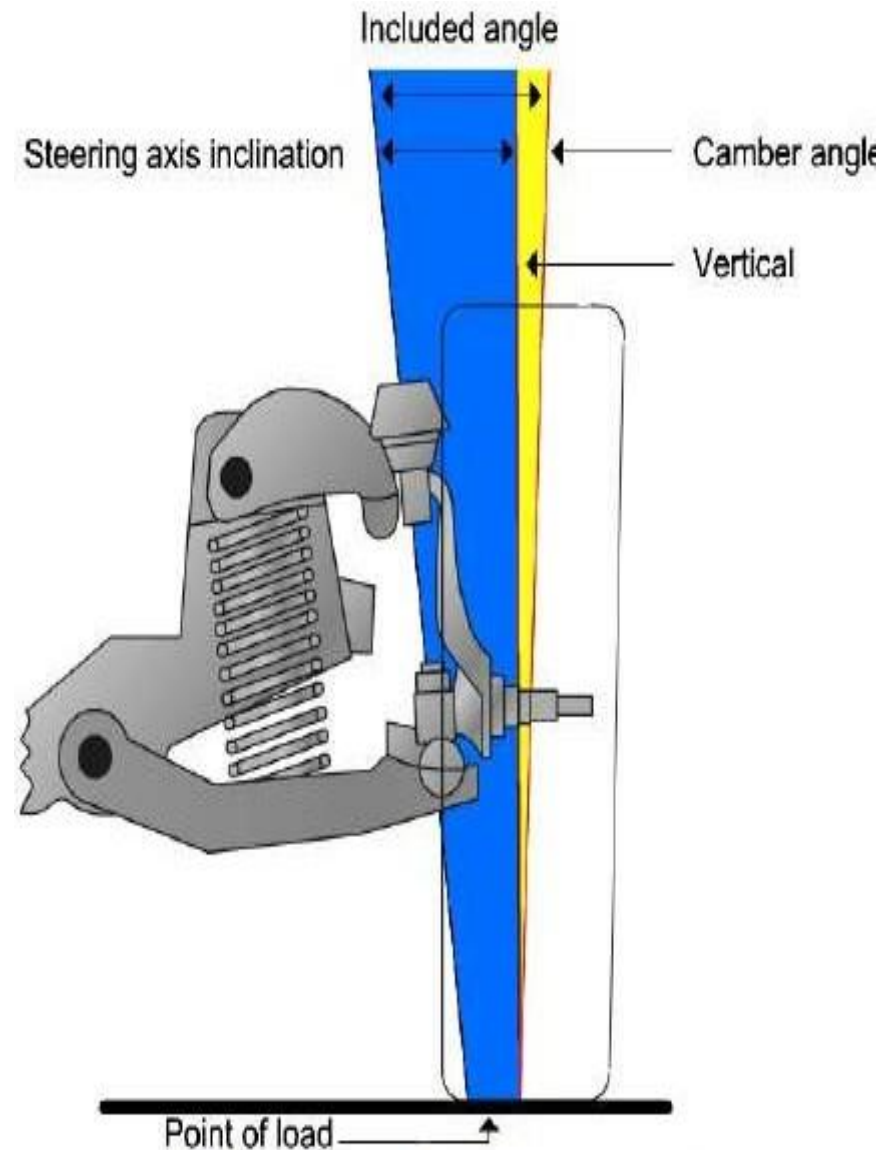




Positive caster on a front bicycle fork

Steering Axis Inclination (SAI)

- The angle, away from true vertical, formed by a line drawn through the ball joints (or the lower ball joint and the upper strut mount on MacPherson strut systems)
- The SAI is always an inward tilt.
- The function of SAI is similar to caster, only more so. SAI helps return the steering to straight ahead after a turn and keeps the vehicle going straight with little steering wheel correction needed.



The SAI helps the vehicle steer straight ahead.

Scrub Radius

Distance From which the ground plain intersection of the Steering axis and the center of the tire contact patch

Large effect on drivers feel and steering effort

