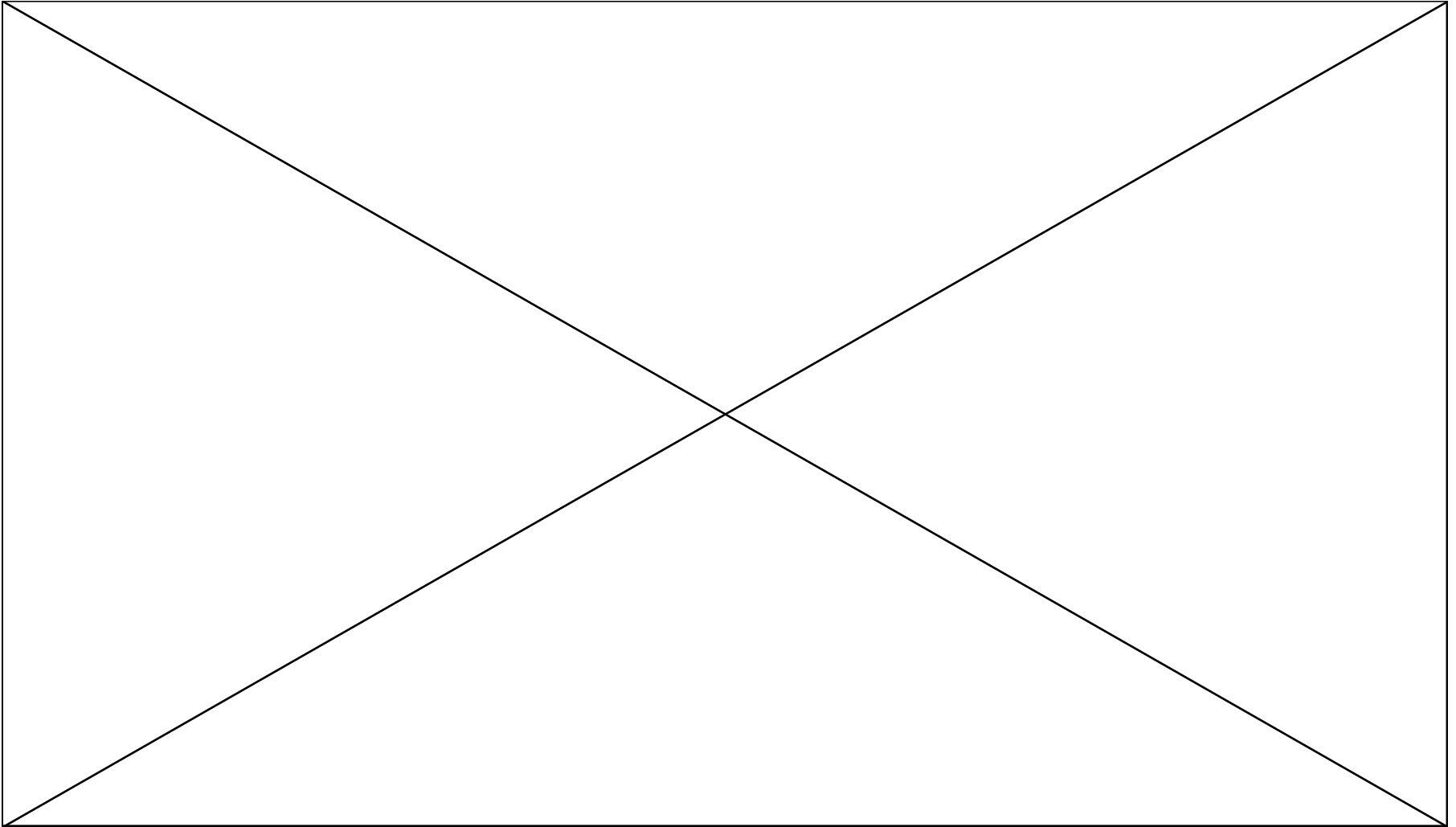


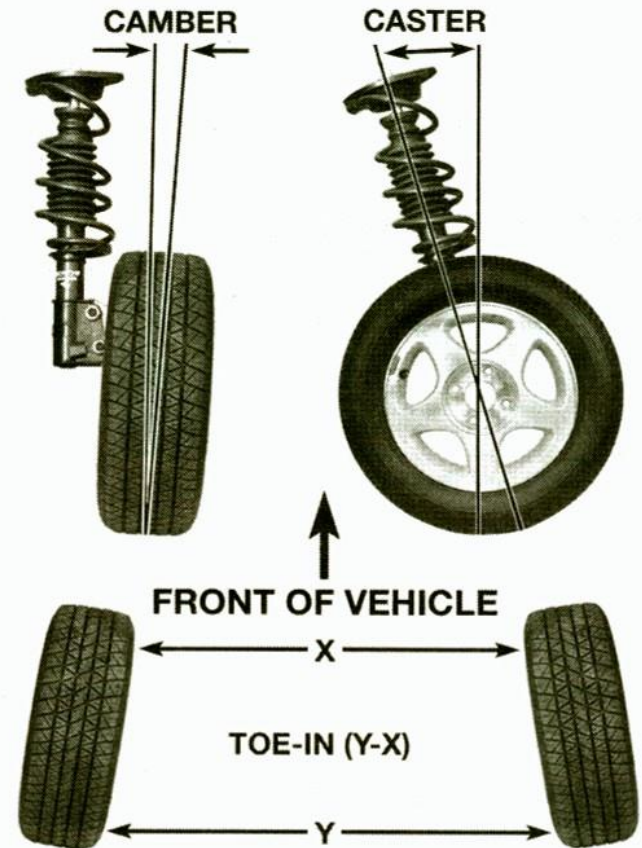
Why do cars need Alignment



Alignment

The main purpose of wheel alignment is to make the tires roll without Scuffing, slipping, or dragging under all operating conditions.

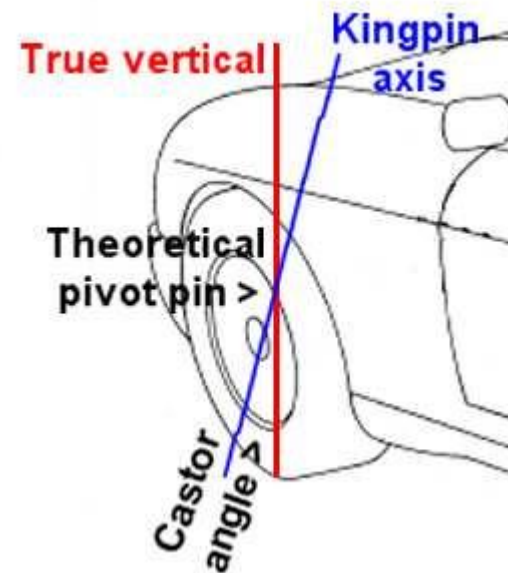
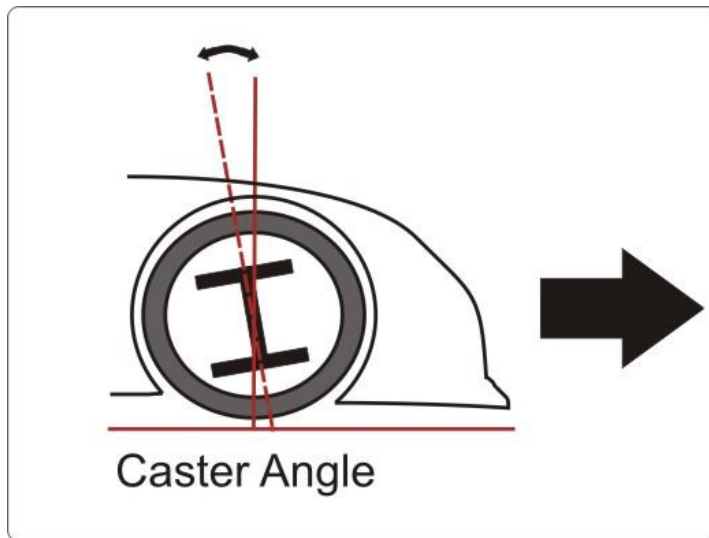
- Caster
- Camber
- Toe
- Steering axis inclination
- Toe-out on turns (turning radius)
- Tracking (thrust line)



22.1 Camber, caster and toe-in angles

Alignment

Caster is basically the forward or rearward tilt of the steering knuckle when viewed from the side of the vehicle.



Basic purpose:

- To aid directional control of the vehicle.
- To cause the wheels to return to the straight ahead position.
- To offset *road crown pull* (steering wheel pull caused by hump in center of the road).

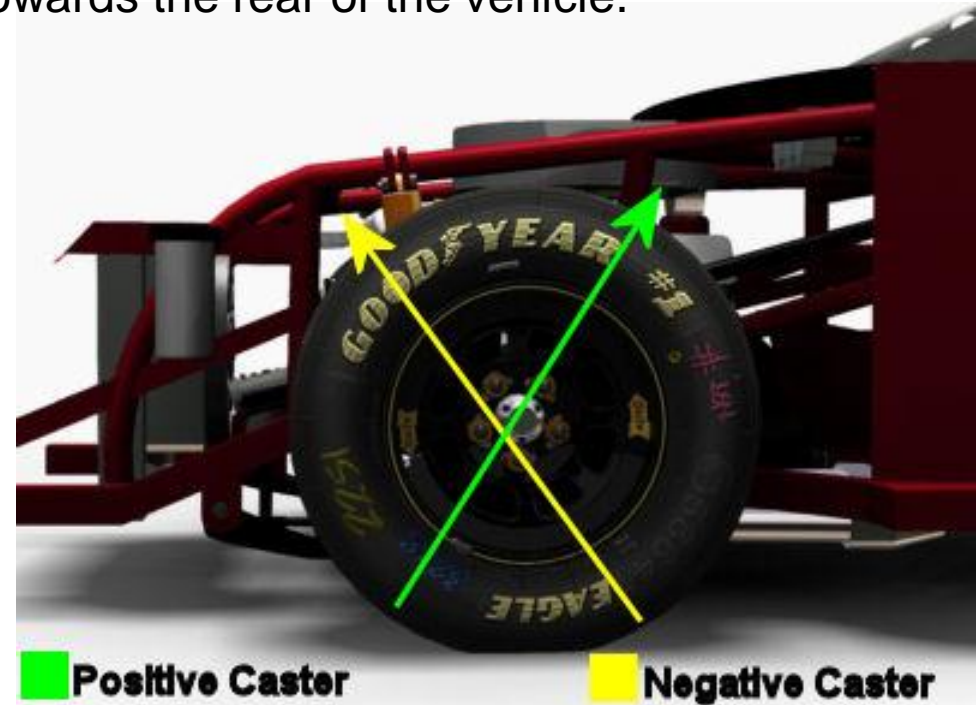
Alignment

Positive Caster

- Tilts the top of the steering knuckle towards the rear of the vehicle.
- Helps wheel traveling in straight line.
- When turning, the vehicle lifts up, the resistance to the extra weight returns the wheel to straight ahead position.

Negative Caster

- Tilts the top of the steering knuckle towards the front of the vehicle.
- Wheel is easier to turn.
- Wheel will tend to swivel and follow the imperfections in the road.



Caster is measured in degrees.

Alignment

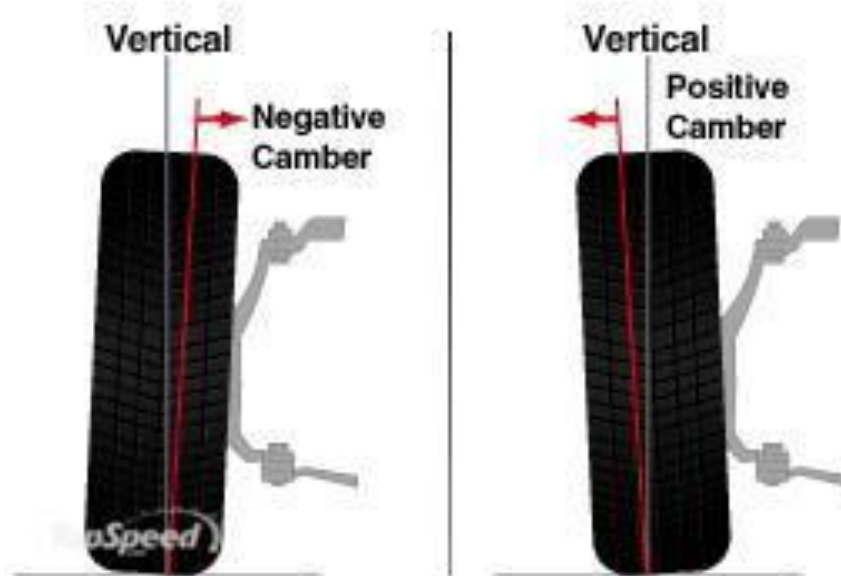
Caster-Road Crown Effect

- Road crown is normal slope towards the outer edge of the road surface.
- Caster is different on both wheels, this prevents the vehicle from pulling toward the outside (lower) edge of the road.
- Right front wheel may be set with slightly positive caster than the left.



Alignment

Camber is the inward or outward tilt of the wheel and tire assembly when viewed from the front of the vehicle.



- To prevent tire wear on the outer or inner tread.
- To load the larger inner wheel bearing.
- To aid steering by placing vehicle weight on the inner end of the spindle.

Alignment

Positive Camber

- Top of the wheels tilt outwards when viewed from the front of the vehicle.

Negative Camber

- Top of the wheels tilt inwards when viewed from the front of the vehicle.

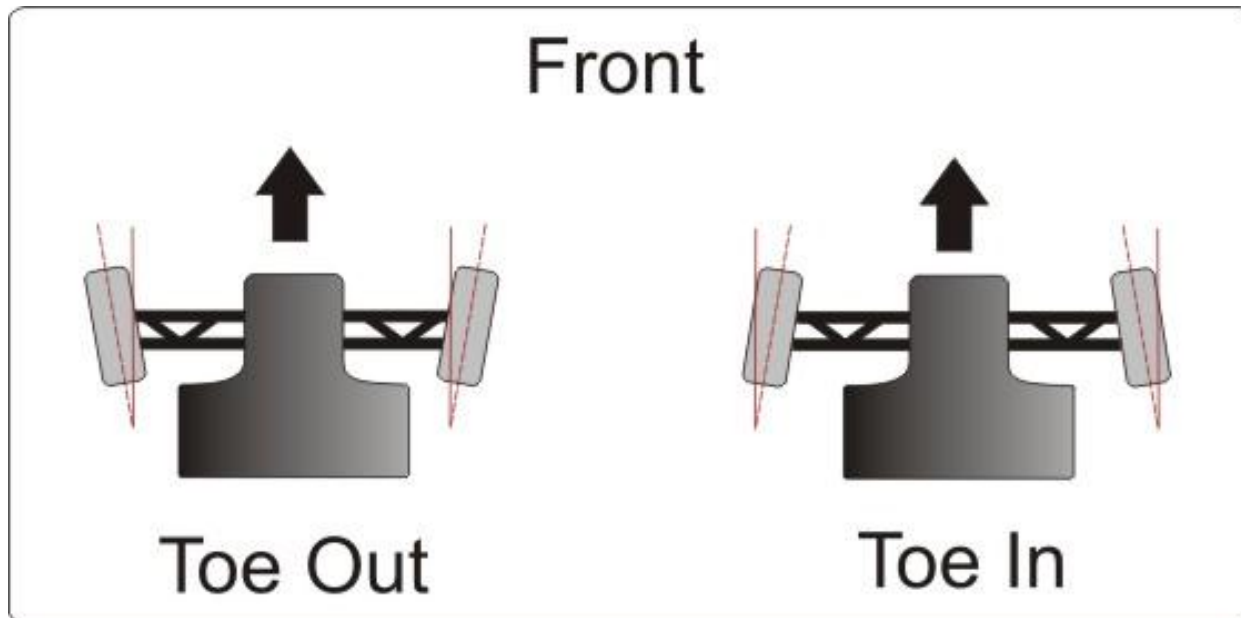


Most manufacturers recommend a slight positive camber setting of about $\frac{1}{4}^{\circ}$ to $\frac{1}{2}^{\circ}$ (compensate the weight).

Alignment

Toe is determined by the difference in the distance between the front and rear of the left and right-hand wheels.

- Toe controls whether the wheels roll in the direction of travel.



Toe-out wheels are farther apart at the front than the rear.

Toe-in wheels are closer at the front than at the rear.

Alignment

Rear-Wheel-Drive Toe Setting

- Front wheels tend to toe-out while driving.
- As the tires roll over the road, they are pushed rearward, causing the tires to turn outward (toe-out).
- To compensate this the front wheels are set to have toe-in at the front wheels ($1/16'' - 1/4''$).

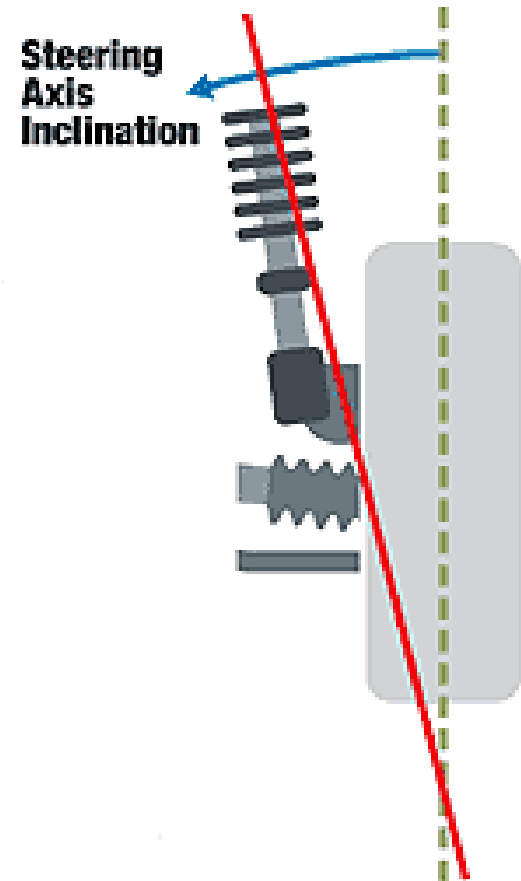
Front-Wheel-Drive Toe Setting

- Front wheels propel the vehicle, they push forward by engine torque.
- This push causes the wheels to point inward (toe-in).
- To compensate this the front wheels are set to have toe-out at the front wheels (approximately $1/16''$).

Alignment

Steering Axis Inclination (SAI)

- Angle away from the vertical, formed by the inward tilt of ball joints, king pin, or MacPherson strut tube.
- Always an inward tilt.
- Not a tire wearing angle.
- Not adjustable.
- Must replace part if not correct.

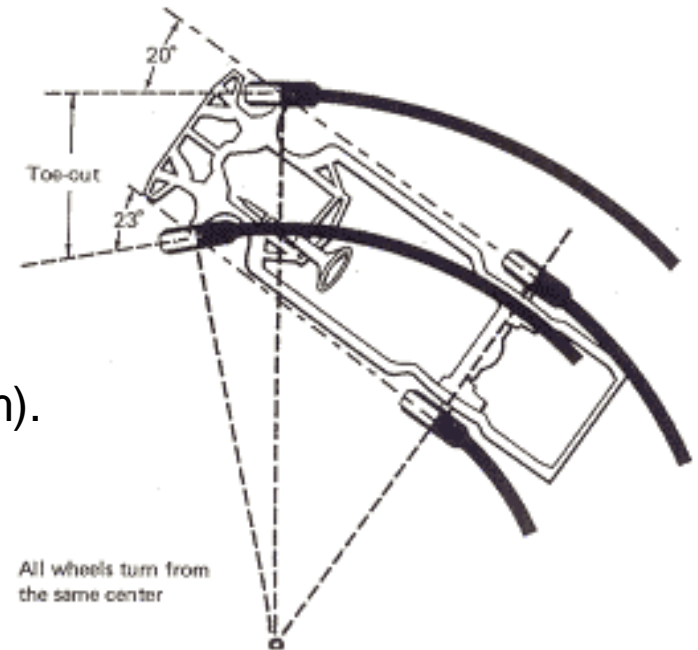


Alignment

Toe-Out on Turns (Turning Radius) is the amount the front wheels toe-out when turning.

- Around the turns the inside tire must travel in a smaller radius circle than the outside tire.
- Prevents tire scrubbing and squealing.
- Is not adjustable (built in angle of steering arm).
- If incorrect, check for bent or damaged steering parts.

Toe-Out In Turns (Ackerman Angle)



Alignment

Pre-Alignment Inspection

- Loose wheel bearings
- Wheel or tire run-out.
- Worn tires.
- Tires of different size and types.
- Incorrect tire inflation.
- Worn steering components.
- Worn suspension components.incorrect curb height and weight.

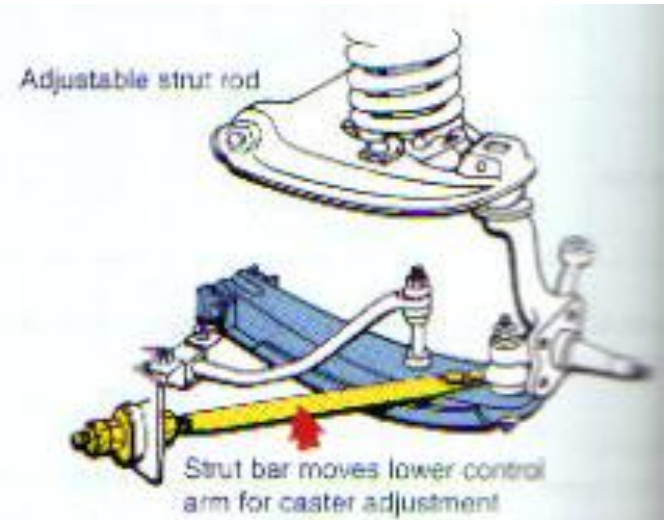
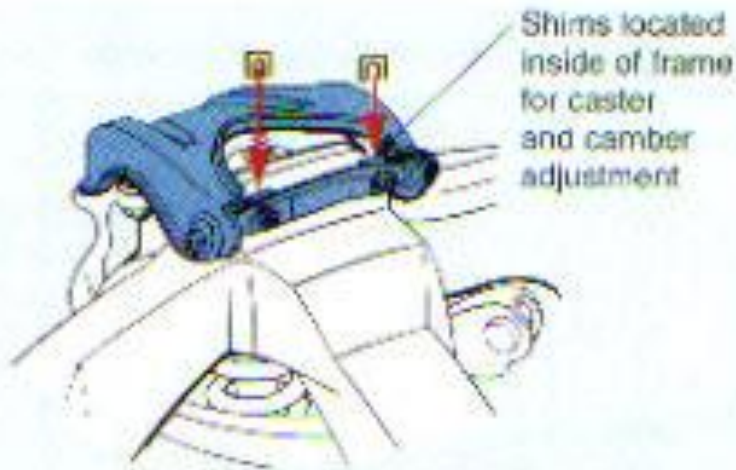


Alignment

Caster is adjusted by moving the control arm so that the ball joint moves toward the front or rear of the vehicle.

Control arm can be moved by :

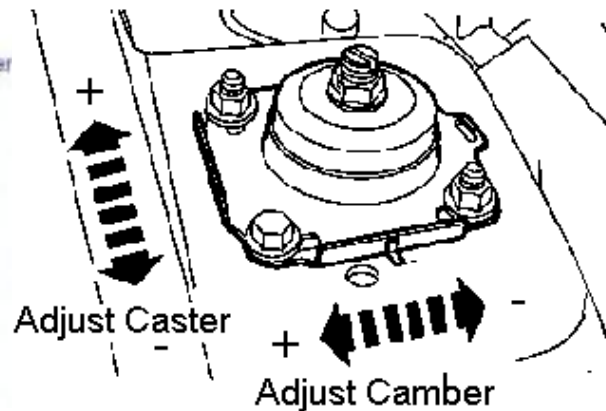
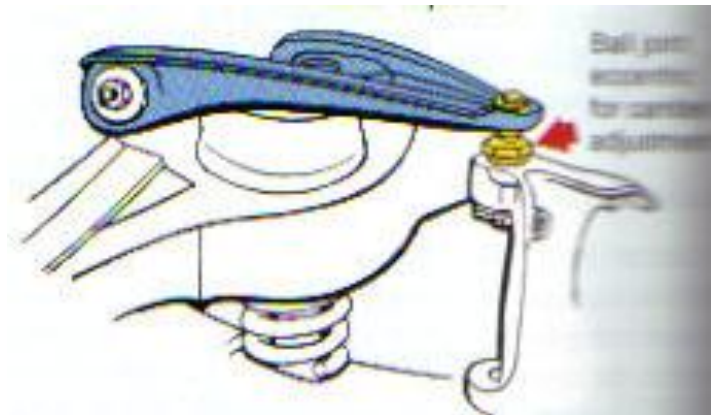
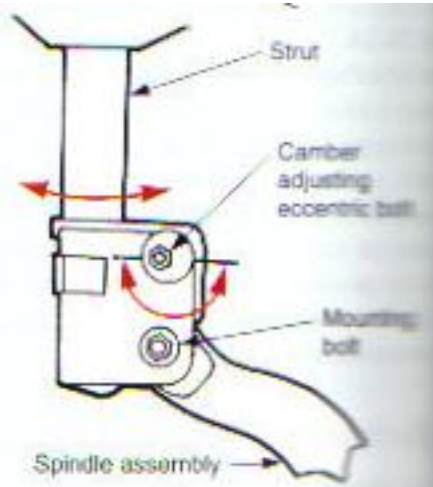
- Adding/removing shims
- Adjusting strut rod
- Turning eccentric bolt
- Shifting control arm shaft bolts.



Alignment

Camber is changed by moving the control arm in or out without moving the ball joint.

Adjusted by shims, slots, or eccentric bolts.



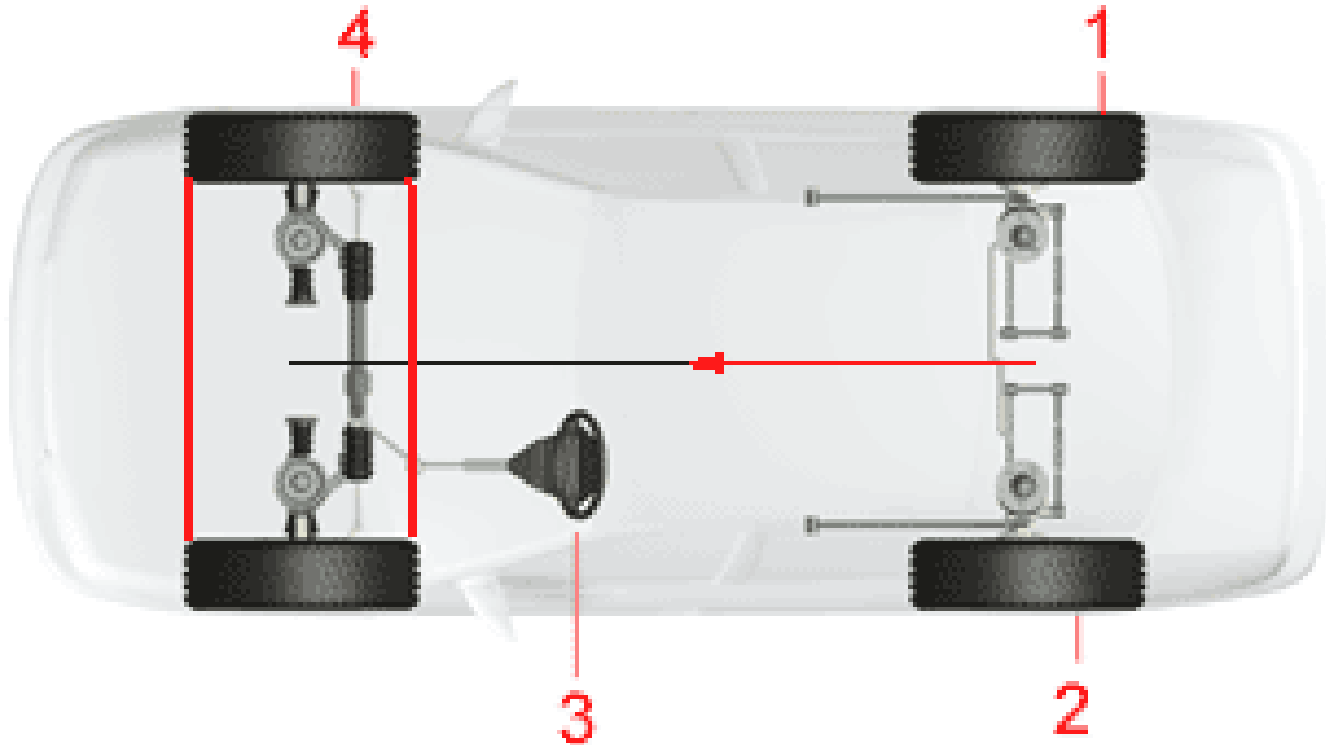
Alignment

Toe is adjusted by lengthening or shortening the tie-rods.



Alignment

After installing tie-rod ends, check toe-in.



Alignment