

Suspension Alignment: Understanding and Adjusting Caster

Caster is the angle between the steering axis and the vertical axis as viewed from the side of the car. Caster affects straight-line stability and "camber gain". Positive caster is when the top of the steering axis is tilted back (steering axis intersects the ground in front of the tire contact patch). Negative caster is when the top of the steering axis is tilted forward (steering axis intersects the ground behind the tire contact patch). I have never seen negative caster used in suspension setup, and I do not believe it is beneficial in automobile suspension geometry. Therefore, for the rest of this section, when I refer to caster, I am talking about positive caster.

To visualize caster, think about the wheels of a shopping cart. The steering axis of the wheel intersects the ground far ahead of where the wheel touches the ground. As a result, the wheel is essentially dragged behind the steering axis. This keeps the wheel moving straight. If the steering axis intersected the ground at the same spot that the wheel touched the ground, then there would be no caster effect. The wheel would be free to spin around the steering axis as long as it was not held in place by some other force.

Unlike in a shopping cart, the steering axis on a car is placed close to the hub of the wheel. Therefore, the only way to make the steering axis intersect the ground ahead of the tire contact patch is to tilt the steering axis back. The more the axis is tilted (in the positive caster direction), the greater the caster effect.

Large caster settings increase the tendency of the front wheels to center themselves. This tendency is mainly due to the camber gain that occurs when the steering axis is tilted and the wheels are turned. Camber gain involved with caster is not easy to visualize. Think about the extreme case where the steering axis is tilted to the point where it is horizontal. When you turn the steering wheel in this case, the front wheels would stand up on their edges. If you turn left, the left tire will stand on its outer edge, and the right tire will stand on its inner edge. If you turn right, the left tire will stand on its inner edge the right on its outer edge. The same type of camber gain, only on a smaller scale, takes place with less caster. This camber gain is exactly what you want in a corner. Read my accompanying on camber to see what it is and why it's beneficial.

When the tires stand up on their edges, the front of the car is actually raised up. This is why the wheels "center themselves" when you let go of the steering wheel. The weight of the car pushes the wheels flat on the ground, which resets the steering. This improves high-speed stability because it keeps the steering firmly in the center position. However, it is difficult to turn a car with a large caster setting because, while turning, you are actually lifting the front of the car with the steering. This effect is most visible in luxury sedans, where high-speed stability is important and sophisticated power steering makes up for the extra steering effort. If you watch one of these cars as the wheels turn to full lock (maximum steering angle), you will see the front end of the car rise slightly.

Increased caster is advantageous for racing and, in some cases, street driving. The only disadvantage is the added steering effort. While camber gain due to caster is generally good for increasing the grip of the front tires in a corner, too much camber gain will cause the tires to heat up, lose grip, and wear out prematurely. Therefore, do not use more than a few degrees of caster. If your car uses a MacPherson Strut suspension, it may be necessary to modify the strut tower mounts or tension rods to be able to adjust caster.

Visit my website for more information about caster adjustments: www.240edge.com

Short note about the author

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I have been an automotive enthusiast throughout my life and have participated successfully in various amateur racing series. I specialize in tuning the Nissan S platform cars, particularly the US domestic market Nissan 240SX. Visit my website www.240edge.com, which focuses on Nissan 240SX modifications, to get information about suspension setup, quality upgrades, and general 240SX tuning.

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