

E30 Rear Semi-Trailing Arm Roll Center

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How does geometry affect roll center?



Most automotive enthusiasts have heard of the term "roll center". It is a property of both front and rear automobile suspensions and determines, among other things, how far a car rolls during cornering. A roll center which moves around a lot as the suspension compresses and extends is considered undesirable, and can make a car "feel weird" to drive. A small amount of motion of the roll center in the vertical direction is tolerable, but movement of the roll center in the lateral direction is not good.

It is the location of the roll center in relation to the center of mass that governs how far one end of a car will tend to want to roll during lateral acceleration (cornering). This is called the "roll-couple". The ratio of the front roll-couple to the rear roll-couple is one of several factors that determines the tendency of a car to either oversteer or understeer.

An explanation of how the roll center and center of mass combine to form the roll-couple can be found here: "[How lowering a car affects roll-couple](#)"

To visualize the rear roll center you really need a picture. The digital drawings that follow are large - they need to be in order to show the detail properly. I suggest the reader have a look at the first drawing and then come back to the text:

[Semi-trailing arm ROLL CENTER for a standard configuration.](#)

Note the references to "IC" which stands for "instant-center". The instant center is the virtual location about which a wheel "rotates" at any particular time (as seen from the front of the car or from the side). Here we are not referring to the wheel rotating about its axle as the car rolls down the road. Rather we mean the "imaginary" location about which a wheel rotates as it moves through its suspension range of travel. Although one would like the roll center to stay in one place, it is quite normal for the instant centers to constantly change location as the wheels move up and down. What you want is that as a car rolls, and one side of the suspension compresses while the other side

Observe that the instant center for the right rear wheel is on the left side of the car and visa versa. Once you find the instant centers, locating the roll center is easy. You simply draw a line between each tire contact patch and its instant center. The intersection of these two lines (one for each wheel) is the roll center.

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