Even One Degree: Steering And Suspension

What's a degree? A unit of temperature, an educational milestone/recognition, an angle? In this case, we are referring to the measurement of an angle. In steering and suspension, we commonly refer to caster, camber, and toe measurements, these are not independent of alignment angles, rather they are directly tied in with, and inseparable, from them.

When talking about how much one degree is, one may think, one degree is one degree. Simple! However, when looking at different inch or mm measurements for different suspension types and how it is directly related to one degree of suspension movement or adjustment (caster, camber, or steering axis inclination (SAI) for example), one degree is no longer simple.

For a typical strut suspension with a distance of approximately 28 inches between the upper strut mount and the lower ball joint (steering axis pivot points), it takes about ½ inch or 13 mm of movement of one of the points forward or rearward to affect a one degree change of caster.

Move a pivot point 13 mm towards or away from centerline on that same 28-inch strut system and you will change SAI (and camber) one degree. Knowing this will help you understand the effects of a shifted crossmember or cradle, and how it affects steering centering, scrub radius, and wheel alignment in general.

Using trigonometry, which, roughly translated from Greek, means "triangle measure", there is a relatively simple mathematical equation that uses the distance between pivot points, and the variation angle. If you know the measured distance between the steering axis pivot points and the angle of the variation in degrees, you can determine the distance of this variation in inches or mm. In addition, if you know the measured distance of the variation, you can work the math differently to find the angle of the variation.

Understanding how much one degree equates to inches/mm is a powerful "tool" to have in the toolbox. What do you do when a vehicle comes in from an alignment shop with an alignment report and numbers out of spec? You can analyze the degree numbers on the report to determine how much something is off in inches or mm and then measure to find it. Once it is located, it can be determined what the damage is, and you can better plan your repair.

Vehicle tolerances are tighter and wheel alignments affect far more than tire wear and handling on technology packed vehicles of today. Be sure your customer has the deck stacked in their favor. A complete, safe, and quality repair is not gamble, someone's life may depend on it!