How to Fix Wheel Alignment Problems

Has this ever happened to you? You have the alignment checked on a car or truck and found that it was within the acceptable range of specs for the application, but it does not steer straight. It is a common enough problem, so keep reading any maybe we can straighten things out for you.

As anybody who has spent much time under an alignment rack knows, the range of factory tolerances that are included in the data banks of most electronic alignment equipment today (as well as alignment reference books) may not be tight enough for every vehicle you are apt to encounter. The alignment specs that everyone uses are compiled from information supplied by the vehicle manufacturers, and are based on the vehicle's suspension geometry, drivetrain configuration, handling characteristics, weight distribution, average loading, etc. As long as a vehicle is within the range of specs listed, wheel alignment should be acceptable under most circumstances. But sometimes it is not. Some vehicles are more sensitive to slight variations in alignment than others, just as some drivers are more sensitive about how their car or truck steers and handles. So just because a vehicle's wheels are aligned somewhere between the minimum and maximum allowable specs does not mean it will always steer straight.

For starters, most experts say wheels should be aligned to the "preferred" alignment settings rather than accepting anything that is between the minimum and maximum values. Why? Because preferred settings are closer to the mark than the minimum or maximum values.

Another suggestion is to keep the difference and camber and caster readings side-to-side to half a degree or less. Why? Because more than half a degree difference in camber or caster between sides may cause the vehicle to lead to one side.

WHY STEERING PULLS

Three simple conditions must be met for a four-wheeled vehicle to travel in a straight line:

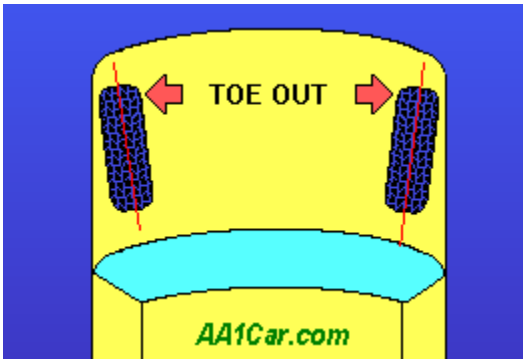
1. All four wheels must be pointing in the same direction.

That is, all four wheels must be square to each other and square to the road surface (in other words, parallel to one another, perpendicular to a common centerline, and straight up and down).

2. All four wheels must offer the same amount of rolling resistance. This includes the "caster effect" between the front wheels that steer.

3. There must be no play in the steering or suspension linkage that positions the wheels.

If all three conditions are not met, the vehicle will drift to one side depending on which forces are at work. This creates a steering pull which the driver will counteract by steering the other way. Having to constantly apply pressure to the steering wheel to keep the car traveling in a straight line can be tiring on a long trip. It can also be hard on the tires, too.



A toe-out condition is the most common cause of toe wear on front tires.

TOE MISALIGNMENT

Only 1/8 inch of toe misalignment front or rear produces the equivalent wear of scrubbing the tires sideways 28 feet for every mile traveled. Yet many toe specs allows for this much variation!

Toe wear typically causes rapid shoulder wear on the tires on the INSIDE edge of both front tires.

Inside shoulder wear like this on both front tires indicates toe misalignment. If only one front tire is worn like this, the cause is camber misalignment.

The need to have all four wheels pointing in the same direction and square to each other and the road sounds obvious enough, but it is surprising how many alignment jobs fail to achieve it when the wheels are aligned anywhere between the maximum and minimum specs rather than to the preferred specs.

Checking toe will tell you if the front and rear wheels are parallel to one another and how close they are to the preferred specifications. If they are within the acceptable range of specs, but the tires show obvious signs of toe wear or the vehicle has an off-center steering or a pull to one side, then it should be obvious that close enough is not good enough. The wheels need to be realigned to the preferred settings.

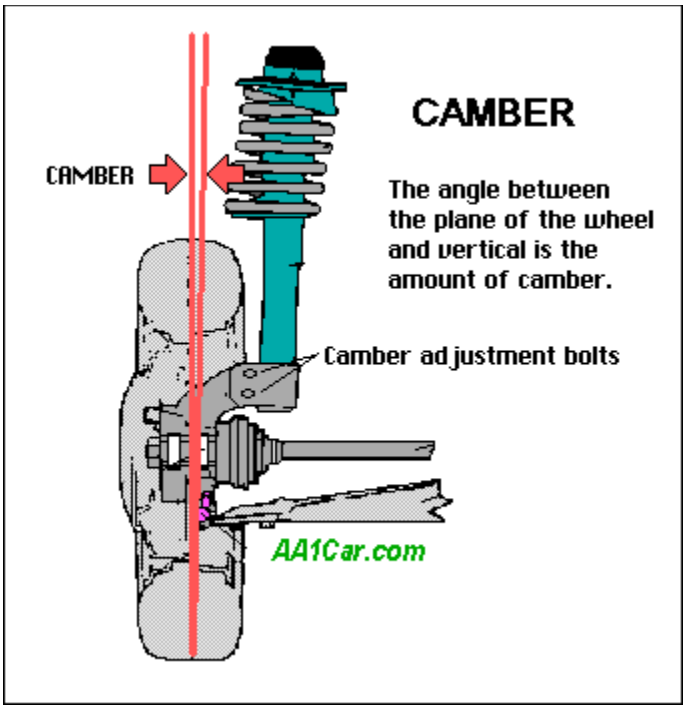
It is important to remember that rear toe is just as important as front toe, especially on cars and minivans with front-wheel drive or vehicles with independent rear suspensions. If rear toe is off the mark, it can create a rear axle steer condition that a simple front wheel alignment check will never detect or cure.

Rear toe is also different from front toe in that front toe misalignment tends to be self centering. When the front wheels are toed-in or toed-out with respect to one another, the two wheels share the toe angle equally while rolling down the road with tread wear

being about the same for both tires. With rear toe that is not necessarily true because the rear wheels are not free to steer nor are they tied together with a steering linkage.

On a rear-wheel drive car or truck with a solid rear axle, a cocked axle will toe-in one wheel and toe-out the other by an equal amount. This kind of misalignment will make the vehicle dog track and create a thrust angle that induces a steering pull as well as toe wear in the front wheels (turning the wheels, even slightly, causes them to toe-out which can increase tread wear). If the rear axle misalignment cannot be corrected by repositioning the spring mounts, installing aftermarket offset control arm bushings, etc., you can at least minimize the problem by having the front wheels aligned to the rear thrust angle.

On applications that have an independent rear suspension, or front-wheel drive cars or minivans that have a one-piece rear axle, one wheel that is toed-in or toed-out will also induce a steering pull. If toed in, the wheel will push to the inside. If toed-out, it will pull to the outside. This can also create dog tracking problem with both tires suffering toe wear (though the wheel that is off may show more wear).



CAMBER MISALIGNMENT

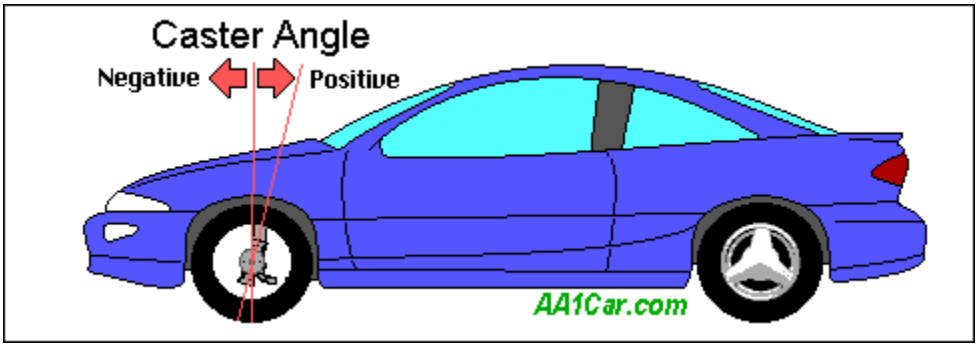
When camber is set to factory specs, the wheels should be more or less perpendicular to the road at normal ride height (a good reason for always checking ride height prior to aligning the wheels!). Camber will vary as the suspension travels through jounce and rebound, but as long as the camber changes are the same side-to-side, there should be no "bump steer" or twitch to either side.

But factory specs allow for a lot of camber variation. A typical spec may have an acceptable range of up to a full degree of camber either way. If one wheel is at the maximum acceptable limit and the other is at the minimum acceptable limit, you could end up with a difference of almost two full degrees side-to-side! That is way too much camber difference. Consequently, the vehicle will pull towards the front wheel that has the most positive camber or away from the wheel that has the most negative camber. Keeping camber differences to half a degree of less should minimize this kind of problem.

Rear camber is just as important, too. If there is a difference between rear camber alignment, the rear axle can drift to one side or the other, creating a condition similar to rear axle steer that makes the vehicle steer crooked.

So what do you do if a vehicle has no factory camber adjustments, or the limited range of adjustment is not enough to equalize readings or to achieve the preferred settings? Before any shims, wedges, offset bushings or other alignment aids are installed, the suspension should be checked to make sure something is not bent, broken or worn. A weak or broken spring, a collapsed control arm bushing, a mislocated strut tower or engine cradle, or a bent strut or control arm can all throw camber off the mark.

Checking and comparing SAI readings side-to-side is a good way to identify "hidden" problems such as those just described. Even though we tend to think of it as a nonadjustable angle that is built into the suspension itself, it is still a useful angle to look at (even if specs are not available) because it can reveal conditions or damage that affect a vehicle's ability to steer straight. On front-wheel drive cars where the lower control arms are attached to the engine cradle, a shift in the cradle's position to either side will upset SAI as well as camber. The result will be a steering lead towards the side with the least SAI. Ideally, right and left SAI readings should be within half a degree of one another.



CASTER MISALIGNMENT

Like camber, caster readings should also be set to the preferred specs and be within half a degree side-to-side. A greater difference side-to-side can make the vehicle lead

towards the side with the least caster. Increasing caster increases steering stability because it forces the suspension to lift when the wheels are steered, while decreasing caster eases steering. Sometimes steering wander can be a problem if the front wheels have insufficient caster. Steering pull that is caused by road crown can sometimes be compensated by adding positive caster to the left front wheel.

If caster is out of range, check for worn strut or control arm bushings, a mislocated MacPherson strut tower or a bent lower control arm.

OTHER WHEEL ALIGNMENT FACTORS

In addition to wheel alignment, anything that creates unequal rolling resistance or friction side-to-side on a vehicle's suspension or brakes can make it steer crooked. This includes such things as underinflated tires, mismatched tires or dragging brakes.

Before wheel alignment is checked, the tires should be inspected. Check and equalize tire inflation pressures. Note tire sizes and brands. A vehicle will pull towards the side that offers the greatest rolling resistance. So if the tires on both sides of an axle are not the same construction (bias ply or radial), diameter, tread width, tread pattern and even brand in some instances, there may be enough difference in rolling resistance to induce a slight pull to one side.

A dragging or frozen caliper, or weak or broken return springs in a drum brake can create enough friction to also cause a noticeable steering pull. If you suspect brake drag, the easiest way to find the offending brake is to raise the wheels off the ground and spin each one by hand.

A vehicle's ability to steer straight can also be undermined if there is excessive play or looseness in the steering linkage or wheel bearings. Loose tie rod ends, idler arms, a worn steering rack, even loose rack mounts can all have an influence on directional stability. So be sure to perform a thorough inspection of the steering and suspension before aligning the wheels.

The alignment of the steering linkage itself is also important. If the rack, center link and/or steering arms are not parallel to the ground, it may create unequal toe changes that result in a bump steer condition when the suspension travels through jounce and rebound. Measuring and comparing the height of the inner and out tie rods ends on each side can help you identify this kind of problem. Another technique is to check for equal toe changes on each side when the suspension is raised and then lowered.

Another condition that may even cause a vehicle to steer crooked is a power steering problem. Internal leaks in the power steering control valve can route pressure to where it is not needed. The pressure imbalance may make the car drift to one side or, if bad enough, the car may try to steer itself with no assistance from the driver! You can check for this kind of problem by raising the wheels off the ground and starting the engine. If

the steering wheel starts to turn all by itself, power steering work is what is needed here, not an alignment.

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