

Motorhome Handling Problems & Solutions

A Primer by Gary Brinck

Motorhome handling is a complex issue and is often perceived differently by different drivers. Each motorhome chassis manufacturer makes multiple versions of the same chassis, with different wheelbases and different GVWRs, so one cannot simply compare Freightliner to Spartan or Workhorse to Ford. Furthermore, the chassis manufacturers cannot control the weight distribution after the various coach manufacturers add the motorhome body to the chassis, nor can they predict how the owner will load his gear aboard. This results in an almost infinite variety of motorhome handling characteristics, even within the same chassis type or coach model.

Because of the variety of motorhome handling problems and unfamiliarity with the terminology, most drivers don't know how to describe their handling problem or what sort of fix to ask for. "Doesn't handle worth a darn" or "wanders all over the road" is the usual complaint and "Make it better" the requested action. The average RV shop often isn't any more knowledgeable and generally recommends a one-size-fits-all solution, which varies according to the shop or even which service advisor on duty. One will always say "stiffer shocks" while another always recommends a steering damper, with the result that motorhome owners usually end up buying add-on parts until they finally hit on the one that addresses their particular problem. This is also the reason why one owner will swear that a particular handling device is wonderful and another will call it a worthless (but expensive) piece of scrap iron. Each of them had a different problem, on a different rig, caused by different circumstances. Armed with the knowledge of handling problems that you will learn about here, hopefully you will be able to more quickly - and less expensively - zero on the right solution for your problem.

Weight & Wheelbase

Weight distribution has a major effect on the vehicle center of gravity [VCG] and VCG in turn is a major factor in handling on a large, heavy vehicle. Motorhome handling improves dramatically as the VCG moves down [lower] and toward the center of the axles, both side to side and fore and aft. Another major and related factor is the length of wheelbase relative to the overall length of the coach. Wheelbase is simply the distance between the front and rear axles. In the case of tandem rear axles (drive axle + tag axle), the rear axle is considered to be at an imaginary point midway between the two. A longer wheelbase generally places the VCG more between the axles rather than toward either end. A rule of thumb is that the wheelbase should be more than 50% of the overall length, with 53% or more deemed to be "good". Because there are so many factors in good handling, it cannot categorically stated that a wheelbase ratio under 53% will result in poor handling, but all experts seem to agree that "more is better".

Weight & Tire pressure

Weighing your motorhome is the preliminary step in diagnosing nearly all handling problems. Besides, you must have accurate weights to correctly inflate the tires, another factor in proper handling as well as for tire safety. Weigh the motorhome front and rear axles separately and if possible also get the weights on individual wheels. If you can get the weight for each axle, front and rear, and for one side, you can calculate the weights on each wheel closely enough for most purposes. Get the tire manufacturer's inflation table for your brand of tire. This will tell you how much pressure (psi) is needed in the tire to support a given amount of weight. Use that pressure, plus a safety margin of 5-10 psi, as the pressure in the tires. All the tires on one axle should be inflated the same, so use the weight on the heaviest side to determine the tire pressure for that axle. Front, rear and tag axles can have a different pressure.

Alignment

Wheel alignment is another important step in good motorhome handling. Alignment consists of three measurements, **toe**, **caster** and **camber**. Toe is the inward or outward angle of the wheels with respect to

straight ahead. Caster is the tilt of the wheel in the vertical plane, normally angled slightly so that the steering tends to self-center when the vehicle is moving forward. Camber refers to the side-to-side tilt of the wheel, i.e. how perpendicular it is to the road. Each chassis will have detailed specs for these three things and it is crucial that they all be as close as possible to dead center on the target numbers. Sometimes each item will be within the tolerances for that spec, but the combined effect of all three being slightly off target can cause the whole coach to steer poorly. Alignment can also change as weight is added or moved around in the coach, so try to have it aligned as you expect to drive it. The coach is aligned at the factory, but it is empty then and things can change after it is loaded for travel.

Worn suspension

Sloppy fitting mechanical parts in the steering mechanism can also cause fidget steering because a sloppy fit allows the two front wheels to wander even when the steering wheel is held straight. Sloppy fit is a result of wear or sometimes just excessive tolerance in manufacturing. Each part is manufactured to a specification which allows a certain amount of variation, plus or minus, in the size. If too many of the steering parts are at the extreme of their size tolerance, the accumulated tolerance of multiple parts can result in steering which feels loose and requires constant correction. If you are having steering problems, make sure your front suspension is aligned as close as possible to its "dead center" specifications. If the problem persists, have a skilled mechanic check the tolerances on the steering system components.

One common source of sloppy steering is a part of the steering known as the bell crank, which translates the turning of the steering wheel into side-to-side motion of the front wheels. One particular brand of bell crank was widely used in Chevrolet P30 and older Freightliner chassis with a solid axle. It was notorious for poor manufacturing tolerances and quick wear, leading to numerous complaints about steering. A high quality replacement bell crank was designed and manufactured under the **Supersteer** brand name and is highly recommended if you have one of these chassis. The inferior bell crank was used in new production up until about 1998 or early 1999.

Pitching, Porpoising & Roll

Coaches with a long rear overhang and/or heavily loaded in the rear (e.g. generators, air conditioners, water tanks or rear engine) will have a tendency to teeter-totter around the rear axle in the vertical direction, resulting in a fore and aft plunging movement called **pitching**. To minimize this condition, the front axle should be loaded in the same proportion to its load rating (GAWR) as the rear. If the rear is near max load (common in motorhomes) but the front is only 50-60% of its max rated capacity, pitching is a given. Shock absorbers with a heavier (stiffer) motion resistance can sometimes alleviate the symptoms, but the only real fix is to redistribute weight. However, stiffer shocks will generally degrade the overall ride because more wheel bounce is transmitted to the frame. A chassis with a tag axle is much more resistant to pitching than a single rear axle because the second axle resists the teeter-totter effect.

A movement similar to pitching is called **porpoising**, named for the high arching maneuver of a dolphin surfacing in the ocean. In porpoising, the front end of the motorhome leaps into the air when going over a dip or short rise in the road. This may throw the front seat passengers towards the roof and be quite alarming. If it fails to steady out immediately, this is a sign of worn shocks. The front shocks should be replaced immediately, and perhaps the rears as well. However, some rigs will leap once and steady right out. In this case the shocks are doing their job OK but the passengers are still unhappy. A stiffer shock absorber can be used to better control the rapid rise of the front suspension, but the overall ride will be a bit harsher as a result.

A high positioned VCG and maximum weight will result in more vehicle lean or **roll** during cornering and a perceived loss of control in emergency maneuvers. To help avoid this, heavy objects should be stored as low as possible and weight evenly distributed from side to side. Motorhomes also may roll when turning onto or off from a road and going up or down a slight incline, as is typical of entering a driveway or fuel station. Sometimes **anti-sway bars** (aka anti-roll bars) are added to help reduce roll by stiffening the resistance to the roll movement. This doesn't stop the rolling, but it slows down the action and may reduce the feeling of uncontrolled movement. Modern motorhome chassis usually have anti-sway bars designed in, but in some cases it may be possible to add another or substitute a stiffer one. Coaches with air suspension can also be enhanced with **motion controllers**, which limit the speed with which the air suspension responds to changes in weight distribution as the coach slows or turns. This can limit body roll quite effectively, at the cost of a slightly stiffer ride overall.

Crab and Yaw

Another major factor in motorhome handling is the large surface area of the sides. Strong side winds can actually shift the motorhome on its suspension to the point where the body is skewed at an angle to the chassis as it moves down the road, called **crabbing**. Speed should be reduced whenever this happens, since the force acting on the sides is proportional to the square of the air speed and thus even a small difference in speed can make a huge difference in the amount of force applied. Vehicles with a larger rear overhang will typically be more affected by side winds because they will tend to pivot horizontally around the rear. When caused by gusty winds or the airstream surrounding passing vehicles, this horizontal motion is called **yawing** - or more humorously, "the tail wagging the dog". The rear end moves sideways in the direction of the wind and pushes the front end the opposite way, requiring a steering correction. The correction alters the direction of the wind force and that requires another, sometimes opposite, steering correction. A small curve in the road or wind direction change can be enough to change the wind force, also requiring a steering correction. A day of driving in variable side winds can leave the driver exhausted, due both to actual work at the steering wheel and the stress of coping with frequent steering changes.

Rut Tracking, Fidgeting and Wandering

Heavily traveled highways, especially interstates, will develop ruts or tracks which are often nearly invisible. If your vehicle's wheel track (the distance between the front wheels) is different than the space between the road ruts, or if your driving habits have you trying to drive to one side or the other of the worn track, the front wheels will continually be trying to ride up or down the sloped side of the worn track and getting pushed from side to side. This side play usually results in many and frequent small steering corrections, sometimes called **fidgeting** but more often lumped in with the broader term of **wandering**. To see if rut tracking is causing excessive steering correction, try driving in the left hand lane of a 4-lane highway, which usually has less wear. Crowned roads (high center) and banked roads (tilted sideways, usually at curves) will also have an effect similar to rut tracking as the steering wheels try to run down the grade to the lower side. Leaf spring suspensions are more susceptible to side play than good quality air suspensions, probably because air suspensions have no inherent resistance to sideways movement and thus must have anti-side-play mechanisms designed in.

A device called a **panhard rod** can often provide substantial relief to wheel tracking problems. A panhard rod locks the leaf spring stack in place laterally, preventing axle side play. More on panhard rods later.

Back Steer

There is a phenomenon in large vehicles known as **Back Steer**, where the input of the road surface, wind, etc. pushes back on the steering wheel and causes the driver to make a correction. Most major roads have nearly invisible ruts worn in them from continuous heavy traffic. The ruts work to keep you in line if your wheels all conform to the rut, but if your wheels are spaced wider (typical of a motorhome) or you have to drive slightly off the rut track, the road continually tries to pull the tires back down into the rut. That is a classic example of back steer. Gusts of wind can also try to move the coach suddenly sideways.

A related phenomenon occurs with a leaf spring chassis, where sideways motion in the springs and bushings allows the front wheels to jiggle and/or react to the road surface. This is the fidget steering problem described earlier and requires almost constant steering correction. Sometimes the wheel jiggle just makes the driver feel as though a correction is needed when it is not, resulting in over-correction followed by a reverse correction to get back on track. The rear springs can also move sideways under pressure from wind or a passing vehicle, causing the tail of the motorhome to "move sideways, thus pushing the front end in the opposite direction. This is called **yaw** and typically requires a large steering correction. Crosswinds and passing trucks can cause similar yaw action, as the wind pressure pushes the front or back of the coach sideways. The primary means of correcting for yaw are the panhard rod and the anti-sway bar.

Driver Fatigue

This need for continual steering correction causes driver fatigue as well as the familiar "white knuckle" complaint, which refers to the need to grip the wheel firmly 100% of the time as well as the stress of constant decision making.

A device known as a steering damper is sometimes used to help control unwanted control steering movement. Steer Safe and Safe-T-Plus are prominent aftermarket RV steering dampers but some chassis, such as the Ford F53, have a similar device right from the factory. A steering damper is essentially a shock absorber and spring combination that works laterally on the steering system to reduce unwanted movement of the steering wheel. Steering dampers are most effective at reducing sudden sideways movements caused by the front wheels striking potholes or curbs. They are less effective on fidget steering problems and have almost no effect on steering yaw. However, some drivers find they reduce steering fatigue, but fatigue should not occur at all if the underlying handling problem can be identified and corrected.

Aftermarket Steering Dampeners and Track Bars

There are four popular aftermarket devices designed to deal with motorhome steering problems. These are the Safe-T-Plus and Safe Steer steering dampeners and the Davis and Henderson Track Bars. Both track bars are a type of device known generically as a panhard rod.

Some shops recommended the Safe-T-Plus over the Steer Safe and others the opposite. However both appear to be excellent products. Many RVers have attested that each product works to prevent sway from passing vehicles, ruts, etc. and improved their driving experience. Through their design, they also help to reduce steering pressure from crosswinds. They do, however, increase the steering effort somewhat, which places additional load on the power steering pump and you may hear it "growl" a bit louder when you need to turn sharply. The driver, however, will probably not feel any difference in effort.

Safe-T-Plus

The Safe-T-Plus (STP) is a combination double-acting spring (two springs pushing toward each other) inside a hydraulic cylinder, similar to a shock absorber. The springs within the STP work to self-center the Motorhome steering mechanism with hydraulic damping. The STP mounts by clamping to the axle and the tie rod, pulling the front wheels back toward center whenever a external force pushes them sideways.



Steer Safe

The Steer Safe is installed on the front steering arms and bolted to the front axle. Two large springs apply approximately 400 pounds of tension on the front wheels to counteract outside forces. This is intended to keep the front wheels pointed straight, even during a blowout

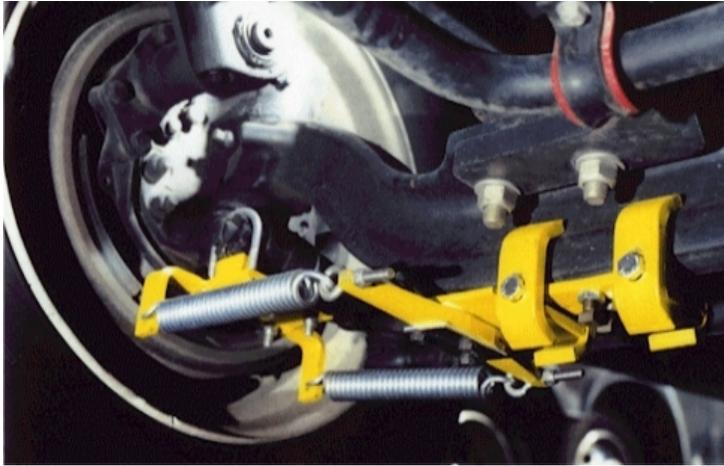


Photo courtesy of Steer Safe

Davis TruTrack Bar

The Davis Tru-Track Bar installs on the front end, tying the spring suspension on one side to the chassis frame on the other, preventing any possibility of side play. A pivot in the mount allows the spring to still move up and up as needed. This action effectively stops the sideways movement that is the root of most steering jiggle and wander. It also counteracts the yaw that occurs when the back end of the coach is pushed sideways by passing trucks.

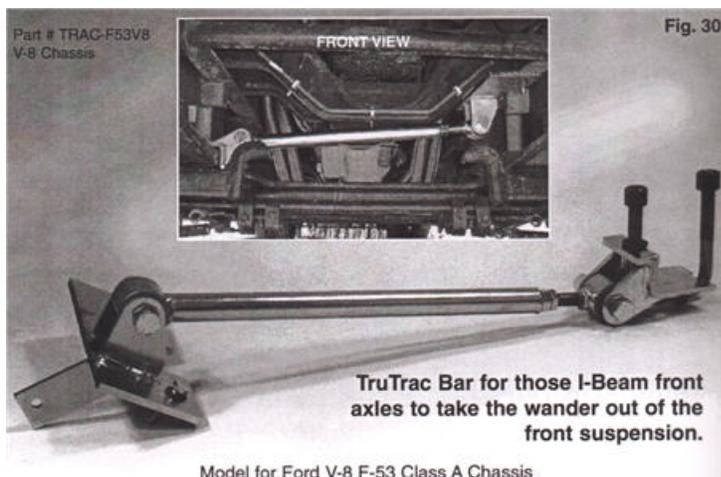
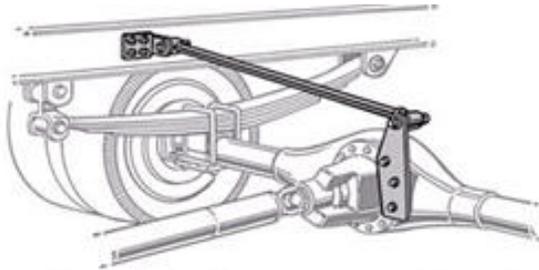


Photo courtesy of Davis TruTrack

Henderson Supersteer Track Bar

The Henderson Track Bar is similar to the Davis, but it installs on the rear end and ties the springs on one side to the either the rear differential or the chassis frame, depending on the chassis model. It totally stops side play while allowing the normal up/down action of the suspension to continue. Like the Davis bar, it stops most jiggle and wander.



Workhorse chassis with SS302 Rear Trac Bar illustrated

Photo courtesy of Henderson Supersteer

Which One Do I Need?

In most coaches, either the Davis or the Henderson track bars will stop most steering wander by preventing sideways movement. Since the front end moves in the opposite direction as from the rear end, locking either one down generally stops both from moving to any significant degree. However, a few coaches may benefit from having both installed. RVers who have installed either one report a night and day difference in steering and handling, with all tendency to wander gone. Either of these devices is highly recommended for any leaf spring chassis motorhome that has steering issues. They are easily installed by any handyman with access to a 1/2 or 3/4 inch socket wrench and large deep well sockets (those suspension bolts are huge!).

Do you need both a track bar and an STP or Steer Safe? It depends on what you want to achieve. The one thing the steering assist can help with that the track bars cannot is the wrenching motion that occurs if a tire blows out or a wheel drops off a low shoulder on the road edge. Some people feel that this protection alone is worth the price of the Safe-T-Plus or Steer Safe assists. Here is a testimonial from one owner, which was received by John Wilson at Eric's RV and relayed to RVforum member Jim Godward:

"Today I can give thanks that I had Safe T Plus installed on my last visit to Eric's RV. The right front tire blew out at 65 mph just outside of Albuquerque, NM. Other than a very loud bang and a lot of smoking rubber I had no problems bringing the coach to a safe stop on the side of the road. I was lucky both tires hadn't blown, tho I religiously checked the air pressure I was unaware that the tires had worn to the cords in the very inside of the wheel (this in only 7,000 miles). If anyone asks - does it really work, or make a difference - I'll tell them YOU BET! Thank you for steering me to Safe_T_Plus - no pun intended."

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