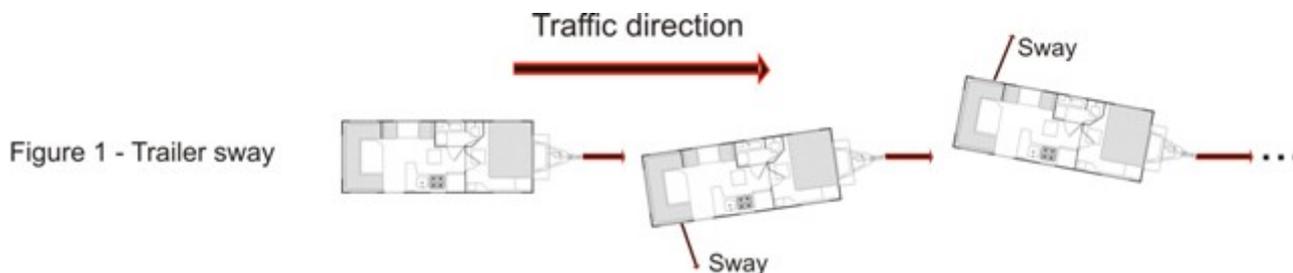


## Trailer Sway; What It Is & How To Control It

This article was written by Jose Aduato de Souza & Mark Polk



Trailer sway, that side-to-side fishtailing movement, (**Figure 1**) occurs when there is a force perpendicular to the tow vehicle and trailer trajectory, applied to the hitch ball. An important factor in controlling sway is the amount of tongue weight applied to the hitch ball, and how that weight is distributed to the tires on the tow vehicle. A general rule is trailer tongue weight should be 10 to 15% of the fully loaded trailer weight, for trailers weighing over 2,000 pounds. If the tongue weight (what generates friction to the tow vehicle rear tires) is properly distributed to the rear tires of the tow vehicle most lateral forces encountered will not be sufficient to start sway. If the lateral forces do overcome the tire friction trailer sway will start.

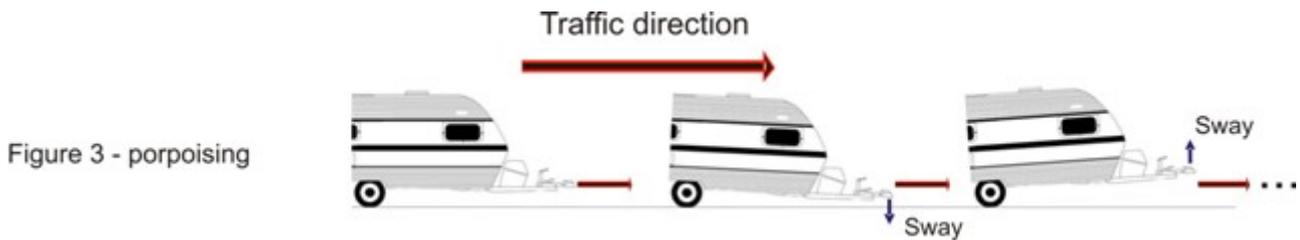
This would be a good time to include an analysis about tow vehicle and trailer traffic speed. As speed increases, tire traction decreases with a corresponding increase in the possibility of trailer sway. At 60 mph, and under wet road conditions, a weak lateral wind may start a lateral trailer displacement.



Natural trailer balance, when travelling, may be understood as a vertical pendulum, but in the opposite direction (**Figure 2**). The trailer sway is similar, but the displacement is horizontal, over the road, with the trailer (and the tow vehicle by consequence) going from one side to the other many times. If the trailers vertical stabilization, associated with the suspension, is working properly it helps in preventing small sways. Weight distribution bars reduce vertical displacements (swings) and transfers the hitch weight to the vehicle and trailer tires. This results in the rear tires gripping the road better, and may avoid these sideslips. So, it is important, before leaving on a trip, that we complete a checklist of all items associated with the tow vehicle and trailer stabilization. These checks would include inspecting items like tires, weight distributing bars, proper hitch adjustments, the trailer and tow vehicle suspension systems, and that all cargo is distributed evenly. If these items are not in a good shape, it will decrease the speed that we can safely travel at.

The bigger the trailer is (taller and longer) increases the chance for sway. There are two reasons for this: an increase in weight and an increase in mass (the area that will receive lateral winds). Weight increase will augment the forces applied to the hitch ball, especially when traveling downhill, due to the gravity, acceleration and also in case of any vehicle brake activation. If there is any unbalanced item in the towing system, it may become sufficient to start sway. If the trailers lateral area is larger, the amount of forces due to lateral winds is also

increased. These forces may destabilize the tow vehicle and trailer motion, increasing the chance for sway.



There is another very important item associated with sways, and that is the number of trailer axles. Compared to one axle, two trailer axles increases the number of wheels 100% over the ground, and by consequence the increased tires gripping the road decreases the chance for sway. Another peculiarity associated with one axle is the vertical motion (front-back direction, referred to as porpoising) associated with vehicle brake activation (**Figure 3**). In this situation the trailers front end will tend to push downward. This vertical downward motion enhances the tow vehicles back wheel traction, but decreases the front wheel traction, and the forces applied in the opposite direction (up) will reduce the tow vehicles rear wheels traction. Depending upon total weight balance, the tow vehicle and trailer may start a back or front sway and the tow vehicles front motion control will be compromised. It is well known that for both single and dual axle trailers, the larger the trailer is the more unstable it is when talking about porpoising. Proper hitch work can mitigate some of this from occurring.

Statistics prove that 5th wheel trailers are more stable and sways associated with them are seldom reported. Why? It is mainly because a more stable condition is obtained due to the 5th wheel hitch being positioned over and close to the towing vehicle rear axle. In the case of a 5th wheel, lateral forces do not affect it like a trailer that is hitched at the rear of the tow vehicle. The weight at the hitch position of a 5th wheel trailer is higher and over the axle, enhancing the tow vehicle traction on the road surface. But, when towing a 5th wheel, the driver must be more careful in descending an incline because the natural tendency will be for the weight of the trailer to push the towing vehicle.

Always keep in mind the towing vehicle has a maximum tow capacity and that you must compute total RV weights including, passengers, cargo, and fluids and fuel. Also keep in mind that any weight added to the tow vehicle takes the same amount of weight from the towing capacity.

The most important items associated with trailer sways are:

- a) underinflated tires
- b) improper weight distribution
- c) improper hitch adjustments
- d) no sway control
- e) air pressure from transfer trucks passing
- f) long downhill (descent)
- g) lateral wind
- h) towing speed
- i) inadequate towing vehicle
- j) overload conditions
- k) hitch to tow vehicle rear axle distance
- l) poor trailer design
- m) mismatched tow vehicle & trailer
- n) not completing trailer/tow vehicle checklist

So, to help avoid trailer sway, we recommend the following remedies:

**a) Underinflated tires:** Never leave on a trip without a tire inspection. If necessary, adjust the inflation pressure according to manufacturer recommendation. Always check and inflate tires when they are cold, before traveling more than one mile. Whenever you stop, inspect the tow vehicle and trailer conditions to include tire conditions. Check tire and hub temperature. In case of abnormally hot tires, or hubs, there is something wrong. It may be bearing problems, underinflated tires or axle overloads. Try to identify the problem and correct it.

**b) Improper weight distribution:** When a trailer is manufactured it has very stringent weight balances. When you add after-market equipment or load the trailer try to balance the loaded weight from side-to-side and front to back. Bad lateral weight distribution can provoke sways and bad front to back weight distribution may generate up/down sways (Figure 3). Remember that the weight over the hitch ball should be 10 to 15% of the total loaded trailer weight. If the trailer has less than 10% tongue weight, load more weight towards the front of the trailer.

**c) Hitch adjustments:** Whenever using a weight distribution hitch it is extremely important that it is adjusted properly. If you are not sure how to adjust the hitch components take it to an authorized RV service center to have it adjusted.

**d) No sway control:** Sway controls help to limit the possibility of sway starting. Whenever possible have a sway control installed and make sure you understand how to adjust it.

**e) Transfer trucks passing:** Large trucks will pass you and you need to be prepared to make slight steering adjustments. When a truck passes you the main factor is the air displacement. The air pressure coming off of the truck pulls and pushes against the trailer. Try to observe wind intensity and direction, as well the air moisture which is the main villain. Humid air is heavier and increases lateral trailer displacements when being passed. Being aware of the situation is the best defense. Be prepared to make slight steering corrections, but do not over steer.

**f) Long downhill (descent):** When descending inclines reduce your speed, use a lower gear and apply weak vehicle braking, if necessary. Never do any abrupt vehicle braking. Continued use of the vehicle brakes can cause them to fade and not work properly. It may be necessary to manually activate the trailer brakes periodically to help slow down and/or to control sway. Slowly slide the brake lever over to activate the trailer brakes. It is important to manage a safe and manageable speed when descending inclines.

**g) Lateral wind:** Strong cross winds and windy days in general can be very dangerous when towing a trailer. It is better not to travel on very windy days. If you do experience lateral wind reduce your speed substantially and remain alert.

**h) Towing speed:** It is difficult to state what a safe speed is when towing a trailer. There are many variables, but not exceeding a speed of 60 miles/hour is a fair assessment. Use lower speeds if the traffic conditions are not normal (lateral winds, high humidity, rain, road conditions, downhill, etc).

**i) Inadequate towing vehicle:** Your tow vehicle may have enough power to move a trailer down the road, but what must be considered is whether the tow vehicles weight is adequate to support slowing down and to help prevent trailer sway. Every tow vehicle has weight limits and ratings. It is very important that these weight ratings are not exceeded. The farther you are from exceeding weight limits the safer it is for you and your family. A very general rule is the tow vehicles towing capacity should be capable of towing the Gross Vehicle Weight Rating (GVWR) of the trailer you are towing.

**j) Overload conditions:** Never overload the tow vehicle or the trailer. Overloading tires, axles, Gross Vehicle Weight Ratings (GVWR) and Gross Combined Weight Ratings (GCWR) is

extremely dangerous. Make sure all cargo loaded in the trailer is secured and that all weight added is properly distributed.

**k) Hitch to tow vehicle rear axle distance:** The distance from the tow vehicles rear axle to the hitch ball can contribute to sway. Less distance is always better. Ideally a longer wheelbase vehicle with a shorter overhang from the rear axle to the hitch ball is the best scenario. Basically it is associated with the lever effect. The distance between the rear axle and the hitch ball position may be understood as the lever length; and the longer the distance it is the higher the lateral forces applied to the axle position.

**i) Poor trailer design:** When there is too much weight behind the trailers axles causing the tongue weight to be less than 10% of the trailers weight it has a natural tendency to sway. In this case it will be necessary to load some of the weight towards the front of the trailer to increase tongue weight. Ideally tongue weight should be between 10 to 15% of the loaded trailer weight.

**m) Mismatched tow vehicle & trailer:** The tow vehicle and trailer need to be properly matched to make a safe towing system. An improperly matched tow vehicle and trailer can result in trailer sway. A tow vehicle without the proper towing capacity for the trailer it is towing, too light of a suspension system for the amount of tongue weight, too short of a wheelbase for the size of trailer can all contribute to trailer sway. The tow vehicle should be rated to tow the GVWR of the trailer you purchase.

**n) Tow vehicle/trailer checklist:** The tow vehicle and trailer must be in good mechanical condition to safely tow. The brakes and suspension on both the vehicle and trailer must be in proper operating condition. Prior to leaving on a trip inspect the suspension (shock absorbers, springs, bars, tires and other components on the trailer and the vehicle) and the operation and adjustment of the electric brakes for the trailer. Tires must be in good condition and inflated properly for the load. A checklist can help you remember what items to check.

**Note:** Adhering to these recommendations can help prevent sway from starting, but keep in mind there are no guarantees you will not encounter sway. If you do experience trailer sway you should gradually reduce speed, avoid using the vehicle brakes if possible, avoid harsh steering movements if possible and manually apply the trailer brakes by sliding the lever over on the electronic brake control to help bring the sway under control.

Everyone towing a trailer, even the most experienced, is a potential sway victim. When it comes to trailer sway caution is a necessity, but not always sufficient. Safety first! Being aware of what sway is and what you can do to help prevent it can help prepare you in the event your trailer starts to sway.

**Note:** Something else to keep in mind is wheel bearing and brake maintenance on your trailer. With routine wheel bearing and brake inspections and maintenance you can rest assured that not only will the bearings and brakes operate properly and safely, but you can prevent costly and untimely breakdowns.

Happy Camping,  
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A few weeks ago I was contacted by Jose Adauto de Souza, who lives and works in Brazil. Adauto is a Petroleum Geologist/Geophysicist close to being retired. Since 1978 he has been a camping enthusiast, starting with tents, then a pop-up, travel trailers and now has a Class A

motorhome. (I have been through the same RV progression, and around the same time frame as Aauto).

He is a member of a regional RVing group in Rio de Janeiro State called "Amigos do Rio RV Group (Rio's Friends) (Brazil)". Over the last year Aauto has been researching and compiling free RV information for other RV enthusiasts in Brazil, since they do not have a bibliography about RVing in Brazil. He was working on a trailer sway article when he contacted me, to help educate some of the RVers in his group on sway issues. He wanted to know if I would be interested in working together with him on the article. At times it was a bit difficult to translate what each of us were saying to each other, but I think we figured it out.