How To Tow Safely

A Complete Towing Guide

by JD Gallant

How To Tow Safely — A Complete Towing Guide

RV Consumer Group
Box 520 • Quilcene, WA 98376
(360) 765-3846 • Fax (360) 765-3233
Web site at www.rv.org / email: rvgroup@rv.org

Gallant, JD
How to Tow Safely — A Complete Towing Guide / version 2.0
ISBN 1-890049-14-X $15.95 2003
1. Towing a Vehicle--Safety. 2. Recreational Vehicles--Towing.

I. Gallant, JD II. Title:
How to Tow Safely — A Complete Towing Guide

Other Books/CDs by JD Gallant:

The Green Book—RVs Rated - 1992 edition with The Language of RVing
The Language of RVing
How to Buy an RV Without Getting Ripped Off
How to Outwit Any Auto, Truck, or RV Dealer Every Time (published in Book & CD format)
How to Select, Inspect, and Buy an RV
RV Walkabout CD-ROM (CD format only)

NOTICE

The information in this book is designed to guide—not to direct. It is strictly opinion based on personal experiences and research. It is the author's intention to correct any inaccuracies by periodically providing new editions and notices of any error. The author or publisher assumes no responsibilities for inconveniences or damages resulting from the use of this material. All users are encouraged to use this book in the manner for which it is intended.

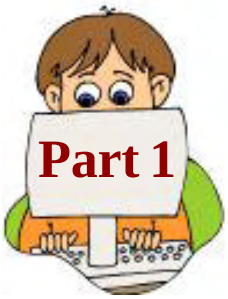
Printed in the United States of America

About the Author

JD Gallant has been an RV enthusiast and RV trekker for over 40 years. Besides loving the fun and adventures of RVing, he has actively worked as a technical writer, teacher, auto and RV salesperson, and consultant for many years. Through his books, seminars, and workshops he has been instrumental in raising the awareness level of consumers when searching, buying, and using their autos, trucks, and RVs.

JD is co-founder and chairman of RV Consumer Group, a nonprofit organization dedicated to consumer education. He has authored other books including *The Green Book—RVs Rated, The Language of RVing, How to Buy an RV Without Getting Ripped-off!, They're All Crooks!, How to Outwit Any Auto, Truck, or RV Dealer Every Time, and How to Select, Inspect, and Buy an RV.*

Table of Contents - Click on Selection

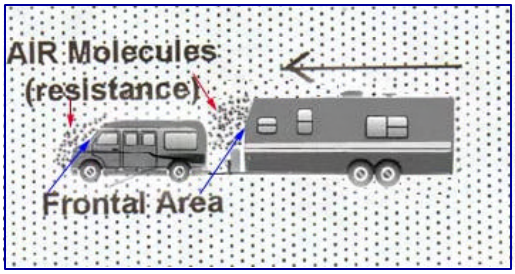


An Introduction to Safe Towing

RV owners often think they can tow anything because they have the horsepower. Power has almost nothing to do with handling characteristics. Just because your vehicle has a powerful engine, it doesn't mean you can tow any size trailer your heart desires. The size of the engine is not relevant to safe towing. If anything, it can be considered detrimental. A lot of power can lull the driver into thinking that he or she has good control of the situation at any speed. Power gives you speed and speed is a major cause of towing accidents with fatalities. Having the right-size engine and gearing is important for economy, but it does not tell you how large a trailer you can tow. Remember this equation: **engine power + complacency = tragedy**.

In relation to engine power, it's also necessary to consider frontal area. Frontal area is defined by Ford as the total area in square feet that a "moving vehicle and trailer exposes to air resistance," and other auto manufacturers use a similar definition (Illustration 1). Because frontal area is based on flat resistance into the wind, if vehicles are aerodynamically designed, the air resistance will obviously be less. It also makes sense that the effect of air resistance will vary in proportion to engine size and axle ratios. Thus, the more power, the less noticeable the effect of the resistance. Manufacturers' manuals usually give a figure for the frontal area based upon the engine size, gear ratios, and heavy-duty cooling packages. If you exceed the manufacturer's recommendations for trailer frontal area or weight, you need to realize that the efficiency and longevity of the vehicle will be decreased accordingly.

Illustration 1



Frontal area is the total area in square feet that a towing combination exposes to air resistance.

When I give seminars on towing techniques and equipment, I always emphasize wheelbase — which I illustrate with the scenario of a trucker pulling his 50-foot trailer with three axles onto an exit at highway speed, totally unaware that there's a curve ahead covered with gravel. If the truck is a Kenworth with a long wheelbase, it should have no problem overcoming the tendency of the multiple axles to go straight, but if it's a short-wheelbase cabover truck, the gravel might prevent the front wheels from "grabbing" the road and pulling the multiple axles around the corner. If this happens, the truck goes off the road. Simply: any short-wheelbase vehicle has difficulty controlling the tendency of multiple axles to go straight ahead or to return to a straight course after it has been

forced off that course by substantial air movements from a bow wave or the wind. Just as drinking and driving don't mix, short-wheelbase towing vehicles and long multi-axle trailers don't mix — for commercial trucking or RV towing.

Towing vehicles come in all shapes and sizes but, for practical purposes, fall into four basic categories: SUVs, vans, trucks and motor homes. I haven't included automobiles in general because, most often, the average automobile is not a safe tow vehicle for a trailer of any livable size. Nevertheless, SUVs, vans, trucks and motor homes each have their advantages and limitations when it comes to towing.

Illustration 2

The typical SUV has a high center of gravity.

SUV Towing: Sports Utility Vehicles, or SUVs, as they're commonly known, were designed to meet consumer demand for a compact, yet rugged off-road vehicle. However, with their relatively short wheelbases and high centers of gravity, they have acquired a bad reputation as towing vehicles (Illustration 2). This doesn't mean that you shouldn't tow a trailer with an SUV, it just means that you need to know the vehicle's limitations.

A short wheelbase combined with high ground clearance is an automatic red flag for those who are knowledgeable about trailer towing. But because few technicians understand the natural, and unnatural, behaviors of big boxes being towed through variable air currents at high speeds, we tend to see far too many accidents involving SUVs pulling trailers. It is unfortunate that so many variables are involved in the towing problem that indicators of handling characteristics must come from RVers' complaints about handling problems and from accident analyses rather than engineering formulas. However, all these recurring patterns and behaviors can be accounted for by laws of nature.

Illustration 3

An SUV and a fold-down trailer make a good towing combination.

The auto industry and consumers in general know that all SUVs are not created equal in handling characteristics — whether or not they're used for towing. Wheelbase is not the only issue. We know that track, weight, and center of gravity are factors that could improve an SUV's towing characteristics in spite of wheelbase; but experience has shown that these factors are not influential enough to allow you to disregard reasonable parameters for safe towing. Just being a "bit" safer is not safe.

If you want to tow a trailer, an SUV might work for you (Illustration 3). However, like any tool or appliance you use, it has its limitations. For example, you wouldn't use your hair dryer to dry your hair while you're still in the shower. If you did, you could destroy yourself as well as your equipment. Similarly, if you overstep the towing limitations of your SUV, you place yourself and your passengers, as well as your vehicles and towing equipment, in harm's way.

Illustration 4

If correctly matched to the trailer, most vans are excellent towing vehicles.

Van Towing: In my years of research, I've learned that a van can be an excellent towing vehicle if matched correctly to the trailer (Illustration 4). For many families, a van is ideal because it provides plenty of room, usually has good safety features in case of rollover or collision, and is available in a wide variety of sizes with a number of different power trains (Illustrations 5 and 6). I've found that the van's design is not generally a drawback to towing except in models with a long overhang (Illustration 7). RVers frequently complain that vans with this design handle poorly on the highway even when they're not being used for towing. Another problem is that long overhangs invite overloading with further impact on steering control — especially when towing.

Vans can be divided into two broad categories: full-size vans (Illustration 5) and minivans. Like pickup trucks, full-size vans are rated as 1/2-ton, 3/4-ton, and 1-ton. If you are planning on pulling a trailer with one of these, you need to keep in mind that this tonnage classification refers to the capacity of the suspension, not the power.

Minivans (Illustration 6) generally have a trailer-pulling capacity somewhere between 1,500 and 5,000 pounds. They lack the capacity to tow a trailer of reasonable length for live-in use, and to attempt to do so could seriously jeopardize your safety on the highway. On the other hand, if overnight and weekend camping will satisfy your RVing needs, you might consider a fold-down or a small telescoping trailer.

There are generally only two types of trailers we need to consider for towing behind a van. The first type is the trailer coach. The second type is the low-profile trailer such as a telescoping (crankdown) trailer, fold-down (tent) trailer, boat trailer, or flatbed (utility) trailer. Most trailer coaches have a profile that extends above the roof of the van while all low-profile trailers fall below the roofline, presenting less frontal area for air resistance (Illustration 8).

Connecting any trailer to a towing vehicle takes careful planning. Whether you own or are considering a full-size van or a minivan, you'll need to match it to a trailer that will be limited in length and weight by specific towing guidelines.

Illustration 5

The Ford Econoline is an example of a full-size van. Notice the extra-long wheelbase and short overhang--both of which contribute to good control on the highway.

Illustration 6

The minivan has a noticeably lower profile than a full-size van, a shorter wheelbase and a slightly longer overhang. Towing options are limited with a minivan.

Illustration 7

A van with a long overhang can tempt the RVer to overload in the rear, which would impact steering control.

Illustration 8

When the trailer profile extends well above that of its towing vehicle — as seen here — it presents considerably greater frontal area to the wind than a telescoping trailer or a fold-down.

Truck Towing: Trucks are very popular in the RV arena. They are often considered the ideal tow vehicle for fulltimers who want to pull large trailers. In fact, depending on size, trucks can tow all types of trailers from small, lightweight fold-downs to substantial trailer coaches and fifth wheels (Illustration 9). This versatility suits them to every type of use from jobs around the farm to weekend family outings. But even with all their versatility — and power — trucks do have their limitations.

Illustration 9

A fifth wheel hitched to a truck is the most forgiving of towing combinations.

Safe towing with a pickup depends upon a combination of factors that varies for every type of travel situation and pairing of vehicles. If you choose a pickup for your towing needs, you'll probably be towing with a 1/2-ton, 3/4-ton, 1-ton, or one of the new two-tons (Illustration 10). These truck classifications approximate the weight the truck can carry in its bed. However, the deciding factor for how much weight the truck can handle will most often be the hitch weight. In the case of fifth wheels, a 3/4-ton truck can carry a hitch load of about 1 ton and a one-ton will carry about 3,000 pounds of hitch weight. On the other hand, regardless of the truck's carrying or towing capacity, I have found that wheelbase is the best indicator of the maximum-size trailer you can control. Not pull — control! It is a towing axiom that pull is determined by engine and gearing whereas control is determined primarily by wheelbase. Wheelbase will be your number-one determinant in matching a trailer to your pickup. (See Part 5 for a full discussion of wheelbase).

Illustration 10

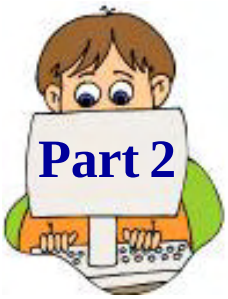
To pull a large trailer coach or fifth wheel, you'll need at least a one-ton truck.

Motor Home Towing: Towing with a motor home generally involves pulling a small auto — which is most often called a "dinghy" but sometimes called a "toad" (Illustration 11). As I'll mention later, this supposedly simple process is complicated by convoluted legalities and some technical difficulties. Another vehicle commonly pulled by motor homes is the trailerable boat. Pulling a boat behind a motor home is usually simple and safe if the combined weight of the boat and trailer is less than half the weight of the motor home — but I have seen problems here, too. Sometimes motor homes are used to pull cargo trailers, recreational trailers, and horse trailers — all of which require special know-how.

Illustration 11

Towing a “dinghy”.

When I began my crusade for RV safety, I had to start from scratch, collect information, separate the wheat from the chaff, and analyze it. In this document, I'll share with you what I've learned in 20 years of intensive study, observation, and firsthand experience with the towing and hitching of trailers. Because connecting a trailer to a tow vehicle always takes careful consideration and planning, my goal is to give you a system for safe towing and to show you how and why it works.



The Problem That Won't Go Away

Good hitching is not a new subject for technical writers. During the past twenty years, Bill Estes, (TL-1990 Illustration 1) Bob Livingston (TL-1989), John Thompson (TL-1980) and yours truly wrote books and articles about the matching of vehicles, proper hitch weights, the importance of good balance, the types of equipment needed, hitching techniques, and other criteria for safe towing. The big difference between my fellow technical writers and me is that by the late eighties, when I started my advocacy, the dynamics were changing. New forces and challenges were coming into play. Average highway speeds were increasing at the same time that manufacturers were building smaller cars. Coming in on the cutting edge of these changes, I began to incorporate the results into my own writings.

Illustration 1

"Many trailerists become accustomed to being uncomfortable or even frightened by trailer sway when they encounter strong crosswinds, trucks overtaking from the rear, or mountainous roads. They think it's normal — the way all trailers handle. Not so! Properly designed, well-matched tow vehicles and trailers have positive control, good road manners and are fun to tow."

Bill Estes, RV Handbook (1991, TL Enterprises)

Gradually, it became clear to me that the wheelbase of the towing vehicle plays a major role, if not the major role in controlling a trailer. Although writers, dealers, and other professionals have been aware of basic guidelines for vehicle matching, an in-depth look at the importance of wheelbase in towing control has not been attempted until recently.

Good RV salespeople have been as diligent at adhering to basic rules when matching tow vehicles to trailers as they have been when recommending hitching equipment (Illustration 2). When I approached Gary Lien, of Sumner RV in Washington State, about towing a trailer with a 107-inch wheelbase SUV, he said "No!" to both a 23-footer and a 21-footer and recommended an 18-footer. This man didn't mention wheelbase parameters — I'm quite sure he was unaware of them. He knew from experience and observation that there is a point where loss of control is probable. He spoke of the relationship between the weights of the two vehicles and about using proper hitching equipment. Although Gary Lien's explanation may not have been as complete as I would like, this is the kind of conscientious attitude you need in a salesperson (see Illustrations 3 and 4).

Illustration 2

This dealer recommended an 18-foot trailer equipped with a sway bar for a 107-inch wheelbase Blazer. (Courtesy Sumner RV, Sumner, Washington.)

Everyone who is knowledgeable about trailer coach or fifth wheel towing agrees on the following three must-haves:

1) You must have a towing vehicle with enough mass and wheelbase to overpower any adverse movement of the trailer.
2) You must have a trailer that is designed with a good hitch weight and proper axle placement.
3) You must have a hitching system that will prevent swaying or at least keep a swaying trailer from steering the towing vehicle.

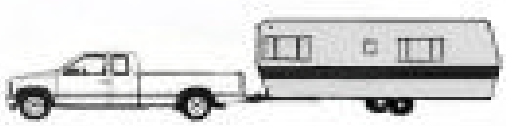
Illustration 3

A responsible dealer would recommend a lightweight, low-profile trailer, like this telescoping trailer, for towing behind this short-wheelbase minivan.

Although there may be some dissension on specifics, everyone from commercial truckers to horse pullers agrees that these are the three prime considerations. When you understand these three things, you will know just about everything you need to know about trailer towing.

Even if you're just starting to think about RVing with a trailer, it's never too early to learn the reasons for good hitching practices and what could happen if you don't use them. And it's absolutely essential that your towing vehicle, trailer, and hitching system are all well matched and properly connected. Although many RV salespeople are informed about hitching techniques and equipment, too few are knowledgeable about matching a tow vehicle to a trailer using wheelbase as the primary factor. You must take the lead in insuring your own safety.

Illustration 4



Good salespeople know how to match a pickup to a trailer coach and advise customers on a proper hitching system.

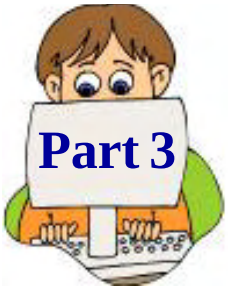
I've studied dozens of accidents involving trailer coaches, and the problem was control in every case — except for one where the driver fell asleep at the wheel. The problem that crops up again and again is the "tail-wagging-the-dog" syndrome caused by air turbulence from crosswinds or bow waves. Because of unpredictability, the nature and effects of air turbulence must be studied directly through practical experience and observation if we're going to mitigate or overcome their potential danger to trailering safety.

The standard of care (see Glossary of Towing Terms, Section 2, Part 2) in the RV industry indicates that dealers and salespeople have accepted the idea of parameters in some aspects of towing with the result that, up to now, their policy has been to focus on the size of the towing vehicle as their primary criterion in vehicle matching. Rules were established a little over two decades ago, derived from a study funded by the Department of Transportation #DOT-HS-7-01720 (1979) that shows beyond question that vehicle size parameters are critical in preventing trailer "snaking problems" that lead to rollover accidents. However, these rules have remained loose and further investigation by the DOT has not led to firm vehicle-matching guidelines. One conclusion of this

study is that a trailer should weigh substantially less than the towing vehicle unless hitch weights in particular can be maintained consistently at approximately 10% (or 25% for fifth wheels). This, among other conclusions, was assimilated into articles and published primarily through Trailer Life Books until the early nineties when RV Consumer Group picked up on the issue. Unfortunately, accidents are still happening because too many RV salespeople, RV technicians, and RV consumers are unaware of or simply ignore the basic towing rules as established by the DOT study — which many view as stagnant.

However, we believe the evidence has shown that wheelbase is superior as a guide to the selection of the proper size of towing vehicle for the trailer of your choice. Only when the industry as a whole accepts firm parameters in either wheelbase or size will we know that serious effort is being made to reduce the numbers of trailer-related accidents that, according to recent figures released by NHTSA, number almost 60,000 annually.

Now, let's take a look at one of the most frequently-encountered but least understood causes of trailering accidents — bow waves and crosswinds.



Forces of Nature — Bow Waves and Crosswinds

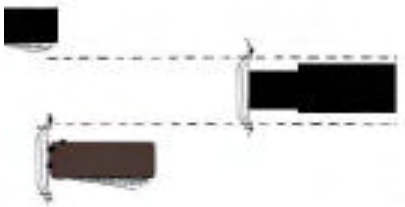
A bow wave can easily ruin your day, as shown in Illustration 1. A bow wave is defined as the turbulence of air created by a moving vessel or vehicle (Illustration 2). An understanding of bow waves is critical to your safety on the road. To demonstrate: Any moving vehicle — whether it's a boat displacing water or a motor vehicle displacing air molecules — creates turbulence by moving the water or air away from the moving object. This turbulence impacts the immediate area around the vehicle and will affect any other vehicle in the area (Illustration 3). However, unlike a bow wave from a boat, a bow wave from a speeding truck is dangerous because it comes at you like a tornado without warning. You can't see it and you can't feel it until it hits. It's this unpredictability that makes bow waves a primary factor in trailer accidents.

Illustration 1

Look what happens when towing parameters are ignored.

Bow waves can increase the tendency of a trailer to sway, particularly in cases of bad design, improper loading, inadequate hitching, or towing with a too-short-wheelbase vehicle. The bow wave itself does not cause excessive sway, it merely acts as a catalyst. The phenomenon of the bow wave is explained by Newton's third law of motion, which states that for every action there is always an equal and opposite reaction. I think that what Newton's law is telling us about bow waves is that if one hits your trailer something's gotta give.

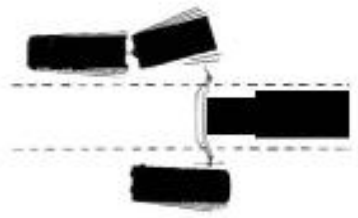
Illustration 2



Moving vehicles create bow waves as they travel down the road.

When a bow wave or crosswind hits a moving trailer, it forces the trailer to pivot on its axle(s) with the rear moving in a lateral direction (technically called "yaw") to put it out of line with the towing vehicle (Illustration 3). The towing vehicle then tries to pull the trailer back onto a straight course, which usually results in the trailer swinging to the opposite side (Illustration 4). If the combination of towing vehicle, trailer, and hitching mechanism is correct, these oscillations (sway) will decrease until the trailer straightens out behind the towing vehicle, with the driver hardly noticing what took place. But, that's a big "if". With a poorly-matched towing combination, control will be compromised and what you'll get is the "tail-wagging-the-dog."

Illustration 3



A bow wave from a moving truck initiates sway.

You can't avoid bow waves. They are an inherent part of highway travel. When driving the family vehicle, you can feel a bow wave every time you pass a truck or a truck passes you. How much it affects your vehicle depends upon the specifics and characteristics of the vehicle in

relation to its ability to "hug" the road. Wheelbase, track, suspension, tires, and body design all influence a vehicle's control when it's hit by this torrent of air molecules. We know all of this because it is basic information collected from people's experiences and observations — explainable by the simple laws of nature that you learned in high school with the principles of fulcrum, lever, inertia, friction, mass, force, and acceleration. It is as easy as explaining how the wind in a wheat field picks up the chaff and blows it in your face. There's Newton again!

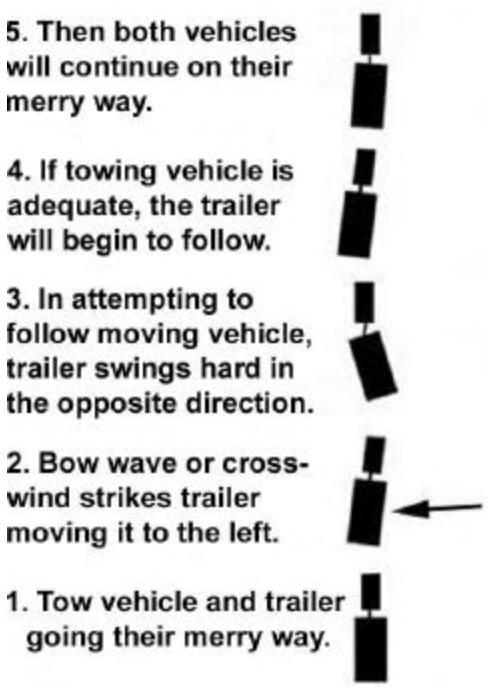
You cannot blame the bow wave for an accident any more than you can blame eating for food poisoning. It is obvious that the towing vehicle must have enough mass and wheelbase to control the trailer, and that the trailer is designed, maintained, and loaded to negate the action of a bow wave, and that the hitching system is adequate to prevent sway. Ignore these criteria and an accident is waiting to happen.

Crosswinds of up to 30 miles-per-hour are natural occurrences on every highway that a well-matched trailer / tow vehicle combination should handle with ease. If crosswinds exceed 30 M.P.H. you should slow down because, combined with bow waves and adverse road conditions, any weakness in matching, design, and hitching could suddenly show up and turn against you. Never forget the three natural conditions that, with any deficiency in the system, can lead to disaster: 1) bow waves, 2) crosswinds, and 3) adverse road conditions.

Motor homes and crosswinds are like dogs and cats — they generally don't mix. Real battles take place when the motor home has a wheelbase-to-length ratio of less than 50% — which I guarantee will result in losing the fight with the steering wheel. Although towing a dinghy or small trailerable boat does not generally exacerbate motor home wander, a travel trailer coach or cargo trailer can present some dangers when buffeted by crosswinds or bow waves. You need to be especially cautious whenever the towing characteristics of the trailer and the wheelbase of the motor home are questionable.

Part 4 will show you why a trailer reacts the way it does to bow waves and crosswinds.

Illustration 4



If you have the right towing vehicle, it will regain control of the trailer in the aftermath of the bow wave.

Catching the Wind

As we've learned in the previous section, bow waves and crosswinds can come out of nowhere and upset your best-laid plans. In spite of the variety of forms that air turbulence can take on the highway, its effects on your vehicle can be mitigated through understanding and preparation.

First of all, every vehicle (or structure) has a sail area. Let's define sail area as the collector of air molecules when the vehicle is hit by the moving air — just like the sail on a boat. The sail catches the wind and causes a reaction, pushing the boat sideways or forward. The sidewalls act as the sail area of a trailer or motor home (Illustration 1). They catch the force of moving air and react to that force in direct proportion to its strength. The laws of nature tell us that with a certain force and a specific resistance we will get a determinable reaction. Thus a 35-foot trailer or motor home that is 10 feet high, weighs 10,000 pounds, and is hit directly on its side by a 20-MPH wind will tend to move X number of inches — every time!

Illustration 1

The sail area of a vehicle is equivalent to the square footage of its sidewalls.

So let's accept the premise that if all conditions are the same every time, we are going to get pretty much the same reaction. Even though conditions will not be exactly the same because there are too many variables, the premise is solid. If you pull this 35-foot trailer down the road and you get hit by a bow wave from a passing truck, we know that you will get an adverse reaction from the trailer. But here is the cruncher: The movement of the trailer is not the problem. The movement of the trailer becomes a problem only when it moves the towing vehicle enough so that the driver has difficulty steering. Since we can't prevent the trailer from reacting when it's hit by a bow wave, we need to figure out how to keep the "tail from wagging the dog."

Let's take a look at what happens to the towing vehicle when the trailer starts to sway. One of the first and obvious behaviors that takes place is the suspension and tire flex that sets the towing vehicle off course. This movement requires immediate correction so that the angle between the two vehicles does not increase enough to cause the towing vehicle's wheels to skid. Once the skidding takes place, it's pretty much all over. Even when adverse factors such as bad trailer design cause some tire and suspension flex, control is relatively easy to maintain when the towing vehicle has an adequate wheelbase.

One of the most common questions RVers ask is, "Why does the trailer just wobble a bit one moment and a few minutes later we're upside down in the middle of the highway?" The explanation does not involve natural phenomena, such as air movement, as much as it does the machinery at work. The speeds of two vehicles passing each other cannot be exactly the same, the road conditions are not exactly the same, and the driver's reaction is never exactly the same. The speeds, the closeness, and the angle of the striking molecules of air all affect the amount of force hitting the sail area. When you're driving on a hilly highway and the road changes from an upgrade to a downgrade, you have changed the dynamics of the weight distribution between the two vehicles (Illustration 2). A bit of difference in the reaction of the driver at the steering wheel can easily reduce or increase the movement of the trailer simply because the trailer may resist correction. It wants to tip a bit, wobble a bit, and then continue on its merry way. The trailer doesn't have a mind of its own. The problem is the inability of the towing vehicle or the hitching system to compensate for changing conditions. Remember: sway is an accident waiting to happen.

The height of any vehicle is a determining factor in highway stability. Winds created by passing vehicles make a taller vehicle more likely to sway than a lower-profile vehicle. Length is also a major consideration. A vehicle that is too long has a reduced highway stability and a tendency to sway out of control when hit by a bow wave or crosswind; and when you factor a "widebody" into the equation, the possibility of pitch and roll is added to the stew of potential problems, especially if the axle width is not increased. Many of these conditions can easily make your otherwise happy home on wheels very unforgiving to unexpected incidents or conditions that are lying in wait for the unwary traveler.

The good news is that there is a cure for the loss of control that causes so many white knuckles and accidents. You need only adhere to specific parameters, be sure you have good machinery, and live by techniques that work — as I'll show you in Part 5.

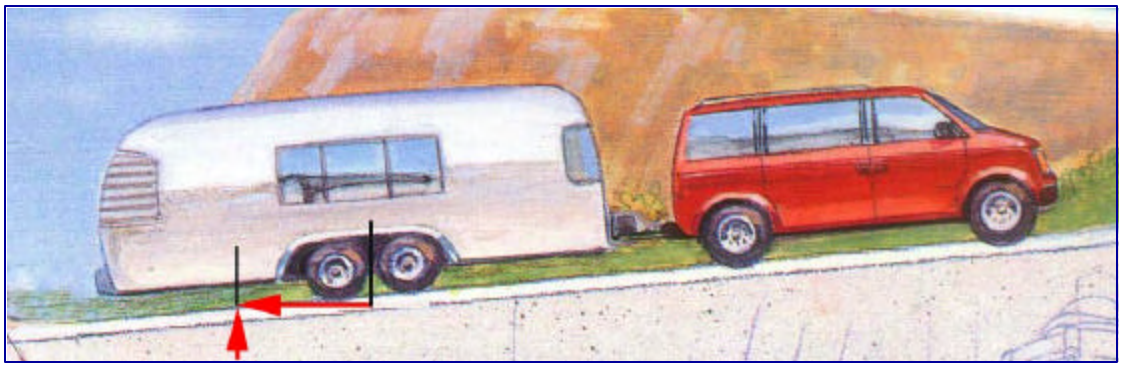
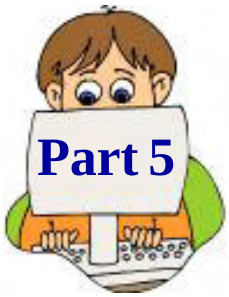


Illustration 2

Weight distribution between the vehicles changes when shifting from an upgrade to a downgrade.



The Importance of Wheelbase Parameters

Previously, I mentioned sail areas, crosswinds, and bow waves. As you'll recall, I demonstrated that the natural movement of the trailer created by air turbulence puts a burden on the towing vehicle to correct any adverse action. Once trailer sway is initiated, only two things can fix it: 1) a towing vehicle with enough wheelbase and mass to take control and 2) a properly-functioning hitching system (Illustrations 1 and 2). For any vehicle to maintain control, it must have adequate wheelbase for the particular towing situation.

Wheelbase is critical to anyone towing a trailer because it is an indication of the stability and maneuverability of the towing vehicle as measured by the distance between the center of the front axle and the center of the rear axle (Illustration 3). Wheelbase should always be your number-one consideration in matching a trailer to a towing vehicle.

In explaining the importance of wheelbase, I'll have to take you back to those days of yesteryear, when you might have had your "Mr. Groves" trying to ram physics into your head.

Mr. Groves drummed into me that any mass at rest or in motion tends to stay at rest or in motion until something comes along to change that status. (Newton's first law) A vehicle in motion is a mass of metal, fabrics, cargo, and bodies. This mass has been accelerated from its tendency to stay at rest by a force delivered at the wheels by an engine. We know this for a fact because we experience it every day of our lives. However, when a vehicle is connected to a trailer, it takes more power to accelerate the total mass of both vehicles to highway speed. As I said before, acceleration and power are not the main issues in trailer towing — the real issue is the ability of the towing vehicle to maintain control of itself and the fully-loaded trailer when the towing combination is in motion.

Once the two vehicles have attained a highway speed of 55 miles-per-hour, the resistance of air molecules striking them head-on would naturally slow them down. It's the power at the rear wheels that acts as a force to keep them going. So it's really your foot on the accelerator that tells nature you have control of the situation and that it should take a back seat. You are determined to keep this mass in motion at 55 miles-per-hour by overcoming the combined forces of air resistance and gravity.

Illustration 1

This SUV's wheelbase is adequate for the trailer it's towing.

Illustration 2

When going big, the towing vehicle must still have enough mass and wheelbase to control the trailer.

Illustration 3

Wheelbase is the distance between the front and rear axles of a vehicle.

Crosswinds and bow waves consist of fast-moving air molecules. When the mass of the two vehicles has adequate resistance to the force of a crosswind, the towing vehicle and trailer will barely move from the path you have chosen for them. When a bow wave from a big truck tries to move the vehicles off course, an adequate mass will "resist" movement and both vehicles will continue on their merry way. However, when you don't have enough mass in both vehicles, you will get an adverse reaction to the air turbulence from either crosswinds or bow waves.

So when is mass sufficient to overcome the kinds of air turbulence you typically encounter on the highway? Because there are so many intangibles and interacting forces at play, crosswinds and bow waves cannot be used as constants in any kind of formula for computing either the amount of force being applied or the resistance to that force in trailer-towing situations. Even so, life is so valuable that we need to cover all the bases by establishing techniques and parameters that will reasonably minimize trailer movement and maximize towing vehicle control.

In my years of research I've learned that the wheelbases of modern cars, trucks, and motor homes are excellent indicators of their mass and controllability. There is enough evidence in the commercial trucking industry and in the sports car arena to support this premise. My parameters for wheelbase are more stringent than guidelines — they are based upon the results of accidents and patterns of handling characteristics. However, they are also based upon averages. Thus, it is the average towing vehicle, the average hitch configuration, and the average driver that are taken into consideration.

Because trailer coach towing so typically illustrates the problems with bow waves and crosswinds, my wheelbase parameters are based on this type of trailer. As shown in Illustration 4, a good towing length for a travel trailer coach begins at 20 feet or less for 110 inches of wheelbase. For each additional foot of trailer length, the formula adds 4 inches of wheelbase. These figures represent strict parameters for safety established through accident reports and consumer input regarding handling characteristics for trailer coaches. These reports tell us two things: 1) that these parameters are right on and 2) that if you want to go with a longer trailer, you should go to a longer-wheelbase towing vehicle.

Illustration 4

Towing Vehicle Wheelbase Parameters Based on Trailer Coach 8’ Wide and 9’ High

Trailer Length (feet)	Wheelbase (inches)	Trailer Length (feet)	Wheelbase (inches)
15' to 19'	100" to 110"	30'	150"
20'	110"	31'	154"
21'	114"	32'	158"
22'	118"	33'	162"
23'	122"	34'	166"
24'	126"	35'	170"
25'	130"	36'	174"
26'	134"	37'	178"
27'	138"	38'	182"
28'	142"	39'	186"
29'	146"	40'	190"

Wheelbase Parameters for Towing Vehicles

Because the above parameters were calculated for trailer coaches, we need to adjust for trailers that have a much-reduced sail area (low-profile) and fifth wheel trailers — because they are much more forgiving to crosswinds and bow waves. Our database reduces the required towing-vehicle wheelbase for these types of travel trailers by 10%. If these trailers are well balanced with adequate back-of-ball ratio (explained in Part 6), there should be no problem overcoming the effects of crosswinds and bow waves.

As we discussed in Part 1, vans and motor homes with long overhangs present special towing problems. These problems — especially the tendency to waddle and wobble — are magnified by improper loading. We almost have to look at the wheelbase parameters for these vans the same way we look at wheelbase for motor homes by taking into consideration not just the wheelbase measurement per se, but the wheelbase-to-length ratio as well. Inadequate wheelbase-to-length ratio can also cause 'floating" of the front wheels to occur when you're pulling a trailer without adequate hitching — which is especially dangerous on slippery or gravel-covered roads. When towing a trailer coach with a van, the wheelbase-to-length ratio should be 65% minimum (Illustration 4).

Illustration 4

The driver in this family says, "This towing combination handles like a charm."

When towing any trailer, the overall safety of the trailer and towing-vehicle combination depends upon the following factors, in order of importance:

1) wheelbase of the towing vehicle,
2) sail area of the trailer,
3) hitch configuration,
4) trailer design,
5) balance of the trailer from loading,
6) highway stability of the towing vehicle when not towing,
7) total weight of the trailer, and
8) pulling capacity of the towing vehicle.

Next, in Part 6, let's explore some of the trailer design factors that can make or break towing control.

The Impact of Trailer Design

When I became an RVer in 1956, I towed a 26-foot trailer with a giant Buick station wagon. I had no problem making it from Maine to Florida, where I stayed a number of years before migrating west. In those days we didn't have weight-distributing hitches and I don't think that we even had electric brakes. But speeds of 30 to 40 miles per hour were acceptable with this combination. Today things have changed.

Faster highway speeds and smaller vehicles have changed the dynamics of towing. We now need to compensate for these changes with better-designed, better-balanced, and better-hitched trailers. If we're going to reduce the risk of an accident, we need to carefully match the trailer to a towing vehicle. In fact, the first rule of trailering is to match the trailer to the towing vehicle using solid parameters with wheelbase as the foundation.

It's essential to learn the towing characteristics of the trailer by studying the manufacturer's specifications and the actual layout of heavy items like freshwater and wastewater tanks, slideout rooms, generators, and heavy accessories. We also need to study the profile to determine sail area and trailer frontal area, the total loaded weight, the back-of-ball ratio, and the unloaded and loaded hitch weights. These are the specifications that will give you a pretty good idea of what kind of tow vehicle and hitching device you'll need to tow the trailer.

Basically, the "big three" design factors that make a trailer coach safe to tow are:

1) a constant hitch weight of between 8% and 12% of the total loaded weight,
2) an axle placement that yields a back-of-ball ratio of at least 70%, and
3) a minimum of 15% of the GVWR available for personal payload.

The reasons for the 8-12% hitch weight are 1) the limitations of fixed-ball weight-distributing hitches and 2) the load-carrying capacities of the average towing vehicle. Although a 15% hitch weight on a 30-foot trailer coach (about 1,200 pounds) may work for your towing vehicle, for most vehicles and hitches it would be too much. Thus, the need for this 8-12% standard.

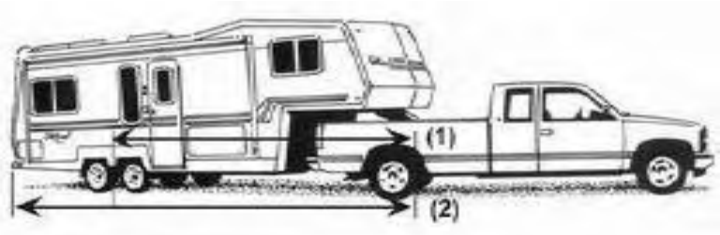
A constant hitch weight is critical to your safety on the road — whether dry or wet. (The dry hitch weight is the actual weight at the tongue of a trailer at the factory before any liquids are added. The wet hitch weight includes liquids.) This means that unless the freshwater tank is located directly above the axle, the hitch weight will change dramatically when water is added or every time the plumbing is used. Because hitch weight is extremely important for safe towing, all holding tanks should be in proximity

of the axles or empty when the vehicle is underway — especially in the case of trailer coaches. If you want good steering control, you should have a consistent hitch weight within a range that works well for your vehicle.

We talked about the importance of wheelbase in the previous section. Now we need to discuss the back-of-ball ratio (BOB for short) — another measurement you'll need for safe towing. BOB is nothing mysterious; it's easy to find when you know how. It is the ratio obtained by measuring from the center of the hitch ball to the center of the trailer axle divided by the overall length of the trailer in inches. If you have two axles, measure to the center point between the axles. If you have three, measure to the second axle (Illustration 1). This figure is expressed as a percentage. According to our parameters for trailer coaches, 70% BOB is acceptable and 60% is deficient — whether towing with an SUV, van, truck, or motor home. If the BOB ratio is too low, the trailer will have an inclination to wander and wobble as you tow it down the road and may tend to unload the hitch. An unloaded (or light) hitch could cause a serious safety problem as was experienced by the RVers shown in Illustrations 3 and 4.

The back-of-ball ratio is extremely important if you want the trailer to follow well. Because setting the axles back adds to the stability of towing, you will find commercial vehicles with axles almost in the rear. For example, if you've ever rented a U-Haul trailer, you may have noticed that the largest size is usually 6' x 12' with the axles set well back toward the rear of the trailer. This gives these cargo trailers less propensity to wander or sway compared to travel trailers, which often have the axles set farther forward by the manufacturer to compensate for the addition of forward-located slideouts and permanently-fastened household appliances and accessories. You will also notice that most boat trailers have the axles set back to as much as 80% BOB to improve towing stability. When towing boats, horse trailers, and cargo trailers with motor homes, BOB and wheelbase are extremely important (Illustration 5). A short wheelbase and a low BOB can spell disaster with any combination.

Illustration 1



(1) From center of hitch-ball socket or fifth-wheel pin to center of axle in relation to:
(2) Length of trailer measured from hitch connection to extreme rear of trailer.

Back-of-ball ratio is easy to find when you know how. Simply divide the first measurement in Illustration 1 by the second measurement to get a percentage.

Illustration 2

Water tank placement is critical for trailer balance. The freshwater tank and all holding tanks should be in proximity of the trailer axle(s).

Illustration 3

This combination looks good, but the trailer waddles like a duck.

Although BOB is not listed in manufacturer's specifications, you can assume that most trailer coaches with a front slideout room will have a short back-of-ball ratio. Optional slideouts and other heavy add-ons may be potentially dangerous because they will significantly change the overall balance of the trailer. Usually the manufacturer leaves it to the consumer to figure out how these options will affect the balance of the trailer and, if necessary, compensate with a different tow vehicle or hitch. In any event, if your BOB falls somewhere between 60% and 70%, you should be safe provided your hitch weight falls between 8% and 12%, you're properly hitched, and your towing vehicle is well within the recommended wheelbase parameters.

Illustration 4

A truck towing a trailer coach with a short BOB is subject to towing problems. (An understatement in this case).

Next, you need to consider payload capacity. Payload is the total weight of gear and personal belongings that can be loaded into the trailer without exceeding the trailer's gross vehicle weight rating (GVWR). You can determine this by subtracting the curb weight (the weight of the trailer including water and fuel) from the GVWR, which is the maximum load-carrying capacity of the axles, tires, wheels, and other components of the suspension. The best way to find your payload capacity and how close you are to the GVWR once the trailer is fully loaded is to weigh the RV on a commercial scale. Your payload capacity should be between 15% and 25% of the GVWR. With anything less than 15% payload capacity, you could be in danger of overloading, which could cause anything from premature wear on suspension components and tires to blowouts or frame damage.

Illustration 5

The length of the rear overhang is a good indicator of the highway stability of a motor home.

Back-of-ball, base hitch weight, and payload capacity are designed into the trailer at the factory. They do not change. You might say that they are "hidden" qualities of the trailer until your eyes are opened to their significance. Once you know how these factors impact your towing situation, you can work them to your advantage. For instance, a BOB of less than 70% would not be an optimum design, but if it's 60% or more, you can compensate with the correct hitching and vehicle-matching techniques. A lack of knowledge could put you in danger. When it comes to towing, ignorance is definitely not bliss.

Once you are satisfied that you have a good match of trailer and towing vehicle, it's time to take a look at hitches and hitching practices — covered in Parts 7 through 10 — with special attention to fifth wheels in Part 8 and auxiliary braking for dinghy towing in Part 11.

Hitch Basics

It almost goes without saying that to pull any trailer you need a hitching device. The hitch needs to be strong enough to pull the weight of the trailer and carry the hitch weight yet light enough to attach or remove without difficulty. It needs to be solidly fastened yet flexible enough to turn corners. It should also assist in controlling the trailer whenever it's hit by a bow wave or crosswind. One thing I've discovered for sure is that hitching systems are not created equal.

This inequality, unfortunately, often shows up in the pages of accident reports. We've also heard horror stories from first-time trailerers who were left on their own by their dealer when it came to hitch selection — as if it were a minor issue. This kind of attitude can and has resulted in tragedy for the RVers. If the manufacturer and the dealer won't educate you, it is up to you to be well-informed about hitches before you even think about hitting the road.

Putting hitches into very specific categories of type and class makes your job easier when you have to select the right one for your rig. The three basic types are:

1) weight-carrying hitches,
2) weight-distributing hitches, and
3) fifth wheel hitches — which are relevant only to truck towing.

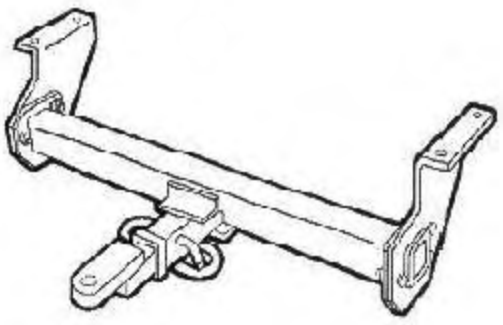
But before I get into talking about all the different types and classes and what they'll do for you, let me show you a quick rule of thumb for figuring out what kind of hitch you'll need for the towing job you have in mind. Actually, this is the simple part of hitch selection.

If you are towing a small boat or utility trailer weighing under 1,500 pounds, you need only a well mounted **weight-carrying hitch**. If you're going to pull any trailer weighing more than 2,000 pounds, you'll probably want to look at some sort of **weight-distributing hitch** unless your towing vehicle is a heavy-duty truck. If you are pulling a trailer coach that weighs over 3,000 pounds, you will definitely need a **weight-distributing hitch**. Weights between 2,000 and 3,000 pounds are in a gray area, depending on the towing vehicle. To be on the safe side, your best bet is to go with the next higher hitch classification. Now, isn't that simple? But when it comes to safety on the road, "simple" won't be quite enough.

While there are only three types of hitches, there are currently five classifications based on the amount of weight a particular hitch type can carry. Class 1 includes weight-carrying hitches that are bolted onto the rear of the towing vehicle and can handle a trailer to a maximum weight of 2,000 pounds (Illustration 1). Class 2, also comprised of weight-carrying hitches, can tow trailers of up to 3,500 pounds. Class 3 consists of both weight-carrying and weight-distributing hitches rated for up to 10,000 pounds. Class 4 hitches are designed to tow trailers that weigh between 10,000 and 12,000 pounds. Class 5 can tow in excess of 12,000 pounds. When you're towing with an SUV or a minivan, you'll probably be limited to a Class 3 weight-distributing hitch. With a full-size van, you'll need a Class 4 weight-distributing hitch to pull a large trailer coach. Trucks, depending upon size, may utilize all five classes. However, for most trailer-coach-towing situations with 1/2-ton to one-ton pickups, you'll still be looking at Class 3 and 4 weight-distributing hitches.

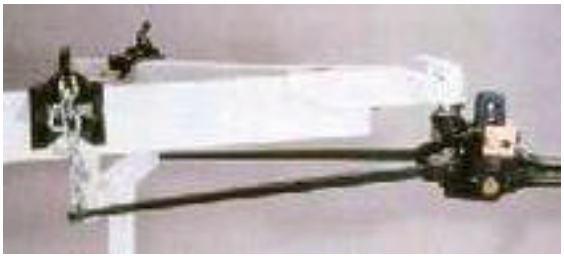
Class 1 weight-carrying hitches should be used only for some utility and boat trailers. Class 2's may sometimes be used for very small travel trailers, but are more commonly used with cargo-carrying trailers. However, for practical purposes, serious RVers will be looking at some variant of the weight-distributing hitch, of which there are two kinds: fixed-ball weight-distributing hitches and articulating weight-distributing hitches (Illustrations 2 and 3). With that in mind, we'll look at these hitches in greater depth and detail in Parts 9 and 10. But first let’s take a look at fifth-wheel towing in Part 8.

Illustration 1



This weight-carrying hitch can tow up to 1,500 pounds.

Illustration 2



All standard fixed-ball weight-distributing hitches have the same basic components.

Illustration 3

The Hensley Arrow is an example of an articulating hitch.

Towing a Fifth Wheel

A fifth wheel trailer properly hitched and matched to a truck will go just about anywhere. Our research shows that the happiest full-time and part-time RVers are pulling 30-to 34-foot fifth wheels with 3/4-to 1-ton pickups (Illustration 1). Generally, when pulling fifth wheels in this range, these tow vehicles need no special adaptations. Larger fifth wheels will require at least a one-ton pickup, while the smaller lightweight fifth wheels in the 25'-27' range may get by with a half-ton, providing the truck has adequate wheel-base and a pin weight of less than 1,500 pounds. Fifth wheels over 34 feet long will generally require a class 4 LDT or a medium-duty truck. A compact pickup, even with an extended cab, is not suitable for towing a fifth wheel.

Illustration 1

A properly-matched truck and fifth wheel can go just about anywhere.

Fifth wheels are the most forgiving of travel trailers because they are designed to put all the hitch weight in the bed of the truck rather than somewhere behind the rear bumper. It is well known that the fifth wheel configuration gives this towing combination a high degree of stability as long as the trailer weight never exceeds its GVWR and that the hitch weight is between 17% and 25% of the total trailer weight. For those of you who want to hit the road with a home rather than a "camper," I definitely recommend a fifth wheel.

Illustration 2

The fifth wheel hitch is usually installed in the truck bed just forward of the truck's axle.

Towing a fifth wheel naturally requires the use of a fifth wheel hitch, which is usually installed so that the hitch pin is just forward of the truck's axle (Illustration 2). It is usually best to position the hitch as far forward as possible while allowing for a 90-degree turn without the trailer hitting the truck's cab. The center of the truck's bed is usually positioned slightly forward of the axle so that some of the load is shifted toward the center of the chassis and the front to provide better balance — which in turn improves handling and control. This tells us that the more forward the pin location, the better the stability of the truck as long as you don't overload the front axle.

A fifth wheel hitch properly placed makes balancing the load relatively easy. Balance means maintaining an optimum hitch weight and not exceeding the axles' GAWR. Our parameters

establish 20% of the pin weight as optimum, but the maximum hitch weight of the trailer when towing with pickups should not exceed 25% of the trailer's total weight. A hitch weight below 17% can be dangerous because too light of a hitch makes for very unstable towing. We see this problem too often when the trailer's axles are placed too far forward. (See BOB in the Glossary.) Location of holding tanks, as in all trailers, is also critical for good fifth wheel balance. Freshwater, gray water, and black water holding tanks should always be in proximity of the axles. Tanks that are too far forward or aft make for inconsistent balance.

Proper balance on a fifth wheel means traveling level and maintaining a constant pressure on the hitch. If all the trailer's wheels do not exert the same pressure on the road, balance cannot be achieved. If poorly-located freshwater and waste tanks cause a severe fluctuation of hitch weight, balance will be adversely affected. With this in mind, you can see that a proper balance check involves the fifth wheel being perfectly level (if off level, the weight shifts) and checking it with and without fresh water. This will not be necessary if the freshwater tank is directly over the axles (where it should be) and the holding tanks are in proximity of the axles. Either way, what you're after here is to find out if the hitch weight is reasonably constant.

The prevalence of four-wheel drive pickups requires raising a fifth wheel by either flipping the axles or mounting springs on top of the axles instead of the bottom. This modification compounds the problem of traveling level because it is difficult to fine-tune the hitch height in the truck bed to the trailer pin box. If you are considering a four-wheel-drive truck, you need to get out a measuring tape and ask a lot of questions about being level and getting the needed clearance between the bed rails and the bottom of the fifth wheel overhang — normally between 4 and 5 inches.

Fifth wheels are not exempt from overloading problems such as overheating trailer brakes, tire blowouts, and suspension breakage. To find out if you are within the GVWR of the fifth wheel, you need to weigh the loaded trailer on commercial scales. And don't forget that the large front compartment on fifth wheels often tempts the RVer to overload on the front (Illustration 3), which affects front-to-rear balance.

Illustration 3

Large front compartments often tempt the RVer to overload.

Illustration 4

The most common type of fifth wheel hitch has a fore-and-aft pivoting motion.

Loading for side-to-side balance is also important. Most RVers simply measure from the bottom of the trailer to level ground to see how close the side-to-side balance is. If you are loaded and ready for a trip and you want a perfect check, the only way to properly check for balance is to weigh each wheel of the fifth wheel fully loaded. Most commercial scales will help you with the process.

Although the subject of fifth wheel hitches can seem complicated to the novice, there are just a few basic types — all readily available on the market. The most common type of fifth wheel hitch has a simple fore-and-aft pivoting motion and consists of two tracks (each about 3 feet long) bolted on the bed floor just over the truck frame. Two support pieces, which make up the hitch base, are then slid into the track and pinned (Illustration 4). The hitch base holds a cross piece with the fifth wheel dish (plate and jaws) by which the trailer is secured. The cross piece and the hitch base can be removed separately, which allows the truck bed to be used for utility purposes.

The **four-way pivoting hitch** allows the trailer to move independently of the towing vehicle. This freedom of movement will make the trailer easier to connect to the truck when the ground is uneven. It will also make the truck and trailer easier to handle under rough road conditions. Because it reduces stress on fastening points, it should also reduce wear-and-tear on the hitch and the truck. This type of hitch is recommended for heavy trailers — especially those used on back roads and in wilderness campgrounds. Like some other types of fifth-wheel hitches, four-way pivoting hitches are mounted over or slightly ahead of the axle and are easily removed from the truck bed. For larger fifth wheels, a cushioned pin box or hitch is helpful (Illustration 5).

If you plan on towing with a short-bed pickup, you'll need a slider hitch of which there are two types: **manual** and **automatic** (Illustrations 6 and 7). The **manual slider hitch** is cheaper and most common. This hitch allows for highway towing in the normal position and hard turns or backing in the rear position. Although this sliding hitch may be handy when entering or backing into campsites, if you drive with it in the back position, you can lose the natural forgiveness of the fifth wheel. Because the fifth wheel needs a minimum of 70 degrees in relation to the

Illustration 5

A cushioned pin box is helpful for heavy-duty towing applications.

Illustration 6

The manual sliding hitch is used in short-bed trucks to facilitate backing and turning. However, it must be adjusted by hand every time you need to make a sharp turn.

Illustration 7

Automatic sliding hitches adjust themselves in turns and when the towing combination returns to in-line travel. They are worth the investment if you must tow a fifth wheel with a short-bed truck.

truck's position, to avoid hitting the cab on tight turns, the fifth wheel overhang could easily wipe out part of the cab if the truck and fifth wheel jackknifes at a fast rate of speed while the hitch is in the forward position. For these reasons, I do not recommend short-bed trucks for fifth-wheel towing unless an automatic sliding hitch is installed — which adjusts itself when making forward or backward sharp turns, thus eliminating the danger of the trailer hitting the cab and the hassle of making frequent adjustments. It's the fifth wheel answer to the articulating hitch, with a price to match, but worth the investment if you must tow with a short-bed truck.

Another type of hitch, the **gooseneck hitch**, is primarily used by farmers who need to have their trucks readily available for a variety of non-towing purposes (Illustration 8). Although it's a heavy-duty system, it is not traditionally used by the RVing community. Installation of a gooseneck hitch might depreciate both your trailer and truck if resale becomes an issue. Keep in mind that the attachment to the truck bed is totally different than for other types of fifth wheel hitches and usually involves a cut in the floor of the bed, leaving it clear of obstructions to the loading of cargo.

If you'll be pulling a fifth wheel with your truck and your needs don't include towing a trailer coach, you can skip Parts 9 and 10. However, if you choose to tow a fifth wheel, be sure to study the FAQs relating to fifth wheels in Section 2, Part 1.

Illustration 8

Gooseneck hitches, often used on farm trucks, are available in a variety of brands and models, some of which involve making a cut in the bed of the truck.

What Weight-Distributing Hitches Do

A weight-distributing hitch (Illustration 1) has a single purpose: to take a portion of the weight off the rear of the towing vehicle and distribute it between the front axle and the trailer axle or axles. The weight on the rear of the towing vehicle comes from two sources: the hitch weight of the trailer and the load carried in the towing vehicle. Without a weight-distributing hitch, the front of the towing vehicle would be too light and the rear of the towing vehicle would be too heavy — which could result in diminished steering control.

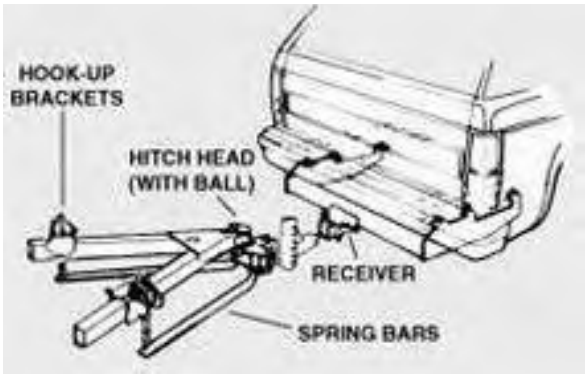
The standard weight-distributing hitch, (as shown in Illustration 1), has a receiver (Illustration 2), a ball (Illustration 3) fixed to a shank (adjustable or otherwise), and some sort of spring bar mechanism. The receiver is the assembly that is fastened to the rear of the towing vehicle (Illustration 2); the shank connects to the receiver; the ball is the physical connection between the trailer and the towing vehicle (Illustration 3); and the properly-tensioned spring bars lift the hitch weight off the rear of the towing vehicle (Illustration 5). Although hitch configurations vary greatly from brand to brand, every weight-distributing hitch has a receiver, a ball, and one or two spring bars. In addition, some brands include an anti-sway device.

In Illustration 4, you can see what happens when you try to pull a trailer without a weight-distributing hitch. It would be very difficult to maintain control in this scenario. In Illustration 5, you can see the way a trailer and towing vehicle should look when properly hitched.

A weight-distributing hitch distributes the weight through the spring bars. When a loaded trailer is hooked up, the tension on the spring bars "lifts up" on the towing vehicle's rear and distributes some of the tongue weight among the other axles.

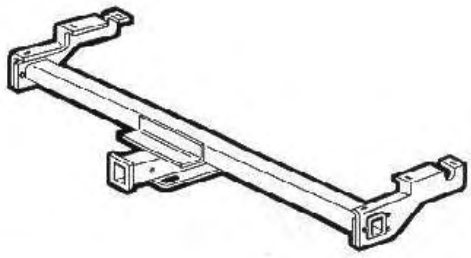
The spring bars are the most misunderstood part of the assembly. Many accidents happen when the towing vehicle loses control as a result of incorrectly-tensioned spring bars.

Illustration 1



A weight-distributing hitch takes a portion of the weight off the rear axle of the towing vehicle and distributes it between the front axle and the trailer axle or axles.

Illustration 2



The hitch receiver assembly attaches to the rear of the tow vehicle.

Illustration 3

This basic example of a hitch ball shows one of the many forms this critical hitch component can take.

Adjusting the spring bars is critical to the satisfactory performance of a weight-distributing hitch. Spring bars are rated by the manufacturer for various hitch weight capacities. As a general rule, however, your hitch weight should be no more than 75%-85% of the spring bar rating to allow for a range of adjustment. If the spring bars are rated too low, they will not respond to varied load and road conditions. However, if they are rated too high the RVer may be tempted to overtension the spring bars (Illustration 6), which would remove enough pressure from the rear axle to cause the rear wheels of the towing vehicle to lose traction with the resulting loss of steering control.

As an exaggerated example, imagine driving down the road in a vehicle that has a hinge between the front wheels and the rear wheels. Control would obviously be impossible. The same thing would happen if you removed all pressure from the rear wheels of a vehicle towing a trailer. As you increased the weight on the rear wheels you would gain control in proportion to the amount of weight applied. Optimum control is probably realized when the weight on the towing vehicle's rear wheels is slightly greater than when the trailer is disconnected.

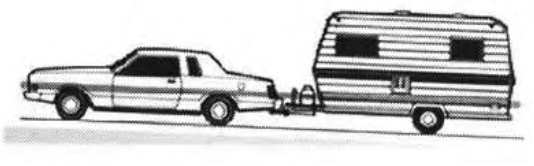
Weight-distributing hitches are rated for their maximum hitch weight, given in increments of 50, up to a hitch weight of 1,200 pounds. A valuable guideline for towing safety is never to exceed the lowest-rated component of your towing outfit whether it's the hitch, the capacity of your towing vehicle, or your trailer's GVWR.

Unfortunately, many dealers simply recommend a standard weight-distributing hitch with sway control for all situations. This can be dangerous advice. With this "fixed-ball" hitching plus sway-controller arrangement, the trailer will attempt to maintain a straight line with the towing vehicle even when turning a corner. This unforgiving quality makes the use of some sway controllers unsafe when the wheelbase of the towing vehicle is inadequate for the size of the trailer. Because the number of trailering accidents that have occurred with the use of fixed-ball weight-distributing hitches — even with added sway controls — is double that of non-towing accidents per mile, I am firmly convinced that this type of hitch has become obsolete. In Part 10, I'll show you why we recommend an articulating hitch for towing travel trailer coaches.

Illustration 4

This is what happens when you try to tow without a weight-distributing hitch.

Illustration 5



This is the way the trailer and towing vehicle should line up when properly hitched.

Illustration 6

Overtensioned spring bars give the towing vehicle's rear wheels a tendency to "lift up".

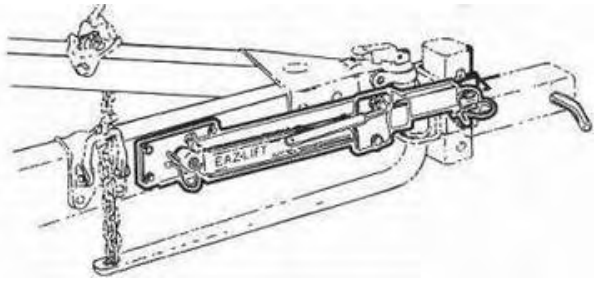
Sway Control Makes a Difference

As we discussed in parts 3 and 6, all trailer coaches have a tendency to sway when hit by bow waves or side winds — but they should never sway!

Because trailer sway is such a common problem, there are numerous anti-sway devices on the market. The typical sway controller is nothing more than a metal bar with two friction pads that are squeezed against the bar with a hand crank (Illustration 1). All this bar does is decrease the tendency of the trailer to sway by resisting the normal flexing action at the hitch ball. A problem with this type of sway bar is that there is no gauge for accurately adjusting the pressure to produce the optimum amount of friction needed to reduce sway without impeding the natural flex that is characteristic of good towing behavior. This type of bar needs to be adjusted for varying road and weather conditions. On a straight and level highway you will need a maximum adjustment because of the prevalence of bow waves and crosswinds. But when you get off the freeway you will need to reduce the friction on this type of sway control if you encounter curvy, gravelly, and / or wet roads. Keep in mind that the natural function of the sway bar is to stiffen the total combination into one long RV. However, when the connection between the two vehicles is too stiff, steering control is hindered. The theory behind anti-sway bars is good when all factors and conditions are ideal, but they are definitely inadequate for today's vehicles and high-speed highways.

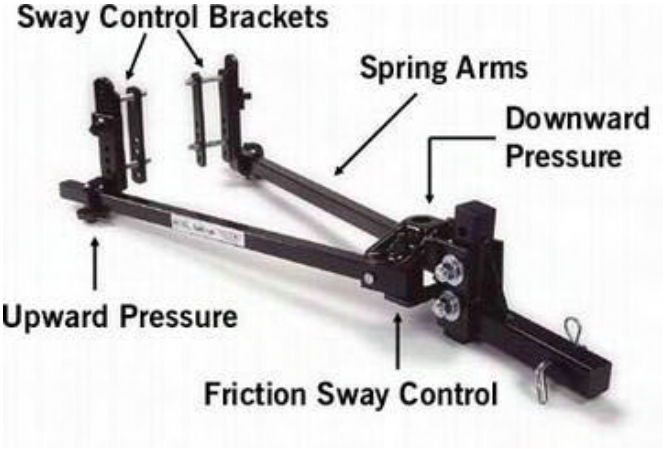
Some standard weight-distributing hitches have sway control as an integral part of the assembly. The Equal-i-zer Hitch is a fixed-ball hitch that is claimed to reduce sway through the effects of friction at the spring bar brackets (Illustration 2). This friction is created by the downward pressure exerted by the trailer tongue load and the lifting pressure of the tensioned spring bars.

Illustration 1



A typical sway control fastens to the hitch shank and the trailer tongue.

Illustration 2



The Equal-i-zer is a fixed-ball weight-distributing hitch that is claimed to reduce sway through the effects of friction at both ends of the spring bars.

These forces combine to keep trailer and towing vehicle aligned, thus reducing sway. Without extensive empirical data, I cannot conclude that there is any major difference between the Equal-i-zer and any standard fixed-ball weight-distributing hitch except that it might offer minor sway control.

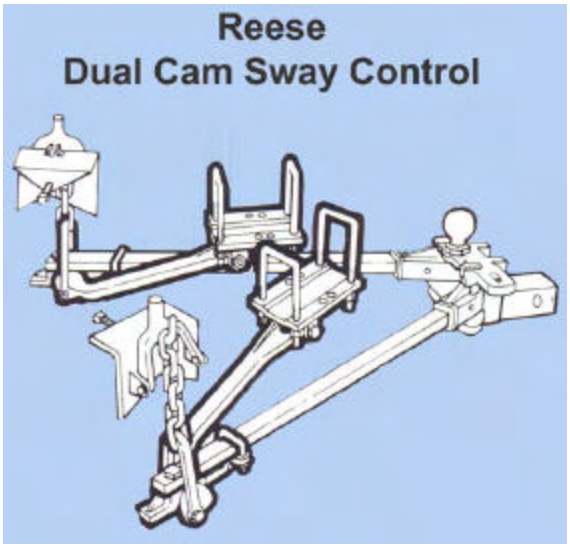
The Reese Dual-Cam (Illustration 3) derives its name from the cams at the ends of the spring bars. Because the cams' action tends to keep the trailer centered behind the towing vehicle, there is probably some anti-sway benefit to this device, especially when an additional sway bar is added. Although many RVers have used these hitches without noticeable problems, it should be kept in mind that the same towing parameters used for any standard weight-distributing hitch, with or without add-on sway controls, should be applied to the Equal-i-zer, the Reese Dual-Cam, and other hitches of this type.

The second type of weight-distributing hitch — an anti-sway device in itself — is the articulating hitch, so called because of its movable joints. This type of hitch lets the trailer track better behind the towing vehicle than it would with a fixed-ball hitch, while virtually eliminating the "tail-wagging-the-dog" syndrome. In the case of a trailer 20' long or more being towed by an SUV, a van or a short-wheelbase truck, a hitching device that allows the trailer to move without wobbling the towing vehicle is essential.

Use of an articulating hitch improves the safety factor in trailer towing as long as the following conditions are met: 1) the trailer and towing vehicle are matched according to wheelbase parameters, 2) the correct class of hitch is used for the trailer / towing vehicle combination, 3) proper hitching procedures are observed, and 4) the trailer is correctly loaded and balanced. However, for articulating hitches I do allow a 10% adjustment in wheelbase parameters.

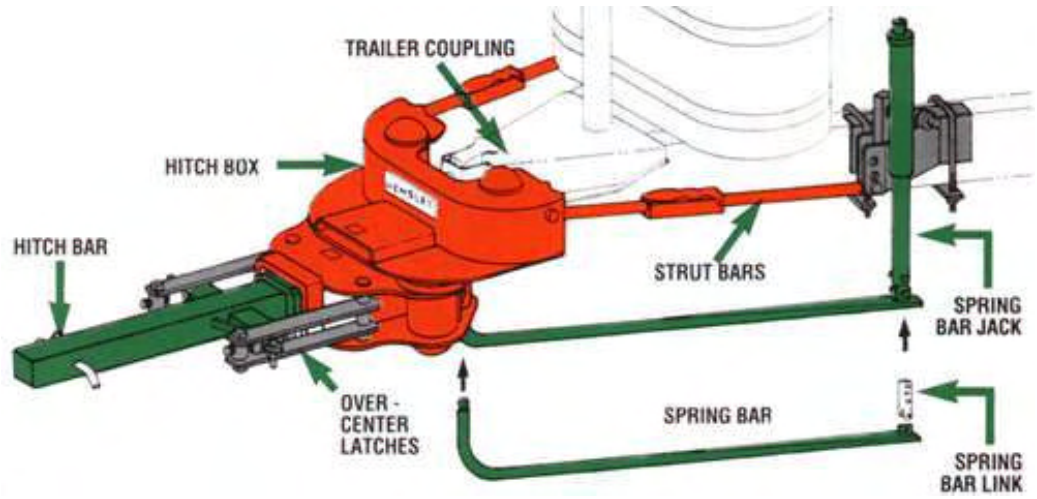
To my knowledge, the only two articulating hitches currently available are the PullRite and the Hensley. The PullRite hitch is an articulating, weight-distributing hitch that the manufacturer claims helps reduce the danger of sway by placing the pivot point of the hitch directly behind the rear axle. The ball mount is extended behind the towing vehicle bumper so that the draw bar can slide on the arc-shaped rail. The spring bars, in addition to their weight-distributing function, serve the purpose of preventing the trailer from rotating on the hitch ball. If you've been using a conventional

Illustration 3



The Reese Dual-Cam is a weight-distributing hitch that keeps the trailer centered behind the tow vehicle by the action of cams at the ends of each spring bar.

Illustration 4



The Hensley articulating hitch is one of the most popular hitches of its type.

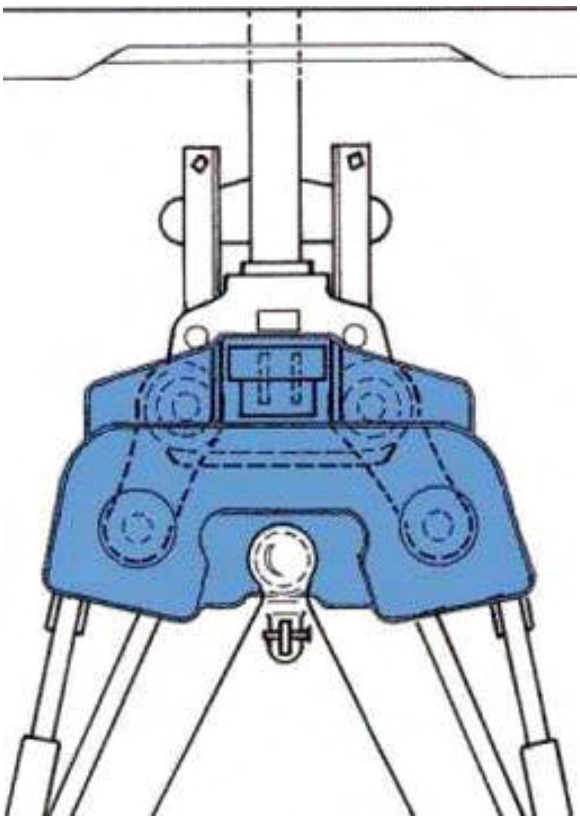
hitch, it will take some adjustment to keep the trailer off the curb when turning a corner using a PullRite hitch.

The Hensley Arrow (Illustration 4) is an articulating hitch that uses an interlocking system of arms and pivots to form a trapezoidal configuration that effectively projects the trailer's pivot point forward of the hitch ball (Illustration 5). The manufacturer claims that the design of the linkage prevents lateral forces such as bow waves and crosswinds from influencing the driver's control at the steering wheel.

User reports indicate that sway problems resulting from bow waves caused by passing 18-wheelers are drastically reduced with the use of a Hensley or PullRite hitch. Although I am convinced that these hitches compensate for some trailer design deficiencies, the RV must still be correctly loaded and balanced and reasonable wheelbase parameters observed. In other words, this hitch won't allow you to safely tow a 40' trailer with a 100"-wheelbase vehicle. And, most critically, any hitch, regardless of its design characteristics, is not a substitute for safe driving practices.

There may be some factors that cannot be corrected by articulating hitches. An example would be a hitch weight well under the recommended optimum of 10% of the gross weight. This condition could virtually lift the rear wheels of the tow vehicle off the ground under certain conditions — as discussed previously. In this scenario, an

Illustration 5



The Hensley effectively projects the trailer's pivot point forward with a system of interlocking arms and pivots.

articulating hitch would undoubtedly help, but under extreme conditions, it might not help enough.

From our research, we know that the risk of an accident caused by sway is so low it's almost nonexistent when you're using an articulating hitch. However, I would not want to say that employing an articulating hitch will make your towing setup as forgiving as a well-balanced fifth wheel towed by a pickup truck, but its performance will definitely be superior to that of a fixed-ball hitch. Our data from experimentation and observation show that the PullRite and Hensley systems, in particular, are extremely effective in minimizing or eliminating trailer sway.

Even though they cost substantially more initially than fixed-ball hitches, I'm sure that you'll find the extra forgiveness provided by an articulating hitch well worth the additional expense. Think of it this way: If the fixed-ball hitching systems were outlawed, would that stop you from trailering? Of course not! You would just include the price of the hitch in the budget and go from there. Or, think of it this way: If you were going on a serious week-long adventure, would you opt for a package of bandages rather than one of those more expensive, compact first-aid kits? Of course you wouldn't! The only reason you might hesitate to pay more for a better hitch is that the salesperson is giving you the choice of a cheaper system that "will probably work okay if you drive carefully" and an expensive system that "will work okay." Because you'd rather spend $600 than $2,000, you hear the "okay" that comes from both statements. Well, it's not "okay" to risk your life, the life of your passengers, and endanger other highway travelers because you want to save a few bucks.

According to the most recent statistics from NHTSA, accidents involving towing vehicles exceed the number of accidents involving non-towing vehicles. This gives us something to ponder. The risk is too high to ignore. Life and soundness of body are too valuable to gamble at any odds.

The Hot Issue of Dinghy Brakes

One of the hottest ongoing controversies in the RV arena is the issue of dinghy brakes. Generally the argument stems from the extra cost of dinghy braking systems and from convoluted legalities. Although the average cost of an auxiliary braking package is $600, I find that it is not as much of an obstacle as is the confusion about the necessity of brakes for vehicles towed behind a motor home — which is aggravated by the wide variation in state law and by enforcement issues.

Each state has its own laws regarding trailer braking. In many states, brakes are required if the trailer's gross vehicle weight rating (GVWR) is 3,000 pounds or more, and in other states the maximum GVWR of the unbraked towed vehicle can be as low as 1,000 pounds. A big problem is that the law rarely clarifies at what weight it is permissible to tow a dinghy behind a motor home. One thing is absolutely clear: Every state has a weight limitation for towing a dinghy without auxiliary brakes.

Illustration 1

This shows what could happen if you tow an unbraked dinghy behind your motor home.

Regardless of the law in any state, I agree with the many motor home manufacturers who recommend that any towed vehicle that weighs over 1,000 pounds needs to have its own brakes. Over the years, RVCG's study of accident reports and consumer input has proven to us that it's a bad idea to tow a dinghy without its own brakes behind a motor home. To travel with a dinghy that is not equipped with auxiliary brakes is tantamount to endangering the lives of the motor home's occupants as well as other drivers on the highway. Considering the moral and legal issues, I stand firm on the premise that auxiliary brakes should be required for every dinghy (also called toad) being towed behind a motor home.

Whether legal or not, the only safe way to tow a dinghy without auxiliary brakes is when the total weight (GVW) of the towed vehicle is included as part of your payload. Accidents and deaths

occur every year because this rule is violated. I know of a particular accident situation in which several members of a family lost their lives and others were severely injured because their dinghy wasn't equipped with brakes. In another case, overheated brakes caused a motor home towing an unbraked dinghy to go out of control on a downgrade, killing the driver and nearly mowing down highway workers in the process. Just recently an accident occurred near our offices when a motor home couldn't stop because it was towing an unbraked 3,500-pound pickup that exceeded the payload limits of the motor home. RV Consumer Group has other cases on file where RVers were killed or injured because of stopping problems related to dinghy towing.

Illustration 2

This RV-show display shows how the Brake Buddy pushes on the brake pedal from a console that sits on the floor in front of the driver's seat.

There are many braking systems designed for dinghy towing, some of which include a breakaway device that will stop the dinghy if it becomes disconnected from its towing vehicle — a legal issue in some states. Some dinghy brake systems are cable-activated through a mechanism at the hitch that uses the forward momentum of the dinghy to pull the brake pedal down to apply the dinghy's brakes (Illustration 2). Another type is air-pressure-activated using its own pressure system that is controlled by the momentum of the dinghy through a pendulum-like device (Illustration 3). You might even come across a brake system that is vacuum activated, triggered by the motor home's brake light. Then, if you have air brakes on your motor home, you'll be able to use a system that uses that air pressure to activate a plunger that pushes the brake pedal. There is even one popular system that uses a pole-like apparatus between the driver's seat and the brake pedal to apply pressure directly to the pedal without cables or steel tubing. All these systems have their pluses and minuses for effectiveness, longevity, and cost. Because most require modifications to one or both vehicles, you will need to do a little research to determine which type is most suitable for your setup.

Illustration 3

The BrakeSafe system makes use of an actuator installed on the brake pedal arm.

I have seen many auxiliary braking systems tested and have not found one yet that works as consistently as a driver pushing on the brake pedal. I am always reluctant to endorse one or the other because official testing results are nonexistent. With this said, I must emphasize, however, that you are much better off with any one of the currently-marketed systems than you are without any auxiliary brakes on your dinghy.

Finally, let's review the most important rules for towing travel trailers and a few tips and cautions to consider before hitting the road — and then l'll answer some FAQ's.

Some Rules, Tips, and Cautions

If you want to have a fun and safe trailering experience, it's important to follow a few specific rules and observe certain cautions. Let's consider some of the rules that are commonly violated, along with some tips and cautions to help prepare you for trouble-free travel.

Your vehicles must be matched. Matching your trailer to the towing vehicle (or vice versa) is critical for maintaining control. If you treat wheelbase and size lightly, the trailer will be in the driver's seat.

The hitch must be adequate for the size of the trailer. This means that it must be the right type and classification. You can't just pick one off the shelf like you would a loaf of bread.

Be sure the back-of-ball ratio of the trailer is above 60%. At 60% or less, the towing vehicle's control of the trailer could be compromised.

Never, but never, overtension the spring bars on a weight-distributing hitch. If you do this you are courting disaster. I consider overtensioned spring bars to be one of the major causes of trailer accidents because excess tensioning removes traction from the rear wheels. It's about the same as hitting a patch of ice on the highway. If you don't want to lose it, don't lift it.

If you decide to use a sway bar, make a practice of adjusting it when going from straight to winding roads or vice versa. As you probably concluded from this document, I don't particularly favor sway bars when there are better alternatives — and there are better alternatives!

Be sure the trailer-to tow-vehicle electrical connection will stay connected. Lives have been lost because the trailer lost its brakes when the electrical connector came loose. Because of my involvement with a case in which a death occurred as the result of a disconnected Bargman plastic connector, I highly recommend that you frequently inspect your connector for tightness — or better still, replace it with a high-quality all-metal connector. If there is any question about fit and you can't replace it immediately, take an extra minute and wrap the thing with duct tape. Better to tape than crash.

A double-check walkaround is a must. After you start the engine of the tow vehicle, get out and do a second check by walking all the way around the complete rig. Visually check everything — lights, hose connections, tires, camping area (for cleanliness and anything forgotten), hitch, safety chains (if applicable), and trailer-to-tow vehicle electrical connector. This must become a habit!

Safety chains should be strong and sturdily fastened. These things have a purpose that few like to think about. But if you ever have a trailer break free, believe me when I tell you that you'll want the trailer to follow you rather than taking out half the highway traffic.

All tires must be properly inflated. Of course you know that, but do you check them or just look at them? If your trailer tires should have 30 pounds of air pressure and they have 20, they'll wear excessively and perform poorly. Don't guess.

Practice using the brake controller both by foot and hand. Develop a "feel" for the application of the trailer's brakes and your heart will pump steadier and palms stay dryer. Practice reaching for the manual control (lever) so that you can apply it lightly to correct sway (which you should never have) at lower speeds.

Travel level. It's imperative that both the towing vehicle and the trailer are level in relation to the ground. Being off level is dangerous for you and your passengers and hard on the vehicles. Make a practice of standing back and looking at the combination from a distance to check level.

Weigh your trailer at the axles and at the hitch with an average load. You absolutely do not want to overload the trailer's tires and you do not want a hitch weight that is excessive for the hitch. I know this is a tough rule to follow, but believe me, it's very important if you want low-risk trailering.

Your towing vehicle may need a "towing package" that may either be part of the standard equipment or an option. Towing packages usually consist of a hitch receiver, oil and transmission cooler, and a wiring harness. They vary widely, depending upon the brand and model of the towing vehicle and the trailer you want to tow. It's a good idea to ask your dealer what's needed for your particular situation.

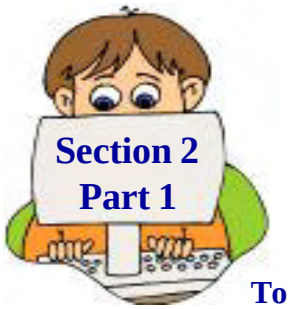
Consider an RV driver's training course — especially if you're rusty or inexperienced in pulling a trailer. Check your local listings and the Web for RV driving schools in your area.

Know the Law that relates to towing in all the states you'll be passing through. Most states have length limits on towing combinations as well as required registration with the Department of Motor Vehicles. A brush with the law can spoil your travel plans. Better to be informed ahead of time than lighten your wallet later.

Now that you've come this far, you have a good grasp of the basic principles of hitching and towing. Because there's a lot of information to digest and keep in your mind when you're visiting a dealership or getting ready to tow, we've included a convenient glossary of terms in Section 2, Part 2 for quick reference.

Good luck on all your adventures.

JD



Towing FAQs — Index

To view an individual FAQ, click on it.

1) Trucks: What Size Fifth Wheel Can I Tow?

To begin with, you'll need to understand the following terms:

GVWR (Gross Vehicle Weight Rating) is the total amount the loaded car, truck, or trailer can weigh without potential damage to some part of the vehicle's chassis or suspension. See Section 2, Part 2 - Glossary and The Language of RVing for more on this and the following terms:

GCWR (Gross Combined Weight Rating) has been established as the total load-pulling capacity of a motorized vehicle. Simply: the GCWR tells you almost nothing about how much you can tow unless you weigh the truck with full fuel, average number of passengers, and average cargo carried.

GVW (Gross Vehicle Weight) indicates what the trailer weighs at any given time. A weigh station will provide the GVW. The only good term that may be substituted for GVW is "loaded weight."

The GAWR (gross axle weight rating) of the truck's rear axles is extremely important because it will tell you how much of a hitch weight you can carry with the truck. Like GVWR, the GAWR is determined by the carrying capacity of the tires, wheels, brakes, axles, and suspension.

Tow capacity is often listed in the truck's towing guide to give the prospective buyer an idea of how much weight can be pulled by the truck with any given cargo. Generally, the manufacturer simply uses the GCWR and subtracts the minimum weight of the truck with driver and fuel to arrive at a tow capacity.

Generally, tow capacity does not indicate how large a fifth wheel you can tow, but it will tell you how heavy a boat you can pull. See the difference? Tow capacity is actually pulling capacity in weight. Also, tow capacity does not tell you how much hitch weight the truck can safely carry. For that you need "bed capacity".

A well-designed fifth wheel has a hitch (or "pin") weight between 20% and 25% of the gross weight. This means that a fifth wheel that weighs 12,000 pounds loaded should have a hitch weight between 2,400 and 3,000 pounds. Because we know that a typical 1/2-ton pickup may carry approximately 1,500 pounds safely and a 3/4-ton pickup generally can carry between 2,000 and 2,500 pounds, we know that a 1/2- or 3/4-ton truck is generally not adequate for this fifth wheel and that you'll probably want a one-ton pickup. Generally, a one-ton pickup doesn't like trailers that weigh over 14,000 pounds and pin weights over 3,500 pounds. If you exceed the 3,500 pounds of pin weight you will probably want to go for a class 4 light-duty truck that has a GVWR of between 14,000 and 16,000 pounds. Examples of class 4 trucks would be the Ford 450 and the Chevy Kodiak C4500.

When you look at fifth wheels 35 feet or longer that weigh from 8 to 10 tons, you should probably be looking at big rigs for towing. A medium-duty truck should be considered for most fifth wheels that are designed for fulltiming and have large slideouts. These class 5, 6, and 7 trucks range from 16,000 to 33,000-pound GVWRs and come with a large variety of GCWRs to pull any fifth-wheel travel trailer. I see no reason why you would need a class 8 heavy-duty truck which would have a GVWR in excess of 33,000 pounds.

You need to know "real" capacities and "real" weights before you match a truck to a fifth wheel. Guessing will only get you grief down the road.

Back to Towing FAQs Index

2) Fifth Wheel Travel Trailers: How do I go about towing a fifth wheel with a short-bed pickup?

While a long-bed truck has a greater turning radius — which can be more difficult to maneuver in tight traffic — the short-bed presents some major disadvantages. For example, with a standard fifth-wheel hitch there's a good chance you'll chop off up to 12 inches of the truck's cab with the front of the fifth wheel when you make a tight turn, depending upon the length of the truck's bed. In an accident situation that involves jackknifing at fast speeds, this could be dangerous to anyone sitting in the rear of an extended cab pickup and could result in a catastrophe.

If your towing vehicle is a short-bed (Illustration 1) or if you are determined to purchase one, you'll need a hitch that automatically moves the front of the fifth wheel backwards whenever it moves at an angle to the truck. Although these automatic sliding fifth-wheel hitches, made by Pulliam, are increasingly available, they cost a pretty penny and must sometimes be custom-made for your truck. Nevertheless, the cost is minimal compared to the value of your life.

With the manual sliding hitch, you must, as the name implies, get out of the towing vehicle and adjust the hitch position every time you want to back up or execute a sharp turn. Although it allows you to move the hitch to the rear so you can back into a camping site, these hitches are not meant to travel in the back position.

In some states it is illegal to be unable to make a turn of less than 70 degrees. With a short-bed and a standard fifth-wheel hitch, a straight pin box will often restrict turning to between 50 and 60 degrees. An extended pin box moves the house backwards so that you will receive a few more degrees of turning when maneuvering in a tight spot. Although this will sometimes get you the 70 degrees, this does not prevent problems in a tight jackknife situation. (You should never modify a straight pin box because this can change the delicate balance of the fifth wheel as established by the manufacturer.)

Back to Towing FAQs Index

3) Travel Trailer Coach: How do I go about matching a tow vehicle to my trailer?

The wheelbase of a vehicle is the distance between the center of the front axle and the center of the rear axle. This measurement is important to RVers because it is an indication of the stability and maneuverability of the towing vehicle. Wheelbase applies equally to motor homes and trucks used for towing trailers. If a towing vehicle has too short a wheelbase, there could be a serious problem with control. A vehicle with a 90-inch wheelbase should not tow any trailer. Although many people are not comfortable with the towing characteristics of such a short wheelbase, a 100-inch wheelbase vehicle might handle up to a 2000-pound travel trailer of approximately 15 ft. in length. Towing a 3000-pound travel trailer of 18 to 20 ft. in length will require a wheelbase of at least 110 inches if you consider safety a factor.

A good towing length for a travel trailer coach begins at 20 ft. for 110 inches of wheelbase. For each additional foot of trailer length, add 4 inches of wheelbase. Since this is only a guideline for safety, the overall safety of the RV unit will depend upon:

1. wheelbase,
2. gross combined weight rating (GCWR) of the towing vehicle,
3. weight of trailer,
4. length of trailer,
5. balance of trailer from loading,
6. design of trailer,
7. hitch configuration and handling characteristics of the towing vehicle from reputation.

A primary problem is that an RV may handle well on a smooth, flat, and straight freeway but may not be controllable on gravelly, slippery, or curvy roads.
Emergency stopping is always a problem with short-wheelbase vehicles unless the trailer is adequately and properly braked.

Towing Vehicle Wheelbase Parameters
Based on Trailer Coach 8' wide and 9' high.

Trailer Length (feet)	Wheelbase (inches)	Trailer Length (feet)	Wheelbase (inches)
20’	110”	30”	150”
21’	114”	31’	154”
22’	118”	32’	158”
23’	122”	33’	162”
24’	126”	34’	166”
25’	130”	35’	170”
26’	134”	36’	174”
27’	138”	37’	178”
28’	142”	38’	182”
29’	146”	39’	186”
		40’	190”

Back to Towing FAQs Index

4) Travel Trailer Coach: What size trailer coach can I pull with a pickup?

RVCG gets many questions about towing trailer coaches with pickup trucks. Most people's concerns boil down to one basic thing: The length of trailer they can pull with the truck they have or the size truck they need to pull the trailer they have. Some of these RVers have read our material on wheelbase and seem to be of the opinion that wheelbase is the whole story. Nearly all the questions reflect confusion about the difference between power and control — a technical issue that stumps most RVers when they are searching for a just-right match of trailer and towing vehicle.

First of all, safe towing with a pickup depends upon a combination of factors that varies for every type of travel situation and pairing of vehicles. Although pickup trucks are ideal for pulling fifth wheels, you'll encounter some problems when pulling trailer coaches — or even cargo trailers — that need to be addressed.

In most cases, you'll be towing with a 1/2-ton, 3/4-ton or 1-ton. These truck classifications approximate the weight the truck can carry in its bed. This designation does not tell you how much hitch weight you can safely carry off the rear of the truck — as when you're pulling a trailer coach. Hitch weight is critical when pulling with any vehicle. With pickup trucks, however, you have a potentially serious safety issue because keeping traction on the rear is often a problem. To overcome this problem you need to keep a constant hitch weight that neither "lifts" the rear wheels or "raises" the front wheels. This balancing technique needs constant attention with pickups as much as it does with short-wheelbase SUVs.

When pulling a travel trailer coach, it really doesn't matter whether you have a 1/2-ton or a 3/4-ton truck. The engine size and axle ratio will determine how much you can pull. *The Green Book—RVs Rated* and the *RV Ratings CD-ROM* are designed to give a recommendation for a 3/4-ton truck if the GVWR exceeds 6,000 pounds. However, I have found that 3/4-ton trucks and vans handle hitch weights in excess of 600 pounds much better than 1/2-ton trucks.

For safe towing there is one thing you must consider in addition to a long wheelbase. From studying numerous accidents involving pickup trucks pulling trailer coaches, it is clear that having a load in the bed of the truck is critical. It is the load that keeps the rear wheels on the ground if something begins to go wrong. From 500 to 800 pounds should be adequate if it is spread evenly in the bed.

Back to Towing FAQ's Index

5) Trucks: How are trucks classified?

Trucks are classified from 1 to 8 depending on the GVWR.

Class 1 is 6,000 pounds GVWR and under. (light-duty)
Class 2 is 6,001 to 10,000 pounds GVWR. (light-duty)
Class 3 is 10,001 to 14,000 pounds GVWR. (light-duty)
Class 4 is 14,001 to 16,000 pounds GVWR. (light-duty)
Class 5 is 16,001 to 19,500 pounds GVWR. (medium-duty)
Class 6 is 19,501 to 26,000 pounds GVWR. (medium-duty)
Class 7 is 26,001 to 33,000 pounds GVWR. (medium-duty)
Class 8 is 33,001 pounds GVWR and above. (heavy-duty)

You will notice from this chart that all pickups fall into the light-duty category. The Ford 450 and the Chevy 4500 are class 4 light-duty trucks. Many RVers use class 5, 6, and 7 for towing big fifth wheels. The big rigs with 2 or more rear axles will fall into the class 8 heavy-duty grouping and are rarely used for RVing.

Back to Towing FAQs Index

6) Medium-Duty Trucks (MDT): Are full-size trucks an answer to hauling today's large fifth wheels?

Some RVers are of the opinion that a heavy-duty truck is needed to pull a large fifth wheel safely. I think these RVers are just a bit too tough on medium-duty trucks. If you crunch the numbers, it's quite clear that an MDT will carry any fifth wheel currently being built. A loaded weight of more than 16,000 pounds will require a medium-duty truck — which spans classes 5, 6, and 7 in the standard truck classification based on GVWRs ranging from 16,000 to 33,000 pounds. These capacities will handle the pin weight of any fifth wheel travel trailer. MDT's come in such a variety of GCWRs that you can pick almost any pulling power you want out of the hat. Truck shopping is a little like being in a candy store when you're hungry: Be careful you don't get so much truck you can't handle it.

Medium-duty trucks equipped to pull fifth wheels are running between $40,000 and $60,000 without any conversion. If you want to spend $100,000 for a good rig, I'm sure you can find someone to give you everything you want.

Back to Towing FAQs Index

7) Ford Trucks: Is the F-450 a medium-duty truck?

Although the F-450 is often considered a medium duty truck, it is not. According to the standard truck classifications, the F-450 is a light-duty truck in the class 4 range because it has a GVWR of between 14,001 and 16,000 pounds. The light-duty classification also fits all pickups (class 1, 2, and 3). The 1/2-, 3/4-, and 1-ton pickups are all considered light-duty trucks.

Because the F-450 is not a regular pickup and it's not an MDT, I guess you could call it a class 4 LDT. It sounds good to me!

Back to Towing FAQs Index

8) Medium Duty Trucks: Where do the Fords fit?

Illustration 1

Ford produces an F-450, F-550, and an F-650 (Illustrations 1, 2, and 3) for fifth-wheel travel trailer towing. The Ford F-450 is a class 4 truck ; thus it is in the light-duty class — which is limited to GVWRs of up to 16,000 pounds. The F-550 and the F-650 are in the medium-duty class, which has a minimum of 16,000 and a maximum of 33,000 pounds GVWR. You need to keep in mind that the GVWR has to do with the carrying capacity of the truck, not with its pulling capacity.

Ford gives you a variety of choices regarding GCWR based on the engine and drive train of the F-550. You will need to follow these recommendations closely if you want good life from the truck and safe traveling. For example, with a package including crew cab, 4x2, 4.88 rear axle, and 7.3 turbo diesel, Ford recommends towing a fifth wheel that weighs no more than 17,700 pounds. Because at about 17,000 pounds a trailer should have a maximum pin weight of about 4,500 pounds, and the truck has a maximum GVWR of 19,000 pounds with a carrying capacity of about 11,000 pounds, you should have no problem pulling most fifth wheels up to 36 feet long that have only two axles. The limiter in this case is the GCWR — not the pin weight.

Illustration 2

If you are considering a fifth wheel over 37 feet long (which should have 3 axles), you will probably want to consider an F-650. The F-650 is a class 6 truck with a maximum GVWR of 26,000 pounds and a carrying capacity of well over 14,000 pounds — plenty for the pin weight of any fifth-wheel travel trailer. The pulling power (GCWR) of the F-650 can go as high as 43,000 pounds — allowing for much more gross weight than that of the largest fifth wheel.

Illustration 3

If you are considering a medium-duty truck, it is important that you don't get a lot more carrying capacity than you need for the hitch weight. If the suspension is too stiff, you will need more shock absorption at the rear axle and fifth-wheel hitch to avoid damage to the pin box or chassis frames.

Back to Towing FAQs Index

9) Travel Trailer Coach: SUV's — How does an articulating hitch influence towing with an SUV?

This typical question came from John Platt of California who has a Jeep Grand Cherokee V8 with towing package and wants to tow a fold-down. He is puzzled about just how to determine how much trailer he can safely tow with 235 HP, 5500-pound tow capacity, and 106-inch wheelbase when using an articulating hitch.

First of all, using an articulating hitch should greatly reduce the chances of an accident caused by sway. It should also negate any turning problems normally associated with fixed weight-distributing hitches and conventional sway bars. However, the total weight, the balance of the trailer, and the frontal area will affect the life of the Cherokee and could entail some risk to the occupants if lack of power encourages the driver to go into a "roller-coaster effect". Even though control may be improved with an articulating hitch, pulling power and braking power must be taken into consideration for both economy and safety. Keep in mind that some fold-downs can be almost as heavy as a conventional trailer.

I would like to mention here that not all fold-downs tow well. Low hitch weights and back-of-ball-to-length ratios will greatly affect towing characteristics as discussed in Part 6 of this publication.

Back to Towing FAQs Index

10) Fifth Wheel Travel Trailers: Is it safe to remount springs on top of a large fifth wheel's axles to get truck bed clearance?

It is a common practice to raise a fifth wheel by either flipping the axles or mounting springs on top of the axles instead of the bottom. This change is usually made because of the higher bed on four-wheel-drive pickups. Because it raises the trailer, it will tend to be a bit more top heavy. Some RVers get by with between 4 and 5 inches, but it is a touch close. Raising it might mean you will need three entry steps. This process will not affect payload, but it can affect balance if the trailer is not adjusted to travel level. Be sure you get enough height (6 inches is ideal) to clear the bed sides. Other than catching a bit more frontal and side air, there should be no problem if you watch balance and speed.

Back to Towing FAQs Index

11) Fifth Wheel Travel Trailer: Pin Weights — How can I be sure that the weights are correct?

You need between 17% and 25% of the gross weight of the fifth wheel on the hitch. If you want good performance from the truck, hitch weight should be between 50% and 75% of the bed capacity. Your goal will be to have the fifth wheel traveling level so that weight distribution is equal on both axles. If all wheels do not exert the same pressure on the road, balance cannot be achieved. To get good behavior from the towing combination, you need a good hitch mounted at least 4 inches ahead of the truck's axle, an engine that is tuned so that there is no surging, and good shock absorbers on your truck.

It'd be great if everyone weighed their trailers before the initial load and again loaded. If you do it loaded only, you'll never know if the balance is designed into the fifth wheel or whether the loading is the determining factor. Because a fifth wheel is very forgiving unless it's way out of balance, I think an occasional good check when loaded is more important than trying to do a perfect one and never doing it again. All this, of course, is assuming that the trailer weight never exceeds the GVWR and that the hitch weight never exceeds 25% of the total trailer weight.

When a well-designed fifth wheel comes out of the factory, it should have about 20% of the total weight on the hitch. Your goal will be to load the fifth wheel in a manner that will keep the hitch weight between 17% and 25%. With a big storage compartment in the front, you'll probably find that ample supplies in the rear galley can help to offset the supplies and equipment you'll undoubtedly load in the front.

Then, of course, you might want to check the fifth wheel from side to side. This can be difficult to do accurately because most scales are not set up for weighing in this manner. To determine how close the side-to-side balance is, most RVers simply measure from the bottom of the trailer to a level ground. If you are loaded and ready for a trip and you want a perfect check, the only way to properly check for balance is to weigh each wheel of the fifth wheel and weigh the truck with and without the fifth wheel (fully loaded, including driver and passengers). This takes portable scales, so don't expect to do it at a truck stop.

If you want to be very particular, you need to check it with and without fresh water. This will not be necessary if the freshwater tank is directly over the axles (where it should be) and the holding tanks are in proximity of the axles. Either way, what you're after here is to find out if the hitch weight is constant.

Back to Towing FAQs Index

12) Dinghy Towing: What about those 3,500-pound hitches?

Judy Mason, of Florida, noticed that almost all manufacturers of gas-powered 32-foot to 35-foot motor homes have a 3,500-pound capacity hitch. It seemed to her that many towed vehicles would exceed that amount. According to Judy, this means that many people are not following guidelines for safe dinghy towing. Whenever she has questioned salespeople on this issue, their standard answer is that no one has ever mentioned this before and that everyone is towing dinghies with these motor homes. To be on the safe side, when she and her husband took delivery on their motor home, they specified that the 3,500-pound-rated hitch be replaced with one that has a 5,000-pound rating.

Many motor home manufacturers are uncomfortable showing a hitch capacity above 3,500 pounds because most have chassis extensions that are welded or bolted to the original chassis framing or because the motor home is already close to its towing capacity. Because of this, if you feel you need a 5,000-pound hitch receiver, it's definitely best to have it installed by the manufacturer or an authorized dealer.

Back to Towing FAQs Index

13) Dinghy Brakes: Do I absolutely need auxiliary brakes for my dinghy?

A fact set in stone is that for safety and legal reasons every dinghy being towed by a motor home should have auxiliary brakes. Not to have a dinghy equipped with auxiliary brakes endangers the lives of the motor home's occupants and others on the road. It is almost always unsafe because the weight of a towed vehicle that does not have brakes must be figured as part of the payload. In other words, you must add the towed weight to the weight of the towing vehicle and still not exceed the towing vehicle's GVWR (gross vehicle weight rating) — even though some manufacturers allow 1,000 pounds more than the GVWR. Do not confuse GVWR with GCWR (gross combined weight rating). GCWR has to do with pulling power. GVWR has to do with carrying and stopping capacity.

You should be aware that dinghy brakes are required by law in most states. It is unfortunate, however, that the language of the law in California (and some other states) is ambiguous regarding this issue, and RVers who live in California, as well as those planning to travel there, need to know about it. According to California Vehicle Code, Section 26303, "Every trailer coach and every camp trailer having a gross weight of 1,500 pounds or more, but exclusive of passengers, shall be equipped with brakes…". Although the code should have specifically mentioned automobiles in tow, it should be assumed that a dinghy being trailed behind a motor home is a trailer. The "trailer coach" and "camp trailer" reference should indicate that the code is directly referring to non-commercial recreational vehicles, which would include a dinghy hitched to a motor home. The confusion may be compounded by commercial requirements which, according to California Vehicle Code, Section 26302 (b), limits commercial trailers to 3,000 pounds before brakes are required. To assume that this writing implies that a motor vehicle, regardless of weight, being towed behind a motor home does not require auxiliary braking is walking on dangerous ground. Although interpretation of the law is left up to lawyers, I think if there's a gray area you should protect yourself by taking that step into the black. You should also realize that although California law may not be totally clear on the issue, other states are. Having California plates, for instance, will not protect you once you cross the border into another state.

A cautionary note: I know of an accident in which a whole family was killed because a dinghy didn't have brakes. I am certain there are many disasters caused by laxity and misinformation about brakes. Be sure to equip your dinghy with brakes, a good tow bar, adequate safety chains, taillights, stoplights, and turn signals. Let's not pull any punches on auxiliary brakes.

Back to Towing FAQs Index

14) What is available on the market for auxiliary-braking systems?

Because both chassis and motor home manufacturers are stressing the importance of supplemental braking systems when motor homes are towing a dinghy, accessory manufacturers are coming aboard. However, because there appears to be a rat race to get something on the market, many of these products need close scrutiny. Although I am going to list some manufacturers of dinghy braking systems, please remember that absolutely no one of consequence has attempted to rate any of these systems for performance. You'll need to do some further research to satisfy the requirements of your motor home and dinghy.

Blue Ox Products

Apollo: This supplemental braking system sits on the floorboard of the dinghy and applies air pressure to the brake pedal. In this box there's a control device that electronically senses any changes in speed and the degree of road incline. Thus, as you slow the motor home, the sensor sends a signal to a valve that applies stored air pressure to the arm that pushes the brake pedal. A surge suppressor supposedly helps prevent unnecessary stops when you're driving on rough roads or over any minor obstacle in the road, such as railroad tracks, and an optional Alert system (which I don't think should be optional) consists of a dashboard light that tells you when the brakes are activated.

One advantage of the Apollo Braking System is that it is self-contained in one box-like unit, making it quick to install or to transfer to another vehicle. (It can simply be plugged into the dinghy's cigarette lighter). It has no cables and does not require modifications to the towed vehicle or any special equipment.

Expect some mixed feelings about the adequacy of overall performance, but with a little care it should be okay. The whole system will probably end up costing you between $995 and $1,100.

AutoStop: This is a mechanical system that's based upon the amount of pressure being applied by the dinghy when the motor home brakes are applied. I helped install one of these and was surprised at the amount of adjustments it took to get it working somewhere near right. The system is simple and probably will have a reasonable life if kept adjusted and maintained. According to Blue Ox, this is their simplest system, but I don't think you'll find it as simple as it sounds.

AutoStop works by utilizing the force of the dinghy's movement in the direction of the hitch when the motor home slows down. When this occurs, AutoStop pulls back on the cable that is attached to the dinghy's brake pedal, activating the brakes proportionately to the force applied. There's a 5,000-pound version and a 7,500-pound version. However, I don't recommend pulling any dinghy that weighs over 5,000 pounds.

A disadvantage of this system is that you'll need to readjust the cables for different driving conditions and terrain. Also, it's stipulated that the towbar must be within two inches of level to properly install AutoStop. Figure about $500 (maybe closer to $600) by the time you're finished.

BrakeSafe: BrakeSafe is primarily designed for motor homes with air brakes but Blue Ox makes two versions that can be used with hydraulic brakes. According to Blue Ox, the dinghy's brakes are applied proportionally as the driver applies the brakes in the motor home.

Blue Ox's BrakeSafe is air-pressure activated by means of a cylinder that is bolted to the brake pedal arm of the dinghy with two brackets. When the driver pushes the brake pedal of an air-braked motor home (or a motor home with air-over-hydraulic brakes), air pressure from the brakes is ducted to the air cylinder in the dinghy and

either pushes or pulls the dinghy's brake pedal, depending on which of two models is installed. For motor homes with hydraulic brakes, a pendulum in a remotely located control box senses the forward momentum of the towed vehicle when the motor home slows or stops, activating the cylinder. Although the system does not tap into the dinghy's braking system, the pull model does have a semi-permanent appendage attached to the brake-pedal arm that might interfere with normal foot movement when you're driving.

The hose that connects the two vehicles must be watched carefully for locking and securing in place. Overall, the BrakeSafe appears to be a sound system for those of you with air brakes and it is transferable to another vehicle. A breakaway system is optional. Plan close to $1,000 by the time you write the check (or more for motor homes with hydraulic brakes).

ToadStop and ToadStop II: This is an elaborate system designed for either pushers or pullers but the dinghy must have vacuum-assisted brakes.

The ToadStop braking systems operate through vacuum power supplied by the motor home, and work with either air or hydraulic brakes, although the towed vehicle must have vacuum-assisted brakes. Diesel-powered motor homes, which don't produce their own vacuum, will require an auxiliary vacuum pump in the dinghy. Electric current from the motor home's brake switch activates the vacuum unit. The vacuum unit in turn pulls a cable that applies the towed vehicle's brakes. The system is claimed to achieve a gradual, "balanced" pressure on the brakes of the towed vehicle. Toadstop includes a dashboard indicator light and a theft deterrent that prevents driving the dinghy while the system is in place. A breakaway device is also included. This is a complicated system in terms of components, and you'd probably be better off having it professionally installed than trying to do it yourself. Its price is $995 for motor homes with hydraulic brakes and $1,195 for air-braked (diesel) RVs. The Pro/Port Control (see below) will cost you another $85.

According to the manufacturer, ToadStop II works the same way as the basic model and includes all its features, but has the advantage of being self-contained in a box-like design that can remain in the car (placed behind the driver's seat or elsewhere out of the way of the driver) when you're driving it and won't interfere with the car's operation. It's also easier to install and includes PRO/PORT Control, that by means of a switch mounted on the tow bar receiver, turns on and off according to the changes in position of the receiver/towbar connection as the vehicles move down the road. (Something like a surge-system.)

With all the bells and whistles, the ToadStop II will probably cost you about $1500 installed.

Please note: The ToadStop and ToadStop II are the same products as ToadStop Qi and ToadStop Qi II, made by safe-tech Solutions (aka RV Stuf and More). Blue Ox is licensed to sell the ToadStop, although it was originated by safe-tech Solutions, which also holds the copyright.

Blue Ox Products
PO Box P | One Mill Road, Industrial Park
Pender, NE 68047
888-425-5382 | 402-385-3360 (Fax)
http://www.blueox.us | email: info@blueox.us

Henderson's Lineup

Super-Stop Fitzall Tow Brake System: Yet another air-activated braking system is the Super-Stop Fitzall, with versions both for motor homes with air brakes or with hydraulic brakes when a small "power pack" is installed. The Super-Stop operates all the brakes of both vehicles through application of the motor home's brake pedal. Because the system uses an air-actuated cylinder that attaches to the dinghy's brake pedal and connects to an air line by means of a simple plug, it takes only a short time to install or remove.

Plan on about $600 for motor homes with air brakes and $850 for those with hydraulic brakes.

SuperSteerSuperStop
417 SW Marion
Grants Pass, OR 97526
888-898-3281 order line / 541-955-0769 tech support
http://www.supersteersuperstop.com / email: sales@supersteersuperstop.com

Jack Brake:

The Jack Brake, rather than using air from the motor home's brakes, takes its air from a compressor that is part of a self-contained system that sits on the floor of the towed vehicle with an attachment to the brake pedal. Air from the compressor goes through a regulator that you set for the degree of stopping power desired. A wire running from the dinghy to the motor home's cockpit connects to a control panel containing a mercury switch that senses deceleration. The amount of deceleration needed to engage the dinghy brakes is adjustable by the driver. Also included are a monitor light, a breakaway system, and a buzzer that sounds if breakaway occurs or the wire connecting the motor home with the unit in the dinghy comes loose. Installation can take several hours, but can be disconnected and reconnected in seconds. This systems sell for around $1,000 installed - and you should have it installed.

Jack Brake
201 W. Katy St.
Scammon, KS 66773
(620) 479-6837

M&G Engineering

M&G Braking System: For motor homes with air brakes, the M&G Braking System works by means of an air cylinder that is placed between the master cylinder and the dinghy's vacuum booster, with air pressure being supplied through a hose from the motor home's brakes. The company claims that the RV and the towed vehicle will stop simultaneously. One possible disadvantage of the M&G system is that, when you're driving your car, the air cylinder remains attached and acts as a "pushrod." However, according to the manufacturer, drivability of your car is unaffected. Because it may not fit on another dinghy in case you upgrade, you might want to look twice at the system if you're considering a change down the road.

For motor homes with hydraulic brakes, the M&G Braking System is mounted in the same way, but additional equipment (an air compressor, air tank, and proportioning valve) must be installed on the exterior frame of the RV. An air hose connects the motor home with the dinghy.

Cost of the M&G Braking System for air-braked RVs is $600 with an installation kit. For coaches with hydraulic brakes, the price is about $900 with the installation kit.

A third version of this system is available for motor homes with air-over hydraulic brakes, which need only a proportioning valve in the way of supplemental equipment to be installed on the RV. This valve senses hydraulic pressure and controls air pressure delivered to the towed vehicle's brakes accordingly. This version costs about $750 with the installation kit.

M&G Engineering
PO Box 1107
Athens, TX 75751
(800) 817-7698 / FAX 903-675-2701
http://www.m-gengineering.com or http://www.mysweetwatercafe.com/BrakeSystem.html

Master Concepts

Brake Buddy: The Brake Buddy is a self-contained box-type unit that plugs into the towed vehicle's cigarette lighter. A pendulum and microswitch sense the forward momentum of the towed vehicle when the motor home slows or stops. When this happens, an air cylinder attached to the dinghy's brake pedal activates the brakes. The system, priced at about $900, is relatively quick and easy to install and disconnect because of its simple, compact design. Plan on spending about $1200 if you opt for a breakaway device and wireless Alert dashboard light that tells you when the system is in operation.

Master Concepts
1-800-470-2287
http://www.brakebuddy.com / email: stop@brakebuddy.com

Night Shift Auto

ReadyBrake: Similar in operation to Blue Ox's AutoStop is the ReadyBrake, made by Night Shift Auto. The ReadyBrake employs its own spring-loaded hitch receiver assembly with attached cable. This cable connects to the towed vehicle's brake pedal. Using the dinghy's forward momentum, the cable is tightened and pulls on the brake pedal. The stopping power is claimed to be proportional to the motor home's rate of deceleration. This system, with only a few parts to be concerned about, is relatively easy to install. However, I am always concerned about cables that are not well designed to prevent binding. You need to watch for this in all cable-activated systems.

Depending upon the type of hitch or tow bar you have, prices range from $382-$537.

Night Shift Auto, Inc.
Home of the ReadyBrake Towed Vehicle Braking System
129 North Kentucky
Iola, Kansas 66749
(620) 365-7714 voice / (620)365-7488 fax / (800) 933-3372
http://www.readybrake.com / email: sales@readybrake.com

Remco Manufacturing

The Remco Braking System (RBS): Remco Manufacturing produces the RBS (Remco Braking System), which is a hydraulic surge brake system much like you'd use on a boat trailer. Like other systems of this type, when the motor home's brakes are applied, the dinghy's forward momentum is used to activate the device that applies its brakes — in this case, the dinghy's front brakes. In the RBS, a ball mount on the receiver is pushed forward by the dinghy as the motor home slows, activating a master cylinder on the assembly, which then diverts brake fluid to the car's front brakes. The cushioned ball mount also acts as a shock absorber, preventing unpleasant jolts that can occur with sudden stops, on rough terrain, and on downgrades.

Although the RBS, with its multiple components must be welded to the motor home's hitch and can take several hours to install, once it's in place, it takes only minutes to disconnect. As you probably know, surge brakes have been around for decades and have worked well for towing large boats. This system should be reliable, but keep in mind that, like many other systems, it does not assist in stopping the towing vehicle. Thus if you lose the brakes on the towing vehicle the brakes on the towed vehicle will not work.

Suitable for any motor home with a 2" receiver, the RBS costs about $600. Different models are available, depending upon whether your towed vehicle has front-wheel drive, rear-wheel drive, or four-wheel drive. Another version that does not require welding to the RV costs about $700.

Remco Mfg.
PO Box 27998
Omaha, NE 68127
(800) 228-2481 / FAX: (402) 339-6552
http://www.remcotowing.com

Roadmaster Inc.

BrakeMaster: BrakeMaster, manufactured by Roadmaster, Inc. applies the dinghy's brakes through the use of air pressure from the motor home's brakes with an air cylinder attached to the towed vehicle's brakes. The amount of pressure applied to the motor home's brakes then applies the dinghy's brakes proportionally. This setup works for motor homes with air brakes or air-over hydraulic brakes and also includes a breakaway system and monitor light. For coaches with hydraulic brakes, an air compressor, tank, and proportioning device must be added.

BrakeMaster for motor homes with air brakes takes several hours to install, while initial setup for hydraulic brakes can take up to eight hours because of the number of components involved. Roadmaster highly recommends professional installation for both versions. However, once the basic systems are in place, disconnection and reconnection takes only minutes. The price for the air brake model of BrakeMaster is about $800 and for hydraulic brakes about $1,000.

Brake Pro: Roadmaster's new product, which may or may not be available as of this writing (September 2003), is called BrakePro. It's supposed to be a self-contained unit that is easy to install. The little bit I can find out about this system is that it works by means of an air cylinder that applies the dinghy's brakes proportionally to the slowing of the motor home. The system includes a breakaway device and dashboard indicator light, and is expected to sell for about $1,100.

Roadmaster Inc.
5602 N.E. Skyport Way
Portland OR 97218
(800) 669-9690 / (503) 288-9898 / FAX: (503) 288-8900
http://www.roadmasterinc.com

safe-tech Solutions

Toad Stop Qi and Qi II: This is the company that originally created, marketed, and still holds the patent on the supplementary braking system known as ToadStop. Newly termed Toad Stop Qi and Toad Stop Qi II, these braking systems operate via a vacuum system and are the same products as the ToadStops marketed by the Blue Ox company, which is licensed to sell them along with the Pro/Port System. (See ToadStop and ToadStop II under Blue Ox Products for a description of how they work). Safe-tech Solutions is the originator of both versions of the ToadStop and the Pro/Port Control. They say that they've recently attempted to make life easier for the consumer by including user-friendly color diagrams with detailed instructions to facilitate installation. (Qi stands for quick-install). Another feature of safe-tech's system is a handheld trigger (Blue Ox calls it "push-button control") that you can use inside the car when you're driving it to test the effectiveness of the braking system. The company claims this "test trigger" allows stopping even in the event of engine failure or if the driver is incapacitated.

Both versions of the ToadStop may be purchased from safe-tech, with the Qi selling for about $800 and self-contained Qi II for $900. In spite of the color diagrams, with all the adjustments needed, you'll probably want to have the Qi's professionally installed.

safe-techsolutions, Inc.
190 Wilson Blvd.
Naples, FL 34120
1-800-478-7883
http://www.rvstuf.com

SMI Manufacturing

SMI produces only vacuum-type dinghy brake systems, which are as follows:

FourWire: The FourWire is designed to send a signal, activated by the motor home's brake lights, to a control box in the driver's area that then measures the degree of stopping force and sends a message to the unit mounted in the dinghy. This causes the towed vehicle's brake pedal to be applied through the action of an attached cylinder powered by a built-in vacuum pump that also powers the dinghy's vacuum booster. An indicator light in the motor home's cockpit lets you know when the towed vehicle's brakes are activated. Although several hours are required to install the system, it is quick to disconnect and reconnect. Including breakaway device and indicator light, the outfit retails for about $900.

PlugAndPlay: This braking system, like the others manufactured by SMI, also uses vacuum-activated braking to stop the dinghy. The PlugAndPlay operates in the same way as the FourWire although there is no control box mounted in the motor home. The only item needed in the motor home is the indicator light. According to the manufacturer, installation takes about 2 hours — somewhat less than other similar systems — and disconnecting and reconnecting are a snap. PlugAndPlay with breakaway costs just under $1,000.

SilentPartner: As with the other SMI systems, both the brake lights and the motor home's stopping force are needed for activation of the SilentPartner. The system utilizes a vacuum pump in the supplemental braking unit to power the dinghy's vacuum booster. This FM radio-controlled system allows for more adjustment and fine-tuning from the cockpit of your motor home, although it does not require wiring between the RV and the dinghy. The dashboard module allows you to adjust the amount of braking pressure that will activate the towed vehicle's brakes and contains three LED displays that light 1) when the signal is being transmitted to the dinghy's brakes, 2) when a breakaway occurs (along with a buzzer that sounds), and 3) when the towed vehicle's brakes are activated. The module also allows the driver to determine brake operation in "real time" or "latched" modes. "Real time" causes release of the towed vehicle's brakes when stopping force diminishes, and "latched" mode keeps the brakes on as long as there is pressure on the motor home's brakes. Supposedly, installation time is about the same as for the PlugAndPlay with easy disconnect and reconnect. Its relatively high price of $1,500 means you're paying for lots of bells and whistles.

Stay-IN-Play: SMI says that its newest entry in the dinghy brake market is activated in the same way as the other SMI systems. Transmitter and receiver are located in the motor home and the self-contained operating unit can be located anywhere in the towed vehicle. The vacuum cylinder that provides the stopping power is mounted on the towed vehicle's brake arm. An additional "Panic Stop Braking Circuit" provides extra proportional braking when the force of the braking motor home goes beyond the level for which the system is normally set.

The Stay-IN-Play takes about the same time to install, disconnect, and reconnect as the PlugAndPlay and the Silent Partner. It retails for about $1,000.

SMI Manufacturing, Inc.
1501 A Allens Lane
Evansville, IN 47710
1-812-428-2794 / 1-800-893-376
http://www.smibrake.com

Tow Brake International Ltd.

VIP-Tow Brake: An entirely electrically-operated system, the VIP-Tow Brake consists, in part, of an electric motor that is mounted in the towed vehicle and attaches to the brake pedal. Automatic activation of the dinghy's brakes occurs when the motor home's brake lights come on and the mercury switch in the control box, powered by the brake light switch, senses deceleration. A signal is then sent to the unit in the dinghy to turn on the motor that activates the brakes. This little-known manufacturer claims that the mechanism can also be activated manually from a control box in the motor home, if desired, or when road conditions change.

The control module in the cockpit also includes indicator lights that tell you when the dinghy brakes are applied (along with a chirping sound) or when breakaway has occurred (with an alarm bell). Although initial installation takes several hours, disconnect and reconnect are supposedly quick and easy. Including lights and breakaway feature, the VIP-Tow Brake costs $900. An all manually-operated system may be purchased for under $700 but I'm not sure what that will do or not do for you. Research! Research! Research!

Tow Brake International, Ltd.
52 Old Highway 11
Evening Shade, AR 72532-9324
800-927-6778 (Sales Line) / 877-927-6778 (Technical Help Line)
http://www.towbrake.com

Tow-V-Aire Braking Inc.

Tow-V-Aire: Another air-activated braking system, the Tow-V-Aire unit is a self-contained box that houses an air compressor and storage tank and is positioned behind the dinghy's driver's seat. This unit is connected by a small hose to an air cylinder that attaches to the towed vehicle's brake pedal. A cord with sockets on both the RV and the car connects the braking system to power from the motor home's battery and brake light signal. Dinghy brakes are activated when a signal is received via the brake lights that the motor home's brakes are in use. A cockpit dashboard light also comes on when the system is operative. The manufacturer claims the Tow-V-Aire can be installed by the consumer, but it does take several hours for initial setup. After that, it takes only minutes to hook up or disconnect. Including breakaway system, the Tow-V-Aire is priced at about $750.

Tow-V-Aire Braking Inc.
PO Box 1604
Lake Placid, FL 33862
(888) 464-1105
http://www.tow-v-aire.com / email: wto@strato.net

U.S. Gear

Unified Tow Brake: The Unified Tow Brake derives its name from the fact that it utilizes both the pressure on the motor home's brakes and vacuum pressure from the dinghy's power brake booster in an electrically-controlled system. According to the manufacturer, the control box in the motor home's cockpit contains sensors that register the degree and direction of stopping power applied by the motor home's brakes. A signal is then sent to an electronic solenoid located under the towed vehicle's driver's seat, which connects via a cable under the rug to the brake pedal and the brakes are activated. A power module located in the towed vehicle turns on a vacuum pump in the engine compartment when the motor home's brakes are on and feeds vacuum to the dinghy's power brake booster, supplying extra braking force. The company claims that, because electric power is used to operate the solenoid, by varying the amount of current supplied to the dinghy, proportional braking can be achieved. The driver can also override the system and operate it manually.

Initial setup can take up to six hours and should probably be done professionally. Once completed, the Unified Tow Brake is intended to remain in place, with the exception of a wiring harness and breakaway switch connecting to the motor home, which are easy to disconnect. The Unified Tow Brake, which includes a breakaway system, dashboard indicator light, and installation instructions in CD-ROM format, costs about $1200.

U.S. Gear Corporation
9420 Stony Island Ave.
Chicago, IL 60617
(800) 874-3271 / (773) 375-4900
http://www.usgear.com

I hope this summary of currently-available dinghy braking systems will help direct your further research. I also recommend talking to other RVers to find out what worked for them and watching some installations, if possible. Please let RVCG know about your successes and failures with these products and their manufacturers. Your feedback along with our research may enable us to rate dinghy braking systems in the future. Our email address is staff@rv.org

Back to Towing FAQs Index

15) Exhaust Brakes: Is having an exhaust brake absolutely necessary?

Pickup-truck brakes generally are designed to stop from 2,000 to 4,000 pounds of payload. RVers and technical writers know about problems of stopping large trailers that often weigh from 10,000 to 15,000 pounds. This extra weight is very relevant. If the trailer brakes become inefficient or fail, stopping or even slowing these large loads on a downgrade is often impossible. We strongly recommend exhaust brakes on all trucks when the total weight of both truck and trailer exceeds one-and-a-half times the truck's GVWR. With this premise, a truck with an 8,000-pound GVWR will undoubtedly need an exhaust brake when the total weight of truck and trailer exceeds 12,000 pounds. With most fulltiming fifth wheels weighing more than 12,000 pounds and pickups in the 6,000-pound range for a total of 18,000 pounds, Ford and Dodge should start looking at safety above economy.

Back to Towing FAQs Index

16) PullRite Hitches: How good are they with SUVs?

First of all, it must be understood that the guidelines established in my "Towing Vehicle Wheelbase Parameters" are firm. Consumer feedback and the results of accident reports have shown us that if you exceed those parameters, you should use the best towing device and towing techniques available. My personal opinion is that an articulating hitch, such as the PullRite, may allow for a reasonable extension of the parameters if all hitching techniques are properly applied. Your trailer should be well balanced with at least a 70% back-of-ball axle placement. I am also concerned with putting so much pressure on the spring bars that too much weight is removed from the rear wheels. However, with a PullRite hitch, good hitching techniques, and careful driving, I think going 10% over the parameters is reasonable. Keep in mind, however, that even with an articulating hitch, the trailer must be well balanced with a hitch weight between 10% and 12%. An articulating hitch cannot compensate for an out-of-balance trailer.

Back to Towing FAQs Index

17) Nissan Frontier: Do you need an articulating hitch?

The Nissan Frontier, with its wheelbase of 116 inches, can easily tow a trailer of up to 21 feet in length under normal road and speed conditions with the proper hitching mechanism — provided the trailer is well-balanced and designed. Nevertheless, I have occasionally found towing combinations in this range that should have handled well but didn't. The problem is usually trailer design. For example, if the trailer axle is too far forward you could have severe wobble as well as an inconsistent hitch weight. With such a design even a single-axle, 17-foot trailer, for instance, could be very difficult to handle under certain conditions. Please study the story: "Coleman Defects Make Outdoorsmen Of Three Brothers" in the RVCG web site's Archives Library (under Brands/Manufacturers / Trailers) to get a better picture of what can happen with a poorly-designed trailer.

At a minimum, the hitching system I recommend for the Nissan Frontier is a fixed-ball weight-distributing hitch with at least one anti-sway device for highway travel. For maximum safety, an articulating hitch could be considered. However, these hitches are generally designed for trucks and larger SUVs to pull trailers weighing between 5,000 and 10,000 pounds. The best choice would probably be the Hensley standard hitch. This should offer maximum towing safety, plus it would allow for an upgrade in the future without additional hitching expense. The Hensley is rather expensive at around $2,500, but with its high resale value and the value of one's life, it is probably worth every penny.

Back to Towing FAQs Index

18) Banks Power Pack: Does it really give more power with less fuel?

As I learned in Mechanics 101, the better the breathing the better the volumetric efficiency. Interpreted, this is supposed to mean more power and better fuel mileage. How much of an improvement any special adaptation or modification makes will depend on the built-in inefficiencies of the engine prior to the change. Banks (Gale Banks Engineering's web site: www.bankspower.com) should have collected hundreds of testimonials with solid data to satisfy inquiries. With all the equipment they sell, there should be some test reports to back their claims. When it gets down to the nitty-gritty of it, simply ask for solid data and I'm sure they'll have it for you.

Back to Towing FAQs Index

19) Suspension: Would having three axles on a trailer increase its safety rating?

There are advantages and disadvantages to having three axles on a trailer. The three axles are generally placed on the vehicle after the manufacturer has determined the weight and the GVWR needed. The only real negative to triple axles is the tendency for multiple axles to resist turning. Thus, two axles would have less resistance to turning than three, and a single axle would have none. Resistance to turning is usually a problem only on gravel or slippery roads when there is inadequate weight on the front axle of the towing vehicle. Simply put, it takes more force to pull a trailer with triple axles through a turn. Positives to multiple axles are the spreading out of the weight over bumpy roads and having more tires on the ground as a reserve in case of a tire or wheel problem. Unless you are looking at a trailer that has a gross weight in excess of 12,000 pounds, you probably won't be looking at triple axles.

Back to Towing FAQs Index

20) Water tank: What if it's in the very front or very rear of the trailer?

If you fall in love with a 30-foot travel trailer coach that has the freshwater tank in the rear, like David Potts did, what do you do? David is quite concerned that even with his F-250 diesel short-bed crew cab with 156-inch wheelbase, he might jeopardize safety.

When I threw this out to some of the members, Cynthia Bik responded. "I have the same truck. My trailer is 32'11" with a hitch weight of 1,140 pounds. We did install an articulating hitch and our trailer pulls beautifully. It is scary that it pulls so well. You can almost forget about it being there."

Like David, Cynthia has an ideal towing vehicle. Unlike David, she already owns an excellent hitch. The combination of the truck and hitch should provide as safe an RVing mode as one could expect. But because a variable hitch makes maintaining a constant hitch weight very difficult, I'm not happy that the water tank is in the rear of the trailer. With an excellent towing vehicle and an excellent hitch, however, there is probably some compensation for the trailer's design deficiencies.

RVCG recently received information about a "flip-over" trailer accident where the hitch was an articulating hitch. The owner said that he suspected a light hitch weight and a low back-of-ball-to-length ratio caused the accident. With this in mind, I'm going to stick to my guns and assert that any hitch weight below 10% could be dangerous with any type of hitch.

Back to Towing FAQs Index

Glossary of Towing Terms

Acceleration is the process by which a body or an object is either set in motion from a state of rest or caused to change its velocity.

Air turbulence refers to the movement of air molecules, unpredictable with any degree of accuracy, that in the form of bow waves and cross-winds can cause problems for vehicles on the highway.

Anti-sway device: Because almost all travel trailers have a propensity to sway, there are numerous anti-sway devices on the market. The most common of these is the sway controller (see Sway bars), a device that attaches to the trailer tongue. Other anti-sway devices are those hitches that are designed to minimize sway. The PullRite, Hensley, Easy Rider, and Equal-i-zer hitches are examples of weight-distributing hitches that are claimed by their manufacturers to minimize or eliminate sway. (see individual entries for these hitches).

Articulating Hitch: This is a type of weight-distributing hitch that has movable or articulating joints. Different brands have different configurations, but they operate to move the trailer's pivot point farther forward than is the case with a standard fixed-ball weight-distributing hitch. This lets the trailer track better behind the towing vehicle, drastically reducing the problem of sway and virtually eliminating the "tail-wagging-the-dog" syndrome. In the case of a trailer 20' long or more being towed by an SUV, a hitching device that allows the trailer to move without wobbling the towing vehicle is essential and highly recommended even when towing with a heavier vehicle. It avoids the problems that can result from the use of a fixed-ball hitch. The Hensley and PullRite hitches are examples of articulating hitches. (See entries below)

Axle ratio: To acquire more power at the rear wheels, all engine-driven vehicles have a system of gears for the driving wheels. These gear sets come with varying ratios needed to acquire either power or efficiency. As an example, a 4-to-1 axle ratio will allow for power, while a 3-to-1 axle ratio will allow for fuel efficiency when cruising. Most of what you need to know about axle ratios can be found in your operator's manual.

Back-of-ball ratio (BOB): Back-of-ball is the ratio between 1) the distance from the ball of the towing vehicle's hitch to the center of the towed

vehicle's axle, and 2) the distance from the ball of the towing vehicle's hitch to the rear of the towed vehicle. All trailers with axles placed less than 70% of the trailer's length from the hitch ball will have a tendency to sway. A ratio of 60% or less is considered dangerous.

Balance: Generally refers to a state of equilibrium. When applied to RVs, however, it usually indicates proper distribution of weight for optimum performance.

Bow wave: A bow wave is the turbulence of air created by a moving vessel or vehicle. For example, if you're sitting in a small boat and the bow wave of a larger boat strikes it, you'll feel its effects in no uncertain terms. If you're towing a trailer with a vehicle that has a wheelbase that's too short for the trailer's length, the trailer will start to sway, and may overpower the towing vehicle, causing it to go out of control and creating the conditions for a possible rollover accident.

Brake Controller: This device automatically applies electric trailer brakes when the towing vehicle's brakes are applied. Some brake controllers are strictly electronic while others are both electronic and hydraulic. Most RVers use the electronic controller because it doesn't need to be tied into the towing vehicle's hydraulic system. Good brake controllers have a sensitive internal pendulum that adjusts for the stopping force.

Every brake controller has a lever that will allow the driver to actuate the brakes without foot operation. This lever should be used to check brake operation at the beginning of each day's venture and to check minor sway when traveling at speeds below 50 M.P.H.. Use of the hand control on downgrades should be very conservative since electric brakes are even more subject to brake fade than hydraulic brakes. Electric brakes are designed to stop or slow the trailer — not the towing vehicle.

Center of gravity: This is defined as the point around which an object suspended in midair will rotate in any direction. The higher the center of gravity, the more prone a vehicle will be to body roll or rollover. A taller vehicle usually has a higher center of gravity than a lower-profile vehicle. For example, if you place a tall camper shell on a pickup truck, you've effectively raised the center of gravity of the entire vehicle. A high center of gravity will also give a towing vehicle a propensity to roll over when trailer sway becomes extreme. In addition, badly placed front-to-rear or side-to-side centers of gravity will adversely affect handling.

Center of mass: For our purposes, the same as center of gravity.

Center of moments: A very technical term that refers to the axis upon which rotational forces are concentrated. In trailer towing one may refer to this as a point of pivot.

Crosswinds are patterns of air turbulence that strike a vehicle at right angles as it moves down the road. Since their occurrence and the amount of force applied are unpredictable, crosswinds — like bow waves — can cause an improperly-matched towing setup to lose control.

Curb weight: Trailer curb weight is the actual weight of the trailer when it sits at your curb and is ready to take on you, your passengers, and your personal payload. Freshwater holding tanks, fuel tank, and propane containers must be full. Even though you do not normally fill your freshwater tank to start your trip, a true curb weight would include water. The only way you can obtain the curb weight is to have it weighed without any persons or personal equipment and supplies aboard. GVWR minus curb weight should give you a true personal payload figure.

Towing vehicle curb weight is generally defined in the automotive industry as the weight of a vehicle with standard equipment and a full fuel tank.

Damping is an engineering term for the acquisition of trailer stability through design.

Dry weight: The weight of a vehicle with no fluids added. In trailer brochures, dry weight generally refers to a trailer with standard equipment only. A few manufacturers add the weight of commonly-ordered options to their dry weight. Check for a footnote in the brochure. If the specifications include only the gross dry weight (hitch dry weight plus axle dry weight) or UVW, you will need to add the weight of fresh water, fuels, and options to arrive at an estimated curb weight.

Easy-Rider Hitch: The Easy-Rider Hitch is a standard weight-distributing hitch, claimed by the manufacturer to reduce trailer sway, and, by means of air bags included in the assembly, to effect a smoother, less bumpy ride for both trailer and towing vehicle.

Equal-i-zer Hitch: a standard, fixed-ball weight-distributing hitch that has sway control devices built into the unit rather than added on as optional equipment. The manufacturer claims that sway is reduced through the effects of friction at both ends of the spring bars. This friction is created by the downward pressure exerted by the tongue load and the lifting pressure of tensioned spring bars. Because the Equal-i-zer functions as a weight-distributing hitch, the same towing parameters that are used for other standard weight-distributing hitches with conventional sway controls must still be applied to the Equal-i-zer. (See Weight-distributing hitches)

Fifth Wheel Hitch: All types of fifth wheel hitches have a fore-and-aft pivoting dish and some have four-way pivoting action. The latter is called a “gimballing” or “pivoting hitch.” Other types are the automatic slider, manual slider, and gooseneck hitch.

Fixed-ball hitch: With this type of hitch configuration, all components of the coupling assembly are static except for the rotation that takes place at the ball and socket. All weight-carrying and most weight-distributing hitches are fixed-ball hitches.

Force: Technically, force is the power exerted upon an object that either sets that object in motion or accelerates or retards its motion.

When applied in a practical sense in relation to vehicles, we think of force as a pull, a push, or a twist. An example of force in towing is the tendency of a trailer that's too large to overpower the towing vehicle once sway is initiated. At this point the "force" from the trailer is "pushing" laterally against the rear of the towing vehicle.

Friction: The resistance of motion (sliding) between two surfaces that touch. Dividing the force required to slide one object over another at a constant speed by the pressure holding them together is a constant, and is known as the dynamic coefficient of friction. This value is always the same for any given material or surface. The force required to initiate a sliding motion is almost always greater than the dynamic coefficient of friction and is known as the static coefficient of friction. For example, the static coefficient of a tire on dry pavement is about 0.8, so if the tire is supporting a 1,000-pound load, 800 pounds of lateral force is needed to push it into a skid. The dynamic coefficient is 0.5, so once the skid starts, only 500 pounds of force would be required to maintain the skidding motion. Observations of these effects of friction in action led to the development of antilock brakes.

Frontal area: The frontal area of a vehicle or vehicles is defined by Ford as the total area in square feet that a "moving towing vehicle and trailer expose to air resistance."

Because frontal area is based upon flat resistance into the wind, if the vehicles are aerodynamically designed the air resistance will be less than with a less efficient design. Also, the more power the towing vehicle has, the less noticeable the effect of resistance. It's important to realize that if you go beyond the manufacturer's recommendations for your towing setup based on frontal area or weight, efficiency and longevity may be substantially decreased.

Fulcrum: A fulcrum is a point of support upon which a rigid structure, such as a metal bar, turns. That structure or bar is called a lever, and the relationship of the two is known as the lever / fulcrum principle. This principle is useful for calculating balance and for understanding how forces are transmitted from one point to another.

GCWR: GCWR (gross combined weight rating) is the manufacturer's specification of the maximum allowable combined weight of a tow vehicle and trailer. It expresses the limitations of the vehicle's engine and drive train to pull another vehicle with reasonable efficiency and without destroying themselves in the process. Exceeding the manufacturer's recommendations can result in frustrating performance and costly repair bills for the towing vehicle.

GVWR: The GVWR (gross vehicle weight rating) is the maximum load-carrying capacity of the vehicle's axles, tires, wheels, and other components of the chassis. A vehicle should never weigh more than the GVWR.

Hensley Hitch: The Hensley Arrow is an articulating weight-distributing hitch that, according to the manufacturer, is designed to eliminate trailer sway and the phenomenon of "the tail wagging the dog" that occurs when a trailer sways and sets up a rhythmic oscillation between the trailer and its towing vehicle. This hitch uses an interlocking system of arms and pivots that form a trapezoid, effectively projecting the trailer's pivot point forward of the hitch. The trailer tongue is thus kept aligned with the tow vehicle — preventing it from moving from side to side unless the tow vehicle turns. Therefore, the trailer follows more like a fifth wheel than it would with a standard hitch.

Hitch capacities: Hitch capacity has to do with the weight of the trailer and the amount of weight the hitch is structurally designed to support. For example, the average curb weight of a 22-foot travel trailer coach is about 4,000 pounds. The average GVWR is about 6,000 pounds, so the class of hitch you decide to use will depend upon how much you load into the trailer. I never recommend exceeding the capacity of the hitch. (See also Hitch weight and Payload).

Hitch classifications are rated by the manufacturer according to the maximum amount of weight they are engineered to handle. Class I travel trailer hitches are rated for towing as much as 2,000 pounds. Class II units are for loads up to 3,500 pounds. Class III's are rated for 7,500 pounds, and Class IV's can handle loads of up to 10,000 pounds. Class V hitches are designed for towing up to 14,000 pounds. These ratings based on class category may vary depending on the manufacturer. The weight rating refers to the total weight of the fully-loaded trailer.

Hitch receiver: A hitch receiver consists of a metal platform that is bolted or welded to the towing vehicle's frame and a receiver tube that acts as a receptacle for the hitch shank. Hitch receivers are necessary for towing systems intended to tow trailers with GVWRs over 3,500 pounds. Standard receivers usually cost from $150 to $200, and bolt-on assemblies are available for most motor homes and towing vehicles.

Hitch Dry Weight: The hitch dry weight is the actual weight at the tongue or pin of a trailer at the factory before any liquids are added. This means that unless the freshwater tank is located in proximity to the axle, the hitch weight will change dramatically when water is added. Because hitch weight is extremely important for safe towing, all holding tanks should be in proximity of the axles or the trailer should be pulled only when they are empty. This is especially important when you're pulling a trailer coach.

Since most manufacturers give a hitch weight that includes only standard equipment — thus excluding optional equipment — the hitch weight can also be affected by the adding of options, especially heavy items, such as slideouts, generators, or large appliances — for example, a residential-size refrigerator.

Hitch Wet Weight: Weight at the hitch or trailer tongue when all fuel, propane, and freshwater tanks are full.

Inertia is the inherent property of an object to remain in either a state of rest or motion unless acted upon by an external force. For example, when an object is in motion, its inertia will cause it to remain at the same speed until an outside force acts upon it to either increase or retard its speed. In relation to towing, it will take a stronger force to stop the motion of a large trailer than one that's relatively small in the same distance or time.

Lever: See Fulcrum

Mass: Technically, mass is defined as the measure of a body's resistance to acceleration. For practical purposes, in the presence of gravity, mass can be expressed simply as weight. (Mass equals weight divided by 32.16)

A basic understanding of the behaviors of masses in motion is critical to towing because of its impact on highway control.

Momentum: In physics, the momentum of a moving object is equivalent to that constant force which would bring it to a stop in one second. Talk to any physicist about momentum, and you're likely to get a highly technical and complicated dissertation. However, according to Webster, momentum is simply the "product of a body's mass and its linear velocity". In common usage, this is usually thought of as the amount of force a given object has when it's moving in a straight line at a given speed. For example, let's say you're pulling a trailer traveling down the road at 50 mph. Side-by-side on the floor of the trailer you have a 50-pound toolbox and a one-pound sack of pillows. When you slam on the brakes at 50 mph, both will fly forward at the same speed, but the greater mass of the toolbox gives it greater momentum, causing it to strike the front of the trailer with sufficient force to result in extensive damage. Thus, the greater the momentum, the more force is required to stop an object's forward motion and the greater the impact of that object when it encounters resistance, such as another hard surface.

Multi-axle is a term describing a vehicle with more than one axle in a group, such as a tandem-axle truck or trailer. Many trailers have only a single axle.

Newton's Laws of Motion: First law: Any body or mass in a state of rest or motion will remain in the same state in a uniform direction until it is acted upon by an external force. Second law: The change of motion is proportional to the force applied and takes place along the straight line in which the force is applied. An unbalanced force acting on a body causes an acceleration of that body in the direction of the force, of a magnitude proportional to the force and inversely proportional to the body's mass. (Force equals mass times acceleration) Third law: For every action (of a force) there is an equal and opposite reaction (of the body or mass acted upon).

Oversteer is an inherent problem of certain chassis that have a tendency to steer too far into a turn, either as a result of turning the steering wheel, the action of a lateral force such as a bow wave or crosswind, a fore / aft application of force, or a combination of all three. Oversteer as a chassis characteristic is often simply referred to as "the back end wanting to come around." When people-related, an "over-steer" is what happens when a driver turns the steering wheel too far in either direction — in other words, an overcorrection. **Understeer**, on the other hand, is an inherent tendency of a chassis to resist turning when the driver moves the steering wheel while accelerating.

Parameters: For our purposes, parameters are strict guidelines or limitations used in matching a towing vehicle to a trailer or vice versa, and concerning the wheelbase of the towing vehicle in relation to trailer length. These parameters are derived by mathematical formula based on empirical data from case histories and field observations. We also use the term "parameters" in a more general, subjective sense as a guide to hitch selection and to describe all-around safe towing practices.

Payload is the total weight of people plus their personal gear and supplies that can be loaded into an RV without exceeding its capacity rating. This should be GVWR minus curb weight. If the trailer's specifications include only the gross dry weight or UVW, you will need to add the weight of fresh water, propane, fuel, and options to arrive at an estimated curb weight. A few manufacturers add the weight of commonly-ordered options to their gross weight. Check for a footnote in the brochure. If you have the manufacturer's posted unloaded vehicle weight for this particular unit, you'll need to add the weight of water (8 pounds per gallon) to that figure before you subtract from the GVWR. It still remains that the best way to find your payload, and how close you are to the GVWR once you load, is to get the RV weighed on a commercial scale. (See Curb weight).

Pitch: To revolve about a lateral axis so that the front lifts or descends in relation to the rear. When repeated, the pattern is known commonly as "porpoising".

Polar moment of inertia of any given surface is technically defined as the moment of inertia with respect to an axis through the center of gravity at right angles to the plane of the surface.

Imagine your trailer as a barbell with the weights at each end. Picture trying to quickly turn and stop the barbell while holding it in one hand. Because of inertia, it's difficult to turn and difficult to stop turning once it starts. Now, move the weights in close to the center of the bar and try it again. The bar turns, and stops turning, much more easily because the weights have less distance to travel.

A trailer that has high polar inertia, such as one with a full water tank at one end, has a tendency to continue swaying once sway has begun.

PullRite Hitch: An articulating, weight-distributing hitch that helps reduce the danger of sway by placing the pivot point of the hitch directly behind the rear axle. The ball mount is extended behind the towing vehicle bumper so that the draw bar can slide on the arc-shaped rail. The spring bars, in addition to their weight-distributing function, serve the purpose of preventing the trailer from rotating on the hitch ball. The PullRite allows the trailer to follow the towing vehicle more like a fifth wheel than is possible with a conventional fixed-ball hitch. In contrast to the Hensley hitch, this is a physical forward movement of the pivot point, not an apparent one. This difference, however, does not imply that one system is "better" than the other — merely that two hitches of the same type have different designs and achieve similar ends in different ways.

Reaction time is the elapsed time between a stimulus and a response. The average reaction time between perception and the response of your fingers, for example, is 0.16 seconds.

Sail area for a trailer is the total area of its sidewalls in square feet. It acts as the collector of air molecules when the vehicle is hit by moving air — just like the sail on a boat.

Shank: the portion of the hitch that is inserted and fastened into the hitch receiver at or near the rear of the towing vehicle. On heavy-duty towing systems, a ball mount is either welded or bolted to the shank and spring bars are attached by means of metal brackets.

Speed: Speed is the rate at which a body is moving, expressed as the product of distance and time, as in miles per hour. For example: 55 miles traveled, times 1 hour, equals 55 MPH.

Spring bars: A weight-distributing hitch distributes the weight through spring bars. When a loaded trailer is hooked up, the tension on the spring bars lifts up on the towing vehicle's rear and distributes some of the weight on the rear axle among the other axles. Adjusting the spring bars is critical to the satisfactory performance of a weight-distributing hitch.

Spring bars are rated by the manufacturer for various hitch weight capacities. As a general rule, however, your hitch weight should be no more than 75%-85% of the spring bar rating to allow for a range of adjustment. If the spring bars are rated too low, they will not respond to varied load and road conditions. However, if they are rated too high the RVer may be tempted to overtension the spring bars, which could remove enough pressure from the rear wheels to cause the rear axle of the towing vehicle to lift up — resulting in loss of steering control just as it would without the use of a weight-distributing hitch.

Standard of care: The minimum performance requirements established for a product or category of products and / or services by an industry or association of professionals.

Surge brakes are hydraulic brakes that are used mostly with lightweight trailers such as boat trailers and some utility trailers. They work by means of a master cylinder filled with brake fluid that is compressed by the forward-moving force of the trailer during deceleration. This action applies the brakes and stops the trailer in much the same way your car brakes work. Surge brakes are not used with trailer coaches and fifth wheels, which use an electromagnetic braking system.

Suspension: The system of springs, shock absorbers, linkages, and other hardware that suspend the body structure over the wheels and axle assemblies. Components are generally connected to the body structure through rubber bushings which help to dampen the effects of road shock and vibration and also allow some flexing of the suspension. The suspension isolates the body from bumps and plays a major role in the handling characteristics of cars and trucks. In many small or inexpensive trailers it consists of nothing but springs and shackles.

Suspension and Tire Flex: The "give" in a suspension system which allows lateral movement of the body structure in relation to the surface on which the vehicle rests, due mainly to tires and rubber mounts. This flexing action can be observed by simply pushing sideways on one end of a car.

SUV: Sport(s) Utility Vehicle. Originally defined as a rugged automotive vehicle similar to a station wagon, but built on a light truck chassis. The classification has since been expanded to include vehicles similar in most respects to ordinary passenger cars.

Sway: There are two types of sway. The first type (technically known as "yaw") describes the behavior that occurs mostly when a trailer is hit by crosswinds with the result that it deviates from its intended course until corrected through the action of the hitch or towing vehicle. When the trailer's back end reverses direction and sets up a pattern that continues until a sufficient force intervenes to stop it, we call it "fishtailing."

The second type of sway is "body roll." This is seen most often in motor homes and trucks with slide-in campers as a "leaning over" behavior that occurs when the vehicle turns a corner or is pushed by side winds. The taller the vehicle is (in the case of winds) or the higher the center of gravity (in the case of cornering) the more severe it will be. As the vehicle rolls, the center of gravity moves in the direction of the roll.

Sway Bar: A metal bar or bars that can be attached to the trailer tongue (not to be confused with "anti-roll "sway bars), designed to prevent or retard the initiation of trailer sway. However, if the trailer is too long or too heavy for the towing vehicle, the sway bar's effect will be insufficient to keep the trailer from swaying out of control, especially when hit by a strong bow wave or crosswind.

Tandem axles: According to the National Truck Equipment Association, a tandem axle on a motor vehicle consists of two axles "mounted as a group", while a grouping of three axles is often called a "tri-axle tandem." "Tandem axle" is a term that also applies to trailers.

Tongue weight: Tongue weight is the amount of downward pressure exerted by the ball of a trailer coach hitch on the towing vehicle. Like pin weight for fifth wheels, it can vary when the vehicles are loaded, so that care must be taken not to overload.

"Tail-wagging-the-dog": This is what happens when trailer sway literally overpowers the towing vehicle to the point that its movement is controlled by the trailer. The trailer then causes the towing vehicle to sway as well, which may result in loss of control and possibly a rollover situation.

Torque: A force or combination of forces that acts upon a body or object to produce a twisting or turning motion at a given point — most often expressed in foot-pounds. Say you are trying to remove a lug nut on your trailer wheel. Set the wrench horizontally and stand on the very end. If your wrench is 1 foot long and you weigh 200 pounds, you are now applying 1 x 200, or 200 foot-pounds of torque to the nut.

Track: Once generally considered the distance from the outside of the tire on one side of the vehicle to the outside of the tire on the other side. In today's usage, the term is usually synonymous with tread width.

Tread width: Sometimes referred to as track, tread width on any given axle is the distance from the center line of the tire on one side of the vehicle to the center line of the tire on the opposite side. The wider the tread width, the more the vehicle tends to resist sway and body roll. In towing situations, a wider tread width reduces the towing vehicle's propensity for rollover when trailer sway reaches an extreme.

Van: A multipurpose motor vehicle with a boxy shape, extra headroom, and generally, wide doors in the rear and on one side. As a rule, vans are designed to carry more passengers or cargo than other vehicles of similar size. Full-size vans are built on truck-type chassis while minivans are usually built on modified car chassis with front-wheel drive.

Vehicle matching: The most critical factor in towing safety is the careful matching of towing vehicle and trailer based on strict parameters for wheelbase of the towing vehicle relative to trailer length. Other factors such as footprint and hitch type, of course, also come into play.

Vehicular footprint: The formula for vehicular footprint is wheelbase (in inches) times tread width (in inches). This combination of wheelbase and tread width will provide an excellent calculation for illustrating the stability of a towing vehicle. Although weight (mass) of the towing vehicle is also important, it is usually not relevant for towing vehicles such as SUVs because the curb weight is usually consistent with the footprint.

For example, take the 2001 2-door Chevy Blazer, which has a wheelbase of 100.5 inches and a tread width of 55 inches, and you'll get a footprint of 5,578 inches. Compare this with a 2001 Suburban with a 130-inch wheelbase and a tread width of 65 and you'll get a footprint of 8,450 inches. In this case, you'll find the overall stability greatly improved, primarily because of the longer wheelbase. With wheelbase giving increased towing stability and tread width giving more roll stability than in the first example you'll be getting better overall stability with the larger footprint. You should also realize that, according to current definitions, tread width and track are closely related, if not synonymous. (See tread width).

Although other factors like center of gravity are also important, particularly in the case of roll, considering vehicular footprint when towing a trailer coach can be important. By dividing the sail area of the trailer by the footprint of the towing vehicle you will come up with a ratio that appears very relevant. Generally, you should be looking at the ratio of the sail area to the footprint of about 3-to-1 for good stability when pulling a trailer coach. A 4-to-1 ratio should be acceptable with all other factors about perfect, but, according to my research, any ratio over 4-to-1 will make for precarious towing.

Velocity, in common usage, is the same as speed.

Weight-carrying hitch: This type of hitch is bolted onto the rear of the towing vehicle and should only pull a trailer with a maximum loaded weight of 2,000 pounds.

Weight-distributing hitch: A weight-distributing hitch has a single purpose: to take a portion of the weight off the towing vehicle's rear axle and distribute it between the towing vehicle's front axle and the trailer's axle or axles. The weight on the rear of the towing vehicle comes from two sources: the hitch weight of the trailer and the load carried in the towing vehicle. Without a weight-distributing hitch, the front of the towing vehicle would be too light and the rear of the towing vehicle would be too heavy — resulting in diminished steering control.

A weight-distributing hitch distributes the weight through two spring bars. When a loaded trailer is hooked up, the tension on the spring bars "lifts up" on the towing vehicle's rear and distributes some of the weight on the rear axle among the other axles.

Weight distribution: Weight distribution refers to the locations of various weights in a structure. Weight distribution affects balance and inertia and is critical to good handling, especially in trailer coaches and short-wheelbase motor homes.

Wheelbase Parameters for Towing Vehicles: The wheelbase of a vehicle is the distance between the center of the front axle to the center of the rear axle or axle assembly if the vehicle has multiple axles. This measurement is critical to anyone towing a trailer because it is an indication of the stability and maneuverability of the towing vehicle. If a towing vehicle's wheelbase is too short, there could be a serious problem with control, resulting in increased accident risk. Thus, there is a need to define the limitations within which a towing vehicle can safely pull a given trailer, minimizing the risk of losing control.

While the importance of matching vehicles according to wheelbase of the towing vehicle has long been recognized in the RV arena, it was not until 1991 that actual workable parameters were firmly established. During his years of research into the variables involved in trailer towing, JD Gallant discovered that wheelbase is the most reliable indicator of a towing vehicle's controllability on the highway. Strict wheelbase parameters were first published in the 1991 edition of his book, *The Language of RVing*, and they have proven successful in the succeeding years.

Width of tread is the actual width of the tire tread. Don't confuse this with "tread width" which has generally replaced "track".

Yaw is technically an object's rotation about a vertical axis. For practical purposes, yaw is the deviation from course that initially occurs when a trailer is hit by a bow wave or crosswind — not the oscillating motion of sway itself which might be called "repetitive yaw".