

Vulcan Carrier Safe Steering Load, GVWR, GAWR & GCWR

CHASSIS LIMITATIONS

Safe operation of your equipment is limited not only by the ratings of your equipment, but also by the amount of weight remaining on the front axle when towing and by your chassis ratings. When towing a vehicle it is important that you:

1. Maintain at least 50% of the original weight on your front axle for steering. 50% is generally accepted by the towing industry as the amount of original front axle weight that should be maintained on the front axle for safe steering under good towing conditions on paved surfaces. More than 50% of the original front axle weight should be maintained on the front axle when towing on gravel roads, wet surfaces, snow or other adverse towing conditions.

Furthermore, information may be available from your chassis manufacturer that tells you to maintain a specific amount of weight on the front axle of your chassis for safe steering. If the chassis manufacturer recommends that you should maintain more weight on your front axle than safe steering formula indicates, then you should adhere to the manufacturer's recommendation.

2. Do not exceed the GVWR (Gross Vehicle Weight Rating) of your chassis when you are towing a load. Exceeding the GVWR of your chassis can effect its braking and handling.
3. Do not exceed the GAWR (Gross Axle Weight Rating) of your truck.
4. Do not exceed the GCWR (Gross Combination Weight Rating) of your truck. Exceeding the GCWR can affect braking and handling of your chassis.

Item number 1, 2, 3, and 4 above are important because a carrier's load capability is usually limited by the chassis on which it is installed. Chassis limits are usually reached before the limits of the bed and towing device are reached. A carrier chassis should not be loaded in excess of any of its ratings. Of particular concern are the GVWR and rear GAWR, although care must also be taken not to load the carrier in such a way that would make the steering wheels too light for safe steering, especially when towing a second vehicle on the tow bar or wheel lift.

Calculating Safe Steering Load

When you obtain a carrier, you should calculate its maximum load for safe steering. The 50% safe steering formula is important when you have one vehicle loaded on the carrier bed and you have a second vehicle in tow on the tow bar or wheel lift. The size of the vehicle on the bed often affects the size of the vehicle that you can tow with the tow bar or wheel lift. Therefore, Vulcan suggests that you perform tow load calculations for your carrier based on towing a small, medium, and large vehicle on the deck. Then, you can determine the size of the second car you can tow under each condition.

Proceed as follows:

1. Load a small vehicle (approx. 2000 pounds) on the deck and weigh both the front and rear axle of the carrier.
2. Load a medium size vehicle (approx. 3000 pounds) on the deck and weigh both the front and rear axle of the carrier.
3. Load a large vehicle (approx. 4000 pounds) on the deck and weigh both the front and rear axle of the carrier.

Once you have obtained these three sets of front and rear axle weights, then you can follow the steps below for calculating the safe steering load. You can determine the maximum load that you can lift with your tow bar or wheel lift when you have a small vehicle, a medium vehicle, or a large vehicle on the deck.

Once determined, you should record that information on a sticker and put it in the cab within easy view of the driver/operator. All drivers should be required to observe the limits shown on the sticker. Decals for this purpose are available from Vulcan.

The maximum towing load for safe steering is the maximum load that can be lifted by the tow bar or wheel lift without making the tow truck's steering traction unreliable and dangerous. It should be calculated after all equipment is mounted.

Weight on the steering wheels should NOT be reduced to less than one-half of their original weight.

If you have any questions concerning the safe steering formula or if you need assistance with your calculations, you can contact Vulcan for assistance.

A simple formula for calculating the maximum load that can be lifted by the tow bar or wheel lift while still maintaining safe steering is shown below. It is based on the requirement for maintaining one-half the original steering weight.

The formula below has been used by the towing industry for many years and has proven reliable for determining steering under good towing conditions as stated above.

$$ML = 1/2 FAW \times WB / OH$$

where:

AL = maximum lifted load for safe steering.

FAW = the unladen (unloaded) weight at the front axle.

WB = wheel base (distance between the center of the front axle and the center of the rear axle(s))

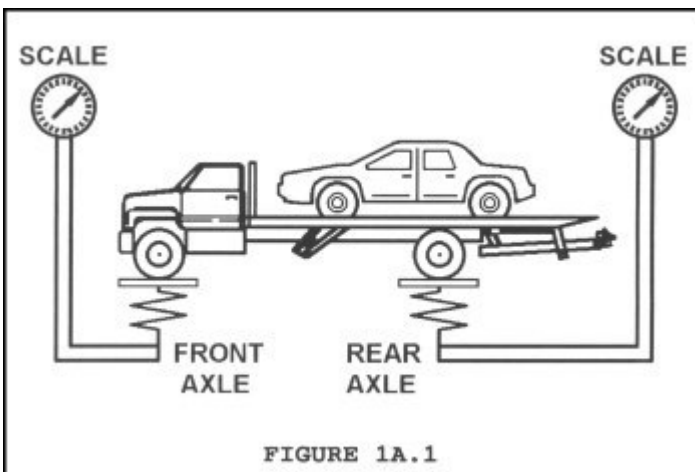
OH = overhang (distance from the center of the rear axle(s) to the lift point of the towing device).

To use the formula, divide the unladen weight at the front axle by two. Multiply the result by the wheel base. Then divide that result by the overhang. The last number you get is the maximum lifted load for safe steering.

Use the step by step instructions that follow to calculate safe steering tow loads for your tow bar or wheel lift.

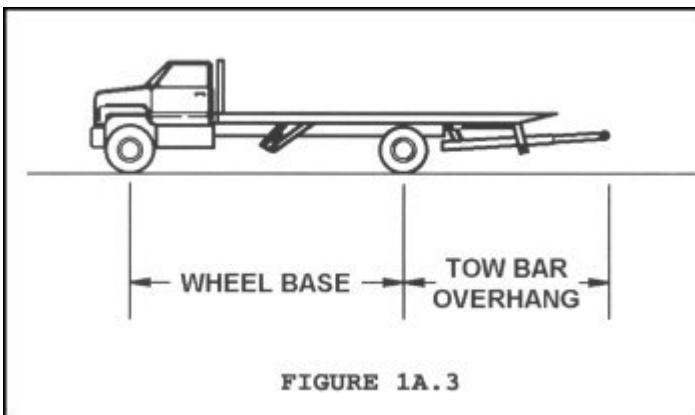
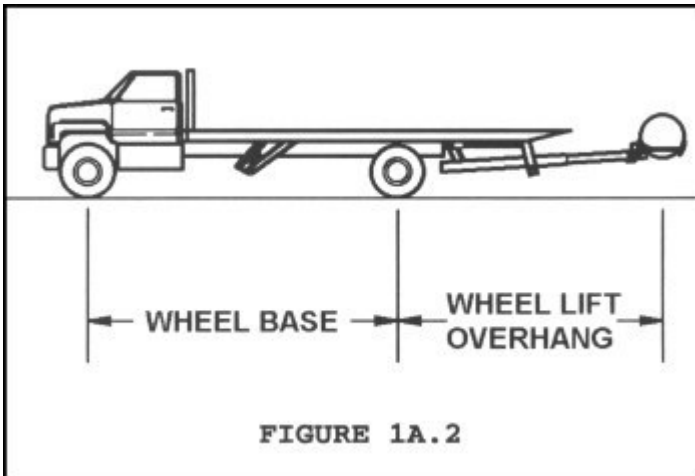
You can use pounds and inches or centimeters and kilograms in your calculations. If you use kilograms instead of pounds and centimeters instead of inches, the safe steering limits will be in kilograms. Do not mix pounds and kilograms, nor inches and centimeters in the same calculation. If you use kilograms, convert the chassis ratings to kilograms before making calculations.

1. Load a small vehicle as described above onto the carrier bed, then weigh the truck at its front and rear wheels and note the weight in either pounds or kilograms. Make sure the truck has a full tank of fuel, that the driver is in the cab, and that the truck is unloaded, except for usual towing equipment. On trucks with tandem axles, include the combined weight of both rear axles. See Figure 1A.1.



2. Load a medium size vehicle as described above onto the carrier bed. Then repeat step 1 to obtain front and rear axle weights with the medium size vehicle on deck.
3. Load a large vehicle as described above onto the carrier bed, then repeat step 1 to obtain front and rear axle weights with the large vehicle on deck.
4. Carefully measure the wheel base and note the distance in either inches or centimeters. See Figures 1A.2 and 1A.3

NOTE:
THE TOW BAR OR WHEEL LIFT MUST BE IN ITS POSITION NORMALLY USED FOR TOWING! OTHERWISE, THE TOWING LIMITS WILL BE WRONG.



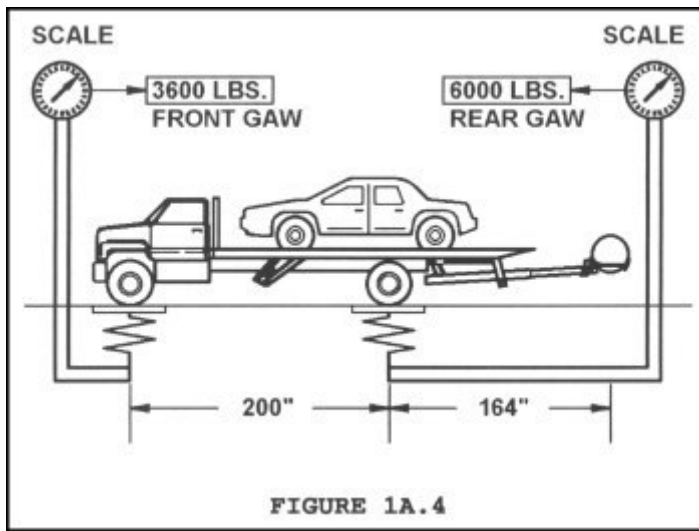
5. Measure the overhang and note the distance in either inches or centimeters. Refer to Figures 1A.2 and 1A.3.
6. Using the front axle weight of the carrier with the small vehicle on deck, divide that number by 2.
7. Multiply the result of step 4 by the wheel base.
8. Divide the result of step 5 by the overhang. The result is the maximum load that the tow bar or wheel lift can lift with a small vehicle on deck and still maintain safe steering.
9. Perform steps 6, 7, and 8 again using the front axle weight of the carrier with a medium size vehicle on deck.
10. Perform steps 6, 7, and 8 again using the front axle weight of the carrier with a large vehicle on deck.

EXAMPLE FOR A WHEEL LIFT:

1. Assume you found the following for your carrier with a small vehicle loaded on the deck:

3600 pounds front axle weight
6000 pounds rear axle weight
200 inches wheel base distance
164 inches overhang distance.

See Figure 1A.4.



Now, make these calculations:

3600 divided by 2 is 1800
 1800 multiplied by 200 is 360000
 360000 divided by 164 is 2195

1. (cont'd) In the above example, 2195 pounds is the maximum safe steering load that should be lifted by the wheel lift at its usual towing position when a small vehicle has already been loaded on the deck. Remember, this is the maximum load that should be lifted with the wheel lift under good towing conditions.

2. Assume you found the following for your carrier with a medium size vehicle loaded on the deck:

3700 pounds front axle weight
 6900 pounds rear axle weight

Substituting these front and rear axle weights into the safe steering formula gives a new maximum safe steering load of 2256 pounds.

3. Assume you found the following for your carrier with a large vehicle loaded on the deck:

3800 pounds front axle weight
 7800 pounds rear axle weight

Substituting these front and rear axle weights into the safe steering formula gives a new maximum safe steering load of 2317 pounds.

Remember, the tow loads calculated above relate only to steering. Other factors such as GAW, GVW, and GCW that affect braking and handling are discussed below. GAW, GVW, and GCW are often more limiting than the safe steering load on carriers.

Calculating GAW, GVW, and GCW

Always consider GAW, GVW, and GCW as well as safe steering load and equipment ratings and adjust tow load limits so you will not exceed the lowest limit or rating.

GAW and GVWR are often the limiting factors for car carriers. Always compute the GAW and GVW and compare them to the chassis GAWR and GVWR to see if you should reduce your tow loads to avoid exceeding those chassis ratings.

Simply add certain numbers from previous calculations to determine GAW (Gross Axle Weight) and GVW (Gross Vehicle Weight). Compare what you get with the chassis GAWR and GVWR. That will tell you if your chassis will be

loaded within its ratings when towing the maximum load for safe steering.

Each example below shows how to calculate GAW, GVW, and GCW for two car towing (one vehicle on the deck and one vehicle on the tow bar or wheel lift).

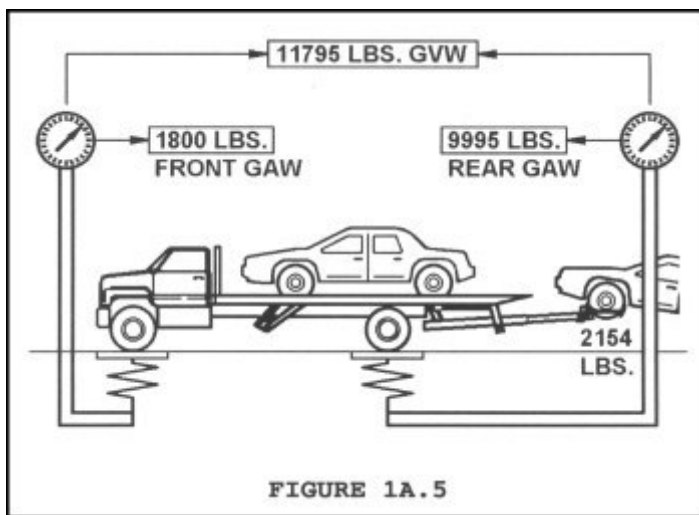
The size of the vehicle on the bed will greatly affect the GAW, GVW, and GCW.

EXAMPLE OF CALCULATING REAR AXLE GAW:

This example uses numbers from the previous example with a small vehicle on the deck to show the types of information to use:

$$\begin{aligned} & 1800 \text{ 1/2 the front axle weight} \\ & + 2195 \text{ maximum load for safe steering} \\ & + 6000 \text{ rear axle weight} \\ & = 9995 \text{ GAW of rear axle} \end{aligned}$$

See Figure 1A.5.



Thus, the rear GAWR of the truck chassis used in the example should be at least 9995 pounds.

Similarly, if we take the numbers from the previous example, we find that a medium size vehicle on the deck would require at least a 11,006 pound rear GAWR and a large vehicle on the deck would require at least a 12,017 pound rear GAWR.

EXAMPLE OF CALCULATING GVW:

This example uses numbers from the earlier example with a small vehicle on the deck to show the types of information to use:

$$\begin{aligned} & 3600 \text{ front axle weight with small vehicle} \\ & + 6000 \text{ rear axle weight with small vehicle} \\ & + 2195 \text{ maximum load for safe steering} \\ & = 11795 \text{ GVW} \end{aligned}$$

Refer to Figure 1A.5.

Thus, the GVWR of the truck chassis used in the example should be at least 11,795 pounds.

Similarly, if we take the numbers from the previous example, we find that a medium size vehicle on the deck would require at least a 12,856 pound GVWR and a large vehicle on the deck would require at least a 13,917 pound GVWR.

EXAMPLE OF CALCULATING GCW:

To calculate GCW, simply add the total weight of your carrier plus the total weight of the vehicles you intend to tow.

For example, suppose you have a small vehicle on the deck and you intend to tow a vehicle that weighs 4,000 pounds with the tow bar or wheel lift.

The following example uses numbers from the earlier example with a small vehicle on the deck to show the types of information to use:

$$\begin{array}{r} 3600 \text{ front axle weight with small vehicle} \\ + 6000 \text{ rear axle weight with small vehicle} \\ + 4000 \text{ weight of towed vehicle} \\ \hline = 13600 \text{ GCW} \end{array}$$

Refer to Figure 1A.5.

Thus, the GCWR of the truck chassis used in the example should be at least 13,600 pounds.

Similarly, if we take the numbers from the previous example, we find that a medium size vehicle on the deck would require at least a 14,600 pound GCWR and a large vehicle on the deck would require at least a 15,600 pound GCWR.

Remember, these are only examples. You must use the actual weights and dimensions of your carrier when calculating GAW, GVW, and GCW.

Weights for most vehicles that you might encounter when towing can be obtained from various trade sources and consumer report magazines. We suggest that you acquire such information to help you stay within the ratings of your equipment and chassis.