IS A Level Rig A Safe Rig?

We look at the difference between getting a rig level and properly handling the ball weight

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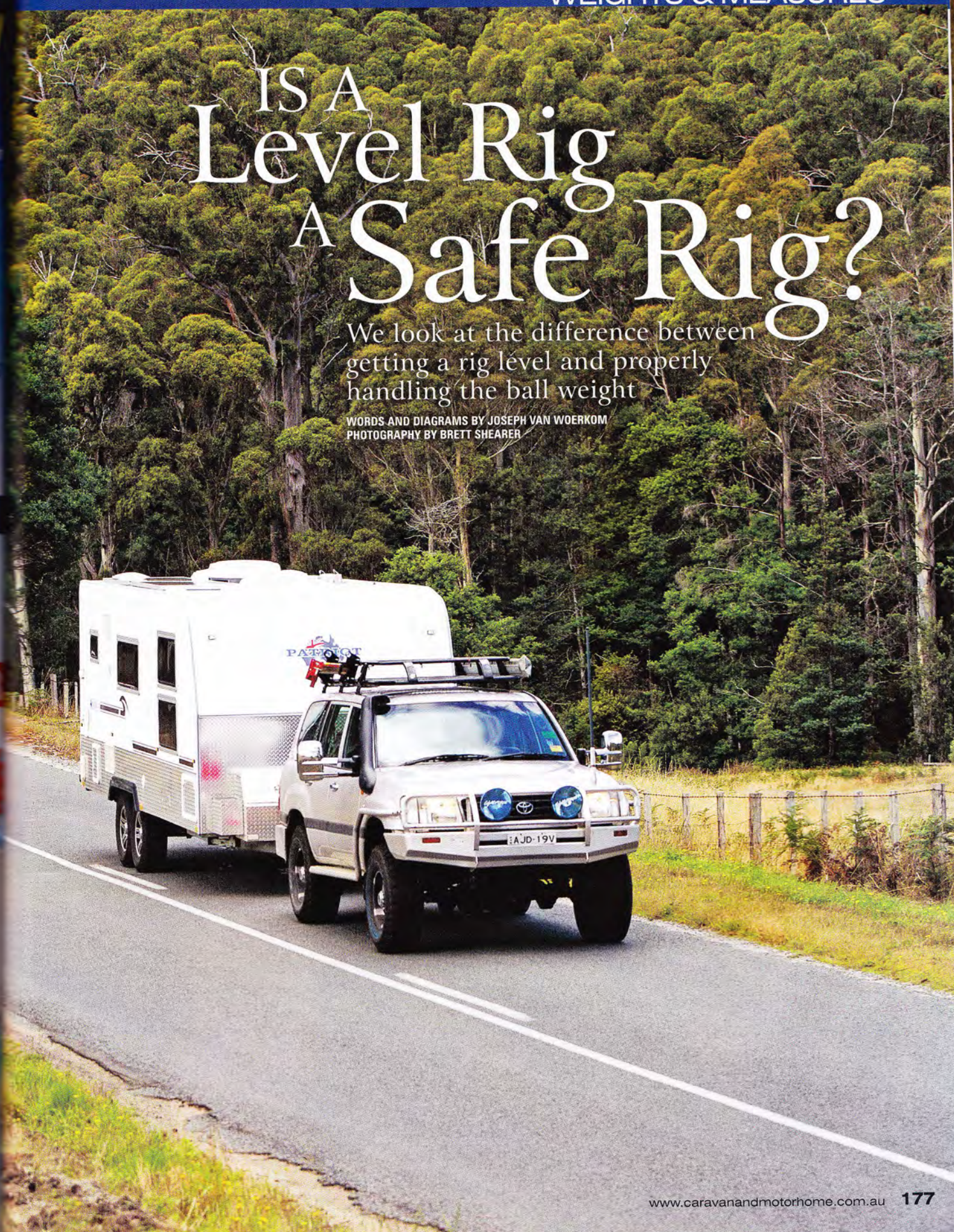
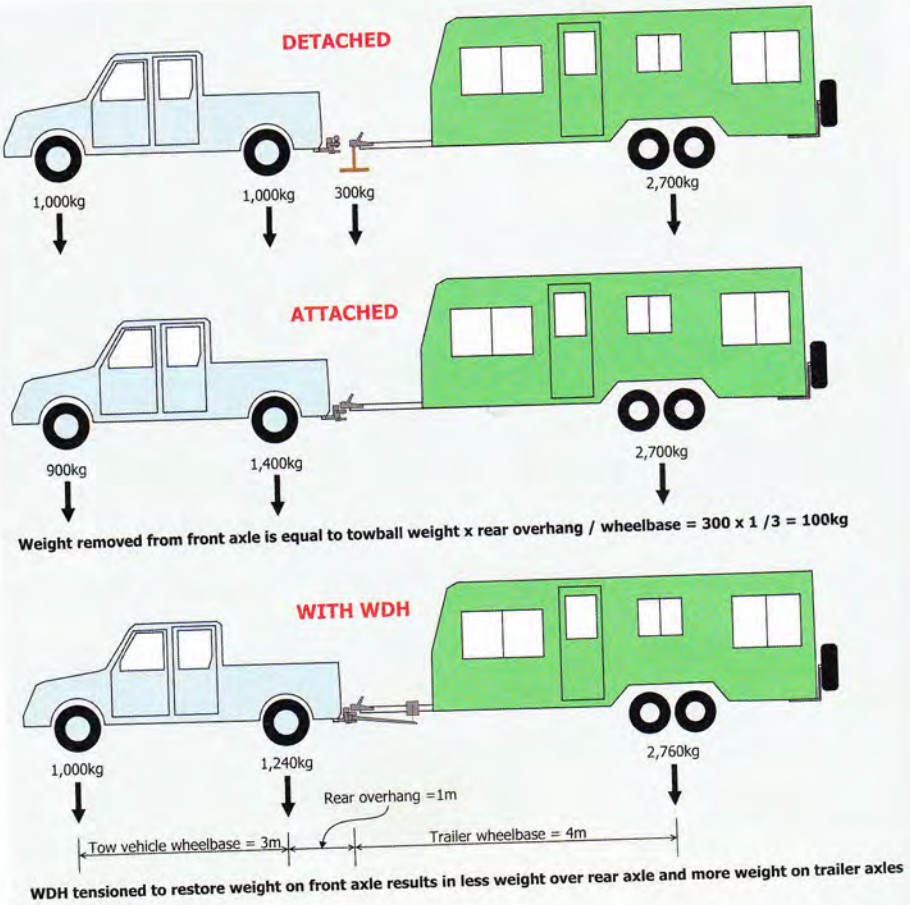


One thing that irritates most caravanners is a rig that doesn't sit level. This irritation is probably a good thing, because a rig where the tow vehicle has its rear-end sagging near the ground is a good indication that there is too much load on the rear end and, as a consequence, there has been too much load taken off the front axle.

It's also a fact that most tow vehicles have been designed to have most of the load carried by the rear axle, with the front suspension designed to carry a relatively constant load. The reasoning for this is related to both safety and comfort. The safety aspect comes from the fact that the front end is responsible for all of the steering and most of the braking, both of which are adversely affected by a reduction in front-axle load. Therefore, the aim of the game when caravanning is to ensure that the front-axle load is not reduced when the caravan is attached.

Now there's a misconception among some caravanners that all that's needed to keep the correct weight over the front axle is for the combination to be level to the eye. It's easy to see why they might think this way, because without the van attached, the vehicle is level with the correct front-axle weight. So, if it's level again after the van is attached, the front-axle weight can't have decreased, can it?

Measuring the height of the front wheel arch



Weight redistribution using a WDH

Well yes, it can if the vehicle is made level simply by stiffening the rear suspension. All that happens when stiffer suspension is fitted to the rear is that the rear doesn't drop as much under the same load, because it compresses less under the same load. Unfortunately, the weight on both axles doesn't change no matter how stiff or soft the suspension is, nor what's used to make it stiffer – whether that be airbags, helper springs or stronger springs – all that happens is that the rear-end height changes.

That's not to say that stiffer suspension is not a good idea when carrying heavy loads. Stiffer suspension increases the rear ride height which improves the amount of upward axle movement, so that the suspension won't bottom out when encountering irregularities in the road surface. The vehicle will also be less prone to body roll when cornering, which improves road safety and passenger comfort.

However, there's no escaping the fact that the load on the front and rear axles doesn't change by changing the stiffness of the rear end suspension. Believe it or not, you can even lock the rear suspension with blocks of wood so that there is no drop as the load is added and the axle loads will not change one bit.

You can check this yourself by measuring the distance to the ground from the centre of the front wheel arch with the van disconnected. Then hitch up the van without connecting up any load levelling devices. If the ball weight is at all significant, you will notice that the front wheel arch is now further from the ground. If you have adjustable airbags in the rear then inflate them to a higher pressure, then decouple the van and repeat both measurements. You may be surprised to find that in both cases the front wheel arch is higher from the ground with the van attached, indicating that weight has

been removed from the front axle.

This measurement method may not give the expected result with vehicles that have self-levelling air bag suspension because they are designed to automatically adjust the pressure in their air bags to keep the vehicle level at all times. However, if you were to place the front tyres of these vehicles of a weighbridge with and without the van attached, you would see that the front-axle load decreases with the van attached in exactly the same way it does with vehicles with more conventional suspension.

The reason that the front-axle load is reduced when the van is attached is because the vehicle chassis acts like a lever pivoting over the rear axle. The amount of weight removed from the front axle can be worked out by dividing the ball weight by the distance between the front and rear axles (wheelbase) and then multiplying this by the distance between the rear axle and the tow ball (rear overhang).

Put another way, the amount of weight removed from the front axle is equal to the ball weight multiplied by the rear overhang then divided by the wheelbase. For a vehicle with a wheelbase of 3m and a rear overhang of 1m, the amount of weight removed from the front axle is 1/3 of the ball weight.

Obviously, the shorter the rear overhang and the longer the wheelbase the less effect the ball mass will have on reducing the weight on the front axle. This is why short wheel base tow vehicles have a much choppier ride when towing than their long wheelbase counterparts, and also why it's a good idea to keep the towbar as close to the tow vehicle as possible.

It's the tension in the chains that pulls the rear of the tow vehicle back upwards

ENSURE THAT THE FRONT-AXLE LOAD IS NOT REDUCED WHEN THE CARAVAN IS ATTACHED

For small ball weights, the reduction in load on the front axle due to the ball weight is not a problem, but with caravans becoming heavier and heavier the amount of weight removed from the front axle can easily be in excess of 100kg. The effect of this amount of weight reduction is a noticeable increase in understeer, longer stopping distances and often an effect called 'porpoising'.

This is where the vehicle pitches up and down at the slightest irregularity in the road surface, making the vehicle feel unstable and increasing the amount of concentration required to drive it.

So what can be done to overcome the problem and restore the weight onto the front axle? The answer is that the only

You can check how a WDH works at a public weighbridge


Heavy-duty weight-distribution hitch

way this can be done is to use a weight distribution hitch. These devices also use the lever principle to lever some of the weight imposed by the caravan's ball weight away from the rear axle towards both the front axle of the tow vehicle and also the caravan's axles.

The amount of weight transferred is determined by the length of the weight distribution arms and the tension in the attachment chains (heavy-duty HR style), or the load on the attachment brackets (shepherd's crook arm style). If the WDH tension is adjusted to exactly restore the front-axle load, the amount of weight added to the rear axle by the caravan is reduced to (trailer wheelbase)/(trailer wheelbase + rear overhang) times the ball weight and the additional weight on the caravan's axles is (rear overhang)/(trailer wheelbase + rear overhang) times the ball weight.

To show you how this all works, we've put together an example where we have two-tonne tow vehicle with an equal weight of 1000kg on each axle and a caravan that weighs three-tonne with 2700kg carried by its wheels and 300kg on the ball. When the van is attached to the tow vehicle, the load on the tow vehicle's front axle decreases by 100kg and the load on its rear axle increases by 400kg.

With the WDH attached, the load on the tow vehicle's front axle is increased by 100kg back to 1000kg, and the load on its rear axle is reduced to 160kg to 1240kg with an additional 60kg imposed on the caravan's axles.

Some people are surprised that a WDH increases the load on the caravan's axles. So if you're heavily loaded, it may be worth a trip to a public weighbridge to ensure that the van's GTM (maximum permissible load on the caravan axles) has not been exceeded. ■