

CONSIDERATIONS REQUIRED WHEN RAISING THE 4WD

SHOCK ABSORBER, SUSPENSION, BRAKES, TOWBARS
AND WHEEL ALIGNMENT SPECIALISTS

When a vehicle's ride height is raised or lowered, there are quite a number of things that happen.

Such as tail shaft angle change, brake bias can alter, the centre of gravity of the vehicle will change. All of the above will effect the vehicle's overall operation.

50mm or 2 inches is the most common height that 4WD vehicles are lifted. In 2009 the New South Wales Government introduced legislation requiring engineering compliance to accompany any lift greater than 50mm. Experience suggests that this is about all that is required to enable a car to tackle difficult terrain while maintaining a good level of practicality and serviceability. Any higher than this generally requires extensive and expensive modifications to related steering and suspension components.

After market lift kits will generate a high centre of gravity on the vehicle. Take a tall 4WD like a Troop Carrier for instance, add a raised suspension kit and then load up the roof rack with a hundred kilograms of supplies and spares, you begin to get a very unstable car, when cornering at speed or travelling along laterally sloping roads or tracks.

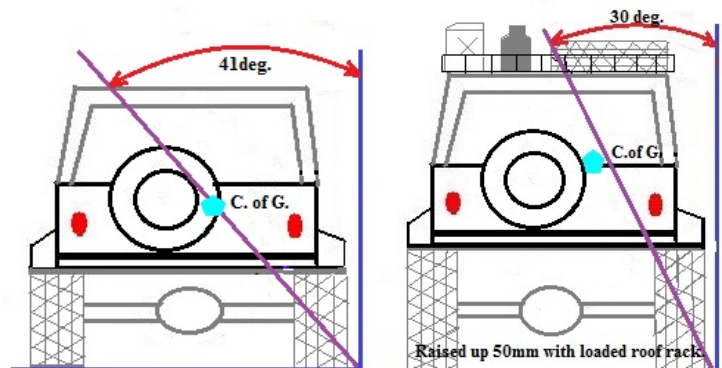
We are going to have a look at the following issues that manifest themselves when the car is taken out of its comfort zone:

- Centre of Gravity.
- Drive line.
- Wheel Alignment.
- Live axle angle changes.
- Centre line verses thrust line.
- Leaf springs.
- Shock absorbers.
- Brake Bias (Proportioning valves).
- Flexible Brake hoses.



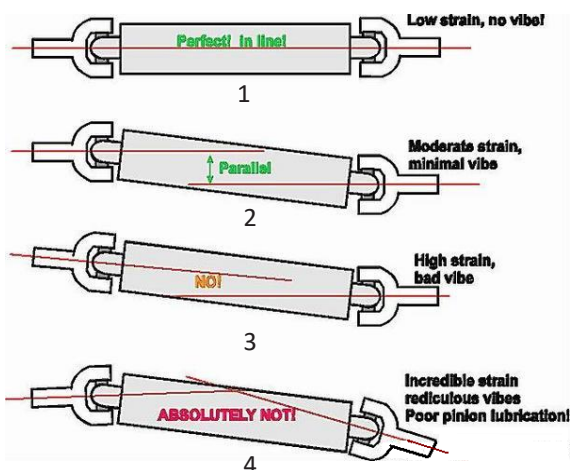
Centre of Gravity:

- The C. of G. is the calculated centre of mass of the vehicle. The higher the point the more the chance of the vehicle "falling over".
- This is also exaggerated, when owners load up the roof rack with extra fuel and water containers, spare wheel and luggage. This weight can reach 90 to 100kgs .
- So, when raising a client's vehicle, keep it within the bounds of safety and sensibility.



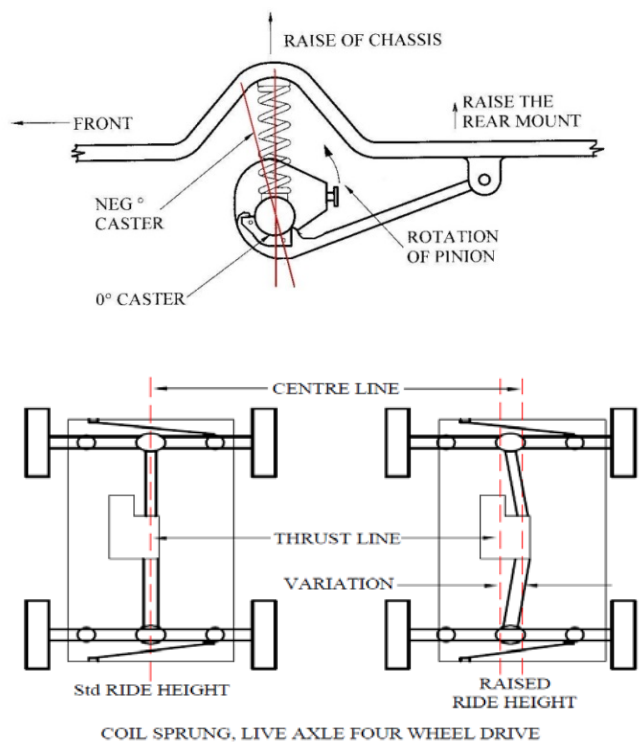
Altering the Angle of the Drive Line

- When raising the 4wd vehicle, the only things that go up are the sprung components, which include the transmission and the transfer case.
- Attached to these are the tail shafts, at the end of each tail shaft is a cardan joint (U.J.).
- These joints really only like working through a maximum angle of around 3° to 5°. If this angle is increased, there is a big chance that a vibration will be created.
- Also, what must be taken into consideration, is the matching angles. On a single cardan joint, the flange angles are to be phased to be the exact same angle. (as depicted in image 2).
- Also, a vibration can be created by changing the angle of the tail shaft, as the position of the needle roller bearings have moved on the cross bar.
- If a Cardan joint, Hookes joint, Universal joint has been in service for a number of kilometers, a slight brindleing can occur (wear marks) on the cross bar. When the angle alters the needle rollers will move around the shaft and are now in a different position. There is a good possibility that this may cause a drive line vibration.
- If you are unsure of the condition of the cardan joint, remove the shaft from the vehicle and move the joint by hand through it's full spectrum of articulation to see if there are any "high spots" or binding. The rotational movement should be smooth with no "free play".



Altering Wheel Alignment Geometry

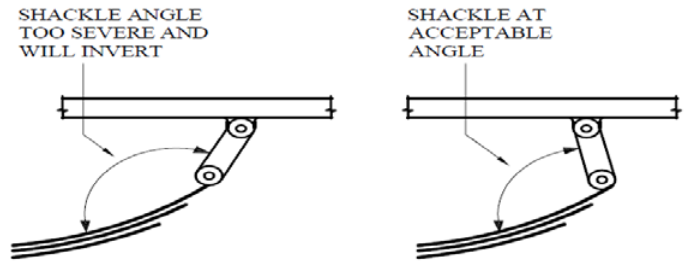
- On coil sprung vehicles with live axles, they are fitted with trailing arm type suspension. The arms are mounted to final drive housing and the other end to the chassis rails.
- Therefore when the sprung weight of the vehicle is raised the rear mounts of the trailing arm also move up and in turn will rotate the housing forward, effecting:
 - Caster angle.
 - Pinion flange angle.
 - Housing moves sideways, because of pan hard bar.
 - Steering box moving off centre, which will alter steering turning circle left to right.
- One of the ways to correct this anomaly, is the fitment of "offset bushes" into the radius arms. This will rotate the housing back to its original position.
- With leaf spring vehicles, the rotation of the pinion angle may not be as bigger problem, but the same tail shaft issues could exist.



The Correct Position of the Swinging Shackle

The angle of the swinging shackle is very important. As you are aware, they are fitted to allow for the varying length of the spring when compressing and rebounding.

- If the original springs are reset to raise the vehicle, the situation will probably arise that, because extra camber has been set into the spring, the distance between the eyes is shorter.
- Now what happens when fitted to a vehicle, is that the shackles will face inwards, when the spring is worked hard, there is a possibility that the shackle will invert.
- Use a longer main leaf, or new Pedders leaf springs.



The Use of Dampers (Shock Absorbers)

- The use of correct length dampers at ALL times is important.
- Measure from top to bottom mount at full droop (Max. open).
- Then with the vehicle at loaded ride height, measure between the bump stop and the strike plate and do not forget to allow for compression of the bump stop. (see Fig. 3).
- This will give you the operating window of the damper.
- But, there is a catch, if the vehicle has been raised 50mm, then the shock will need to have an extra 50mm of rebound. But what happens to that extra 25mm when the vehicle experiences a huge impact and uses all the bump stroke. There is a big possibility that the unit will bottom out and cause damage to the shock absorber internals .
- The answer: fit 25mm longer bump stops.
- Always take into account the motion ratio of the damper when calculating operational length.

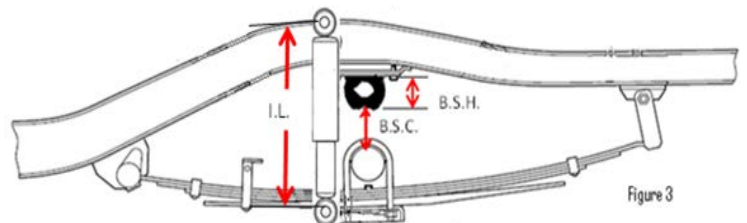
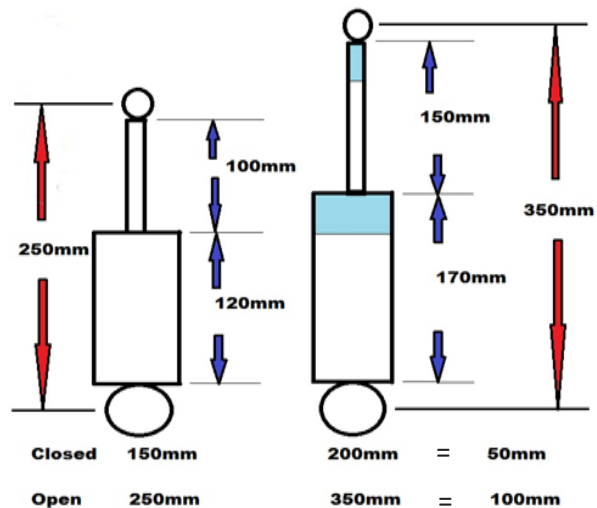


Figure 3

I.L. = Installed length of the shock absorber, B.S.C. = Bump stop clearance, B.S.H. = Bump stop height

$$\text{Compressed Length} = (IL - BC - (\frac{BHS}{1.5})) = (435 - 100 - \frac{95}{1.5}) = (335 - 63) = 272\text{mm of C.L.}$$

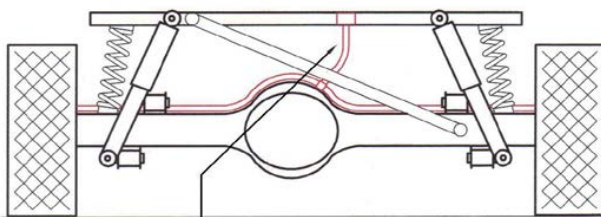
CONSIDERATIONS REQUIRED WHEN RAISING THE 4WD

SHOCK ABSORBER, SUSPENSION, BRAKES, TOWBARS
AND WHEEL ALIGNMENT SPECIALISTS

Brakes: Bias Adjusters

- Most large 4W.D. or ute type vehicle may be equipped with load sensitive Brake Proportioning Valves.
- The way they operate is that, when a load is applied over the rear axle and the chassis goes down, pressure is altered on the valve and this will increase rear braking effect.
- When the load is removed, the rear goes up changing the pressure on the valve and therefore decreasing brake hydraulic pressure.
- When raising a 4W.D. we are indirectly telling the bias valve that there is no weight on the rear and therefore there is no need for full brake pressure to be applied to the rear. It is prudent to check the brake pressure to see if an adjustment is required.
- To validate the adjustment. You can always check the pressure with a gauge and hose fitted to the bleed nipple port at the wheel cylinder.
- You can also visit your Pedders store and have the car checked on the Beissbarth Test Lane, brake rollers, by conducting a before and after brake pressure check.
- Note: both coil and leaf sprung vehicles can have this problem.

Flexible Brake Hoses



CHECK THE LENGTH OF THE FLEXIBLE HOSE ON FULL EXTENSION
NOTE: CHECK FRONT AND REAR HOSES

- The checking of the flexible brake hoses is very important. If there is more extension travel than the flexible length of the brake hose, then the hose will separate from the union and create a fluid leak and in turn no rear brakes.

- There is a requirement to check both front and rear on full extension and it does not make any difference if the vehicle is coil or leaf sprung.
- I would recommend that this procedure take place on any vehicle that has been taken out of its standard operating range.

Braking Efficiency

The final consideration is brakes, how efficient will they be, with a car that has an increased Gross Vehicle Mass. (GVM) and the Gross Combination Vehicle Mass (GCVM) when towing. All of the following will affect the braking efficiency:

Dual fuel tanks, Dual Fuel(gas), shelving and/or racks in the back, de-bogging equipment, camping gear, supplies, roof rack, extra spare wheel, 20l of water and finally larger wheels and tyres.

The brakes were designed on that vehicle to perform at a given weight, now that there has been more weight added and larger wheels and tyres fitted, the brakes may not perform as efficiently as they might on a standard vehicle.

The customer has gone to great lengths to raise the vehicle, fitted H.D. suspension to carry the loads but done zero about improving the stopping power of the vehicle.

So, when you are discussing a TrakRyder Lift Kit, a TrakRyder Suspension Kit or Towing Aides with your customer, please talk to him about the possible requirements for upgrading the braking system so it will be capable of handling the extra mass.

PEDDERS
4X4/SUV BRAKE PADS
CERAMIC TECHNOLOGY



PEDDERS
SLOTTED 4WD/SUV ROTOR
GEOMET COATED

