

## Australian 4WD Hire Briefing Information

### **National 4WD Council Code of Ethics;**

1. Obey the laws and regulations for recreational vehicles that apply to public lands.
2. Respect the cultural, heritage and environmental values of private / public land, by obeying restrictions that may apply.
3. Respect our flora and fauna. Stop and look, but never disturb.
4. Keep to formed vehicle tracks.
5. Keep the environment clean. Carry your own, and any other, rubbish out.
6. Keep your vehicle mechanically sound and clean to reduce the environmental impact.
7. Adopt minimal impact camping and driving practices.
8. Seek permission before driving on private land. Do not disturb livestock or watering points, leave gates as found.
9. Take adequate water, food, fuel, basic spares and a first aid kit on trips. In remote areas travel with another vehicle and have Royal Flying Doctor Service, or equivalent, radio contact.
10. Enjoy your recreation and respect the rights of others.
11. Plan ahead and lodge trip details with a responsible person.
12. Support 4WD touring as a responsible and legitimate family recreational activity. Consider joining an affiliated 4WD club.

### **Drive Train**

A 4WD can be a constant 4WD, part-time 4WD or both. An example of a constant 4WD is a Range Rover. It is always in 4WD and cannot select 2WD at all. A Nissan Patrol is an example of a part-time 4WD, which means that it can switch between 2WD and 4WD. However 4WD can only be selected when on slippery surfaces.

A Mitsubishi Pajero is an example of a 4WD that can be both a constant 4WD and a part-time 4WD. It can select 2WD, constant 4WD and locked 4WD. The difference between the Patrol and the Pajero is that the Pajero has a centre differential. A centre differential allows 4WD to be used on normal roads (constant 4WD) and can be locked for off-road use (part-time 4WD). The "axle/transmission windup" text below explains why a part-time 4WD cannot be driven in 4WD on the bitumen.

### **Axle/Transmission Windup**

When a 4WD is travelling in a straight line all four wheels rotate at the same speed, but during cornering each wheel travels at a different speed due to the radius of the turn. All vehicles have a differential on the front and rear axles to allow the wheels on the same axle to rotate at a different speed. Constant 4WD's have a central differential fitted to allow for different speeds between front and back wheels, but most part-time four wheel drives do not.

When a part-time 4WD (without a centre differential) is in 4WD an attempts to corner on bitumen, all wheels need to rotate at different speeds, but without a centre differential they cannot. This creates the phenomena called "axle windup" or "transmission windup". High strain is placed on the drive shafts and transmission, eventually causing one of two things to happen. Either one of the wheels slips or spins to overcome the stress or the drive-shaft/transmission breaks. This is why part time 4WD's should never select 4WD on bitumen.

Constant 4WD's have a central differential within the transmission to overcome this problem. However once in the dirt a constant 4WD can be bogged with only one wheel spinning. This is why they have a central differential lock that stops the action of the centre diff and makes it like a part-time four wheel drive in 4WD mode. The centre diff lock should never be used on bitumen or non-slip surfaces for the reasons mentioned above.

In reality, a 4WD is only a two wheel drive with one front and one back wheel driving when traction is lost. One wheel on each axle spins while the other receives no drive at all due to the action of the differential. The exception to this is where a limited slip or locking differential is fitted. A limited slip diff allows a limited amount of drive to be applied to the stationary wheel before the other wheel on the same axle spins. A locking diff allows no slip at all and both wheels on the same axle turn at the same speed, regardless of the amount of traction.

### **High/Low Range**

To enable a 4WD to travel at lower speeds while travelling on rough terrain it needs lower gear ratios. Not all 4WD's have low range gearing and this restricts their ability to tackle rough terrain. However 4WD's that lack low range gearing are generally not built for severe off-road conditions or sometimes have a "crawler" 1st gear to compensate for the lack of low range gearing.

The high range ratios in 4WD mode are the same as the gear ratios in 2WD. When low range 4WD is selected, the gear ratios are approximately half that of high range, although the exact ratio varies for each vehicle manufacturer. For example this means that if an engine speed of 3000 rpm in high range fourth gear is 100 km/h, then in low range at the same engine speed and the same gear, the speed would be around 50 km/h.

### **Some points to note about low range gearing are:**

- You cannot select low range in 2WD mode.
- You do not have to use low range as soon as you put the vehicle in 4WD, but only if the terrain requires it.
- On most vehicles you have to be stationary when changing from high to low range, check your owner's manual for your particular vehicle. A handy hint when reversing with your vehicle while towing select low range 4WD to be able to move very slowly without having to slip the clutch. However you can only do this if you have a constant 4WD or your part-time 4WD is fitted with free-wheeling hubs AND they are not locked in, otherwise you will cause transmission windup.

### **Free Wheeling Hubs**

If your vehicle is fitted with freewheeling hubs, you will need to lock them in before selecting 4WD. The freewheeling hub connects the front wheel to the front axle allowing it to be driven when four wheel drive is selected. Freewheeling hubs are fitted to reduce wear on the front diff and drive shaft, and to (marginally) help improve fuel economy when it is in 2WD. Permanent 4WD's do not have freewheeling hubs as they are always in 4WD and need the front wheels to be permanently connected to the axle. If you select 4WD without the freewheeling hubs locked in, then you will only be in 2WD, even though the 4WD dash light indicator (if fitted) will show 4WD. Even experienced 4WD drivers make this common mistake of forgetting to lock the freewheeling hubs.

### **Approach and Departure Angle**

The approach angle is the steepest incline that the vehicle can approach from a level surface without touching any part of the vehicle. The departure angle is the same thing for the rear of the vehicle. The higher the angle, the lower the chance of impacting when climbing or reversing over obstacles.

### **Ramp over Angle**

The ramp over angle is the largest peak that a vehicle can drive over without touching the under body. A short wheelbase vehicle invariably has a better ramp over angle than a long wheelbase vehicle. The larger the angle the steeper peak the vehicle can travel over.

### **Sand Driving**

The fundamental theme with sand driving is to conserve your momentum. Since traction is at a premium, any increase in speed can be difficult, if not impossible, and you do not want to lose any momentum, as you may not be able to regain it.

### **Tire Pressures**

The first thing to do before driving on sand is to lower your tire pressures. This is done to provide better flotation by increasing the size of your "footprint" and thus dramatically improving your traction. It also reduces the amount of strain on your vehicle and minimizes wear and tear on the tracks. The optimum tire pressure depends on your vehicle, the type of tires fitted and the terrain. The following technique provides a good starting point to find the optimum pressure and is best performed before leaving the bitumen. Park your loaded vehicle on a level surface and place a brick 1 cm away from the sidewall of your rear tire. Deflate that tire until the sidewall just touches the brick and then measure the tire pressure. Use this pressure as your starting point when initially lowering your tire pressure for sand driving. As you become more familiar with sand driving, you can alter this pressure as the terrain dictates. If you haven't performed the above technique before you reach the sand, don't fret. A good rule of thumb is to use a pressure of 18 psi. Driving a vehicle with low tyre pressure at speed can kill you your friends and family. Remember though, if you are going to lower your tire pressures, ensure you have a pressure gauge and some means of pumping your tires back up. As you lower tire pressure, the tire becomes more vulnerable to damage by stoking the sidewall or rolling the tire off the rim. **The lower the pressure, the higher the risk.** However the gain in traction can be remarkable and may make the difference between becoming hopelessly bogged or simply driving away. The "correct" tire pressure becomes a decision between better traction versus increased risk of tire damage. In severe cases of bogging, tire pressure can be lowered to a minimum of 40 kPa (6psi), as most tires require at least 6psi to remain seated on the rim while stationary. In almost all situations 10psi should be used as the minimum pressure as 6psi is likely to result in tire damage i.e. tires rolled off rims or punctured sidewalls. Speeds should be severely restricted at these low pressures. To minimize tire damage, it is important that these low pressures are only used on sand and tire pressures should be increased if limestone or rocky outcrops are encountered, or when the terrain becomes more firm. Failure to do so will almost certainly result in tire or rim damage.

### **Sand Driving Techniques**

When travelling on sand, you should endeavour to follow in the tire tracks of the vehicle in front as they have already compressed the sand to form a firmer surface than un-traversed ground. Never drive on vegetation as this will destroy it and lead to erosion and environmental damage. You should avoid rapid changes in speed when accelerating or braking. Braking on sand will cause a mound to build up in front of all wheels and possibly prevent your vehicle from taking off. Rapid acceleration simply digs the wheels in and can actually lead to slower take-off speeds. Take-off should be performed as smoothly as possible with gear changes done at fairly high revs. Sand driving

requires plenty of engine power to get your vehicle "planning" on the sand. It is advisable to use low range as this multiplies the amount of engine torque available and will provide that extra gear if you encounter a particularly soft patch of sand. Check that your tires are pointing straight ahead when taking off to reduce the takeoff effort required. When stopping on sand, depress the clutch and allow the vehicle to coast to a stop. This will minimize any sand build-up in front of the wheels. If the terrain permits, coast to a stop, rather than braking, with the vehicle pointing downhill as this will aid take-off. Avoid the soft sand at the base of most dunes and gullies when stopping. When turning, make the turn as wide as possible to reduce the chance of bogging. Your front wheels act more like a rudder in sand and turning too sharp has a similar effect to applying the brakes. Steep sand dunes can be traversed only straight up or down. If you drive even on a slight angle, the weight transfer is to the downhill side wheels. If the vehicle starts to slip, the downhill wheels tend to dig in and make the angle of the dune even worse, leading to a potential rollover. If you are travelling straight down a steep dune and the back end starts to slip sideways, it is best to accelerate slightly to try and straighten the vehicle. Never use the brake, as this will cause weight transfer to the front wheels and can increase the back end movement. If travelling up a dune and you do not get to the top, reverse down the dune in gear, NEVER coast down the dune and NEVER attempt a U turn. When you return home after a beach trip, it is important to hose down your vehicle to remove all traces of sand and salt. Pay special attention to areas like the mudguards where sand is sprayed around and tends to get trapped. Thoroughly hose underneath your vehicle as well, as there are many nooks and crannies where sand can also get trapped.

### **Vehicle Recovery in Sand**

As soon as you become bogged, avoid the temptation to simply floor the accelerator as this will just make vehicle recovery more difficult. Put the vehicle in reverse and gently try to back along your tracks as they provide a compacted path. When you have reversed a sufficient distance, try going forward again while being careful not to dig yourself in. Hopefully you will travel further each time you repeat this technique and eventually be able to slowly pass through a particularly soft section. If you cannot reverse out of trouble, get out of the vehicle and let your tires down further. A rule of thumb is to drop them by a further 12 psi. Remember Low tyre pressure and speed can cause death, the rim can spin off. Before trying to reverse out, remove the build-up of sand from behind the tires. See if any part of the underside is touching. If it is, clear the sand away to allow the vehicle to reverse out. You may need to try this several times. Also, never underestimate the assistance of your passengers giving a push. If you are still stuck and your tires are down to the minimum pressure, you will have to resort to a snatch strap, winching or jacking to extricate yourself. The easiest method is usually by snatch strap, but this relies on another vehicle being present. If you are by yourself you will have to resort to winching (if you have one!) or jacking. Or start digging and keep your sense of humour, it is part of the experience

### **Summary-Sand Driving**

- lower tire pressures to greatly improve traction and reduce track erosion
- drive smoothly with gear changes at high revs
- ensure wheels are pointing straight ahead when taking off
- avoid the soft sand at the base of dunes and gullies
- make turns as wide as possible
- ONLY travel straight up or down dunes
- follow in others tire tracks to drive on compressed ground
- avoid braking by coasting to a stop
- do not floor the accelerator if you are bogging down
- when bogged, try to reverse on your own tracks
- thoroughly hose down your vehicle after a beach trip
- remember you are to return your hire vehicle clean and no sand left in the vehicle
- Only drive on the beach 3 hours before low tide and two hours after

### **No Drive zone on Fraser Is**

- Not allowed any further North than Indian Head
- Not allowed to drive on the western side of the Island
- Only allowed around Hook pt at dead Low tide with barge captain Permission
- Only allowed to drive on the beach 3 hours before low tide and 2 hours after low tide

### **Snorkel**

**Is designed for higher and cleaner air intake for the engine and is not water tight or proof.  
Do not submerge in water Any Vehicle higher than lowest point of driver door.**

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