



Bush Fire Brigade Drivers Guide



Coondle – Nunile Bush Fire Brigade Offroad Drivers Guide

INTRODUCTION	2
SOP (Standard Operating Procedure)	2
Vehicle Instability	2
Bogged or Broken down	2
DOWNHILL TECHNIQUES	3
Gear Selection And Braking	3
Stopping On A Decline	3
Starting on a Very Steep Decline	3
Downhill Dangers	4
Downhill Summary	4
UPHILL TECHNIQUE	5
Summary Uphill	5
ROCK CRAWLING	6
Summary Rock Crawling	7
GULLIES, RUTS & LOGS	8
Summary, Gullies, Ruts And Logs	8
SAND	9
Driving Through Sand	9
Turning In Sand	10
Stopping In Sand	10
Starting In Sand	10
Tyre pressure alterations	11
Summary Sand Driving	11

INTRODUCTION

SOP (Standard Operating Procedure)

4-wheel-drive low-ratio should be engaged upon entering the fire ground.

All driving described in this manual assumes you are in 4WD low-ratio.

If a section of 'risky' track is only a small distance and its safe to do so, get your crew to get out of the vehicle and walk to the other end of the 'risky' area. They will see any further obstacles and can warn you of these and you can see both where and how they walk which will be another aid in giving you ground conditions.

Offroad we will mostly be driving over gravel, sand or rocky ground, we will therefore not cover mud driving techniques in much detail.

In modern vehicles it is always wise to turn the airconditioner OFF when approaching tricky situations, as the automatic regulator systems can create rev alterations in the engine at inopportune moments which can cause unnecessary problems for you.

Recovery techniques are not discussed here as they are to be avoided and would be used only in a worst case scenario and carried out only by trained persons.

Vehicle Instability

Any vehicle with a high Centre of Gravity (COG) is more dangerous on hills and slopes, they are also more likely to roll over when the vehicle alters direction.

Our trucks not only have a high COG, but they are even MORE DANGEROUS as they have an unstable, moving COG. The water in the tank does not remain over the centre of the vehicle when going on slopes or around corners. On a side-slope the water moves to the downhill side of the vehicle, in effect making it even more likely to tip over than a similarly loaded vehicle with immovable weights rather than liquid water.

Turning a corner with less than a full tank sends water to the outside of the corner making the vehicle more likely to tip. Even though there are baffles in the tanks, you will find that particularly on long corners the vehicle becomes more and more unstable the further around the corner you get.

Drive smoothly, and be aware of your vehicles capabilities.

Bogged or Broken down

If you do get bogged or stuck or break down - the FIRST thing you should do is get on the radio and let your controller / sector commander / leader know. Give them a complete sitrep letting them know; 1) the severity of the situation, 2) if you can see any other vehicles likely to be able to assist, and 3) most importantly, where the fire is.

Do I have to go there - is there a safer, better route?

DOWNHILL TECHNIQUES

(In 4WD language if you're driving downhill you are going down a decline, uphill is an incline.)

Gear Selection And Braking

Before driving downhill select the lowest gear you will need, ie - DON'T wait until you're half way down a steep decline to change to a lower gear. Remember that often hills get steeper the further you go down, so its best if unsure at all, to be in 1st low from the beginning rather than finding yourself having to try and change gears halfway down.

On a steep slope DO NOT depress the clutch to change down gears, the vehicle will freewheel while the clutch is depressed and you will pick up speed dangerously.

Come to a complete stop, then change gears. It is far better to be in too low a gear and travel down slowly rather than be in too high a gear and have a potentially dangerous situation arise.

Use engine braking and exhaust braking as much as possible and minimise the use of wheel brakes. However it is also better to use the brakes than allow the vehicle to 'run away' and pick up speed. A braking technique known as modulation is best, ask your instructor to show it to you. It mimics in some ways ABS braking. Using this technique the driver gently applies and releases, applies and releases the brakes in a gentle 'pulsing' or 'pumping' rhythm, never allowing the brakes to grip or be totally released.

Stopping On A Decline

If you must come to a stop on a **very** steep decline, apply brakes carefully and smoothly. A generally accepted 4WD practice of stopping on a steep decline is to use engine braking, (Jacobs brake) but no wheel brakes, until you are ready to stop, then apply brakes and turn the ignition off, letting the engine stall and stop the vehicle, without touching the clutch. This is followed by the application of the foot and hand brake once stopped. The object is to stop as smoothly as possible, not allowing the wheels to slide at all.

Starting on a Very Steep Decline

With Jacobs brake (exhaust brake) on, start the truck whilst in low-1st gear. The vehicle will do a slight surge and then settle into an engine and exhaust braking descent. Keep off the clutch. Brake as described in the braking section above (modulating).

Don't turn on a steep decline.

Very steep declines and inclines should be tackled SLOWLY and straight up and down.

If you brake and turn you are more likely to have the rear wheels trying to 'overtake' you - so BRAKE WHEN STRAIGHT - and turn smoothly when moving forward.

A good thing to remember in all situations is that A TURNING WHEEL WILL STEER AND BRAKE BETTER THAN A SLIDING WHEEL - so try to keep the wheels turning at all times.

Downhill Dangers

- rear end skid
- sidehill roll over

Downhill Summary

- ✓ Use engine braking
- ✓ Leave the clutch alone
- ✓ Leave the brakes alone
- ✓ Air-conditioner off
- ✓ If braking, always keep the wheels turning

Is there another way down?

UPHILL TECHNIQUE

(In 4WD language if you're driving uphill you are going up an incline)

Choose a gear that will allow you to get to the top without having to change gear. Carrying the weight of water we do means that we lose momentum very quickly. If you put the clutch in to change down a gear while on a steep incline you may find yourself going backwards if you aren't able to change quickly enough. If this happens, rather than drop the clutch and shock load the drivetrain, it is better to stop completely with brakes, re-assess the situation, then take off in 1st low.

Turn the air conditioning off before going up very steep hills. It will give you a bit more power, which you may need to make it to the top.

It is often a good idea to either walk a steep incline yourself or have an experienced crewman walk it for you to work out the best path that will get you all the way to the top. I emphasise ALL the way to the top, too often people only walk the first half of the way and glance at the rest of the track.

While driving, always monitor the track further ahead, planning the best line to take, looking for obstacles to avoid and considering wheel placement and alternatives, don't just look at the ground directly in front of you.

DON'T try to turn around while on a steep incline, if you get halfway up and cannot go any further, reverse down - don't try and turn around, you can tip over sideways.

Go straight up and come straight down steep slopes.

Summary Uphill

- ✓ Air-conditioner off
- ✓ Select lowest gear needed
- ✓ Straight up

<h2>Is there an alternative route?</h2>

ROCK CRAWLING

Try and avoid crossing bad rock fields.

Toodyay SOP of firefighting when thick bush or a rock outcrop is encountered is to wait at the edge of the dangerous area and wait for the fire to come to us. We don't chase fire into high risk areas.

If you must cross a rock field, it is better to cross it 'in the black', driving through the burnt areas so you can see the rocks you must cross over.

Driving through a rock field covered in tall grass is an extremely risky exercise (if you must cross it) and would be best attempted with a person/s on the ground a safe distance in front of the vehicle, guiding you through it. Large holes, trenches and rabbit warrens can also be hidden, so be very wary.

The basics of rock crawling begins with the most important rule: **Go slow**. The technique is to ease your way through your chosen track, thinking at all times of protecting your tires and the drivetrain. As we have diesels the vehicles have great 'lugging power' to climb, even in idle, or with very little acceleration.

Use low ratio 4WD 1st gear and only shift up gears when in the clear.

Keep your thumbs out of the center of the steering wheel. Large rocks can cause the front wheels to suddenly turn and that can jerk the steering wheel around (even with power steering) injuring or breaking thumbs or wrists.

If you can't avoid it and must climb over a large rock, put one of the front wheels directly on the rock. Don't pass over rocks by straddling them between the wheels. If you misjudge the clearance, you can damage vital underbody parts, or even the steering linkage and suspension. Put your front wheel squarely on the rock. Avoid driving up the left or right edge of the rock as your wheel may slip off to the side, tearing the sidewall of the tyre on the rock's jagged edge.

Ease up onto the rock, **DON'T TOUCH THE CLUTCH**, leave it all the way out. Use the throttle to control your progress. You can burn out the clutch **very** quickly if you use it to control your speed as you go on and off large rocks (known as riding the clutch). **DON'T USE THE CLUTCH**. Ease down gently off the face of the rock using engine compression to slow you down, leaving the clutch out. Feather the brakes gently to keep your speed even.

Avoid wheel spin when easing up onto a rock or rock step. Spinning is very hard on the tires, and if the spinning wheel suddenly grabs traction it can shock load and break parts of the drivetrain and throw the vehicle sideways off track.

Pick your line through a field of rocks strewn along a rough trail. Look far ahead down the trail, and decide exactly what track you need to take to clear all the obstacles along the path. Also look for places you can turn if need be.

The same rules apply in rock crawling as all other offroad driving, try to keep the vehicle level. A large rock can make a slight side slope into a steep side slope and tip you over if you put the wrong wheel on a large rock.

Summary Rock Crawling

- ✓ Go slow
- ✓ Drive in 'the black'
- ✓ Don't straddle large rocks
- ✓ Don't touch the clutch

...or wait for the fire to come to you

GULLIES, RUTS & LOGS

Try as much as possible in all off road driving to keep the vehicle as level as possible for better traction (and comfort). If possible, straddle ruts in the road with a wheel each side. The only time to drive in the ruts is in wet conditions to prevent skidding, or on a very steep descent it will help keep you on track.

When crossing small eroded gullies or over logs, cross over them at an angle, bringing only one wheel at a time across the obstacle - don't put both front wheels into a gully or onto a log at the same time, you could get stuck there. The only time to cross a log, gully or washout straight on is if you are on a very steep decline at the same time. The risk of rolling over is greater than the risk of getting stuck on a log or in a gully.

Gullies can vary in size from a large eroded wheel rut to a full creek bed and techniques vary.

When you need to cross a creek bed or a large washout - WALK IT FIRST. Your approach and departure angles when entering and departing a creek bed should be at 90 degrees. If it has a steep bank you may find it necessary to build a small ramp. Sometimes only a few rocks, logs or sand can make the difference between getting out easily and getting hung up.

Be wary of dry looking creek beds, they may have wet mud just below the surface and you could break through into it.

Summary, Gullies, Ruts And Logs

- ✓ Straddle ruts
- ✓ Cross small gullies and logs at an angle
- ✓ Cross small gullies and logs straight on when on a steep decline
- ✓ Enter and depart creeks and larger gullies at 90 degrees
- ✓ Road building

<h2>Can I Cross Elsewhere?</h2>

SAND

Techniques used to drive in sand will vary depending on the sand, whether it is fine or coarse, whether wet or dry and whether hot or cool, and only experience will help you vary your techniques accordingly.

The sand driving we do mostly in the Avon is unlike sand driving at the beach (there's no tide and no wet edge to follow), nor are there sand dunes like those on many off road trails to our north. Generally while fighting fires we will only experience dry, coarse hot sand in flat areas near water courses and in valleys and gulleys.

Dry, hot coarse grains of sand do not stick together and therefore do not give much grip to a turning wheel. Vehicles will often need high speed and therefore high gear selections to avoid getting bogged down.

MOMENTUM and tyre pressures are the most important things when sand driving. We will rely solely on momentum here in the Avon. Only when we go to a fire out of our area in a sandy place like Wanneroo will we need to lower tyre pressures, as we will be crossing more sand than we do in the Avon.

Driving Through Sand

Sand gives less traction and once you enter sand it is difficult, if not impossible to increase speed. If you lose momentum, you may not be able to regain it.

To keep momentum up, avoid rapid changes in speed when accelerating or braking. Keep your speed up and use higher gears. Don't spin your tires, and don't stop till you're out of the deep sand. If your wheels start to spin, ease off the throttle just a bit and allow the tires to slow down to match the vehicle speed and regain traction.

Sand driving requires plenty of engine power to get your vehicle "up on top" of the sand. Even though higher speeds may be needed STAY IN LOW RATIO for Avon Valley sand conditions, as this will multiply the amount of engine torque available and will provide you with an extra gear if you encounter a particularly soft patch of sand.

Our diesel vehicles are fitted with governors that restrict revs, preventing the engines from over-revving. So 'taking it to the governor' ("pedal to the metal") with accelerator fully depressed, will operate the engine at the maximum safe revs, giving you the maximum possible revolutions while crossing sand patches.

If you find you are losing traction and are slowing down below the speed at which you are getting good torque out of the gear you are in, and you must change into a lower gear, do so smoothly but quickly. Often the moment people get bogged is when they release the clutch after changing down a gear. Releasing the clutch and accelerating too fast, spins the wheels and digs a hole.

If you find you are struggling, coast to a stop without applying brakes, reverse and try again. Trying a new line can also be an option.

When travelling on sand, you could try to follow in the tyre tracks of the vehicle in front as they have already compressed the sand to form a firmer surface with better traction. If it appears the sand is loose and the vehicle in front has struggled and chopped up the track, it may be better to try a clean path.

Turning In Sand

Turning is one of the biggest causes of getting bogged when driving through sand. Turning should be kept to an absolute minimum, the reason being that as the sides of the front wheels are presented to the sand they act as brakes, slowing the vehicle down.

When turning, make the turn as wide as possible to reduce the chance of bogging. Remember your front wheels are driving IN the sand rather than on it, so tyres turning act like a rudder in the sand with a similar effect to applying the brakes.

The opposite is true however if you have lost almost all traction and the vehicle is barely moving. By turning the steering wheel quickly from side to side in short strokes (only 1/8th turn) will often allow the walls of the front tires to get extra grip on the sand which may just get you the last few metres you need to get out of the sandy area. This is something you would only do as a last resort to get you a last meter or two. It is a bad technique not often used because it can leave a mess of the track for other vehicles.

You must be careful to avoid bogging the wheels in the sand. It is always better to stop ON the sand to do a recovery, than get bogged 'in' it, caused by spinning wheels.

If you are losing traction, DO NOT spin the tyres when forward movement ceases. It is better to gently freewheel to a halt and to reverse over the sand track you have made behind you, making a choice then to either reverse out of the area, or to go forward again, using the previously made track as a 'launch pad'.

Stopping In Sand

Braking on sand will push sand forwards and cause a mound to build up in front of all wheels and possibly prevent the truck from taking off again. When stopping on sand, press the clutch and allow the vehicle to free wheel to a stop, trying to avoid using brakes if safe to do so. This will minimise any sand build-up in front of the wheels.

If the terrain permits, coast to a stop with the vehicle pointing downhill as this will aid take-off.

Starting In Sand

If you are stopped on soft sand, first reverse a meter or two to give yourself a runway or launch pad, then go forward. Check that your tyres are pointing straight ahead when taking off to reduce the takeoff effort required. You should take off as smoothly as possible and continue as far as possible IN A STRAIGHT LINE.

Rapid acceleration simply digs the wheels in and can actually lead to slower take-off speeds. Gear changes should also be done at higher than usual revs because the

moment you press the clutch in to change up gears, you will slow down markedly (remember you can take it to the governor).

Tyre pressure alterations

Some vehicles do carry a tyre pressure guage and some of the heavy units even have a compressor that will allow you to reinflate the tyres if you have deflated them in order to get yourself out of sand. Look in your log book for recommended deflated and inflated pressures.

Summary Sand Driving

- ✓ keep momentum up
- ✓ take it to the governor
- ✓ drive smoothly with gear changes at high revs
- ✓ ensure wheels are pointing straight ahead when taking off
- ✓ make turns as wide and gradual as possible
- ✓ follow in others tyre 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

...or - avoid the sand