**How to cross diverse terrain**

Before you set off, check your seating and hand positions.

**Seating** Be comfortable and sit in a fashion that ensures that you are not pulled away from the wheel when travelling upwards or pushed forward when descending, keep your seatbelt on and your thumbs out of the wheel spokes. Even with power steering your thumbs could get injured if the wheel kicks back-this could happen if the vehicle stalls and power steering is lost.

With regards seat belts and child seats follow all manufacturer specifications as well as the relevant *ISOFIX* standards.

**Hands** Generally a *ten-to-two* position is taught: however nowadays with the fitment of airbags one should drive in a *quarter to three* position. If the airbag deploys your arms will be protected, being outside the force of the bag. Keep windows closed almost to maximum as you do not want branches to swing into the vehicle and injure you or your passengers. This is also safe practice in the event of a roll over as all limbs will be contained within the vehicle.

**Your Line** A key skill is the ability to select or read a line and commit to it. When off-road the ability to keep your wheels in contact with the ground is paramount. Your line is the path that you select to maintain traction through the obstacle. A good line will keep your wheels on the ground and not offer resistance. This coupled to knowledge of your vehicles capabilities and dimensions will optimise your off-road experience.

**Look Before You Proceed**

If conditions allow it get out of your vehicle and survey the obstacle by walking through it to determine your entry and exit points-use your passenger as a *spotter* to guide you through difficult obstacles with hidden hazards. Walk before you proceed and take nothing for granted.
To maintain the line it may be necessary to fill ruts and *axle twisters*, rebuilding a section of road ensures that you get through the obstacle safely, this assists in maintaining the trail.

Wheel-spin is dangerous and leads to a lack of traction while damaging the environment, avoid this (decelerate).

Keep a safe distance between vehicles. Enter an obstacle when you are sure the vehicle in front of you is clear.

Avoid travelling after sunset or before sunrise, as this is when most collisions occur.

**The Stall Start** Learn the stall start and practise.

**Manual Transmission**
- Hold the vehicle on its footbrake and handbrake.
- Engage low-range reverse gear (1st gear if stalled on a descent).
- Remove your foot from the clutch.
- Release handbrake.
- Remove your foot from the brake.
- Vehicle will settle.
- Turn the ignition key.
- The vehicle will start and move back slowly.
- Check and control your rearward descent until you are in a position to stop and re-try the obstacle.

**With An Automatic Transmission**
- Hold the vehicle with its footbrake, engage handbrake.
- Select reverse-low range (1st gear if stalled on a descent).
• Start the engine.
• Release the handbrake.
• Slowly release the footbrake and reverse or descend forwards.

If You Have An Ignition That Only Operates With The Clutch Depressed
• Engage the handbrake.
• Depress the clutch and brake.
• Engage applicable gear.
• Start the engine.
• Release the handbrake, clutch and brake then reverse slowly.

In the case of a forward or rearward stall start you may have to cadence brake until engine braking takes place. If you stalled on a descent, check the front of your vehicle as there may be an obstacle that caused the stall. On an ascent one generally stalls because of insufficient momentum.

General Obstacles Encountered
Engage 4WD before an obstacle. As a rule, high range for gravel and sand, low range for rough terrain. Do not forget to lock hubs – if you have manual hubs fitted.

An obstacle is any hindrance along your route which may require 4WD. It is often a good idea to avoid really bad obstacles when travelling so as to ensure that you do not damage your vehicle.
**Water** Avoid water and mud. If you can’t, the following tips should help you. Before entering the water, *wading sheets* should be fitted across the grille. A silicone spray can be applied to critical electric components to *water-proof* them, use a water repelling spray.

Do not wear seatbelts when crossing water as you may need to get out of the vehicle in a hurry if things go wrong. In the case of a short, deep crossing, it is wise to open windows as well. However, when crossing long stretches of shallow water, close the windows and turn on the air conditioning to a high speed, this builds up a cabin ‘pressure’ which helps prevent water seeping in.

Lubricant expands in hot transmissions and differentials. When water cools the lubricant, it contracts causing a vacuum which can suck water into a differential/transfer case through the breather pipe. Check the location of your breathers as it may possible to re-route them. On your return from a trip change transmission and differential oils.

- Check depth and strength of flow by wading the crossing, if there are animals in the water and you have to get through, have a spotter on the bonnet of a suitable vehicle and drive through. The spotter can probe the river bed using a long stick, checking for ruts, hidden obstacles and available traction.
- Enter water and mud slowly in low-range. Do not splash water over your bonnet as this could go into the engine compartment and affect the electrics. Aim for a predetermined exit point, keep engine revs low and do not spin your wheels.
- Keep a steady momentum which ensures a bow wave in front of your vehicle.
- If you run into an obstacle, switch the engine off before stalling.
- Evaluate the cause, if necessary recover the vehicle to dry land for analysis.
- Check the air filter to see if it is wet.
- Check oil to see if water has been sucked in the engine (a milky white residue indicates the presence of water).
- Do not restart the engine until the appropriate repairs have taken place.
- Once safely through the obstacle, check the vehicle for damage.
Mud And Soft Turf
• You should be in low range 4-WD with differential/s locked.
• Select an appropriate gear, 1st gear will often cause wheel – spin and you could bog down.
• Choose the line of least resistance, if there is an existing track use it!
• Maintain a steady momentum and know the position of your wheels so as not to push against mud.
• Decelerate if necessary to control wheel-spin.
• If you feel a loss in traction, your tread may be clogged.
  Move the steering wheel left to right to clear the tread. Use your tyres sidewall against the wall of the track for additional traction.
• Be careful of hidden obstacles buried in mud.
• Avoid building up a wall of mud in front of the valance as you could get stuck.
• If in doubt, attach recovery equipment either to the front or to the rear of your vehicle before going into the mud.

As soon as possible check your radiator. Mud clogs up its core which could affect its cooling. Check rims as dry mud will affect wheel balance when on tar again.

Ascents And Descents
Establish your line before tackling an ascent or descent on a slope. Gradient and traction are critical here. Tackle the slope head-on to keep the vehicle level. If you go diagonally, your vehicle's centre of gravity comes into play. With a lack of traction the vehicle could slide or roll over.

Ascents
• Check the terrain to establish your approach using your spotter, if it is smooth and not too steep, use gentle momentum.
• If it is rutted, potholed and rocky a low gear and less momentum should do the trick.
• Avoid bounce especially with independent suspension: this will cause a loss of traction.
• Be cautious when using 1st gear low-range on smoother surfaces as you may get wheel spin.
• Avoid gear changes and the momentary loss of traction.
• As you approach the crest, decelerate to avoid wheel spin and bounce.

Descents
• Check your line using your spotter.
• Select the lowest gear to ensure a controlled descent. Avoid using the brake or clutch.
• Disengage the handbrake and release the clutch. Use engine braking/compression in a descent for control.
• If you start to run away, cadence brake to slow you down without sliding.
• Do not use your brake in a slide as this worsens the slide, rather accelerate to bring the vehicle under control.
• Do not change gears as the loss of grip coupled with forward momentum, could be disastrous.

Side Slopes
When off-road, you may be forced to traverse terrain diagonally.
• Get out and evaluate the slope to establish your line.
• Is the surface slippery?
• Are there obstacles that may impede momentum such as ruts or rocks?
• A momentary drop into a hole or rut radically increases lean.
• Ensure sure your load and loose items are secure.
• Use your spotter to guide you and check wheel position.
• If the vehicle slides or feels as if it is going to roll, steer down the slope, accelerating slightly. This will reduce the risk of a roll over.

Rocks Beds Prevalent in mountain routes, dry river beds or river crossings. It is important that you know your vehicles clearances and the position of components under your vehicle.
• Slight deflation may be necessary as the tyre will grip better but you will lose clearance so rather start at road pressures.
• Check your line and use your spotter.
• Put a wheel on a rock to gain height. Proceed slowly in 1st gear low range, with sufficient acceleration to maintain momentum. This raises the vehicle, adding clearance to the undercarriage. This is very important with vehicles with independent suspension
• Don’t straddle rocks. This may leave you hung up on the chassis or a differential, and cause damage.
• Tyres sidewalls could easily be sliced by sharp rocks, a slightly deflated sidewall is more puncture resistant.

Snow And Ice 4x4s have double the traction of passenger cars, giving more grip. Braking is the same, except you are heavier so your stopping distance will be greater. That means that you have to watch your speed.
• Select 1st gear high range.
• Engage centre diff lock if vehicle is a full time 4x4.
• Pull away slowly and brake carefully to avoid lock-up.
• Be aware of hidden obstacles under snow.
• Do not push up a wall of snow in front of your bumper/valance.
• Fit snow chains if possible.
• Ensure that you have recovery equipment.
• In light snow, your tyres will break through the surface and compact it, but be wary of ice underneath.
• If others have driven the route before you be careful of sticking to their tracks as they may be slippery, if so move out of them onto fresh snow.
• Snow off-road is safer as there is more traction as the surface is not tarred.
• An on foot inspection by your spotter, probing the snow in much the same way as water is still required.
• Wheel-hub height is a safe depth to tackle.

Ruts And Erosion Rough tracks often deteriorate into gullies due to water erosion. Driving in the ruts will scrape your under body and could see you getting stuck.
• Power out of the rut and straddle it.
• If alone, wind window down to observe progress.
• Adjust side mirrors down to observe progress of rear wheels.

Sand And Dunes
• High range is more suited to sand as it allows the correct momentum which gives flotation. As always you need to read the line, and check if the sand is dry, damp or wet.
• Dry sand disperses quickly and is difficult to get through.
• Damp sand offers the most traction. Sand is generally damp early in the morning and later in the afternoon or after rain. It binds together which allows better flotation.
• Wet sand has a shimmer, avoid these patches as they are dangerous.
• Salt flats can be treacherous, breaking through the crust can bog you down.
• Small dunes tend to be weak and are best avoided.
• Larger dunes allow sufficient space to attack them correctly, learn the technique to crest a dune and decelerate before going over, momentum and gearing are critical.
• On sickle dunes, stop before going over the crest as there is no back face.
• Deflation (± 50% of the recommended pressure for tar) and gear selection is key to flotation.
• Select a gear that you feel comfortable with. Some drivers use with 1st gear high range, others prefer low range 2nd or 3rd gear, but avoid wheelspin. Changing gears while driving will break your momentum.
• Follow existing tracks, when stopping simply decelerate. Braking will dig you in.
• Be aware of other vehicles and pedestrians.
• If you are following existing tracks and need to leave them, aim in the direction of travel and accelerate to ‘power out’ of the tracks.

Ditches Dongas and Sand Ridges
Cross obstacles at an angle, one wheel at a time. This increases the clearance of the vehicle, at all time try to avoid cross lifting your wheels.
• Enter the obstacle slowly, using engine compression in 1st gear low range to have control and stability.
• Crossing a sand ridge or donga head on may cause you to foul your undercarriage, or damage the rear end as which is generally longer than the front of your vehicle.
• Be aware of your break over angle, ground clearance and wheelbase. A long wheelbase vehicle requires careful driving.
Gravel Roads  Many 4x4 accidents happen here due to poor driving resulting in costly insurance claims or injuries. Corrugations on gravel roads are formed by vehicles that regularly use the road, when driving, find a comfortable speed.

• Watch your front wheel for a moment, you may feel comfortable but your wheels and suspension are really working and not always in contact with the ground.
• Due to the varying surface, braking capacity is diminished.
• Steering precision is also affected.
• On gravel, extra traction is required, use 4WD or AWD.
• Dangers areas are along the verges where sand accumulates as well as drop offs, if you go around a corner and your front or rear wheels leave the stable surface and slide – you could roll your vehicle.
• Be careful of erosion ruts along the sides of gravel roads, dropping a wheel into a rut could have serious consequences.
• Speed, hard braking and aggressive steering should always be avoided.
• Avoid driving on gravel roads at night.
• In poor visibility, put your headlights on and slow down.
• Avoid moving to the right side of the road as there may be oncoming traffic.
• Keep a safe following distance when in convoy or when vehicles are in front of you. Flying stones could damage your vehicle.
• Be aware of the surface at all time, many gravel roads have marble like stones which reduce traction.
• If travelling for long periods on gravel you can reduce tyre pressure (10% of road pressure).
Driving In A Convoy From a safety and security perspective it is wise to travel in a group. Vehicles following one another is known as a convoy and need to follow these guidelines:
• Brief the group before departing, set communication protocols.
• Vehicles with essential equipment should be placed at equal intervals (29MHz radios, Satellite phones, recovery kits, first aid kits and fire extinguishers).
• Avoid travel after sunset and before sunrise.
• The last vehicle must be a competent off-roader to ensure that all convoy members complete the route.
• Avoid obstacles that some vehicles may not be able to traverse.
• Only enter obstacles once the preceding vehicle is clear.
• Ensure the vehicle behind you is following.
• Keep a safe following distance as the vehicle in front of you may need to stop or back up.
Pre and Post Trip Inspections
• Maintain the manufacturers servicing schedule!
• Use specified lubricants.
• Use the correct fuel and ascertain availability before departing.
• Inspect key components regularly.
• Maintain correct tyre pressure, do not forget to re-inflate tyres once back on tar or gravel.
• Check the condition of your tyres and take a repair kit.
• Know the vehicle’s coolant, fuel and lubricant capacities.
• Do not exceed the vehicles rated capacities.
• Follow the *walk of life* principles!

Tools and Spares
• Carry a full set of spanners and sockets, a mix of screwdrivers, pliers and wrenches.
• Wheel spanner, jack and jack crank.
• Bulbs and fuses.
• Belts and radiator hoses.
• Repair manual.
• Duct tape.
• Epoxy glue.
• Cable ties.
• Allen keys.
• Pre drilled steel bars (selection).
• Radiator seed net.
• Fire extinguisher and warning triangle
• Wading sheet.
• Recovery kit.
• Collapsible hiking pole to check mud and water depth.
• Carry at least two spades, both with rounded noses and short handles.
• An air jack works well in water and mud and can help in a variety of situations.
• A comprehensive first aid kit is a vital, it should contain scalpels drips and Intra-veinous lines. A kit like this should come with prescriptions that will allow you to cross borders.

Check The Following Items
• Radiator core is not blocked with grass or mud as it affects cooling.
• Grass caught up around the prop shaft, exhaust and catalytic converter could cause a fire when you stop.

Attend 4x4 driving, first aid and recovery courses before going off-road.

Get a 4x4 insurance policy that provides adequate cover when travelling outside South Africa.