

TILE – Theory Module 2

Learner guide

January 2024



Government of South Australia
Department for Infrastructure
and Transport

Build.
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We acknowledge the Traditional Custodians of the Country throughout South Australia and recognise their continuing connection to land and waters. We pay our respects to the diversity of cultures, significance of contributions and to Elders past, present and emerging.



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Purpose

This document is for the express purpose of instruction for future drivers of Heavy Combination Vehicles, who are undertaking Training in Lieu of Experience (TILE). This resource includes definitions and knowledge required by heavy vehicle licence applicants.





The information contained within this document may change without notice and it is advised the user regularly check with SA Department of Infrastructure and Transport's website for currency of information.

Completing these courses is directly related to the requirements of industry. Some of the terms and road rules contained in this module may have been covered previously.

Refer to the South Australian licensing website for further information about your Heavy Vehicle license by clicking [here](#).

Creating safer and more knowledgeable transport drivers.

Truck terms, interpretations, and definitions

Description	Example
<p>Agricultural implement</p> <p>A vehicle without its own automotive power, built to perform agricultural tasks.</p>	<p><i>Example:</i> Hay baler</p>  <p><i>(Courtesy New</i></p>
<p>Agricultural Machine</p> <p>A machine with its own automotive power, built to perform agricultural tasks.</p>	<p><i>Example:</i> Combine harvester (header)</p>  <p><i>(Courtesy Claas)</i></p>
<p>Air bag suspension</p> <p>Instead of the weight of a vehicle being supported by springs, it is supported by air bags containing compressed air.</p>	 <p><i>(Courtesy: WordPress.com)</i></p>
<p>Angel gear</p> <p>The term used to describe coasting down a hill in neutral, preceding disaster. Impossible to recover in a non-synchromesh transmission without stopping first.</p>	 <p><i>(Courtesy NewsBeezer)</i></p>

Articulated vehicle –

A vehicle being a prime mover towing one semi-trailer.



(Courtesy Flickr)

B-Double

An articulated vehicle with a second trailer (**B** trailer) Connected to the first semi-trailer (**A** trailer) by a turntable.



(Courtesy Southern Cross Truck Rentals)

B-triple

Essentially a **B-Double** with an additional **A** trailer. This is also a type 1 Road Train being less than or equal to 36.5 metres.



(Courtesy GKR Transport)

Belly dumper

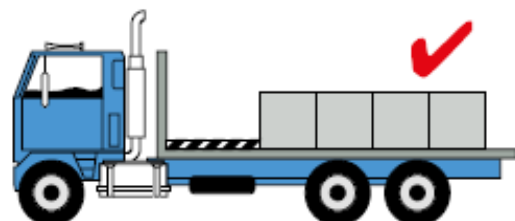
A container that is fitted with bulk discharge doors at the base and is either open top or fitted with roof hatches. Used for any loose bulk commodity (grain, coal etc)



(Courtesy Graham Lusty Trailers)

Block

A solid object, often a large piece of timber placed against the load and fixed securely to the vehicle to prevent movement of the load.



<p>Bolster</p> <p>A piece of steel or heavy timber firmly attached to the vehicle (often bolted to the chassis) to support the load and/or prevent it moving.</p>	 <p>(Courtesy Forest Centre)</p>
<p>Bus</p> <p>A vehicle used for carrying passengers and designed to carry 13 or more seated persons (including the driver).</p>	
<p>Cap tarpaulin</p> <p>A tarpaulin designed to keep freight dry and clean, which is fitted over the top of the load and reaches about halfway down the gates.</p>	 <p>(Courtesy Ellis & Sons Group)</p>
<p>Chassis</p> <p>The vehicle frame.</p>	 <p>(Courtesy Science and Education Publishing)</p>
<p>Chocks</p> <p>Suitable blocks used to restrain loads which could move during transit. Chocks may also be used ahead or behind road wheels to prevent movement of the vehicle.</p>	

Clearance lamp

A lamp when lighted provides an indication of the width or height of a motor vehicle together with any load or equipment either from the front, side, or rear of the vehicle.



(Courtesy Truckaus)

Clutch brake

A device located on the transmission input shaft in a non-synchromesh transmission. It retards the rotating masses of the clutch assembly and transmission gears to enable the selection of the initial gear. It is activated by the last 2cm of clutch pedal travel to the floor and takes a few seconds to fully operate.

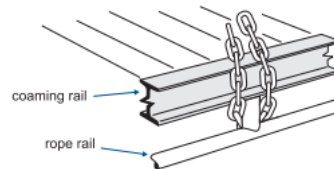


The clutch brake is the small disc shown to the left of the clutch assembly.

(Courtesy Meritor clutch kit – Transport Diesel and Marine)

Coaming rail

A frame border around the outside of a vehicle's loading deck. A device used for tensioning and lashing.



Combination vehicle

A rigid truck or bus towing one or more trailers



(Courtesy: Trailer Sales Pty Ltd)

Converter dolly

A unit designed to convert a semi-trailer to a steerable dog trailer. It includes a fifth wheel assembly, a draw bar, and an axle group.



(Courtesy: Construction Sales)

Day cab

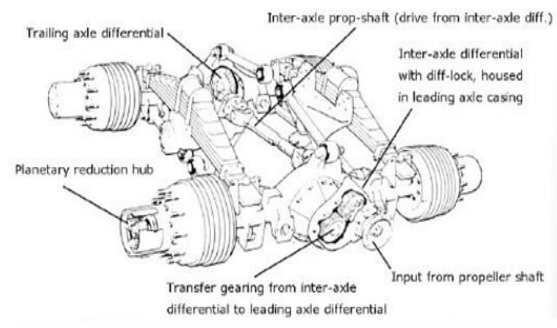
A body style fitted with seats but no sleeping compartment and having a good all-round view for the driver. Mainly used for local area work. Driving with no trailers attached is referred to as driving “bobtail.”



(Courtesy: Stillwell trucks)

Differential lock

Locks the drive wheels so each wheel group receives the same amount of torque. May be fitted to the front axle, the rear axle or both. Must only be used when travelling straight head and in slippery conditions at speeds not greater than 40 km/h because steering may be badly affected. Must be de-activated as soon as it is no longer needed.



(Courtesy: Benz Actros)

Dog trailer

A trailer with two axle groups, of which the front axle group is steered by connection to the towing vehicle. On some vehicles the turntable can be locked to aid in reversing.

A super dog has 3 axles, and a quad dog has 4 axles.

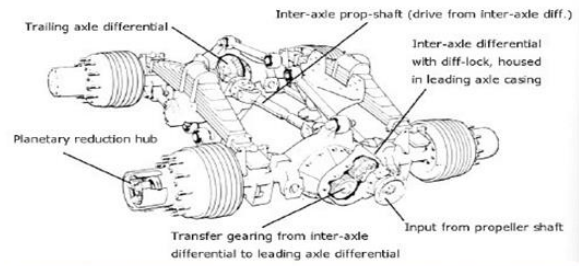


(Courtesy: Grays Online)

<p>Fifth wheel – see <i>Turntable</i>.</p>	
<p>Flat top</p> <p>A rigid truck or semi-trailer has a flat goods carrying area. This can easily be used for carrying pallets, machinery, or any general freight.</p>	 <p>(Courtesy: Transport spares and equipment)</p>
<p>Forward control vehicle</p> <p>A truck with the cab mounted over the engine, also called a 'cab-over' vehicle. This has the advantage of a shorter overall cab length allowing for a greater load area.</p>	  <p>(Courtesy Isuzu)</p>
<p>Gates</p> <p>Panels (usually tubular sections) fitted to the sides of a tray of a flat top to contain (not restrain) the load.</p>	 <p>(Courtesy: Gates for Trucks & Trailers)</p>
<p>Hub-odometer</p> <p>A measuring device mounted centrally on the end of an axle of a vehicle, and which converts axle revolutions to actual distance covered.</p>	 <p>(Courtesy: Veeder)</p>

Inter axle lock (also referred to as a 'power divider')

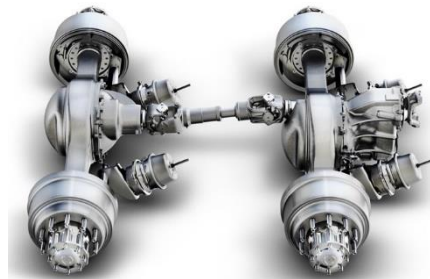
Locks up the inter-axle differential front to rear, so drive is shared equally by both driven axles in slippery conditions. It may be used at all speeds and for long time periods in conditions such as rain, snow, or gravel roads. Should be engaged first when entering poor traction conditions. As conditions worsen the diff lock can then be engaged. With both locks engaged the road speed must be kept below 40 km/h. Ensure there is no loss of traction or wheel spin is happening as either lock is being engaged. The method for engagement is the same as for 'splitting' half gears up (*explain*).



(Courtesy: Benz Actros)

Jack shaft

A short drive shaft connecting and transmitting power from one drive axle to another.



(Courtesy: Detroit Diesel Corporation)

King pin

The pin fitted to the skid plate of an articulated trailer, which locks into the turntable jaws and so attaches the articulated trailer to the prime mover.







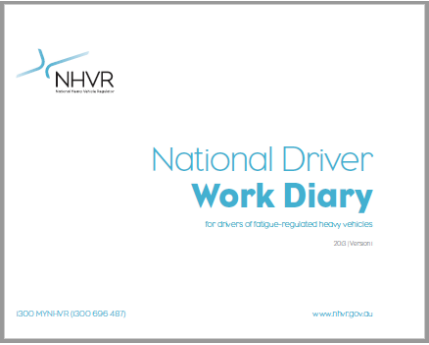
(Courtesy: WordPress.com)

Landing gear

The pair of retractable legs near the front of a semi-trailer which are used for support when uncoupled from a prime mover. Operated by handle and a two-speed crank, but sometimes by an electric motor. Note how the handle is out and the feet are slightly off the ground. This trailer is in the process of being coupled.



(Courtesy: Heavy Vehicles)

<p>Lazy axle</p> <p>An axle that is part of an axle group, but which is not driven. Some are designed to be retracted when not in use. Note the design of centre hub.</p>	 <p>(Courtesy: National Truck Wholesalers Pty Ltd)</p>
<p>Line-haul</p> <p>Part of the transport journey, which involves direct running between terminals with no loading or unloading along the journey.</p>	 <p>(Courtesy: Geoffrey's Transport)</p>
<p>Loading agent</p> <p>A business arranges to have customers' loads picked up and delivered but does not handle the goods on road.</p>	 <p>(Courtesy: OOG Logistics)</p>
<p>Low loader</p> <p>Gooseneck design trailer used for oversized / over mass loads, often including a low loader dolly for mass distribution. Referred to as a 'float.'</p>	 <p>(Courtesy: Midland Industries)</p>
<p>National Driver Work Diary</p> <p>A record of the driver's work and rest hours showing compliance with Heavy Vehicle National Law.</p>	

Owner-driver

A road transport operator who owns (leases, owns, or is buying) one or more trucks.



(Courtesy: Schneider Transport)

Pantehnicon, Pantech, or pan.

A completely enclosed compartment on a rigid vehicle, semi-trailer, or trailer. Note the diesel-powered refrigeration unit at the front. These types of insulated and refrigerated trailers are known as 'reefers.'



(Courtesy: Gray's Online)

Point of articulation

Means the axis of rotation of a turntable or a fifth wheel assembly. It is where the king pin is secured on the turntable.



(Courtesy: Ebay)

Power divider

See Inter-Axle lock.

Prime contractor

A transport company who enters into an agreement (contract) with a large organisation to provide freight services (also see "sub-contractor").



(Courtesy: Centurion)






Prime mover

A rigid vehicle used to tow a semi-trailer. This combination is then known as an articulated vehicle.



(Courtesy: Grays online)

<p>Public road</p> <p>A road any person, body, or authority is under any statutory duty to maintain, except such a road that is included in, or forms part of, a place or premises set apart or established for the parking of vehicles.</p>	
<p>Pyrometer or EGT gauge</p> <p>A temperature gauge measures the temperature of the engine exhaust gases.</p>	
<p>Rigid Motor Vehicle</p> <p>A vehicle having a frame that is a single unit.</p>	 <p>(Courtesy: Brigade electronics)</p>
<p>Ring feeder</p> <p>The common term for an automatic tow coupling by which a trailer is attached to the towing vehicle as the drawbar eye touches the spring-loaded towing pin.</p>	 <p>(Courtesy: Evans Clarke National)</p>
<p>Road train</p> <p>A rigid motor vehicle towing two or more trailers, or an articulated vehicle towing one or more trailers, and which is not a B-double. The standard configuration is prime mover, semi-trailer, converter dolly, semi-trailer, converter dolly, semi-trailer.</p>	 <p>(Courtesy: Bruce Avery Transport)</p>

<p>Rope rail</p> <p>Usually made of pipe and fitted under the coaming rail. Used for attaching ropes, chains, and hooks to secure loads.</p>	 <p>(Courtesy: Adams and Currie)</p>
<p>RPM</p> <p>Revolutions per minute is the rotational speed of an engine. Note operating range.</p>	 <p>(Courtesy: djtruckparts.com)</p>
<p>Semi-trailer</p> <p>A trailer with one axle group at the rear of the unit and supported at the front by a prime mover, which also tows it. Note the position of the landing gear.</p>	 <p>Courtesy: www.semetrailersales.com.au</p>
<p>Shipping container</p> <p>Steel box used for the transportation of goods in bulk. Usually fitted with receptacles for twist locks in each corner and provision on the base for forklift handling</p>	 <p>(Courtesy: Royal Wolf)</p>
<p>Skel trailer</p> <p>A skeletal trailer (or semi-trailer that has no tray), but has attachments fitted to the frame for carrying goods such as logs. It is also commonly used for carrying containers.</p>	 <p>(Courtesy: Trailer Sales Pty Ltd)</p>

Sleeper box

A separate sleeping compartment fitted behind the cabin. The trend is to integrate sleepers rather than separate units such as this.



(Courtesy: Kenworth Trucks)

Sleeper cab motor vehicle

A commercial motor vehicle as described in the Certificate of Registration of that motor vehicle and issued under the law of any State or Territory of the Commonwealth, as a vehicle fitted with an approved sleeper-cab



(Courtesy: Freightliner Trucks)

Speed limiter

A device that limits the top speed of a truck without limiting engine revs or power in the lower gears.



(Courtesy: SABO)

Spider hub

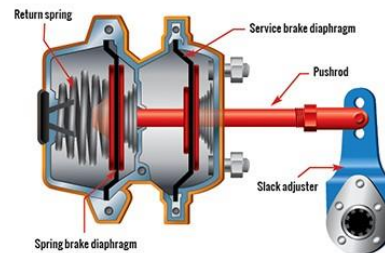
The cast spokes of a wheel upon which the rim is mounted. Shown is the rim and tyre in the process of being removed from the hub. The nuts were all loosened but not completely removed and the cleats (wedges) had the tension removed by a sharp tap with the wheel brace. After confirming they were all loose, the nuts and cleats are being **safely** removed



(Courtesy: Trade Trucks)

Spring brake

A brake that is mechanically applied by a spring and released by air pressure compressing the spring. The brake automatically applies itself if air pressure is lost, it is a fail-safe system. Spring brakes, used for parking, are also called Maxi-brakes, as in “apply the maxis.”



Sub-contractor

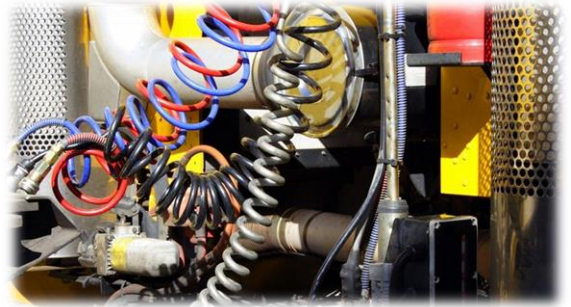
A transport operator (driver) who enters into an agreement with a prime contractor (transport company) to provide freight services (also see “prime contractor”).



Suzi coils

Air brake Suzi coils are:

- Heavy duty nylon hoses
- Supply air between each vehicle for the operation of the brakes.
- Self-supporting due to their design.
- Included is a coiled electrical lead.
 - Red line is for supply and emergency fail-safe application.
 - Fills the air tanks on the trailer and holds the brakes in the released position.
 - If the air supply is lost for whatever reason, the brakes will automatically apply to the maximum.
 - Blue line controls the brakes by varying the air pressure in the system. Both lines are fitted with either a male or female fitting so they cannot be connected incorrectly and are supported on the prime mover by a flexible “pogo stick” shown to the right








(Courtesy: Hose Bargains)

Tail shaft

The shaft transmits drive from the transmission to the drive wheels (also known as a drive shaft or propeller shaft). Note exploded image of yoke and universal joint.



(Courtesy: Driveline Service of Portland)

<p>Tandem drive (Bogie)</p> <p>A group of two axles in tandem, both of which are driven. The drive is commonly transmitted from one axle to another by means of a jack shaft.</p>	
<p>Tare</p> <p>The mass of a vehicle without the load. Also referred to as the unladen mass,</p>	 <p>(Courtesy: NHVR)</p>
<p>Taut liner</p> <p>A Pantechicon having sliding curtain sides that are pulled tight by a ratchet mechanism and then held down along the sides by straps attached to the combing rail</p>	 <p>(Courtesy: Websell.net.au)</p>
<p>Tow operator</p> <p>A road transport operator who provides a prime mover only and who tows trailers provided by a prime contractor or freight forwarder. This is described as an owner-driver.</p>	 <p>(Courtesy: Truck, Bus & Forklift)</p>
<p>Trailer</p> <p>A vehicle without engine power constructed to be towed behind a motor vehicle.</p>	 <p>(Courtesy: NYK Group)</p>

Turntable

A coupling device used to attach a semi-trailer to a prime mover or converter dolly.



(Courtesy: D'Angelo)

Turntable jaws

The parts of the turntable that lock around the semi-trailer pin.



(Courtesy YouTube)

Twin steer axle group

A combination of two single tyred axles fitted at the front of a heavy vehicle and connected to the same steering mechanism, allowing for a greater GVM.



(Courtesy Prime Mover Magazine)

Twist lock

A device welded to the frame of a rigid truck or trailer and used to attach a freight container securely to the vehicle. One twist lock is used on each corner of the container.



(Courtesy: Utrailerparts)

Turnbuckle –

A device used to tension chains used in securing loads on trucks or trailers. The diagram on the left is of two types of ratchet turnbuckle tensioners. The other diagram is of an over-centre style load binder (a dog) with an extension (cheater bar).

A cheater bar should **not** be used to gain extra tension. This practice is extremely dangerous because the cheater bar can rebound quickly during tightening and releasing and may even fly into the air taking your face with it.



(Courtesy: Workcover QLD)

Wide tyre

A tyre with a section width of at least 375mm. Note the dual tyres in the foreground for comparison.



(Courtesy: Best Truck Companies)

Vehicle check list

Checking your vehicle for roadworthiness and safety are required to ensure you are safe as the driver and to meet all compliance laws and National Heavy Vehicle licensing laws.

Refer to [National Heavy Vehicle Inspection Manual](#) for more information.

Access the [Heavy Vehicle Inspection Checklist](#) and the [Heavy Trailer Inspection Checklist](#).

An example of a daily check sheet can be found [here](#). To maintain compliance, all requirements must be followed, and this includes record storage.

Prior to starting any trip complete the following **checks**.

Area	Check
Pre-start under cab	Engine oil
	Engine coolant and hoses
	Power steering fluid
	Drive belts
	Windscreen washer reservoir
Pre-start outside cab	Registration
	Appropriate signage on truck and trailer
	Leaks under vehicle <ul style="list-style-type: none"> • Transmission • Differential • Engine • Radiator • Power steering • Wheel seals • Hub bearings • Fuel tanks • Fuel lines
	Wheel bearings
	Tyre pressure and wheel nuts
	Prop shaft and universal joints
	Turntable adjustment and coupling
	Air tanks
	Mirrors and windscreen clean, unbroken, and secure

OFFICIAL

	Load security
	Secure vehicle equipment (toolbox, steps, mud flaps, fuel caps etc)
	Load securing devices (Tarps, ropes, chains) are safely stored
	Suspension and vehicle posture
	Air lines and electrical lead
	Windscreen wipers, horns, lights, indicators, reflectors
	Battery security and fluid levels
	Previous damage recorded
Pre-start procedure	Check maxi brake applied
	Check transmission in neutral
	Adjust seating position
	Adjust mirrors
	Locate instruments and controls
	Fasten and adjust seat belt
Start-up procedure	Recheck maxi brake applied
	Depress clutch (except air assisted clutches when air is low)
	Select neutral
	Check air conditioner, radios and other accessories are switched off.
	Turn ignition to on position and check gauges (allow for engine check on computerised engines)
	Start up and allow motor to idle. (start up without throttle for computerised engines)
	Release clutch slowly
	Check all gauges
Pre-drive inspection	Check air tanks are drained of moisture
	Check air brake couplings and lines for leaks (this must be done when air system is fully charged)
	Ensure exit is clear
	Re-enter cab
	Check brake pedal and trailer brakes (Tug test)
	Move off slowly.

Note: Promptly report any defect or noise, as early as possible, to the company mechanic or your supervisor to prevent the problem becoming worse.

Wheel (tyre) changing

Changing a truck tyre is a valuable skill to learn. In many instances you will not be able to change the tyre and you will need to call in a mechanic with specific skills. Remember your tyres need to have a tread depth of 1.5 mm across 75% of the service.

Big trucks have big tires that require **heavy-duty tools**. To manage the truck's weight, take proper safety precautions by parking it on a flat and stable surface, away from other traffic.

Remember to check tyre pressures at least once per month while they are cold.

Spider is the **cast spoke hub** of a wheel upon which a rim is mounted. They are known as demountable rims as they have no centre. The rims are mounted onto the vehicle via a (Spider) spoked hub on an axle.

The **wheel hub** assembly keeps your wheels attached to your vehicle and allows the wheels to freely turn, enabling the driver to safely steer. A pair of tyres need to be compatible to minimise tyre wear.

To change a truck tyre you will need:

- Truck-sized wrench (anything smaller is useless)
- Hydraulic bottle jack or lifting platform
- Pneumatic impact gun – if wrench fails
- Mount/dismount bars
- Air compressor
- Bead hammers or club hammers

Note: Get chunks of concrete to chock other tyres. This stops them from moving during your tyre change. It can happen.

To change a tyre you will:

1. Chock front and back of tyre **opposite** the one you are going to change to prevent any movement.
2. Lift vehicle off the ground with a suitable jack to take weight off tyre – taking ALL safety precautions.
3. Loosen the lug nuts and wedges ready to take wheel off the hub.

4. Raise vehicle fully.
5. Remove nuts and place in a safe space
6. Lift wheel up and remove
7. Position spacers and valves and align new wheel on hub for retightening
8. Tighten wheel nuts and align

In many transport company yards today, specialised tyre fitters are employed to keep an eye on the fleet's tyres. The tyres are then replaced when required, however, if you get a tyre issue where it is impossible to get assistance, knowing how to change the tyre will be helpful.

Coupling

Coupling is the function of connecting the trailer to the tractor or the power to the payload.

Before coupling the semi-trailer, the driver must make sure a complete check of the equipment has been carried out.

1. Inspect the surface of the 5th wheel for proper greasing (or if the grease insert is in good condition)
2. Check the trailer spring brakes are on to avoid possibility of trailer moving.
3. If there is ANY doubt about the brakes on the trailer, CHOCK the rear wheels to prevent any movement.

The trailer is ready to be coupled.

Modern trailers are fitted with spring brake actuators, so it is highly unlikely you will encounter this issue.

Note: Chocking trailer wheels is compulsory on some work sites and may be required when rear-loading is performed off a dock.

This is an example showing the two separate compartments with the compression spring on the right and the diaphragm service brake on the left.



(Courtesy: Fleet Watch)

4. Reverse prime mover:

- a. Use mirrors to line up outside edge of the mudguards with the sides of the semi-trailer.
- b. Stop when the tops of rear guards are in line with front of semi-trailer, so the turntable does not go too far back.
- c. Once in position apply Park Brake and lower the airbags.
- d. Exit the prime mover and check for alignment of turntable and king pin.
- e. Check jaws are open
- f. Check the clearance between bottom of semi-trailer and turntable.

Note: NEVER step under a semi-trailer that does not have the safety of a prime mover ready to support the trailer should the legs collapse or sink into the ground.

5. Return to the prime mover.

- a. Disengage the park brake.
- b. Reverse so the top of the front mudguards are in line with the front of the semi-trailer.
- c. Apply park brake.
- d. Check the turntable is under the skid plate.
- e. Check kingpin is within the 'V' of the turntable.
- f. Return to prime mover.
- g. Adjust position as required.
- h. Raise airbags.
- i. Apply park brake and exit vehicle.

6. Once airbags are fully raised (with no gap between the skid plate and turntable)

- a. Wind the legs up approximately 1-2 cm so the weight of the semi-trailer is taken by the turntable.
- b. This will allow the prime mover to move if required during coupling.
- c. Return to the prime mover.
- d. **Disengage** park brake.
- e. Reverse **slowly** until turntable locks onto the kingpin.
- f. Engage 1st gear and attempt to move forward.
This is called the **tug test** and checks the semi-trailer is actually connected.
- g. Apply park brake.

7. Exit vehicle.

- a. Check locking lever is locked away.
- b. Check jaws are locked – use a torch if needed.
- c. Wind up legs until fully raised.
- d. Stow handle.
- e. Connect airlines, ensure they are open.
- f. Connect electrical lead.

8. Return to cab.

- a. Supply air to the semi-trailer – in new vehicles this is a red 8-sided dial.
- b. Turn on headlights.
- c. Check all lights are clean, clear, and functional.
- d. Perform general roadworthy check.

9. Return to prime mover.

- a. Engage 1st gear.
- b. Hold trailer brake handpiece on.
- c. Release park brake
- d. Perform a secondary '**tug test.**'
- e. Release trailer brake handpiece
- f. Move forward 1 metre then,
- g. Gently apply trailer brakes to stop.
- h. Apply park brake.

For prime movers fitted with **springs** rather than **air bags**, ensure there is **clearance** between the top of the turntable and the bottom of the semi-trailer.



(Courtesy: Toowoomba Chronicle)

Uncoupling

1. Check the trailer is positioned on firm and level ground.
 - a. To make uncoupling easier **reverse park** the trailer.
 - b. This **releases pressure on the turntable jaws** making them easier to open.
 - c. **Apply the park brake.**
 - d. **Isolate the air supply** to the trailer by the appropriate controls.
 - e. **Exit** vehicle.
 - f. **Disconnect air lines.**
 - g. **Disconnect electrical lead.**
 - h. Stow all lines securely.

Avoid contaminants entering the airlines by joining them together or connecting them to dummy fittings.
 - i. **Wind down legs**, checking they are moving at the same rate.
 - j. After **legs** have **made contact with ground** continue to wind until **air is heard escaping from suspension.**
 - k. **Open turntable jaws** by firmly pulling the handle then locking in place.
 - l. **Return** to prime mover.
 - m. **Select first gear** and **release park brake.**
 - n. **Move forward** slowly by no more than 30 cm.
 - o. **Stop.**
 - p. **Apply park brake.**
 - q. **Select neutral** then lower airbags.
 - r. **Exit** vehicle.
 - s. **Check turntable is clear** of skid plate and kingpin.
 - t. **Ensure lines** are **not caught** around any part of the semi-trailer.
 - u. **Return** to prime mover.
 - v. **Select 1st gear.**
 - w. **Release park brake.**
 - x. **Drive forward** until rear mudguards are in front of the semi-trailer.
 - y. **Raise the airbags.**

z. Once airbags are fully raised prepare to drive away.

If the prime mover is fitted with springs rather than air bags at the rear, the semi-trailer will need to be raised above the turntable by winding the legs down further until the gap can be seen between the bottom of the trailer and the top of the turntable.

Note: The procedure could change depending on the vehicle equipment or the actual vehicle configuration. The main emphasis must be placed on **safety**. If you are **distracted** at any time during the coupling or uncoupling process, systematically **double check** the steps to ensure you follow the procedure. **NEVER TAKE SHORT CUTS.**

Note: Trailers with a block, mounted behind the kingpin, are suitable for coupling to a ball race turntable only.



(Courtesy: Trucksales.com.au)

Fault diagnosis

Following are suggestions for problems you may encounter.

1. Noise coming from transmission check the following:
 - Tail shaft/shafts bent or damaged.
 - Universal joints worn.
 - Gearbox bearings, pinion bearing (Front) or rear gearbox bearing.
 - Low oil level.
 - Gearbox bearings (there are many bearings in a gearbox, the main internal bearings are on the main shaft:
 - Clutch bearing (thrust bearing)

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- Always be aware of the correct airbag setting when travelling 'bobtail' (prime mover only without a trailer), as the incorrect setting will give you a phantom suspension fault.

Other noises could be mistaken for transmission noises could be the differential wheel bearings. The gearbox will make noises if it is misaligned, due to the gearbox mountings being worn and/or broken.

2. Alternator not charging or light coming on:

- Not charging is usually caused by one of the following:
 - Fan belt broken.
 - Fan belt slipping.
- Light coming on is usually caused by one of the following:
 - Internal failure of the alternator.
 - Fan belt broken.
 - Low fluid level in the battery.
 - Poor earth in electrical circuit.



(Courtesy Pinterest)

3. Severe engine noise could be:

- **Low oil in sump** (computerised engines will de-rate and then shut down when the level is too low)
- **High operating temperatures** have caused internal damage through heat stress of moving parts.
- **Low oil pressure** due to failure of oil pump or low oil level. (Computerised engines will de-rate and then shut down when the oil pressure is too low)
- **Other components** attached to the engine block have failed.

The list of components that **could fail** in the engine compartment is too large to mention. The following are **major components** that could be causing the noise:

- **Fan assembly** (some fan assemblies sound noisy on idle but may be serviceable, check with workshop)
- **Alternator** bearing failure.
- **Air compressor** failure (usually piston and / or bearing noise)
- **Loose or broken air cleaner** or bracket (diesel engines have a large intake of air and would be very noisy in this case)
- **Power steering pump** squeal (this would usually only occur when engine running and steering being operated)

Be aware the engine fan is often very noisy when it is operating. The engine fan robs the engine of a few horsepower when operating. This can be very useful when descending a steep hill because it will also lower the engine revs by a small amount, helping to prevent over-run.

Computerised engines have the ability to monitor many of the faults that may cause engine or engine component failure. You need to refer to the engine and vehicle manufacturers operating procedures to understand how these affect the driveability of that particular engine.

Defensive driving (Driver awareness)

What is defensive driving?

Defensive driving is, driving a motor vehicle with **emphasis on safety**, achieved through **superior observation** and **judgement** in order to **anticipate danger** and **avoid crashes**.

The best defence is to be aware of the risks and identify the best way to avoid them before they happen.

This is “**driver awareness**” and is the foundation of being a **professional driver**.

What skills do you already have?

The skills you currently use are:

- Sight
- Hearing
- Reaction
- Perception
- Current knowledge of driving
- Current knowledge of road rules

Training and **on-road experience** will **build on skills** you currently have.

Looking at each skill in detail:

Skill	Detail
Sight	<ul style="list-style-type: none"> Peripheral vision is the ability of the eye to detect objects that are not in the direct line of sight (objects that are to the side of where you are looking). Colour recognition is the ability of the eye to recognise and distinguish colours, e.g. traffic lights and road signs. Accurate recognition is the ability of the brain to process the information from the eye quickly and accurately. Blind spots are the areas that you do not see that may place you at risk of a collision. These blind spots may be within the eye (the optic nerve), within the vehicle such as screen pillars, mirrors or outside the vehicle such as roadside structures (signs or light poles).
Hearing	<ul style="list-style-type: none"> You need to train yourself to become attuned to traffic sounds for example an approaching ambulance or other emergency vehicles. Driving with the radio too loud will impair your hearing and place you and others at risk.
Reaction	<ul style="list-style-type: none"> Average reaction time is accepted as .75 sec. for the average alert driver. At 60K/h this represents a reaction distance of 12 metres and a total stopping distance of approximately 80 metres in a heavy vehicle Add to this worn or inadequate tyres, suspension, and brakes. Then add lack of defensive skills (anticipation). Then add wet or gravel road, rain, poor visibility, darkness. <p>You now have an estimated braking distance in excess of 100 metres, and that is after you have seen the obstruction. Slow down. If you did not see the hazard and plan a suitable course of action, then at that distance the result is going to be disastrous for you and your vehicle.</p>
Perception	<ul style="list-style-type: none"> Is the ability to read the possible outcome of an event before it happens, based on your previous experiences. Do not commit yourself to a situation based on the assumption that the other driver is going to take the path that he/she has shown intentions of taking. Use your skills of perception to read the situation and leave yourself an avenue of escape and/or the ability to control the situation by varying your intended path or speed.
Current driving knowledge	<ul style="list-style-type: none"> Take nothing for granted. Think of all the near misses you have had and use this knowledge to enhance your driver awareness skills.
Current knowledge of road rules	<ul style="list-style-type: none"> It is no surprise that many drivers do not follow or understand the road rules completely. Do you understand the current Australian Road Rules (ARR)? These were introduced in 1999 and many of our older drivers are either not aware of them or have not updated their knowledge.

	<ul style="list-style-type: none"> It also comes as no surprise that the requirement to give way is often ignored to force a way into traffic especially where a large vehicle can be used to intimidate other road users.
City driving	<ul style="list-style-type: none"> Driving with other traffic can create many distractions. A driver must continuously scan for hazards and be prepared to react accordingly, especially if there is the need to swerve or brake harshly. With superior forward planning, a driver will often be able to maintain momentum and avoid many complete stops. By planning the approach position for turns and other manoeuvres, you will be able to use the available room to the best advantage. Blind spots are unavoidable. Constant looking around mirrors and pillars is essential to get the maximum view at all times. Never change direction or commit to a turn without being as certain that there is nothing in your blind spots.
Country driving	<ul style="list-style-type: none"> The need to plan the trip (allowance for breaks etc.) Allow sufficient time to reach destination within hours of driving and to allow for adequate meal breaks. Knowledge of the route to be used (low bridges and other restrictions) Comply with weight and height limits. Able to keep safe and legal following distances. Be aware of noise levels and the use of exhaust/engine brake.

Hazards

A hazard includes anything which will either cause you or has the potential to cause you to change speed or direction.

Hazards include a series of features which need to be considered by a driver when approaching or negotiating the hazard.

When negotiating intersections, roundabouts, and other potential hazards such as road works, railway crossings, and lane changes. It is important to **control the vehicle's speed** and **cornering forces** before entering the hazard.

Drivers following the system of vehicle control will be concentrating on potential trouble spots, not on the brakes and shift lever.



By considering the following steps, your intentions will be clear to other road users.

Step	Function	Detail
1	Course	Determine the course to be taken to negotiate the hazard
2	Mirrors	Check behind the vehicle and along both sides
3	Signal	Signal your intentions to give sufficient warning prior to any manoeuvre
4	Brake	Adjust your road speed early so you can downshift.
5	Gears	Change down, and repeat process if necessary, so that you are in the appropriate gear before entering the hazard.
6	Mirrors	Check mirrors again for safety
7	Manoeuvre	Negotiate hazard, monitoring the position of the rear wheels
8	Accelerate	To leave the hazard safely, having regard to the road surface and traffic conditions .

When performing a manoeuvre such as a lane change, you will not include steps 4 and 5. However, all other steps need to be done to ensure safety.

Long vehicles often need to use more space approaching a turn. Greater emphasis will need to be placed on road position and mirror checks through the turn.

Following the system of vehicle control produces a controlled, deliberate driving style that reduces risk. This is particularly so at roundabouts, where three directional changes can occur. Vehicles with a high centre of gravity or “live” loads can easily rollover and therefore a cautious approach is necessary.

Road transport in Australia is a high-risk industry, according to SafeWork SA. Work related road crashes incur a greater time lost in worker absences than any other work injury claim.

Some of the hazards that can occur when heavy vehicles are on the road include:

- **Environmental** factors (bad weather, poor road surface, limited visibility, sun position)
- **Fatigue** (long hours, long distances)
- Total awake time including travel to and from work.
- Driver **distractions** (eg. mobile phone)
- **Time pressures** (work scheduling and demands)
- **Drugs and alcohol** (including prescription and non-prescription medication)
- **Vehicle maintenance** (or the right vehicle for the job)

- Working around a vehicle with other vehicles in close proximity
- Entering/exiting the cab (fall from height)
- **Loading and unloading material** or stock (fall from height)
- Other road users (unpredictability)

Employers and workers are required to **take responsibility** for the **safety of the driver, the truck, and the load**. Drivers of heavy vehicles and their employers are required to abide by the legislation, law, and code of practice that governs their roles.

When turning always set up your approach and position in plenty of time before reaching the actual turn. This includes the need to straddle lanes to ensure your truck makes the turn safely.

Never **change gears** when negotiating a turn, have this done **before** you commit to the turn.

Vehicle stability and the weight over the drive wheels are affected by rolling through the turn. All turns should be set up correctly on the approach and should, under normal circumstances, be taken at a constant speed on the accelerator pedal.

Overtaking

Overtaking in a heavy vehicle has inherent dangers due to the greater length, slower acceleration, and the need for more road to affect the passing manoeuvre.

There is often less opportunity to pass which together with the need for greater clearances from other vehicles coupled with a lack of knowledge of some road users, can cause much frustration for the truck driver.

When overtaking a driver must assess hazards, available space, speed of vehicle being overtaken, oncoming vehicles, and the rate at which your vehicle can travel fitted with a speed limiting device.

When it is safe to overtake, use the following 'check system':

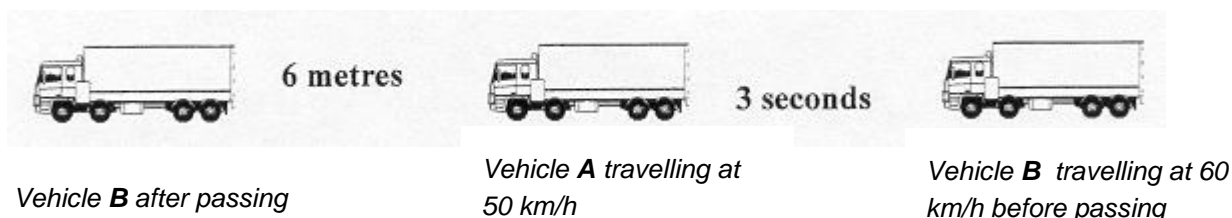
1. Mirrors
2. Signal right
3. Gears
4. Mirrors
5. Evasive action (if required)
6. Approach and position (clearance from vehicle being passed)
7. Clear the other vehicle
8. Mirrors
9. Signal left
10. Move back to correct position on road

Never overtake if:

- A vehicle is coming from the opposite direction
- A vehicle has stopped for a railway or tram crossing
- Another vehicle is stopped at a pedestrian crossing
- You do not have clear view to pass safely

In the diagram below:

- Vehicle **A** is travelling at 50km/h
- Vehicle **B** is travelling at 60km/h and intends to overtake vehicle **A**
- Vehicle **B** would take 17 seconds and cover 289m to close the 3 second gap
- The total passing manoeuvre (allowing 6m clearance after overtaking) would take
- 21 seconds and vehicle **B** would have covered 357m.



The recommended safe following distance in a heavy vehicle is at least **3 seconds** under good conditions.

To calculate your following distance: when the vehicle in front passes a fixed object, count 1001, 1002, 1003,. If you reach the same fixed object on or after this time, you are 3 seconds or more behind that vehicle.

You must add more time when driving in adverse conditions (rain, fog, gravel),(i.e. another 3 to 4 seconds)

Night driving

Dipping your headlights at night is a legal requirement. This is to prevent 'dazzling' the person coming toward you or travelling in front of you.

You must dip your headlights:

- Travelling in the same direction as another vehicle and you are 200m behind them
- 200m from any oncoming vehicle

The requirement to dip your headlights includes travelling with lights on during the day.

- Driving in poor visibility and using headlights during the day ensure you do not have your lights on high beam.
- Outside of a built-up area, the edge of the road is painted with a solid edge line to show the shoulder of the road. It is especially useful to reference when an oncoming vehicle has bright lights. This line is commonly referred to as the 'fog line.'

Your eyes may be distracted by moving objects inside the vehicle such as cords from CB handsets or objects hanging from the centre mirror.

Generally this is overcome by the other eye 'covering' the area, but it is possible for an object to become 'lost' in this blind spot, for example a motor cyclist or a pedestrian.

'**Blind spots**' can be created by the screen pillars inside a vehicle, other vehicles, or objects outside the vehicle, so although the eyes are 'looking' they will not see something that is hidden. You would be surprised at the size of blind spots created by the mirrors. To overcome these, you will need to move around, looking behind and in front of each mirror.

Driving at night has its own problems as the eye, like a camera, relies on light to see and 'photograph' an image so if there is no light the eye cannot see. In a vehicle this is overcome by driving behind headlights which only light up the road in front so we can see only what the lights show us.

When a vehicle approaches from the opposite direction you must "**dip**" the headlights which further reduces our field of vision and as our eyes are attracted to the lights coming towards us there is a tendency to look at them, which can cause glare or 'temporary blindness' as the eyes take time to recover.

Note: Headlights / rear lights should be used during daytime periods of low visibility caused by low cloud, rain, dust, or heavily overcast conditions, to ensure your vehicle is seen by other road users.

The five rules of observation

1. **Aim high in steering.** Be sure to look well ahead, not to the area just in front of your vehicle. This will give you the opportunity to see any hazards earlier and give yourself more time to react.
2. **Get the big picture.** Look all around you, not directly in front, you need to know what is to the sides and in the rear-view mirrors.
3. **Keep eyes moving.** Alter and vary the focal length for far and middle distance and short range to check the instruments and gauges inside the vehicle. Do not focus on any one object for more than a few seconds.
4. **Leave yourself an 'out.'** Always have an option open so you do not become involved in someone else's crash. Never let yourself get 'boxed in' so you have nowhere to go.

5. **Make sure other road users see you.** Do not hide in other drivers' blind spots, use headlights when appropriate and give clear signals when turning or slowing.

Note: Rarely do brakes fail on heavy vehicles going downhill unless they are poorly maintained. Usually, it is the driver who is at fault for not selecting a sufficiently low enough gear to maintain a safe constant speed for the descent. This should require minimum, if any, use of the service brake.

Driving industry adage, "You can go down a hill **too slowly** a thousand times, but you only go down a hill **too fast** once."

Reaction and braking

- Brake in **plenty of time** (early and gently, never savagely)
- Brake **firmly**, only when travelling in a **straight line**. When the brakes are applied to a moving vehicle, the weight is thrown forward and downward onto the front wheels and the rear tends to lift. The unequal distribution of weight makes steering heavy and reduces the general stability.
- Vary the brake pedal pressure according to the condition of the road surface.
- When descending a steep winding hill:
 - Engage a low gear prior to the descent.
If needed brake firmly on the straight stretches and ease off on the bends.
- Ability rapidly decreases on a corner due to centrifugal forces generated by the cornering vehicle. The load wants to keep moving forward while the vehicle is trying to change direction.

Air brakes

Air brakes feel different to hydraulic brake. In an air brake system, the pedal is connected to a spring-loaded valve. The amount of braking achieved depends on how hard you push the pedal and how far you open the air valve against the return spring.

Experience will teach you how far to push the pedal against the return without locking up the wheels. When the vehicle is loaded, you will need to push the pedal further down to achieve the same degree of braking as when loaded.

When you apply the primary brake pedal you open a valve that allows pressurised air to flow to the brake chambers at each wheel.

Effective braking depends on how **FAR** you depress the pedal, unlike a car where the braking effectiveness depends on how **HARD** you depress the pedal.

It is important to check air brakes regularly, to minimise brake failure you should check manual and automatic slack adjusters daily, during your pre-trip inspection

Reaction time and distance

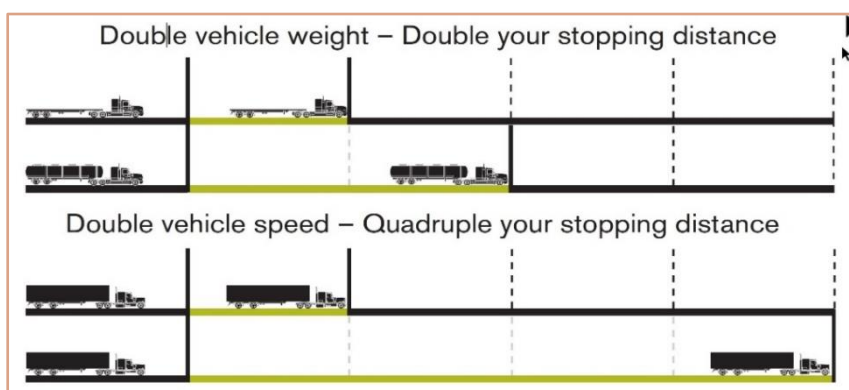
- **Reaction time** is the time between the moment the driver observes the need for action and commences to act.
- **Reaction distance** is the distance travelled within the reaction time.
- **To calculate** a reaction distance, multiply the reaction time (in seconds) by speed (in metres per second)

$$\text{Equation: } \begin{array}{ccccc} \textit{Reaction Distance} & = & \textit{Reaction Time} & \times & \textit{Speed} \\ \text{(metres)} & & \text{(seconds)} & & \text{(metres per second)} \end{array}$$

Braking distance

The braking distance is the distance it takes to stop the vehicle once brakes have been applied. This can be influenced by factors such as: downhill gradients, which may increase the braking distance or uphill gradients which may reduce the braking distance. Wet or slippery roads, uneven or unsealed roads and varying weight will affect the distances.

- Once the brakes have been applied the distance taken to stop increases at a proportionally greater rate as the speed increases.
- As the speed doubles (X2) the braking distance increases by four times (X4).
- The reason for this is that the distance taken to stop is proportionate to the square of the speed so if the distance taken to stop from 30km/h is 5 metres, the distance taken from 60 km/h is 20 metres (2x the speed, 4x the distance)



(Courtesy SGI: Stopping distance)

- Braking distance of commercial vehicle can vary depending on the weight that is being carried. A light load can sometimes take longer distance to stop as there is less weight to create a downward force on the tyres and create the friction needed between the tyre and road surface. Fully loaded vehicles may also take further to stop as the brake have to stop a heavier load.

- Remember the benefits of good maintenance



(Courtesy: Bendix Brakes)

- Excessive use of the brakes can cause a build-up of heat leading to a loss of effectiveness and an increase in stopping distance. It is essential to use the supplementary braking systems, such as engine and exhaust brakes, when descending steep gradients

Skidding

Definition: An involuntary movement of a vehicle due to the grip of the tyres on the road becoming less than the force or forces acting on the vehicle. A vehicle skids when one or more of the wheels slide instead of having pure rolling action.

Causes of skidding:

- Excessive speed for conditions
- Sudden or excessive braking
- Harsh or excessive acceleration
- A rapid change of direction
- A combination of all or any of the above

Factors that increase the risk of skidding

- Ice, snow, leaves, oil, or fuel on the road
- Water (aquaplaning) loose surface, corrugations, or potholes
- Adverse camber, downhill slopes
- Bald or poorly inflated tyres
- Suspension faults, steering mechanism faults
- Painted lines and arrows, metal inspection plates, steel plates covering roadworks.
- Panicking

Poor load distribution – the weight must be over the drive tyres irrespective of the vehicle. With multiple trailers, having the **B trailer full** and the **A trailer empty** will lead to a loss of traction.

Brake adjustment/truck-trailer bias especially with empty trailers. Load proportioning valves help to reduce rear wheel lock-up under braking.

Trucks and buses use low gear signs. (ARR108)

1. Where a road displays a trucks and buses use low gear sign:
 - The truck or bus must be in a gear that is low enough to limit the speed.
 - Must not include the use of the primary brake.
2. Subrule (1) does not apply to the driver of a bus if information on the sign indicates it applies to **trucks only**.
3. The truck and bus low gear sign applies to the length of road **beginning at the sign** and ending at:
 - The sign indicates a distance when the rule ends. (e.g. for next 10 km)
 - Or a sign indicating an end to trucks and buses low gear requirements.
4. Primary brake means the footbrake, or other brake, fitted to a truck or bus that is normally used to slow the vehicle down. It does not include a supplementary brake such as an engine or exhaust brake.

Note: Severe penalties apply if drivers of heavy vehicles are detected driving unsafely on the down-track of the South-Eastern Freeway into Adelaide.

5. Signage is displayed on roads where there is:
 - A short steep descent. 6% or greater for 600m to 1.5 km
 - A steep descent. 6% or greater for 1.5 to 2.5 km.

Long steep descent 5% or greater for 2.5 km or longer

Note: The South-Eastern freeway has a descent of approximately **7 % for 7km** from Crafers to Glen Osmond.



(Courtesy: The Advertiser: South-Eastern Freeway).

South-Eastern Freeway

Although some roads (*i.e. South-Eastern Freeway*) have these signs, drivers of **ALL** heavy vehicles must exercise extreme caution when driving down hills no matter what signs are or are not displayed.

Observe all signage. It is there for a reason!

- The driver must know the effective gear to use in all conditions.
- As a rule, if your vehicle is fitted with a good retarder, go down the hill one gear lower than you go up. If the retarder is not efficient, drive down the hill two gears lower than you drive up.
- In an automatic vehicle select manual mode, divide the gears by two then lose two more gears (*i.e. 18=9=7*) for safety.
- If unsure of the conditions, use the UHF radio and ask for information.
- Do no gear work on a steep descent – slow down and gear down before you drive down the hill.



- On a downhill gradient, change down at 200 RPM lower than normal. (*i.e. If you normally change down at 1000 RPM for a single gear on level ground, reduce this to 800 RPM before changing.*)



(Courtesy: abc.net.au)

Jack-Knife and trailer swing

Jack-knifing can occur when there is a **loss of traction** in either the prime-mover or the trailer.

If the prime mover loses traction and the driver is unable to correct it in time, the trailer pushing from behind will continue to push the prime mover until it spins around.

Similarly, if the trailer loses traction under braking and the prime mover is doing all the braking, the uncontrolled momentum of the trailer can result in a jack-knife position (trailer jack-knife).

Another way you can jack-knife is if you enter a turn too fast, the momentum of a laden trailer can push the turning prime mover causing a jack-knife.

Downhill turns are especially prone to this.

How to avoid a Jack-Knife

Steady braking over the longest distance possible will **avoid brake lock-up**.

If the brakes do lock and your vehicle starts to skid, take your foot off the brake immediately and correct by steering into the skid as you would with a rigid vehicle.

If a skid is not corrected, it can be aggravated by the trailer pushing from behind and the vehicle will jack-knife.

To avoid jack-knifing through corners or bends, **avoid braking in the bend**, particularly when coming down a hill. Make sure you are at the correct speed to take the corner or bend prior to changing direction.

If you ever need to take **preventative action**, **Do Not Brake**, and **Swerve at the same time**:

- **Brake first** to slow the vehicle down as much as possible,
- **Release the brakes** in order to swerve.

In this way, you have a better chance of remaining in control of the vehicle.

Once you are back in position, you can re-apply the brakes if necessary.

Keep both truck and trailer **properly maintained**. Uneven brakes, worn tyres and faulty suspension components increase the risk of an uncontrolled skid and loss of control.

Be wary of light loads. A properly driven, loaded, and maintained heavily laden vehicle is less likely to jack-knife.

Jack-knifing can occur **more frequently with empty trailers** or when the **weight of the load is badly distributed**, providing too little traction where it is needed.

Vehicle and trailer brakes are designed for a full load, and if incorrectly applied are too powerful for an underweight trailer.

When the brakes are applied heavily, the trailer wheels could lock up, and cause skidding resulting in loss of control of the trailer.



Reversing

(ARR 296) Driving a vehicle in reverse

Read **Page 55** of the [Heavy Vehicle Driver's Handbook](#)

Most heavy vehicle classes must be reversed into loading docks. Reversing is often unavoidable but must be considered and planned. A driver who does not reverse a vehicle safely is breaking the law, refer to the Australian Road Rules.

- The driver of a vehicle must not reverse the vehicle unless the driver can do so safely.
- The driver of a vehicle must not reverse the vehicle further than is reasonable in the circumstances

Many reversing collisions occur at low speed, due to poor reversing visibility, and would be preventable if drivers took some simple safety precautions and modified their driving behavior.

There are differences between reversing an articulated vehicle and a rigid vehicle.

- An articulated vehicle appears to bend in the middle, and the steering appears to react in the opposite direction.
- More space is required to reverse an articulated vehicle.
- View in the mirrors is partially lost.
- Vehicle is usually longer than a rigid
- More tyre contact with road so more 'tyre scrub' (damage to the road surface)

Safety precautions

Safety precautions to take before reversing include:

- Walk around the vehicle to check for obstructions and clearances
- Check width and height of opening to be entered
- Use a second person as a guide outside the vehicle
- Ensure mirrors are correctly adjusted
- Use of warning buzzer and hazard lights to alert pedestrians.

Consider alternatives to avoid danger:

- Replan the route to avoid reversing
- Enter from another direction that eliminates need to reverse
- Position the vehicle to reverse in a straight line rather than around a corner

Avoid reversing if possible.

This may seem impractical but in fact this is what a professional driver will try to do. It has nothing to do with the ability to reverse, it is because a professional driver is aware that reversing is always a dangerous operation and raises the chances of vehicle damage.



If you need to **reverse**, follow these steps:

1. **Walk around vehicle** first and observe any possible hazards
2. Have your **mirrors clean** and set up correctly
3. When reversing always travel very slowly
4. Be aware of **overhead obstacles**
5. Constantly **check mirrors**
6. If possible, have **someone guide you**.
7. Remember the **5 points to check**:
 - Right side
 - Left side
 - Front
 - Top
 - Rear
8. Reverse from the right and **not the left**, if possible, to avoid blind spots.



Gear changing

For all types of vehicles, there are two main transmissions for **manual** gearboxes, synchromesh and non-synchromesh.

Non – synchromesh truck gearbox is not difficult to operate. In order to change gears the engine revs need to match the road speed for the gear change to happen successfully.

- Depress the clutch and disengage the current gear
- Let out the clutch to re-engage the neutral gear and then match the revs to the gear you want to engage.
- Depress clutch and engage the next gear.
- **Synchromesh truck gearbox** does not require the driver to **double clutch** as the truck gearbox has synchro rings which match the road speed and the engine revs which allows the gear to be selected. Many of the trucks doing local deliveries tend to use this type of gearbox as it is easier for the driver to operate and allows companies more choice when selecting drivers.
- **Automatic truck gearbox** more trucks are being manufactured and purchased with automatic gearboxes due to technological improvements over the past decade. The automatic truck gearbox is slightly different to a car automatic gearbox in that they are, essentially, an automated manual transmission. This means that there is an automated shifter changing gears for the driver manual gearbox.
- It is necessary to **warm up a cold gearbox** and reduce strain imposed by lugging and surging. Warming up the gearbox allows engine oil and transmission fluid to circulate and lubricate.
- If the gear train is forced to start or stop turning suddenly, or when a heavy load is suddenly applied to a set of rotating gears, a '**shock load**' on gearing is imposed.
- A good example of this, is when a driver of a car slams or bangs a car into gear without skilled use of the clutch which causes the car to lurch.
- This creates high stresses on the gear teeth so gears subjected to shock loads may fail due to metal fatigue of the gear teeth rather than wear out due to contact.
- The gearbox transmits the drive from the engine to the wheels and to constantly use lower gears to slow down imposes extra strain on the gears. It is not fuel efficient.



(Courtesy: Atlas Truck Repair)

The use of lower gears to slow down before commencing the descent on the South-Eastern Freeway, however, is recommended.

- Going down a **steep descent** select a **lower gear** to slow down the vehicle, **without** the constant use of brakes.
- If you miss a gear when trying to gear down, stop the vehicle with the brakes immediately, then select correct gear. It is **dangerous to coast** whilst struggling with the gears.
- Use auxiliary brakes to help control the vehicle speed.
- Reserve your primary brakes for coping with emergencies in traffic conditions or sharp corners.
- If you need to use your brakes, try to do this on straight sections of road as this reduces the chances of skidding.

Note: You must select a low gear before commencing steep descents. Trucks and bus drivers must obey '**trucks and buses use low gear**' signs by selecting a gear low enough to limit the speed of the vehicle without the need to use the primary brake (footbrake)

The selection of a lower gear prior to descending a steep hill is used to firstly slow the vehicle but then stop it from gaining speed.

It is economical to:

- Progressive gear shifts up through the gear box cause less fuel usage, less wear on components and less heat generated.
- Skip shifting up and down through the gear box. Correct gear for the occasion, fewer gear changes, less wear on the transmission.

Matching the engine speed to the road speed to the gear, using a non-synchromesh gear box requires you to double de-clutch. The process of double de-clutch is explained further on.

Precaution when starting the engine

We warm up our body before we play sport to prevent muscle or joint damage.

The truck needs to warm-up to **prevent damage** to the moving parts. The lifeblood of the vehicle is the **oil**. If it is not ready to lubricate the moving parts and you place heavy loads on these parts, you run the risk of component damage.

Before you start work, warm up the vehicle:

1. Press the **clutch pedal** to the floor to **disengage the clutch**, this breaks the connection between the engine and transmission, and reduces the load on the starter motor.

(If the vehicle is fitted with a clutch brake, depress the clutch pedal 6-8 centimetres only – about halfway down).

2. Ensure the **gear lever** is in the **neutral** position. This will stop any damage to the transmission.
3. If engine is computerised, turn the key to the first position and allow the engine to go through the normal checks.
4. If the engine is fitted with a **Jacobs Brake** or a similar retarding device, ensure that it is **turned off**.
5. If all warning lights for the engine checks have gone off, **start the engine** using **no throttle**. (This does not include the warning buzzer and lights for low air).
6. **Slowly** remove your foot from the clutch pedal.
7. If the engine is **not computerised raise revs** just above idle. If the engine is computerised this may happen automatically, if in doubt check the guide from the engine manufacturer.

When **not** using the clutch, keep your foot off the clutch pedal. There is a chance, the drive could be disconnected, it could put more load on the drive train or cause the clutch to slip and overheat.

Gearbox operation

Just like yourself when starting in the morning, give the gearbox time to warm up. This means not changing the gears rapidly up and down when the gearbox is cold. Slow deliberate changes with full gears for the first few occasions to gradually warm up the gearbox.

The oil in the gearbox will warm up in a relatively short space of time. You will notice that the gears will be easier to select when the gearbox is fully warmed up.

Gear changing

The engine in the vehicle will develop only a certain amount of **power** which can be **multiplied by the use of gears**.

Low gears give a **lot of power**, or torque, but not much speed whereas the **higher gears** will allow **more speed** but do not have the power. Having started in the lower gears and changed progressively through to the higher gears as the speed builds, it will be necessary to change down to the lower gears if the speed drops (for example, to turn a corner or climb up a gradient).

Gears, together with an **engine or exhaust brake**, can also be used to **help retard** or **restrain** the progress of a vehicle when **descending a hill**, especially when heavily loaded. This will **minimize the use of the brakes** allowing them to stay cool and not build up excessive heat through friction.

The **gears**, when driving the vehicle, **are under load**, or torque; so when making a gear change it is necessary to release this load or torque effect by using the clutch which “breaks” the drive and allows the gears to be moved. To attempt a gear change without using the clutch creates enormous stresses on the selector mechanism which over a period of time can wear and will eventually break.

If the gears are synchronized in a '**sychromesh**' type of gearbox it will be possible to disengage the clutch (pushing the pedal down) and move the gears into and out of engagement with relative ease; but if the gearbox is of the '**non sychromesh**' type it will be necessary to 'double clutch' which means using the clutch twice, once to take it out of gear, then engaging the clutch to match the road speed of the gears to the speed of the engine then clutching again to engage the next gear. This is a technique which requires a great deal of practice but once mastered can make for very smooth gear changes.

In **2021**, approximately **80%** of trucks in Australia had **automatic transmissions**.(Refer [Truck Sales](#))

This was up to 4,500kg GVM at that time, however, the trend continues to grow across the whole GVM range worldwide.

Clashing gears:

Clashing or crunching gears happens when a driver tries to mesh or engage two gears (or cogs) that are revolving at different speeds with one turning at road speed and the other at engine speed.

Truck engines develop a great deal of power (torque) that is transmitted to the gearbox so if the gears are not turning at precisely the same speed at engagement, they will grind together which over a period of time will cause damage to the gears (cogs) and to the selector mechanism

Shock load on components:

Bad timing of gear changes and incorrect use of the clutch will result in damage to many parts of the drive train. If you clash the gears and force them to mesh at the incorrect speeds, abnormal stress will be placed on components that will not be able to sustain this stress.

Components of a heavy vehicle are built to take enormous stresses, but everything has its limitations, for example, downshifting followed by releasing the clutch when the road speed is too high will cause damage to the engine by over-revving as will engaging the clutch to go forwards while rolling backwards on a hill.

Other components that could be affected are clutch plates, drive axles, universal joints, tail-shaft, differentials, and a host of minor components.

Think of the cost!

One bad gear change from a modern truck whose engine develops over 500 horsepower will generate twisting forces through the transmission and through to the axle and wheels which the vehicle was never designed to withstand.

Constant poor gear changing will lead to damage and breakages, which leads to vehicle downtime and unnecessary repairs and running costs.

Up shifting and down shifting

There is a technique for changing gears smoothly and accurately. Firstly you need to understand the difference between a synchromesh gearbox and a non-synchromesh gearbox, commonly called a 'crash box.'

The synchromesh gearbox is popular with many European trucks, and there is no need to double clutch when changing gears. In this type of gearbox there are components called 'cones' which are built onto the gears. They are designed to slow gears to similar speeds, so when engaging or meshing the gears they will slide on to the other with little or no resistance. Due to this feature, the clutch is pushed down (disengaged) once while the gear lever is moved into the next gear. The clutch is then engaged slowly as it takes up the new gear to drive.

Method for an effective gear change:

1. Slow the vehicle to an appropriate speed (changing down only)
2. Disengage clutch (pushing the pedal down) while removing pressure from the accelerator.
3. Move the gear lever through the neutral position and into the next appropriate gear.
4. Engage the clutch, by releasing the clutch pedal smoothly
5. Apply the appropriate power, via the accelerator, to match the road speed.

Double clutching

In a vehicle fitted with a non-synchromesh or 'crash' gearbox it will be necessary to use the clutch twice for every gear change.

This is because there are no 'cones' to slow the gears to similar speeds so this has to be done by engaging the clutch while the gears are in neutral and matching the speed of the engine to the road speed of the vehicle.

Having done this, the clutch is disengaged, and the new gear engaged. The clutch pedal is allowed up gently to take up the new gear.

Changing up:

1. Press the clutch pedal down, just enough to disengage the drive while at the same time.
2. Removing pressure from the accelerator pedal so as to reduce the engine revs.
3. Move the gear lever through neutral to a position ready for the next higher gear.
4. Let the clutch pedal up until the transmission is re-engaged, then depress the clutch quickly.
5. Move the gear lever to the position for the next higher gear
6. Release the clutch pedal smoothly while simultaneously applying appropriate power to match the road speed

Changing down:

1. Release the accelerator and reduce speed by braking to the required speed
2. Disengage the clutch by pushing the pedal down
3. Move the gear level to neutral, positioning it for the next appropriate lower gear
4. Let the clutch pedal up to engage the clutch.
5. Apply sufficient power to increase the engine speed (revs) to match the gear to the road speed of the vehicle
6. Push the clutch pedal down sufficiently to disengage the transmission and then select the next lower gear
7. Apply appropriate power while releasing the clutch pedal smoothly being sure to 'balance' the power to match the new lower gear.

Note: Always be sure to maintain adequate engine revs when re-engaging the clutch.

Never attempt to change gear without using the clutch as damage can be done over a long period of time leading to premature wear of the gears and selector mechanisms.

Progressive shifting

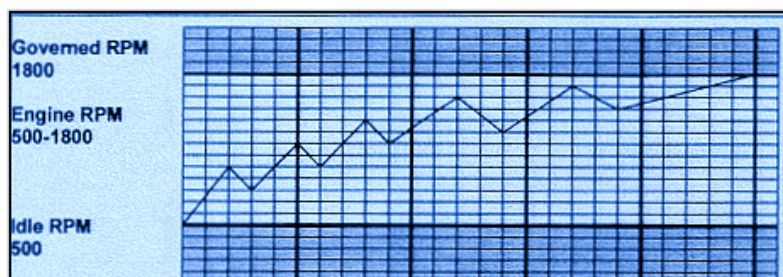
Progressive gear shifting is a method where the first few gear changes are made without the need to drive the engine to its governed rev limit before shifting to the next higher gear. It will, in fact, make it easier and cleaner to change gears.

As an example, this would be a typical progressive shift pattern:

- In first gear accelerate to approximately 1000 rpm
- Make the first gear change at approximately 1100 rpm
- Make the next gear change at approximately 1200 rpm and so on

Progressively adding 100 rpm to each higher gear. In this way you will conserve fuel and, at the same time, pull the load reaching the required highest gear in the least amount of time.

This is also called the '**gear fast - run slow**' method. Minimum revs are required, and the highest usable gear is reached in shortest time.



(Progressive shift pattern)

To conserve fuel:

- Keep **engine revs down** in the **early stages** of moving the vehicle.
- **Start** in the **lowest gear** required and in the first few shifts,
- Develop **only the RPM** needed to **get rolling**.
- As you **up-shift**, **increase engine RPM** progressively.
- **Continue to accelerate** in this way until the desired **road speed is reached**.

With the development of variable (horsepower) rated engines if you use excessive engine revs you will actually lose power. This is because the computer that governs the amount of horsepower the engine develops is directly related to the engine manufacturer's specified RPM




Note: Heavy trucks take longer to get up to speed and to slow down safely. This takes quite a long time to get used to, *so resist the urge to move off and keep up with the cars.*

Load placement and security

Every year, debris from unsecured loads causes road closures and disruptions, incur thousands of dollars in damages and can be a major contributor to serious crashes and injuries.

Basic principles: loading a heavy vehicle correctly is important, in order to **prevent damage to the load, the vehicle, the driver, and other road users**.

A properly restrained load will not dislodge, even after the most severe braking, swerving, and cornering. A heavy load is just as likely to fall as a light load, the same 'g' forces are acting on both. Many crashes resulting from a loose load occurs at low speeds within a short distance of the trip commencing.

<p>Motor Vehicles</p> 	<p>The load consists solely of motor vehicles</p> <p>The height of the vehicle, including motor vehicles being carried does not exceed 4.6 metres.</p> <p>The vehicle is constructed as a multiple deck vehicle transporter and does not exceed constructed height of 4.3 metres. No vehicles are loaded on the upper deck unless each deck below is fully loaded.</p>
<p>Livestock</p> 	<p>Height of the vehicle and load does not exceed 4.6 metres</p> <p>Load consists solely of livestock. No animals are overloaded on the upper deck unless each lower deck is fully loaded</p> <p>If any deck is not fully loaded, the animals must be confined in a full width compartment which is fully loaded.</p>
<p>Baled hay and wool</p> 	<p>Baled wool shall not be loaded more than four layers high.</p> <p>The maximum overall vehicle height shall not exceed 4.6 metres. Vehicles more than 4.3 metres, the ground width must be greater than 2.1 metres.</p> <p>The load must be symmetrical as possible across the width of the vehicle.</p> <p>Baled wool carried on the vehicle shall be secured in accordance with guidelines detailed in the Load Restraint Guide</p>

Factors that cause the load to move.

Under normal driving conditions a load is subjected to many forces that may cause the load to shift and include:

- Speed (acceleration)
- Change of direction
- Attitude of the vehicle e.g. camber of the road
- Braking
- Cornering
- Travelling in hills
- Airflow against the load
- Rough roads

Arranging the load

Incorrect positioning of the load on a vehicle will affect three main factors:

- Maintaining vehicle stability
- Steering and braking performance
- Overloading of tyres and axles

Load securing equipment

There are as many types of load securing devices The main types are:

- Ropes
- Load binders
- Chains
- Gates

Friction

It is important to understand that load restraints do not actually hold the load on the vehicle; they only increase the amount of friction between the load and the surface it is resting on. For this reason you should keep friction in mind.

When securing the load and ensure that contacting surfaces are:

- Clean and dry – dust and moisture can act as a lubricant
- Free from grease and any loose material

Consider using a **rubber load mat** or other high friction material between the load and the surface.

Factors that cause a load to move

- Speed
- Altitude e.g. camber of road
- Acceleration
- Travelling in hills
- Rough roads
- Change of direction
- Braking
- Cornering
- Airflow against the load

Load distribution

- Placement of load for weight distribution
- Arranging a mixed load for safety

When loading remember that friction will take place between items. Ensure surfaces that contact each other are clean, dry, and free from grease and loose material. When some of the load is delivered remember to evenly distribute the weight of the remaining load.

Load security equipment

Compliance and enforcement (also known as Chain of Responsibility) requires appropriate load restraint equipment and training is provided. Loads are required to be secured correctly and restrained to the 'g forces' specified by law.

Even if you were not the person who secured the load. Check it.

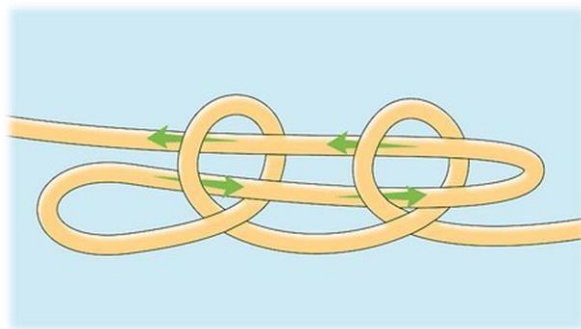
There are different types of load restraint depending on the load being carried:

Restraint	Load
Ropes	Used for restraining relatively light loads
Chains	Suitable for side gates or other containment methods
Binders	Used to tension a lashing.
Gates	Used at front, sides, and rear of a loading deck. Not for tall or small loose loads, can control loads when supported by diagonal lashings.
Headboards	Can reduce lashing numbers, used to attach chains and secure load.
Twist-locks	Used to attach a load to a vehicle.

Ropes

Ropes are best used when using tarpaulins to cover a load, to tie them down securely.

The "**Trucker's Hitch**" is the go-to knot for securing loads of cargo on trucks or trailers. It can also be used on roof rack tie-downs for your outdoor adventure.



(Trucker's Hitch Courtesy WikiHow)

The knot is accomplished by tying one end of rope to a fixed object such as a roof rack, bumper, or tailgate.

1. About mid-way on the rope, you will tie a slippery half hitch to form a loop in the middle of the line.
2. You'll want to make sure the loop part is formed with the **slack part of the rope**, or it will tighten down on itself under pressure.

Ratchet type load binders

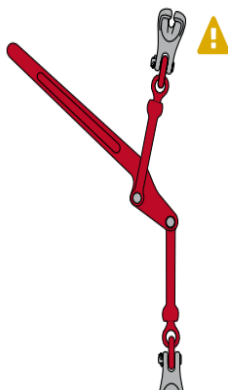
The ratchet secures to the rail under the train carriage. Spread the webbing across the load taking care to protect it from sharp edges, checking there are no twists, securing it and tightening it with a ratchet.



(Courtesy: Elphinstone Weighing) Load Binder winches.

Chain 'Dog'

- The use of over-centre tensioners (dogs) is strongly discouraged, and an alternative tensioner should be used where possible. There is a higher risk of injury using the load tensioning (dog) devices. Your local WH&S agency may be able to provide further information on the risks.



Over-Centre tensioners (dog)

*(Courtesy: NHVR Load
)Restraint Guide)*

Chain and ratchet type chain tensioner

- Chains should be the same length and the same angle to be seen as working together.
- Chains are most effective for belly wrapping.
- It is possible to attach a ratchet to the chain for tensioning

Note: Do not mix and match chains and straps on the same load. They have different stretch factors and breaking points, which may cause lashing to fail.

Cover a load with tarpaulin

All loads must be secured to prevent any part of the load being dislodged and causing a hazard.

Loose loads such as gravel or sand can be covered with sheets or tarpaulins to help prevent them from coming off the truck. Tarpaulins are not strong enough for loads except very light bulk loads. Tarpaulins will only protect from the weather as they are waterproof.

Ropes should be used to tie down a tarpaulin using the rope hook attachments surrounding the loading deck.

Brakes

Foot brake

Unlike a hydraulic braking system where pushing the brake pedal compresses the brake fluid which applies the brakes, most heavy vehicles **use air to operate the brakes**. When the brake pedal is pushed, a valve is opened which releases compressed air from a storage tank which reaches the brakes through air lines and which, in turn, applies the brake shoes or pads onto the drums or discs.

The harder the brake pedal is pushed, the more the valve is opened allowing a greater flow of compressed air to be released from the tank which in turn applies more pressure to the brake shoes or pads.

The air is created by an **engine driven compressor** and is supplied to the brakes via a proportioning valve. This valve not only supplies air to the system it also regulates how much air goes to which axle group thereby maintaining even, constant air pressure to the prime mover and/or trailers as required.

Trailer brake

The trailer brakes work in conjunction with the **foot brake** and are applied when the brake pedal is used, allowing the prime mover and trailer to brake as one unit.

A separate hand control allows the trailer brakes to be applied without the prime mover brakes and is used when coupling the prime mover to the trailer. The trailer brakes can also be used to hold the vehicle when stationary in traffic or when making a hill start, as it is the air that holds the brakes on and there is little delay in expelling the air to release the brakes when moving off.

It must be noted that this is this is **NOT** a parking brake and should be regarded as an extension to the foot brake.

Spring brake

This system, often called “maxi brakes” is a parking brake and can be used as an emergency brake system. The brakes are held on by strong mechanical springs and it is the air pressure that keeps the brakes ‘off’, so if there is a loss of air due to a leak or a hose coupling breaking, the brakes will be applied. To release these brakes it is necessary to have sufficient air pressure which may take a short time to build up in the system.

When there is insufficient air pressure, it is possible to wind off the spring brake, by inserting the key and winding back the spring.

Braking is friction which creates heat that can lead to brake fade so consider the use of lower gears, engine brakes, exhaust brakes, gearbox retarders etc. when descending hills.



Professional driver

A professional driver is one who makes allowances for and is aware of the various experience and skill levels of other road users.

Many skills are required in order to gain a position in the transport industry that will offer you satisfaction and good employment opportunities.

The Transport Industry requires professional drivers to perform a task as part of the total package they offer to their customers.

Professional drivers are not just people who have been trained to drive a truck.

The qualities you will be expected to have to be considered a professional driver are:

- To drive a range of vehicles from pick-up point to the destination or unloading point
- Handle the paperwork and deal with customers.
- Knowledge and ability to take responsibility for loading and load security of the vehicle.
- Correctly operate not only the vehicle but also any ancillary equipment.
- A good attitude to work, be able to relate well with customers and present a positive company image.
- A good worker is an asset to any company!

Simple?

No, it is not simple. Consider all the other aspects that impact a day's work as a transport driver.

As a professional driver you will be required to have a good working knowledge of the following:

- Vehicle mechanical knowledge
- Public relations.
- Driver responsibilities
- Load distribution
- Coupling / uncoupling trailers
- Manoeuvring trailers
- Paperwork
- Pre-operational checks
- Defensive driving (driver awareness)
- Customer service
- Specialist load and load carrying equipment.

- Load restraints and protection from the elements.
- Road law.
- Legal requirements for heavy vehicles.
- Fatigue management.
- Work Health and Safety.

You need the following basics to be considered for a position as a professional driver:

- Experience
- Clear offender history
- Positive attitude
- Punctuality
- Clean and tidy personal appearance
- Self-control
- Fit and healthy
- Sober habits
- Good (insurance) record
- References

There is a lack of professional operators, and specialist employment agencies are seeking more drivers for their books. There is considerable value in being a good employee and advantages in graduating from medium to heavy rigids to combination vehicles. Learning as you go.

The employer expects reliability, honesty, punctuality, courtesy, politeness, and neatness from all of their employees.

Consider the costs to your new employer if you fail to act professionally and:

- Cause mechanical damage.
- Cause damage to the load.
- Cause major vehicle damage in a road crash.
- Jeopardise their contracts by poor customer service.
- Jeopardise their company's image by poor public relations.

What it may cost!

- A prime mover: \$150K - \$250K
- A trailer combination: \$ 60K - \$150K
- Load cost: \$ 5K - \$ 1 million

This means an employer is entrusting you with his reputation, contracts and assets that could be worth over \$1.5 million.

If you have a major crash the employer is up for an undetermined amount of insurance.

A heavy vehicle driver has a lot of responsibility. He or she must be alert at all times and be a proficient and professional driver.



(Courtesy: Border Mail)

Stress

As a result of the pressures of driving other areas can impact your stress levels to a greater extent.

Common causes of **stress** include:

- Family and financial problems
- Instability in relationships
- Social problems at work
- Media related problems (poor reputation)

Methods of managing your stress include:

- Relaxation
- Positive attitude
- Punctuality and time management
- Appropriate sleep.
- Healthy diet and exercise.



Truck driver considerations:

OFFICIAL

Do	Include
Check before starting out and during long trips.	<ul style="list-style-type: none"> • Brakes • Fuel • Water • Lights • Oil • Equipment
Personal problems	Leave your problems at the kerb when you start driving if you can.
Keep up to date	<p>Changes in road rules and observe them at all times.</p> <p>Respect laws of physics relating to forces, momentum, and centre of mass of your truck and load.</p>
Watch out	For pedestrians – especially children!
Do not tailgate	<p>Keep enough distance between your vehicle and the one ahead to allow faster vehicles to pass.</p> <p>Let following traffic pass on long grades.</p>
Be prepared	To give way rather than compete with other drivers.
Never	Drink alcohol or take drugs while on the road or before starting a trip.
Sleep	If drowsy, get off the road and take a short rest.
Reduce speed	Do not hesitate to reduce your speed and be ready to stop the instant potential danger appears.
Be considerate	Give other drivers the breaks you wish others would give you.

