DEFENSIVE DRIVING

AIGA 041/06

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1 Introduction

Driving large vehicles safely requires the correct attitude and skills. It requires drivers to give their full attention, concentration and dedication. Lack of awareness, failure to practice safe driving procedures and fatigue are factors that can lead to traffic accidents.

Defensive driving is about practising driving skills that would allow you to have more time to react to any given situation on the road. The premise of defensive driving is that you, as the driver, must be alert and able to react to all potentially dangerous situations.

A defensive driving programme is an advanced form of training for drivers, over and above the mastery of the rules of the road and the basic mechanics of driving. The goal of defensive driving is a proactive driver who can avoid dangerous road situations or the poor conduct of other drivers. This can be achieved through adherence to a variety of general rules as well as the practice of specific driving techniques.

This document aims to give you a better understanding of defensive driving and describes several tools that are used in defensive driving. However, this is not meant to be a training guide. It is recommended that drivers acquire the proper knowledge and skills by attending programmes conducted by defensive driving schools.

2 Major causes of accidents

- **Poor speed and space management** – Drivers tend not to maintain a safe following distance; they drive too fast and too close to the front vehicle. This will not give them enough time to observe, anticipate, and take corrective action if something goes wrong.
- **Lack of attention** – Most drivers do not focus on driving but daydream or get distracted by unrelated things round them.
- **Failure to suit driving conditions** – Drivers fail to adjust their driving techniques to suit the road, weather, traffic and other conditions, thus presenting a danger to others.
- **Poor attitude** – Drivers tend to get emotional, arrogant and aggressive when behind the wheel.
- **No experience** – Drivers do not equip themselves with proper defensive driving skills and knowledge, resulting in poor road discipline and unsafe conduct on the road.
- **Poor discipline –** Some drivers fail to comply with safe driving procedures by getting intoxicated, taking drugs, or neglecting fatigue management.
- **Vehicle integrity** – Some drivers believe there is no value in checking their vehicles before every trip, hence any defects of the vehicles are not detected and rectified.

3 Defensive driving training

Defensive driving training is a systematic way to impart to drivers the proactive driving skills to prevent motor vehicle accidents.

Total awareness, observation, and anticipation are the primary elements of the technique.

The training emphasises the importance of:

scanning the road space and being aware of the surroundings, the road conditions and other vehicles on the road,

- identifying potential hazards,
- analysing the situation and taking the appropriate action.

Safe and efficient driving also requires drivers to be physically and mentally fit. Understanding driver fatigue is an important part of the training. Lack of rest and sleep will reduce alertness. Drivers must understand the safe work and rest hour policy, and get enough rest and sleep so that they will be physically and mentally ready to perform their duties.

3.1 Types of training

Defensive driving training is available in different forms. Typically a comprehensive programme for truck and tanker drivers should cover the following scope.

- Induction training

  Once employed, an induction training programme is recommended for new drivers. A typical example is a 10-day training programme, comprising five days in the classroom and five days of practical training on the road. The latter should also cover the critical tasks of loading and unloading products.

- Refresher training

  This is typically a 2-day training programme comprising one day in the classroom and one day of practical training. Priority should be given to those drivers who are potentially prone to misconduct, such as non-conformance to standard procedures when driving or loading and unloading products. Nevertheless, all other drivers should be required to undergo refresher training at least once every 12 to 18 months. An annual medical examination and alcohol and drug test should be included.

- Remedial training

  This is typically a 5-day training programme comprising two days in the classroom and three days of practical training. This should cover driving skills, product knowledge, and the loading and unloading of products. This is recommended for the drivers who have been involved in accidents, if the company decides to retain their services.

4 Techniques in defensive driving

The following sections briefly describe some of the tools that are used in defensive driving. This is not meant to be a comprehensive guide on all the elements of defensive driving which are taught in a proper defensive driving training course.

4.1 Hazard avoidance

A driver should be able to identify all potential hazards, determine the relative position of the vehicle and the hazard, maintain an awareness of the surroundings, and have time to respond to an unexpected situation (overtake, bypass, turn, stop, etc, to avoid the hazard).

The hazard avoidance technique is a systematic approach on how to anticipate, manoeuvre and handle the vehicle when faced with a hazard. As shown in the example in figure 1, a smooth transition past a hazard will require the driver to plan and take a series of appropriate actions to avoid a collision or accident.

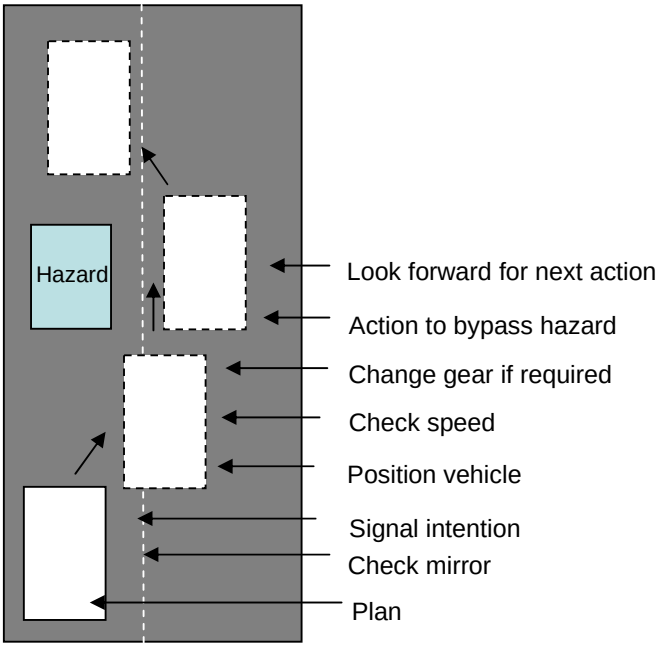


Figure 1: Avoiding a hazard

4.2 Scanning the road – use of mirrors

Scanning the road by checking the mirrors is one of the important elements in defensive driving technique. The rear, left and right views are equally important; always check the mirrors as the vehicle moves and the traffic changes. Observe the surroundings continuously and anticipate any possible problems.
The driver should not stay focused on an object for more than 2 seconds otherwise he will miss looking at other things on the road.

Blind spots, the areas around the vehicles that are not visible to the driver either through the windshield, side windows or mirrors cannot be eliminated.

The blind spots around the truck are similar to shadows; they follow the driver and do not disappear! There are no specific techniques on how to handle blind spots. The driver will need to be more careful and maintain his professional discipline especially when making turns or reversing the vehicle.

As an illustration, before moving the vehicle from a stationary position, the driver should do a ‘shoulder check’ – bear in mind that the over the shoulder check can only be done from the driver side. For the opposite side the driver should rely on the wing mirror.

4.3 Making turns

Turns should be made from the proper lanes. Before crossing over lane lines or centre lines, ensure that the turn can be made safely without interfering with other traffic.

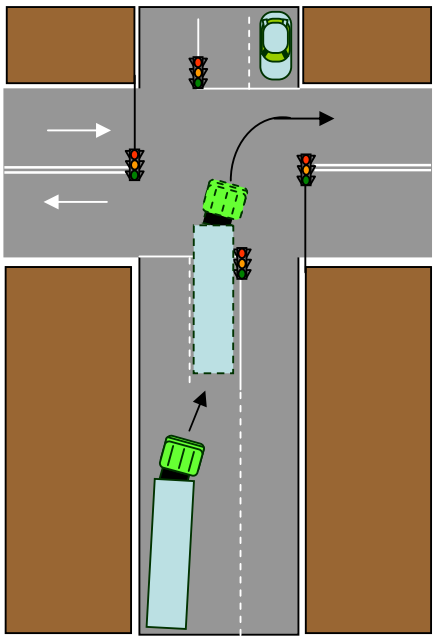


Figure 2

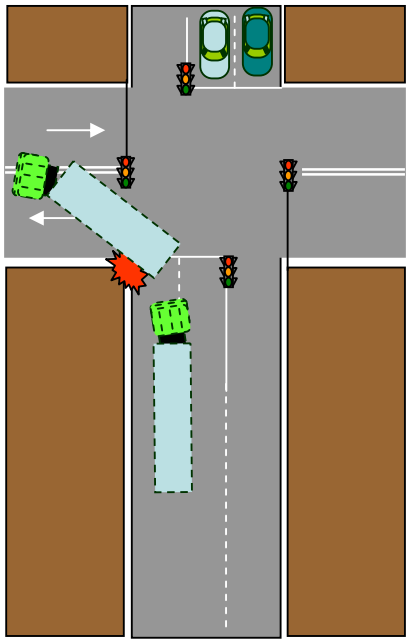


Figure 3

Figures 2 and 3 show a tractor-trailer making a right turn and left turn respectively. Before making any turn, position the vehicle to allow the trailer to follow throughout the turn. Running over kerbs and sidewalks is dangerous to pedestrians and can cause tyre damage. Beware of fixed objects such as lamp posts and road signs around the area when turning.

When making a right turn in a long tractor semi-trailer, it may be necessary to “drag-left” out of the right hand lane to make the swing and clear the right kerb, or to avoid vehicles parked near the intersection. This should be done gradually from a reasonable distance, prior to entering the intersection and after signalling the turn. Ensure that there are no other vehicles around the trailer, especially in the ‘turning radius area’.

Always check the left and right mirrors as they are equally important.

Conduct a route assessment to ensure the route is free from any permanent hazards, limited height clearance areas, narrow intersections, etc. Notify the supervisor so that the route can be changed if necessary.

For right hand drive vehicles, when there are two or more right turn lanes, the outside lane is preferred so that other turning lanes will be visible on the driver’s right; change to the appropriate gear prior to turning; proceed slowly and watch for potential hazards around the vehicle all the way through the turn. Refer to figure 4 and 5.

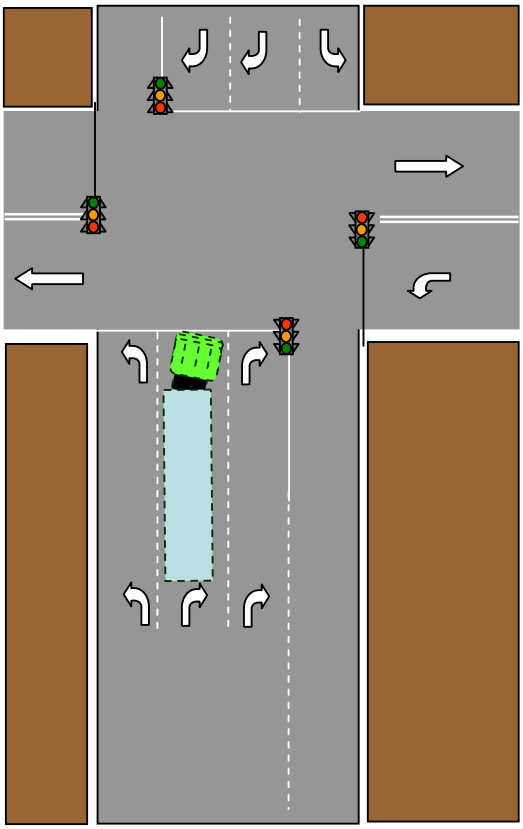


Figure 4: Right hand drive

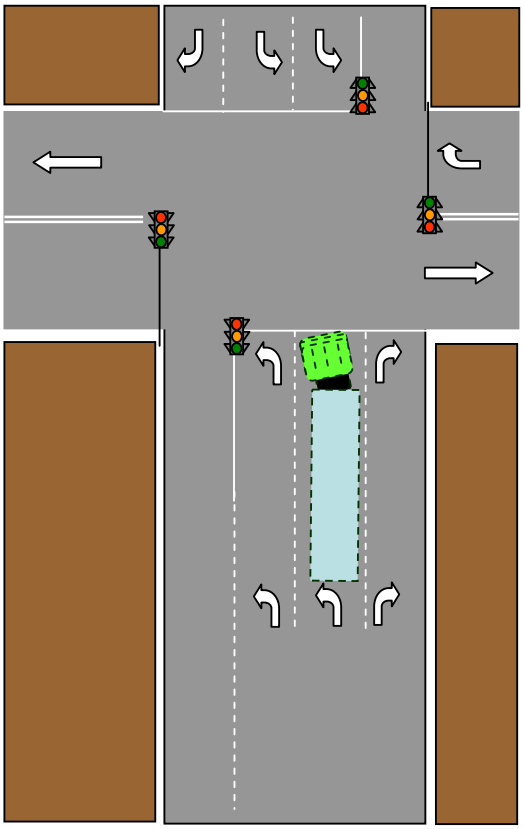


Figure 5: Left hand drive

4.4 Crossing intersections

About 75 to 80 percent of vehicle collisions occur at intersections. When approaching an intersection, plan the route and position the vehicle to indicate your intention. Approach slowly and ensure the surrounding area is free from any hazard. When the lights change from red to green, do not enter the intersection immediately in case any of the cross traffic does not stop in time. Allow three to four seconds before moving off.

Figure 6: Typical intersection warning signs

4.5 Railroad crossings

For the unmanned railroad crossing, all truck drivers are required to take special precautions when stopping at railway crossings. Make a full stop not more than 15 metres or less than 5 metres from the nearest rail. Proceed only when you are sure there is no train and that it is safe to cross.

If you are not sure, stop!

4.6 Maintaining a safe following distance

Following too closely is another bad habit of most drivers.

Do not follow too close or you may not be able to stop in time and will hit the front vehicle if the driver makes a sudden stop. Apply the 'four-second' rule in normal road conditions and double this during adverse road conditions.

'Four-second' rule

Use the four-second rule to measure the safe following distance: when the vehicle in front of you passes a fixed object (such as a tree or sign post), start counting 'one thousand one, one thousand two, one thousand three, one thousand four'. If you reach the same fixed object before 'one thousand four', you are following too close.

This timed interval works at any speed and is for normal and ideal driving conditions. If the driving conditions are bad, you must allow for more time. When raining, your following distance should be at least doubled. When there is snow or ice, the distance should be increased 3 to 4 times the normal distance.

Figure 7: Following too close

Figure 8: Correct following distance

4.7 Overtaking or passing

Always drive in the left lane (for right hand drive vehicles) and do not overtake or pass if it is not necessary. Do not attempt to overtake or pass in the following situations:

- When the road space is too narrow (figure 9)
- When driving uphill and you cannot anticipate the traffic conditions ahead (figure10)
- When approaching a curve (figure 11)
- When driving in bad weather with poor visibility and poor traction (figure 12)
- When approaching railway tracks, an intersection or junction, or crowded areas (figure 13)

Figure 9: Road space is too narrow

Figure 10: Going uphill

Figure 11: Approaching a curve

Figure 12: Poor visibility

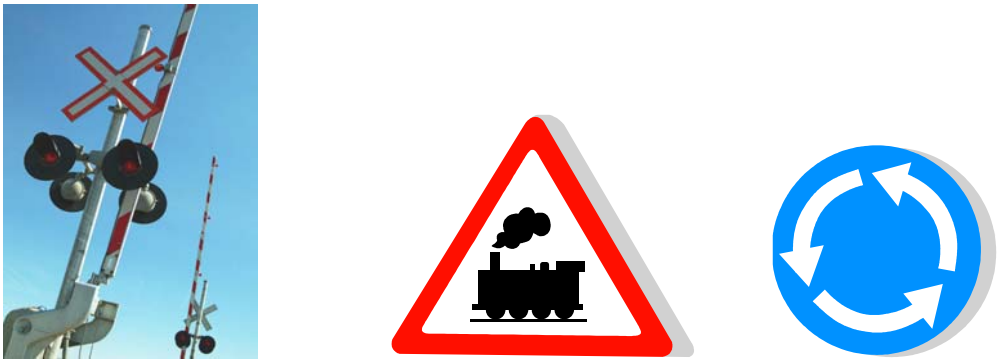


Figure 13: Approaching railway tracks, intersection or traffic junction

When it is safe to overtake, apply the hazard avoidance technique:

- Signal your intention. Make sure you can see other drivers and they can see you. Do not assume the other drivers will allow you to overtake them. Get their attention by tapping the horn or blinking the headlights at night.
- Move to the overtaking lane and be alert in case you need to pull back or increase your speed.
- Ensure the speed and space are adequate for overtaking, signal and return to the normal lane safely as soon as possible.

When you are being overtaken by another vehicle, do not increase your speed. Let the vehicle overtake safely. Decrease your speed to make it easier for it to overtake. Do not 'invite' other vehicles to overtake your vehicle. Pay attention to your own driving in case any preventive action is needed.

4.8 Bridges, tunnels and overhead clearances

Bridge clearance, weight limit, tunnel clearance or height clearance signs are usually at least 500 metres before the bridge or overhead obstruction, or at the nearest exit point prior to entering the area.

Ensure that you know your vehicle and load details. Also be sure to obtain updated clearance information, as over time the road may be resurfaced, and the signs may no longer be accurate.

Avoid wooden and narrow bridges if possible. The bridges might not have been built in accordance with proper engineering standards. Get updated weight limit information from the authorities.

4.9 Braking and stopping

- Always maintain a safe speed and ensure the vehicle is under your control at all times.
- Check the air pressure gauge to ensure the air supply for the brakes is adequate.
- Do not apply the brakes suddenly and avoid sudden stops which may lead to skids and jack-knifing.
- Always apply the brakes gradually. In certain circumstances, you may need to apply the exhaust or engine brakes; remember that the latter will not activate the brake lights.
- When you need to stop, signal and slow down gradually to allow following vehicles to know of your intention.
- To avoid skidding or jack-knifing, slow down to a safe speed before negotiating a curve so that you can drive around the curve safely with your foot on the accelerator and not on the brake or clutch pedal.
- Do not brake or change the gear while negotiating a curve especially at a high speed.

Engine or exhaust brakes

The engine or exhaust brakes are used to slow down the vehicle without applying the conventional braking system. These are not to be used to stop the vehicle. Engine or exhaust brakes are designed to enable the driver to control the vehicle's speed when going downhill, without continuously applying the foot brake. The retardation efficiency is dependent on the road topography, speed, gear selection, road and weather conditions. A good driver will always use the engine or exhaust brakes before applying the foot brakes to reduce speed.

Independent trailer control valve

Never use the independent trailer control valve in place of the foot brake. Do not use the hand control as a parking brake.

It is a good habit to use this control valve to hold the vehicle when stopped on a gradient momentarily. This is to prevent the vehicle from rolling backward if the driver fails to balance the accelerator and the clutch.

Parking or spring brakes

These brakes are used for parking and for emergency stops in case of complete air system failure. Once the spring brakes have been applied, they can only be released by air pressure from an auxiliary air tank, which is actuated by a valve located in the cab.

Tractor trailer parking control

This is usually a yellow knob which is pulled out to set the spring brakes on the tractor and on the trailer.

4.10 Braking with anti-lock brakes

Anti-lock braking systems (ABS) allow the driver to better control the vehicle in various road conditions or when required to stop suddenly. ABS is designed to prevent the tyres from being locked when brakes are applied too hard. ABS cannot counter bad driving behaviour and it is a wrong perception that ABS will make it easier to stop the vehicle and allow risk taking.

Drivers of trucks with ABS should know how to operate them. When applying the brakes, press the pedal down continuously; you are **not** required to pump the pedal.

On **non-ABS** equipped vehicles, a pumping action on the brake pedal is used to prevent the tyres from being locked and helps prevent skidding which may lead to a jack-knife occurrence.

4.11 Avoiding jack-knifing

Jack-knifing is normally caused by driving too fast and braking too hard. This results in an excessive angle between the longitudinal axes of the tractor and the trailer. When the brakes are locked, directional control at the axle is lost. Sooner or later a sideway pull develops that affects the directional stability of the vehicle which may cause a rollover. This situation is aggravated by the improper brake adjustment on all axles.

Jack-knifing can be avoided by:

- Adjusting your speed and space to suit road and traffic conditions.
- Never attempt to overtake and avoid lane changing, do not exceed the allowable speed limit, avoid sudden stops and or hard braking.
- Do not follow too closely and pay attention to vehicles around you.
- Careful driving and a good knowledge of how to drive in wet and winter conditions.
- Ensure the ABS is functioning well.
- Avoiding increasing the speed sharply as this can cause the drive wheel to spin and may lead to jack-knifing.

4.12 Driving under adverse conditions

Night driving

At night the visibility is reduced drastically compared to day time driving. Be extra careful; adjust the speed and distance to suit the conditions. The worst case scenario is driving in the rain at night.

Do not exceed the speed limit, control the headlights, and stay alert.

Ensure that the windscreen is clean and the wiper blades are in good condition and working properly.

For trucks equipped with Daytime Running Lights (DRL), be sure to switch on the regular (normal) lights at dawn and dusk or during any low visibility conditions, such as heavy fog or snow. Switch on low beam headlights to help other drivers see you.

'Dangerous Goods' vehicles may be required to drive with headlights on even in the day time in some countries.

Do not use the high beam when there is oncoming traffic as this will blind the drivers. High beam can be used only whenever there is no oncoming traffic.

Similarly, always use the low beam when approaching and negotiating a curve or bend

It is totally unsafe and unacceptable to drive a truck without both headlights on at night. If there is a fault in the electrical system, stop at a safe location and contact your supervisor. Keep fuses and bulbs ready if you are able to make such minor repairs. If you are not sure how to fix them, do not attempt to do so as it may cause a short circuit which could lead to a fire.

High altitude driving

Drivers who need to drive at high altitudes (above 2,500 metres) must be certified medically fit. This is to ensure the drivers are free from any potential cardiovascular risk or other specific disorders such as epilepsy or any sleep disorders.

Use the same gear for driving uphill and downhill.

Slippery roads and winter driving

Slippery road surfaces require special braking techniques. Improper braking can lead to skidding, jack-knifing and/or rollover. Remember the total stopping distance is based on speed. The greater your speed, the longer the stopping distance required.

- Ensure the braking system is functioning and tyre treads are adequate before starting any trip.
- Adjust your speed to suit the conditions.
- Never attempt to overtake and avoid lane changing. Do not exceed the allowable speed limit, do not use the cruise control, and avoid sudden stops and hard braking.
- Stay alert, observe and anticipate any emergencies.
- Do not follow too closely and pay attention to vehicles around you.
- For non ABS vehicles, take precautions to prevent the wheels from being locked up when braking.

4.13 Handling liquid loads

Drivers of liquid tankers must pay extra attention as the surge of liquid in the tank can affect the truck characteristics and require different driving techniques.

As the liquid surges from one side to another or end to end, the centre of gravity moves in the corresponding direction. Liquid load problems are most noticeable when tankers are partially loaded. A good driver must know how to control the vehicle under these circumstances.

The additional momentum of the liquid load may require extra ‘rolling space’ to avoid rear-end collisions. Always maintain a safe speed and allow more time to stop safely.

When the vehicle has stopped completely, maintain pressure on the brake pedal until the liquid stops surging back and forth. Gradually reducing speed will help minimize the surge effects of liquid loads.

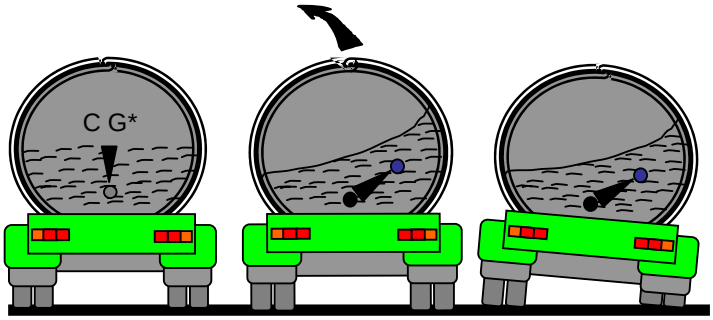
When the vehicle makes a turn or drives through a curve, centrifugal force pulls the vehicle away from the direction you are turning into. The centrifugal force also pulls the liquid load outward. This shifts the centre of gravity and could potentially make the vehicle unstable and cause a rollover.

The following are the guidelines for dealing with liquid loads:

Enter curves at a safe speed below the posted speed limits. Drive at a constant reasonable speed through the curve. Do not attempt to brake or change gear whilst in the curve. This is to ensure the load on board is stable and minimize the risk of skidding and rollover. Excessive speed when negotiating a curve can cause the truck to roll over.

Reduce speed before entering the curves. If the speed is still unsafe, reduce the speed further without sudden braking, by using the engine or exhaust braking. This will give you better control and avoid skidding or rollover caused by centrifugal force. A partially loaded tanker is more dangerous than either a completely full or completely empty tanker as there is more sloshing of the

liquid in the former case and this causes the centre of gravity of the tanker to shift more. Refer to figure 14.



Straight ahead Left curve Loss of traction

* C G – Centre of gravity

Figure 14

4.14 Avoiding driver fatigue

All drivers need to understand the causes of fatigue and how to avoid it. Driver work hour policy, proper driver roster, and breaks are some of the tools for fatigue management

Drivers need to stay alert all the time. If you feel sleepy or tired, stop at a safe place, and take a break and get some fresh air.

Plan the trip, stop at least 15 minutes for every two hours of continuous driving; do some physical exercise (such as walking around the truck to check it). Recognize the signs of fatigue and don't go 'against' it.

4.15 Parking the truck

All dangerous goods vehicles are allowed to stop at designated stop and rest areas only. The vehicles must be parked a reasonable distance away from the public area and/or any flammable or chemical substances. Do not park the vehicles where they will disrupt the traffic flow, and never leave the vehicles unattended.

Always park the truck in a safe area that has an even surface, apply the parking brakes, chock the wheels, lock the cab and pump compartment. Try to find a parking space where the vehicle can still be seen from a distance. Ensure that the cab doors as well as the rear cabinet are securely locked.

When you return to the vehicle, check around and inside the vehicle before resuming driving. Look for any peculiar or foreign object within your vehicle which is not familiar or does not belong to you.

5 References

EIGA 54/03 - Road vehicle safety programme

Appendix: Glossary of commonly used terms

ABS (Anti-lock Braking System): Computer, sensors and solenoid valves which together monitor wheel speed and modulate braking force if wheel lockup is sensed during braking. Helps the driver to retain control of the vehicle during heavy braking on slippery roads.

ATC (Automatic Traction Control): Usually an optional feature based on ABS, it prevents spinning of the drive wheels under power on slippery surfaces by braking individual wheels and/or reducing engine throttle. Also called ASR, an acronym sometimes loosely translated from the German as anti-spin regulation.

Axle: Structural component to which wheels, brakes and suspension are attached.

- Drive axles are those with powered wheels.
- Front axle is usually called the steer axle.
- Pusher axles are unpowered and go ahead of drive axles.
- Rear axles may be drive, tag or pusher types.
- Tag axles are unpowered and go behind drive axles.

Blind spot: The areas around the vehicles that are not visible to the driver either through the windshield, side windows or mirrors.

Brakes: Heavy trucks use air brakes exclusively. Most are drum-like units. Air enters the chamber when the brakes are applied, the push rod moves out, turning the slack adjuster which rotates the S-cam and forces the shoes into the drum.

Brake horsepower (bhp): Engine horsepower rating as determined by brake dynamometer testing.

Centre of gravity (CG): Weight centre or balance point of an object such as a truck body. Calculated to help determine optimum placement of truck bodies on chassis.

Chassis weight (kerb weight, tare weight): Weight of the empty truck, without occupants or load.

Driver fatigue: Driver fatigue is the term commonly used to describe the condition of being sleepy, tired or exhausted while driving a vehicle. Fatigue is both a physiological and a psychological experience, and is one major cause of truck accidents. Driver fatigue can severely impair judgment and can affect anyone. It is particularly dangerous because one of the symptoms is decreased ability to judge one's own level of tiredness. Other symptoms vary among drivers, but may include:

- Yawning
- Poor concentration
- Tired or sore eyes
- Restlessness
- Drowsiness
- Slow reactions
- Boredom
- Feeling irritable
- Missing road signs
- Difficulty staying in the proper lane

It is important to note that driver fatigue is not simply a function of time spent driving but relates to many factors including hours since the driver last slept (hours of wakefulness) and the time of day or night.

Daytime Running Lights (DRL): System that automatically turns on a vehicle's low beam headlights when the parking brake is released and the ignition is on.

Fifth wheel: Coupling device attached to a tractor or dolly which supports the front of a semi-trailer and locks it to the tractor or dolly. The fifth wheel's centre is designed to accept a trailer's kingpin, around which the trailer and tractor or dolly pivot in turns.

Grade: Steepness of a grade, expressed as a percentage. For example, a vehicle climbing a 5% grade rises 0.5 metre for every 10 metre of forward travel.

Gradeability: Vehicle's ability to climb a grade at a given speed. For example, a truck with a gradeability of 5% at 100 kph can maintain 100 kph on a grade with a rise of 5%.

Gross Vehicle Weight (GVW): Total weight of a vehicle and everything on board, including its load.

Gross Vehicle Weight Rating (GVWR) Total weight a vehicle is rated to carry by the manufacturer, including its own weight and the weight of its load.

Jack-knife: To place the trailer at a very sharp angle to the tractor.

Once the angle of articulation between the centre-line of the tractor and semi-trailer exceeds fifteen degrees a jack-knife will occur. Jack-knifing usually happens when a tyre locks up, causing the trailer to lose lateral stability. This can happen when the driver is downshifting, accelerating on a low friction surface, or entering a curve to fast. If the tractor jack-knifes with any speed, it is likely to roll over.

There are different types of jack-knifes. A classic jack-knife is when the tractor spins into the trailer. It takes about 1/2 second to occur. The classic jack-knife usually results from the sudden application of the brakes. The drive axle brakes lock before the trailer brakes or the front axle brakes, and usually the vehicle cannot recover. Empty trailers have a greater risk of a classic jack-knife since there is less weight on the tandems.

The second type of jack-knife is the trailer tandems jack-knife. Trailer tandems jack-knife happen when the rear tandems of the trailer lock up before the drive axle tandems or the front axle. This type of jack-knife is much slower and can be recovered from.

Retarder: Device used to assist the brakes in slowing the vehicle. The most common type of retarder on over-the-road trucks manipulates the engine valves to create engine drag. Other types of retarders include exhaust retarders, transmission-mounted hydraulic retarders and axle-mounted electromagnetic retarders.

Tank truck: Vehicle which carries cargo in a body mounted to its chassis, rather than on a trailer towed by the vehicle.

Tractor: Truck designed primarily to pull a semi-trailer by means of a fifth wheel mounted over the rear axle(s). Sometimes called a truck tractor or highway tractor to differentiate it from a farm tractor.

Tractor trailer: Tractor and semi-trailer combination.

Tri-axle: Truck, tractor or trailer with three axles grouped together at the rear.

Trip recorder (on-board computer): Cab-mounted device which electronically or mechanically records data such as truck speed, engine rpm, idle time and other information useful to trucking management.

Truck rollovers:
Big trucks roll easily. If a truck goes around a curve too fast, it will roll over. Trucks can go over in a curve even at low speeds if their rear tyres hit the kerb or other object while cornering. Trucks can still roll-over at 8kph especially when a jack-knife occurs while backing up. Some rollovers happen when drivers try to return to the road after putting a tyre off the pavement. They can rut in soft ground or catch a pavement separation and roll-over.