



CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

SMART DRIVING TRAINING MANUAL



Making progress possible. Together.

This Smart Driving Training Manual was developed by the City of Cape Town as part of the City's Smart Living Campaign.

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If you have any comments, suggestions or updates, please send an e-mail to lindie.buirski@capetown.gov.za.

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SECTION 1

SMART DRIVING BACKGROUND



INTRODUCTION

In order to efficiently serve its residents, the City of Cape Town has an impressive fleet of about 8 700 vehicles operated by approximately 10 000 fleet drivers. Most of these drivers are from the directorates Economic Opportunities and Asset Management, Water and Waste, and Energy and Climate Change.

The operation of this fleet resulted in the consumption of 17 364 756,19 litres of fuel (diesel and petrol combined) during 2018, costing the City R246 533 460,15 and giving off a total of 44 418 tonnes of CO₂.

The Smart Driver programme was initiated in 2013 as a behaviour change intervention. The fundamental premise of the training is to keep drivers safe on the roads and looking at economic benefits through reduced fuel consumption. It also makes sure that vehicles are driven in accordance with smart driver principles to emit less carbon dioxide.

Through ongoing skills development, training, and monitoring of fleet drivers, the programme promotes safer, greener and more economical driving.

As part of the programme, managers and supervisors responsible for driver and fleet management are also trained on managing risk in transport. The MyCiTi and Dial-a-Ride bus drivers are also trained as part of the programme.

The Spatial Planning and Environment Directorate's Environmental Management Department is the custodian of the programme and implements the training.

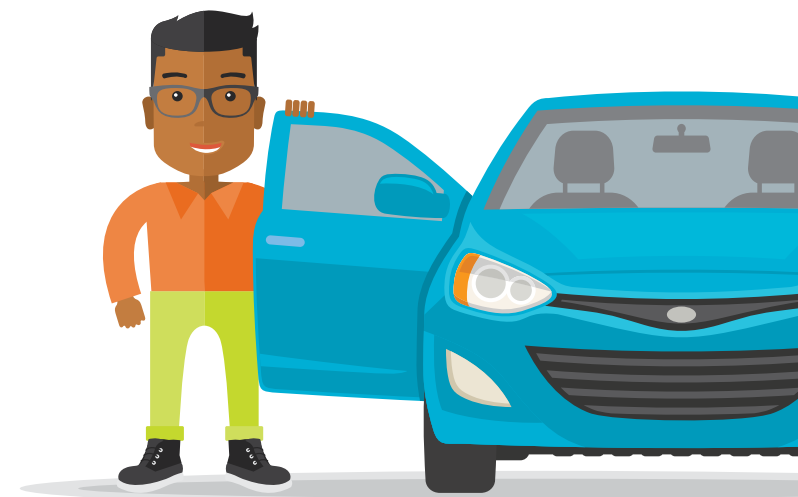
ABOUT THE SMART DRIVER PROGRAMME

The main aim of the programme is to train all City fleet drivers to develop responsible driving behaviour that aims to achieve the following outcomes:

- ✓ Improving driver safety and well-being by reducing and preventing accidents
- ✓ Improving vehicle efficiency by changing driving habits
- ✓ Improving cost effectiveness by reducing fuel consumption and maintenance costs
- ✓ Reducing vehicle carbon emissions, which has health and environmental benefits
- ✓ Monitoring drivers who participate in the training and their vehicles to establish safety, savings and greenhouse gas emission statistics
- ✓ Improving the vehicle's life-span through better driving techniques
- ✓ Improving vehicle maintenance and appearance as drivers take better responsibility of their vehicles
- ✓ Improving public image, building a sense of work pride, and increasing the asset life of the fleet
- ✓ Minimising the risk of liability and accident claims and costs and ensuring adherence to industry norms, as well as government regulations and laws

The City of Cape Town will ultimately benefit from the cost savings, through less damage to fleet vehicles with associated reduced insurance claims, cost and downtime, fewer traffic violations, reduced maintenance costs and significant fuel cost savings if the programme is rolled out across the organisation.

These benefits could be achieved by training and tracking City staff and monitoring City fleet drivers and vehicles over a period of 18 months after training is completed.



ABOUT THE TRAINING

The training programme has two components:

1. TRAINING OF CITY FLEET DRIVERS

This training consists of five components:

1. Basic environmental awareness (half day)
2. Smart driving theory (one and a half days)
3. Smart driver practical assessment (30 min per person)
4. Monitoring and evaluation (M&E) on completion of training (18 months)
5. Feedback on M&E to drivers and management, making use of the Smart Driver Business Intelligence reporting tool. The results are sent and presented to line departments

2. MANAGING RISK IN TRANSPORT TRAINING FOR OPERATOR OR MANAGER

This training is a three-hour intervention with operators, managers and supervisors looking at managing risk when dealing with fleets, drivers and transport.

The Smart Driving Training Programme is rolled out in partnership with Corporate Fleet Management's Driver Behaviour Safety Programme, which also aims to improve and change driver behaviour and safety. A training tender is in place.

The National Road Traffic Act (NRTA) of 1996, Section 49 (c) states that "The owner/operator/proxy of a vehicle shall exercise proper control over the driver of such motor vehicle to ensure the compliance by such driver with all the provisions of this Act". Therefore, with specific attention to the Act, the Smart Driver training programme is now mandatory for all fleet drivers. Driver ID tags must be renewed periodically and before this can be processed, all fleet drivers will be required to first complete the mandatory training, be declared competent Smart Drivers and submit their competency certificate before their driver ID tags will be renewed.

The Smart Driver training is a City Manager approved programme, so staff do not have to use time from their normal 10-day training allocation per annum for this training.



MONITORING

The Smart Driver Business Intelligence Reporting System, developed by RAMM Technologies is used to monitor drivers.

The main focus areas of monitoring currently are on driver behaviour, e.g., driver scorecard related to speed and harsh braking, petrol usage and CO₂ emission using the e-fuel, and driver tag systems will also be looking at making use of heat maps of high accident areas.

In future, the following will be added as reporting tools:

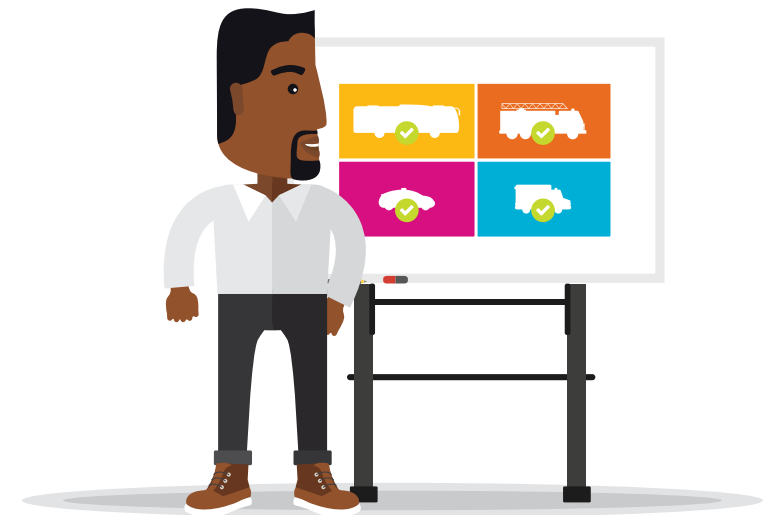
- ✓ Vehicle repair workshop records (brakes, tyres, gearbox, clutch plates) and tyre repair records
- ✓ Fleet accident records and insurance claims feedback
- ✓ Medical records required – professional driving permits fit to drive and fit to operate and injuries on duty (IODs)
- ✓ Traffic offences controlled through the Electronic National Administration Traffic Information System (eNaTiS) and the Administrative Adjudication of Road Traffic Offences (AARTO) when implemented by the National Department of Transport

TRAINING MATERIALS

This course material was originally developed by the City of Cape Town, but has been updated in partnership with THABO Training and Services, as well as Steadfast Greening. If the content of the Smart Driving Training Manual or related course materials are used for training programmes or any other purpose, the City of Cape Town must be acknowledged as the original developer and owner of the training materials.

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BEST PRACTICES FOR IMPROVING DRIVER BEHAVIOUR AND SAFETY

According to industry statistics, motor vehicle crashes are the leading cause of fatalities in the workplace – more than fires, explosions, trips, falls and equipment combined.

Driver safety is top of our mind when dealing with potential issues in fleet operations. We would want to:

- ✓ Protect our drivers' well-being
- ✓ Prevent accidents from happening through pro-active interventions
- ✓ Minimise the risk of liability, accident claims and costs
- ✓ Adhere to industry norms, as well as government regulations and laws

Employee safety is top of the agenda, but unsafe driving and accidents can negatively impact on service delivery:

- ✓ Potential fines for drivers and the City
- ✓ Negative perception of the City's reputation
- ✓ Decreased productivity in fleet operations and line departments
- ✓ Increased operational costs

AWARENESS AT OPERATIONAL SITES

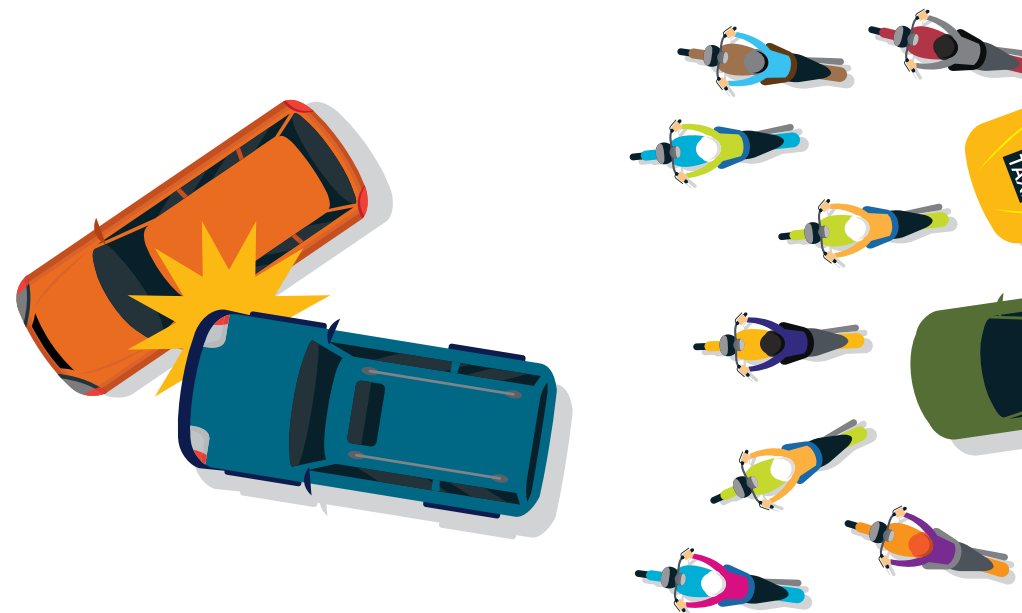
Think safety first before executing a task.

Five basic steps to safety:

1. What am I about to do and in what environment? (Know your own and vehicle limitations)
2. What are the hazards and risks?
3. What tools and equipment am I about to use and are they safe?
4. What can go wrong while doing the job?
5. What am I going to do to prevent harm to others, myself and the environment?

General life-saving rules:

- ✓ Always be aware of your surroundings and prevailing hazards and risks
- ✓ No overriding or modification of safety equipment or vehicle specifications
- ✓ Report unsafe conditions, hazards, incidents and near-misses IMMEDIATELY to line manager
- ✓ No person shall operate any equipment without the required permit applicable to the equipment
- ✓ Vehicle lights shall be switched on at ALL times when driving but remember to switch off the lights when the vehicle is parked
- ✓ Adhere to all site rules while driving in depots



CONCERNS AROUND UNSAFE DRIVING

Did you know that the true (indirect) cost of an accident is two to five times more than the direct expense?

Here are some of the indirect costs to take into consideration:

- ✓ Lost time and repair costs can be very expensive
- ✓ Lost productivity, lack or delayed service delivery
- ✓ Increased insurance premiums and damaged reputation
- ✓ Increased customer complaints
- ✓ Down-time of vehicles
- ✓ Possible fatalities
- ✓ Delayed response times due to lack of vehicles for Safety and Security
- ✓ Reputational damage

INCIDENT MANAGEMENT PROTOCOL

INCIDENT, ACCIDENT, NEAR MISS, NEW HAZARD OR RISK IDENTIFIED, ABUSE, MISUSE OR COMPLAINT

The employee involved and/or who identified the potential danger

- ✓ Immediately report the situation to line manager
- ✓ As far as possible, activate appropriate critical role-players and take reasonable step to minimize or control the impact of the immediate situation
- ✓ In emergency situations, please ensure that instructions are followed (liaise with line manager)

RISK CONTROL REPORT - TIME LINES

INCIDENT - IMMEDIATELY

The employee to immediately report to the line or depot manager (supervisor).

BASIC INFORMATION - WITHIN TWO WORK DAYS

The employee involved and the line or depot manager (supervisor) to complete.

OHS OPERATIONAL POLICY STATEMENT

The City is committed to:

- ✓ Ensuring compliance with OHS legislation, standards
- ✓ The aim shall be effective OHS management by ensuring a systematic approach through encouragement and prevention by adopting a SAFETY FIRST culture and actively promoting health, safety and protection of the environment
- ✓ Ensuring prompt reporting, investigation and introduction of appropriate control measures when hazards or risks are identified or incidents are encountered

Incident Management Procedures can be found on www.capetown.gov.za.

TOP FIVE CAUSES OF VEHICLE ACCIDENTS IN SOUTH AFRICA

In 2017, road deaths in South Africa reached the highest level in 10 years. Here are some of the major causes of these accidents and how you can avoid becoming a statistic, according to a local news article¹.

In the SA Road Traffic Management Corporation 2016-2017 report, they describe human factors as the primary reason for 77% of all fatal road accidents. This is followed by road conditions at 16%, and the condition of a vehicle at 6%. Those statistics reveal a frightening truth: if we were more cautious on the road, the number would be lower.

So, what are these top five reasons that seem to be more human-related than anything else?

1. DISTRACTIONS

This includes things like talking on your cellphone, texting, eating, applying makeup and setting GPS devices while driving, to name a few. Of all the accidents in this group, 25% are caused by using a cellphone while driving.

2. DRUNK DRIVING

According to SAPS Zero Tolerance, your blood may not have an alcohol content of more than 0,05%. Now, depending on one's body, for some people that means just having one beer could put them over the limit. The consequences for this could be a fine of up to R2 000, or winding up in prison with a criminal record and a suspended licence. Or worse, driving drunk could result in a fatal accident.

¹ <https://blog.suzukiauto.co.za/blog/9-most-common-causes-of-road-accidents-in-south-africa>

3. SPEEDING

At 110 km/h a vehicle with the critical components in good condition and the driver paying attention to the driving task acting within the parameters of perception-, reaction-, actuation time and braking distance, stopping distance would be in the region of 170 m depending on road layout and conditions. Speed is not the main contributing factor, but increases the intensity of impact. The faster you drive, the harder you hit.

4. RECKLESS DRIVING

We see this every day – accidents caused by drivers who cut into tight spaces at high speeds, or who don't concern themselves with the rules of the road, skipping stop signs and robots.

5. PEDESTRIANS

Pedestrians can also cause a bit of havoc on the roads. As mentioned in the Road Traffic Management Corporation's annual reports, pedestrian deaths far outnumber those of passengers or drivers. The report shows that in 2016 alone there were 5 410 pedestrian deaths, compared to 408 passengers and 360 drivers. This could be because of not looking before crossing the road or being distracted before doing such.

It is our responsibility as drivers to not only concern ourselves with our own lives, but with the lives and well-being of those around us. So, the next time you're out on the road, remember that you could be the reason someone makes it home or not – so, do all you can to ensure that you keep your fellow road users safe.

WHAT YOU WILL LEARN DURING SMART DRIVER TRAINING

Participation in this programme does not imply doubt in anyone's driving ability. It does mean that people are valuable and they should receive skills to improve their driving safety. Driving is all about time – how much time you give yourself to perceive and react in specific situations.

Participants in the Smart Driving Training Programme will:

- ✓ Receive environmental information related to driving
- ✓ Receive facilitated instruction on the theory and practice of Smart Driving
- ✓ Participate in interactive presentations, discussions and training activities
- ✓ Be required to perform in a group-based practical assessment
- ✓ Be required to participate in a monitoring programme
- ✓ Receive feedback from the monitoring and evaluation

RISK ASSESSMENT DRIVING

Smart Driving training includes Risk Assessment Driving Techniques, which raise the level of a driver's overall effectiveness by increasing awareness, placing more knowledge at a driver's disposal and sharpening skills of observation, perception and forward planning.

Drivers who successfully complete the programme will be able to:

- ✓ Explain basic environmental, sustainability and climate change concepts. Why is there a problem and why it is relevant?
- ✓ Identify the links between transport and sustainability. Why be fuel-efficient and how can carbon emission be reduced?
- ✓ Apply practices and techniques that promote sustainable Smart Driving habits. What is Smart Driving? How to become a Smart Driver?

OUTCOME OF PROGRAMME:

The following outcomes are anticipated for the programme:

- ✓ Safer employees/drivers/vehicles
- ✓ Safer communities and roads
- ✓ Better and improved service delivery and customer service

THE FOUR MAIN BENEFITS OF SMART DRIVING

1. SAVE MONEY

- ✓ Use less fuel (up to 30%)
- ✓ Reduce vehicle wear and tear
- ✓ Reduce maintenance costs
- ✓ Increase vehicle lifespan
- ✓ Reduce insurance costs

2. BUILD A BETTER FUTURE

- ✓ Respect human rights
- ✓ Comply with government laws
- ✓ Support City policies
- ✓ Obey traffic regulations

3. IMPROVE HEALTH AND SAFETY

- ✓ Respect human rights
- ✓ Comply with government laws
- ✓ Support City policies
- ✓ Obey traffic regulations
- ✓ Drive safer vehicles
- ✓ Have fewer accidents

4. SAVE OUR PLANET

- ✓ Reduce emissions
- ✓ Reduce air pollution
- ✓ Reduce water pollution
- ✓ Limit chemical spills
- ✓ Reduce resource consumption

SECTION 2

SMART DRIVING ENVIRONMENTAL IMPACT



INTRODUCTION

One of the principles of the City's Environmental Strategy is to ensure that resource efficiency and low-carbon development principles are embedded in all aspects of the City's work. The City will support and drive the implementation of innovative technologies and behavioural changes that promote resource efficiency and programmes that lower people's carbon emissions and footprint.

Transport is currently the biggest consumer of energy in Cape Town (64%), and the sector also produces the most greenhouse gas emissions. This section addresses the environmental impact of vehicles, why it is important and what you can do to reduce your negative impact.

Electricity is carbon heavy in South Africa.

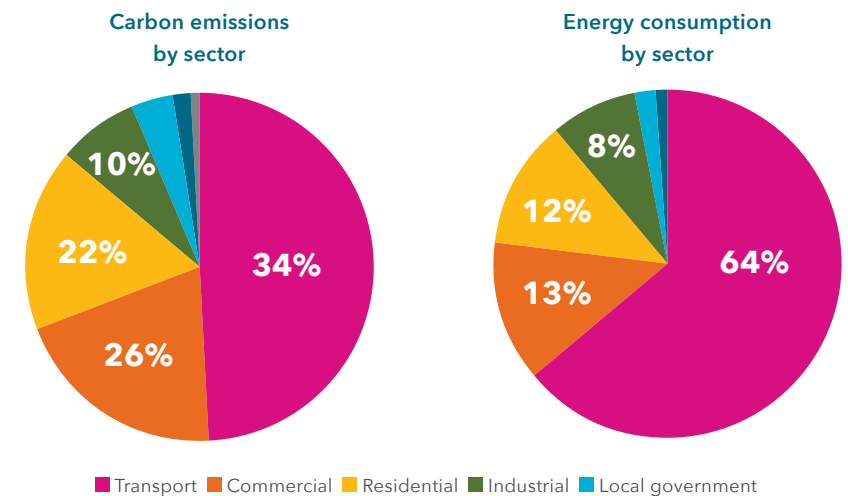


Figure 1: Cape Town's energy consumption by sector (right) and carbon emissions by sector (left).

Source: Cape Town Energy 2040, City of Cape Town.

BURNING FOSSIL FUELS

The world demands over 100 million barrels of oil and liquid fuels per day, which has increased from 84 million barrels in just 10 years². Each barrel contains 159 litres of fuel. Transport consumes around 63,7% of the oil produced per year and 20% of global energy reserves.

Carbon dioxide (CO₂) is one of the human-induced greenhouse gas emissions contributing to global warming and climate change. Carbon dioxide is a by-product of burning fossil fuels such as oil, petrol, diesel and liquid petroleum gas (LPG) in the vehicles we drive.

Carbon dioxide equivalent (CO₂e) is a term for describing different greenhouse gases in a common unit. For any quantity and type of greenhouse gas, CO₂e signifies the amount of CO₂ which would have the equivalent global warming impact.

The more fuel we burn in our vehicles, the more polluting gas emissions are pumped into the air. For every litre of petrol burned, 2,3 kg of CO₂ emissions are released into the air. For every litre of diesel burned, 2,7 kg of CO₂ emissions are released, depending on the type of vehicle.

We all need to become more fuel-efficient. Scientists expect the world's oil reserves to start running out from 2050. According to peak oil theory, fossil-based fuels will also become extremely expensive over the next 50 years.

Table 1 provides a summary of carbon dioxide equivalent (CO₂e) per fuel type per litre fuel consumed.

Fuel type	Kg CO ₂ e / litre
Diesel	2,68 kg CO ₂ e
Petrol	2,31 kg CO ₂ e
Bio-diesel (B20)	2,20 kg CO ₂ e
Liquid petroleum gas (LPG)	1,52 kg CO ₂ e
Compressed natural gas (CNG)	0,48 kg CO ₂ e

Source: DEFRA 2018 conversion

² <https://www.statista.com/statistics/271823/daily-global-crude-oil-demand-since-2006/>

PETROL OR DIESEL?

Although diesel fuel contains slightly more carbon dioxide (2,68 kg CO₂e/litre) than petrol (2,31 kg CO₂e/litre) based on the fuel type, overall carbon emissions of a diesel car tend to be lower because less fuel is needed to drive the same distance. On average, this equates to around 200 g CO₂e/km for petrol and 120 g CO₂e/km for diesel based on the distance driven.

Two of diesel fuel's environmental advantages have always been that diesel engines get better mileage than traditional gasoline engines and diesel fuel requires less refining. Diesel fuel is heavier and oilier than gasoline and when it was first used in cars during the oil crisis of the 1970s, people found their cars covered in soot. Indeed, diesel engines do emit a fair amount of nitrous oxides and highly carcinogenic particulates (soot), which contributed to the brown haze in Cape Town. So, although carbon emissions are lower, other emissions are a concern.

In South Africa, new cars attract a carbon tax, which affects the price of diesel cars more than petrol cars, due to their higher carbon emissions. In order to help stop or slow down global warming, we need to reduce greenhouse gas emissions produced from burning fossil fuels.



CLIMATE CHANGE

Ninety-seven percent of climate scientists agree that human activity is driving a climate crisis across Earth³. While weather refers to the atmospheric conditions over the short-term (temperature, humidity, wind, etc.), climate refers to the long-term weather patterns (typically over 30 years) in a specific region.

During the last century, the climate has changed – including 15 of the 16 hottest years on record. The reason for this is that the atmosphere is like an insulator keeping in greenhouse gases (e.g., carbon dioxide, methane, water vapour and nitrous oxide). These greenhouse gases trap the heat, just like a car parked in the hot sun, or a greenhouse used for growing vegetables.

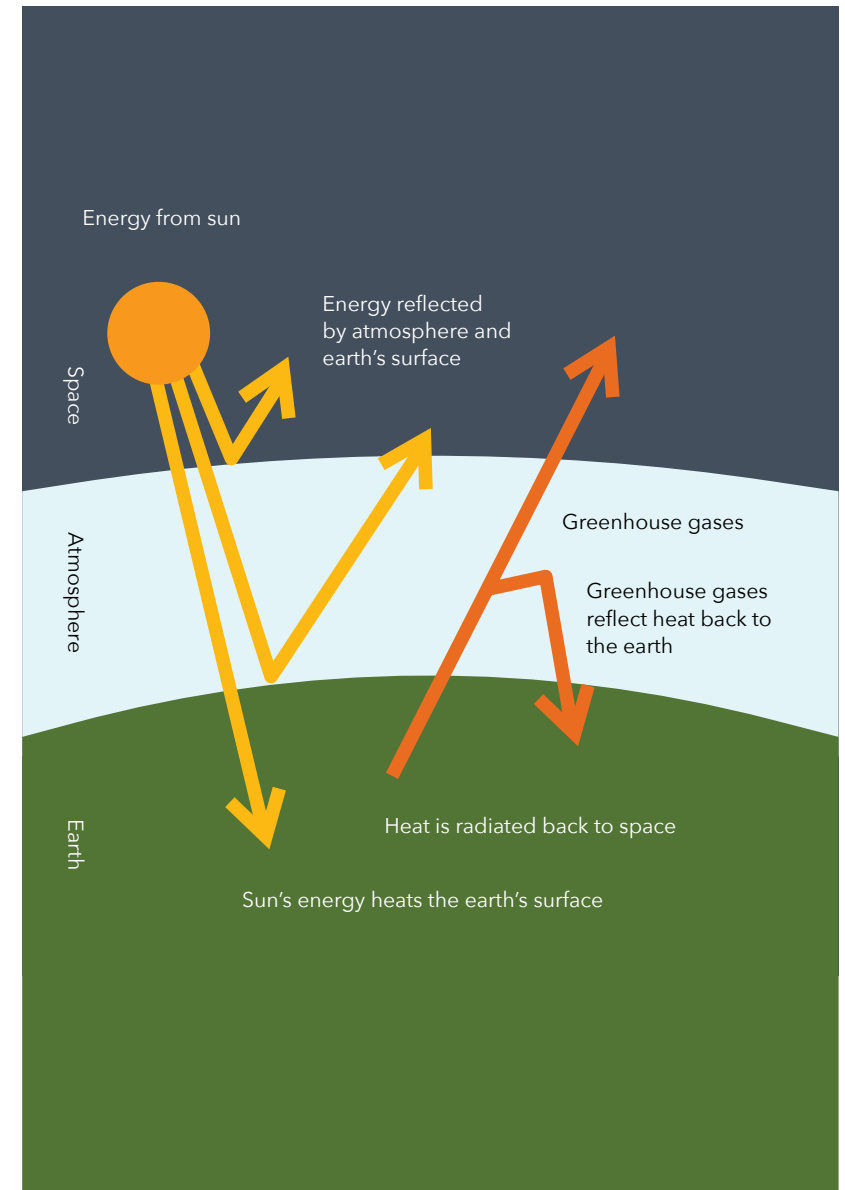
As temperatures increase, oceans evaporate, resulting in more moisture in the sky. Warmer air can hold a lot more water vapour, leading to bigger storms and floods. As global temperatures continue to increase, Earth's water cycle intensifies even more, leading to larger and deeper droughts. Hotter years typically have more fires, as it is warmer and drier. It is more difficult to fight fires with higher wind speeds. Access to clean water is a critical issue all around Africa, intensified by climate change issues. Hotter temperatures, stronger storms and rising seas threaten the health of our families and future generations to come.

Some of the climate change indicators that reflect climate change include the increase in temperature over the ocean and land, reduction in sea ice, glaciers and snow cover, and the increase in water vapour.

We know it's happening, and we know why: carbon pollution from fossil fuels is warming our planet and throwing natural systems out of balance.

What can we do? Shift from dirty fossil fuels to affordable clean energy sources like wind and solar. The choice is ours. We can solve this crisis. We can power our lives and economies without destroying our planet. But we all have to act now!

³ <https://www.statista.com/statistics/271823/daily-global-crude-oil-demand-since-2006/>



AIR QUALITY AND POLLUTION

Burning fossil fuels, such as petrol or diesel, produces smoke that affects the air quality in the city. The quality of the air we breathe impacts our local environment and the health of our communities. There are different kinds of polluting substances that affect the quality of the air.

During the winter months in Cape Town (March to August), there is often serious air pollution, or smog, hanging over the city. This smog is a mixture of toxic gases and soot particles, mainly from the exhaust fumes of diesel vehicles, which is trapped close to the ground. The fine particulate matter that is produced can also cause cancer and have acute respiratory effects. The main concern relating to toxic emissions include nitrogen dioxide (NO₂) and nitric oxide (NO). Nitrogen dioxide is produced by combustion, such as from car engines or when coal and gas are burned for energy.

This typically occurs during the morning peak traffic on calm days when there is no south-easterly wind, or 'Cape Doctor', to blow the pollution away. According to the Cape Town brown haze study (1997), 65% of air pollution could be attributed to vehicle emissions. The health risks of pollution include lung cancer and the aggravation of asthma and tuberculosis, and can furthermore lead to acid rain.



RESOURCE CONSUMPTION

Having more fuel-efficient vehicles, and driving these in a more fuel-efficient manner, will reduce the amount of fuel used and reduce resource consumption.

We need to explore ways to move away from a linear economy mind-set (e.g., take, make and dispose) towards a circular economy where materials are made from renewable sources and returned for reuse. It should be taken into consideration from the raw materials and design, through to production, distribution and consumption, with closing the loop through considering the end of life treatment (e.g., reuse, repair, recycle, compost, energy recovery).

Excessive resource extraction and processing of resources are leading to biodiversity loss and water stress. The sixth extinction is under way and focuses on insects. This threatens to collapse nature's ecosystems, putting food security at risk. The growing demand for meat is resulting in an alarming amount of global biodiversity loss. It is predicted that more sustainable use of material and energy would add an extra two trillion dollars to the global economy by 2050.

Using less fuel will impact positively on peak-oil demand, while the reduced burning of fuels will help to reduce the impact of climate change. Proactive maintenance of vehicles will reduce wear and tear and provide an increased vehicle life span, thereby reducing the need for mining materials to manufacture new vehicles.

Idling of vehicles cause spark plugs to become dirty more quickly than usual, leading to increased fuel consumption.

A car idling for longer than 10 seconds uses more fuel than restarting your engine, so switch off and save.

CLEANER, RENEWABLE TECHNOLOGY

Currently transport and vehicle technologies mostly use non-renewable resources, such as fossil fuels. However, technology is steadily moving away from fossil fuels and towards cleaner, renewable energy including biofuels and electric vehicles; thus reducing carbon dioxide emissions and improving air quality.

Investing in new technologies can be expensive, but there are many economic and environmental long-term benefits by using renewable energies. While most of us can't afford an electric vehicle, there is some progress being made towards cleaner technologies, including:

- ✓ Manufacturers improving existing vehicle technology in everyday vehicles, such as automatic stop/start instead of idling at traffic lights
- ✓ Oil companies developing better fuel for efficient engine technology
- ✓ More efficient vehicle inspection and maintenance programmes
- ✓ Developing hybrid, electric and hydrogen fuelled vehicles
- ✓ Developing biofuels and alternative fuels

It is, however, not just about having the 'latest and the greatest'. When looking at buying a car, consider what size you really need. A more compact car is ideal for city living and is much more economical. Compact cars have lower operational and maintenance costs, and even the carbon tax is lower. When selecting which car to buy, don't just consider the make and model, but ask the difficult questions around efficiency, consumption and technological features that encourage economic driving and will save you money over the long term.

CLEANER, RENEWABLE FUELS

While petrol and diesel are still the core fuels for vehicles, there are some other options on the market that are being explored⁴.

- ✓ **Ethanol:** An alcohol-based alternative fuel made by fermenting and distilling crops such as corn, barley or wheat. It can be blended with gasoline to increase octane levels and improve emission quality. Positive: Materials are renewable. Negative: Ethanol subsidies have a negative impact on food prices and availability.
- ✓ **Natural gas:** Natural gas is an alternative fuel that burns clean and is already widely available to people in many countries through utilities that provide natural gas to homes and businesses. Positive: Cars and trucks with specially designed engines produce fewer harmful emissions than gasoline or diesel. Negative: Natural gas production creates methane, a greenhouse gas that is 21 times worse for global warming than carbon dioxide.
- ✓ **Electricity:** Electricity can be used as a transportation alternative fuel for battery-powered electric and fuel-cell vehicles. Battery-powered electric vehicles store power in batteries that are recharged by plugging the vehicle into a standard electrical source. Fuel-cell vehicles run on electricity that is produced through an electro-chemical reaction that occurs when hydrogen and oxygen are combined. Positive: Electricity for transportation is highly efficient, and we already have an extensive electricity network. In the case of fuel cells, they produce electricity without combustion or pollution. Negative: Most of our electricity in South Africa is generated from coal or natural gas, leaving a big carbon footprint.
- ✓ **Hydrogen:** Hydrogen can be mixed with natural gas to create an alternative fuel for vehicles that use certain types of internal combustion engines. Hydrogen is also used in fuel-cell vehicles that run on electricity produced by the petro-chemical reaction that occurs when hydrogen and oxygen are combined in the fuel 'stack'. Positive: No bad emissions. Negative: Cost, lack of fuelling infrastructure and difficulty of putting it in place.

⁴ <https://cleantechnica.com/2012/03/08/top-eight-alternative-fuels/>

- ✓ **Propane:** Propane – also called liquefied petroleum gas or LPG – is a by-product of natural gas processing and crude oil refining. Already widely used as a fuel for cooking and heating, propane is a popular alternative fuel for vehicles. Positive: Propane produces fewer emissions than gasoline, and some countries have developed infrastructure for propane transport, storage and distribution. Negative: Natural gas production creates methane, a greenhouse gas that is 21 times worse for global warming than carbon dioxide.
- ✓ **Biodiesel:** Biodiesel is an alternative fuel based on vegetable oils or animal fats, even those recycled after restaurants have used them for cooking. Vehicle engines can be converted to burn biodiesel in its purest form, and biodiesel can also be blended with petroleum diesel and used in unmodified engines. Positive: Biodiesel is safe, biodegradable and reduces air pollutants associated with vehicle emissions, such as particulate matter, carbon monoxide and hydrocarbons. Negative: Limited production and distribution infrastructure.
- ✓ **Methanol:** Methanol, also known as wood alcohol, can be used as an alternative fuel in flexible fuel vehicles that are designed to run on M85, a blend of 85% methanol and 15% gasoline. Positive: Methanol could become an important alternative fuel in the future. Negative: Automakers are no longer manufacturing methanol-powered vehicles.
- ✓ **P-Series Fuels:** P-Series fuels are a blend of ethanol, natural gas liquids and methyltetrahydrofuran (MeTHF), a co-solvent derived from biomass. P-Series fuels are clear, high-octane alternative fuels that can be used in flexible fuel vehicles. Positive: P-Series fuels can be used alone or mixed with gasoline in any ratio by simply adding it to the tank. Negative: Manufacturers are not making flexible fuel vehicles.

GLOBAL TRAFFIC SCORECARD

Rapid urban growth is leading to congestion on our roads and an increased demand for safe and efficient transport. A global traffic scorecard by INRIX analyses the traffic congestion and mobility trends in more than 200 cities across 38 countries, delivering in-depth insights for drivers and producing a chart of cross-national rankings (<http://inrix.com/scorecard/>).

Cape Town ranked 28th on the international index based on hours lost in congestion, with the average Capetonian spending a massive 162 hours each year sitting in traffic, the equivalent of nearly a week. Bogota in Columbia, whose residents spend a shocking 210 hours, which is almost nine days a year, takes the number one spot on INRIX's index.

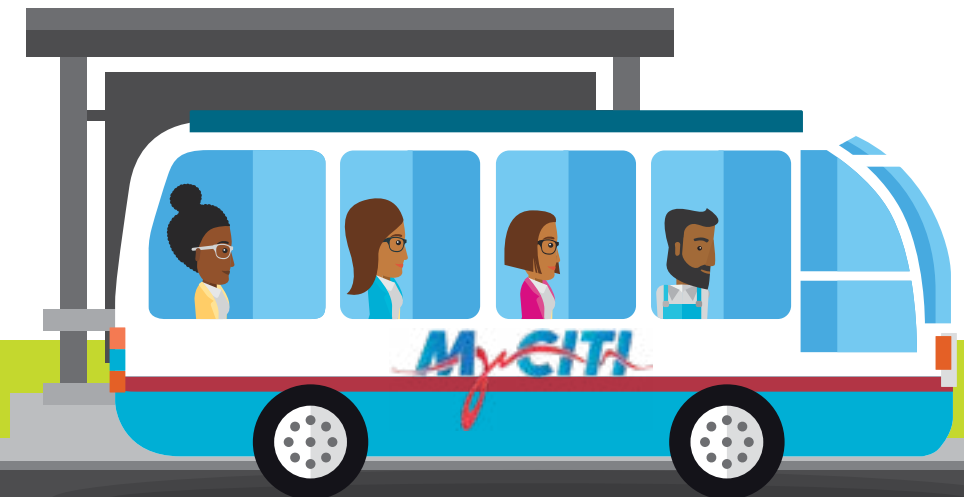
This places the Mother City on the top of the rankings in South Africa, with the closest competitor being Pretoria at 143 hours lost, followed by Johannesburg (119 hours) and Port Elizabeth (71 hours).

By changing our habits, we can reduce time spent in traffic. Promoting telecommuting and videoconferencing for office workers, providing flexi-hours or allowing staff to work from home can cut down on transport requirements during peak time traffic.

ECOMOBILITY

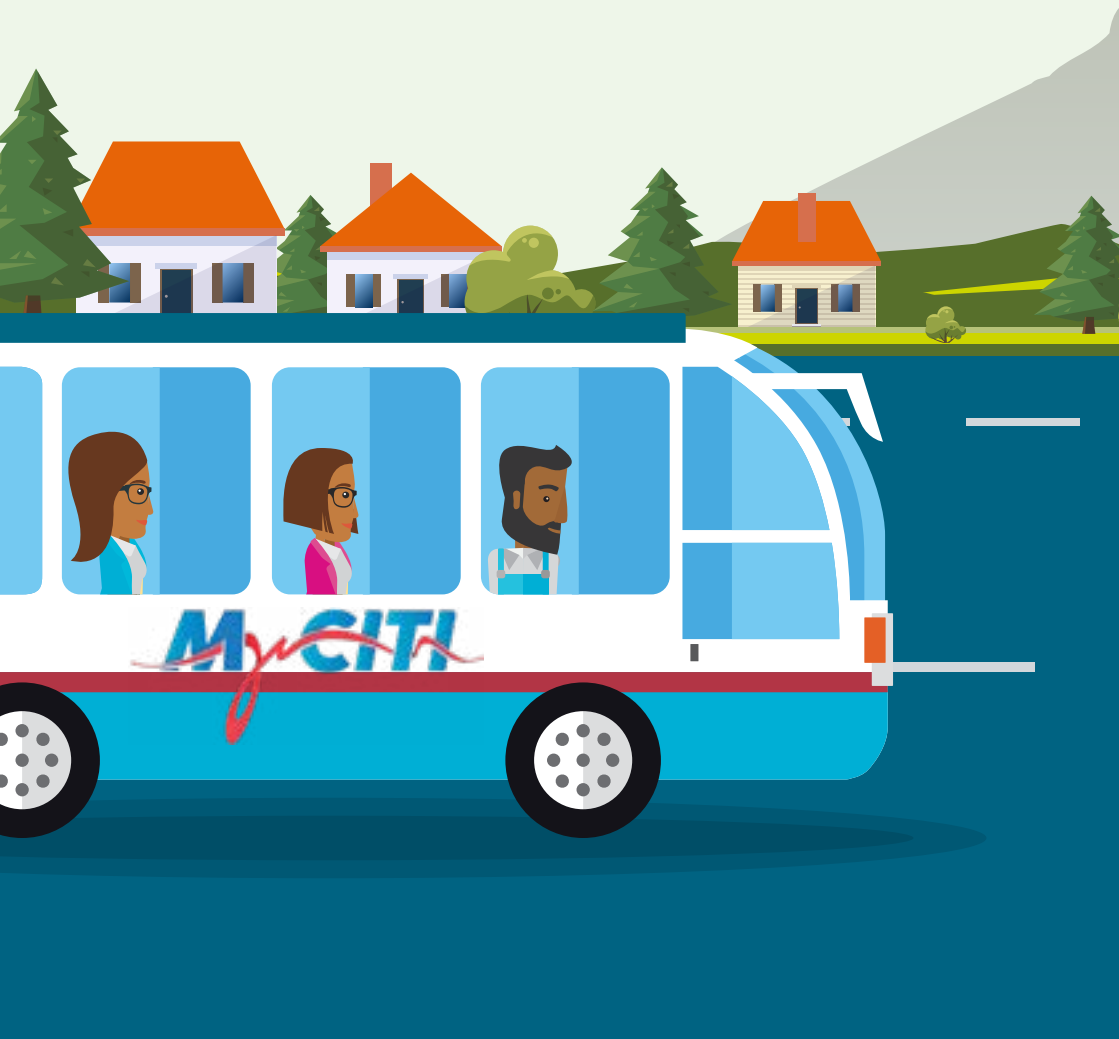
Sustainable urban mobility promotes the shift from private cars and trucking to different modes of transport and public interventions. This includes active mobility where people actively participate, such as walking, cycling or skateboarding, but also concepts such as car sharing and providing preferential parking.

EcoMobility has a very strong focus on shared or public transport which helps to decrease pollution and road congestion. EcoMobility combines the concepts of environmentally friendly and socially inclusive and accessible transport. It supports citizens' quality of life, increases travel choices, and promotes social cohesion.



SECTION 3

SMART DRIVING PRACTICES AND TECHNIQUES



INTRODUCTION

Smart Driving training is not about teaching you how to drive, but about giving you information that makes you an even more skilled and competent driver. By applying the risk assessment driving methods, you increase:

**AWARENESS + OBSERVATION + CONCENTRATION
= FORWARD PLANNING**

WARNING: IGNORANCE IS NO EXCUSE

Saying 'I did not know' is no excuse. The law states that if you enter a certain field of work, the responsibility is on you to familiarise yourself with all the expectations of the job. An example is undertaking proper vehicle inspection (Chapter V / SANS 10047 Traffic Act).

Also, if you know, or can 'foresee the possibility' that your actions may lead to the death or injury of someone, you have the option to carry on or not. As examples, refer to factors in exercise 1. If you intend on carrying on (dolus eventualis) and you are involved (as an operator, agent or manager) when someone dies, you can be charged with murder and not culpable homicide. For example, if the vehicle is not roadworthy or overloaded, or the driver is fatigued, speeding or using a cellphone.

EXERCISE 1

Please write what you regard as a FAST speed:km/h
(Please draw a circle around the number you choose)

How often do you:	Never	Quite often	Often	Very often
Exceed 120 km/h on freeways	1	2	3	4
Exceed 80 km/h (trucks)	1	2	3	4
Exceed 60 km/h in built-up areas	1	2	3	4
Drive fast	1	2	3	4
Which vehicle do you most often drive?	Make: Model:			
What is the tyre size specified by the vehicle manufacturer?				
What are the recommended tyre pressures?	Front: Unladen/empty: Rear: Unladen/empty: Front: Laden/loaded: Rear: Laden/loaded:			
What is the braking distance in metres from 100-0 with brakes fully applied?				
A = Good	B = Lucky	C = Not my time		

THE GOLDEN RULES OF SMART DRIVING



1. ANTICIPATE TRAFFIC FLOW

Read the road ahead as far as possible. Two city blocks or 12 seconds forward vision - 'scanning and planning' and 'distant and around-the-bend driving'.

At high speeds, drivers may hit potholes because their vision is focused too far ahead and they miss foreground detail.



At slower speeds, vision may be too shallow and drivers may miss important detail up ahead, like traffic suddenly stopping.

ADDITIONAL EXPLANATION:

Increasing vehicle-to-vehicle distance in traffic flow significantly improves overall road safety. Increasing the distance between your vehicle and the vehicle driving ahead to a distance equivalent of around three seconds gives you more options to act, instead of just react, and reduces risky situations.

Key action: If traffic flow is slowing down, step off the accelerator to maintain your safety distance. With this simple action, speed fluctuations in traffic can often be equalised and gently managed. As a result (strong) braking, which wastes built-up kinetic energy, can also often be avoided, as well as the need to accelerate again after too-hard deceleration.

2. MAINTAIN A STEADY SPEED AT LOW REVOLUTIONS PER MINUTE (RPM)

- ✓ Use the highest possible gear at the lowest possible RPM for improved fuel consumption
- ✓ Read and manage traffic lights from a distance
- ✓ Harsh braking and rapid acceleration results in excessive wear on tyres and brakes
- ✓ Fuel consumption increases in the lower gears because energy is needed to get the vehicle's mass moving and build momentum
- ✓ Drive inside the vehicle's torque or green band
- ✓ Exploit momentum peaks going downhill and uphill, and never freewheel in neutral
- ✓ Use gears to retard vehicle speed on the downhill, keeping inside the green band

ADDITIONAL EXPLANATION:

Unnecessary speed peaks and abrupt braking not only waste fuel, but also raise driver stress levels causing additional safety risks.

Key action: Use Smart Driver techniques for a smooth driving style and easy driving in traffic. Cruise control can support a smooth ride on freeways.

3. SHIFT UP EARLY

- ✓ Stay in the green band (torque) and do not 'over rev' or labour the engine
- ✓ Find the 'biting point' position of the accelerator when going uphill (2/3 or 3/4 up)
- ✓ Do not force the accelerator down to get more speed or power on the uphill - select the correct gear inside the torque
- ✓ Petrol engines = 3 000 RPM and diesel engines = 2 000 RPM

ADDITIONAL EXPLANATION:

Driving at high or medium engine RPM always consumes more fuel than driving at low RPM. Therefore, early shifting is highly recommended. Vehicle specifics and the particular traffic situation have to be taken into account. The optimum gear shifting for each vehicle has to be identified.

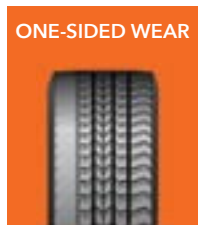
Key action: Safety first also applies for acceleration. When strong acceleration is required (for example, when overtaking, changing lanes, driving onto a freeway) use full-throttle acceleration to quickly achieve the required speed and safely manage the specific situation. Do not exceed speed limits. With an automatic transmission, avoid kick-down to accelerate, except when it is required for safety reasons.

4. ENERGY COSTS FUEL AND MONEY

Use air-conditioning and electrical equipment wisely and switch off if not needed.

5. CHECK TYRE PRESSURE FREQUENTLY

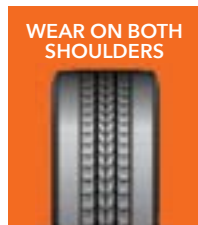
- ✓ Tyres contribute considerably towards fuel consumption, road-holding and grip, braking and water dispersion.
- ✓ Check the manufacturer's tyre pressure specifications and adjust frequently, taking the load into account.



Cause: Misalignment

Risks: Steering response

Solution: Inflate tyres to the correct pressure, according to manufacturer's specifications



Cause: Under-inflation or overloading

Risks: Compromises braking and traction

Solution: Inflate tyres to the correct pressure, according to manufacturer's specifications



Cause: Over-inflation

Risks: Compromises braking and traction

Solution: Deflate tyres to the correct pressure, according to manufacturer's specifications



Cause: Faulty suspension

Risks: Compromises braking and traction

Solution: Check shock wear or get a diagnosis from the experts



Cord damage

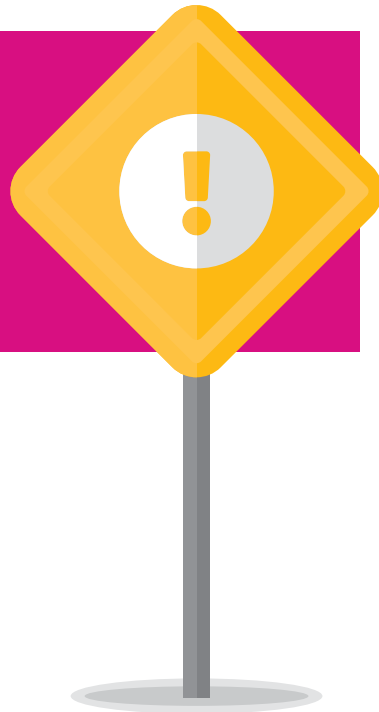
THE SILVER RULES OF SMART DRIVING

- ✓ Avoid unnecessary trips. Cold engines use more fuel compared with warmed-up engines and cause equivalently more CO₂ emissions
- ✓ Drive off immediately after starting the engine – do not warm up the engine by idling, but keep revs low till the engine has heated up
- ✓ Do not push the throttle while starting the engine
- ✓ If a waiting period is longer than five minutes, switch off the engine. Wait three minutes to cool down turbo. This does not replace the stop-start technology fitted to newer vehicles
- ✓ Close the windows while driving at higher speeds, as open windows increase aerodynamic drag and the vehicle consumes extra fuel
- ✓ Check your vehicle regularly and have it serviced to keep it 'smart-fit' and 'safety-fit'
- ✓ Fuel saving starts with choosing a low-emission vehicle – choose a fuel-efficient model with reduced CO₂ emissions where possible
- ✓ A fuel consumption display helps you save fuel if you keep on competing with yourself to lower your fuel consumption

- ✓ Consider alternative means of transport, including using different vehicles:
 - From a work perspective, consider using an alternative smaller vehicle.
 - Rethink how you use your own car: Around 25% of all vehicle trips are less than two kilometres, and 50% are less than five kilometres
 - Cycling and walking have positive effects on the environment and also on your health and budget
 - Using public transport saves you money, avoids stress and reduces emissions
 - Consider a carpool with friends or colleagues or try vehicle sharing to save fuel and reduce costs

KEY SMART DRIVING TIPS

- ✓ Anticipate traffic flow, maintain a safe following distance and vehicle momentum
- ✓ Maintain steady speed at low RPM driving slowly
- ✓ Shift up early



THE FIVE PHASES OF SMART DRIVING

SMART DRIVING TECHNIQUES

Save fuel, help maintain the condition of the vehicle and, most importantly, look after the environment. The following five phases of Smart Driving present a basic but comprehensive outline of the main techniques required to achieve these outcomes. The key to a good driving technique is smoothness, and the secret to smoothness is good preparation.

1. PREPARATION

- ✓ **Weight:** Unnecessary weight means extra fuel use
- ✓ **Streamline:** Unused roof racks create additional wind resistance
- ✓ **Pre-trip inspection:** Inspect all components as per the check sheet
- ✓ **Driving posture:** Correct driving posture reduces fatigue and improves your control
- ✓ **Plan your trip:** Work out the most efficient route prior to departing using apps or maps
- ✓ **Combine short trips:** Organise tasks into one trip rather than making multiple short trips
- ✓ **Avoid peak traffic:** Leave earlier or later and save 50% on driving time and fuel
- ✓ **Fill your tank wisely:** Don't over-fill the tank as fuel expands in the sun and may overflow or evaporate, resulting in wastage
- ✓ **Don't idle your engine:** Letting a vehicle idle wastes fuel and pollutes the air - starting a vehicle uses less fuel than one minute of idling. For non-turbo vehicles it must be 10 seconds or less

2. ACCELERATE SMOOTHLY

3. MAINTAIN A STEADY SPEED

4. ALLOW THE VEHICLE TO LOSE SPEED GRADUALLY

5. BRAKE GENTLY AND IN GOOD TIME

DID YOU KNOW?

Driving at 110 km/h uses up to 9% more fuel than driving at 95 km/h and 15% more than driving at 80 km/h. Cruising at 130 km/h uses up to 25% more fuel than at 110 km/h.

GEAR SELECTION TECHNIQUES

The rules of gear selection:

- ✓ Driving in a gear that is too low is uneconomical – change up earlier
- ✓ Look as far ahead as you can when driving and you may not have to come to a full stop at a hazard such as traffic lights

Going up and down hills (heavy vehicle with load):

- ✓ Ease up on the accelerator before the crest of a hill and momentum will carry you over
- ✓ Applying and releasing the brakes frequently heats them up faster
- ✓ Use brake aids, such as retarders, exhaust brakes and the gears
- ✓ If the road is clear, release the brake aid (retarder) before the bottom of the hill to exploit the momentum peak
- ✓ Brake gently and gradually so there is less wear on brakes
- ✓ When going down long hills, apply the three-second rule

Moving off, gear changing and stopping procedures:

- ✓ Move off gradually to prevent over-revving the engine and increasing tyre wear
- ✓ When approaching a red traffic light, decelerate gradually by lifting your foot off the accelerator
- ✓ Do not gear down in a light motor vehicle unless you need to accelerate and the torque is too low, for example, when the traffic light changes from red to green
- ✓ When necessary, squeeze the brake pedal lightly
- ✓ Skip gears where possible

BEWARE OF BRAKE FADE: Overheated brakes can lead to complete failure of brakes or glazing of brake linings.

FUEL CONSUMPTION AND MAINTENANCE

The way you drive affects how much fuel you use, as well as the amount of costly wear and tear on the vehicle. Handling the vehicle incorrectly, or with a lack of understanding or sympathy for the vehicle, can result in very high running costs. The main aim of driving in a sustainable, eco-friendly way is to use as little fuel as possible to reduce polluting gas emissions and keep maintenance costs low.

Rolling resistance	Aerodynamic resistance	Gradients	Resistance to acceleration
Affected by: – Vehicle mass – Tyre pressure – Road surface – Vehicle speed	Affected by: – Vehicle speed – Vehicle front area – Vehicle shape 'drag' coefficient	Affected by: – Road angle and camber – Vehicle gross mass (weight and load mass)	Affected by: – Increase in speed over given distance – Vehicle RPM – Vehicle gross mass

DID YOU KNOW?

Fuel-efficient driving can cut fuel consumption and gas emissions by 30%.

It's important to check your vehicle daily for the following reasons:

- ✓ Small defects can become huge expenses: A nail in the tyre can lead to injury, death or damage with claims and prosecution
- ✓ Unnecessary downtime on the road leads to expensive recovery costs and an unproductive vehicle and driver
- ✓ Unnecessary traffic fines, or even arrests, may be incurred
- ✓ Suspension of licences, with AARTO demerit points a definite possibility
- ✓ Compliance with the rules of the road, Section 49 of the National Road Traffic Act and the Occupational Health and Safety Act related to safety of road users
- ✓ Safety of driver and passengers, preservation of life
- ✓ Broken down vehicles are soft targets for criminals and put the driver and passengers at risk of robbery, hijacking and even death



These are some of the regular maintenance items to be checked:

Air filters	Ensure filter element is serviced regularly to remove dust - this could improve fuel efficiency by up to 10%
Injection pumps	Check, change and maintain oil level regularly to ensure cleaner running engine
Cooling system	An engine running too cool or too hot may waste 10-15% of the fuel you put into the tank
Belt tensions	Belts drive air-conditioning, water pump, power steering pump, etc. Ensure tensions are set correctly
Battery	Top up if required, check for corrosion and tightness
Brakes	Have a specialist check brakes regularly, report defects
Wheels	Alignment, condition, compliance, pressure, rims, bearings
Suspension	Shocks condition, spring packs, airbags
Windows	Clean, no damage
Mirrors	Clean, no damage, not loose
Lights	Clean, no damage, not loose
Number plates	Clean, no damage, correspond with licence
Discs	Licence/roadworthy certificate/operator - valid, correspond with licence

DEFAULT REPORTING AND SIGN-OFF

Any defaults, shortages and errors must be reported to the supervisor, manager or responsible person. All defaults must be repaired, inspected and signed-off before the vehicle may depart.

What is the correct sign-off procedure?

- ✓ Ensure that all defaults, shortages and errors are recorded on the applicable check sheet or in the logbook, and feedback is given on status
- ✓ Ensure correct documentation, personal protective equipment (PPE) and all accessories as applicable are in place and on board
- ✓ Ensure the correct documents applicable to the load are in place
- ✓ Where dangerous goods are loaded, ensure that the correct placards are displayed and the correct documents for the substances as loaded are in the designated space (for example, Tremcard, Hazardous Goods Declaration, route instructions, waste certificates or container packaging slips)
- ✓ Ensure driver documentation is available (e.g. ID document, valid driving licence, crane operating ticket or PrDP as applicable per the class of vehicle and commodity and hazardous goods carry card)

PREVENTATIVE MAINTENANCE

Preventative maintenance is important to reduce the running costs of a vehicle, and should include the following practices:

- ✓ Listing all kilometres daily in vehicle logbook
- ✓ Reporting all defects on a daily basis in vehicle check sheet or logbook
- ✓ Keeping fuel index and oil usage records and reporting excessive usage
- ✓ Ensuring that service or inspection intervals are adhered to
- ✓ Recording driver details using the touch-key (on-board computer)
- ✓ Recording use of the vehicle with tracker (on-board computer)
- ✓ Recording refuelling and vehicle kilometres using e-fuel system

The purpose of preventative maintenance is to:

- ✓ Ensure the vehicle is roadworthy and road-ready
- ✓ Optimise the life of vehicle components
- ✓ Proactively promote safety by ensuring that parts are in good condition
- ✓ Prevent operation failure due to component fatigue
- ✓ Prevent excessive fuel and oil consumption and component wear
- ✓ Ensure engine settings are correct against manufacturer's standards
- ✓ Ensure optimal mixture of gases and oxygen to minimise emissions

MANUFACTURER'S SPECIFICATIONS

Every vehicle is manufactured with specifications for specific use to ensure that the vehicle performs at its best. It is therefore extremely important that vehicles are correctly driven within the limits set by the manufacturers.

When the City buys a new vehicle, drivers can request the manufacturer's handbook to familiarise themselves with the specifications relating to the following:

- ✓ Torque (green band) driving
- ✓ Correct start, warm-up and shut-down procedures
- ✓ Oil (engine, transmission and gearbox)
- ✓ Tyre or wheel size and tyre pressures
- ✓ Service intervals
- ✓ Fault-finding list

REPORT SMOKING VEHICLES

Vehicles producing excessive smoke must be reported to the City's Air Quality Management Department: Tel 021 590 1419 (during office hours).

City fleet vehicles must be reported to fleet workshop.

PSYCHOLOGICAL RESPONSES AND STRESS

Stress can have a major impact on driver behaviour on the road. Stress is defined as the psychological and physical response of the body that occurs when we must adapt to changing conditions, whether these conditions are real or perceived.

Stress has powerful effects on mental functioning, mental and physical performance (FRUSTRATION), interpersonal encounters (ROAD RAGE), and physical well-being (CONDITION). Stress can even cause illness, such as ulcers, asthma, migraine headaches, arthritis and cancer.

Table 4: Major types and sources of stress

Type	Source	Example
Frustration	Stress due to any situation in which the pursuit of some goal is blocked	Under time pressure – being frustrated with slow traffic
Conflict	When faced with multiple motivations or goals, you must choose and this is where the conflict arises	Under time pressure – late for an appointment
Change	Changes are noticeable alterations in one's circumstances that require adjustment	Traffic conditions and situations (weather, traffic flow, road users' behaviours, vehicle having problems)
Pressure	Expectations or demands that one must behave in a certain way	Forced to drive or work long hours, speed, using a defective vehicle

TIPS FOR REDUCING STRESS BEFORE DRIVING

- ✓ Use risk assessment driving techniques
- ✓ Proper route planning and route selection
- ✓ Departure times: Allowing enough time for the trip
- ✓ **DO NOT TAKE YOUR THOUGHTS TO THE STEERING WHEEL**



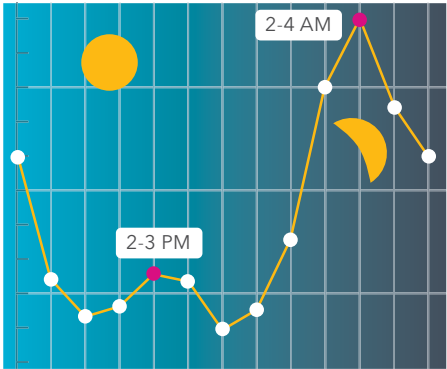
PHYSICAL CONDITION FOR DRIVING

Driver fatigue is a major safety hazard. Accidents due to driver fatigue tend to be severe, with little or no braking or avoidance action leading to high-intensity collisions. The risk of death or serious injury to a driver and passenger, and to the occupants of other vehicles, is very high in a fatigue-related crash.

Just as we get hungry or thirsty when our body needs food or water, feelings of tiredness and fatigue are signals from our body that we need sleep. These signals cannot be overcome by willpower. By understanding the processes that make us tired, you should be better able to plan and manage your daily routine to minimise the risk of fatigue.

WHAT CAUSES FATIGUE?

Your body is governed by circadian rhythm, a 24-hour internal body clock that runs in the background in your brain and dictates cycles of sleepiness and alertness at regular intervals. This causes your level of wakefulness to rise and dip throughout the day.



As a driver, you will be at your least alert between 01:00 and 06:00 in the morning, which is when many crashes happen. Your body clock also turns down alertness after lunch, known as the siesta period, and there is a small increase in road crashes at this time too.

Fatigue can lead to loss of alertness, drowsiness and even falling asleep behind the wheel. Effects of tired driving include the following:

- ✓ Poor concentration and judgement
- ✓ Lack of awareness and observation
- ✓ Slower perception and reaction times
- ✓ Decreased driving skill levels
- ✓ Drifting into 'micro-sleep', which is a brief nap that lasts around three to five seconds

Causes	Effects
Body clock factors Working when you normally sleep or sleeping when you would normally be awake	Loss of alertness Slow response to potential dangers
Sleep factors Getting less than normal sleep or getting poor sleep	Drowsy driving Drifting in and out of sleep occasionally without knowing it
Work factors Working very long hours or no time to recover from work	Falling asleep at the wheel Driver completely unaware of events before the crash
Health factors Medical sleep problems or general health and lifestyle issues	Poor memory Can't remember how you got from A-B
	Bad mood You are irritable and not very good company at work or at home

EXERCISE 2

Drivers who get less than six hours of sleep a night experience four times as many dangerous situations while they are driving. If you get less than 7½ hours' sleep each night, you will build up a 'sleep debt'. Complete the following to find out if you have a sleep debt:

SLEEP DEBT TABLE (must be 0 at the end of the week!)					
Day	Minimum hours	Minus	Actual hours slept	Equals	Sleep debt
Monday	7 ½	-		=	
Tuesday	7 ½	-		=	
Wednesday	7 ½	-		=	
Thursday	7 ½	-		=	
Friday	7 ½	-		=	
Total	37 ½	-		=	
Saturday	7 ½	-		=	
Sunday	7 ½	-		=	
Total	52 ½	-		=	

WAYS TO REDUCE FATIGUE

Listen to your body clock:

- ✓ Plan your trip to ensure you get enough rest
- ✓ Get off the road if you feel drowsy
- ✓ Stay alert in the cab – commentary driving keeps you alert
- ✓ Eat sensibly – just enough to keep you going – and at regular times
- ✓ Drink plenty of water
- ✓ After driving continuously for two hours, take 10 minutes of rest away from vehicle
- ✓ Use your time off to recover from sleep debt

Beware of stimulants:

- ✓ Caffeine in coffee and cold drinks is an excellent mild stimulant
- ✓ Avoid excess consumption of stimulants, in high-energy drinks (Red Bull, Monster)
- ✓ Remember: If you need to take stimulants, you need more sleep – stimulants are not the answer to fatigue

Look after your health:

- ✓ Regular health checks are important
- ✓ Uncontrolled diabetes can also make you feel fatigued
- ✓ Being overweight or obese causes high blood pressure and diabetes and may also cause you to have medical sleep problems
- ✓ Exercise regularly to increase fitness and energy levels, reduce your weight and improve blood circulation



TROUBLE SLEEPING? FEELING TIRED?

There are a number of medical conditions that can prevent you from getting a good night's sleep that leaves you refreshed. If you have the opportunity for enough sleep during the night but you still feel tired and drowsy during the day, you should consult your doctor who may refer you to a sleep specialist.

One medical problem is sleep-disordered breathing, or apnoea, which is worsened by being overweight. Another problem is falling asleep during the day with no obvious sleep problem at night. This is called narcolepsy and can be treated. Some people also suffer from restlessness at night that keeps them awake, also known as insomnia.

If you think you suffer from any of these, no matter how mildly, then seek medical treatment.



RISK ASSESSMENT DRIVING

Risk assessment driving, or defensive driving techniques, is an important part of Smart Driving. It involves driving not only your own vehicle, but also 'driving' the vehicles around you to prevent collisions. Operation depends on vehicle condition, type of vehicle, driver ability and skills, weather and environmental conditions. Defensive driving describes the driving skills needed to handle a vehicle in such a manner that optimal care is taken to promote road safety to all road users. Managers should take all these factors into consideration when scheduling tasks.

Risk assessment driving is:

- ✓ A positive attitude
- ✓ A responsible way of thinking and reacting on the road
- ✓ Continual assessment of every potential hazard and planning ahead for any possible scenario

A hazard on the road is anything which could cause a change in speed or a change in direction, or both. Drivers face many hazards on the road every day, which must be identified as the continual 'scanning and planning' and 'driving around the bend' in order to take the necessary action to safely avoid or pass them.

There are three main types of hazards, and a fourth, which is a temporary hazard, such as roadworks.

Fixed hazards	Moving hazards	Changing hazards
Physical features such as intersections, potholes, bends, hill crests, road signs	Pedestrians, vehicles, animals	Weather conditions and change in road conditions

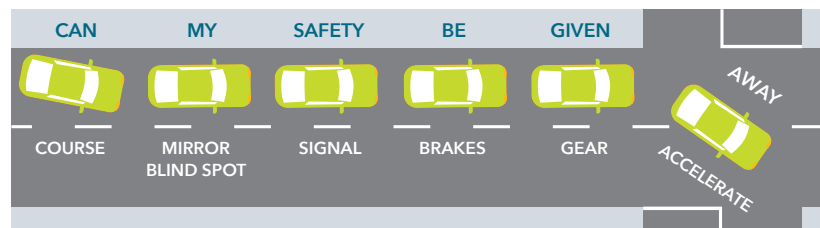
DEFENSIVE CONTROL OF YOUR VEHICLE

As a driver, you should be continually aware of everything happening around you, so that you will be prepared to react in the correct manner. The defensive system of vehicle control involves an ongoing mental process, also known as the SIPDE process, consisting of five actions:

- ✓ **Search:** Constantly search for hazards
- ✓ **Identify:** Type of hazard and how it will affect you
- ✓ **Predict:** How could you be influenced by the hazard - 'What if?'
- ✓ **Decide:** What action to take
- ✓ **Execute:** Follow your decision without delay

It is essential to continually search 360° around your vehicle for anything that could cause you to change speed or direction, making use of all available mirrors and checking the blind spots. Search for hazards 12-15 seconds, or two city blocks, ahead of your current location. The faster your vehicle is going, the further the scanning distance that is required.

Allow your eyes to scan continuously from one hazard to another. Scan far ahead and open your peripheral vision to include all possible hazards approaching from the sides. This involves 'bringing your eyes back' to shallow and wide vision. This will ensure that you are ready to react in the correct manner according to the system of vehicle control.



PERCEPTION - REACTION - ACTUATION

Perception delay is the period between the instant when a hazard is seen, heard, smelled or felt, and when it is actually understood.

Reaction time is the time taken to react after a hazard has been understood and identified.

Actuation, or lag time, is the time it takes for the vehicle components to react to an instruction from the driver, for example, to brake, swerve, brake and swerve, or accelerate.

HOW LONG DOES THIS TAKE?

It will take you about $\frac{3}{4}$ -1½ second of perception time (see-think) and another $\frac{3}{4}$ -1½ second of reaction time (do). Vehicle components take anything from $\frac{1}{2}$ -1 second to activate all the components involved in the action (air brakes 3-6 seconds).

HAZARD MANAGEMENT

- ✓ Early anticipation of danger, leaving nothing to chance
- ✓ Always seek to minimise risk and maximise safety
- ✓ Always be ready for 'what if?' scenarios

CALCULATE YOUR VELOCITY

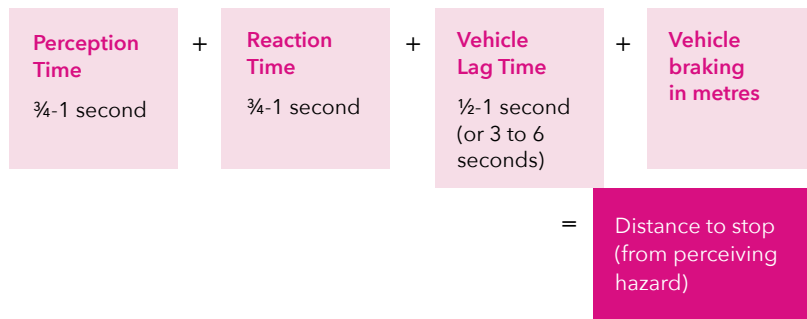
- ✓ Speed = kilometres per hour (km/h)
- ✓ Velocity = is metres per second (m/s)

To convert km/h to m/s, divide by 3,6. There are 3 600 seconds in one hour and 1 000 metres in one kilometre, so divide 3 600 by 1 000 = 3,6.

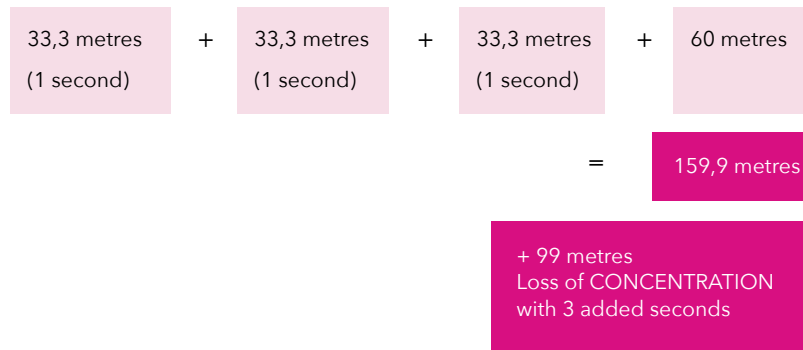
Divide your driving speed by 3,6 to see how many metres per second you are covering. For example, 120 km/h divided by 3,6 = 33,3 metres travelled every second!

STOPPING DISTANCE

Stopping distance is the driver's perception time + reaction time + brake lag time + braking from the moment the hazard was perceived.



Example: Speed = 120 km/h: Velocity = 33,3 m in 1 seconds



STOPPING DISTANCE TABLE

VEHICLE	AUDI A6 Avant	ALFA 147 JTD 1.9	BMW 750 Li	FIAT Strada 1.6 LDV	FORD Ka 1.3	JAGUAR X-Type 2.2 D	NAVARA Diesel	AVER- AGE
Metres	56,62	39,83	37,14	68,22	61,34	60,51	46,70	51 m
Seconds	3,42	3,00	2,97	4,25	3,74	3,55	3,53	3,48 s
Mass (kg)	1940	1380	2130	1080	920	1550	2010	
Brakes	Dual C Servo ABS EBD	ABS EBD	Dual C Servo ABS EBD CBC DBC ASC DSC	Discs Drums	Discs Drums	ABS EBD	ABS EBD ABD	

Brakes, steering and weight have a great influence on the stopping distance of a vehicle. The heavier a vehicle, the more stopping distance will be needed, so laden light and heavy vehicles pose more of a challenge.

By law, high beams (brights) must illuminate the road for a minimum of 100 metres and low beams (dim) for a maximum of 45 metres. A vehicle travelling at 100 km/h with a velocity of 27 m/s means that, with an average driver perception and reaction time, a distance of 54 metres is covered every two seconds. This is nine metres further than the 45 metres of illumination range of the low beams, excluding lag time and braking distance.

EXERCISE 3

Working in groups, calculate the distance to stop:

Group	Perception time (seconds)	Reaction time (seconds)	Actuation time (seconds)	Speed (km/h)	Braking distance (metres)	DISTANCE TO STOP
1	¾	¾	0,5	60	18	
2	¾	¾	0,5	80	40	
3	¾	¾	0,5	120	72	

MANAGING RISK AT INTERSECTIONS

More than 80% of accidents happen at intersections or as a result of what happens at an intersection. This is because there may be vehicles approaching from as many as four directions. You also may only have a side window to protect you from injury.

These are the most important factors to consider at an intersection:

- ✓ Scan the intersection far in advance from all four directions
- ✓ Adapt speed or velocity to circumstances and road conditions
- ✓ Cover brake, if necessary
- ✓ Signal clearly and in good time
- ✓ Proceed positively but with caution, scanning all the time
- ✓ Do not follow others too closely

TWO GOLDEN RULES AT INTERSECTIONS:

Never proceed into the intersection unless you have made sure that it is clear at least 100 metres up the road and that all vehicles have come to a stop.

On approach, never enter an intersection unless you have scanned the intersection from at least 70 metres out to ensure that all vehicles are stationary from all directions.

CORNERING

The problem of driving a vehicle through a curved path is mainly solved by the method of approach. The vehicle cannot negotiate a curve with safety and on the course directed by the driver unless the tyres retain sufficient grip on the road surface.

When a vehicle enters a bend or corner certain forces (centrifugal force) apply, which tend to break the grip of the tyre on the road. Tyre adhesion (centripetal force) must be capable of exercising the necessary inward pull on the vehicle to prevent it slipping outwards under the effect of centrifugal force. If the grip is maintained, the vehicle will follow the curved path dictated by the driver; if not, it will slide outwards across the road.

This effect is heightened on a vehicle with a high centre of gravity, which will thus 'heel' over further than others. For example, light delivery vehicles, trucks and passenger-carrying vehicles such as buses.

'ROUND THE BEND' DRIVING

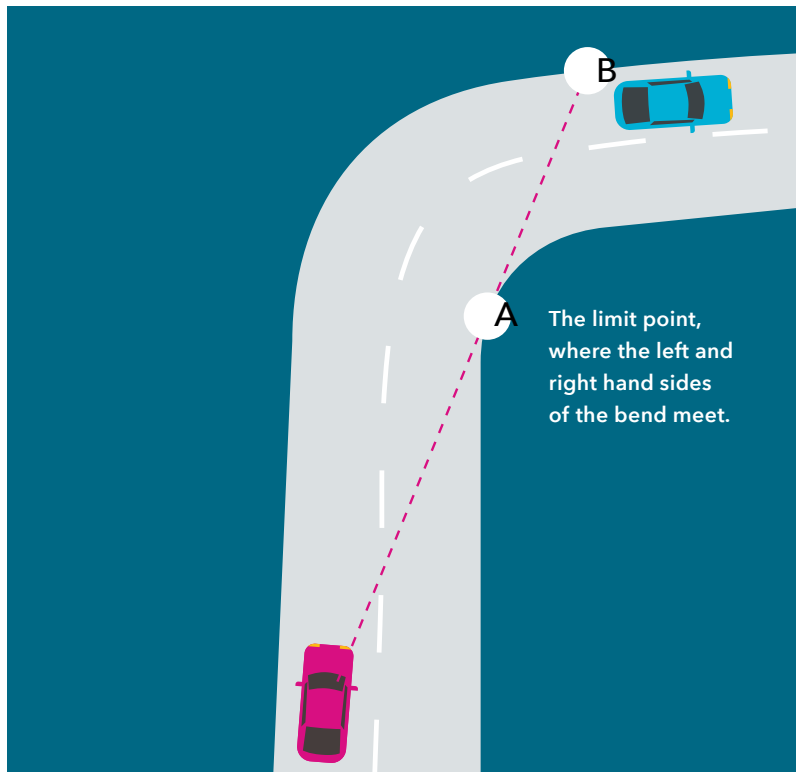
Do not only look straight ahead when approaching a bend. Wherever possible, try to look 'around the bend' or across the road to areas where you can see. This is to give you extra time, by decreasing your perception and reaction time, in case of hazards.



LIMIT POINT ANALYSIS

Another way to take a bend is by using the limit point analysis method. The limit point is the most distant point of the bend you can see.

As you approach the bend, be sure that if needed, you could stop before you reached the limit point. Then ask yourself if the limit point is getting further away. If it is, and you can see further ahead, then your speed is fine. If it is getting closer, you should continue to reduce your speed until the limit point begins to move with you and your view opens up again.



THE ESSENCE OF SAFE DRIVING

AWARENESS

Look to see! In other words, be aware of what is going on around you and take in what you see. If your awareness levels are sharp, you will reduce your perception time.

OBSERVATION AND INFORMATION

Good road observation and awareness skills can help you avoid 90% of all potentially dangerous situations. Observation includes information gathered from all the main senses of sight, touch, hearing, feeling and smell.

CONCENTRATION

The ability to manage concentration levels is essential. Good drivers will plan the drive to ensure they remain alert and focused throughout. Much of safe driving is concentrating on driving, avoiding distractions, and applying patience and common sense.



RESPECTING PEDESTRIANS

In South Africa, there is a general lack of respect for the rights of pedestrians and cyclists. The concept of 'vehicle is king' is deeply entrenched in the psyche of the South African motorist.

As part of Smart Driver training, it is essential that drivers are reminded to be respectful of pedestrians and cyclists and, especially, to respect their legal rights.

Pedestrians are extremely vulnerable. They are exposed to fast-moving traffic and a poor standard of pedestrian infrastructure. Many people have no choice but to walk long distances to work, school or public transport, and their lives are made more difficult by inconsiderate drivers.

The National Road Traffic Regulations stipulate that drivers must give right of way, slowing down or stopping for pedestrians crossing the road in a pedestrian crossing. This includes zebra crossings. At the same time, pedestrians must act responsibly and obey the rules of the road.

Apart from these legal requirements, drivers should treat all pedestrians with respect. If you see that a pedestrian is trying to cross the road, do what you can to ease their crossing. It is important to drive slowly when in the vicinity of pedestrians. If you hit a pedestrian while driving at 80 km/h, the pedestrian is almost certain to die. At 60 km/h there is a 90% chance of death, while at 45 km/h there is a less than 50% chance that the pedestrian will survive. However, if you hit a pedestrian while driving at 30 km/h or lower, there is a 90% chance the pedestrian will survive.

TRAFFIC SIGNALS AND PEDESTRIANS

Pedestrians are often at risk at signalised crossings

- ✓ Where a pedestrian crossing is controlled by a traffic signal (light), pedestrians must cross only when the lights are in their favour
- ✓ When the red man flashes, pedestrians already in the road should cross as quickly as possible. Pedestrians who have yet to enter the road area should not do so
- ✓ When the red man signal is shown, pedestrians should not cross the road

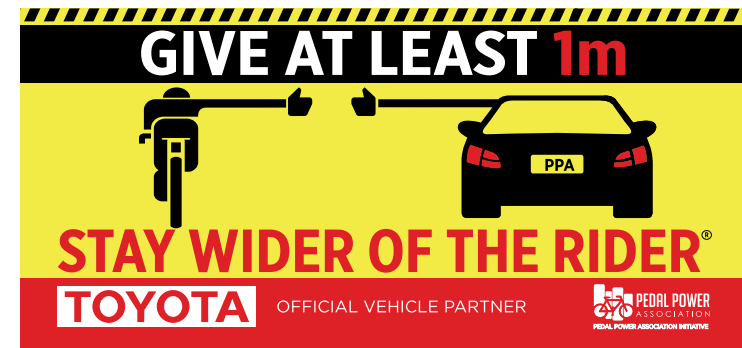


CYCLISTS AND MOTORCYCLISTS

Like pedestrians, cyclists and motorcyclists are also vulnerable road users who deserve greater respect from motorists. The City is promoting cycling both to improve health and reduce congestion on the roads. The law classifies a bicycle as a vehicle and, therefore, bicycles are allowed on the road.

Drivers can help keep cyclists safe by doing the following:

- ✓ Think bike – expect to see cyclists and take care
- ✓ Slow down and drive smoothly, keeping in speed limits
- ✓ Expect sudden movements by cyclists, especially in windy weather and on bad road surfaces
- ✓ Signal – always at circles and every time you pass a cyclist
- ✓ Watch for riders on the inside when you turn left, and don't cut them off
- ✓ Give cyclists space – 1,5 m or at least half a vehicle's width (legislative distance is 1 m, but allow more if possible to be safe) – and never force your way past them
- ✓ Be patient – sparing a few seconds for a cyclist hardly affects your total journey time
- ✓ Right-turning cyclists need space and time
- ✓ Park considerately
- ✓ Always look out for cyclists before opening a vehicle door
- ✓ Don't drive in lanes reserved for bicycles
- ✓ Use dipped headlights
- ✓ Expect speed from bikes
- ✓ Think of a bike as a vehicle – it is one



THE MAIN CONTRIBUTING FACTORS TO ACCIDENTS

The majority of traffic accidents are directly driver-related. Vehicle failure, acts of God and natural disasters are the only causes that are not related to drivers. Many accidents occur through the driver failing to adjust to conditions on the road.

The following list is a summary of the most common causes:

- ✓ Not enough time
- ✓ Attitude
- ✓ Insufficient attention – lack of awareness, observation and concentration
- ✓ Not preparing for the mistakes of other drivers
- ✓ Unskilled
- ✓ Inexperienced
- ✓ Failure to adjust to conditions – road, load or weather
- ✓ Vehicle failure

DID YOU KNOW? In South Africa, 90% of all accidents are preceded by a traffic offence.

THE ABC OF DEFENSIVE DRIVING

A = ATTITUDE

Your attitude will determine the outcome of all situations that you may encounter.

B = BACK OFF

The verb for back off is yield, meaning to give way. You should give the next person a chance to either enter the lane or drive faster.

C = CLEAR SPACE

Clear space (crash avoidance space) is vitally important in the handling of hazards. As a driver, you should ensure that you have a clear space all around your vehicle.



ASSESSING AND ADJUSTING TO CONDITIONS

There are many different driving conditions and we must adjust our driving style accordingly. They include road surfaces, terrain (hills and flats), weather conditions, visibility, traffic volume (urban or town, freeway, rural or countryside).

Being aware of and adjusting to driving conditions is a quality that separates a good driver from an average or poor driver.

Once we have identified the different driving conditions and are aware of the hazards the conditions present, we need to change our driving style. Remember, on a single trip, a driver may encounter different driving conditions, such as changing weather or travelling off the tar surface and on to gravel.

TRAFFIC - DOS	TRAFFIC - DON'TS
The first rule: Always DRIVE SLOWER ...	Never ...
In shopping centre precincts, parking lots, and central business districts (CBDs)	Rubberneck (slowing down to look at collisions or anything else)
On roads with heavy traffic	Tailgate (follow too closely)
Over narrow bridges and through tunnels	Change lanes unnecessarily – weaving in and out of freeway lanes
When you see the brake lights of several vehicles ahead of you	Eat, drink, groom yourself, talk on a cellphone or text message, read the newspaper, etc.
Near schools, playgrounds, and heavy pedestrian concentration areas	Drive a poorly maintained vehicle – vehicle is malfunctioning or running out of fuel
Through toll plazas	
At night	

PEAK TRAFFIC AND URBAN DRIVING

In these areas, drivers need to be extra alert because of the volume of traffic. Points to consider include:

- ✓ Following distance
- ✓ Braking distance
- ✓ Visibility
- ✓ Traction
- ✓ Speed
- ✓ Correct lane selection
- ✓ Lane changing
- ✓ Traffic volume
- ✓ Indication signals
- ✓ Lane positioning
- ✓ Route selection and knowledge

FREEWAY DRIVING

When driving on freeways, there is usually a free flow of traffic with limited congestion.

The greatest advantage is that the vehicles are all moving in the same direction, with multiple lanes to allow easy overtaking. Points to consider include:

- ✓ Following distance
- ✓ Braking distance
- ✓ Visibility
- ✓ Traction
- ✓ Speed
- ✓ Lane changing
- ✓ Keeping left, passing right to allow traffic flow
- ✓ Traffic volume
- ✓ Indication signals
- ✓ Overtaking

DRIVING IN FOG AND MIST

Fog and mist are dangerous conditions for driving as visibility is severely affected.

Points to consider include:

- ✓ Following distance
- ✓ Braking distance
- ✓ Visibility – pull off the road if necessary. Turn off lights, take foot off the brake so that other motorists do not think you are moving and drive into you. Activate hazard lights and, if required, put out warning triangle
- ✓ Traction on different wet road surfaces
- ✓ Slippery road markings
- ✓ Speed
- ✓ Tyre condition
- ✓ Windscreen wiper blade condition
- ✓ Lights – low beam
- ✓ Hidden obstacles, such as potholes
- ✓ Avoiding lane changes or crossing traffic
- ✓ Listening for traffic you cannot see

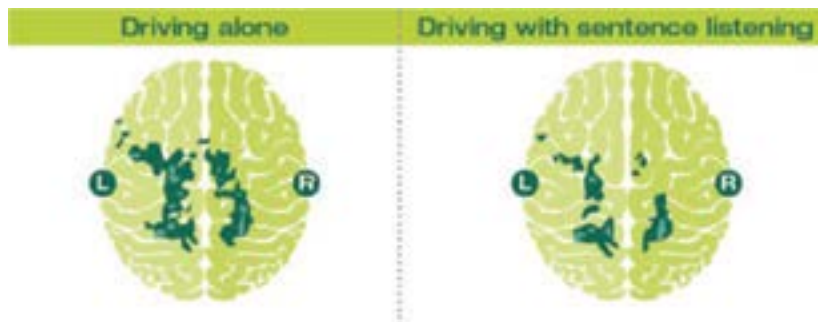
CELLPHONES AND DRIVING

Did you know that having a conversation on a cellphone while driving is equally dangerous whether you are holding the phone (which is illegal) or using a hands-free system? This is because, contrary to popular belief, the human brain cannot multi-task.

Driving and talking on a cellphone are two thinking tasks that involve many areas of the brain. Instead of processing both simultaneously, the brain rapidly switches between the two cognitive activities. Activity in the parietal lobe, the area of the brain that processes movement of visual images and is important for safe driving, decreases by as much as 37% when listening to language. Drivers talking on cellphones can miss seeing up to 50% of their driving environments, including pedestrians and red lights. They look but they don't see. This phenomenon is also known as 'inattention blindness'.

A controlled driving simulator study conducted by the University of Utah found that drivers using cell phones had slower reaction times than drivers with a .08 blood alcohol content.

Unless it's absolutely necessary, only make or take calls when your vehicle is off the road and stationary, so that your attention to the road is undivided.



HANDLE EMERGENCY AND OPERATIONAL SITUATIONS

(A points man is a person who controls the safety at the scene)

Accidents, breakdowns, tyre changes (if allowed), operations in or near the road

- ✓ Scene safety is paramount! FIRST MAKE SURE THE SCENE IS SAFE BEFORE ANY ACTIVITIES COMMENCE
- ✓ Prescribed reflective clothing shall be worn at all times
- ✓ Vehicles operating at night shall be highly visible through reflective markings
- ✓ Vehicles equipped with emergency lights shall have it switched on during the emergency or operational activity
- ✓ Place warning triangle 45 m (45 long steps) behind the stranded vehicle and if the vehicle is inside a bend or near the summit of a hill at the back and the front of the vehicle
- ✓ Place barricades at prescribed areas and distances from the operational activities
- ✓ Always have a points man securing the scene until the scene is cleared up and everybody out of the road
- ✓ The points man SHALL at ALL times face oncoming traffic between the triangles and the emergency or activity!
- ✓ Points man shall warn approaching vehicles by flagging them down during daytime and with a torch at night
- ✓ The Points man shall NEVER put him-/herself in harm's way facing oncoming traffic
- ✓ The Points man shall warn other employees audibly of any non-complying approaching drivers timeously
- ✓ The necessary safety equipment like fire-extinguishers shall be at hand
- ✓ Make sure all objects are removed from the roadside and spillages neutralized to prevent further incidents
- ✓ Complete the prescribed forms and report any unsafe acts and conditions not covered

FUEL-SAVING TIPS

DRIVE WITH A 'SOFT FOOT'

Smooth acceleration and deceleration saves fuel. When you start your vehicle, wait a few seconds for the oil to circulate and then drive off gently. Avoid jack-rabbit starts and stops. Make smooth, gradual lane changes. Build up speed in anticipation of approaching a hill. It takes three times more fuel to get up to cruising speed than to maintain it.

✓ **Save up to 100%**

OBEY THE SPEED LIMIT

Vehicles are most efficient at 100-120 km/h. If you are driving above 120 km/h, you can save 7% for every 8 km/h you slow down.

✓ **Save up to 7-23%**

KEEP YOUR CAR WELL-TUNED

A well-tuned vehicle uses less fuel. Give your vehicle a tune-up twice a year, or as specified by the manufacturer and always get a tune-up before embarking on a long trip.

✓ **Save up to 3-20%**

MAINTAIN PROPER TYRE INFLATION

Low tyre pressures can cause drag, which wastes fuel. Check tyre pressure every two weeks and before a long trip to make sure tyres are not under inflated. Under or over-inflated tyres are a safety hazard and can cause premature tyre failure. Maintaining tyres properly will also extend their life. Rotate your tyres every 15 000 km and have the wheels balanced.

✓ **Save up to 5-15%**

REMOVE UNNECESSARY WEIGHT

Extra weight decreases your fuel economy.

✓ **Save up to 1-25%**

REMOVE ROOF RACKS AND CARRIERS

Reducing your vehicle's wind resistance is one of the most important elements in getting good consumption, especially at high speeds. Roof-top racks and carriers disrupt air flow. Take them off when not in use and carry items inside the vehicle if possible.

✓ **Save up to 30%**

AVOID 'COLD STARTS'

The best way to warm up the engine is at low speeds: accelerate gradually. Warming up too long wastes fuel.

✓ **Save up to 10%**

CHANGE YOUR OIL FREQUENTLY

Change the motor oil according to manufacturer's specifications and keep fuel filters changed and clean.

✓ **Save up to 4-5%**

KEEP YOUR CAR WELL-MAINTAINED

Exhaust leaks and plugged mufflers can cause poor fuel economy. Clean your heating and cooling systems.

✓ **Save up to 20%**

CHANGE THE AIR FILTER REGULARLY

Dirty air filters increase fuel consumption and can cause poor performance. Replace the air filter according to manufacturer's specifications or even more often in dusty conditions.

✓ **Save up to 4-5%**

CHECK YOUR BRAKES

A stuck brake caliper or lining can create drag and that wastes fuel.

✓ **Save up to 20%**

CHOOSE THE RIGHT OCTANE

Only use the correct fuel, according to manufacturer's specifications.

✓ **Save up to 1-5%**

AVOID UNNECESSARY IDLING

Idling wastes more fuel than turning off and restarting the engine; the bigger the engine, the more fuel is consumed.

✓ **Save up to 30%**

AVOID TRAFFIC CONGESTION

Being stuck in traffic wastes fuel. Start trips early in the day while traffic is light. Plan compulsory stops to coincide with likely periods of traffic congestion.

✓ **Save up to 30%**

TRACK YOUR CONSUMPTION

To see if your efforts are paying off, keep a record of your fuel consumption and car maintenance on a monthly basis. Reset your trip meter each time you fill up the tank to allow precise observations. Low kilometres to the litre may indicate your vehicle is not operating at peak performance and should be inspected.

SECTION 4

SMART DRIVING MONITORING AND ASSESSMENTS



MONITORING

After the completion of the Smart Driving training, the monitoring process will commence.

What is monitored?

- ✓ Fuel consumption
- ✓ Accidents and incidents
- ✓ Unnecessary and unauthorised trips
- ✓ Unnecessary prolonged idling

Methods of monitoring include:

- ✓ The e-fuel system
- ✓ Reports
- ✓ Tag monitoring system
- ✓ Insurance claims
- ✓ Vehicle maintenance records
- ✓ In the event of non-compliance, a tag may be suspended and action taken as required and guided by the City corporate fleet and human resource policies.



PRACTICAL DRIVING ASSESSMENT DOCUMENTATION

Smart Driving practical assessment			
Name		Date	
Age		Time	
Staff nr		Reg nr	
Branch		Make	
Designation		Type	
Licence class		PrDP	
I hereby confirm all information to be accurate and correct			

	YES	NO	COMMENTS
Preliminaries			
Vehicle check - outside			
Vehicle check - inside			
Logbook			
Manipulation and Controls			
Depotment: Driver posture			
Acceleration sense: Too harsh, too slow			
Brakes use: Harsh, too late, too early			
Clutch use: Ride, coasting, jerking			
Gears use: Incorrect, scratch, to reduce speed			
Horn use: Not at all, too late, too much			
Indicators use: Too late, too early, not at all			
Mirror and blindspot use: not at all, too late			
Pedal management: Uphill smother, jerky			

	YES	NO	COMMENTS
Manipulation and controls			
Revs: Too high or low (2 000 and 3 000)			
Steering: Hands position			
Brake assist use (retarder, exhaust)			
Vehicle sympathy			
Road sense			
Awareness: At intersections, general			
Clear space: Too close, too big			
Concentration: Distracted easily			
Cornering: Cutting or wide			
Following distance: Too short, too long			
Hazard assessment: Perception too long			
Intersection management: Unsafe entering, unsafe moving off, stopping unnecessary			
Observation: Scanning and round the bend			
Overtaking: Dangerous, hesitant			
Position on road and straddling			
Reaction time: Too slow			
Speed management: Too fast, too slow			

Comments:			
Assessor:	Name:	Surname:	Signature:
Driver signature:			

DRIVER'S PRE-TRIP INSPECTION CHECKLIST

DATE:	
DRIVER:	
DEPARTMENT:	
VEHICLE MAKE AND MODEL:	
REGISTRATION PLATE NO:	
INSPECTION START AND END TIME:	

DOCUMENTS AND VEHICLE EQUIPMENT	SATISFACTORY	UNSATISFACTORY	COMMENTS
Documents and licence (driver and vehicle, PrDP, operator card)			
In cab: Operation of lights, gauges, ventilation, safety belts, horn			
Windows, windscreen, wipers (operation and condition)			
Doors operation and mirrors: clean, unbroken, not loose			
CRITICAL COMPONENTS: ANY DEFECTS NO DRIVING! REPORT IMMEDIATELY			
Lights: Headlights, indicators, tail lights, brake lights, hazards (operation and condition), side markers, red reflectors			
Tyres: Pressure manufacturer spec thread depth min 1 mm. Defects inside and outside: cuts, bubbles, cracks, black rings			
Brakes: Stationary (hydraulic and air) brake tests done			
Brake components: Hydraulic brakes: discs, leaks. Air brakes: Leaks, boosters, position slack-adjusters, air tanks drained			
Steering: Steering play, wear on steering components - ball joints, steering box, CV joints (do shake test)			
Suspension units: Shocks leak, springpacks broken, u-bolts loose			

DOCUMENTS AND VEHICLE EQUIPMENT	SATISFACTORY	UNSATISFACTORY	COMMENTS
Registration plates			
Engine components levels: oil, power steering, engine coolant, wiper washer, brake fluid, hydraulic clutch, battery. Fan belt tension (up and down max 8 mm). Open wires. Battery not loose, not corroded			
Engine operation. Transmission operation			
Emergency equipment: Jack, spare wheel, wheel spanner, warning, triangle, fire extinguisher (where applicable)			
Other:			

REPORT ALL REPAIRS NEEDED BELOW IN COMMENTS AREA

BODY DAMAGE DESCRIPTION:			
ADDITIONAL COMMENTS:			
NOTIFIED SUPERVISOR OF ANY DEFECTS	Yes	No	SUPERVISOR SIGN:
I have personally inspected the vehicle above and have found it to be in the condition listed above.			
Driver's signature:	_____		

SECTION 5

SMART DRIVING REFERENCE INFORMATION



GLOSSARY

OBC	on-board computer
PPE	personal protective equipment
PPM	parts per million
PrDp	Professional Drivers Permit
Plant	The buildings, fixtures, and equipment, including machinery, tools, instruments, necessary for industrial operation or institution.
Particulate filters	A device designed to remove diesel particulate matter or soot from the exhaust gas of a diesel engine.
RPM	revolutions per minute: A measurement of how fast your engine – specifically your crankshaft – is spinning.
tremcard	transport emergency card.
B20	A blend of biodiesel with 80% normal diesel and 20% biodiesel.
carbon dioxide (CO₂)	The main human-induced greenhouse gas emission contributing to global warming and climate change.
carbon dioxide equivalent (CO₂e)	A term for describing different greenhouse gases in a common unit.
Circular economy	An economic system aimed at minimising waste and making the most of resources. This regenerative approach is in contrast to the traditional linear economy, which has a 'take, make, dispose' model of production.
greenhouse gas (GHG)	A greenhouse gas is a gas that absorbs and emits radiant energy within the thermal infrared range. Greenhouse gases cause the greenhouse effect. The primary greenhouse gases in Earth's atmosphere are water vapor, carbon dioxide, methane, nitrous oxide and ozone.
Non-renewable resource	A natural resource that cannot be produced, regrown, regenerated or reused fast enough to sustain its consumption rate indefinitely.
Peak-oil demand	The point in time when peak global oil production occurs.
Renewable energy	Energy that is collected from renewable resources, which are naturally replenished on a human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat.
Renewable resource	A resource which can be used repeatedly and replaced naturally.

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Environmental Strategy

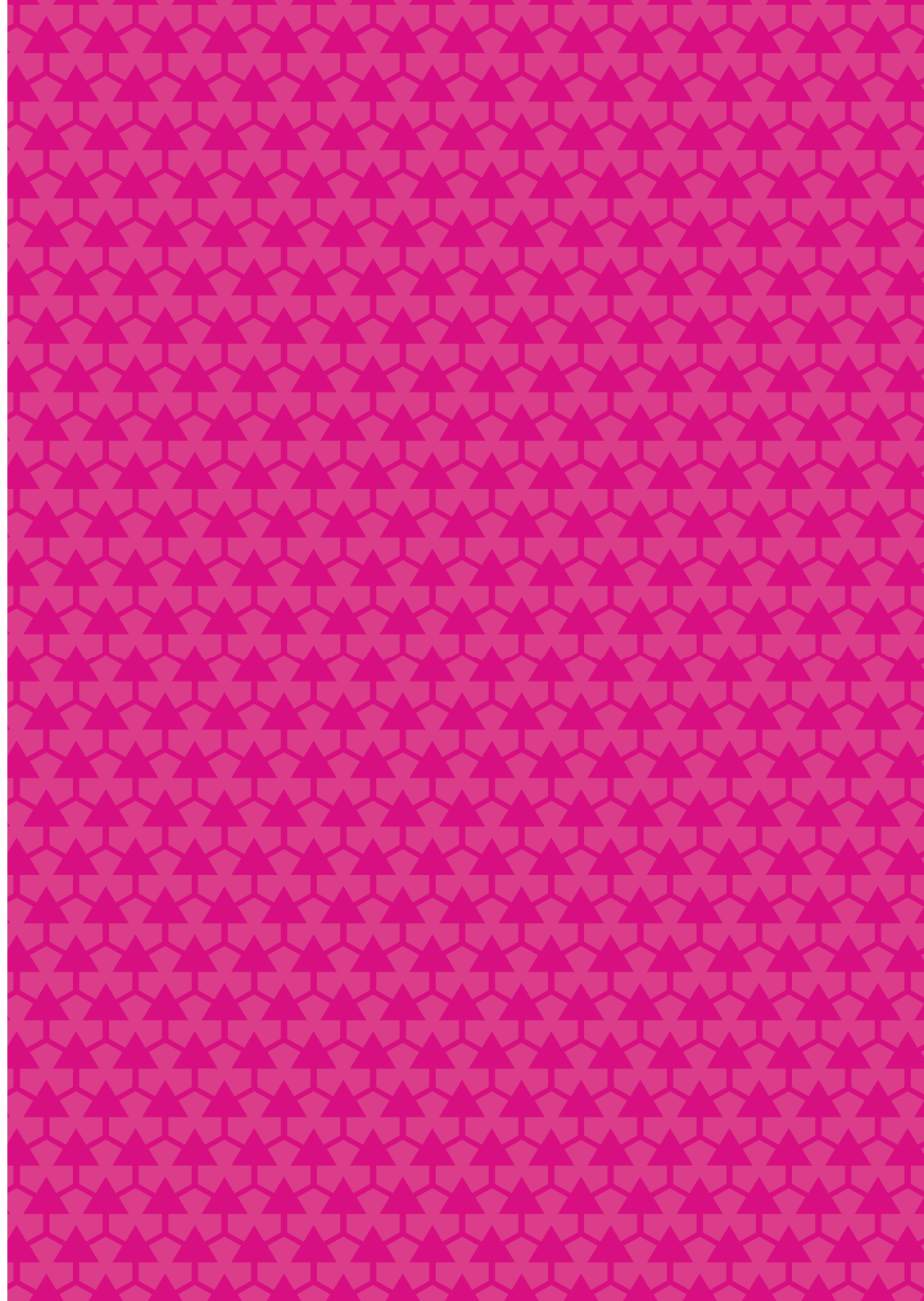
Fleet Management Strategy and Best Practices for improving driver behaviour and safety

Smart Living Handbook, 4th Edition, May 2011. City of Cape Town.

Water and Sanitation's Life saving rules and vehicle risk protocol

Useful app to download to help plan your trips: Waze

NOTES

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

Making progress possible. Together.