Controlling your vehicle's stability

A vehicle's stability is reduced when you brake, accelerate or steer because these actions produce forces that alter the vehicle's weight distribution and balance, and reduce tyre grip. A vehicle may skid when one or more of the tyres loses normal grip on the road. This chapter gives advice on how to avoid skidding, and what to do if a skid develops.

New vehicles are fitted with a growing range of active safety features to increase vehicle stability. The principles of ABS, traction control and electronic stability control (ESC) – also known as electronic stabililty programme (ESP) – are briefly explained here. Although the principles of each feature are similar, there are significant differences between manufacturers in how their particular device is activated and how it behaves.

It is vital that you refer to the manufacturer's handbook to know how your vehicle's safety features work and when they may intervene.

You may on occasions drive an older vehicle not fitted with ABS or other active safety features. The final part of this chapter explains how to deal with a skid manually in a vehicle without these devices.

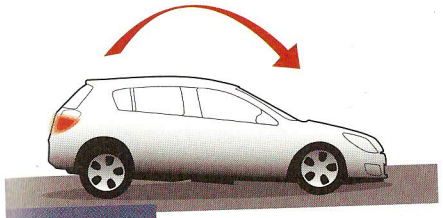
Avoiding skidding

Avoiding a skid by driving safely within the limits of the road conditions is better than having to correct one. Research shows that it is not poor road or weather conditions that cause skids but the driver's response to them. Skidding is caused by excessive speed, coarse steering, harsh acceleration or excessive or sudden braking. The real cause of the skid is therefore the driver.

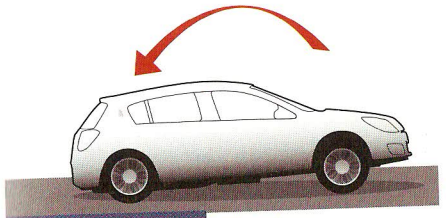
Aim to control your vehicle so that it does not skid. This becomes more difficult when road or weather conditions deteriorate, but you can minimise the risk by driving more slowly and using your skills of observation, anticipation and planning.

How does a skid happen?

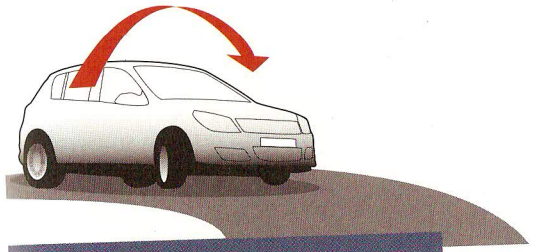
A vehicle skids when one tyre or more loses normal grip on the road, causing an involuntary movement of the vehicle. This happens when the grip of tyres on the road becomes less than the force or forces acting on the vehicle:



Braking, ...



accelerating ...



and **cornering** are the forces that cause a vehicle to lose tyre grip.

These forces act on your vehicle whenever you operate the controls – the brake, the accelerator, the clutch or the steering wheel. If you brake or accelerate while steering round a bend or corner, two forces are combined. There is only limited tyre grip available so if these forces become too powerful they break the grip of the tyres on the road. Look back now at the diagram on page 61 which shows how each of these forces affects the vehicle's stability and reduces tyre grip.

Never drive to the limits of the tyre grip available – always leave a safety margin to allow for the unforeseen.

It takes much less force to break the grip of the tyres on a slippery road surface.

Reducing the risk of skidding

Check your vehicle

The condition of your vehicle can reduce or increase the risk of skidding:

- **check tyre treads and tyre pressure regularly**
- **check the vehicle's brakes before you drive – defective brakes are especially dangerous on slippery surfaces.**

Avoid skidding in the first place – use observation, anticipation and planning to adjust your driving when the road surface may be slippery.

See Know your vehicle, page 164

Observe – weather and road conditions to watch for

Skidding is more likely in bad weather conditions and on slippery road surfaces. Watch out for:

- snow, ice, frost, heavy rain
- wet mud, damp leaves or oil, which can create sudden slippery patches on the road surface
- cold spots in shaded areas, under trees, on slopes or hills – watch how other vehicles behave in icy weather
- dry loose dust or gravel
- a shower or rain after a long dry spell – accumulated rubber dust and oil mixed with water can create a very slippery surface
- worn road surfaces that have become polished smooth
- concrete – may hold surface water and become slippery, especially in freezing conditions
- cobbled roads – these become very slippery when wet
- changes in the road surface on bridges, which may be more slippery than the surrounding roads.

You are at greater risk from these hazards at corners and junctions because you are more likely to combine braking, accelerating and steering in these situations.

Anticipate and plan – adjust your driving to the road conditions

Use your observation skills – watch out for and assess poor weather and road conditions accurately and adjust your speed accordingly:

- leave plenty of room for manoeuvre, reduce your speed and increase the distance you allow for stopping to match the road conditions – on a slippery surface a vehicle can take many times the normal distance to stop
- use lower revs in slippery conditions to avoid wheel spin, especially when moving off. Use a higher gear when travelling at low speeds
- on a slippery surface aim to brake, steer and change gear as smoothly as possible, so that you don't break the tyre grip
- use the principles of cornering (see Chapter 8) to negotiate corners carefully in slippery conditions.

Recognising the cause of a skid

If your vehicle loses stability and a skid begins to develop, you need to recognise the cause of the skid. The commonest causes of skidding are:

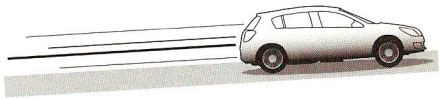
- driving too fast for the circumstances
- harsh acceleration
- excessive or sudden braking
- coarse steering.

Speed in itself does not cause skidding as a constant speed exerts no change in the vehicle's balance; but at higher speeds, braking or turning places a much higher demand on tyre grip.

Each skid is unique and every vehicle responds differently. How you apply the principles and techniques outlined in this chapter will depend entirely on the circumstances and on the vehicle you are driving.

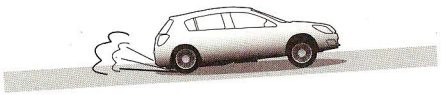
You need to be able to recognise different types of skid in the early stages so that you can respond appropriately and regain tyre grip as soon as possible.

Cause: Driving too fast for the circumstances



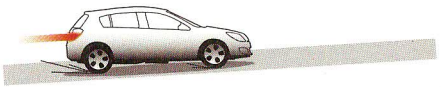
At higher speeds you need more tyre grip to corner or stop. When surface grip is low, altering speed or direction can exceed the available grip, causing a skid. The faster you go the more likely this becomes. The vehicle's own weight or a change in road surface can reduce the grip of front or back tyres. Weight in the boot will alter the vehicle's normal balance and tyre grip.

Cause: Harsh acceleration



Harsh acceleration can cause the wheels to spin, even at low speeds.

Cause: Excessive or sudden braking



Excessive braking for the road conditions causes skidding because the tyres lose their grip.

Cause: Coarse steering

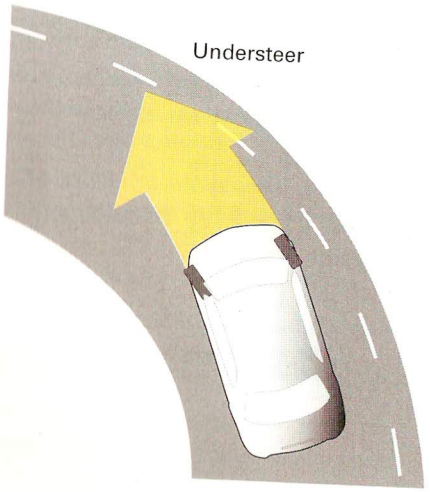
A moving vehicle uses least tyre grip when travelling in a straight line. As soon as you start to corner you place extra demands on the tyre grip. If you steer too sharply for the speed you will cause the vehicle to understeer or oversteer. This may break the tyre grip and the vehicle will then go into a skid. Aim to make your steering as smooth as possible.

In different vehicles, you may need to negotiate the same corner at different speeds.

Understeer and oversteer

Understeer is the tendency of a vehicle to turn less, and oversteer is the tendency of a vehicle to turn more in response to a given turn of the steering wheel. This can happen even at low speeds.

The tendency to understeer or oversteer is a characteristic of the vehicle itself coupled with the driver using excess speed for the circumstances. Historically, front wheel drive vehicles tended to understeer and rear wheel drive vehicles tended to oversteer. New vehicles may be designed to compensate for this tendency so take time to get to know the handling characteristics of a vehicle you are not familiar with.



How active safety features work

Activating a safety device means you are losing control of the vehicle – safety devices are not a replacement for *Roadcraft* skills.

Manufacturers are constantly seeking to improve vehicle stability with active safety features that can help safety and stability during braking, acceleration or steering. The active safety devices explained below are:

- antilock braking systems (ABS)
- traction control systems (TCS)
- and electronic stability control systems (ESC).

If an active safety system is fitted, you will see an icon light up on the dashboard when you turn on the ignition or start the engine. If more than one device is fitted, they may be displayed separately or combined in a single warning light.

Vehicles fitted with active safety devices behave differently from vehicles without.

These systems intervene at different points and some models have a deliberately delayed point of intervention. You must know how to use each device correctly in each vehicle that you drive. If you activate any of these active safety systems, you are not driving within the safe limits of the vehicle or the road conditions.

Antilock braking systems (ABS)

Most modern vehicles are fitted with ABS, an electronic active safety device which adds to the conventional hydraulic braking system by giving you some ability to steer during harsh or emergency braking.

The footbrake applies the brakes to all four wheels at once, but ABS is designed to control the braking applied to individual wheels. It works by sensing when a wheel is slowing down and about to lockup. When this happens, ABS releases the brake on that wheel before it locks up fully. It reapplies the brakes once the wheel starts to rotate again.

The advantage of ABS is that it allows you to steer the vehicle under full braking power, because it prevents the wheels locking up.

Once ABS is activated, the driver has to maintain maximum pressure on the brake pedal throughout. ABS may reduce or lengthen the stopping distance of the vehicle compared with conventional brakes on different road surfaces but allows the driver to retain some steering control.

ABS cannot increase the grip of the tyres on the road, nor can it fully prevent the possibility of the vehicle skidding.

When ABS is activated you will see a warning light on the dashboard and will feel the brake pedal vibrate or judder momentarily as the system modulates the brake line pressures. If you become aware that the ABS is cutting in, you should learn from this and reduce your speed for the rest of the journey.

Traction control systems (TCS)

When you accelerate, it is possible for the wheel turning power of the engine to exceed the amount of available tyre grip, especially when moving off on icy or slippery roads, on a steep hill or accelerating out of a corner. This may cause the driven wheels to spin. Wheel spin reduces both the vehicle's ability to accelerate and its stability.

Traction control systems work by controlling excess wheel spin on individual wheels. They apply independent braking to the spinning wheel. Some may also limit the wheel turning power of the engine to increase tyre grip.

TCS allows you to make maximum use of tyre grip, especially on slippery surfaces or where the friction of the road surface is uneven (for example, where one wheel grips the normal surface and the other slips on ice or snow).

When TCS is activated, you will see a warning light on the dashboard. If when you pull away from a standstill traction control cuts in, reduce pressure on the accelerator to regain control of the steering.

Electronic Stability Control (ESC)

Electronic Stability Control is an extension of conventional antilock braking (ABS) and traction control (TCS) systems. It is designed to help the vehicle's stability by detecting when the vehicle is driven beyond its physical capabilities.

There is more variation between types of ESC than between types of ABS or TCS, so **it is vital to consult your vehicle handbook** and follow the manufacturer's advice on what to do if a skid develops.

Sensors working at each wheel work in combination with a sensor that monitors the rotation of the vehicle – called a yaw sensor. If these detect that the driver is about to lose control, the system intervenes and applies the brakes to individual wheels in order to correct understeer or oversteer and realign the vehicle to the driver's intended path. The intended path is detected by a sensor on the steering assembly so it is crucial that you steer in the direction you want to go.

Not all ESC systems have steering sensors; some only have yaw sensors. Most systems interact with the engine management system, reducing or increasing the engine power to the driven wheels. Some also interact with the transmission system.

If you drive a vehicle beyond its physical capabilities, Electronic Stability Control does not guarantee that the vehicle will remain stable and under control.

Key points

- If you brake too hard, ABS prevents the wheel from locking up.
- If you accelerate too harshly, traction control prevents the wheel from excessive spinning.
- If you steer too sharply, electronic stability control can help prevent the resulting oversteer or understeer from developing into a skid.

Different types and makes of safety system vary widely in how they operate and intervene. Never rely on them – you should drive in such a way that they are not necessary.

Skid control in vehicles fitted with active safety features

Skid control in a vehicle fitted with one or more of these active safety systems will depend on the features fitted.

If you regularly drive different vehicles, be aware that different manufacturers use a range of systems which intervene in different ways. **You must take note of the manufacturer's advice, and guidance in the driver's vehicle handbook**, so that you fully understand how each vehicle is likely to behave in extreme circumstances.

Attitudes to vehicle safety technology

Some research suggests that ABS and other active safety devices may give some drivers a false sense of security, causing them to take more risks than they would in a vehicle without the safety features.

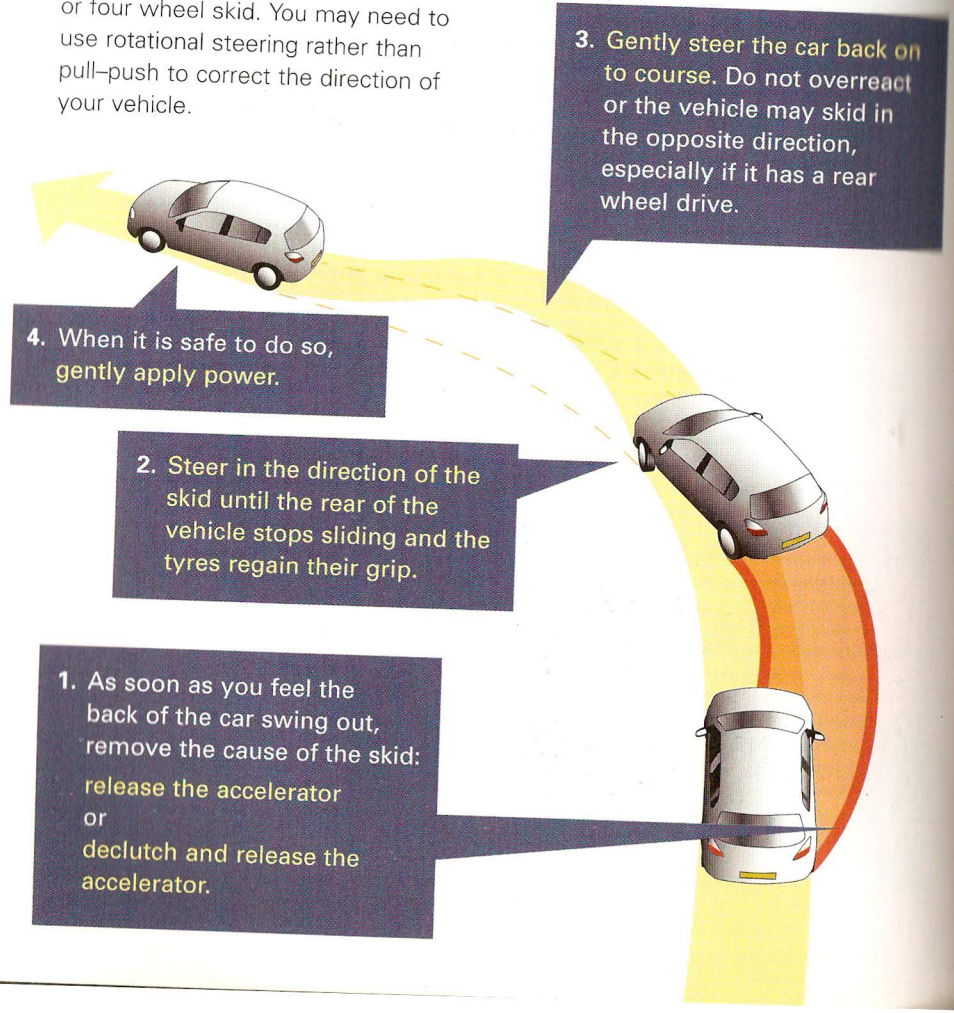
Safety features cannot change the law of physics – they don't make a vehicle perform better or increase a driver's s They can help a driver who is on the point of losing control of the vehicle t regain control, provided the driver understands the specific feature and knows how to use it correctly.

Correcting a skid in a vehicle without active safety features

There are still some fleet vehicles that are not fitted with any of the active safety features discussed in this chapter. If the vehicle you drive is one of these, the action you take to correct a skid will depend on whether the skid is a rear wheel, front wheel or four wheel skid. You may need to use rotational steering rather than pull–push to correct the direction of your vehicle.

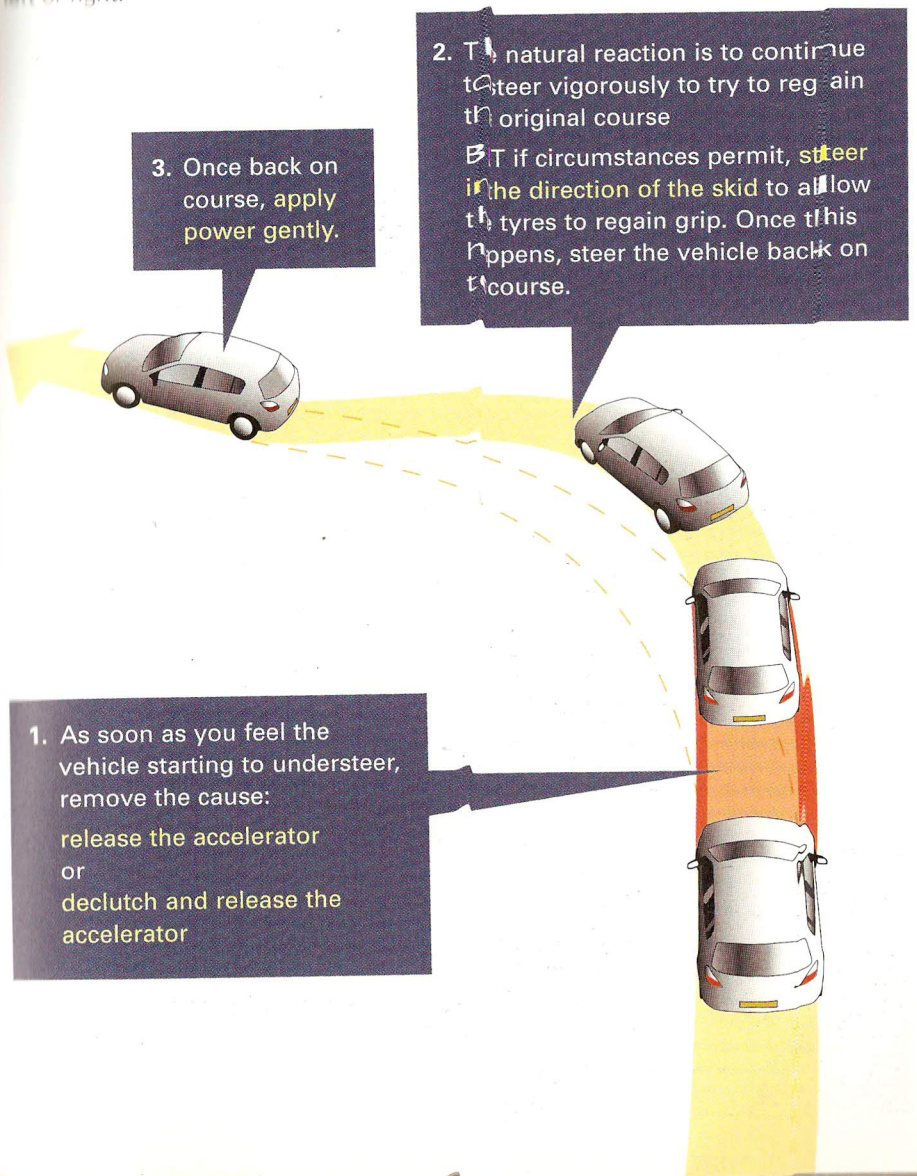
Correcting a rear wheel skid

In a rear wheel skid you feel the back of the vehicle swing out – on a corner or bend the swing is always initially to the outside of the curve.



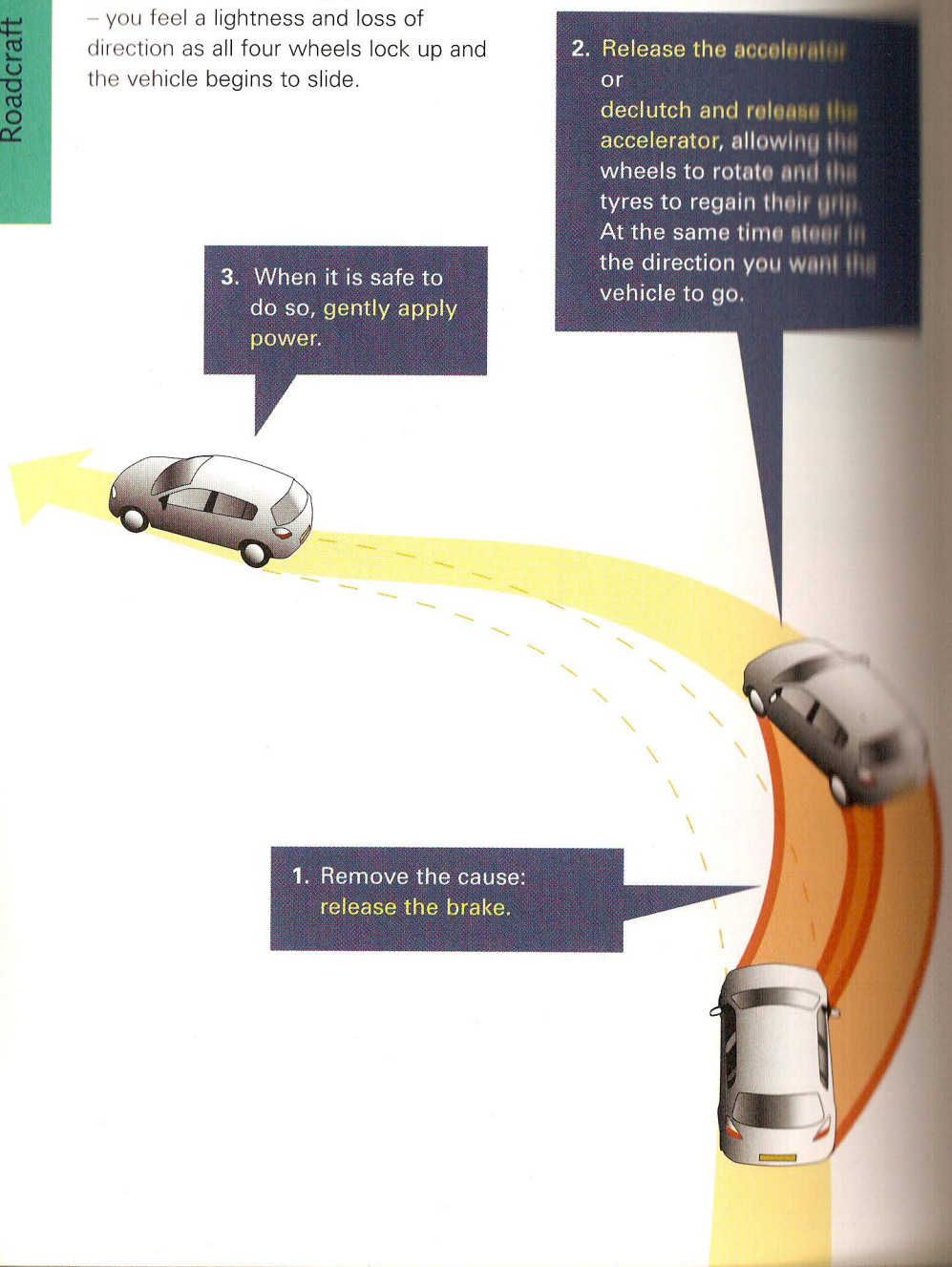
Correcting a front wheel skid

In a front wheel skid you feel the front of the vehicle carry straight on when you are expecting it to steer left or right.



Correcting a four wheel skid

In a four wheel skid – usually the result of excessive or sudden braking causing all four wheels to lose grip on the road – you feel a lightness and loss of direction as all four wheels lock up and the vehicle begins to slide.



What to do in different circumstances

Once you have removed the initial cause of the skid, your next action may depend on the exact circumstances. For instance:

Do you need to steer in order to avoid a collision?

YES NO → Maintain pressure on the brake.

↓

Is the road surface slippery?

YES NO → On a non-slippery surface, release the brakes (except with **ABS**) sufficiently to allow the wheels to turn and restore steering control.

↓

On a slippery surface you may need to pump the brakes rhythmically while steering to avoid a collision (cadence braking – see over page).

Vehicles with different drives

Front, rear and four wheel drive vehicles each behave and respond differently in a skid. The method for correcting a skid is broadly the same for each type of vehicle, but understanding the characteristics of different types of drive can help you anticipate and respond to the vehicle's behaviour more effectively. Refer to your manufacturer's handbook for guidance.

Do you know what type of drive your vehicle has?

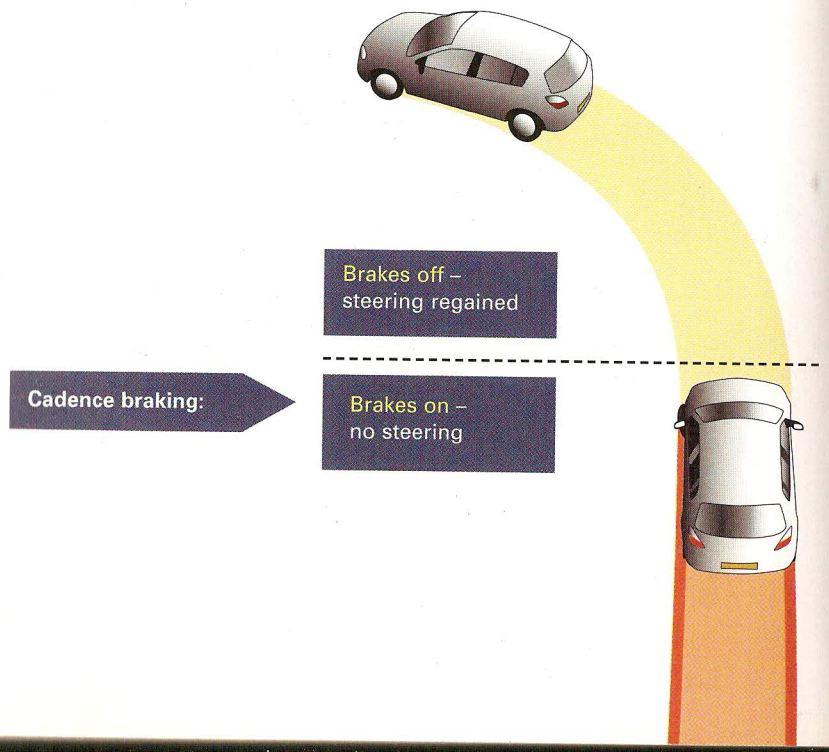
Get into the habit of checking the type of drive whenever you get into a new vehicle.

Cadence braking (rhythm braking, pumping the brakes)

If you brake hard in wet or slippery conditions it is likely that your wheels will lock and you will lose steering control. Your vehicle will skid in a straight line and you may well collide with something before the skid ends.

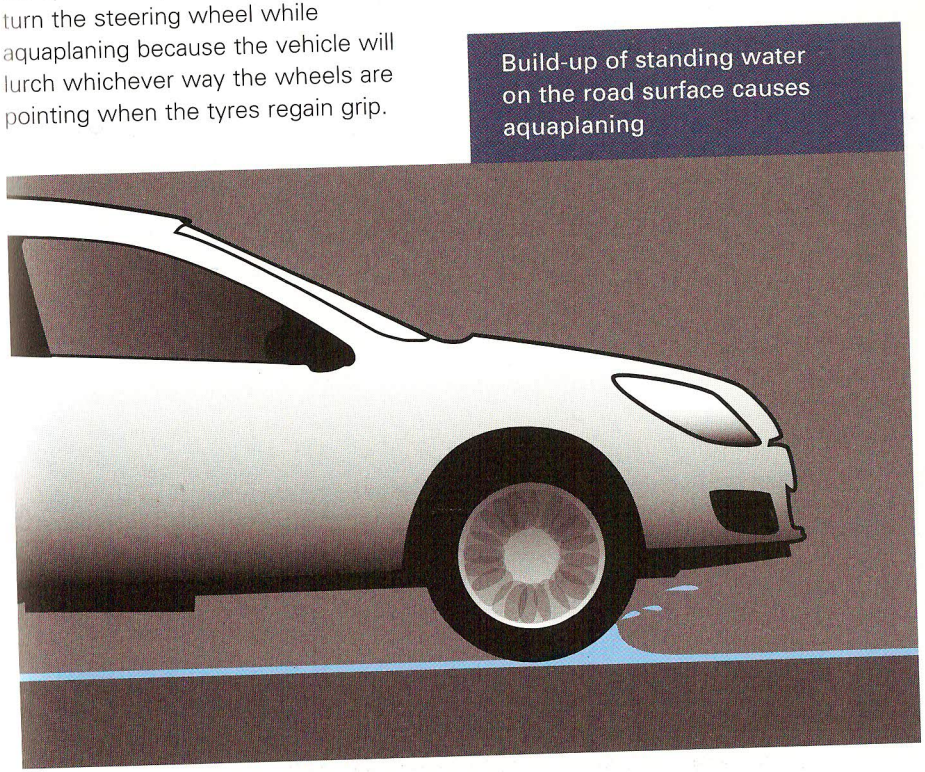
Cadence braking (explained in Chapter 4) gives you a combination of braking and steering effect – braking while the brakes are on, steering while they are off. Pump the brakes with a deliberate movement, pausing momentarily when the brake pedal is fully depressed – but don't bounce the foot on and off the pedal.

See Chapter 4, *Acceleration etc.*, page 76, Cadence braking.



Aquaplaning

Aquaplaning occurs where a wedge of water builds up between the front tyres and the road surface, often because of thin or worn tyre tread. Whether you brake or steer, the vehicle will not respond. The safest solution is to remove pressure from the accelerator allowing the vehicle to lose speed and the tyres to regain their grip. Do not turn the steering wheel while aquaplaning because the vehicle will lurch whichever way the wheels are pointing when the tyres regain grip.



Build-up of standing water on the road surface causes aquaplaning

Review

In this chapter we have looked at:

- the forces affecting a vehicle's tyre grip
- how a driver's actions can cause a skid
- reducing the risk of skidding by observing, anticipating, and planning – and by regular vehicle maintenance
- how to recognise the cause of a skid
- how active safety systems work – antilock braking, traction control and electronic stability control
- how to correct a skid in a vehicle not fitted with active safety devices
- front wheel, rear wheel or four wheel skids
- cadence braking in older vehicles without ABS
- how to deal with aquaplaning.

Check your understanding

What are the main causes of skidding?

What is meant by understeer and oversteer?

Can active safety systems enhance a vehicle's capabilities?

Explain briefly how ABS, traction control and ESC work.

What are the limitations of active safety systems?

How would you manually correct a front wheel skid?

What is cadence braking and when would you use this manual technique?

What is aquaplaning? What is the safest way to deal manually with this type of skid?

If you have difficulty in answering any of these questions, look back over the relevant part of this chapter to refresh your memory.

Chapter 6
Driver's signals

Use this chapter to find out about:

- the purpose of signals
- the range of signals available to you and when you should use them
- how to avoid confusion in giving and interpreting signals
- when to use arm signals
- why courtesy signals help road safety and positive driving attitudes
- how to assess and improve your skill at using signals.