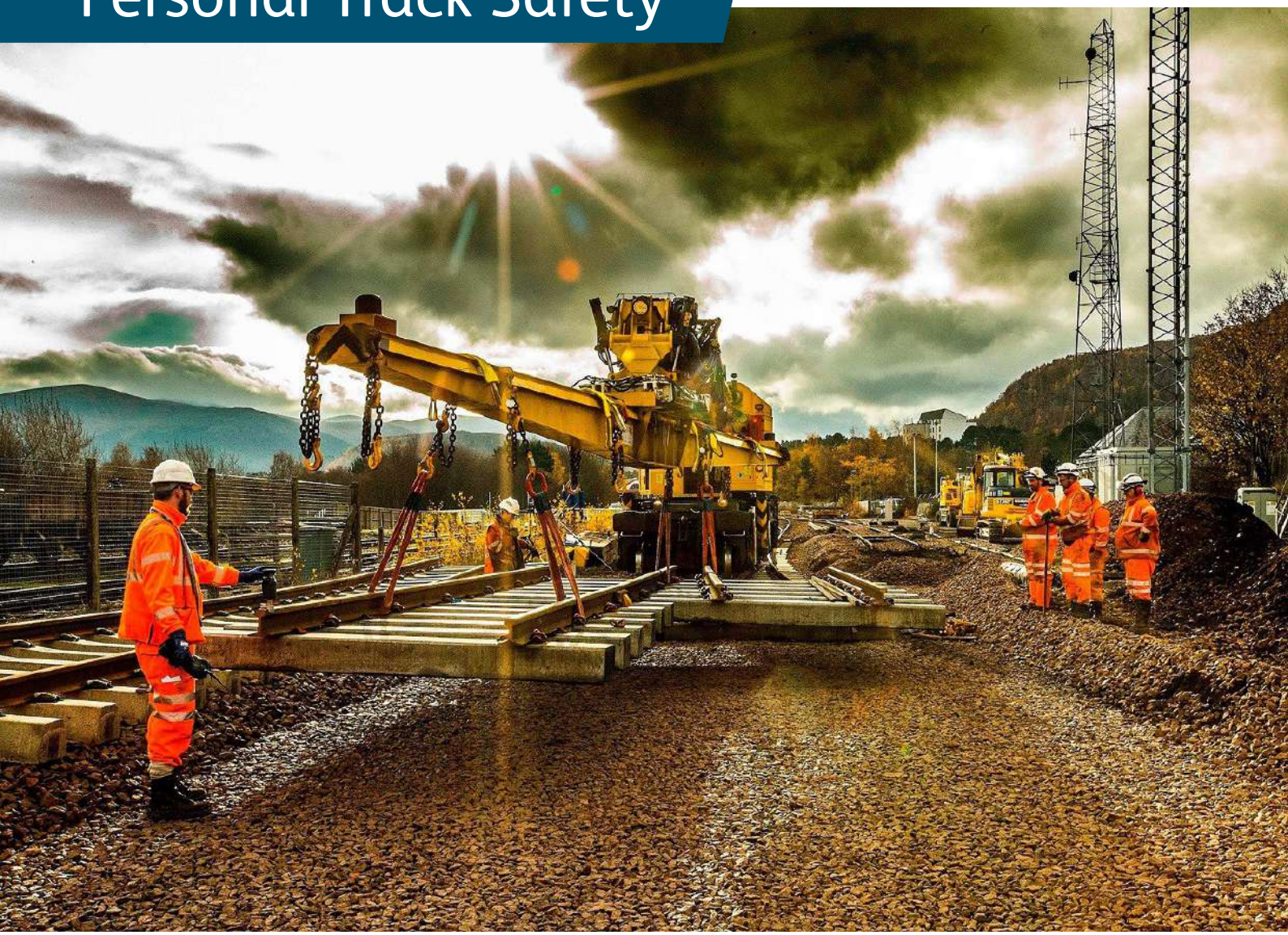
Personal Track Safety



02
Railway orientation

Railway orientation

Introduction

Before you go out on the railway, you'll need to know what you'll find there.

Here's Steve, our Controller of Site Safety (COSS), to explain what you'll cover in this PDF.

> "There's much more to railways than just rails and sleepers. To stay safe while working on track, you'll need to know about the hazards you're likely to come across. There are a lot of them, so take your time to get familiar with how the life on the track works; you'll hopefully be spending a lot of time on it."

Railway orientation

Hit or miss?

When it comes to staying safe on the railways, you need to know the risks.

Here are two possible scenarios showing what can go wrong.

Please note: All track workers must wear full orange Personal Protection Equipment (PPE.)

Hit

Gareth and his team were working on the side of a track. They were laughing and joking about the football match the night before. Gareth's best friend rang him, so he headed a little way down the track to take the call.

A train came round the bend. The team spotted it quickly, retreated to the position of safety and raised their arms to acknowledge it.

But Gareth was still on his mobile, and had covered an ear to hear his friend better. He didn't hear the train. He didn't see the train. The driver realised what was happening right away, but it was too late for Gareth…

Miss

But suppose Gareth had spotted the train? What if he had jumped out the way in the nick of time? No harm done, surely?

But what about the train driver?
He knew how close he had come to ending a life. Night after night, he couldn't get the thought of what might have happened out of his head.

The anxiety that, next time, he might not be so lucky pushed him into a spiral of depression. Eventually, he was signed off from work on sick leave. His depression and inability to work affected his home life and marriage.

Even when there are no fatalities, 'close calls' and 'near miss' incidents have a big impact on people.

Hit or miss: both ruin lives.

Railway orientation

Hit or miss?

Summary

Gareth only had a split second to react to the oncoming train.

A train travelling at 125mph takes just 29 seconds to travel a whole mile.

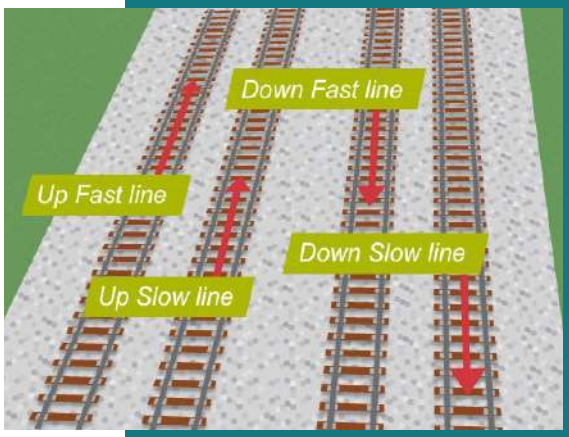
You need to stay alert at all times, as trains can seem to appear out of nowhere.

If you're working when trains are running there must always be an appropriate system of warning in place. This might be a colleague keeping watch (a lookout) to let you know when a train is approaching.

But this doesn't mean you can relax; **you must remain vigilant at all time**s.

Railway orientation

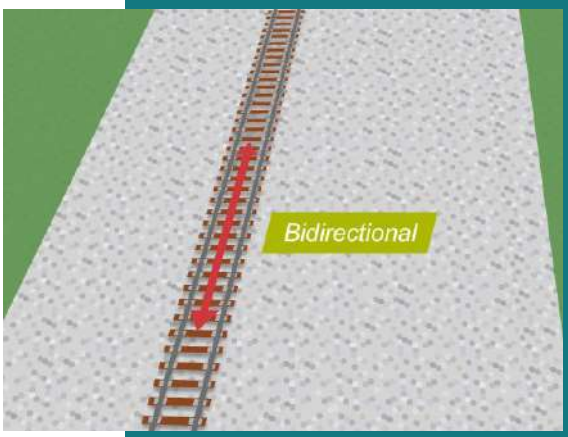
Getting to know the railway



There are many different parts to a typical railway track. These diagrams will help you find your way around.

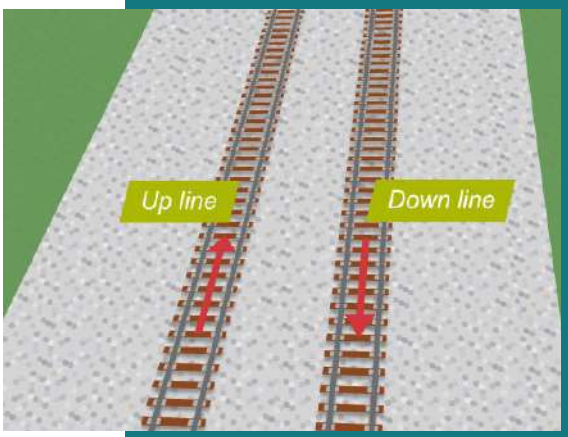
Note: these and all other diagrams used may not be to scale or be technically accurate. They are for demonstration purposes only.

First, there are the lines themselves.



The two parallel rails that train wheels run on are called **running lines**.

A single line like this is usually (but not always) **bi-directional**. This means that trains may be travelling on them in both directions.



Here, you can see a pair of running lines.

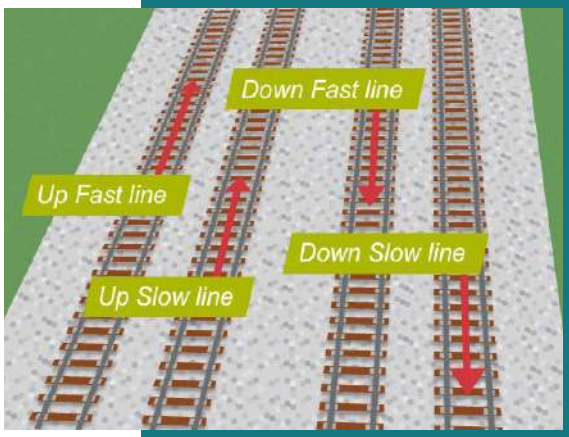
Typically, trains running on these lines will be travelling in **opposite directions**. However, you can't be sure of this from looking at them.

If the lines are heading in different directions, we call one the **Up line** and the other the **Down line**.

An Up line is typically the line that travels towards a major city or destination, while a Down line travels away from it. Always listen to your COSS or Safe Work Leader who will confirm which is which.

Railway orientation

Getting to know the railway

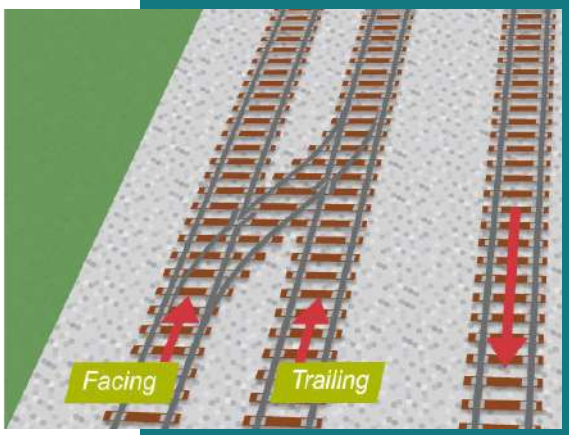


Another common setup is a set of four running lines.
As well as having a **direction**, these lines also have a **speed**.

Here you can see an example of what this might look like, though the exact setup varies between locations.

If a pair of running lines have the same direction they will be given different names. These names vary from area to area.

Often one pair of lines is called the **Fast line**, and the other the **Slow line**. You may also hear lines referred to as **Relief** or **Goods**.

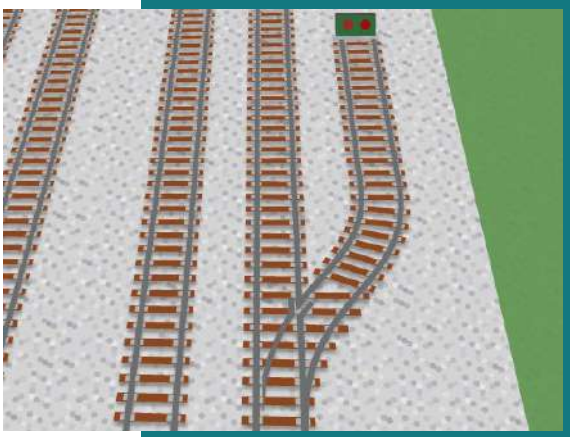


Lines are linked together by **points** (also called 'switches').

These are movable rails that allow trains to move from one running line to another.

Points are normally controlled by Signallers, not train drivers, and can move at any time.

Depending on the direction you're looking, points can be either **facing** or **trailing**. Facing points allow trains to leave the line, while trailing points allow other trains to join the line.



When a train is not being used, it can sometimes be placed in a **siding**.

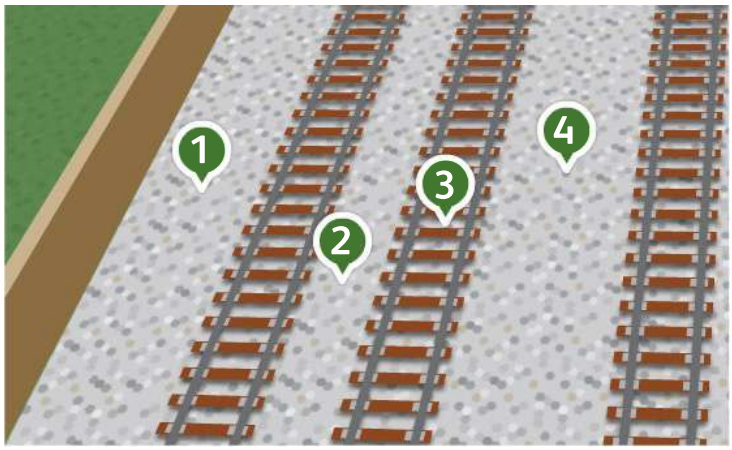
These are short lines that run next to the main lines, connected by points.

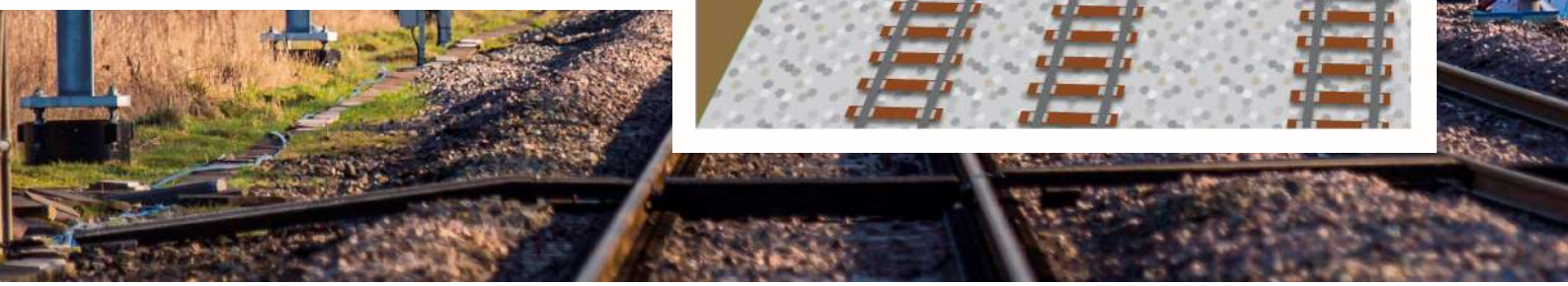
Trains in sidings can move at any moment, so be careful.

Railway orientation

Between the lines

There are several different areas you need to know about because later you'll be told about positions of safety, and where you'll be safest in an emergency.





1. **The cess.**
   This area beside the track is known as the cess.

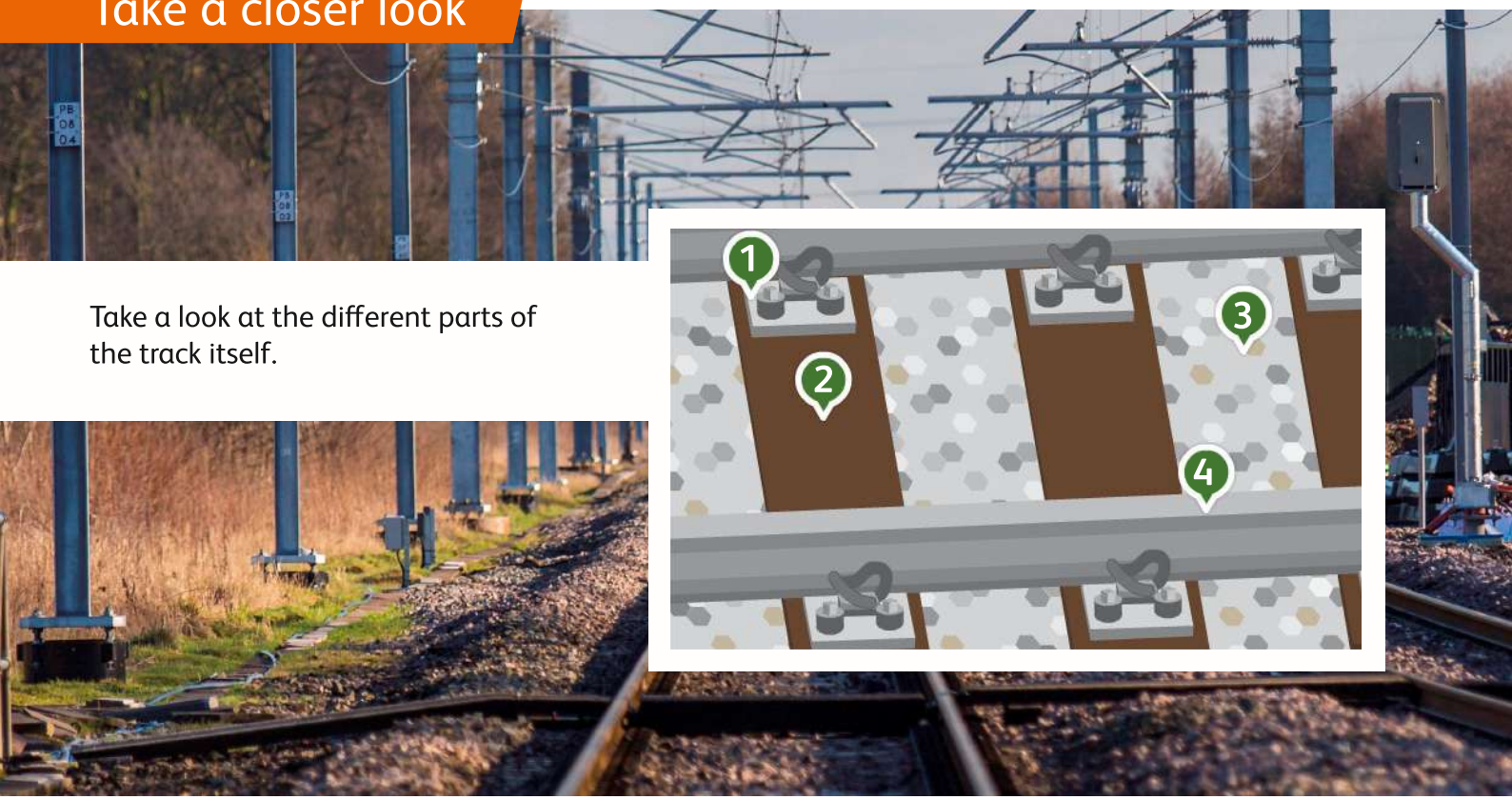
2. **The 6-foot.**
   The area between a pair of running lines is called the 6-foot.

3. **The 4-foot.**
   The area between the rails of a running line is known as a 4-foot.

4. **The 10-foot.**
   Often, you'll see a larger space between two lines on the left and two on the right. This area is called the 10-foot.

Railway orientation

Take a closer look



Take a look at the different parts of the track itself.

1 **Fastenings**
Track fastenings connect the running rail to the sleeper.

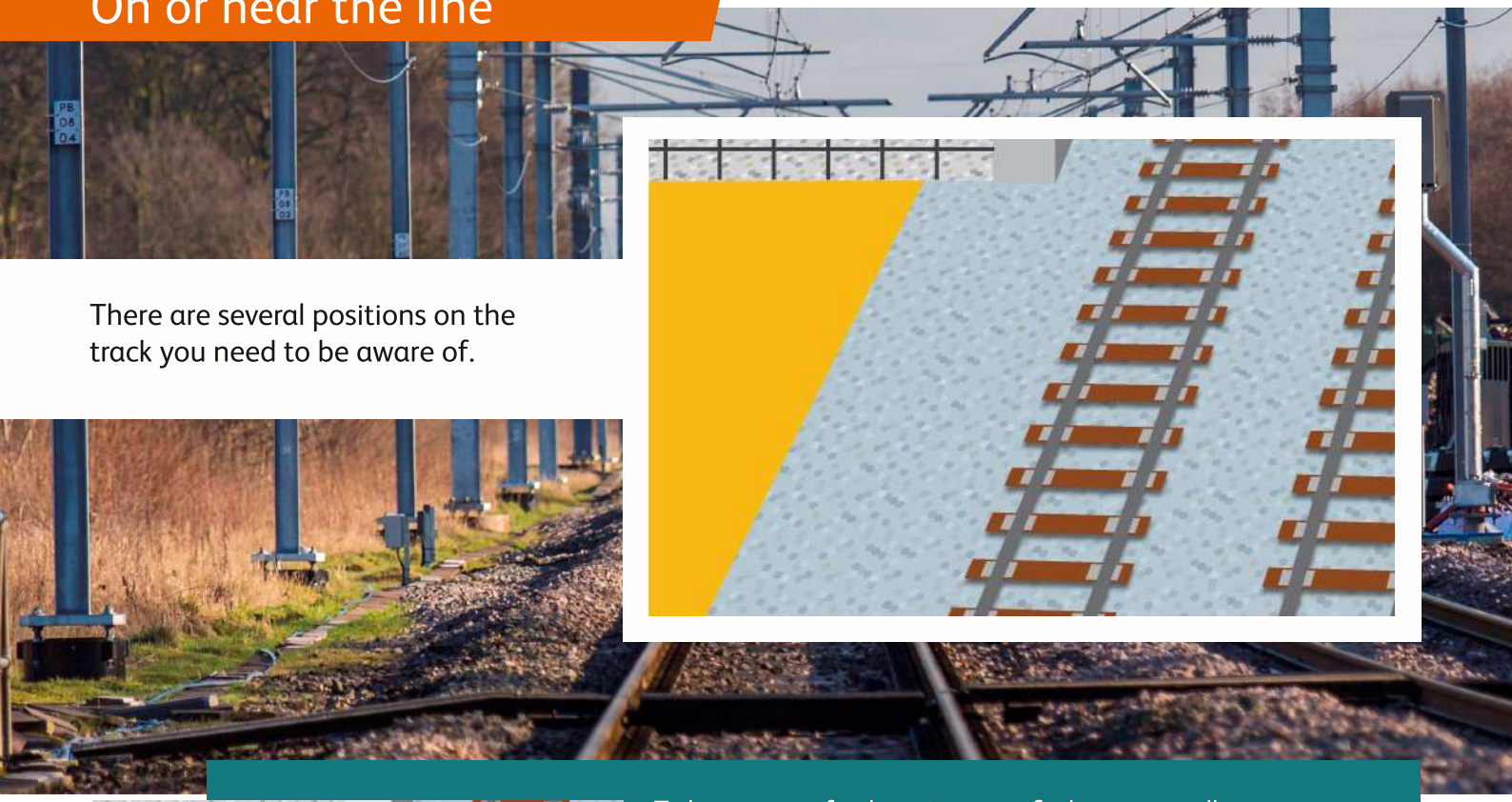
2 **Sleepers**
The sleepers support the rails and keep them to the correct gauge; that is, the correct distance apart.

3 **Ballast**
The stone surrounding the rails and sleepers is known as ballast. This normally consists of angular granite, which knits together to stabilise the track and enable the correct drainage.

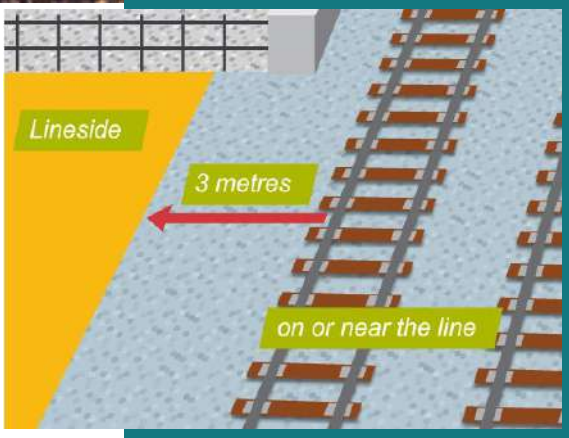
4 **Rails**
The wheels of trains run on rails.

Railway orientation

On or near the line



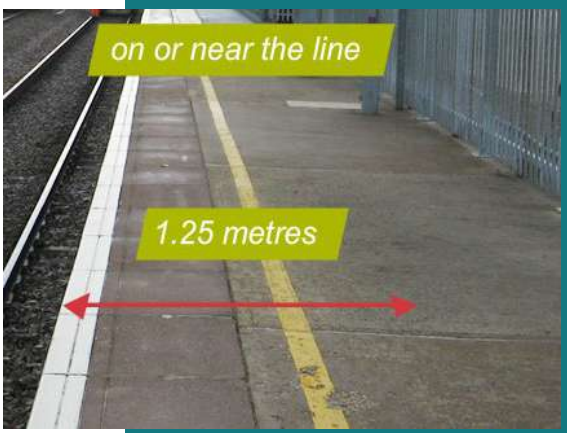
There are several positions on the track you need to be aware of.



To keep you safe, there is a specified area we call on or near the line, which means you are potentially in danger of trains. You are '**on or near the line**' if you are:

- on a line
- within 3 metres (10 feet) of a line with no permanent fence or structure between you and the line.

If you are inside the boundary fence and more than 3 metres (10 feet) from the nearest running line, you are said to be **lineside**.



When doing engineering or technical work on a station platform, the rules are slightly different. Here, you are on or near the line if the distance between you and the platform edge is less than 1.25 metres (4 feet).

Railway orientation

Signals

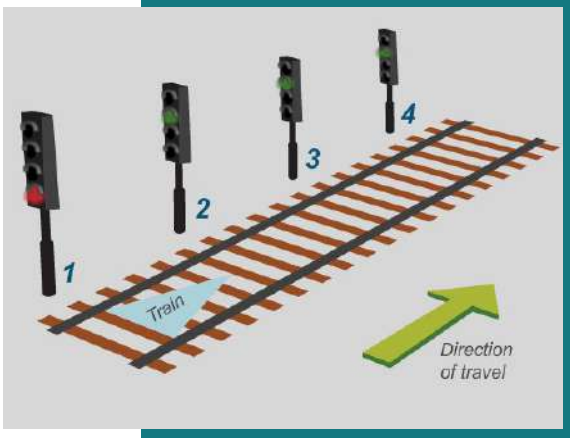
Just as roads have traffic lights, train lines have signals controlling the flow of traffic.

Signals can be controlled by a **Signaller**, but most signals operate automatically by the passage of a train.

The most common signals you'll see on the railways are **colour light signals**.

They use the same colours as road traffic lights, but not in quite the same way.

- A **red** signal means 'danger' and 'stop'.
- A **single-yellow** signal means 'caution'. Train drivers should prepare to find the next signal at red.
- A **double-yellow** signal tells a train driver to prepare to find the next signal at single yellow.
- Finally, a **green** signal means 'proceed'. Train drivers should prepare to find the next signal at green or yellow.

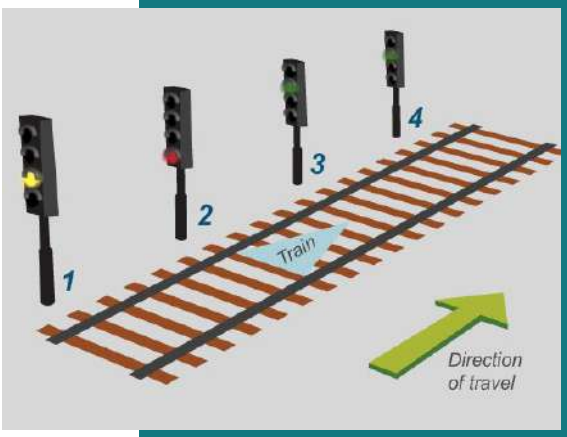


As the train passes the first signal, it changes to **red**, which means any trains behind it must stop.

This keeps a safe distance between the train and others behind it.

Railway orientation

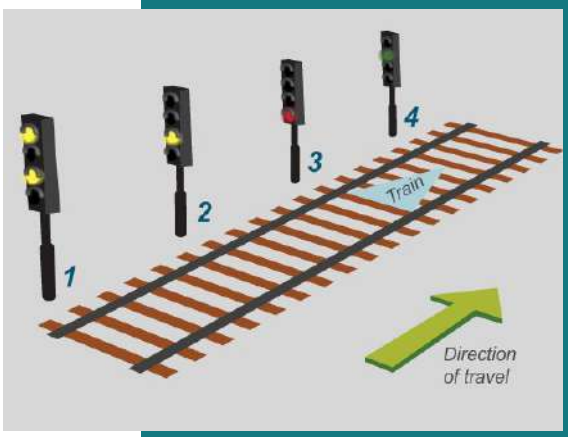
Signals



When the train passes the second signal, it changes from green to red in the same way.

Meanwhile the first signal changes from red to **single-yellow**. This signal means 'caution'.

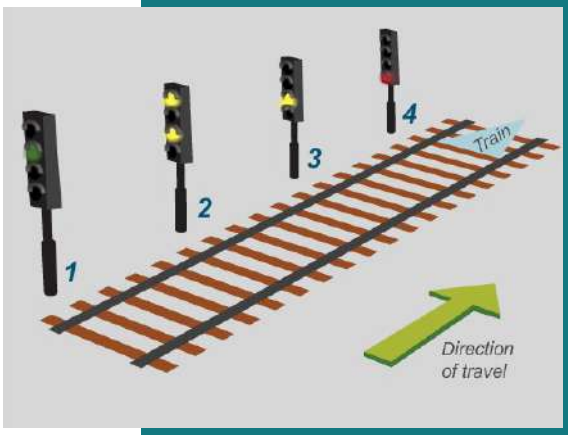
The driver should be prepared to find the next signal at red.



When the train passes the third signal, it turns red. The second signal changes to single-yellow.

The first signal changes to **double-yellow**.

Double yellow signals tell drivers to prepare to find the next signal at caution (single-yellow).



Finally, when the train passes the fourth signal, the first signal changes back to green.

These are **4-aspect signals** (so called because they have four sets of lights, often used in more congested areas).

You may see variations, such as signals without the double-yellow light (known as **3-aspect signals**). However, they all work in the same way.

There are two other types of signal you should be aware of...

Railway orientation

Signals

Semaphore signals are old-style, manually operated signals. They usually have a red light, a green light and a red arm.

A semaphore signal in a horizontal position means **stop**. The red light will also be on.

To allow trains to pass, the arm may either be raised or lowered by 45 degrees (known as **upper or lower quadrant signals**).

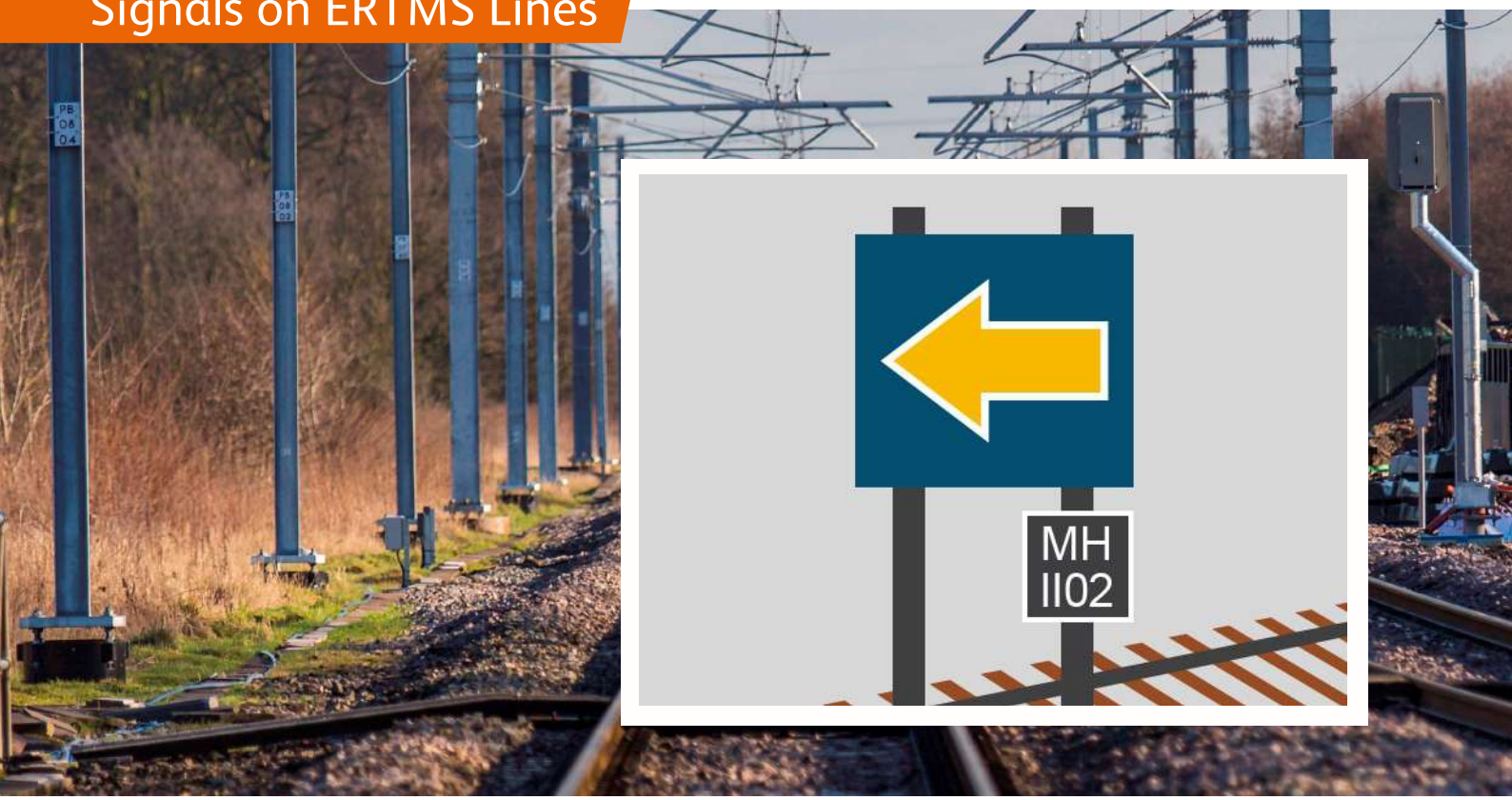
In both cases, the green light will also show.

You may also come across **Position Light Signals**, which are signals in sidings.

These control the movements of trains in and out of sidings.

Railway orientation

Signals on ERTMS Lines



A block marker consists of a reflective square sign showing a yellow arrow on a blue background. The arrow shows which line the marker applies to.

Each block marker is provided with a unique identification plate, of white characters on a black background.

Railway orientation

Limited clearances

Some locations have an adequate space on either side of the running lines and can provide a position of safety. If a train comes, you must move there to get out of the way and be in the position of safety at least 10 seconds before it reaches your location. However, there are certain areas where there is very little space. These areas are called **limited clearance.**

These signs indicate that there is a limited clearance area beyond it.

Here's an example of a limited clearance area.

As you can see, there's no room for you to stand beside the track when a train is passing.

If a train approaches on one these lines, there's no position of safety for the length of the structure or obstruction.

Some areas of limited clearance have **refuges**.

These are areas beside the track that have been created for you to stand in to be safe from passing trains. They might be built over an embankment or cut into a wall.

When working in an area of limited clearance, the position of safety is usually the nearest refuge.

These signs tell you that there are no refuges on this side of the track, but there are on the other side.

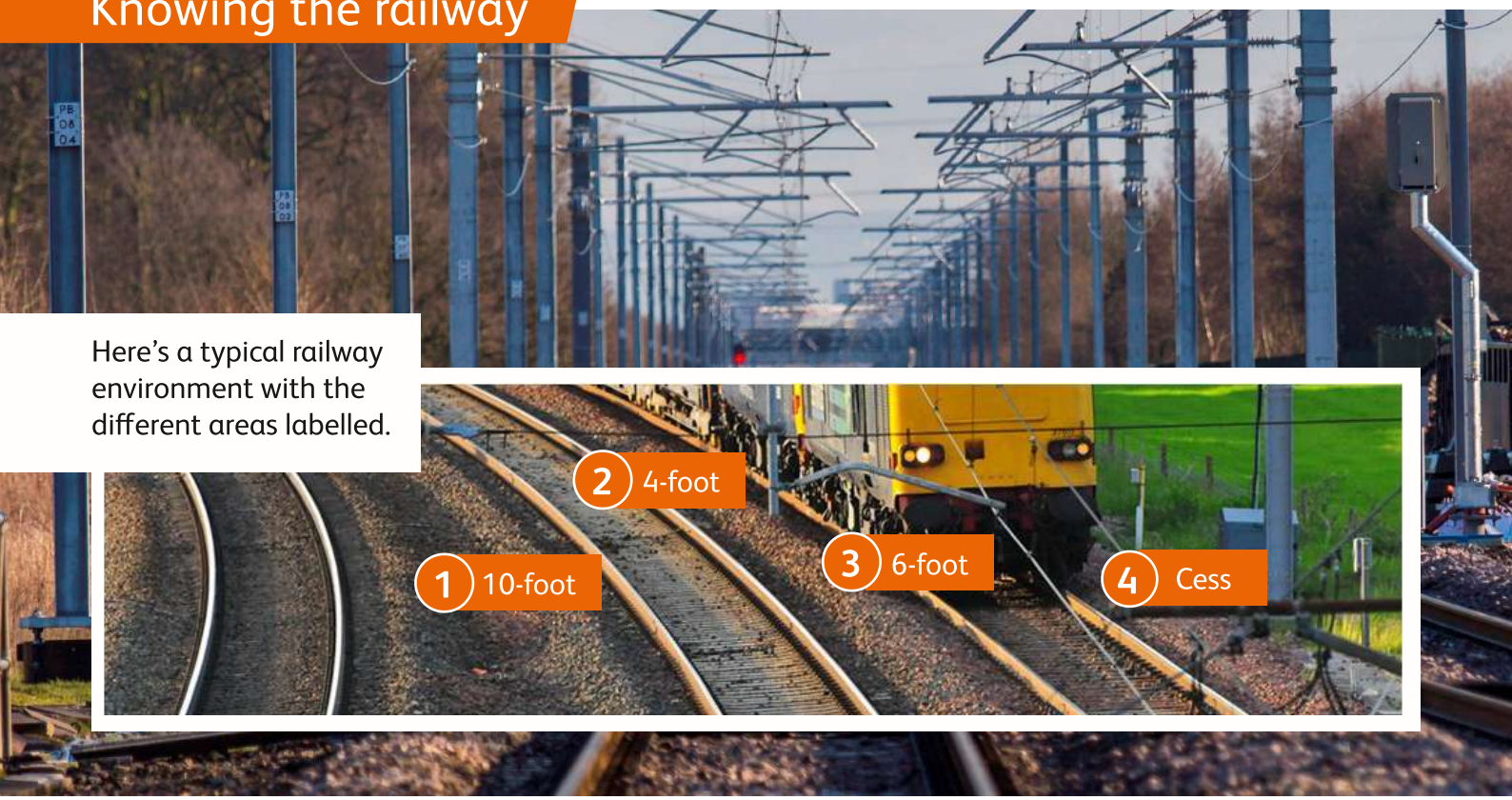
This sign means there are no refuges on either side of the track ahead.

These areas are too dangerous for people to be in when trains are running.

You should only go past this sign if you are carrying out emergency protection or if trains have been stopped.

Railway orientation

Knowing the railway



Here's a typical railway environment with the different areas labelled.

1. The 10-foot is the area between two groups of running lines.
2. The 4-foot is the area between the two rails.
3. The 6-foot is the area between two running lines.
4. The cess is the area off to the side of the track.

Remember though, these are just names and not actual measurements.

Use them to identify the different areas of the track area.

Railway orientation

Identifying where you are

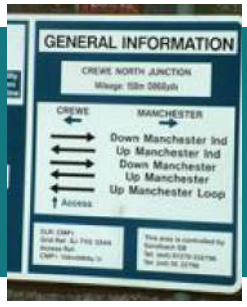
Railways can cover a huge area, and your worksite may be very large. So you need to know how to identify your location accurately, especially if you're in an emergency. This is why the various parts of the railway infrastructure are numbered.

Most **signal posts** have a number which corresponds to the controlling signal box. You should give this number when telling someone (such as a Signaller) your location.

This is an overhead line equipment or **OLE structure**. Its number can be quoted to the Electrical Control Operator (ECO) in the event of an electrical emergency. Other structures such as bridges also have identification number plates.

Points will often have a number which you can use to identify your position.

Mileposts are normally positioned every quarter mile between a major and minor destination. There are often two numbers on a milepost. The top number will indicate full mileage, and the bottom indicates the number of quarter miles. These can be represented as roman numerals, dots or triangles.

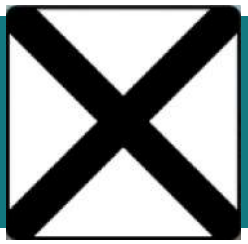


General Information boards can be found at some access points, which are chosen areas you'll use to get to the line. These boards can tell you more about your location.

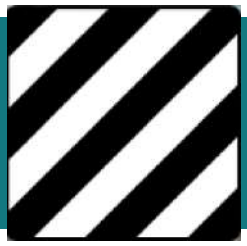
Railway orientation

Telephones

You'll come across a lot of telephones across the rail network, and you'll need to know what they are used for.



Lineside phones (indicated by the black cross on a white background) are found next to points and can be used to contact the Signaller in an emergency.



A **signal post telephone (SPT)** (indicated by the black and white diagonal stripes) is a phone normally attached to a signal post. Picking up this phone will put you straight through to the Signaller for that signal – you don't need to dial a number.

Standard auto phone (black phone on white background).
A standard auto phone (or general railway phone) is for a variety of uses. These phones typically show a list of useful contact numbers from around the rail network.

Emergency phones are identified by a green background. The box normally contains a list of emergency numbers and information about its location and the nearest signal box.

Electrical substations will have **electrification phones** nearby. These are used when you need to contact the Electrical Control Operator (ECO) or switch off electricity in an emergency situation.

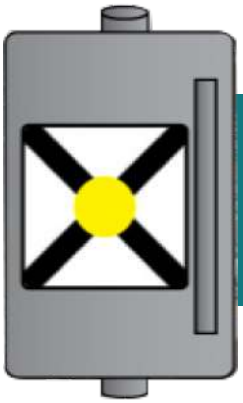
Level crossings have phones that will put you through automatically to the Signaller responsible for the level crossing. These can be used by the public if they need to use the level crossing, or by staff who may need to operate a level crossing.

Railway orientation

Telephones in a limited clearance area

Some trackside phones are in areas of limited clearance and can only be used in an emergency. They are identified by the signs shown here.

A sign for a **signal post telephone** has a yellow circle on it when it is in a limited clearance.

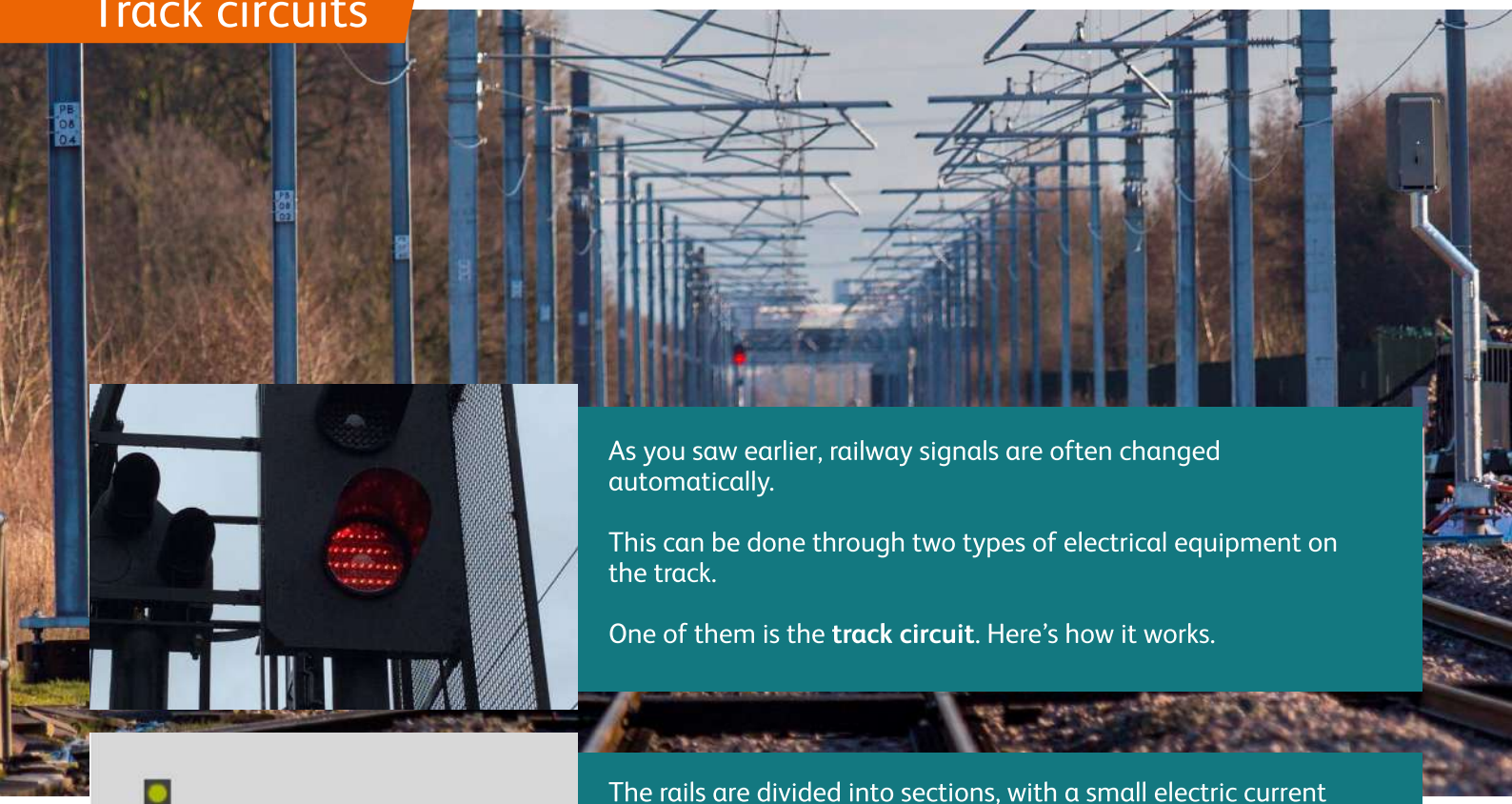


The sign for a **lineside phone** has a yellow circle on it when it is in a limited clearance.

Some **limited clearance phones** are indicated by these signs, showing a black X on a white diamond-shaped sign. Be careful not to confuse this sign with the sign for lineside phones.

Railway orientation

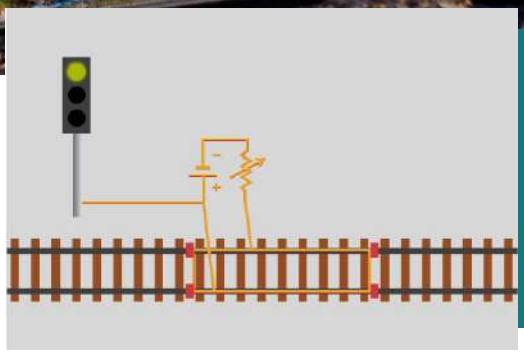
Track circuits



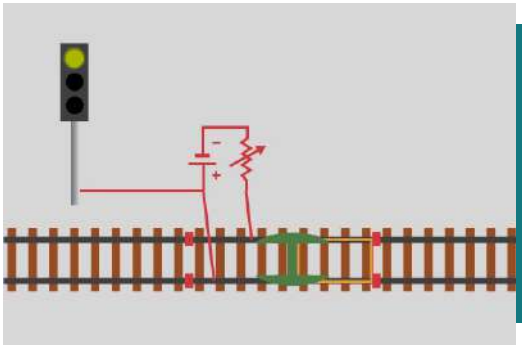
As you saw earlier, railway signals are often changed automatically.

This can be done through two types of electrical equipment on the track.

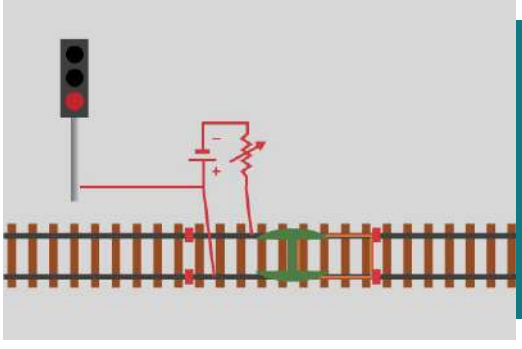
One of them is the **track circuit**. Here's how it works.



The rails are divided into sections, with a small electric current passed around each section.



When a train passes between two sections, the current travels through the wheels and across the axle, which breaks the circuit.



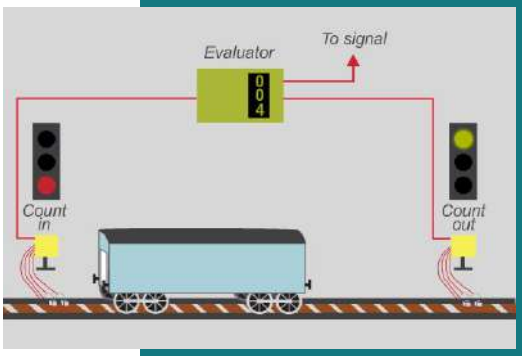
When this happens, the previous signal knows that a train is in that section. It automatically changes to reflect this.

Do not place any objects such as measuring tapes or chains across the running rails. This may still break the track circuit, causing the signal to change even if no train has been detected.

Railway orientation

Axle counters

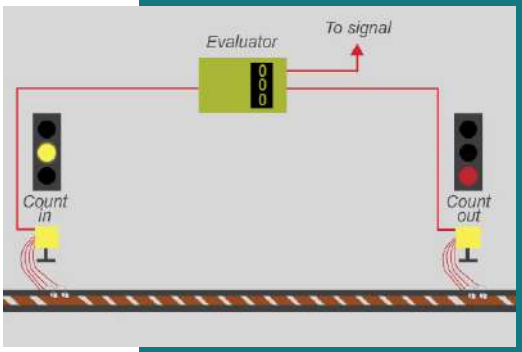
Another way that signals can be updated is through **axle counters**.



These use devices called **counter heads** attached to the rails.

As a train passes over them, they detect and count in the number of wheels.

As soon as a wheel passes over the counter heads, the previous signal turns to red.



Another set of counter heads will be placed further up the track. These then detect and count out the wheels.

Once the count is back to zero (that is, the same number of axles/ wheels counted into the section have been counted out), the previous signal is adjusted to single yellow.

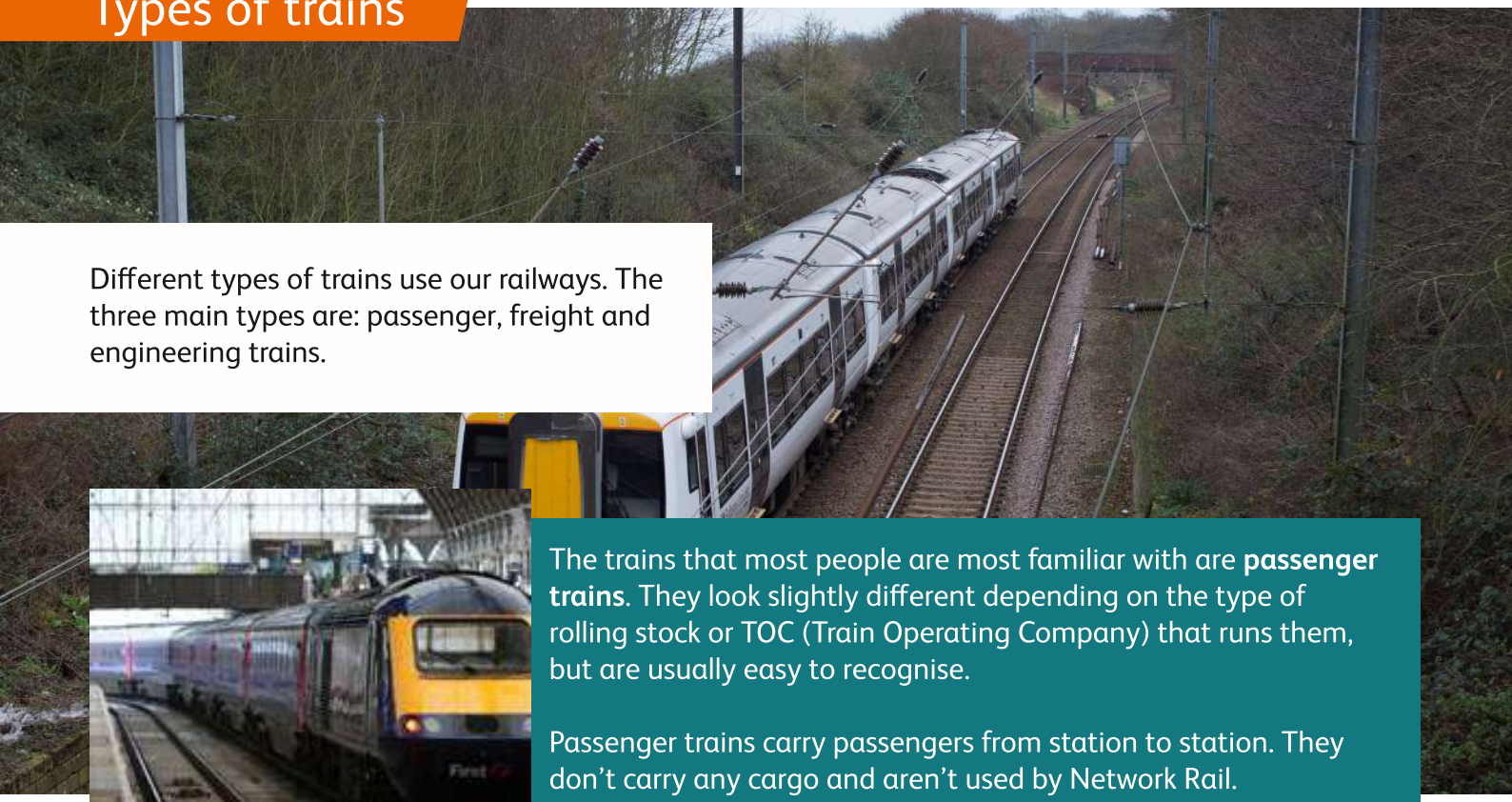
If counter heads become damaged, it can mean that a signal becomes stuck on red.

If you see **damaged or detached counter heads**, report them straight away to the Signaller.

As with track circuits, there are things that can interfere with axle counters. **You must not allow any metal objects to be placed within 300mm of an axle counter head**. The counter heads could detect them as train wheels, and change the aspects of the signals incorrectly.

Railway orientation

Types of trains



Different types of trains use our railways. The three main types are: passenger, freight and engineering trains.

The trains that most people are most familiar with are **passenger trains**. They look slightly different depending on the type of rolling stock or TOC (Train Operating Company) that runs them, but are usually easy to recognise.

Passenger trains carry passengers from station to station. They don't carry any cargo and aren't used by Network Rail.

Freight trains are used by FOCs (Freight Operating Companies) to haul large quantities of cargo from one depot to another.

They sometimes have their own lines and often travel more slowly than passenger trains. However, they're just as dangerous, so don't treat them any differently.

There are some small trains that are kept in sidings for maintenance purposes. These are known as **engineering trains**. While they also travel slower than passenger trains, they can be very quiet, so you may not hear them approaching.

All three types of train will have white lights at the front and red lights at the back. However, if you're out on track, you should always assume a train is coming towards you, rather than moving away.

Railway orientation

Electrification

One of the main dangers on the railways is **electricity**.

Most lines have two running rails. But some have rails near them that trains don't run on. These are called **conductor rails** or DC **electrified lines** and are used to provide high voltage electricity to trains.

You can identify them by the fact that the conductor rail is raised slightly above the running rails on insulators (these look like pots).

Note: conductor rails are not actually painted red, but we've highlighted them red in these photos.

In some areas, you may see two of these electrified conductor rails. These areas are known as **fourth rail** areas. Again, these are the lines highlighted in red.

You won't be authorised to work near an electrified conductor rail until you have completed further training and hold the DCCR (direct current conductor rail) competence.

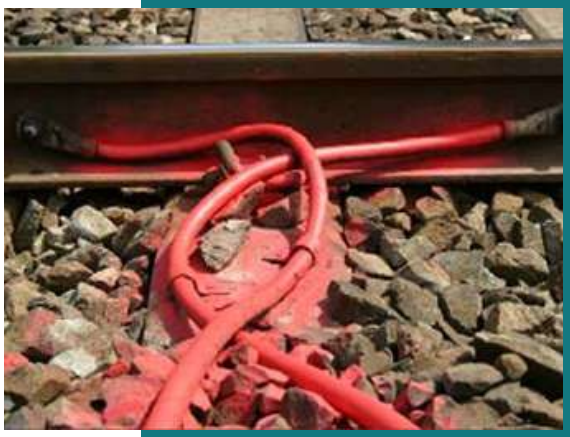
Buried services are cables or pipes laid under the ground carrying electricity, gas, water, and so on.

You'll be told whenever you're working near them, by whoever is supervising the work.

A permit to dig will be required, and the area must be scanned using a Cable Avoidance Tool (CAT Scan) before digging or driving anything into the ground.

Railway orientation

Electrification



One type of cable you may see on track is called a **bond**.

These are clearly recognisable and some are sprayed red (Red bonds). Treat all red bonds as live and electrified equipment at all times.

If you notice any broken or detached bond, do not touch it! The Electrical Control Operator (ECO) must be notified immediately.

As well as cables running along the track, you might see wires supported above it.

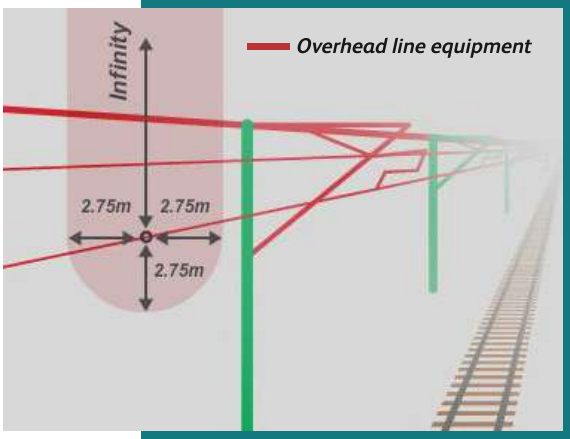
These, and anything connected to them, are called **overhead line equipment (OLE)** and are very dangerous. Red bonds are connected to the return wires on the OLE system. The return wire enables the electrical circuit to be completed.

OLE may carry up to **25,000 Volts** of alternating current (AC). You should **always assume that it is live and dangerous**.

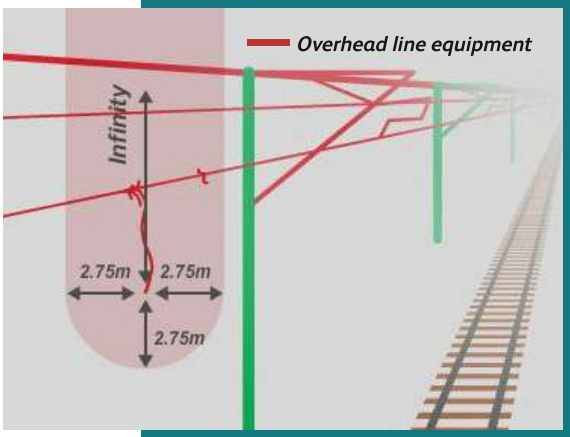
Railway orientation

Overhead line equipment

Overhead line equipment (OLE) is **extremely dangerous** and you must stay well away from it.



You must not carry out any work above live OLE or within **2.75m (9 feet)** in any other direction from live OLE, unless a written method statement (permit) has been provided which has been approved by the equipment owner.



If you see anything hanging from the overhead line, or a part of the overhead line itself that has broken, you must also stay the same distance (2.75m) from it.

Railway orientation

Understanding OLE

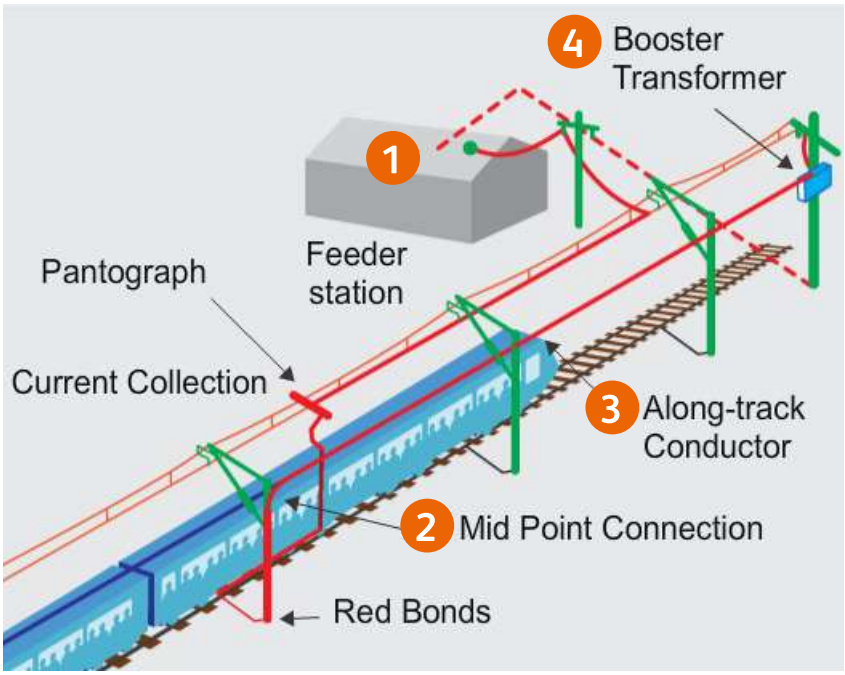
Overhead lines are used to power trains.

Many trains will have a piece of equipment called a **pantograph** which connects the train to the overhead line.

First, the electricity comes in from the National Grid. It then is sent from the feeder station along the following path:

1. Current collection
2. Mid-point connection
3. Along-track conductor
4. Booster transformer

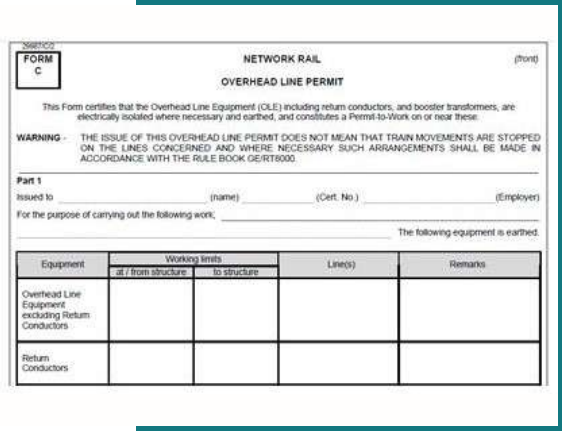
Finally, the current is returned to the feeder station via the red bonds and return wire.



Railway orientation

OLE: Further precautions

There are a few more essential rules for working with OLE.



FORM C

NETWORK RAIL (front)

OVERHEAD LINE PERMIT

This Form certifies that the Overhead Line Equipment (OLE) including return conductors, and booster transformers, are electrically isolated where necessary and earthed, and constitutes a Permit-to-Work on or near these.

WARNING - THE ISSUE OF THIS OVERHEAD LINE PERMIT DOES NOT MEAN THAT TRAIN MOVEMENTS ARE STOPPED ON THE LINES CONCERNED AND WHERE NECESSARY SUCH ARRANGEMENTS SHALL BE MADE IN ACCORDANCE WITH THE RULE BOOK GE/RT8000.

Part 1

Issued to _____ (name) _____ (Cert. No.) _____ (Employer)

For the purpose of carrying out the following work: _____

The following equipment is earthed.

Equipment	Working limits		Line(s)	Remarks
	at / from structure	to structure		
Overhead Line Equipment excluding Return Conductors				
Return Conductors				

If work needs to be done near the OLE, the electricity needs to be turned off.

To do this, the COSS or Safe Work Leader must request an Overhead Line Permit (Form C). This will state exactly which parts of the OLE have been isolated and earthed.

The COSS or Safe Work Leader will give you this information as part of your briefing. You must stay within the working limits they specify at all times. If you're unsure, check with the COSS or Safe Work Leader.

You may sometimes need to work at height.

Working on cuttings, or on top of objects like wagons, structures or vehicles may reduce the distance between you and the OLE.

You **must** still make sure you are the correct distance from any live OLE. Tree cutting and other activities can cause objects to move or fall, which you must also make sure stays the right distance away from the OLE.

Take care when using long objects such as ladders, cables and wires.

If your work requires you to use a ladder, make sure it is insulated. Only approved ladders should be used.

Ladders must be carried horizontally at all times to make sure they are kept away from the OLE.

Railway orientation

OLE: Further precautions

Keep an eye on any liquids you use.

Make sure they are not in any positions where they could fall, splash or be thrown onto live OLE.

Even with some of the OLE isolated and earthed, there may still be trains running on the line.

Again, the COSS or Safe Work Leader will brief you on any open lines, but you must be aware of this.

You must make sure the electricity is switched off before you approach a person who is above the live OLE, or is within 2.75 m (9 ft) of the live OLE.

If you become involved in rescuing a person after an emergency switch-off has been taken, you may have to come into contact with the OLE, or the person touching the OLE.

In either case, you must make sure your hands are covered with something dry which will not conduct electricity. This is because a residual voltage may be present even though the electricity has been switched off.

Railway orientation

Other electrical hazards

Electricity at the trackside is also present as the electrical supply for the signalling equipment. It is typically contained within a location case, supply terminal pillar, relay room or Functional Supply Point (FSP), but we can refer to them all as FSPs (as shown in the pictures).

Note: they could be metallic or wooden. **Do NOT touch these** unless your job requires you to do so and you have tested first.

Note: You must be trained/briefed on use of equipment to test.

The relevant Lifesaving Rule here is: Test before Touch.

Railway orientation

Level crossings

When a railway line and a road cross each other on different levels, they often use bridges or tunnels. But when they're both on the same level, a **level crossing** is used instead.

A **CCTV level crossing** is one that is controlled by a Signaller in a signal box. They close the road barriers whenever a train is approaching. Once it has passed the barriers open again. The Signaller uses CCTV to monitor what's happening at the crossing.

When the barriers go down, an alarm will sound and the red warning lights will flash. These alert road users to the fact that a train is coming and they must not try to go over the crossing.

Automatic half barrier crossings operate automatically by detecting whether a train is approaching. As their name suggests, the barriers on both sides only extend across half of the road.

The alarm and warning lights are used in the same way as manually controlled level crossings.

Foot crossings or 'barrow crossings' are level crossings for pedestrians only. These do not have barriers.

Railway orientation

Finding hazards

As well as the hazards from trains and electricity, there are other common hazards to be aware of, such as slips, trips and falls.

Teams often work at night, as it's the least disruptive time for trains. However, the railway looks very different in the dark, and it can be even harder to see potential dangers.

Here are some hazards which may be difficult to see at night.

You need to watch out for:

1

Catch pit:
this drain, known as a catch pit, has a grille on top of it, but it's not secure. People often fall into these pits if the grille is missing or loose, so be careful around them.

2

Old signal base:
this is where an old signal has been cut off and the base has been left behind. This could easily be tripped over.

3

Exposed troughing:
troughing is a concrete strip alongside the track used to hold cables. Here, the lid of the troughing has been taken off, leaving it and the cables exposed. This is both an electrocution and a trip hazard.

Railway orientation

Summary

That's the end of this PDF.

Here's Steve with a quick recap.

"You should now be clear on:

- Parts of the railway and track
- Line directions and speeds
- Signals and the ways they get updated
- The different types of telephones you'll come across
- Identifying where you are on the railway
- Electrical equipment.

Remember, the most important thing is staying safe.
If you're not sure about anything, ask, and if you're not comfortable, say so.
Be careful and be aware of the risks.

You can come back and revisit this PDF any time you like, and it's probably a good idea to if you're unsure of anything.

That's the end of this part of the Personal Track Safety (PTS) learning. Please read the other PDFs or e-learning topics in this course before you take the online Assessment."