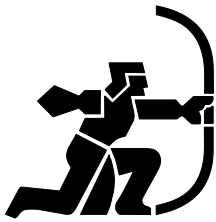
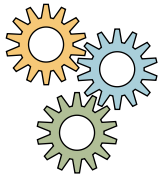
Northern Line

So you want to be a driver?





It is easy to drive a train, I am quite sure that I could show a ten year old what to do and have them driving a train reasonably well after an hour. What that person wouldn't have is the knowledge that a driver needs to do their job safely and correctly. First and foremost, a driver's job is a responsible one. They are in charge of the train and they are responsible for the safety of their passengers. The job can also be demanding, rewarding and often boring. However, like anything, it is what you make of it. If you can take an interest in what you are doing, it will make it less boring for you.
Drivers have to know what to do in all sorts of situations and for this they need training. A driver's training takes around four to five months.

Training begins with rules and regulations, which includes signalling, traction current, procedures and safety. This is followed by stock training which consists of learning the theory of the way the rolling stock works and how to deal with defects that occur on the train, followed by some practical work. Then comes the job training out on the line, which is hands-on driving experience, and road training. Road training is where the driver learns all about the line they will be working on. The driver's knowledge is tested during their training and they are expected to know all that they have been taught. Finally, there is the road test. This is where the trainee is 'passed out' as a fully qualified driver for that line.

This booklet is meant to be an insight into the driver's job and looks at a few of the things the driver encounters on their daily duties. It is quite basic, and meant only as an introduction. Some procedures are mentioned, but again, this is just to give an idea and may not be complete. Everything is gone into in a lot more detail during the driver's training.

The following booklets may be of some use if you require further basic information:

Northern Line Point Types book
Track Circuit Interrupters, Position Detectors and Positive Train Identification book

I/Op Roger Mather
Train Operations Managers Office
Morden

Cab tour

There are various controls in the cab. It may look complicated, but many of these are rarely used.

The train is controlled via a computer called the TMS (Train Management System). Interaction with the TMS is via the keypad on the driver's left and a monitor. There are two monitors. One shows the TMS, the other the platform CCTV pictures. The monitors can be swapped over so that the CCTV is on the left or right according to the driver's preference. If one of the monitors is faulty, the CCTV or TMS can be displayed on the good monitor by swapping over as necessary.

Door controls

There are two door control panels at the front, one for each side of the train. The panel operates the doors on that side of the train only.
On the front panel, the two red buttons open all the doors. For safety reasons, both buttons have to be pressed together. Below this is the doors close button. This closes all the doors. This button lights up on both panels when all the doors are closed on the train. This is the Doors Closed Visual, or "pilot light" as it is more often called.

Below this, the two yellow buttons are the re-open buttons. If one or more doors on one or more cars are detected as open after the closed button has been pressed, pressing the re-open buttons will open all the doors on the car(s) concerned. Although a driver will normally just press the red buttons and re-open all the doors, the re-open buttons are useful when the platform is busy and you don't want the potential problem of having passengers obstructing the doors on other cars.

The green button is for ATO and this is pressed to start the train in automatic mode. This is not in operation yet. The end door cut-out button cuts out the first pair of double-doors on that car and lights up yellow if it is in use. The TMS automatically detects what side the platform is, and therefore what side the doors should be open, by information received from a radio link at that station. This only allows the doors to be opened on the correct side. If the signal is not received, or it is necessary to open the doors other than at the normal stopping mark (i.e. in the depot) then this can be overridden by pressing the Correct Side Door Enable button (CSDE) on the backwall panel. The TMS will also cut out the end doors at stations where this is done on a regular basis.

On the back wall, behind the driver, there are some of the door control buttons that are on the front panel. These are so that the doors can be operated if the

driver is standing up observing the platform from the cab door. On these panels only are buttons to open / close the cab door and a selective close button. This allows the driver to close all but one of the doors on each car. Usually used when the train is at a stand for a while in the open section in bad weather.

There are two ways the car doors can be opened – by the driver and the control buttons, or by the passengers pressing the open button next to the door. The passenger buttons are not used at present, and the driver will always open / close the doors.

Other panels

The environment panel on the driver's left has controls for the cab air conditioning, cab light, windscreen wiper and wash. The panel below is the communications panel and this has the P.A. controls, alarm cancel button and monitor swap switch. There is also cab-to-cab communications available with the rear cab, using the handset.
The radio unit is above. This uses the same handset as the P.A. A button on the communications panel is used to acknowledge the radio if the train is called.

Above the monitors are buttons used during train preparation. Next to them are the speedometer and the air gauge.

On the right of the driver, is the Enable Switch and the Master Switch (sometimes known as the Master Control Switch). These can be thought of as the ignition key and the gear lever.

The adjacent panel has various controls, including buttons to switch the de-icing fluid on and off (if the train has a de-icing unit) and to lower the sleet brushes. The sleet brushes are metal brushes on the front car which are lowered onto the current rails to scrape off snow and sleet. There are also buttons to raise or lower the current shoes if required, and to switch the main car lights on and off.

Above this panel is the run-back detector panel. The train is fitted with run-back detection and the emergency brakes will apply if the train rolls back more than a very short distance. At the rear of the cab are the various cut-out switches and MCBs that are mostly used for when the driver is dealing with a defect on the train.

There are two large red push buttons in the cab – one in front of the driver and one on the right-hand side of the cab. They are emergency stop buttons and the emergency brakes will apply if either of these are pressed. If a member of

station staff has to assist the driver, they may have to operate one of these buttons.
There is also a whistle, which can be loud or soft. There is a whistle lever next to the TMS keypad, and one above the master switch.

In the cabinet on the right, is the tripcock reset cord. If the train is tripped for any reason, the trip arm is knocked back and an emergency brake will apply. The trip arm needs to be reset and this is done by pulling on the cord. This should only be done on instructions from the Service Controller or suitable member of staff.

Controlling the train
On the driver's right is the Traction Brake Controller (TBC). This is used to drive and brake the train. The handle is moved forward from its vertical (aligned with the TBC arm) resting position, turned to the right and held in the horizontal position. The handle incorporates the "deadman". It is on a spring and, if released, the handle will return to the vertical position and the emergency brake will apply. This means that if the driver collapses, the train will automatically stop. The TBC is moved forward to motor the train and moved back to apply the brakes. One minute after the deadman is released, an OPO alarm will sound as a warning to the driver and the driver will need to move the handle to cancel the alarm. If the handle is not moved, an alarm will be sent to the control centre. The purpose of this is so that the control centre is aware if a driver collapses.

TMS
As mentioned earlier, the TMS controls the train. There are preset menus that the driver can access and these are displayed on one of the monitors. These allow the driver to enter information, get information, or to select a pre-recorded message to broadcast. If there is a fault with the train, this can be displayed as a message on the screen giving details of what the fault is and where it is located. In many cases, advice will be given on how to deal with it.

The basic running information, know as the Positive Train Information (PTI), is entered onto the TMS screen. This is the crew (or duty) number, the destination code and the train number. There is also a switch that the driver will operate if the train is not in service. This switch is part of the PTI. The train will display the train number and destination on the front of the train and will display the destination on the scrolling display on each car and make the appropriate station announcements. The PTI information is also used to display the destination on the station dot matrix displays and, in some circumstances, will set the route for the train at a junction.

Emergency equipment
There is an emergency equipment cabinet that contains various equipment that may be needed in an emergency. It also contains the handset that the driver can clip onto the tunnel telephone wires.

Most of what goes on on the train and the driver's actions are monitored by an incident recorder. This is the "black box" and it can provide valuable information in the event of an incident.

There are also CCTV cameras in all of the cars and their images are recorded for future use. These cannot be viewed in the cab.

Door control panel

Master Switch and Enabling Switch

Emergency stop button

Traction Brake Controller

Signals

At present, the Northern line is a conventional line in that the trains are driven manually, although ATO operation will be coming in in the future.

On the Northern Line, there are no signal cabins. Instead there are Interlocking Machine Rooms (IMRs) which are like remote signal cabins. These are controlled by the Service Operator in the control room at Cobourg Street. The week's train service is programmed onto programme machine rolls or a computer and they will operate the IMR at that location. When there are changes to the service, the Service Operator can override these and remotely control the signals and set up routes. The IMR can also be operated manually from a frame in the IMR in the case of a breakdown in communications between Cobourg Street and the IMR or a local failure.

The line needs signals to tell the driver when to go and when to stop and, at junctions, where the route is set for. Signals control the safety and capacity of the line and are placed at a braking distance from the train or points ahead. How far away they are will depend on several things such as the speed and weight of the train and the gradient of the track. You will hear talk of many different types of signals, and indeed there are but, from a driver's point of view, there isn't much difference between many of them.

The main concerns that a driver has are that:
1) they have the train under control to be able stop at a red signal
2) the route is set correctly at a junction signal
3) if the signal remains at danger, they carry out the correct procedure according to the signal type

Colour light signals show a green (or yellow in some instances) aspect when clear, or a red aspect when at danger. There are also repeater signals and these can show a green or a yellow aspect.

The following is some basic information to give you an idea of the different signals:

Signals can generally be divided into two groups, depending on how the driver treats them if they are remaining at danger, plus repeaters:
automatic signals, where the passage of the train causes the signal to show a red or green aspect, and *semi-automatic* signals. Semis, as they are generally referred to, are controlled signals. This means that whilst a train passing the signal will change its aspect from green to red, it will not automatically go back to green and will remain at red until the signal lever is operated to change it to green – the signal is controlled. There are other ways of clearing the signal, but they are beyond this basic explanation.

Equipment such as track circuits and position detectors detect a train. The presence of a train passing over a track circuit or a position detector can clear a signal or put it to danger. All STOP signals, signals on the running line that are capable of displaying a danger aspect, have a trainstop. When the signal is at danger, the trainstop arm is raised. If a train passes the signal at danger, the raised trainstop knocks back a piece of metal called a trip arm that is hanging down near the front of the train. This applies the emergency brake and stops the train. This is generally referred to as “getting tripped”. A train can be tripped because it has accidentally passed the signal at danger (SPAD), deliberately passed the signal at danger, such as on instructions if the signal has failed, or it may have been tripped due to an obstruction on the track.

There are many different types of signals and these can work automatically or semi-automatically, depending on their location and purpose. Almost all signals will show a colour light to the driver – green, yellow, or red. The signal is identified by a white or yellow plate with the signal number on.

Under certain circumstances, such as when there is a signal or points failure, a driver may need to pass that signal at danger. If it is an automatic signal, they may be able to pass it at danger without authority. However, if the signal is a semi-automatic signal, the driver MUST have permission to pass it at danger. Permission to pass a signal at danger can be given in various ways including over a secure radio, via the signal telephone or by verbal instructions from certain members of staff. There may be points ahead of the signal, and the driver needs to ensure that they are properly secured before passing over them.

Here is a brief explanation of some different signals:

Automatic signal
The most common type of signal; shows a green or red aspect. A train occupying the signal’s track circuit will put the signal to danger. As soon as the track circuit is unoccupied, the signal will go back to green. The signal is identified by a white plate with the letter A or S, followed by the signal number. E.g. A624, S679. Automatic signals normally have three digits, but can have two (Charing Cross branch) or four. The signal numbering normally follows a sequence. On the Northern line, most northbound automatic signal numbers are even, most southbound automatic signal numbers are odd.

Semi-automatic signal
Shows a green or red aspect. A train occupying the signal’s track circuit will put it to danger. The signal is cleared by the operation of a signal lever. The signal is identified by a white plate with the cabin code letter, followed by the signal lever number. E.g. Y2.

Repeater
A repeater is used where their may be insufficient sighting time for a signal, such as when the signal is round a corner or its view is obstructed. Repeater signals have a green and a yellow aspect. They are not stop signals because they cannot show a red aspect and they don't have a trainstop. If the signal ahead is green, the repeater shows a green aspect. If the signal ahead is red, then the repeater shows a yellow aspect. The signal is identified by a yellow plate with an R followed by the number of the signal it is repeating. E.g. R678, RU1^{B}, etc. A repeater may repeat more than one signal. E.g. RS695^{BC} repeats S695^{B} and S695^{C}.

The rest of the signals are variations of those already mentioned.

Speed signals are used to slow a train down. The slower a train, the less braking distance it needs. Speed signals can be used to allow a train to get closer to the red signal or points ahead, or to enforce a speed restriction. They are called different names, but the principle is the same. Examples of speed signals are: Draw-up signals, some approach-controlled signals and policemen. Some speed signals may only act as speed signals if there is a train ahead, such as at Oval and Waterloo northbound. At other times they are green.

An automatic home signal and repeater

Draw-up signal - associated with semi-automatic signal G2

Draw-up signals are associated with the signal ahead and can be automatic or semi-automatic, depending on the signal they are associated with. They can show a red, yellow, or green aspect, depending on their associated signal and location. Some semi-automatic ones may briefly show a red and yellow together. If the signal it is associated with is green, the draw-up signal will be green. If the signal is red, the draw-up signal will be red until the train gets nearer, then it will go to yellow or green. This ensures that the train slows down. The signal is identified by a white plate with the number of the signal it is associated with, followed by one or two additional zeros. E.g. B800 is associated with B8, A4160 is associated with A416.

Approach-controlled signals are normally thought of as the station starters that remain at danger and clear as the train enters the platform – they are controlled by the approach of the train. They can be automatic signals, such as South Wimbledon SB starter A715 or semi-automatic such as Charing Cross NB starter C3. In fact, it's not just station starters that can be approach-controlled; most semi-automatic signals are approach-controlled depending on their working. There is no specific identification for an approach-controlled signal, and it has the number plate for an automatic or semi-automatic signal as appropriate.

Policemen, as they are referred to, are trainstops without an associated signal. Mostly found in terminus platforms or reversing sidings, their purpose is to enforce a speed restriction by remaining up until the train is close to them. If the train is going too fast, it will be tripped on the policeman. There may be two, three or more policeman in a platform – High Barnet platform 2 has four. Policemen may also be used in the platform of a running line station where there is speed signalling. Although not associated with speed signalling, there is a policeman in Highgate northbound platform.

Fog repeaters are additional repeater signals in the open section, a fixed distance from the signal they are repeating. They can show a green or yellow aspect and have no trainstop. They are normally switched off, being switched on in times of limited visibility, although now they may be left on permanently in places where there is a SPAD risk. In order to be able to identify a fog repeater, the look of the signal is a bit different – the two aspects are surrounded by a white rectangular fascia. Instead of a plate, the number of the signal it is repeating is shown on the fascia. In addition, to further help the driver distinguish it as a fog repeater, there is a black 'F' painted on the yellow aspect. On the Northern Line, where the number of the signal has changed, a yellow plate with black letters is often used instead and the signal number has the letters FR at the beginning. Fog repeaters only repeat one signal.

Co-acting signals are located at station starters where the view of the starter from the cab might be obscured when the train has stopped in the platform. When stopped, the driver may be able to see the station starter, the co-acting signal, or both. A co-acting signal shows the same aspect as the starter. It is identified by a white plate with the signal letter on and the word CO-ACTING below the number.

Flood signals are semi-automatic signals that are controlled separately from a different location (Bull & Bush on the Northern Line). They are found in areas where there are flood gates. On the Northern Line, this is between Kennington and Moorgate and between Kennington and Tottenham Court Road. They are identified by a white plate with FNX followed by the automatic signal number. E.g. FNX634. The 'N' means Northern. Other lines have their own initial – e.g. FPX for the Piccadilly Line. Most flood signals can be switched to automatic working and have an illuminated 'A' to show this. This goes out when the signal is worked manually.

X signals are usually the last automatic signal before a controlled are. Their purpose is to tell the driver not to pass them at danger without authority because if they do so, they could lock up the signals and points in the area ahead. They are identified by a white plate with the cabin code, followed by an X, followed by the automatic signal number. E.g. EX602.
X signals can also be seen without the cabin code, as X638 and X643 at London Bridge. They are not associated with a cabin, but their purpose is the same – to tell the driver not to pass them at danger without authority.

Pop-up signals are signals that have no aspects, only illuminating as the train approaches them. The reason for them working like this can vary, but one reason is to prevent "read-through" where a driver sitting at a red signal might see a green signal ahead and mistakenly think that is the signal allowing them to go. This would give the potential for a SPAD at the signal they are at. There is one pop-up signal on the Northern Line, A728, at the northbound entrance to the tunnel at Morden. There is no specific identification for a pop-up signal, the identification being that of whatever signal it is.

Shunt signals are used to control a train's movements in areas where passengers do not go, such as in a depot or siding. There are two types of shunt signal on the Northern Line, the most common being the disc type. This is a round white disk that displays a horizontal red stripe when the signal is at danger, and rotates to show a diagonal red stripe when clear. The other type, a position light shunt signal, has three aspects in a triangular formation. It shows two red aspects when at danger, and one white aspect when clear. A shunt signal is a semi-automatic signal, and both types are identified by a white plate with the cabin code and lever number on it.

Home signals is the name given to the group of signals on the approach to the platform. Most stations have home signals. When there is a train in the platform ahead, the following train is held at a signal a braking distance away. Under normal circumstances, that signal would remain at danger until the train had departed the platform and was at least a braking distance from the station starter. This could mean a long delay for the train that is waiting outside the station. To allow the train to get into the platform quicker and increase line capacity, more signals are added on the approach to the station. As the train starts to leave the platform, the first signal clears, followed by the next. These signals are referred to as 'home' signals and, if they are all automatic signals, have the same signal number followed by A, B or C etc. E.g. A669^{A}, A669^{B}, A669^{C}.

Station Starter, or station starting signal, is the name given to the signal in the vicinity of the headwall that lets the train depart the platform.

Wrong Road Starter signals are used when passenger trains are signalled in the wrong direction from a platform, normally over an emergency crossover. They are standard semi-automatic colour light signals.

Route indicators are not signals, but are associated with a junction signal. They indicate to the driver which route is set for the train. A route indicator can be a horizontal or diagonal line, or it can be the route number. Part of the driver's line knowledge is knowing which route to take at a junction and ensuring that the signal displays the correct route. If the junction signal has a repeater, the route indicator will normally be repeated as well.

Signal phones are provided at many of the semi-automatic signals. In the past, if a driver was held at a semi-automatic signal, they would need to contact somebody to find out the reason for the delay and possibly be given permission to carry on. The trains had no radio and so the driver would get onto the track and use the phone at the signal. On the Northern Line, they would speak to the Supervisor at the station ahead. Even though the driver now has a secure train radio, there may still be times that it is necessary to use the signal phone.

Position detectors are used to detect the position of a train and can be found at various locations.

Tripcock testers are provided at stations at certain locations on the line. Their purpose is to detect that the trip arm is present, of sufficient length and correctly aligned so that, if a train was to pass a signal at danger, the trip arm would be knocked back on the raised trainstop. Associated with the tripcock tester is a white or purple light, in the vicinity of the headwall or station starter. This light is normally off, but illuminates when a train enters the platform. As

the trip arm passes over the tripcock tester, it pushes the ramp down and the light will go out. If the light remains on, it is likely that the tripcock arm is faulty and the train must then go out of service at reduced speed with another member of staff to ride with the driver.

Trainstop raised

Disc shunt signal
- clear with a route 2

Disc shunt signal at danger

Position light shunt signal at danger

Traction current

Whilst signals are the driver's main concern, they also have to know the basics of the traction current arrangements – where the substations are, what to do if the traction current needs to be switched off, what to do if the traction current is switched off, etc.

Traction current is supplied at high voltage to the substations, where it is transformed and rectified to 630v DC and fed to the current rails. The train picks up the traction current from the current rails by means of pick up shoes on four of the six cars. The train uses the traction current for the heaters and compressors and, at lower voltages, for the motors, lighting, and various circuits. Jumper boxes are fitted onto the cars that have shoes so that when the train is off current on a shed road, traction current can still be supplied via overhead jumper leads. The negative rail is between the running rails. The positive rail can either be on the left or the right. Each motor car has two negative shoes along the centre and two positive shoes on either side. The two negative shoes are connected together and the four positive shoes are connected together. Because the trainstops are on the right hand side, the positive rail is normally on the left. When the platform is on the left, the positive rail is moved to the right so that it is away from the platform.

The line is divided up into traction current sections, normally with a substation at each end. There is a gap in the current rail at the end of the section called a Rail Gap. If it is necessary to switch traction current off for any reason, a circuit breaker is opened at the substation at each end of the section and this isolates that section. To warn the driver that there is no traction current on the section ahead, a Rail Gap Indicator is provided. When the current is switched off, the rail gap indicator displays three red lights in a triangular formation. If the rail gap indicator is on a bend, a rail gap indicator repeater is provided. If the current is switched off, this displays three yellow lights in a triangular formation.

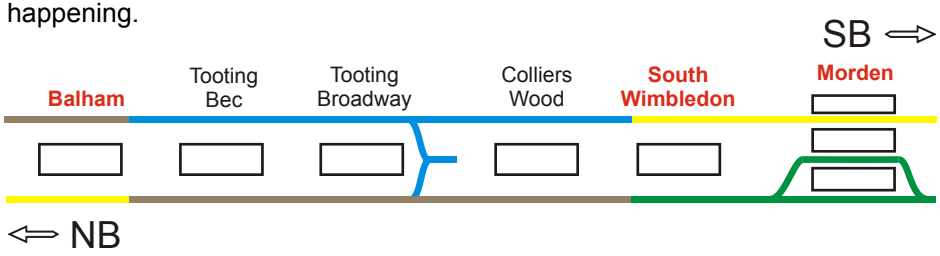
If the driver needs to have traction current switched off in an emergency, they can do this in various ways, depending on whether the train is in a tunnel, a tunnel station, or the open section. In a tunnel section, the driver can pinch and rub the two tunnel telephone wires together that run alongside the tunnel wall. There is a telephone handset in the emergency equipment cabinet on the train and the driver will then clip that onto the tunnel telephone wires to speak to the Service Controller (or Station Supervisor if in a tunnel siding).

There is a Short Circuiting Device (SCD) in the emergency equipment cabinet. It is put across the current rails after traction current has been switched off as a means of protection against traction current accidentally being switched back on again. They can also be used to attempt to switch off traction current in an

emergency if no other means is available. If there is an incident, such as a person under the train, an SCD is placed at each end of the train, away from the train, so as to allow access beneath it.

In tunnel sections, the tunnel lights normally automatically switch on when the current is off.

From a driver's point of view, the main concern if traction current is lost is that the compressors stop running on the train. The train uses air for various things including door operation, brakes and operation of the contactors – the main 630v switches on the train. If there is no traction current, the compressors will not work and the air could gradually leak off. If the air gets too low, the contactors cannot be closed and, even when traction current is switched back on, the compressors will not work because the contactors are open. The driver has to be prepared to isolate some equipment in order to prevent this happening.

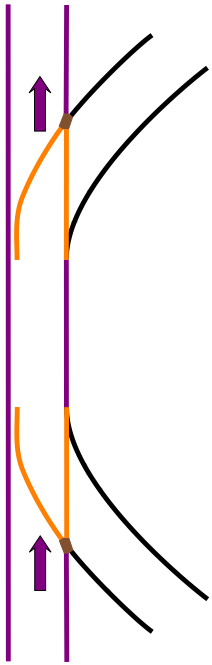


Traction current sections Morden to Balham

Rail gap indicator

Facing points
- a diverging junction

Trailing points
- a converging junction



Track related items

Trains run along the track and points are used to guide the train at a junction. There are different types of points that are used depending on the location and the purpose. Where a train has a choice of routes ahead of it, this is known as a diverging junction and the point layout is facing. Where a train is joining another line, this known as a converging junction and the point layout is trailing.
Catch points are used to “catch” a train if it rolls back on an incline and prevent it fouling an adjacent track.
Trap points are used to “trap” a train if it goes too far, such as if it passes certain signals at danger. As with catch points, trap points prevent a train from fouling an adjacent line.
Where there is a curve, or a gap in the track, a check rail may be used. This is an additional rail on the inside of the running rail and its purpose is to help keep the train wheel on the track. The wheels do not actually run on a check rail.

Speed restrictions are used at various locations on the line, especially where there are curves. The line has a maximum Permanent Speed Restriction (PSR) over sections of the line. For example Morden to Camden Town via Bank has an overall maximum speed restriction of 35 mph. Some parts of the line layout may have a lower PSR because of the line layout, such as a curve. Where the PSR is lower than the PSR for that section, the speed is shown. At the end of the speed restriction, there is either a ‘**T**’ sign (for Termination) or the sign shows the maximum PSR for that section. In tunnel sections, the signs are either internally illuminated or reflective. In the open sections, the signs are larger and enamelled or reflective. Occasionally, they may be illuminated. Yellow PSR repeater signs can be used to give advance warning of a PSR.

When it is necessary to temporarily reduce the speed, such as during track works, a Temporary Speed Restriction (TSR) sign is used. The same type of sign is used in the tunnel and open sections. Flashing yellow warning lights are put on the track bed and, ahead of them, also on the track bed, is a reflective sign which shows either the speed or a T. Where there is speed signalling, such as at Oval and Waterloo NB, internally illuminated signs are used that only light up when the speed signalling is in force. The same type of signs are also used in multi-SPADed areas where the signal visibility may be reduced. A speed sign lights up and this tells the driver to proceed at a reduced speed, therefore reducing the likelihood of a SPAD as the driver will have a greater sighting time.

Signs
There are various signs along the track to pass information on to the driver.

Stopping marks on the running line are a horizontal green bar with a central black vertical stripe. For the train to be correctly berthed, the driver must stop the train in the platform so that the black stripe is in the centre of the small left-hand side cab window or the centre of the right-hand front cab windscreen.

1 – 6 car marker *boards* are provided at each station. They show the driver how far out of the station the train is if it is stopped for any reason. E.g. if the train is stopped at the 4 car mark, it means that the train is fours cars out of the station and there are still two cars remaining in the platform.

Front Door Cut Out boards are provided at all stations and tell the driver whether they need to cut out the front doors (end doors) on that car when the train has stopped. Although the doors should automatically cut out at stations where they are always cut out, the driver may need to cut the doors out if the train has stopped past the stopping mark.
FDCO – if the driver can see this board, all the doors are in the platform and the driver can open all doors.
FDCO limit – if the driver cannot see the FDCO board but can see the FDCO limit board, this means that the front set of doors may not be fully in the platform. The driver cuts out the end doors then opens the rest of the doors as normal. If the driver cannot see this board, then it may mean that the second set of doors are not fully in the platform. The driver must not open the doors and has to follow set procedures.

PTI Reset Point signs are provided at the last station before a terminus or normal reversing point. They are a reminder to the driver to change the destination PTI code for the next trip. This information is then picked up before the next station.

Check PTI signs are provided as a reminder to the driver to check that the PTI has been changed, normally after reversing. The description on the platform dot matrix might give a clue if the PTI wasn't set correctly. The driver may also hear the wrong information being announced in the cars and will probably get black looks from the passengers on the platform!

Reg Point signs are provided at some stations, usually where the starter is a semi-automatic signal. They are a reminder to the driver that the signal may remain at danger if the Service Operator is regulating the service.

Braking point signs are provided in some multi-SPADed areas as an indicator to the driver that they should start braking if the signal ahead is at danger. They are a black letter '**B**' on a white background.

Aiming Point signs are normally used in conjunction with Braking point boards and show the driver where they should aim to stop the train if the signal ahead is at danger. The train is then moved slowly forward to that signal. They have the letters '**AP**' in black on a white background.

Approach Controlled signs are provided at a few signals to let the driver know that the next signal is approach-controlled – see Approach-controlled signals. They have the letters '**AC**' in black on a white background.

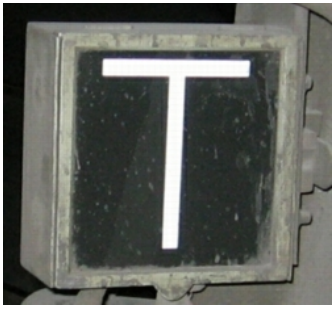
Timing section signs are provided at some speed signals to show the driver where the timing section starts and ends. **TSXX** shows the speed of the Timing Section, **EOTS** shows the End Of Timing Section. The letters are in black on a white background.

Limit Of Shunt boards are provided at most places where a shunt move is made on the running line, normally when reversing to go over an emergency crossover. They are also being used in some places where a train might make a wrong direction move. They show the driver where the train should be stopped in order to clear the crossover or signal before changing ends. The signs have black wording on a white background, although this may vary.

Limited Clearance boards are used, generally in open sections, to show staff that there may not be sufficient room to safely walk or stand when a train is passing. The signs have red wording on a red and white check background.

Driver's Information boards are not signs as such, but are generally provided at the driver's position to pass on non-safety critical information to the driver. Some of these are in a position that cannot be seen by the driver when the train has stopped. Others, because of their position, means that the driver would have to look back at the board to read it. As a consequence, anything written on these boards is difficult to read.

Reflective



Internally illuminated

Assorted tunnel speed restriction signs

About the job

Hours and holidays
The driver's job is a well paid one, currently around £40,000 for a 35 hour week. Drivers work 36 hours a week but only get paid for 35 hours. The extra hour is owed and given as time off in lieu. This is what's known as Banked Rest Days and is equal to six days off a year. Personally, I like this way of doing things. You don't notice the odd hour a week and it is nice to get the extra days off. There are 28 days holiday a year, plus an extra day if you work or are rest day on a bank holiday. This can give you a maximum of 28 + 8 + 6 = 42 days off a year. LU wrongly classify this as 42 days holiday, whereas only 28 days are actual holiday. This is very deceiving when they mention in the papers the hours we work and the pay and leave we get. Outsiders find it very hard to reconcile the fact that we get 42 days leave a year, when they only get around 25 – 28 (plus bank holidays), especially when they think we get the bank holidays off as well as the 42 days!

Annual leave is allocated in two weekly periods throughout the year and these are divided into Spring, Summer, Autumn and Winter leave periods. This gives a total of 40 days off. If you are due less than this, you will work the days, if you are due more days, these are taken by mutual arrangement.
The annual leave periods are allocated on a rota and you have a different position on the rota each year. You can change one or more two week period with other drivers and you could, if you were able to get the changeovers you wanted, have up to eight weeks together.

Train staff do not work overtime, other than when it is unavoidable because of late running and the duty finishes after it is booked to do so.

The 36 hour week is an average spread over the roster. The amount of hours worked in a day varies daily. The first turns book on early in the morning, the late turns book off in the early hours of the next morning. There are also night turns which generally run the last trains at night and the first trains in the morning and run de-icing trains during the night as required. As an example, Morden duties vary from 4h47 to 8 hours long, plus 30 minutes unpaid meal relief. The first duty books on at 04:45, the last duty books off at 01:28.
The roster is generally two weeks of early turns (book on before 12:00) and two weeks of late turns (book on after 12:00), although this does vary. New drivers coming into a depot become 'Pool drivers' until there is a vacant position on the roster. A driver can change duties with another driver, as long as there is at least twelve hours difference between booking off one duty and booking on another one.

Other than on a night turn, a meal relief is normally booked at a crew relief point, where there is a canteen open. The canteens are normally open from between 06:30 to 22:00.

There are currently three crew depots on the Northern Line – Morden, East Finchley and Golders Green, with plans for smaller crew depots at High Barnet and Edgware in the future.

Training
Northern Line drivers drive trains anywhere on the Northern Line, they do not drive on any other line. A driver is trained on the stock that they will be driving on that line. A driver is also taught the line knowledge of that line and is expected to know it all. This includes:

Depots and stabling points – where they are located and how to enter / exit them.
Sidings and reversing points – where they are located and reversing procedures.
Signalling – what routes are required at junctions, speed signal locations, how to approach signals in different areas, peculiarities of any signals in the way that they clear, etc.
Speed restrictions – line speed, permanent speed restrictions.
Traction current – where the substations are, where the rail gaps are, what to do if traction current is lost, etc.
Guidelines on how to drive the trains.

As part of the road training, there are the Driving Techniques - guidelines on how to drive the train with regards to speed and braking in a normal situation at each location. Drivers are taught the correct way to drive a train by their Instructor Operator so that they will always have it under control and will be able to stop before reaching a signal at danger (thus avoiding SPADs). They will also be able to provide a comfortable ride for the passengers.
It is sometimes said that the driver should have the the train under control when entering a platform “so that you can stop if somebody jumps in front of you”. This is nonsense. If you had to be able to stop at any point in the platform, then you would have to drive at under 5 mph. The reason a driver should have the train under control is for the reasons already mentioned, and also to make sure that the train stops smoothly and not overrun the platform.

Once a year, drivers get refresher training to keep them up to date and their knowledge is tested.

It may seem a lot to learn, but you’d be surprised how much you pick up without really thinking about it.

623 duty Monday to Friday

The 30 minutes unpaid Meal Relief (10:50 - 11:20) makes it 08:30 between booking-on and booking-off.

This duty has three trains on it, the driver gets off train 032 on the north and picks up train 115 on the south at East Finchley, with a meal relief at Morden.

Duty:	**623**	*Mons to Fris*			*Duty Length:*	*08:00*
On:	**05:53**	**MOR**	Off:	**14:23**	**MOR**	
Train:	*Depart:*			*Arrive:*		*PTI:*
032	**06:23**	**MOR DT**		**07b30**	**EFY N**	**011**
	Relieved at 07:29					
	Be on train 115 by 07:55½					
115	**07:55½**	**EFY S**		**08b28**	**KEN S**	**107**
	08:37	**KEN N**		**09:21**	**EDG**	**021**
	09:27½	**EDG**		**10:41**	**MOR**	**111**
						031
	Relieved at 10:41					
	Meal Relief 10:50 - 11:20 at MOR					
	Be on train 123 by 11:27					
123	**11:38**	**MOR**		**12:52**	**EDG**	**031**
	13:02	**EDG**		**14:15½**	**MOR**	**111**
						031
	Relieved at 14:20					

Rota	Sun	Mon	Tue	Wed	Thur	Fri	Sat	Hours
001			LEAVE COVER					73:19
002			LEAVE COVER					
003	R	760	674	673	R	675	676	36:21
004	700	722	767	733	724	R	R	35:28
005	R	R	643	631	626	630	727	36:57
006	615	621	R	R	631	626	725	34:29
007	646	672	677	R	R	737	745	35:59
008	675	711	763	701	673	R	R	35:48
009	R	R	651	646	643	647	730	36:55
010	630	646	R	R	656	752	640	36:08
011	653	677	761	R	662	657	R	35:34
012	R	602	614	612	603	R	721	35:49
013			LEAVE COVER					73:19
014			LEAVE COVER					
015	722	R	706	676	R	725	706	36:36
016	677	727	766	720	725	R	R	35:12
017	R	601	742	604	R	633	614	35:31
018	631	651	753	655	645	R	R	34:54
019	R	R	700	761	670	665	662	34:54
020	662	706	R	R	740	723	713	34:58
021	R	743	605	601	R	612	606	35:40
022	602	626	626	745	622	R	R	36:36
023	R	R	701	670	667	700	735	34:35
024	702	725	R	711	766	721	R	35:44
025	623	635	R	R	613	743	610	36:24
026	710	616	620	R	627	631	R	36:51
027	R	736	714	707	R	730	700	35:15
028	665	707	R	R	726	724	741	36:58
029	R	655	646	643	R	754	652	34:49
030	641	753	650	647	655	R	R	34:16
031	R	701	672	675	760	662	R	35:34
032	R	605	612	614	604	R	722	36:55
033			LEAVE COVER					73:19
034			LEAVE COVER					
035	R	R	676	674	761	672	661	36:59

Rota 001 - 035 of the 187 week rota at Morden

The rota shows the **R**est day, duty number, and hours for that week. As can be seen, the rest day days vary from week to week and can give two, three or four consecutive days off together. Duties and rest days can be changed with other drivers.

Leave cover weeks are where you cover other drivers' annual leave or anything else that needs covering. The amounts of hours is shown as the average for those two weeks.

Let's go for a cab ride

We are doing 623 duty at Morden, which books on at 05:53.

We book on with the DMT at Morden, signing the signing-on sheet to say that we are fit for duty. After booking-on, we check for any new notices that might tell us about any changes, such as new temporary speed restrictions. Check the handlamp and radio to make sure they are working and replace the battery if necessary. As we got there a bit early, we have time for a drink. The canteen isn't open yet, so it's either a drink from the machine or make it ourselves.

The train is starting from the depot at 06:23, and a maximum of fifteen minutes walking time is allowed to get to the train. There is a designated route to the depot, which we follow, and arrive at the Shunters cabin where we find out where our train is. Safety is important. Proper protective equipment should be worn when on or around the track and, most importantly, this includes the hi-vi. It must be remembered that, in the darkness, even with a hi-vi on, a person isn't always visible. There can also sometimes be "black spots" where the driver's vision can be obstructed. There are trains moving in the depot, and there are 630v current rails. There are designated walkways in the depot and we have to keep to these. We should only cross the tracks using the walk boards that are provided, all the time keeping a look-out for moving trains.

Morden is the biggest depot on the Northern Line and, in normal circumstances, up to 49 trains could be stabled here. In the weekday, 38 trains enter service from Morden depot between 05:01 and 08:18. Some roads hold two trains - front and back. Our train is on 7 back.

Once on the train, we have to prepare it. The train has already been prepared by the depot staff and signed off by them as being fit for service, we just have to do some final checks and have a brake test. We check that all the MCBs and switches are in the correct position and have a look on the 'trouble card' to ensure that any previous defects reported on there have been signed off. The train is opened up (activated) by using the enable and master switches and the TMS checked for any defects that might be showing. There shouldn't be any, because if there were, the depot staff would have rectified them when preparing the train.

The brake test is next. On older stocks, going back to the opening of the line, this was done to ensure that there was a through flow of air from the driver's position to the rear of the train. This was necessary for the correct operation of the brakes throughout the train. On the modern stock, the brakes are applied in a different way and there is no through air to the brakes. Instead, the brake test proves that pressure switches, used as part of the train's braking system,

are working correctly. Once the brake test is completed, this is entered on the trouble card and signed by the driver as having been correctly carried out.

Finally, the PTI details are set up on the TMS and we're ready to go. The Shunter has called up the train on the radio and given us permission to proceed, so we give a blast on the whistle and move forward as far as the stop board. Because we are passing over a pit road and there are no current rails, we need to let the train coast over it and ensure it doesn't stop. The speed of the train has to be kept to 5 mph when passing through the sheds, then 10 mph through the rest of the depot.

It's important that we check the route is set correctly. All the points as far as the Shunter's cabin are trailing points and if a train passes over them and they're not set, the points will be damaged. At the stop board, we wait for a green handsignal which gives us permission to carry on. All trains are normally washed before going into service from Morden, and we're no exception. The speed of the train must be no more than 3 mph when going through the wash. That's easy to do, because the track is on a downhill gradient and it just means applying the brakes now and again. Make sure you have nothing on the cab floor. Water comes in under the front cab door and will run all over the floor. Having left the wash, we've arrived at the outlet shunt signal. The train is now under the Service Operator's control. On the way, the alarm has sounded a couple of times, with a message saying that traction current has been lost. This will be covered later.

If you look at the track ahead of the shunt signal, you will see there is a set of points leading to a dead end. If the train was to pass the shunt signal at danger, the train would be routed towards the dead end, thus preventing the train fouling the main tracks. There is a choice of three routes from the shunt signal, leading into any of the three platforms. Although the train is booked into a certain platform in the timetable, we accept any route that is given. The shunt signal clears with a route 2. This means we are going into the middle platform, platform 4. As we move off, we give a warning whistle to warn any staff who may be walking along the walkway adjacent to the track. The maximum speed is still 10 mph until the train stops in the platform.

The station starter has cleared before we've even stopped. This means that we are the next train out. We stop on the stopping mark and open the doors on platform 4. We also open the doors on platform 3, although the dot matrix displays no longer list platform 3 as the departure platform. Many passengers still use this platform to board the train. We make a P.A. message telling the passengers that the train is going to High Barnet via Bank and to stand clear of the doors, then press the doors close button for both sides. If the train had been standing in the platform for a while, this is where you then find out if the train has been modified so that there is a delay before the doors actually close.

If it has been, it means that you've made the P.A. message asking the passengers to stand clear of the doors, nothing happens, so they continue boarding, then the doors close, usually trapping passengers in them!

Ahead of you, just before the tunnel mouth, you can see a signal with no aspect. This is pop-up signal A728. It only lights up as the first pair of wheels goes over the blockjoint of the starter. The reason it works like this is so that a driver being held at a red starter doesn't see a green signal ahead, think the green signal is telling them to go, then start up against the starter and SPAD it. This is known as a 'read through'.

We're now moving off and, as we leave the platform, the pop-up signal is now displaying a green aspect. Although it normally shows a green, you always have to be aware that it might show a red and so be prepared to stop. As we near the tunnel mouth, we get an alarm and a TMS message effectively telling us that we have lost the traction current supply to car 1. This is because there are some long rail gaps over the crossovers there. These warnings often appear and, other than than the driver cancelling them, are mostly ignored because the driver knows the reason for them. In most cases, the car is already back on current by the time the warning sounds. However, they are useful in that when they occur unexpectedly, they tell the driver that there may be something wrong. It could be that that particular car has become 'gapped'. If the driver gets a similar message for cars 1, 3, 4 and 6 (the four cars that can pick up traction current) it will normally mean that traction current has been switched off on that current section. We cancel the alarm and clear the message, only to be followed by one showing that car 6 has lost current. Again, we cancel the alarm and clear the message. There are then messages saying a similar thing for cars 3 and 4. We clear these as well. These messages are repetitive and annoying and occur at many places, normally at a terminus or where a train is slow going over points. Just a few more seconds delay before the TMS sends out an alarm would prevent most of them.

Because it's rush hour, we soon catch up with the train in front. We know this, because we start seeing yellow repeaters or, if there is a straight section of track, red signals. If everything is running smoothly, the train ahead will have cleared the section and the signal will be green by the time you get closer to it. However, you must always have the train under control and be prepared to stop. Never assume that a signal will clear, because there are many reasons why a signal may remain at danger. When following a train, one of the more common places to get held at a red signal is the outer home. This signal is protecting the train in the platform and it could be red for a number of reasons:
The station starter is red and so the train in front is being held in the platform.
The station is a busy one, and thus there is an extended dwell time.
There may be a problem with the train in the platform, such as a sticking door.
A Passenger Emergency Alarm has been operated on a car, etc.

We're approaching South Wimbledon, which is on a steep downhill gradient and it's very easy to pick up speed without realising it. It is important to have the train under control. The station is also on a bend which means that all the home signals (there are four) have repeaters. Some repeaters repeat two signals. One of the things you have to watch is that when a repeater repeats more than one signal, it will display a yellow aspect if any of the signals it is repeating is red. This means that you could pass a yellow repeater, come round the bend and see a green signal. You mistakenly think that the route ahead is clear and resume normal speed, only to continue round the bend and see a red signal. This is what used to happen at outer home BX51^{A} at Kennington, making it a multi-SPADed signal. SPAD mitigation measures, including an illuminated speed restriction sign when BX51^{A} is at danger, have helped reduce the amount of SPADs. If you see a yellow signal, always assume that there is a red signal ahead and reduce your speed accordingly. If you are following a train, a few seconds lost will not make the slightest difference.

We've now left Colliers Wood and the next station is Tooting Broadway. After leaving Morden, all the signals have been automatic. Ahead of us is a controlled area, where the signals will be semis. Tooting Broadway is a reversing point and there are sidings at the south of the station. Trains can reverse south to north. They can also reverse north to north. Not really a reversing move, but it is used if it is wanted to stable a defective northbound train in the siding, to get it out of the way until after the rush hour traffic. Years ago, a train used to be stabled in the siding overnight as required.

The first semi we come to is W12^{A}. This is the outer home for Tooting Broadway and protects a train in the platform and the points from the siding. If there is a train in the platform, or the route is set to / from the siding and the northbound platform, W12^{A} will remain at danger. Station starter W9 is the last semi. Tooting Broadway signals are controlled via a programme machine in the IMR. If the train is running early, the programme machine will keep the starter at danger until the correct time. The Service Operator can also hold the signal at danger to regulate the service. There is a Reg Point sign near the signal as a reminder to drivers that this is a regulating point. Normally, by the time platform duties have been carried out, a starter is green. However there are times when it might still be red, and this is especially so in controlled areas. As a driver, you have to be on the alert and make sure you check the starter is green before closing the doors. If not, it's possible that a 'start-up-against' SPAD may occur.

We're still following a train and, as we round the bend after leaving Tooting Broadway, we have a straight bit of track as far as Tooting Bec. The train ahead can be seen in the platform and the three home signals - S702^{A}, S702^{B} and S702^{C} are clearly visible. As we approach the outer home, the train in

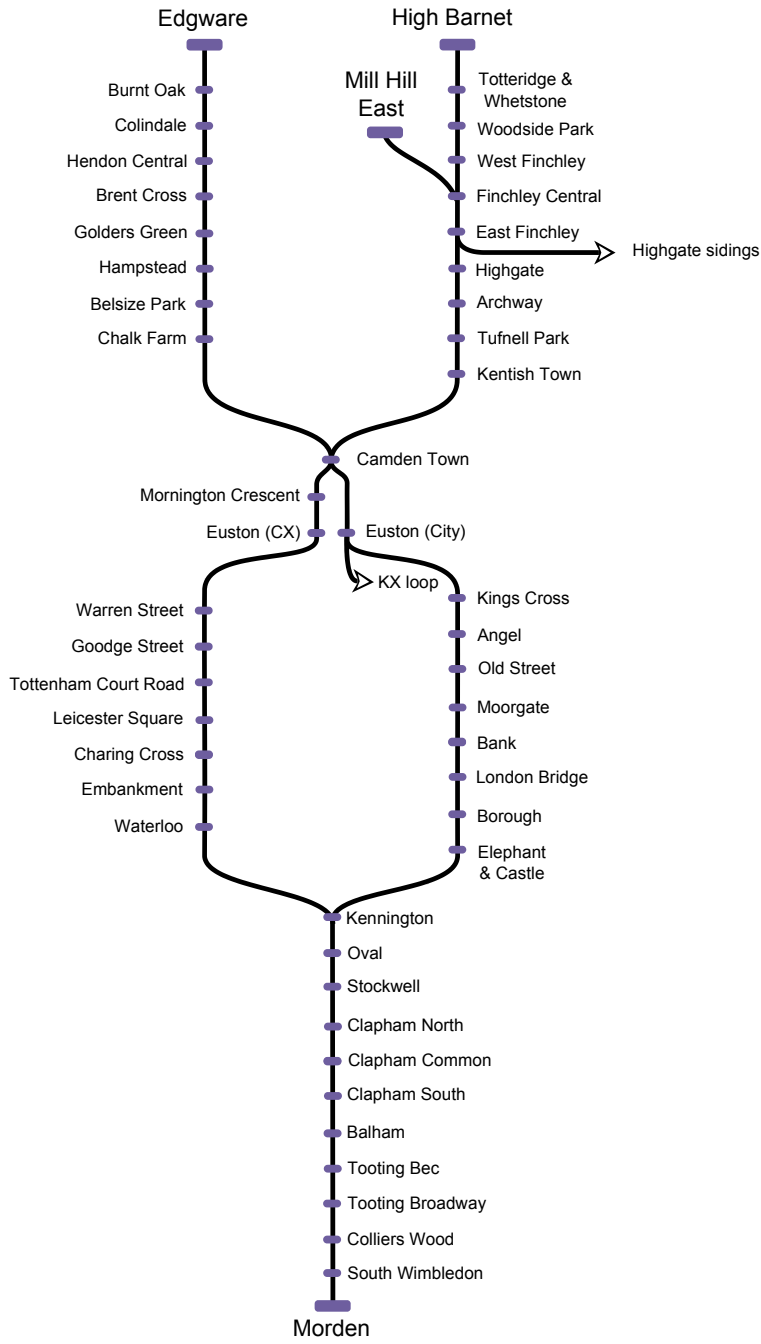
front begins to move away from the platform and S702^{A} goes to green, followed by S702^{B} and, as the rear of the train passes the starter, inner home S702^{C} also clears. This is a good example of how the home signals work.

Let's have a look at the CCTV. The CCTV monitor shows all of the platform, with the screen showing the pictures from two or more cameras. You will notice the short yellow cross line at right angles to the platform edge. A cross line should be seen in all the camera views on the screen. The CCTV cameras overlap and so the cross line on one picture is seen on the other one as well. If there are more than two cameras, then there is more than one cross line. If you can see the cross line in each picture, this proves that the cameras are set correctly and that you are able to see all of the platform. If there is a fault with one of the cameras, or a complete loss of CCTV, then you mustn't move the train until you are given the right from the station staff. This is known as assisted despatch. If there is at least one camera working, the staff must stand on the platform in such a position that you can see them all the while that any part of the train is in the platform. They should remain in that position and watch the train completely out of the platform. Unfortunately, for whatever reason, this isn't always done correctly. If you cannot see the staff, then don't move the train until they are in view, or back in view. If there is no CCTV at all, then different rules apply.

As we're going along, a general message comes over the radio announcing that Borough station has closed and trains are not stopping at the station due to a lift failure. We must remember this when we get to Elephant & Castle, as we will have to let the passengers know.

Station Assistant Trains (SATS) are often on busy platforms during rush hours in order to assist the quick departure of the trains from the platform. This can work quite well and be a help to the driver. Ideally, the SAT should be wearing a hi-vi, standing so they can be clearly seen by the driver on the CCTV and, when they are ready for the train to go, should raise a baton according to the procedure. Some SATS do a perfect job, but are too far away to be seen clearly on the CCTV, some are standing near the platform wall and can't be seen at all when the train has stopped. Many don't have batons for whatever reason, and some just rely on the PA message, assuming that when they say "stand clear of the doors" the driver will then close the doors. Some may even just stand there and then say "mind the doors" after you've started to close them. Ultimately, the SATS are there as a guide for the driver. Often the driver cannot hear any PA messages clearly because the cab air conditioning is on and the noise from that can mask other sounds. As a driver, you have to use your common sense. If the SAT is clearly visible, then wait for the right. If you cannot see a SAT, or it seems that you are not going to get the right, then carry out platform duties and go. When a SAT is on duty, there should be an 'S' displayed on the headwall.

Northern Line



We are now approaching Clapham Common. The approach to Clapham Common is on a tight bend and so there is a permanent speed restriction of 15 mph. This begins at outer home A676^{A} and there is an internally illuminated 15 at the signal. You should always slow the train down to the correct speed by the time the train reaches the start of the speed restriction. The illuminated T for the end of the speed restriction is at the end of the bend, near the start of the platform.

Clapham Common is an island platform, and there are special instructions to follow if the train has to be detrained there or at Clapham North, another island platform. Still following right behind the train, we arrive at Clapham North. This station is one to watch out for. When following a train, the starter may take a while to clear. This is because it cannot clear until the train in front has almost berthed in the platform at Stockwell. Extra care has to be taken to ensure a start-up-against SPAD doesn't occur. This used to be a problem because, depending where the train stopped, the starter might be hidden from the driver's view. As part of the SPAD mitigation process, a co-acting signal for the starter was installed on the opposite side of the tunnel. This can be clearly seen by the driver.

Stockwell is a controlled area. Clapham North starter is the X signal for Stockwell, and this is identified by the cabin code U and the X in the signal number UX670.

The starter has now cleared and we can depart. Stockwell has an emergency crossover north of the station and trains can reverse north to south or south to north. Inner home U11 protects the crossover and will remain at red if there is a train reversing. It can also be a speed signal, to allow the train into the platform at reduced speed. As we enter the platform, we can just about see draw-up signal U100 which is situated under the platform at the far end almost out of sight. Luckily it is normally yellow. U100 is associated with station starter U10. This draw-up signal differs from most in that if U10 is red, U100 is usually yellow. However, if there is a train reversing ahead, U100 then becomes a speed signal and remains red until the train approaches it, then goes to yellow.

Departing Stockwell, we pass two green signals and see a group of reds in the distance - these are some of the home signals for Oval. Unknown to us, the train at Oval has been delayed and will be in the platform for a few minutes. Before we reach the outer home, there is an illuminated 25 mph speed restriction telling us to slow down. As we approach A662^{A}, there is an illuminated 20 mph speed restriction. A662^{A} clears and, with the train now travelling at 20 mph, A662^{B} clears, and allows us up to A662^{C}. The train ahead is still in the platform at Oval but, because we have reduced our speed, the speed signalling has allowed our train to get closer. In fact, we are less than 74 metres away from the train in front. This is quite safe because, as we were

travelling slower, even if we passed A662^{C} at danger, the train would still stop well short of the train in front. If we had been going too fast, the train would have been tripped at A662^{A} or A662^{B}.

The train in the platform at Oval is just departing, and A662^{C} clears, allowing us to move forward. As the train continues to leave the platform, A662^{D} clears, followed by A662^{E}. At the starter is an illuminated 'T'. As we've seen, the first two home signals, A662^{A} and A662^{B} are speed signals if there is a train in the platform at Oval.

We're now ready to leave Oval. Kennington, another controlled area, is the next station. There is a siding and a junction ahead of us. From where we are sitting at Oval, we can see the first of the semis - B34. This signal protects moves between the siding and the northbound line and will remain at danger if the points to / from the siding are reversed. B34 will normally clear as the train approaches it. However that cannot be guaranteed as it is a semi and semis can remain at danger, even though there is no train ahead.

At Kennington, there is a junction with a choice of two routes - go left to the Charing cross branch, or carry on straight ahead for the Bank branch. We are going via the bank branch and need to make sure we get the right route set for us at junction signal B31^{A}. If we were going via Charing cross, we would want a green with a diagonal route indicator to the left. As we're going via Bank, we don't need a route indicator, just a plain green signal.

Kennington is another regulating point. There is often additional time allowed in the timetable between the train's arrival and departure times. As with any delay, if we are stopped for more than 30 seconds, we must use the P.A. to give the passengers the reason why. Sod's law means that the signal will often go to green about five seconds after you've started to make the announcement!

The train in front of us has gone via Charing Cross and so we are no longer following directly behind a train, although the train ahead of us is probably only a few minutes away.

We've arrived at Elephant & Castle. There is a rail gap ahead of the starter and a rail gap indicator. There is a substation at Elephant & Castle, and this is the start of a new traction current section. The section runs from Elephant & Castle to Old Street.

Borough station is still closed, so we use the P.A. to tell the passengers that the next station is closed and the next station the train stops at will be London Bridge. This gives any passengers who want Borough the chance to get off the train and use the existing bus service if they want to.

While we're here, if you look on the track, you can see a piece of check rail on the right. On the left is a "greaser". This is the large blue (or other) colour thing that you often see next to a running rail, especially near the start of a bend. This lubricates the flange of the wheel so that there won't be much friction if it rubs against the side of the rail. When there is no lubrication and the area is dry, this can cause the "wheel squeal" screech that you can hear as the train is moving over that piece of track or curve.

On the way to Borough, we'll give the passengers another reminder about Borough being closed. We can use the P.A., or use a pre-recorded message that we can select via the Broadcast menu on the TMS. On the Northern Line, passenger trains stop at all stations. If a train is non-stopping a station for any reason, the driver must reduce the speed of the train to 5 mph by the time it reaches the starter. It can then resume normal speed. As a reminder to drivers, if a station is closed, the staff will display a "Station Closed 5 mph" sign on the platform.

We're now at London Bridge, and the platform looks crowded with the additional passengers that would have got on the train at Borough. It's a bit early for the SATS, so we will use the train's P.A. to ask passengers to use all available doors and move down inside the train. It's surprising how many people would rather queue up to get in their favourite car when the one next to them might have more space!.

On the way to Bank, there have been some signals with an illuminated 'A'. These are the flood signals. Looking at the starter at Bank, the signal number FNX634 can be clearly seen.

Continuing to Moorgate, we pass two more flood signals although, unless you happened to notice the signal plate, you might not realise it as they do not have an illuminated 'A'. This doesn't mean that the floodgate ahead might be in use, rather that a few of the flood signals are also used as semi-automatic signals during normal running.

At Moorgate there is an emergency crossover, north of the station, so we are now in a controlled area. If the train was going to reverse north to south here, it would detrain in the platform and then go as far as the Limit Of Shunt board in the tunnel. The driver would then change ends and wait for a shunt signal to clear to take the train over the crossover into the southbound platform. As we depart the station, we can see part of the crossover. For trains going north, this is a converging junction and so the points are trailing points. Further along, after the 6 car mark, you can see the limit of shunt board. Trains don't use emergency crossovers very often, but they are useful when the service is disrupted or for booked reversing during engineering works.

Arriving at Old Street, we stop on the stopping mark and press the open buttons. Nothing happens!. The train is berthed correctly, but it is not picking up the track-to-train link which tells the train that it's in the station and what side the doors can be opened. At Old Street, this is a known problem with most trains. One way round it is to stop a little bit further than usual and then the link is picked up. However, this is a good opportunity to show the CSDE operation.

When the doors cannot be opened in the usual way, there is another way to do it. On the panel behind the driver, there is a Correct Side Door Enable (CSDE) button. If the driver presses this, it allows them to open the doors without the track-to-train link being present. However, this does mean that the doors can be opened on either side and so to help prevent the doors being opened on the wrong side, the driver cannot use the doors open buttons in front of them, they have to get out of their seat and use the open buttons on the backwall door panel. The correct procedure is: go to the cab door and open the door on the platform side. Again, doing this means that you are less likely to then open the main doors on the wrong side. Press the CSDE button. Press the doors open button on the platform side. Once the doors are open, close the cab door and return to your seat. Carry out platform duties and close the doors from the front panel in the usual way. If the doors need to be re-opened for any reason, this will have to be done from the back panel, and the same procedure repeated.

As the train reaches Angel platform, you notice that the starter is red, although we're sure we're not following right behind a train. It goes to green as the train comes to a stop. The starter is approach-controlled. This means that it is normally red, only going to green as the train approaches it. The signal is normally cleared by a train occupying a track circuit in the platform. Of course, if the train ahead was still in the signal's section, it would remain at red. Never expect a signal to go to green, always be prepared for it to stay red. Angel starter is an automatic signal and was made approach-controlled when the station was closed for refurbishment. By remaining at red until the last minute, this ensured that trains slowed down to the 5 mph limit when running through the station. This has been the reason for some approach-controlled starters at other stations in the past.

Kings Cross is the next station and as we enter the platform, you'll see a light appear on the headwall. This is for the tripcock tester. If you look between the right-hand running rail and the platform, you'll see the tripcock tester ramp. The purpose of the tripcock tester is to ensure that the trip arm on the train is functioning properly. As the train passes it, you'll hear the 'clunk' as the trip arm touches the ramp. As long as the light goes out, it means that everything is working correctly. If the light remained on, there could be a problem with the trip arm. This is a safety device, so the train will go out of service at that

station. Another member of staff, usually station staff, will have to ride with the driver and effectively act as the tripcock, ensuring that the driver doesn't pass a signal at danger. If the driver did, and the tripcock is defective, there will be no emergency brake. If this happened and you were the assisting member of staff, then you could stop the train by pressing the emergency stop button.

We have caught up with the train in front now, a bit of blocking back at Camden Town means that the trains are queued up to Euston. When we arrive in Euston, there is an illuminated 15 mph sign near the station starter. This is only lit if the next signal (an auto) is red. The signal is round the bend with limited visibility. There is a repeater before it but, because the driver may still be checking the monitor as the train leaves the platform, this might be missed. The sign is part of the SPAD mitigation works for that signal and warns the driver to keep their speed down as the next signal is at danger. This method has successfully been used in other places.

Euston has a cross platform interchange with the Victoria Line. Where there is a cross platform interchange, and you are aware of a train having just arrived on the other line, you should wait for the passengers to cross over. You should also use your common sense. In rush hours, with a train directly behind you and a train entering the platform on the other line just as you are ready to depart, it would probably be better not to wait as you would delay the train behind. That train could already be in the platform by the time the passengers were crossing over.

The trains are moving again, and we're now approaching Camden Town, an important junction. Here the Bank and Charing Cross branches join and split off to the Edgware and Barnet branches. We're going to the Barnet branch so we want a route indicator on junction signal E11^{B}. The junction at this signal is a diverging junction, so the first set of points we are going over are facing points - facing points guide the train over the correct route.

We notice the starter go green as we enter the platform. Camden Town starter is approach-controlled. Both northbound starters are automatic signals, but the Service Operator can hold them at danger in order to regulate the service. Therefore, Camden Town northbound is also a regulating point.

At Tufnell Park, there is a PTI reset board which is a reminder to drivers reversing at Archway that they need to set the PTI for the next trip.

As we approach Archway, there are flashing yellow lights on the track. This is warning us that there is a Temporary Speed Restriction ahead. As we pass the lights, we can see a sign on the track saying 30. The flashing lights and 'T' for the end of the speed restriction are at the end of the platform.

Archway is a reversing point and has a siding north of the platform where trains can reverse north to south. Next to the starter is the round disc shunt signal which allows movement into the siding.

Leaving Archway, we now have a long run ahead of us to Highgate. Mostly straight, this is uphill all the way. Although the maximum PSR between Archway and East Finchley is 40 mph, you would struggle to get 30. Highgate is a long nine car platform, so the stopping mark is some distance from the headwall. Halfway down the platform, you can see the policeman. This is a trainstop without an associated signal and is usually down by the time a train arrives in the platform. If the train ahead was very slow leaving the platform, or had stopped a little way past the starter, then the policeman may remain up and a following train could get tripped at it. At Highgate, it works in exactly the same way as if there was a home signal in the platform instead of the trainstop. The only difference being that there is no signal. If a train did get tripped at it, it should be reported to the Controller although, like any policeman, it is not counted as a SPAD - drivers are not supposed to be looking at trainstops to see if they are up or down!

Finally, we've almost arrived at East Finchley where we will be getting off the train. As we come out of the tunnel, there is a fog repeater that is associated with A522. Originally the signal used to be NPX522. When it was renumbered to A522, the plate with FR522 was added to the fog repeater and the original number on the signal fascia covered over.

Another driver takes us off here. We have to cross over to the southbound side to pick up train number 115.that's going to Kennington via Charing Cross.