South London Network

1 Route Information

1.1 History

The London, Chatham and Dover Railway (LCDR) was authorised to build the line by the South London Railway Act 1862. Designed and engineered under Frederick Banister, it re-used the Wandsworth Road to Brixton section built as part of the LCDR main line. This line was quadrupled and extended to London Bridge. The northern pair (now the Chatham lines), with no stations, was used by the LCDR; the southern (now the Atlantic lines) was used by the London, Brighton and South Coast Railway (LBSCR). Several stations were shared by the two companies.

The LBSCR scheme, authorised in 1903, pioneered main-line rail electrification in the UK, and the first electric train ran on 1 December 1909. The electrification used the overhead system at 6700 V AC, supplied by a power station at Deptford. The line was converted to Southern Railway standard third-rail 660 V DC on 17 June 1928.

Between 1858 and 1860 the LB&SCR joined with the London, Chatham and Dover Railway (LC&DR), the Great Western Railway (GWR) and the London & North Western Railway (LNWR) to form the Victoria Station & Pimlico Railway Company, which included the construction of a new bridge over the River Thames at Battersea and an important new terminus in the west end of London at Victoria.

In 2012 a 2.5-kilometre (1.6 mi) diversion was made at the eastern end, connecting it to the East London Line, a former London Underground line which was reconverted to main line operation as part of phase 2 of the East London line extension project. The diversion used an alignment between Rotherhithe and Peckham that had been disused since 1911, via Old Kent Road station. The link allows trains to run from Surrey Quays to Clapham Junction via Queens Road Peckham, Peckham Rye, Denmark Hill, Clapham High Street and Wandsworth Road. Completion was originally scheduled for May 2012 in time for the London 2012 Summer Olympic and Paralympic Games, but the actual opening date was 9 December 2012.

1.1.1 London Bridge Station

London Bridge station was opened as the London station on 14 December 1836 south of the River Thames in Tooley Street, making it the first and oldest of the current London railway termini.
The London and Croydon Railway opened its line and began using its station on 5 June 1839, the London and Brighton Railway joined it in July 1841, followed by the South Eastern Railway in December 1842.

In 1846 the Croydon and Brighton companies merged with others to form the London Brighton and South Coast Railway (LB&SCR). As a result of these amalgamations, there were now only two companies wishing to use the two adjoining stations at London Bridge. As a result the LB&SCR used the unfinished joint station until 1849, when it was demolished to make way for an enlarged station.

In 1859 the London Chatham and Dover Railway applied to the LB&SCR for running powers from Sydenham to London Bridge, but was refused. The LB&SCR also built the Terminus Hotel at the station in 1861, but this was not successful due to its site on the south bank of the river and so was turned into offices for the railway in 1892.
The LB&SCR electrified the South London Line from London Bridge to Victoria in 1909 using an overhead system. Once this experiment proved to be successful other suburban services from the station were electrified, including the lines to Crystal Palace in 1912. Electrification of the main line to Croydon was not however completed until 1920 due to delays resulting from the First World War.

The grouping of the railways of southern England to form the Southern Railway in 1923 brought the two adjoining stations under single ownership. The Southern Railway electrified the SE&CR suburban lines at London Bridge using a third rail electric system, and converted the existing LB&SCR routes to the same system. At the same time it installed colour light signalling. The Southern Railway electrified the Brighton Main Line services to Brighton and the South Coast in 1932/3, so that by 1936 90% of trains at the station were electric.

British Railways, which took over responsibility for the station in 1948, continued the electrification of the lines from London Bridge during the 1950s and 1960s. Between 1972 and 1978, British Rail undertook a major redevelopment of the station and its approaches. This included a £21 million re-signalling scheme, and a new station concourse. This was opened 14 December 1978. New awnings were added over the former S.E.R. platforms, but the arched Brighton roof was retained. It has been described as "one of the best modern station reconstructions in Britain."

The through platforms, 1-6, are on the north side of the station. Platforms 1-3 are served by trains starting and ending at Cannon Street. Services to and from Charing Cross use platforms 4-6 and a passing loop to the south of Platform 6. Platforms 5 & 6 are also served by Thameslink's Bedford to Brighton services via Luton, St Albans, St Pancras International, Farringdon, City Thameslink, Blackfriars and Gatwick Airport. Platform 6 is the busiest railway platform in Europe, due to the necessity of routing all trains heading to Charing Cross and Blackfriars through it.

Platforms 1-6 were extended to accommodate 12 car trains in the early 1990s, when slam-door suburban rolling stock was being replaced. The track realignment necessary to achieve the platform extensions encroached on the track approaching platform 7, a terminal platform. The platform, which used to be the opposite face of an island with platform 8, was taken out of use and the track-bed filled in.

The terminal platforms, 8-13, are on the south side of the station and are mostly served by Southern services to south London and the south coast. Platforms 14-16 are currently closed as part of the rebuilding work.

London Bridge station is undergoing a major transformation as part of a wider project known as Masterplan to accommodate longer 12-car Thameslink programme trains and provide many other benefits. Three terminus platforms are being closed and three new through-platforms created to allow additional services to continue either to Cannon Street or Charing Cross, or to Blackfriars and onwards via the Thameslink route. Work started in 2013 and is expected to be completed in 2018.

The TS 2015 version of the station represents its appearance immediately before reconstruction commenced in 2013.

1.1.2 Victoria Station

The London and Brighton Railway terminus at London Bridge provided reasonable access to the City of London but was most inconvenient for travellers to and from Westminster. The transfer of the Crystal Palace from Hyde Park to Sydenham Hill between 1851 and 1854 created a major tourist attraction in the then rural area south of London, and the LB&SCR opened a branch line from the Brighton main line at Sydenham to the site in 1854. While this was under construction the West End of London and Crystal Palace Railway also planned a line from Crystal Palace, to a new station at Battersea Wharf, at the southern end of the new Chelsea Bridge. (Despite its location, the new station was called Pimlico; it opened on 27 March 1858.) Shortly afterwards the LB&SCR leased most of the lines of the new railway, and built a further connection from Crystal Palace to the Brighton main line at Norwood

Junction, thereby providing itself with a route into west London, although it was recognised that a terminus would be needed on the north side of the River Thames.

From 1899 the LC&DR entered a working union with its rival, the South Eastern, to form the South Eastern and Chatham Railway (SECR). As a result services from its station at Victoria began to be rationalised and integrated with those from the other SECR termini.

The two stations at Victoria came largely under single ownership in 1923 with the formation of the Southern Railway (SR). The following year steps were taken to integrate the two stations. The platforms were renumbered in a single sequence, openings were made in the wall separating them to allow passengers to pass from one to the other without going into the street, and alterations were made to the tracks to allow for interchangeable working. The SR also concentrated Continental steamer traffic at Victoria, introducing the most famous of those trains, the Golden Arrow, in 1926, and the Night Ferry in 1936.

The greatest change to the station during the 1920s and 1930s was the introduction of third rail electrification for all suburban and many main line services, replacing the original LB&SCR overhead scheme by 1929 and largely replacing steam traction, except on Chatham Section mainline and Oxted line trains. Services to Orpington were electrified in 1925 and Epsom the following year. By 1932 the Brighton main line was electrified, quickly followed by those to other Sussex coastal towns and Portsmouth by 1938.

British Railways took over the station on 1 January 1948. During the 1950s and early 1960s British Railways completed its Kent Coast Electrification schemes, which meant that most of the remaining services from the station were electrified, including boat trains. Some minor services were withdrawn, and the few remaining steam services, to Oxted and beyond, were replaced by diesel-electric multiple units.

The other major change to the station under British Railways was the gradual development of services to the new Gatwick Airport railway station after its opening in June 1958. In 1984 the non-stop Gatwick Express service was started, aiming for a 30-minute journey time. This was coupled with the provision of an airport lounge and check-in facilities at first-floor level, with dedicated escalators down to the Gatwick Express platforms. British Airways and other major airlines had their own check-in desks there.

The eastern (Chatham) side, comprising platforms 1–8, is the terminus for Southeastern services to Kent on the Chatham Main Line and its branches. The central (Brighton) side, comprising platforms 9–19, is the terminus for Southern and Gatwick Express services to Surrey and Sussex, including Gatwick Airport and Brighton on the Brighton Main Line and the East Grinstead branch on the Oxted Line.

1.1.3 Line Features

Southern: Brighton Main Line: South Croydon to London Victoria
Southern: Brighton Main Line: South Croydon to London Bridge
Southern: West Croydon to London Bridge
Southern: West Croydon to London Bridge Via Tulse Hill (and Peckham Rye)
Southern: Inner South London Line: London Victoria to London Bridge (via Peckham Rye)
Southern: Outer South London Line: London Victoria to London Bridge (Via Crystal Palace)

LOROL: East London Line: Surrey Quays to West Croydon
LOROL: East London Line: Surrey Quays to New Cross
LOROL: East London Line: Surrey Quays to Clapham Junction (replaced inner south london line)

Southeastern: London Victoria to Kent House (Chatham Mainline)
Southeastern: London Victoria to Crofton Park (Catford Loop)

2 Class 456 Electric Multiple Unit

2.1 Class 456

The Class 456 was introduced on the Southern Region in 1991 to replace ageing Class 416 2EPB Units. They were rolled out in Network South East livery, which they would wear until their refurbishment for Southern in 2006. The one exception was unit number 456024 which was painted in Connex's white and yellow livery prior to the franchise being won by Southern.

Upon introduction the Class 456 suffered many technical and reliability issues, resulting in a delay in retirement of the Class 416 2EPB units. These were ironed out however, and the Class 456 went on to work numerous services under Southern.

More recently, the Class 456 units have ended their service with Southern, their services being replaced by Class 455 and 5-car Class 377 units. They are now in use with South West Trains, with half being used for driver training, and the other half undergoing refurbishment where they will be painted in SWT Metro livery and receive a refreshed interior.

2.2 Design & Specification

TOPS Number	Class 456
Formation	2-car: DMSO + DTSOL
Unit Weight	72.5 tonnes
Vehicle Length	66ft 11in (20.4m)
Vehicle Width	9ft 2in (2.8m)
Body Construction	Aluminium body with steel ends
Power Collection	750v DC 3rd Rail
Vehicle Power	500HP (373kW)
Design Speed	75MPH (121km/h)
Coupling Type	Buckeye
Brake Types	Air
Seating	152 Standard

Class 456 DMSO Southern

Class 456 DTSOL Southern

3 Creating a Class 456 train set

3.1 Scenario Editor (if creating new scenarios)

To get the Class 456 ready for selection in a scenario that is not located on the South London Network, you will need to enable it in the object set filters, which will add it to the rolling stock browser list.

Follow these steps:

1. Enter the Scenario Editor. (Note: If a route is locked it will need to be unlocked first before you can enter the Scenario Editor. Unlock by clicking the padlock icon in the bottom right of the screen).
2. Click the Object Set Filter button (the small blue cube on the middle left panel).
3. In the new window which opens on the right hand side, select the following:
   RSC/SouthLondonLines
4. The Class 456 vehicles will now appear in the list of rolling stock.
5. You may need to repeat this process on other routes or scenarios where you wish the Class 456 to be available.

3.2 Assigning Destinations and Numbers

For developers wishing to make use of the units in their own scenarios and routes, it is possible to customise the Destination Display during creation of a scenario. This allows the train to correctly display an appropriate destination.

In order to display a specific destination, the correct value must be entered into the vehicle properties window. This number consists of a 12 digit value containing both a letter and numbers.

The 12 digit value is arranged like so: **dVVVVVUUUUUU**

d = the Destination code (See the Destination List below)
VVVVV = the Vehicle number displayed on the side of the coach
UUUUUU = the Unit number displayed on the front of the driving vehicle

Example: d78580456101 *(where "d" is for Clapham Junction)*

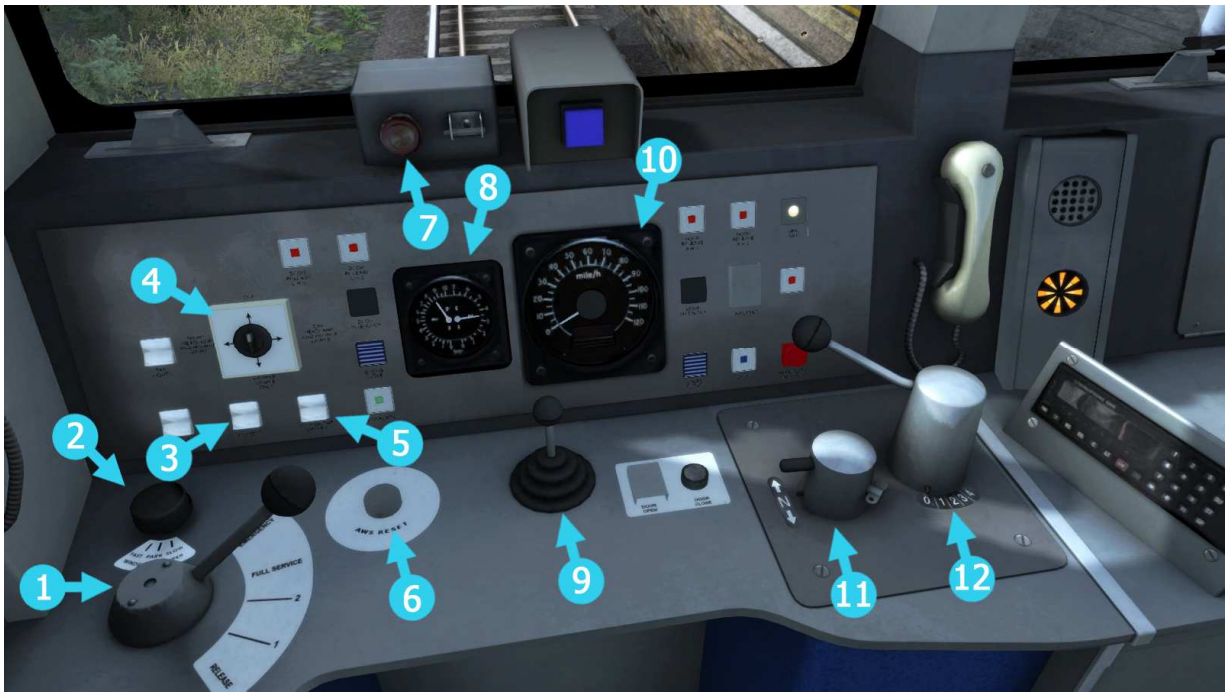
So the above value results in unit 456101, with vehicle number 78580, displaying "Clapham Junction" as the destination

3.2.1 Destination List

a	Battersea Park	**j**	London Victoria	**s**	Tattenham Corner
b	Beckenham Junction	**k**	London Bridge	**t**	West Croydon
c	Caterham	**l**	Purley	**u**	Wimbledon
d	Clapham Junction	**m**	Redhill	**v**	Depot
e	Dorking	**n**	Reigate	**w**	Special
f	Epsom	**o**	South Bermondsey	**x**	Not in Use
g	Epsom Downs	**p**	South Croydon	**y**	East Croydon
h	Horsham	**q**	Streatham Hill	**z**	Crystal Palace
i	Kensington Olympia	**r**	Sutton		

4 Driving the Class 456

4.1 Cab Controls



Main console			
1	Train Brake	7	Drivers Reminder Appliance
2	Wipers	8	Brake Pressure Gauge
3	Cab lights	9	Horn
4	Headlights	10	Speedometer
5	Instrument lights	11	Reverser
6	AWS reset		

5 Class 375 'Electrostar' Electric Multiple Unit

5.1 Class 375

The Class 375 third-rail DC 4 car electric multiple units began service during 2002. Built by Bombardier in Derby, England, they are a member of the 'Electrostar' train family, the most numerous EMU built in post-privatisation Britain. Due to their high power consumption major upgrades were carried out to the 750V DC third-rail power system used on the Southern region. The trains are used extensively on services in south London and on rural commuter services throughout Sussex and Kent where they replaced the aging 4CIG and 4VEP slam-door stock. The Class 375 trains feature external CCTV, a disabled seating area, and toilets in both intermediate coaches. Dual voltage units are fitted with a high speed pantograph to allow operation under 25kV lines as well as the native third rail shoes.

5.2 Design & Specification

TOPS Number	Class 375
Formation	4-car: DMOC+MSOL+PTSOL+DMOC
Unit Weight	173.6 tonnes (35-48 tonnes per vehicle)
Vehicle Length	66ft 11in (20.4m)
Vehicle Width	9ft 2in (2.8m)
Body Construction	Aluminium body with steel ends
Power Collection	750v DC 3rd Rail
Vehicle Power	2,000HP (1,500kW)
Design Speed	100 MPH (161km/h)
Coupling Type	Dellner
Brake Types	Air
Seating	242 Standard

5.3 Class 375 Consist Formations

Class	Consist	Number Range
375/3	DMOC - TOSL - DMOC	375301 - 375310
375/6	DMOC - MOSL - PTOSL (Low) - DMOC	375601 - 375630
375/7	DMOC - TOSL – MOSL - DMOC	375701 - 375715
375/8	DMOC - TOSL - MOSL – DMOC	375801 - 375830
375/9	DMOC - TOSL - MOSL – DMOC	375801 - 375827

The pantograph well should be at the centre of the formation.

3 and 4 car formations are often used on local and branch stopping services.
7, 8, 9 and 10 car formations are used on off-peak fast services.
8 and 12 car formations are commonly seen on peak time fast and express service.

Class 375 DMOC Southeastern

Class 375 PTOSL Southeastern

Class 375 MOSL Southeastern

5.3.1 Destination List

a	London Victoria	**j**	Faversham	**s**	Rochester
b	London Victoria	**k**	Folkstone Central	**t**	Sevenoaks
c	Cannon Street	**l**	Gillingham	**u**	Sheerness on Sea
d	Charing Cross	**m**	Hastings	**v**	Sittingbourne
e	Ashford International	**n**	London Bridge	**w**	Strood
f	Canterbury East	**o**	Margate	**x**	Tonbridge
g	Canterbury West	**p**	Orpington	**y**	Ramsgate/Dover P
h	Dartford	**q**	Paddock Wood	**z**	Not in Service
i	Dover Priory	**r**	Ramsgate		

6 Driving the Class 375

6.1 Cab Controls

Main console		8	Cruise Control	16	Guard communication
1	Master key	9	AWS flower	17	Notice board light
2	Reverser	10	AWS Reset	Side panel	
3	Combined throttle and brake	11	Windscreen wipers	18	3rd Rail Shoe controls
4	Emergency brake	12	Horn	19	Pantograph controls
5	Brake pressure gauges	13	Depot whistle	20	Headlights
6	Speedometer	14	Sander	21	Taillights
7	Cruise control speed	15	Cab light	22	Blinds

6.2 Additional Controls

The following additional keys can be used with the Class 375 units.

Keystroke	Feature
Shift + D	Brake Hold. This can also be activated by pressing the button on the end of the brake/throttle control (3)
Shift + P	Raise the 3rd rail shoes. Also activated by pressing the blue button on the upper left panel (18)
Ctrl + P	Lower the 3rd rail shoes. Also activated by pressing the yellow button on the upper left panel (18)
L	Cab Light
B	Depot Whistle
C	Guard communication (16)
Shift + Numpad Enter	Toggle the Driver Vigilance Device. This is an audio only device so has no visual prompt. By default this feature is turned off.
Numpad Enter	Acknowledge a Driver Vigilance alert

7 Scenarios

7.1 [456] 1. Inner Southern Service

Drive a Class 456 on an Inner South London service from Victoria to London Bridge.

- Date 10th July 2012
- Duration 30 Minutes

7.2 [456] 2. Winter Commuter

Drive a Class 456 on a winter commuter service to West Croydon.

- Date 17th September 2013
- Duration 45 Minutes

7.3 [456] 3. Outer Southern Service

You will be running an Outer South London Line service from London Bridge to London Victoria, calling at all stations en route. The timetable is tight, so keep to line speed.

- Date 7th August 2012
- Duration 50 Minutes

7.4 [456] 4. Croydon Rush

An early morning service running between West Croydon and London Victoria.

- Date 20th August 2012
- Duration 40 Minutes

7.5 [456] 5. Stopper to the Bridge

Drive the first train of the day to London Bridge, calling at all stations.

- Date 19th August 2012
- Duration 40 Minutes

7.6 [375] 6. Delayed Southeastern

Drive a 4-car Class 375 on a stopping service to London Victoria.

- Date 10th December 2012
- Duration 35 Minute

7.7 [375] 7. Hastings Diversions

Drive a Class 375 to London Bridge on a diversion via East Croydon.

- Date 21st September 2012
- Duration 25 Minutes

7.8 [375] 8. Winter Troubles

Snowy weather disrupts a service from Gillingham to London Victoria.

- Date 13th January 2012
- Duration 30 Minutes

8 Signals

8.1 Main Signal Head Aspects

Colour light signals are used for controlling running movements. They display aspects by means of red, yellow and green coloured lights.

Signal Aspect	Description	Instruction to Driver
Red light	Danger	Stop.
Single yellow light	Caution	Proceed: be prepared to stop at the next signal.
Double yellow lights	Preliminary caution	Proceed: be prepared to find the next signal displaying one yellow light.
One flashing yellow light	Preliminary caution for a diverging route	Proceed: Be prepared to find the next signal displaying one yellow light with feather junction indicator for diverging route(s).
Double flashing yellow lights	Indication of diverging route ahead of the next but one signal	Proceed: Be prepared to find the next signal displaying one flashing yellow light.
Green light	Clear	Proceed: The next signal is displaying a proceed aspect.

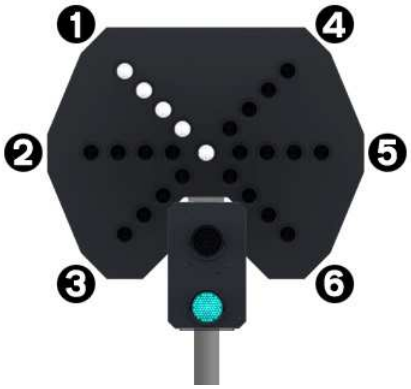
8.2 Theatre Type Signals

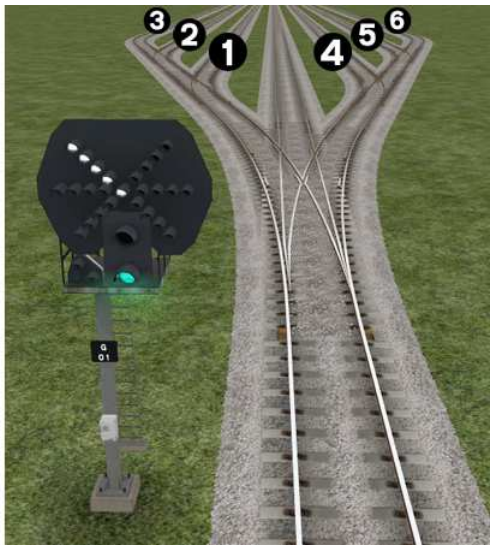
A Theatre alphanumeric route indicator indicates the route to be taken using numbers or letters (or a combination of numbers and letters).

A Theatre indicator is often used to show the arrival platform number.

8.3 Feather Type Signals

A Feather junction indicator indicates a diverging route to be taken by the angle at which a line of five white lights is displayed. *(Position 1 shown)*





Feather Indication	Instruction to Driver
No Feather Indication	Obey main aspect, straight-ahead route is set
Position 1 indication	Obey main aspect, expect divergence to left
Position 2 indication	Obey main aspect, expect divergence to left more extreme than that for position 1
Position 3 indication	Obey main aspect, expect divergence to left more extreme than that for position 2
Position 4 indication	Obey main aspect, expect divergence to right
Position 5 indication	Obey main aspect, expect divergence to right more extreme than that for position 4
Position 6 indication	Obey main aspect, expect divergence to right more extreme than that for position 5

8.4 Ground Signals and Position Light Signals

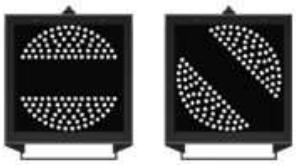
Ground Signals and Position Light Signals (PLS) display their aspects by means of the position and colour of lights. Ground Signals are always illuminated and can have miniature theatre indicators attached whereas PLS only illuminate to allow a train to pass in to an occupied section of line and are mounted as an addition to a main signal head.

Signal Aspect	Description	Instruction to Driver
Two red lights	Danger	Stop.
No aspect (located on a main aspect)		Obey main aspect.
Two white lights	Caution	The line ahead may be occupied. Proceed cautiously towards the next stop signal, stop board or buffer stops. Be prepared to stop short of any obstruction. The associated main aspect (where provided) may be passed at danger

8.5 Entering an Occupied Section of Track

During a scenario your train may be scheduled to enter a platform or section of track that is already occupied by another train or rolling stock. In this situation you should stop at the red signal protecting this section of track as normal. Once your train has stopped press the TAB key on your keyboard to request permission from the signalling centre to enter the occupied section of track. When your train movement is approved the signal will illuminate the two white lights on the position light signal if it has one.

8.6 Repeater Signals



A banner repeater signal indicates whether the signal ahead is displaying a proceed aspect or is at danger. Modern fibre optic banner repeating signals, as shown opposite, consist of a rectangular unlit black background displaying a white circle with a black bar.

Signal Display	Instruction to Driver
Horizontal arm	Be prepared to find the related signal at danger
Arm at an upper quadrant angle of 45°	Related signal is exhibiting a proceed aspect

Repeater signals are intended to provide a driver with advance information of a signal that may be obscured on approach. A train does not need to stop at a repeater signal, only at the related signal if it is at danger.

Splitting banner signals provide two banner signal heads combined to form a splitting banner repeating signal. These are used to indicate the aspect of a signal with a feather junction indicator. If the related junction signal is displaying an illuminated feather then the lower banner head displays an arm at an upper quadrant angle of 45°. Alternatively, if the related junction signal is not displaying an illuminated feather and is indicating a straight ahead route then the higher "main" banner head displays an arm at an upper quadrant angle of 45°.

9 Speed Signs

9.1 Permissible Speed Indicators

These signs display the permissible speed in M.P.H. applicable to the section of line beyond the sign up to the commencement of any subsequent permissible speed section.

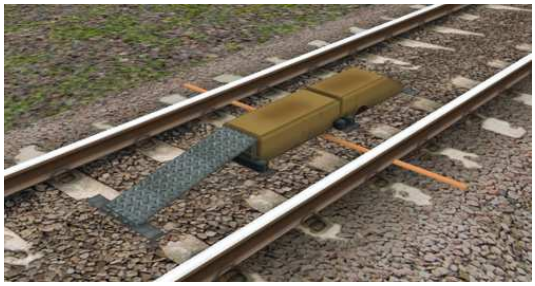
Remember to wait for the complete length of your train to pass these signs before accelerating if the permissible line speed is increasing. If the permissible line speed is decreasing then you must reduce your speed before passing these signs.

9.2 Permissible Speed Warning Indicators

These signs provide advance warning of a reduction in permissible speed ahead. Permanent AWS Ramps (Automatic Warning System) are often installed in conjunction with these signs. In these cases the driver must cancel the AWS warning when triggered on approach to these signs.

10 Safety Systems

10.1 AWS (Automatic Warning System)



AWS is provided to give train drivers in-cab warnings of the approach to signals, reductions in permissible speed and temporary/emergency speed restrictions, and to apply the brakes in the event that a driver does not acknowledge cautionary warnings given by the system.

As a train approaches a signal, it passes over AWS track equipment (magnets) which are fixed to the sleepers between the running rails. The magnets are sensed by a receiver mounted under the leading end of the train.

If the signal ahead is displaying a clear aspect (green), a bell (or an electronic ping) sounds in the driver's cab, and the AWS Sunflower indicator displays "all black". No action in respect of the AWS is required of the driver.

If the signal is displaying a caution or danger aspect (yellow, double yellow or red), a horn sounds in the driver's cab and the display shows "all black". The driver has to acknowledge the warning by pressing the "AWS Acknowledgement" push button. When the driver operates the push button, the horn is silenced and the AWS Sunflower changes to a segmented yellow and black circular display. If the driver fails to acknowledge the warning horn within a set time period, the brakes are applied automatically.

Where AWS equipment is provided on the approach to reductions in permissible speed and temporary/emergency speed restrictions, the cab equipment always operates in a manner equivalent to the approach to a signal displaying a caution or stop aspect. The driver receives a warning and has to respond to it accordingly; otherwise the brakes are applied automatically.

11 Credits

As usual with all projects there is a long list of people to thank. So in no particular order here are the stars of the show.

Jeff Douglas	Colin Ross
Danny Leach	Kevin McGowan
Adam Rose	Ben Jervis
Richard Mills	Edwin Thurston
Adegbenga Adeleye	Tom Walters
Jordan Searle	QA Department
Derek Siddle	Beta Testers

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