

railway.exe



User manual

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1 Introduction:

Welcome to railway.exe, a program that allows you design, build and operate your own railway.

The main features include the ability to:

- build a railway of any size;
- add text of any available colour, font and size;
- set preferred and bi-directional running directions;
- choose light or dark backgrounds;
- develop timetables with shuttle services, changes in direction, splits, joins, and repeating services;
- operate trains; and
- zoom-out for a wider display

The minimum screen resolution should be 1024 x 768. It will adapt to higher resolutions but sidebars will be needed for lower resolutions - likely to be inconvenient and to hide important information.

A wide selection of track element types is available for building the railway, together with station elements consisting of platforms, concourses and footbridges. Also available are non-station named location elements for sidings, works, depots, junction approaches and anything else that needs a name. Location names are displayed on the railway in user-selectable font, style, size and colour. In addition to named locations any other text may be added to the railway, again in any font, style, size and colour. Location names and other text may be moved in order to improve the appearance of the railway and areas of track may be selected and cut, copied, pasted, deleted, mirrored and flipped etc.

Railway files may be saved and loaded in both development form during construction and in operational form on completion. Track element lengths and line speed limits may be set individually, along tracks, or in areas by selection, as can preferred running directions.

Trains may operate to a timetable developed using the internal timetable editor, or under signaller control. Three types of route are available:-

Automatic signal routes: set signal to signal in preferred directions, the route is retained after trains pass and signals automatically return to green (in stages for other than two-aspect signals) as blocks ahead are cleared;

Preferred direction routes: set signal to signal in preferred directions, the route is cleared as trains pass; and

Unrestricted routes: set from most types of track element to other track elements in any direction, again the route is cleared as trains pass.

In addition trains will run on track that has no route set, but they are then much more vulnerable to derailments and crashes.

Signalling can be two, three or four-aspect, and ground signals are also available.

2 General features:

2.1 Backgrounds:

White, black or dark blue backgrounds may be selected when there is no railway present. Track displays black on a white background or white on a dark background. All other colours display the same on either type of background, so try not to select too dark a text colour for dark backgrounds or too light a text colour for a white background. When black or white is selected as a text font colour the stored colour is always black, and it always displays white on a dark background and black on a white background. This means that it is not possible to display black text on a dark background, or white text on a white background, which wouldn't be very useful in any case! Any saved railway or session may be displayed on any background provided the background is selected before the railway or session is loaded. When the program is opened it will use the same background that was in use when it was last closed. This allows a preference to be selected and retained without having to keep changing it via the menu.

2.2 Train characteristics and floating window display:

Train power, mass, maximum running speed and brake force are all set during timetable compilation, and instantaneous values of speed etc are displayable by a floating window enabled by menu selection and made visible by hovering the mouse over a train. The floating window can also provide details of the train's timetable from the current point onwards, and track element information if required.

2.3 Files:

There are two types of railway file. Development files, used during building and modifying a railway, have the extension '.dev'. Railways that are ready for operation have the extension '.rly'.

Timetable files (extension '.ttb') may be saved during development and when finished, and during operation the current state of the railway (a 'session' - extension '.ssn') may be saved at any time and reloaded at a later time.

During operation a performance log of all activities is compiled. This may be viewed on-screen or hidden, and is saved after operation along with a performance summary in a permanent text file (extension '.txt').

Railway image files (extension '.bmp' - bitmap files) may be saved at any time, consisting of track and text, with or without an element grid (useful for planning purposes during construction); with preferred directions; and during operation. Image files always display with black track on a white background, regardless of the track colour and background in use.

It is suggested that unwanted performance logs, sessions and images be deleted periodically as they can take up a considerable amount of space. This particularly applies to image files. If particular images are to be saved then it is best to convert them to '.jpg' files rather '.bmp' files, using a suitable image processing program, since '.jpg' files take

up much less room. If particular sessions, performance logs or images are to be saved, then it is probably best to rename them to something more meaningful so that they are easy to distinguish from other similar files - but be sure to retain the same extension (i.e. '.ssn', '.bmp' etc).

All files apart from images - i.e. railways, timetables, performance logs and sessions, as well as an error log if a fatal error is encountered during program use, are all text files, and are readable using a word processor or text editor, though it is recommended that any file that is used by the program shouldn't be altered outside the program or it may not work correctly afterwards.

2.4 Information:

An 'information' panel is normally displayed during use, indicated by a blue 'I' symbol. This shows in brief what options are available at a particular stage. Additionally, hovering the mouse over any button gives information about its function.

The name of the railway that is currently loaded is displayed in the title bar at the top of the screen, together with the name of the timetable if loaded. If no railway is loaded or a railway is under development but has not yet been saved the title bar displays 'New railway under development'.

A floating window enabled by menu selection and made visible by hovering the mouse over a train or track element is available and provides train or track information.

2.5 Zoom-out display:













A 'zoom' button allows the display to change between detailed and wide view, the wide view displaying at 1/4 scale so that the equivalent of 16 detailed screens may be displayed on a single wide view. The viewpoint may be changed for each type of view so there is no limit to the size of railway that may be created. Note that the wide view only displays track and locations, no location names or text is displayed.







2.6 Program modes:

A number of different modes are available from the 'Mode' menu. These include 'Build/modify railway', 'Set preferred directions', 'Create a timetable' etc. When any of these modes has been selected it will be seen that the 'File' and 'Mode' menus are greyed out and therefore unavailable. In order to change modes or to carry out any operations from the 'File' menu the current mode must first be exited by clicking the red cross. This will make the other menu items available again.

3 Building a new railway or modifying an existing railway:


Select menu item 'Mode' then 'Build/modify railway', and the build/modify toolbar will appear. Only those tools that are available at any particular stage are enabled, the others are greyed-out. The tools are as follows:-

-  Add or remove track elements
-  Connect gaps
-  Link all track together
-  Add or change text
-  Move text
-  Set or change location names
-  Change text or location name font
-  Change text grid alignment
-  Check and set track element lengths and speed limits
-  Toggle screen grid
-  Save railway
-  Exit build mode







At the start with no railway loaded the available tools are  add track elements,  add or change text,  change font,  change text grid alignment,  screen grid, and  exit build mode.




To assist in designing and building railways an option is provided to save railway image files. Select the 'Images' menu item, then 'Save basic railway image' or 'Save railway image + grid'. These generate bitmap images in the 'Images' folder, which resides in the folder where the program itself - 'railway.exe' - resides. These images may be manipulated and printed out using any image processing program, or inserted into a word processor. They can help considerably in finding the optimum track layout during design.

3.1 Adding and deleting track and other railway elements

Click  to add elements, and the railway element panel will appear, containing a wide range of elements, each on its own button, for building a railway.

Selection is by clicking the chosen element, then left clicking the railway area below to place it. It is often helpful to display the screen grid during building to indicate element locations. As many of the same element as required may be placed by repeatedly left clicking the mouse in the railway area, and other elements may be selected and placed similarly. To remove an element just right click it. To navigate off the visible screen

click the relevant 'move viewpoint' buttons    and , or press the arrow keys on the keyboard, or keys 'w' (up), 's' (down), 'a' (left) or 'd' (right) – these are included for use by the left hand if preferred. Holding down the Control (Ctrl) key when navigating moves the screen by a small amount, and holding down the Shift key moves it by a large amount. Think of the railway area as infinitely large, with a window 60 elements wide by 36 elements high visible at any time (60 x 36 elements is for a screen resolution of 1024 x 768, other resolutions contain different numbers of elements). Other views are available depending on the extent of the railway. The 'Home' button (or 'home' key on the keyboard) brings the display back to the original screen, or 'New home' sets a new 'home' position. The zoom-out button  displays the railway at a quarter scale, and in this mode there are 'Home' and 'New home' buttons as before but these operate independently of zoomed-in mode. When zoomed-out, the zoom button changes to zoom-in , which brings the view back as it was. To display a particular area of a large railway quickly, zoom-out, then click the area of screen required. This displays the clicked and surrounding area in zoomed-in mode.

During build the  'unlinked track' icon is displayed on the left. All the track must be properly linked before preferred directions or track lengths and speeds can be set and the railway saved for operation. Track is linked using the  'link track' button, but note that if there are unconnected gaps these must be connected first. Any faults in the layout are indicated by appropriate messages when the 'link track' button is left clicked. When correctly linked the  icon appears.

All track elements, when placed, are allocated an identification code, referred to as the element ID, for example '15-27', based on the position of the element on the screen. In this example the element would be at horizontal position 15 working left to right (first horizontal position being 0) and vertical position 27 working from top to bottom (first vertical position being 0). After the first element has been placed all subsequent elements are placed relative to it. Elements that take negative values (i.e. above the top position of the screen on which the first element was placed or to the left of the leftmost position of the screen on which the first element was placed) are preceded by 'N', so an ID of 'N12-N06' would represent an element 12 places to the left of the first screen and 6 places above the top of the first screen. Element IDs are used in timetables, performance logs and warnings etc.

Note that if track is changed after preferred directions have been set, elements that have been changed will have the preferred directions erased. In these circumstances it is necessary to go back to the 'set preferred directions' mode to check and reset the necessary directions.





3.1.1 Track element types

Straights, curves, buffers, bridges, points and crossovers

Hopefully these are all fairly self-evident. However points and crossovers can't be placed next to buffers as there must be room for a train (2 elements long) without fouling any of

these elements. Note also that some straight elements have directional arrows. These are purely for visual clarity, they don't need to relate to preferred directions (though clearly they should to avoid confusion), preferred directions are set separately.

Signals

Signals can be two, three or four-aspect, or ground position lights. The signal type button  4 represents four-aspect, and clicking the button changes it to three-aspect , then two-aspect , then ground position light , then back to four-aspect. Signals of the appropriate type are placed on the railway whenever the corresponding signal buttons are selected. Note that two, three and four-aspect signals all appear the same when placed, but the type is indicated in the floating window when track information is selected.

Signals are always positioned on the left of the track relative to the direction of travel. Trains recognise and act on signals to their left but ignore signals to their right. Try to avoid placing signals immediately before a bridge, because then it won't be possible to truncate the route to that signal (see 'route setting and cancelling'). This is because a bridge is potentially ambiguous as it may have two routes set on it.

Note that signals can't be placed next to buffers as there must be room for a train (2 elements long) in the siding without straddling a signal. Also two same-direction signals can't be placed next to each other as there must be room for a train between them.

Level crossings

Level crossings work as follows:- All crossings are closed to trains initially (i.e. barriers raised), and are opened by creating a route (preferred direction or unrestricted, automatic signal routes aren't permitted) through them. The barriers begin to lower as soon as the route is in place, the lowering indicated by the 'barriers down' graphic flashing. While it is flashing other routes can be created elsewhere in the railway but no other route can be created across the level crossing until the barriers are fully down. They stay down while there is a route in place, and start to rise as soon as all routes have been cleared - in this case the 'barriers up' graphic flashes. The barriers take 30 seconds to lower and 10 seconds to rise. The first signal behind and facing the barrier stays red until the barrier is fully down.

The graphics display differently for barriers up and down, with barriers shown across the road for down and across the railway for up. Although modern barrier crossings don't really lie across the railway I think it makes it clearer that the way is blocked for trains if barriers are shown in this way. Crossings can be placed across any number of directly parallel tracks, but can only be placed on plain horizontal or vertical track elements. Note that level crossings cannot be placed adjacent to each other on the same track.


Up to three minutes is allowed for a barrier to remain down before penalty times start clocking up, so it doesn't pay to set routes too far in advance of trains. If a barrier is lowered and then raised (by cancelling the route) before any trains have passed, then the three minutes allowance isn't given, penalty times begin clocking up right away. Level

crossings are treated as being closed to trains in all states other than with barriers fully down, and if a train runs into one when the barriers are not down then there is a crash (it's assumed to have hit a road vehicle) and the train has to be removed by the signaller.


Parapets




These are visual elements only, to improve the appearance of the railway by indicating bridge and tunnel parapets, they don't play any part in operation.

Continuations



Elements that represent the limit of the railway, where track extends outside the program's control area are referred to as 'Continuations' . The dotted section represents the outside edge. Trains enter and leave the railway at these elements.

Gaps

Gaps  represent elements that connect to other elements that are not immediately adjacent. There must always be an even number of gaps which are arranged in paired connections. When part of a train moves off one gap it appears immediately on the connected gap. Gaps allow continuous sections of railway to be separated visually, for example to display a long section of track on a single screen. They are also useful for long bridges or tunnels, to avoid having several single-element bridges adjacent to each other. Right clicking the mouse on a gap that has been set shows the two connected gaps - flashing red for the clicked gap, and flashing green for the connected gap. The zoom-out and move screen viewpoint buttons may be used if the gaps are on different screens to each other. Left or right clicking the mouse at a blank area of screen stops the gaps flashing.


When first placed, the oval area of the gap is hollow, to indicate that it isn't yet connected to another gap. When unconnected gaps are present in a railway under construction the  icon is displayed at the left side of the screen, and the  'connect gaps' button is enabled, which is used to connect gaps to each other in turn. During connection the program highlights a gap with a small red circle, at which point the corresponding gap should be left-clicked, this is then highlighted briefly with a green circle before the next gap to be connected is highlighted in red. The screen may be zoomed-out and navigated freely during gap setting, because connected gaps may not always lie on the same screen (though it's clearer if they are). When all gaps have been connected the  icon is displayed.


3.2 Adding, deleting and moving text



Text may be added to the railway by left clicking the  'add or change text' button. When this is selected left click the position on screen where the text is to be added, and a text box will appear. Replace the information text that is already present with that required and press 'enter'. The text will remain where placed in the font that has been selected. To change the font left click the  'change font' button and enter the font, style, colour and size that is required.

To delete text, first select 'add or change text' if not already selected, then just right click the first character, and it will be erased. To change existing text, left click the first character with 'add or change text' selected and a text box will appear with the existing text in it ready for modification.

IMPORTANT: Do not change the names of named locations (see later) by this method, otherwise the displayed name will be changed but the location name within the program will not change and the result will cause confusion.

If the font of existing text is to be changed without changing anything else then select 'add or change text' if not already selected, left click the first character to bring up the edit box with the original text, then change the font using the  button with the edit box still present. Then press 'enter' without changing anything else, and the text will be changed to the new font. Note that this is slightly different to changing the fonts of named

locations. For them the font may be changed first, then the location selected with the  button, 'enter' pressed, and the font will change. The difference is because it is sometimes required to change several location name fonts at the same time, and it would be tedious to keep having to change it for each separately. This is not usually the case however for separate pieces of text.

When placed, text may be moved by left clicking the  'move text' button. When that has been selected, left click and hold the mouse over the first character of the text and drag it to its new location. The  'change text grid alignment' button may be used to set the required precision. When the smallest bar shows green then text will move at the finest precision - one pixel at a time. Each time the button is clicked the bar showing green will move to the right, successively for 2, 4, 8 and 16 pixel precision, then back to 1 pixel precision. Lower precision values (higher numbers) are useful for aligning separate pieces of text with each other.

Try to avoid placing text too close to track, as it may be partly erased by moving trains. Arial 7pt is clear and is small enough to fit between two tracks, only the bottom of the descenders are erased by trains but this doesn't degrade the appearance too much. Also avoid placing text too close to other text or location names, as one may overlap and obscure the other.

If railways are to be shared with other users or used on other computers, ensure that the fonts used for text and named locations are standard Microsoft Windows types, or the Windows operating system will default to the nearest font which might spoil the appearance.

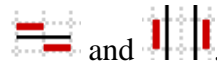


Positions where trains enter the railway should be protected by entry signals that hold trains at the entry position if they cannot proceed immediately. This is because following trains will not enter when the entry is blocked by a train, but if the earlier train is held further along then the later train will crash into it.

3.3 Named locations


Two types of named location are provided: stations, and non-station named locations. Station elements consist of platforms, concourses and footbridges. These are indicated by reddish-brown coloured elements, the narrow ones representing platforms that may be placed alongside horizontal or vertical track elements; the full square representing a concourse, positioned where there is no track and used to link platforms together; and footbridges link platforms and concourses across vertical or horizontal track. Footbridges allow station elements to be linked together that would otherwise be too far apart. All station elements that are linked together take the same name. Trains stop at platforms if the timetable includes the station as a stop, and the stop position is central for through platforms (with one extra free element behind than in front for platforms with an odd number of elements), and is at the buffers for terminal platforms. This arrangement allows for other trains to stop both in front of and behind earlier trains when there is room at the platform to do so.




Non-station named locations are shown as blue squares, and are used to name sidings, depots, works, buffers, tunnels, bridges, continuations, junction approaches and anything else that needs a name. They are positioned either on blank elements or on top of relevant track elements. Note that track cannot be placed on top of a non-station named location, the track must be placed first. All non-station named elements that are linked take the same name, but they do not link to stations so they may be positioned adjacent to station elements but have their own name. Trains will stop at all non-station named locations (providing the name is in the timetable) except continuations - continuation names are for identification and logging purposes only - and it is recommended that these be named for these purposes. The stop position is fixed relative to the length of the named location and direction of train travel, but in all cases the train stops with its front adjacent to the front end of the location, to allow as much room as possible behind for other trains.

Named elements link together vertically and horizontally, but not diagonally. This is straightforward for non-station named locations because they consist of full-sized (16 x 16 pixel) elements only. It can be more confusing for stations, because platforms only occupy part of an element. The point to remember is that an element with a platform on it is a station element, so it will link to any other station element in the vertical or horizontal directions. Hence the following two arrangements are horizontally linked

 and , but the next arrangement is not linked because the station elements are diagonal to each other 


Note that platforms may be located where there are signals, thereby effectively embedding the signal in the platform. This is useful when space is tight but is not generally recommended because problems may occur when trains are required to split - see 'splits and joins'.

Names are allocated using the  'name location' button. Any named element may be selected for this purpose except footbridges. Names are case-sensitive and must be unique (King's Cross and KING'S CROSS are different locations as far as the program is

concerned). A warning is given if a second location is given the same name as an earlier one. If it is so named, the earlier name is erased. When a name has been given it appears as text on the display in the font that is currently set. Generally the position of the name will need to be adjusted using the  'move text' button as described earlier. Fonts may be changed using the  'change text font' button, and this font will apply for all future names. If it is wished to change the font of existing names then first change the default font, select one of the named elements using the  button, then just press 'enter' and the name will change to the new font. This may be done repeatedly to change several location name fonts in turn if required. Note that this is a different procedure to changing the font of existing text that doesn't represent a location name. This is explained under 'Adding, deleting and moving text'.



When a location is named and the text positioned on screen, the positioning system works as follows: if there is space, the top of the text is placed slightly higher than the highest named element. If there isn't space above the highest named element then it is placed slightly lower than the lowest. If the named location covers the entire height of the screen or more, so that there is no higher or lower space for the name, then it is placed in the centre of the screen, at the horizontal position of leftmost named element. This has been explained because it is possible to have a block of concourses or other elements in the position that the name text will occupy, and if so the name will not be visible on screen. It is still there however, and it is possible to move it as described earlier if the position of the first character is known or can be guessed. Nevertheless it is much easier if this situation is avoided.

To erase or change the name of a named location select one of the named elements as above, then erase or change the contents of the box and press 'enter'.

IMPORTANT: Do not change the names of named locations by using the 'change text' method described in section 3.2, otherwise the displayed name will change but the location name within the program (the name used by the timetable) will not change and the result will likely cause confusion. If the text on screen is different to the location name then trains will still comply with the timetable regarding the location name, regardless of what text is on screen. Hence it is best not to alter text that corresponds to a location name, other than to reposition it or to change its font. Location name changes should only be carried out using the method described above. If the screen text is lost or altered inadvertently for a location name, the internal location name may be checked by selecting 'Information', 'Track information' and 'Show', and may be recovered on screen by left clicking the  button and selecting the location. Its name will then appear in the box and may be re-entered by pressing 'enter', at which time it will reappear on the screen - as well as the earlier changed name, which may be removed or moved elsewhere if required.

The program will allow text to be added to the railway that is the same as named locations, but this should be avoided if possible. If this is done and a location name is erased or changed, then the wrong text may be affected, because the program doesn't

know which of the two (or more) identical pieces of text should be allocated to the named location.


When a location name element is first placed, it is shown striped, to indicate that it isn't yet named. When named it changes to full colour. In zoom-out mode unnamed locations appear pink for stations, and green for non-station named locations. These help identify locations that still await naming. A railway that contains unnamed locations has the  icon on the left. When all are named this changes to .




When building a railway try to avoid naming locations until the final position of the track is fixed. The reason is that when areas are cut and pasted elsewhere, or are mirrored or flipped, named locations within these areas lose their names. This is because the program doesn't know whether a whole location or just part is included in the selection, so to play safe it assumes part only and erases the names. Also the text may fail to be included within the selection and have to be erased separately to avoid there being two pieces of text corresponding to a single location. It is also best to avoid naming a location until all associated named elements have been placed. Although additional named elements may be added to an existing named location, and they will take the same name, the process can be time-consuming, especially with a large location and a slow computer.

If railways are to be shared with other users or used on other computers, ensure that the fonts used for text and named locations are standard Microsoft Windows types, or the Windows operating system will default to the nearest font which might spoil the appearance.


3.4 Saving and loading railway files

There are two types of railway file. Development files, used during building and modifying a railway, have the extension '.dev'. Railways that are ready for operation (operational railways) have the extension '.rly'. By default all railway files are stored in the 'Railways' folder that resides in the same folder that contains the program itself - 'railway.exe'.

During development, files may be saved (as .dev files) by clicking the  button, new files requiring a new name, but thereafter being saved under the same name unless 'Save railway as' is selected.

When all gaps (if there are any) have been connected, all track linked, and all locations named, the file may be saved as a '.rly' file. This situation is indicated by the corresponding three left screen icons all being green -   . When saved as an operational railway these icons are not displayed.


Operational railways may be modified, but if anything significant is changed then the railway will revert to development status. If it is still operational, it may be resaved under its old name, but this will have to be selected manually, it isn't automatic. Beware though that existing timetables may need corresponding alteration if they are not compatible with the changed railway. If changes are made to preferred directions only

(described later), then these are not regarded as significant changes and the railway may be resaved automatically under its old name by left clicking the  button. Such changes won't affect timetable compatibility but may well affect the ability to set automatic signal and preferred direction routes (explained later).

When a railway is saved the 'Home' position of the detailed (i.e. zoomed-in) display will be saved, but not the 'Home' position of the zoomed out display nor the actual position of the display at the time of saving. To change the 'Home' position select the display required then left click 'New home'. On reloading the railway the first display will be at the 'Home' position.

3.5 Selecting, cutting, copying and pasting etc.


During build, in 'Build/modify' mode, complete areas of the display may be manipulated using the 'Edit' and 'Select' menus, and defining the area by clicking then dragging the left mouse button. The area is defined when the button is released. If a different area is required then just begin again by left clicking the mouse button. When defined, go back to the 'Edit' menu, and a range of options is presented for cutting, copying, deleting, rotating etc. When cutting or copying are selected, left click the mouse anywhere inside the area, then drag it to the new position. It will stay where it is when the button is released, but it may be picked up and moved again if desired. If it is to be moved to another screen then drag it to or beyond the edge, move the viewpoint in the required direction, then pick it up and move it again. When its position is as required go back to the 'Edit' menu and paste the area. Pasting overwrites any track or text that lies in the pasted area. When a selection has been moved then track element lengths or speed limits will revert to their default values (100m and 200km/h), so they may need to be set again. After a selection has been made there is an option to 'Reselect'. This reselects the original area and is useful for example for repeated copying of the same selection.

When text (as opposed to location names) is enclosed within a selection then it will be moved or copied along with the track, but location names won't be moved or copied because new locations (including moved or copied locations) are always unnamed initially. Be aware also that to move or copy text the top left hand corner of the first character of the text must be enclosed in the selection (and this point will be slightly above the first visible character). Hence even though the text may appear to move with the selection it may well be found that on pasting it has been left behind. If this happens then it may easily be repositioned using the  'move text' button.

Note that if the selected area contains a lot of elements then there will be a delay before the next action can be selected. Please avoid clicking the mouse buttons or dragging the area during this time because although nothing appears to happen the actions take place after the delay and may not be what is expected. The information panel gives advice as appropriate. Also, if a selection is 'cut', and another option selected before selecting paste, then the cut section will be pasted back where it is (although the screen display stays the same the elements will have been deleted from the internal database and need to be replaced), but if gaps are enclosed then these become unset and if named locations are enclosed then these become unnamed.

An option is also provided to set track element lengths and/or line speeds. This is in addition to the ability to set these parameters along the track, which is described later. The option to set an area as a whole is useful for example at stations, where blanket speed limits often apply and track element lengths may be made much shorter so that more track detail may be included without extending distances. Note that when using this option each track element length is set individually to the values chosen. When setting lengths along the track, the complete length is chosen and is divided up between the number of elements that are included. Before this option can be used the track must have been successfully linked together - see section 'Adding and deleting track and other railway elements'. Information about track lengths and line speeds is available from the 'Information' menu by selecting 'Track information'. Then, when the mouse hovers over a track element these values may be seen, along with the track identifier (ID), which is used in timetabling.

3.6 Setting track element lengths and speed limits

These may be set by selecting an area as described earlier in 'Selecting, cutting, copying and pasting etc.', or alternatively by selecting along a length of track by left clicking the  'check and set track element lengths and speed limits' button. Before either method can be used the track must have been successfully linked together - see section 'Adding and deleting track and other railway elements'. After the above button has been clicked, left click the track element that represents the start of the length to be set, then left click another element in the direction required towards the final element of the length to be set and on the desired route, and continue in this way until the final element is reached. Sometimes, if there are two or more routes in different directions from the start position to the next selected position, the program may choose the wrong direction. In this case cancel, then select the start position again, then select the element that is next to the start position in the desired direction. This will set the direction correctly and further points can be selected until the desired end point is reached. If there is only one route between the start and end points then the second element may be the end point.

To truncate part of a selected length just right click at the truncate point. To erase a selection truncate to the start point, and to cancel a start selection without making a second selection just click it again.

Note that the selection can't end on leading points, because the program doesn't know which of the two trailing legs to include. At each position the box will indicate the cumulative length of the current selection, and the speed limit. If the speed limits differ along the length then 'Mixed' will show in the speed limit box. When the end point has been reached the required overall length and speed limit may be entered in the boxes provided. If the length is to be changed but not the speed limit then don't alter the speed limit value, and vice versa. Other options include restoring the selection default values - i.e. just reset to the default values (100m and 200km/h) between and including the start and end points selected; restoring ALL default values - i.e. reset all track elements to their default values (a warning message is given if this is selected); and cancel without making any changes.

If just a single element is to have its length or speed limit set, then use the selection method described in 'Selecting, cutting, copying and pasting etc.'.

In this mode a colour code is used to indicate whether or not each element is set to its default values: original colour = both defaults; red = default length but non-default speed limit; green = default speed limit but non-default length; and blue = both have non-default values.

Selecting menu items 'Information', 'Track information', 'Show' will display individual element lengths and speed limits in the floating window when the mouse is hovered over an element.

To check the distance between two points proceed as for setting lengths, note the overall length in the 'Length' box, then click 'cancel'.

The program only works in metric units but conversion facilities are included to change imperial lengths to metric, and speeds in miles per hour to kilometres per hour.





4 Setting preferred directions (PDs)

PDs are the directions that trains travel in during normal operation. Most signals are set along PDs, and special arrangements are generally needed to allow trains to travel in non-PDs. Track elements in this program's railways may have PDs set either way, both ways, or not set.

The method used to set PDs is the same as that used to set lengths and speed limits, but before they can be set the track must have been successfully linked together - see section 'Adding and deleting track and other railway elements'.

Select menu items 'Mode' then 'Set preferred directions'. Note that if another mode has been selected first then that must be exited by clicking the red cross before the 'Mode' menu becomes available again. When in 'Set preferred directions' mode left click the track element that represents the start of the section to have a PD set, then left click another element in the direction required towards the final element of the section to have a PD set and on the desired route, and continue in this way until the final element is reached. Sometimes, if there are two or more routes in different directions from the start position to the next selected position, the program may choose the wrong direction. In this case cancel, then select the start position again, then select the element that is next to the start position in the desired direction. This will set the direction correctly and further points can be selected until the desired end point is reached. If there is only one route between the start and end points then the second element may be the end point. If the end point is a continuation or a buffer, the section is added straight away and a message given to this effect. To truncate part of a selected length just right click at the truncate point. To erase a selection truncate to the start point, and to cancel a start selection without making a second selection just click it again. Note that the selection can't end on leading points, because the program doesn't know which of the two trailing legs to include.

Note that if the railway is complex a message may say that a path can't be found to the selected element. This is usually because there are too many search paths from the last selected element and the search is becoming too long. In these circumstances select an element nearer to the last selected element. Note also that if there is more than one route between the selected elements then the program may choose the wrong one. In this case truncate back to the last selection and choose an element where there is only a single route available.

At each position relevant buttons will be available consisting of  'add section' to add the selected length to the complete set of PDs,  'erase one' to erase the selection (i.e. remove any PDs from the selected length), and  'erase all' to remove all PDs from the railway. A warning message is given if this is selected. Whenever the  'add section' button is enabled it also has focus, meaning that instead of clicking the button the 'enter' key may be pressed. This is often quicker when adding several sections in succession.

In this mode a colour code is used to indicate PDs: original colour = no PD; red = one PD - the arrows indicate which; and green = both directions set (bidirectional running). Bidirectional running is often used in stations to allow flexibility in routing trains.

The PD is indicated by an arrow on the relevant track on each element, which is clear for all elements except points where just one arrow is shown on the leading part of the points for one or both directions. This may be ambiguous in some circumstances for the point in isolation, but preferred directions cannot end on points, so reference to the directions of adjacent elements should make the situation clear.

Note that if track is changed after PDs have been set, elements that have been changed will have their PDs erased. In these circumstances it is recommended to go back to the 'set preferred directions' mode to check and reset the necessary directions.

In this mode bidirectional tracks may be set for complete areas, via the 'Edit' and 'Select' menu items. Select the area required as described under 'Selecting, cutting, copying and pasting etc.', then select 'Edit' and 'Set bidirectional tracks'. This option is useful for quickly setting bidirectional running in station areas to allow flexibility in routing trains.

5 Timetables:

Note: Before and during timetable development please keep in mind the 'Important points' set out in section 5.11. These summarise some important aspects that will help to avoid errors.

Program-readable timetables normally reside in the 'Program timetables' folder and have a '.ttb' extension. They are readable using the timetable editor within the program, selected via the menu using 'Mode' then 'Create timetable' to construct a new one, or 'Edit timetable' to read or change an existing one. For full editing capability, including the ability to validate the timetable, the completed railway ('.rly' file) that the timetable relates to should be loaded before the timetable is opened for editing. For complex services, especially shuttles with feeder and finishing services (explained later), and to a lesser extent for splits, joins and linked services, it will take some time to understand fully the timetable coding system. For simple services that don't have any of these features understanding should be relatively straightforward. It is suggested that simple timetables be set up first until familiarity is gained, before moving on to more complex timetables. Sample timetables are provided that give examples of both simple and complex services.

Timetables consist of 'entries', usually with one entry per train service. Entries appear in detail in the large window on the right of the timetable editor, and are summarised in the smaller window on the left with one line per entry. The program-readable timetable begins with an entry consisting of a timetable start time in the format HH:MM (hours and minutes). No text may precede this start time, but text may follow it though following text is ignored by the program.

Subsequent entries represent trains and services, but an entry beginning with '*' may be used as a comment, and is ignored by the program. When either a blank line is found, or no more lines, the program-readable timetable ends. Entries preceding the timetable start time (marked '-' in the window on the left of the editor) or following the end of the program-readable part (marked '+'), may be used for comments and are ignored by the program.

Trains and service entries consist of information and service codes, in a strict format for the program to interpret. Service code buttons in the editor insert relevant codes at the cursor position, for convenience, and location names may be selected from the drop-down box similarly if a railway with names is loaded. This information may be entered longhand if preferred.

During operation the timetable clock displays hours, minutes and seconds in 24 hour format, but timetable events just use hours and minutes, again in 24 hour format. In fact the hours may exceed 24, where 24:00:00 to 48:00:00 represents the second full day of operation, and so on. The timetable clock displays up to 95:59:59 (i.e. 4 full days) then after the next second it resets to 00:00:00. The time values of timetable events may also exceed 24 hours, up to a maximum of 95 hours and 59 minutes (95:59). Any timetable time event that exceeds this value, including the maximum time value for any repeat service, will be rejected during validation.

Timetable events may seem a bit cryptic at first but the coding that is used allows a great many trains and services with complex operations to be created from relatively few commands.

A typical service is as follows:-

2V31;Nottingham to Cardiff;150;150;250;25;2500	)	Headcode;description;train data (start speed 150km/h)
07:00;Snt;N19-29 N20-29	)	Start new train + starting elements (train moving)
07:03;pas;Kings Norton Approach (NE)	) =	Pass location
07:05;Fer;N89-39 N89-40	)	Finish by exiting railway + valid exit elements
R;30;2;12	)	Repeat service

The first line in the above service is for a new train (new trains have codes Snt or Snt-sh on the second line) and consists of a service headcode - 2V31; description - Nottingham to Cardiff; starting speed - 150km/h; maximum train running speed - 150km/h; mass - 250te; maximum braking force - 25te; and power - 2500kW. Each piece of information is separated by a semicolon. One additional optional item is permitted on this line - maximum signaller-control speed. This is the maximum speed at which the train may run when it is under signaller control. The default value if nothing is specified for this speed is 30km/h, but it may be set to a different value if required, for example:-

2V31;Nottingham to Cardiff;150;150;250;25;2500;75 would give the above train a signaller-controlled speed of 75km/h.

For entries that represent new services (i.e. not new trains and do not have codes 'Snt' or 'Snt-sh' on the second line), just the headcode (plus optional ';description') is required on the first line. For example 1S16;London to Glasgow. New services continue on from earlier services so the train data is generally the same as for the preceding service. If a new description is not provided then the earlier description is applied.

For the example above (2V31) the second line is 07:00;Snt;N19-29 N20-29.

This tells the program that at 07:00 a new train is required (Start new train), located with the rear of the train on track element N19-29 and the front on N20-29 (trains always occupy two track elements). The train is moving when it is created.

The next line is 07:03;pas;Kings Norton Approach (NE), which tells the program that at 07:03 the train is expected to pass (pas) Kings Norton Approach (NE). The next line is 07:05;Fer;N89-39 N89-40, which tells the program that at 07:05 the train is expected to finish by exiting the railway (Finish exit railway) at either track element N89-39 or N89-40. The last line R;30;2;12 tells the program to repeat (R;30;2;12) the service every 30 minutes (R;30;2;12), with the last two characters of the headcode increasing by 2 for each repeat (R;30;2;12), i.e. first repeat 2V33, next 2V35, next 2V37 etc, and in all there are to be 12 repeats (R;30;2;12).

Another service might be:-

2K14;Shirley to Kidderminster;0;120;250;25;2500	)	Headcode;description;train data (stationary start)
07:00;Snt;140-32 139-32	)	Start new train + starting elements
07:01;Tyseley	)	Depart location
07:03;07:04;Small Heath	) =	Arr. and Dep. location
07:07;07:07;Moor Street	)	Arr. and Dep. location
07:10;Snow Hill	)	Arr. location
07:11;cdt	)	Change direction of train

07:12;Fns;2K15

)

Finish and form new service + its headcode

This is a new train as before, but the starting speed is zero, and the track elements 140-32 and 139-32 correspond to a platform at Tyseley, so the train begins at 07:00 stopped at Tyseley. The next line 07:01;Tyseley tells the program that the train departs at 07:01 from Tyseley, then 07:03;07:04;Small Heath tells the program that the train arrives at 07:03 at Small Heath then departs at 07:04. This line could be split into two separate lines 07:03;Small Heath and 07:04;Small Heath if preferred, it means exactly the same to the program. If a line consists of a time and a location, the program determines whether the time represents arrival or departure from the context. Line 07:07;07:07;Moor Street tells the program that the train both arrives at and departs from Moor Street at 07:07. The train won't depart as soon as it has arrived however, because a minimum period of 30 seconds must elapse between any two consecutive events. Therefore, if the train arrives early, say at 07:05, then it will wait until 07:07 to depart. If it arrives at 07:07 exactly, it will depart at 07:07 and 30 seconds (i.e. 07:07:30), and if it arrives at any later time it will depart 30 seconds later. In other words a train will never depart before a scheduled time, but may depart at any time after that time depending on its arrival time, with a minimum wait period of 30 seconds. Line 07:10;Snow Hill tells the program that the train will arrive at Snow Hill at 07:10; line 07:11;cdt tells the program that the train changes direction (change direction of train) at 07:11, then the final line 07:12;Fns;2K15 tells the program that the train finishes at 07:12 and forms a new service with headcode 2K15 (Finish new service). Another service entry will be needed to take up the story for 2K15. Service codes - Snt, Fns, cdt etc - use capital 'S' for 'Start' events, capital 'F' for 'Finish' events, and small letters for intermediate events.

5.1 Service references for complex services

In all the earlier examples services have been identified by headcodes, and for simple services like those described headcodes are all that are required for identification purposes. However, for more complex types of service, where there are links to other services but headcodes are required to remain the same (as required for example on many suburban services), more complex 'service references' are used. *In the following examples shuttles and joins are used to illustrate the application of service references. The details of how shuttles and joins operate and are coded will be provided later.*

The point to note is that all linked references must be unique*, so if the same headcode is to be used for more than one linked service a prefix (own choice up to 4 extra characters) should be added, though in all cases the final four characters must represent a headcode.

*[*Shuttle services may have two links, one each for the 'out' and 'back' service legs - where one link is from 'out' to 'back' and the other from 'back' to 'out' again. This will be explained later.]*

The following entries represent firstly a non-shuttle linked pair of services where the link represents a join:-

First entry:

1A21;Glasgow to London;200;200;200;20;2500
07:00;Snt;N89-13 N88-13

)
)

Headcode;description;train data
Start new train + starting elements (moving train)

07:00;pas;Galton Br. Approach (W)	)	Pass location
07:03;pas;New Street Approach (NW)	) =	Pass location
07:08;Birmingham New Street	)	Arr. location
07:11;Fjo;1A23	)	Finish and join another service + its headcode
R;30;4;12	)	Repeat service

Second entry:

1A23;Edinburgh to London;200;200;200;20;2500	)	Headcode;description;train data
07:02;Snt;N89-13 N88-13	)	Start new train + starting elements (moving train)
07:02;pas;Galton Br. Approach (W)	)	Pass location
07:05;pas;New Street Approach (NW)	)	Pass location
07:10;Birmingham New Street	) =	Arr. location
07:11;jbo;1A21	)	Joined by other service + its headcode
07:15;Birmingham New Street	)	Dep. location
07:23;Fer;149-22	)	Finish by exiting railway + valid exit elements
R;30;4;12	)	Repeat service

Here, the first service entry - 1A21 reaches Birmingham New Street at 07:08, and at 07:11 the service finishes, by joining train 1A23 (code **Fjo** signifies 'Finish, join other', in this case 1A23). The second service entry is for the corresponding train 1A23, which reaches Birmingham New Street at 07:10, and is joined by 1A21 at 07:11 (code **jbo** signifies 'joined by other', in this case 1A21). The two references 1A21 and 1A23 are the two linked service references and must appear in each other's entries for a proper linkage. In this case there is no need for any prefixes because these headcodes are not used elsewhere.

Note that the repeat information must be identical for all linked services

The next pair of entries represent shuttle services 2-2P48 and 3-2P49 (shuttles will be explained in detail later):-

First entry:

2-2P48;Four Oaks to Kings Norton	)	Reference;description;train data
07:06;Sns-sh;3-2P49;2-2P49	) =	Start new service from feeder, then form shuttle + linked shuttle ref. + feeder ref.
07:07;Four Oaks	)	Dep. location
. [lines removed to simplify]		
07:56;Kings Norton	)	Arr. location
07:56;Fns;3-2P49	) =	Finish and form new service + its reference
R;90;0;08	)	Repeat service

Second entry:

3-2P49;Kings Norton to Four Oaks	)	Reference;description;train data
07:56;Sns;2-2P48	) =	Start new service from another service + its reference
07:58;Kings Norton	)	Dep. location
. [lines removed to simplify]		
08:35;Four Oaks	)	Arr. location
08:35;cdt	) =	Change direction of train
08:36;Fns-sh;2-2P48;3-2P48	)	Finish and link back to shuttle, finally form new finishing service + linked shuttle ref. + finishing service ref.
R;90;0;8	)	Repeat service

This pair of services is just one pair of a number of similar pairs, all of which provide the same train service with the same headcodes, but at different time intervals. The other pairs are not shown. Here it will be seen that the first entry for 2-2P48 contains the

linked service 3-2P49 in two places - line 07:06;Sns-sh;3-2P49;2-2P49 and line 07:56;Fns;3-2P49. This is because, being a shuttle, it links at both ends to the reverse shuttle service. Similarly the entry for 3-2P49 has its linked service 2-2P48 in two places, at the start and at the end for the same reasons. The other service references: 2-2P49 and 3-2P48 represent the initial shuttle feeder service and the final shuttle finishing services, which are not shown. Prefixes are required because the same headcode is used in several sets of linked services, and as the other sets must not use the same reference, the headcode must be prefixed so as to make the overall reference unique.

It is recommended to use different prefixes for separate same-headcode services even when the timetable doesn't strictly require it (i.e. where multiple links for the same headcode aren't used), because it is then easier to identify which service is at fault when errors are reported by the timetable syntax or validity checkers.

Note that because headcode letters and numbers are very small, it is easy to confuse letter 'g' (shown as 9) with number '9' (shown as 9).

5.2 Timetable service codes:

5.2.1 Simple (unlinked) service codes:

Codes: Snt; cdt; pas; Frh; Fer; Time;Location (Arrival or departure); Time;Time;Location (Arrival and departure);

These codes are all independent of each other and independent of other codes. Note that new trains (code Snt) may be stationary or moving, and may be started under signaller control if required. This is done by adding 'S' after the Snt line - e.g. Snt;146-12 147-12;S. No further lines except repeats are permitted for these entries.

Start new train	HH:MM;Snt;rear element ID - space - front element ID [+ optional 'S']
Change direction	HH:MM;cdt
Pass	HH:MM;Location
Finish remain here	Frh
Finish exit railway	HH:MM;Fer;list of valid exit element IDs (at least 1) separated by spaces
Arrival <u>or</u> departure	HH:MM;Location (program will determine which from the context)
Arrival <u>and</u> departure	HH:MM;HH:MM;Location

5.2.2 Service changes:

Codes: Sns; Fns.

These always link together such that a 'Sns' service always follows from an earlier 'Fns' service.

Start new service from another service	HH:MM;Sns;other service ref.
Finish and form a new service	HH:MM;Fns;new service ref.

5.2.3 Splits:

Split codes: Sfs; fsp; rsp.

These always link together such that an 'Sfs' service always follows from an earlier 'fsp' or 'rsp' service.

Start new service from a split	HH:MM;Sfs;service ref. of the train that splits
Front split	HH:MM;fsp;new (split-off) service ref.
Rear split	HH:MM;rsp;new (split-off) service ref.

A train may split from the front, where the new split-off service appears in front of the original service, or from the rear. Codes are 'fsp' ('front split') and 'rsp' ('rear split'). The line that contains these codes also contains the service reference for the split-off service. The split-off service has code 'Sfs' (start from split) and also the service reference for the service that it splits from.

One thing to beware of during operation is that the platform at which the split occurs must be long enough to allow it. The condition is that both trains must be at a platform after the split, although only one element of the train (half its length) need be at a platform. Additionally at least one of the final four elements that the two trains stand on must overlap with one of original train elements, and the program will maximise the number of train elements at platforms. This means that the original train may be repositioned during the split. Therefore the minimum platform length is two elements, providing there is a track element linked at each end. If one end is a buffer then the platform must be at least three elements long. When the timetable is first validated (either during editing or on loading for operation) a check is made that each location at which a split occurs has at least one platform that is long enough, but it is up to the signaller to ensure that the actual platform that the train arrives at is long enough for the split. If it isn't then a warning message is given and the train will need to be moved under signaller control to find an appropriate platform. A second thing to beware of is to try to ensure that after a split both trains lie behind a protecting signal. If one of the trains straddles a signal, then that signal does not provide any protection, and when the train's departure time is reached it will depart without a route having been set. Note that because the number of train elements that will be standing at platforms is maximised, it may be necessary to move an obstructing train further away than would appear to be strictly necessary, but when it has been moved sufficiently the split will occur.

When trains split the mass, power and braking force are split evenly between them (so the performance remains the same), and the maximum running speed is the same for the new service as the original.

Try to avoid descriptions that include the number of cars for services that split. The original service description doesn't change during operation so such descriptions will become incorrect after a split.

5.2.4 Joins:

Join codes: Fjo; jbo.

These always link together such that an 'Fjo' service always links to a 'jbo' service.

Be joined by another train	HH:MM;jbo;joining train service ref.
Finish and join another train	HH:MM;Fjo;service ref. of train to join

Join codes are 'Fjo' ('finish, join other') for the service that finishes by joining another service, and 'jbo' ('joined by other') for the service that has the other service joined onto it. The lines that contain these codes also contain the service references of the corresponding linked services. The thing to beware of during operation is that both trains must be received at the same platform - fairly obvious of course but easy to overlook at a large station when the trains arrive at different times. Failure to observe this will result in signaller control being needed. Also necessary is that the receiving platform must be long enough to accommodate the two trains. Try to receive joining trains at platforms where there will be at least one platform element free for the second train, which may be behind or in front of the first train depending on the arrival direction of the second train.

When trains join, their masses, powers and brake forces are added, and the maximum running speed becomes the smaller of the values for the two trains. Warning messages are given when one or other train is waiting for the other.

For services that join it is best to avoid descriptions that include the number of cars. The original service description doesn't change during operation so such descriptions will become incorrect after a join.

Note that when repeat service trains join, each service must have the same repeat number. Services with different repeat numbers will not join, even though the headcodes correspond correctly. Service repeat numbers are provided in the train status floating window.

5.2.5 Shuttle services:

Codes: Snt-sh; Sns-sh; Frh-sh; Fns-sh; Sns-fsh; F-nshs

The linkage for these codes is quite complex and is explained below.

Start new shuttle train at a timetabled stop	HH:MM;Snt-sh;rear element ID - space - front element ID;linked shuttle service ref.
Start new shuttle service from a feeder	HH:MM;Sns-sh;linked shuttle service ref.;feeder service ref.
Finish and repeat shuttle, finally remain here	HH:MM;Frh-sh;linked shuttle service ref.
Finish and repeat shuttle, finally form a finishing service	HH:MM;Fns-sh;linked shuttle service ref.;finishing service ref.
Start new non-repeating shuttle finishing service	HH:MM;Sns-fsh;linked shuttle service ref.
Finish non-repeating shuttle feeder service	HH:MM;F-nshs;linked shuttle service ref.

A shuttle service is a service that runs from A to B, then forms a new service that runs back from B to A and forms a new service that links to the first repeat of the original

service. **Shuttles are the only way for a service to link back to a service whose first train starts at an earlier time, all other links are forward links to later services.** The pattern must repeat at least once, and may repeat as many times as required.

In practice shuttle services may be a lot more flexible than this, for example: the first service may run from A to B; then form a new service that runs from B to C; then part of the train splits off to form a new service that runs to D (the service that splits off repeats as many times as there are shuttles but is not part of the shuttle in that it can't link back into the shuttle sequence); the remaining train at C changes direction then continues on to E, where it is joined by another service from F (the joining service from F repeats as many times as there are shuttles but is not part of the shuttle). The service from F, together with the train joined from E then returns to A, where it links back to the first shuttle service. The essential feature of a shuttle service is that it represents a loop, with the same start and end locations, and a final service that links back to the starting service. Intermediate events (splits, joins, direction changes etc) are possible, and any number of 'Fns' service finishing events that link to corresponding 'Sns' service starts, but the final finish must link back to the starting shuttle using 'Frh-sh' or 'Fns-sh', thereby completing the loop. No other finish types are allowed. In the above example the shuttle runs from A to B to C to E then back to A. The split off part to D and the service that starts from F and joins at E are not part of the shuttle loop.

Another important point about shuttles is that each shuttle is separate from all other shuttles, i.e. no two shuttles can interact. In fact there is no need for two shuttles to interact since a single shuttle can consist of as complex a sequence as required.

There are two more points to remember, the first is that a shuttle loop cannot consist of a single service. In other words a service that runs from 'A' to 'B', then continues on by returning to 'A', cannot be a shuttle. There must be at least one change of service, i.e. the shuttle finishing service reference must be different from the shuttle starting service reference. This is not to say that the same headcode can't be used for these two services because it can, so to all appearances the same service does in fact keep looping for as many times as there are repeats (though the performance log will still record the fact that a change of service has occurred, albeit with the same headcode). However the service reference (prefix + headcode) must change at some point within the loop. This represents a program restriction in that a service is not permitted to link back to itself. The second point is that a shuttle must have at least one repeat. This should be fairly self-evident since a shuttle that doesn't repeat is just two linked services.

It is recognised that the coding of shuttles services may be difficult to learn, but it is considered to be well worth the effort as sophisticated and interactive services become available. Nevertheless it is possible to run very respectable railways without any shuttles at all, if preferred. A series of interleaving shuttle services is provided in a sample timetable. Study of these will lead to a good understanding of how they work.

The simplest form of shuttle is one that starts as a new train at the shuttle loop start (and end) location (hereafter referred to as the 'loop location'), and at the end of all the repeats remains at that location. The code that starts this type of shuttle is 'Snt-sh', meaning 'start a new train that is a shuttle'. The corresponding finishing code is 'Frh-sh', meaning 'finish

and remain here or form a repeating shuttle'. The lines that contain these codes also contain the service references for the linked shuttle service.

When setting the times for shuttle links the time for the 'Frh-sh' event must correspond to the time for the corresponding 'Snt-sh' event + 1 repeat time. For example, if the shuttle repeats at 30 minute intervals, and the 'Snt-sh' time is 07:00, then the time for the 'Frh-sh' event must be 07:30. Note that this is the service change time, it doesn't need to correspond to the departure time or the overall time to complete the loop, which may be any time less than 30 minutes or 30 minutes exactly, but can't be more than 30 minutes.

As well as the looping shuttle services themselves, two other associated services are available, known as 'shuttle feeder' and 'shuttle finishing' services. A feeder service is a non-repeating service that begins at a location other than the loop location, but ends at the loop location. It is normally used as an empty stock service from a depot to the station at which the shuttle begins. This service starts as a normal service but ends with code 'F-nshs', which means 'finish non-repeating shuttle feeder service'. The shuttle service that it forms begins with code 'Sns-sh', meaning 'start a new shuttle service'. A finishing service is a similar non-repeating service but starts when all the repeating shuttles have finished, and is typically an empty stock movement back to the depot. The code for a shuttle that links to a finishing service (as well as back to other shuttles while they are still repeating) is 'Fns-sh', meaning 'finish and form a new service or a repeating shuttle'. The corresponding starting code for the finishing service is 'Sns-fsh', meaning 'start a new service from a shuttle'. The lines that contain the shuttle codes ('Sns-sh' and 'Fns-sh') also contain two linked service references, the first is the linked shuttle reference, and the second is the non-repeating feeder or finishing service reference. The lines that contain the non-repeating service codes ('F-nshs' and 'Sns-fsh') have just one linked service reference, corresponding to the relevant shuttle. Feeder and finishing services don't have to appear together, a particular shuttle may have a feeder service but no finishing service, a finishing service but no feeder service, both, or neither.

When setting the times for shuttle links the time for the 'Fns-sh' event must correspond to the time for the corresponding 'Sns-sh' event (or 'Snt-sh' event if there is no feeder) + 1 repeat time. This is exactly the same as the situation for 'Frh-sh' described above.

When setting the time for a finishing service the 'Sns-fsh' event time must correspond to the time for the corresponding 'Fns-sh' event + 'n' times the repeat time, where 'n' is the number of repeats. For example, if the shuttle repeats at 30 minute intervals and there are 20 repeats, then if the 'Fns-sh' time is 07:45, the corresponding 'Sns-fsh' time should be 07:45 + (30 x 20) minutes, i.e. 17:45.

5.3 Headcodes:

Headcodes must consist of four consecutive alphanumeric characters, i.e. capital or small letters, or digits. The only restriction is that repeating services with increasing digits between repeats (see below) must contain digits as the last two characters. The standard British headcode consists of 'digit letter digit digit', but other systems use different formats.

5.4 Timetable validation:

Timetable integrity is validated with respect to program interpretation, not with respect to logical structure. It is the user's responsibility to make sure that a timetable makes sense! Two sets of checks are carried out, the first for syntax, and the second for overall structure. The first will reveal incorrect coding, the second will reveal incorrect timings such as a departure before an arrival, incorrect sequences such as arrival at Station A followed by departure from Station B, and incorrect service reference linkages etc. Checking is quite comprehensive, so a timetable that is validated should load and operate correctly.

It is the user's responsibility to ensure that stopping locations are entered in the correct order. If a train is to stop in sequence at A, B, C, D, but station layout is A, D, C, B, then when the train reaches D the program 'thinks' that stations B and C have been missed, so 'missed location' logs will be sent to the performance file. As far as the timetable is then concerned B and C are no longer listed. However the check for missed locations is only carried out as far as the next change-of-direction (cdt) if there is one. This allows for services that stop at some locations on the way out and at the same or others on the way back. For example, stations may be set out in sequence W, X, Y and Z, and a train stops at W and Z on the way out, then changes direction and stops at Y, X and W on the way back. When it arrives at Z ready to return, it hasn't missed X and Y, so 'missed location' logs are not sent for these because they come after the change-of-direction. This situation would normally be set up by changing service at Z (new headcode), but the program allows that same service to change direction and continue if required.

Note that a train that is timetabled to stop at the same station twice without a change of direction in between (running in a ring for example) will cause a validation error as the checker thinks that the second entry is a mistake. To get round this restriction there must be a change of service (Fns - Sns combination) before the station is reached for the second time.

5.5 Timetabled and automatic warnings:

Any service event (except 'Frh' and 'Fjo' - see later) may be preceded by 'W', e.g. [W14:23;Moor Street](#). This represents a 'warning', and when the service reaches this point a warning message is given in red at the top of the display area. Warnings scroll up in two columns, ten in all, and may be erased by right clicking. Warnings are useful for example to indicate when a route will need to be set in the near future, say when a train is approaching a junction at the end of a route controlled by automatic signals. Warnings are also provided automatically in circumstances where the signaller may need to take some action, these include trains prevented from entering or being created by existing trains, locked routes, or on points set to diverge; trains unable to split because the platform is too short or another train is in the way; and trains waiting for another train to join or to be joined by.

Remember to set separate warnings where there are different entries for similar services, e.g. a shuttle feeder service is listed separately from the shuttle service that it feeds, so both the feeder and the shuttle should have warnings at similar locations if appropriate, but the repeat feature will take care of all warnings for the shuttle services themselves.

If a warning is set for an arrival and departure event - `HH:MM;HH:MM;Location` - the warning is given on arrival only, not departure. Warnings are not permitted for 'Frh' codes because these are not events as such, they just represent train termination and indicate that the timetable has finished for the relevant trains. Warnings are also not permitted for 'Fjo' codes. If a warning is required when trains join (as opposed to when they are waiting to join - at which time an automatic warning is given) the 'W' should precede the 'jbo' event, not the 'Fjo' event

5.6 Showing and hiding the timetable editor:

Finding element identification numbers (IDs) for `Snt` and other events that require them is made easier by having the appropriate railway loaded, then temporarily 'hiding' the timetable by left clicking the 'Hide' button, and examining the track by enabling track information and hovering the mouse over the required element. Note that the editor can't be hidden while an entry is being created, it must first be saved by clicking 'Save entry', but it can be saved in any state of completion.

5.7 Repeating services:

Most services may be followed by repeats, as in one of the examples described earlier, consisting of `'R;mins;digits;num'`, where 'R' is the 'repeat' marker, 'mins' is the number of minutes increase between repeats, 'digits' is the last two headcode digit increase between repeats ((this may be zero if all headcodes are to be the same, and if not zero then the numbers roll over at 00), and 'num' is the number of repeats. A repeat service that has a value other than zero for 'digits' must have digits as the last two characters of the headcode. Note that shuttle feeder and finishing services ('F-nshs' and 'Sns-fsh') can't have any repeats, and shuttle services ('Snt-sh', 'Sns-sh', 'Frh-sh' and 'Fns-sh') must have at least 1 repeat.

5.8 Using the timetable editor:

The table on the left of the editor lists all entries, the program-readable part beginning with START and followed by service references or 'Comment' if the entry begins with '*'. If this part ends with a blank line it is marked END. Other entries are marked '-' or '+' for before or after the program-readable part, and contain the first few letters of the text.

The buttons provided are hopefully self explanatory, and each has an associated hint, seen by hovering the mouse over it when it's active. Cutting, copying and pasting of whole entries is done using the buttons, but sections of an entry may be cut, copied, pasted and deleted by highlighting the relevant section, then pressing 'CTRL X' to cut, 'CTRL C' to copy, 'CTRL V' to paste, or 'Delete' to delete. 'CTRL Z' may be used to undo any changes. Pasting may be done into new or different entries than those cut or copied from.

Commas must not be used within services because commas are used internally by the program to separate the events in a service, and if extra ones are added then the events that they appear in will be split and will not be understandable to the program. The commas that separate the events are not visible. Similarly semicolons are used to

separate the components of each event, and they must not be used for any other purpose within services. Semicolons are of course visible so their presence is clearer. Commas and semicolons may be used freely outside services, i.e. in text preceding the start time, in text following all services, and in comments between services.

When adding services it is often helpful to copy an earlier service, then modify it, for example by changing service references, and adding or subtracting minutes (this changes all time values within the entry by the same amount). It is best not to use the HH:MM time format in any position other than as a legitimate service time, because if add or subtract minutes is used it changes every HH:MM time that it finds in the entry.

If a timetable is changed then it must be saved before it can be validated. If a timetable is being developed from an earlier one and the original is to be retained, then the 'Save timetable as' option may be used to save it under a new name.

It is not necessary to load a timetable (via 'File' and 'Load timetable') in order to edit it, but it is necessary to have the railway ('.rly' file) loaded in order to validate it from within the editor. All timetables are validated prior to loading for operational use but for new or changed timetables it is better to check validity with the editor open so that changes may be made if necessary. In order to use the list of railway locations from the timetable editor drop-down box it is necessary to have a railway loaded, but this may be in the form of either a '.rly' file or a '.dev' file. Note that loading a timetable for operational use and for editing are different activities, a timetable still has to be loaded in order to operate the railway after it has been edited and validated. Note also that continuation names are for location identification when trains enter and exit the railway, they are not stopping locations. For this reason continuation names must not be used in the timetable, the validation check will raise an error if they are. Also for this reason the location name drop-down box in the timetable editor excludes continuation names.

5.9 Non-timetabled services:

Non-timetabled services may be set up to use manual (i.e. signaller) control only. Here all control is manual but a timetable is still needed to allow new trains (or trams) to be created and to set data such as powers and maximum running speeds. These entries have start events of the form - `Snt;146-12 147-12;S` - where the final 'S' indicates that it is started under signaller control. For these services it is useful to use the description to indicate the route, so that this shows in the floating window during operation and so helps in applying correct control.

Trains or trams operated under signaller control need skill to stop at required positions because there is no automatic location stopping as there is under timetable control. A train (tram) being stopped by a signaller command brakes at up to three quarters of its maximum braking effort (this may be considerably less if there is a long element in front), and it takes effect when it reaches the end of the next full element. It will always stop at a full element, so there is a need to be aware of element lengths, speed (the higher the speed the more difficult the judgement), and position when the 'stop' command is given. For regular stopping under signaller control - as may be required for tram operation - it is suggested to experiment then mark the brake application positions using text markers.

5.10 Formatted timetables:

When a timetable has been saved and validated (the appropriate railway has to be loaded in order to validate it), it may be exported. Exported timetables help in operating the trains and are located in the 'Formatted timetables' folder. They may be exported from within the timetable editor by left clicking the appropriate button, or, when loaded for operation, from menu items 'File' and 'Export timetable'. Timetables are created in two forms (a) traditional timetable format in spreadsheet form ('.csv' - comma-separated-variable files), readable and reformattable by Microsoft Excel or any spreadsheet program, and (b) chronological order in plain text ('.txt' files), readable by any word processor or text editor. The chronological timetable in particular should be useful in planning operations in a proper sequence, and should match the performance log quite closely if the railway is operated efficiently and without delays. Note that these timetables are likely to be quite big if there are many repeating services, so be aware that a lot of paper will be required if they are printed as a whole files.

5.11 Important points to note in timetabling:

- 1. All train and service entries must contain a single start event which must come immediately after the first line, i.e the line that contains the headcode.**
- 2. Except for signaller-controlled trains (see 5.9) all entries must contain a single finish event, which must either come last, or, if the service is to repeat (see 5.7), must be the one before last - the last being the repeat.**
- 3. Signaller-controlled trains (see 5.9) must contain either a start event on its own, or a start and a repeat.**
- 4. All location names used in the timetable must be where trains can stop, even if they are only used for passing points. The drop-down box in the timetable editor gives a list of valid locations if a railway with names is loaded. Note that although continuations can be named trains cannot stop there.**
- 5. Avoid illegal sequence events by ensuring that arrivals are followed by departures from the same location, and moving train events (e.g. pass times, departures & 'Snt' events for moving trains) are not followed by events that can only occur when stationary and vice versa. Note that an 'Snt' event is treated as moving (even if the starting speed is zero) unless (a) the start location is the next timetabled departure point for that train and the starting speed is zero; or (b) the train is a signaller controlled train, its starting point is a location, and its starting speed is zero.**
- 6. Note that although a time-location (HH:MM;Location name) event can represent an arrival or a departure (the program will determine which from the context), it cannot be both. If both an arrival and a departure from the same location is required without any events inbetween then use a time-time-location event (HH:MM;HH:MM;Location). The times can be the same, in which case departure will be 30 seconds after arrival, or different.**



7. The only way for a service to link back to a service whose first train is earlier than the linking service is by using a shuttle.




8. The program only works in metric units but conversion facilities are included to change speeds in miles per hour to kilometres per hour, and horsepower to kilowatts.

6 Operating a railway:

When a railway has been saved as a '.rly' file and has one or more valid timetables it is ready for operation.




Select menu items 'File', and 'Load railway', then double click on the required file to bring up the railway. Then select menu items 'File' and 'Load timetable', and double click the required timetable. Finally select menu items 'Mode' and 'Operate railway'.

The railway is now in 'Pre-start' mode, which means that the clock is stopped and trains won't run until the 'Run' button  is left clicked, but routes may be set (see later) and train information is available. It is worth setting up automatic signal routes in this mode, which can be done manually or automatically (from v1.2.0) using the 'Preset automatic signal routes' button . This sets automatic signal routes on all track sections without points, crossovers and level crossings that have single preferred directions set and that lie between non-ground signals or between continuations and non-ground signals. Automatic signal routes may be set on tracks that are due to have trains created on them when the timetable begins, and signals that lie behind these trains will be set appropriately as soon as the trains are created. Beware though that any trains that are already in motion may be affected by such signals, so try not to have more than one train created on a given route at any one time. If trains are created on other types of route then the route behind the train will be removed.

After the 'run' button  is clicked and the railway is operating, this button changes into a 'pause' button . When this is left clicked the clock stops and operation is suspended. Information is available in this mode but no action may be taken that affects the railway such as route setting or taking signaller control of trains. Note that if operation is halted for any reason - by a screensaver, displaying on-screen help, or by temporarily changing to another application - it will be in 'pause' mode when it is restored. Also when the 'run' button is clicked the 'Preset automatic signal routes' button changes into a 'Call-on' button .


During operation, although trains are normally running to a timetable, they will run wherever the track leads. They stop at signals and buffers (if there is time and braking capacity), and timetabled stop locations, but will only stop for trains in front if they are being called-on, under signaller control (see later), or at a timetabled stop location. Hence it is the signaller's responsibility to keep trains safe and on the right tracks. Errors other than crashes and derailments may usually be corrected by taking signaller control and making appropriate corrections, at the cost of time and possible delays to other trains. A train that runs on a wrongly set trailing point will become derailed. Crashed and derailed trains must be removed from the railway by the signaller.

6.1 Route setting and cancelling:

Three types of route are available by left clicking the appropriate button: automatic signal routes  (blue button), preferred direction routes  (green button), and unrestricted routes  (red button). Automatic signal and preferred direction routes may only be set on tracks with preferred directions allocated (via the 'Mode' and 'Set preferred directions' menu items), and must run from signal to following signal, but unrestricted routes (red route button) may be set from any point to any other point (other than points, bridges or crossovers and providing there's a track between them), regardless of preferred directions. Unrestricted routes are intended for unusual movements only. When a route is set the direction is indicated by small coloured arrows on the first and last elements of the route. A route that does not involve any point changes will be set in about half a second, but if point changes are needed then about 2.5 seconds are required. In 'Pre-start' mode routes are set instantly.

Preferred direction and unrestricted routes are cancelled automatically as a train runs along them, and all signals passed change to red. Automatic signal routes are not cancelled by trains, they remain in place until cancelled by the signaller (or by a train running on them in the wrong direction). When a train passes a signal on an automatic signal route it changes to red, but (in the absence of any following trains) at the same time the next earlier signal changes to yellow, the next earlier signal to that one changes to double yellow, and the next earlier one to green. That is for four-aspect signals, three-aspect signals omit the double yellow and two-aspect signals omit both yellow aspects. In this way trains may proceed from section to section without intervention by the signaller. If an automatic signal route ends at a continuation then when trains pass the last signal it changes to red as normal, and after a time interval it will change (for four-aspect signals) to yellow, then double yellow, then green. Other aspect signals behave appropriately. The time interval is based on the speed of the departing train - the faster the train the sooner the signal changes.

When a route start and end point are selected the program tries to find an appropriate track linking them. The strategy used is to search from start to end, following points initially in their 'set' direction, and beginning the search in the direction that moves closer to the end point. If there is more than one valid route between the selected start and end points then the program could select either depending on how the points are set. To force a particular selection set the points for the favoured route. Similarly if it is found that the program cannot find a suitable route even though you know there is one, probably because there are facing points with so many ways out that the search takes too long, then set one or more points for the desired route. Note though that sometimes a preferred direction or automatic signals route can't be set because the preferred directions don't allow it, and that isn't necessarily obvious during operation.

When selected, routes may be truncated or cancelled, by left clicking the 'route cancel' button  and then right clicking the track element to truncate to, or the start element of the route to cancel it completely. When truncating automatic signal and preferred direction routes, the truncate point must immediately follow a signal, so that the route that is left ends at a signal. Note that a route that consists of a mixture of preferred

direction and unrestricted route sections is regarded by the program as a single route, which may be cancelled as a whole. However a route that consists of a mixture of automatic and other types of route sections is regarded by the program as a series of separate routes, with automatic signal sections being individual routes, and mixtures of others between similarly being regarded as individual but separate routes. In these circumstances when a route is cancelled, just the relevant section is cancelled. This may sometimes cause problems because the automatic signal routes always take preference and include the signals at both ends. Therefore, if a section of automatic signal route is cancelled, the signal that represents the boundary between it and the other type of route is removed when the automatic signal route is removed. This leaves the other route with a missing signal, and a new section of route can't be created to include it because the program won't permit a route to end next to an existing route. Hence the other section of route must be cancelled also.

Try to avoid having a signal immediately before a bridge, because bridges can't be used as truncate points, so the route can't be truncated to that signal. This is because a bridge is potentially ambiguous as it may have two routes set on it.

Note that a train that runs in the wrong direction on any part of a route will cancel the whole of that route and all signals will change to red immediately. Also if a train is introduced by the timetable at a point in the middle of an existing unrestricted or preferred direction route then the route behind the train will be erased and all signals reset to danger. If this happens on an automatic signal route then the route will remain in place but the signals behind the train will be reset because of the presence of the new train. Any of these events may cause following trains to run past red signals and/or to crash into the new train.

Try to avoid creating automatic signal routes where they may need to be cancelled. The above situation gives one reason, but another is when the route runs into a cul-de-sac. The program will provide some protection here in that it won't allow an automatic signal route into buffers.

To cancel a preferred direction or unrestricted route directly in front of a train select an element ahead of the train, because any element that the train stands on is automatically cleared from the route.

Trains will run whether or not protected by routes and signals, but without protection derailments and crashes are much more likely. When not in a route points may be changed manually by left clicking them. This is useful for manoeuvring a train under signaller control without having to set a route. Points that are linked directly to other points and together provide a means of moving from one track to a parallel track are changed together when one of them is left clicked. If one of a pair of such linked points is in a route or has a train on it then the other can't be changed manually.


If two or more trains are on the same platform, are not protected, and there is at least one track element separating them, then they may crash when one of them reaches its departure time unless they are facing in opposite directions. However if the two are directly adjacent then this won't happen as a train won't start if there is a train directly in front of it.

6.2 Approach locking:

If a route is attempted to be cancelled in front of an approaching train (i.e. within three non-red signals of a train that is protected by the route), or is occupied by a train, then a warning is given that the route will be locked if cancellation proceeds. In this case all signals on the locked section change immediately to red, but the route remains in place in order to protect the trains (no other conflicting routes may be set while it remains in place). It will remain locked for a period of two minutes to allow all relevant trains to come to a stop. Locked routes are marked with crosses over the locked section. If a train is running on an unprotected section of track before reaching a route, then that route may be cancelled immediately because the route is not protecting the train.

Routes that are locked cannot be truncated.

6.3 Session saving and loading:

At any stage during operation a 'session' may be saved by left clicking the  'save session' button. Here the current state of the entire railway is saved to file, to be loaded again at a later time. These files have the extension '.ssn' and by default are stored in the 'Sessions' folder, which resides in the folder where the program itself - 'railway.exe' - resides. A unique name is given to the file on creation, and indicated in a window. This may be changed later if required using the file name change function of 'Windows Explorer'.

Sessions will load in pre-start mode if saved during pre-start mode (i.e. may set routes and change points etc before trains appear), or as paused if saved when either operating or paused.

Note: A session file saved on a computer with a regional setting for number formats (Control Panel - Regional and Language Options) different to that on which it is to be loaded will fail on loading if it uses a different decimal point character. In this case first change the regional setting to the country of origin of the session file, load the file, then change the setting back to normal and immediately resave the session. The newly saved version should then load normally.


6.4 Running trains:

When running, the front reporting number (headcode) character is red, to show that it is the front - obvious when moving of course but not so when stopped. In signaller-control mode (see later) the front is indicated by a blue character, both to show that it is the front and that it is in signaller-control mode.







It is normally useful to keep train status information turned on, by selecting menu items 'Information', 'Train information' and 'Show status'. Timetable information is also useful when the destination is not otherwise obvious, turned on by selecting menu items 'Information', 'Train information' and 'Show timetable'. With one or both of these turned on the information is given in a floating window when the mouse hovers over a train.

Trains have different background colours to indicate the different train states as follows:-

grey = moving (black or white in zoom-out mode depending on the background colour);
pale green = stopped at a timetabled location;
pink = train ready to start from a timetabled location (changes 10 secs before departure);
bright green = stopped by a signal;
red = crashed or derailed;
light cyan = stopped at buffers, no attention needed;
cyan = stopped at buffers unexpectedly;
light blue = stopped by a train in front;
magenta = call-on available;
yellow = signal-passed-at-danger (SPAD);
caramel = stopped under signaller control.

In zoom-out mode (accessed by left clicking the  button) any train that requires attention (stopped by a signal, stopped unexpectedly at buffers, SPAD, crashed/derailed or call-on), is shown flashing, with the colour appropriate to the condition.

Flashing icons are also provided on the left hand side of the screen if signaller attention is needed somewhere on the railway. These are especially useful for large railways when trains may need attention that are off-screen and can't be seen. Selecting zoom-out will enable the train or trains (which will be flashing) to be located quickly. The icons are as follows:-

 shows that a train is held at signals;  shows that a train has arrived unexpectedly at buffers (i.e. it is under timetable control and still has timetable events to complete);  shows that a train may be offered a call-on;  shows that a signal has been passed at danger, and  and  show that a derailment and a crash have occurred respectively.

Sometimes events occur that require signaller attention but are not covered by any of the above flashing symbols. Such events include trains prevented from entering or being created by existing trains, locked routes, or on points set to diverge; trains unable to split because the platform is too short or another train is in the way; and trains waiting for another train to join or to be joined by. Warnings are therefore given in red above the railway display area. These warnings scroll up in two columns (ten visible warnings in all) as later warnings are given, but they may be cancelled by right clicking on the warning. Cancellation is appropriate when a warning has been acted upon or does not require action. It will be seen that when the mouse hovers over any of the warnings the clock stops. This is to prevent new warnings scrolling up just as the right click cancel button is pressed, as then the wrong warning might be cancelled.

These warnings are in addition to any that have been set in the timetable (see 'Timetabled and automatic warnings'). Timetabled warnings are useful for example to indicate when a route will need to be set in the near future, say when a train is approaching a junction at the end of a route controlled by automatic signals.

Try to ensure that trains approach a stop location by passing along all the relevant named elements rather than by entering obliquely via points and missing out some of the named elements. This is to avoid the train missing the relevant stop point for that platform and thereby failing to stop. Stop points are set assuming straight entry into platforms.


If there is a station that has a split platform (i.e. a section of track with no adjacent platform lying between two track sections that have platforms belonging to the same location) then trains will treat these as two separate platforms, but a train that is required to stop will only stop at first platform's stopping point.

6.5 Train performance:

Trains accelerate and brake according to the characteristics that are set in the timetable. The power that is quoted represents gross power, but only 80% of that power is available at the wheel because of internal losses. Acceleration always assumes the application of maximum power. Normal braking uses up to half the maximum braking effort providing there is time to respond, and calculations are made when the train reaches the end of each track element. This explains why a train that has reached the element immediately preceding a red signal comes to a complete stop before accelerating again, even if the signal changes to yellow before the train has stopped. The braking calculation is done by first calculating the maximum speed at which the train can have at the end of the next element in front, then looking forward for the distance from that point that is needed to come to a stop using half the maximum braking effort. If no reason to brake is found in that distance then the train accelerates if can, or stays at the same speed if it can't. If there is a reason to brake then the braking rate is calculated to achieve the necessary stop or speed restriction in the distance needed. Under normal circumstances there should never be a need to brake at more than half the maximum rate, but if signals are reset in front of a train or points are changed that direct the train into a siding then much heavier braking will be needed. The floating window indicates the braking rate that is applied - light braking up to 50% of maximum, heavy braking from 50% to 90% of maximum, and emergency braking above 90%. When emergency braking is used there is a very good chance that the train will fail to stop in the required distance.

When a train enters the railway from outside or is created on the railway, then the starting speed will be as set in the timetable unless there is a reason to reduce it, for example because of adverse signals. This means that a new train should never pass a signal at danger or crash into buffers because of excess starting speed, but it may crash into an existing train if the new train isn't protected and the existing train is in its way.

6.6 Calling-on:

A train that is held outside a station by a signal, which is red because another train is preventing its entry on the track that the held train is directed towards, may be called-on by the signaller into the platform. Under these circumstances the train speed is severely restricted (30km/h max), and the train will stop adjacent to the existing train providing it is not moving towards the called-on train. Call-on availability is indicated by the  'call-on' button, and also by the same symbol flashing on the left hand side of the screen. If the signaller wishes to call-on the train then the 'call-on' button is left clicked, then the signal that is holding the approaching train is left clicked. The position lights then illuminate on the signal and unless a route or part-route has already been set an unrestricted route is created into the platform and the train proceeds into the station.



The following conditions have to be met before a call-on is available:-

- a) the approaching train has stopped at a signal but not at a location;
- b) if the blocking train is facing the approaching train it is stopped awaiting a join or change of direction, has terminated, or is under signaller control;
- c) at least one platform element is free to accept the approaching train;
- d) points (if any) are set for a direct route into the platform;
- e) the approaching train is to stop at the station;
- f) there are no more facing signals between the train and the platform;
- g) the train in front is preventing the stop signal being released for the approaching train;
- h) the train in front is not exiting at a continuation;
- i) the signal is within 4km of the platform; and
- j) the route into the platform does not conflict with any other route.

If one or more of these conditions cannot be met and the train has to enter the station then it will have to be taken under signaller control and allowed to pass the red signal. Trains under signaller control will always stop for trains in front, providing they are not moving towards the called-on train. From v1.2.0 an unrestricted route may be set from the stop signal to the platform and this will set all the points appropriately to allow a call-on.

After a train has been called-on and is stopped in the station, it can't depart until the track is clear to the next signal in front.

6.7 Performance logs:

During operation a performance log is available by left clicking the  'show performance log' button. This may be hidden again by left clicking the  'hide performance log' button. The log may be dragged to any part of or to the side of the screen by left clicking and holding down the button while the log is moved. This log shows all significant events such as arrivals, departures, changes of direction etc. For timed events, providing the time is within a minute of the scheduled time, before or after, it is classed as 'on time'. Note that at least 30 seconds must elapse between any two consecutive train events. Therefore if the scheduled departure time is the same as the arrival time, departure will occur either on time (providing the train arrived at least 30 seconds early), or 30 seconds after the arrival time. When the train is within 10 seconds

of departure the background will change to pink to indicate that the train is ready to depart, and on departure it will start to accelerate away with a grey background. The log is saved to a text file along with a performance summary, score and rating when operation stops. This is available for viewing in folder 'Performance logs'.

6.8 Signaller control

Normally trains run to a timetable, but whenever a train is stopped at a signal, by buffers or at a station, the signaller may take control by right clicking on the train and selecting 'take signaller control' from the popup menu. The train then no longer runs to the timetable, which is suspended for the duration of signaller control. It remains under the direction of the signaller until timetable control is restored.

Signaller-control mode is normally used to manoeuvre a train that has become misplaced, perhaps by arriving at an inappropriate platform, by taking a wrong route, or after a SPAD, or to remove it after a derailment or crash. Trains may also be created under signaller control (see timetable section), in which case they remain under signaller control at all times. This mode is sometimes appropriate for tram or light rail services.

All signaller commands are issued via a popup menu by right clicking on the train, and the options that are available vary according to circumstances. 'Change direction' is not available when any part of a train is on a continuation, or the element in front of a train is a continuation, because the train has then reached the point where its only course is to remain stationary or leave. 'Stop' is similarly not available if a train is on or close to a continuation, and if a train is stopping on a signaller command and it reaches a continuation then it will continue to exit - the command will effectively have been given too late. The reason for these restrictions is that the program needs to distinguish between trains entering and trains leaving at continuations, and a stopped train that is leaving can be confused with a train that should enter. 'Restore timetable control' availability depends on the circumstances when signaller control was taken. If the train was at a timetabled stop, then the train must be returned to and stopped at that location (though not necessarily at the same platform) before the timetable may be restored. If the train wasn't at a timetabled stop then the timetable may be restored whenever the train is stopped.

Note that when a stop command has been given, the train only acts on it at the end of the next full element, which is when train speeds and times are calculated for the next element. If movement by a single track element is required then select 'Step forward one element'. Note that if this is selected and there is a red signal in front then the signal element will be entered and the signal will no longer hold the train. If the train is stopping under signaller control the popup menu is not available until it has stopped.

When under signaller control the maximum running speed is 30km/h by default (for safety reasons since the train is often not protected by a route in these circumstances). This speed may be changed if required by an appropriate timetable entry (see 'Timetables' section), but it can't be changed during operation.


A train under signaller control will obey signals, stop at buffers, and also stop for trains in front that are either stationary or moving away from it (trains under timetable control

only stop - without crashing - for trains in front when entering a timetabled location). Signaller-controlled trains won't stop at timetabled locations however because the timetable has been suspended.

Note that if a train is on a route and is removed, then the signals behind the removed train won't be reset - they will stay red. In these circumstances if the route is still required it should be cancelled and then rebuilt.

When a train under signaller control (or after a call-on) has stopped because of a train in front, it won't move (unless instructed to by the signaller and the train is not immediately in front) until the train in front has passed the next forward signal, or points direct it away from the train in front .

6.9 Adjusting the timetable clock

During operation, but only when paused and not zoomed-out, clicking the  'adjust timetable clock' button brings up the adjustment screen. This disables all other functions and allows the clock speed to be slowed down or speeded up, from a slowest speed of a quarter normal, to a fastest of sixteen times normal. When the speed changes everything that is controlled by the timetable clock changes accordingly - trains, route setting, locked route clearing, etc. The clock can also be incremented by any amount by clicking the appropriate buttons as many times as is required. When the clock is incremented only the clock is affected, train positions stay the same. However if train movements were required during the time that has been skipped then they will run late.
