**PART A: USING THE "INVISIBLE SPEED-SIGNAL" TO SLOW PASSENGER TRAINS FOR STOPPING AT STATION PLATFORMS IN SESSIONS FOR S&C IN TS2009 AND TS2010**

Long sections of the S&C route have speed limits of 70 and 80mph. Within the bounds of these high-speed sections are located stations at which local passenger trains must stop. A driver with human intelligence who knows the route and the braking capability of the train will know when to slow down in advance of each station in order to stop at the platform. The AI Driver, alas, lacks somewhat in this knowledge. You may observe some trains under AI control fail to slow quickly enough on approach to a stopping station. The result is that the train either partially overshoots the platform, so only the trailing carriages service the station., or, more dramatically, the train may completely overshoot the platform, in which case the AI commands to drive to the platform and unload/load are abandoned and the station is bypassed. This overshooting is a problem in particular of stations in the Yorkshire Dales (Kirkby Stephen to Horton, inclusive).

An update of 2 S&C routes that contain the problem stations ("SnC Yorkshire Dales" and "SnC Carlisle Skipton") has been made to provide session creators with a tool to prevent platform overshoot. The "Ribblesdale" route already has this tool and does not require an update. The tool consists of combining the use of an added track asset, **Invisible Speed-Signal v2** <kuid2:137715:23002:2>, with an AI command, **priorityz** <kuid:66277:80003>. The deployment and configuration of the **Invisible Speed-Signals** and the method of using **priorityz** in AI command sequences is the subject of this document.

When you create a new session for an S&C route fitted with Invisible Speed-Signals (**IS-S**), the configuration of each IS-S will be the default one which has no effect on speed limits for any trains. Each IS-S must be found and configured to become active. You can quickly find the IS-S using the Main Menu > Find Objects tool in Surveyor if you search by following the naming convention outlined below when typing in the object-name field of the Find Objects window:

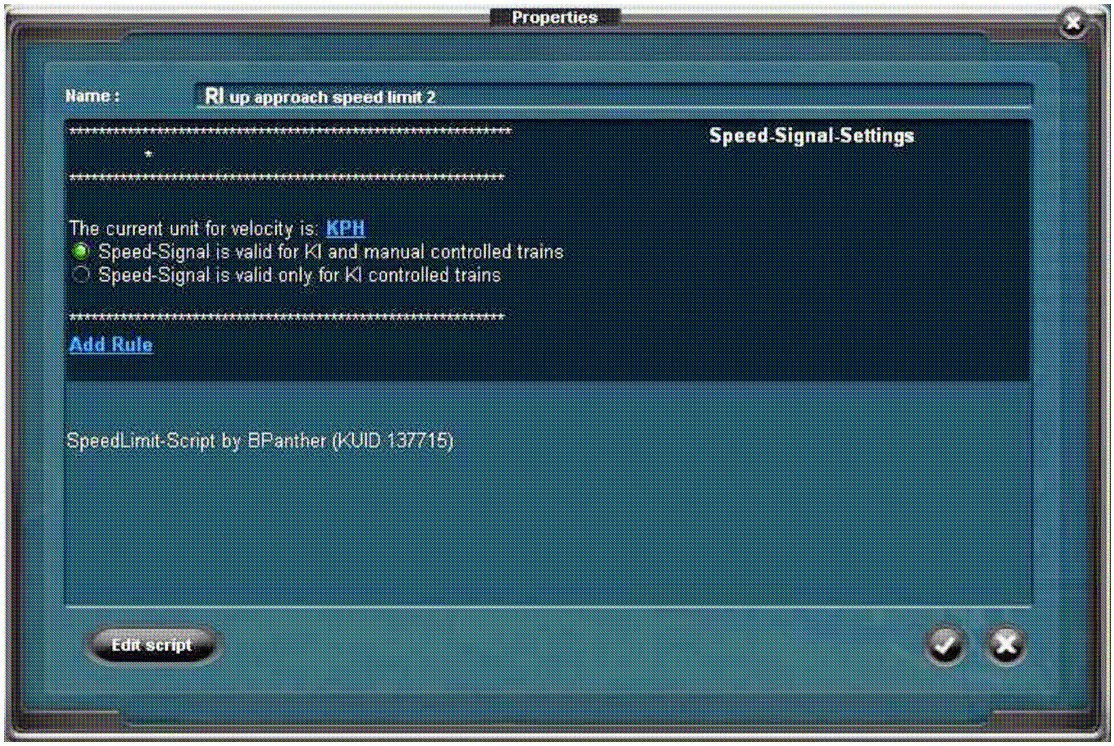
IS-S are named in the format "AA [up/dn] approach speed limit [1/2]"

where AA = 2-letter alpha code for the location
[up/dn] indicates "up" or "down" main line
[1/2] is the sequence suffix "1" or "2"

For example, the second IS-S on the up mainline approach to Ribblehead is named: “RI up approach speed limit 2”.

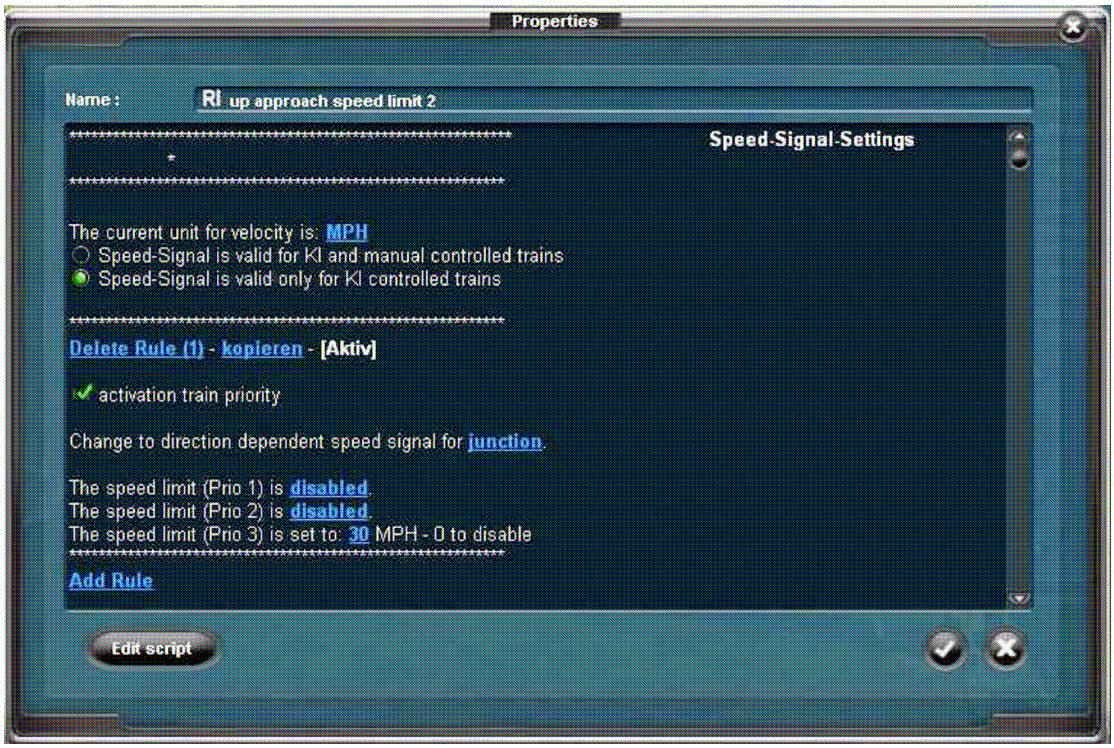
Generally there are 4 IS-S, 2 on the down and 2 on the up mainline, for each location. The first IS-S encountered on approach to a location has the suffix “1” and is located in front of the distant signal. The second has the suffix “2” and is located near the start of the yard area or 4 telegraph-pole separations away from the station on the approach without a yard. The release from the low speed limits imposed by the IS-S is usually achieved by pre-existing speed signs that are located on mainlines at yard or station exits.

Let’s configure an example IS-S. Having opened up a new session on the “SnC Yorkshire Dales” route, search for the IS-S “RI up approach speed limit 2”. When the **Edit Properties** window for this IS-S is first opened in Surveyor it will have the default setting that looks like this:




Firstly, toggle the unit for velocity from KPH to MPH to conform with imperial units used in S&C. Then click on the option “Speed-Signal is valid only for KI (AI) controlled trains” to prevent the IS-S affecting the speed limits shown on the cab HUD for manual-controlled trains – a human driver should not need these speed limit prompts for pulling up at a station. Now click on the **Add Rule** button to open a menu extension of further configuration choices.

On the extended section, check the option **activation train priority**. This will change the last 3 lines of the window to:
The speed limit (Prio 1) is **disabled**
The speed limit (Prio 2) is **disabled**
The speed limit (Prio 3) is **disabled**
You must now decide which train priority - 1, 2 or 3 - to reserve for mainline trains under AI control that are to respond to IS-S. Since Priority 2 is the default given to consists upon creation, it's probably not a good idea to reserve this for activating an IS-S response. In what follows, Priority 3 is reserved for this purpose. Therefore, click on **disabled** in the line "The speed limit (Prio 3) is **disabled**" and enter the value "30" in the entry box that appears. The configuration window should now look like this:




Now save and exit this configuration (click on the tick symbol in the bottom right hand of the configuration window), and use Main Menu > Find Objects to locate the IS-S "RI up approach speed limit 1". Select the same options as before, except enter the value "50" rather than "30" in the entry box for the Priority 3 (Prio 3) speed limit.
Now we have completed the configuration of the IS-S for the up approach to Ribblehead where a Priority 3 train under AI control will have the section speed limit of 70mph reduced to 50mph as it passes the Ribblehead up distant signal, and a further reduction to 30mph will occur when the train gets nearer the station platform.

A similar pattern of configurations should be established in the new session for all IS-S in the down and up direction along the route. Tweaking downwards of some IS-S speed limits may be necessary if it is found that a train still cannot stop at a particular station without overshooting the platform. In particular, the second IS-S in each sequence (the ones closer to the station) may need a reduction from 30 to 25mph for Priority 3 stopping trains to be captured successfully at the platform.

**The IS-S configurations set up for one session will not be carried over to other sessions on the same route. Configurations are session specific, and are not common to all sessions of a route. The default configuration will be maintained in any session that has not had the IS-S configured and saved by editing that session in Surveyor, and so will remain a passive presence in such sessions.**

A stopping train does not have to be allocated Priority 3 from the start of its journey. It may not necessarily stop all stations in traversing an S&C route. By using the **priorityz** command, the train may have its priority level adjusted as the need arises during its journey. Make sure the **priorityz** command is checked in **Surveyor Main Menu > Edit Session >Driver Commands** when creating any new session.
Take the case of a stopping train with default Priority 2 traversing the "SnC Yorkshire Dales" route. If it stops at Garsdale and then skips Dent to stop next at Ribblehead, the section of the command sequence to achieve this might simply be:

DRIVE TO GARSDALE PLATFORM 2
LOAD
DRIVE TO RIBBLEHEAD PLATFORM 1
LOAD

To take advantage of the IS-S, this should be altered to:

PRIORITYZ 3 (to enable slowing by IS-S on approach to Garsdale)
DRIVE TO GARSDALE PLATFORM 2
LOAD
PRIORITYZ 2 (to prevent being slowed by IS-S through the intervening yard at Dent)
DRIVE VIA TM BMum (a track mark beyond Dent but well before Ribblehead)
PRIORITYZ 3 (to enable slowing by IS-S on approach to Ribblehead)
DRIVE TO RIBBLEHEAD PLATFORM 1
LOAD

On departing Garsdale and Ribblehead after stopping, the speed limit for the example train will remain 30mph only until the train passes 70 or 80mph speed signs located near the yard exits.
If a train is to stop at each of a consecutive series of stations, then Priority 3 can be established prior to encountering the first IS-S of the first station in the series and maintained as such until exiting the last station in the series – no intervening reversion to Priority 2 or Priority 1 is required.

## PART B: USING INVISIBLE TRACK EXTENSIONS OR THE "INVISIBLE SPEED-SIGNAL" TO CONTROL SHUNTING SPEEDS FOR S&C IN TS2009 AND TS2010

In most instances of Railsim representations of yard areas on the S&C route, a speed limit of 15mph is set by speed signs placed at all entry points to the yard from the main lines. The limit is a good working speed for shunt operations concerned with the rearrangement of wagons. It can, however, be too high for the approach to some interactive industries located on these sidings. Relevant wagons for loading or unloading at an interactive industry can overshoot the industry trigger points unless the approach speed is lowered. A case in point on the S&C route are the ubiquitous "S and C Cattle Dock 3/4/5 pens TS2009". The loading and unloading of cattle docks under AI control can entail wagon overshoots if the consist enters the dock at the prevailing yard speed limit or the consist can fail to fully enter the dock when it is located on a siding with a short dead-end stub beyond the remote end of the dock. In the latter case the AI Driver anticipates the dead-end so the consist's progress into the dock is halted prematurely, regardless of the prevailing speed limit.

To overcome this problem for the cattle docks in the S&C route updates for TS2010, 2 strategies have been deployed according to the length of the dead-end stub beyond the remote end of the interactive industry. In what follows, solutions will be discussed for the cattle dock, but apply equally to any interactive industry on a siding.

### CASE 1 : Stub length is short such that AI Driver does not permit a consist to enter fully into the cattle dock.

When a dead end is detected by an AI Driver propelling a consist of cattle wagons towards a cattle dock, there are 2 stages to the response. With the leading wagon of the consist approximately 100 feet removed from the dead end, the consist speed is reduced to 2mph. Then at approximately 25 feet the consist is stopped and it can proceed no further. If the dead-end stub is less than 25 feet beyond the end of the cattle dock, the consist cannot fully enter into the dock.

The AI driver can be ‘fooled’ into allowing full entry to the dock by extending the dead end with invisible track (e.g. Railsim invisible track <kuid:35412:38994>). **Invisible track has been added so that the combined length of the visible stub and the invisible track is 80 feet beyond the cattle dock end. The invisible track is terminated with an invisible signal. The buffer stop at the end of the visible stub has been left as is.** As a result, an approaching consist is slowed to 2mph when the leading wagon is 20 feet (100 feet detection distance minus 80 feet extended stub) from the end of the dock, and so it is easily captured upon its encountering the trigger of the end pen of the cattle dock.

**CASE 2 : The track length beyond the cattle dock end is large such that an AI Driver of a consist pushed into the dock uses the prevailing yard speed limit for the entire dock-entry movement.**
The customary strategy in this case has been to employ fixed speed signs of 5mph facing trains entering the cattle docks and located near the leading edge of the dock. In addition, an extra 15mph fixed speed sign is used on the exit path from the cattle dock to re-establish the normal yard speed limit once the cattle dock servicing is complete. The position of this speed sign is somewhat further away from the dock than the 5mph sign since it must be ahead of the leading vehicle (the engine if the cattle wagons are propelled into the dock) when the consist leaves the dock. If there is more than one exit path from the dock, then a 15mph speed sign may have to be added to each exit path if the path branching occurs a short distance from the dock.

There are two disadvantages associated with the use of fixed speed signs in the way described above. The first arises because the use of the cattle dock track is not confined to access of the cattle dock. Other shunting manoeuvres may require the use of the track as a shunt head for sorting vehicles onto different sidings, or as a transit path to another part of the yard if the cattle dock is on a loop rather than a dead-end siding. With fixed speed signs no discrimination is possible between the purpose for which a consist enters the cattle-dock track: all entering consists will be slowed to 5mph. Secondly, AI Drivers look ahead for approaching speed signs and impose these limits prior to actually passing the sign. An AI Driver approaching a cattle dock from the other end of the yard will impose the cattle dock’s entry speed sign limit immediately and traverse the whole yard length at 5mph – time can crawl waiting for this to happen.

To overcome these disadvantages Invisible Speed-Signals (**IS-S**) have been employed in place of the fixed speed signs. The train-priority sensitivity of the IS-S is used to discriminate amongst the purposes for which the cattle-dock track is accessed. Unlike for fixed speed signs, AI Drivers do not anticipate speed limits imposed by IS-S, and so approaching trains do not impose these limits until the speed signal is passed.

In a simple case, like at Garsdale, where there is one 5mph entry speed sign near the leading edge of the cattle dock and one 15mph sign on the only exit path from the cattle dock, 2 IS-S are required. Priority 3 is again used to sensitise a consist to IS-S. However, Priority 1 could be used instead. **The entry and exit speed signs have been replaced with Invisible Speed-Signals. The entry IS-S is configured as per the image on Page 3 and given the name "GA cattle dock speed limit" and a 'Prio 3' speed limit of 5mph. Similarly the exit IS-S is given a name "GA cattle dock limit release" and a 'Prio 3' speed limit of 20mph (the prevailing speed limit for this yard).**

Prior to fitting the IS-S, an AI Driver might load cattle wagons at Garsdale by using the command sequence:

DRIVE TO GARSDALE CATTLE
LOAD
DRIVE TO TM GAlink

To take advantage of the IS-S, this should be altered to:

PRIORITYZ 3 (to enable slowing by IS-S on entry to Garsdale Cattle)
DRIVE TO GARSDALE CATTLE
LOAD
DRIVE TO TM GAlink
PRIORITYZ 2 (to prevent being slowed by IS-S during future shunting manoeuvres that might entail use of Garsdale Cattle track as a temporary wagon store and also to prevent having the speed limit unintentionally raised above 20mph due to encounters with the IS-S fitted to the main line station approaches at Garsdale for stopping passenger trains)

**COMBINING CASES 1 & 2 : There are 2 or more cattle docks on the one dead-end siding. The cattle dock nearest the dead end (inner dock) falls into CASE 1, but the docks nearer the siding junction (outer docks) fall into CASE 2.**

Lazonby, Langwathby, Appleby and Settle have 2 cattle docks adjacent to one another on the same dead-end siding. Petteril Bridge has 3 docks in a row. The inner dock at each of these locations has a very short dead-end stub beyond it. Implementing the CASE 1 alteration – extending the siding with invisible track terminated by an invisible signal – allows AI drivers propelling cattle wagons to the inner dock to stop the leading wagon at the remotest pen of the dock. However, if the target were the outer dock, then the new extended track termination is not detected early enough and the consist will need to be slowed by other means if an overshoot of the outer dock by the leading cattle wagon is to be avoided. In the S&C routes released for TS2009 there are 5mph speed signs located in front of the outer docks and 15mph dock-limit-release speed signs on the dock exit paths at Lazonby and Langwathby (Appleby already has IS-S). There are disadvantages, discussed above under CASE 2, to leaving these speed signs in place, and so these signs have been replaced with IS-S that require configuration as per CASE 2 instructions in each session where the outer docks are used.

Just as there are 2 alterations made at these locations, there are 2 patterns of AI Driver commands for accessing the cattle docks : one for the inner dock and another for the outer docks. The AI Driver propelling to the inner dock at Lazonby does not need the assistance of the IS-S, and so the consist priority should be left at or restored to 2 or 1.

PRIORITYZ 2 (required only if current priority is 3)
DRIVE TO LAZONBY CATTLE 2 (inner dock)
LOAD
DRIVE TO TM LZum

When accessing the outer dock, the IS-S are required and must have been configured in SURVEYOR for use in this session. If the outer docks are not used in a session, the default IS-S configuration can be left as is.

PRIORITYZ 3 (to enable slowing by IS-S on entry to Lazonby Cattle)
DRIVE TO LAZONBY CATTLE 1 (outer dock)
LOAD
DRIVE TO TM LZum
PRIORITYZ 2

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