

DIS114

Aspect Restriction Following Axle Counter Restoration

Issue 24

Author:
Steve Taylor, Atkins.

Approved by:



Chairman, SSI Applications Group

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This document forms SSIAG's interim guidance on this topic pending the production of an update to the relevant chapter(s) of the SSI Applications Manual.

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1. Document Status

This document has been prepared for the SSI Signalling Applications Group (SSIAG) and was approved at the meeting on 18/09/2013.

2. Scope

This paper contains data for the control and indication of Aspect Restriction following axle counter restoration from both a VDU signallers display system via a Solid State Interlocking.

Reference should be made to SSI DIS112 for the core restoration data applied to axle counters controlled via an NX panel. To avoid excessive changes to this document the restoration data examples shown apply to VDU systems only, unless stated otherwise.

Abbreviations

ARFR Aspect Restriction Following Restoration

EPR Engineer's Possession Reminder

MMI Signaller's Display System

STR Special Train Reminder

NX Entrance/Exit

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A.1 Requirements

Network Rail Documents

Axle Counter System Operational and Safety Principles
NR/L2/SIG/30080 Issue 1 05/09/2009

Axle Counter System Design Principles & Generic Application Rules
NR/L2/SIG/30081 Issue 1 05/09/2009

A.2 Brief Description of Data

Aspect Restriction following axle counter restoration (ARFR) is a requirement of the Axle counter concept safety case. Aspect Restriction is not required after use of the Engineer's Possession Reminder (EPR) or after use of the Special Train Reminder (STR) unless Aspect Restriction was in place before and it has not been possible to remove the Aspect Restriction while the reminder was in place. This paper is concerned with the application of Aspect Restriction, the restriction of signal aspects and the removal of Aspect Restriction. For details of axle counter reset/restoration and EPR/STR please see DIS-112.

A.3 Principles of Aspect Restriction

The following is a brief outline of requirements for application of Aspect Restriction, for full details see Axle Counter System Operational and Safety Principles NR/L2/SIG/30080 and Axle Counter System Design Principles & Generic Application Rules NR/L2/SIG/30081.

When an axle counter section is successfully restored an Aspect Restriction Reminder is applied to the section. The application of an Aspect Restriction Reminder may invoke Aspect Restriction on routes reading over the section or routes that are foul of the section depending on the type of signal and class of route. Aspect Restriction is used to enforce a sweep operation under Rule Book Regulation 9 but with the benefit of having the route set.

A latch or latches, depending on the complexity of the section, will be provided for each axle counter section. These latches can be used to prevent the signal from showing a proceed aspect and they will also be used to indicate which sections and which parts of sections will Aspect Restrict a signal.

If, at the time of restoration, an EPR or STR were applied to the section, Aspect Restriction will not be applied.

To remove Aspect Restriction a sweep of the section at low speed is required to ensure the section is clear of any vehicle(s) and this is carried out by the signaller instructing the driver to pass the signal at danger, and examine the line in accordance with Rule Book Regulation 9. In certain circumstances it is possible for the driver to inspect parts of the section that are parallel to the route being traversed.

A Restricted Route Indication will be provided on the MMI for all main controlled signals and position light signals associated with a main aspect that are Aspect Restricted, to show when a route has been set, with the entrance signal reminder device (reminder device only applies to VDU controlled systems), applied and the only conditions holding the signal at red are Aspect Restriction and approach release conditions. This allows the Signaller to regard the signal as operational (rather than defective) when instructing the driver to pass the signal at red. When a Restricted Route is set the signal will be approach locked, it will also inhibit 'Auto' working and stepping up from a Warner to a Main class of route. The signaller must cancel the Restricted Route manually. TORR is not effective because the signal is passed at red.

Aspect Restriction and Restricted Route Indications will be provided as follows: -

Main Controlled Signals – shall be restricted to red (except tunnel signals) and a Restricted Route Indication will be provided. See Section A.6.1.

Tunnel Signals - If the driver can be cautioned at the Tunnel Entrance Signal then the Entrance Signal will be restricted to red with a Restricted Route Indication and the Tunnel Signal will be released to a proceed aspect. This proceed aspect will be limited to a single yellow by holding the Exit Signal at red until the train has passed the Tunnel Signal. If the driver cannot be cautioned at the Entrance Signal then the Tunnel Signal will be restricted to red with a Restricted Route Indication. See Section A.6.2.

Distant Signals – shall be restricted to single yellow, and the stop signal in rear shall be restricted to red. A Restricted Route Indication will not be provided for Distant Signals. The data will be of the same format as Automatic Signals. See Section A.6.3.

Banner Signals – shall not be Aspect Restricted.

Automatic Signals – shall be restricted to red. A Restricted Route Indication will not be provided. See Section A.6.3.

Position Light Signals associated with a Main – Aspect Restriction and associated Restricted Route Indication will only be provided in the following circumstances: -

- a) Where the driver of a train using a shunt route may be required to examine a parallel part of the same track section that is imposing Aspect Restriction on a route. This will normally only apply in the case of trap points, see Section A.8.6.
- b) If a call-on or permissive shunt route (with no equivalent non-permissive shunt route) is used that always requires a specific track section in route to be occupied, the driver may anticipate that occupation state, and therefore may not drive with suitable caution over an intervening section that has been restored. Therefore, call-on and permissive shunt routes shall be Aspect Restricted UNLESS the section that has been restored is the permissive section.
Note: If permissive and non-permissive shunt routes are provided or a permissive route requires a track section occupied OR clear, the position light signal will not be Aspect Restricted and the signal may be cleared.
- c) If there are both main and shunt/call on routes over the reset section then for consistency aspect restriction should be applied to all routes from that signal. (See NR/L2/SIG/30081 Section 6.4.9 Note 1.)
See Section A.6.1

Ground Position Light Signals – shall not normally be aspect restricted; they shall only be Aspect Restricted in cases a) and b) above as for Position Light Signals associated with a Main. A Restricted Route Indication will not be provided, as it is impractical to display the Restricted Route Indication and Electric Traction Reminder simultaneously on the Replacement Target. See Section A.6.4.

Preset Signals – Ground Position Light Signals in Preset 'mode' shall be Aspect Restricted when the associated main route is restricted. A Restricted Route Indication will not be provided. See Section A.6.5.

Note: Call-on and shunt routes may be used to sweep a section and remove Aspect Restriction, even when these routes are not Aspect Restricted themselves.

A.4 Identities and Indications

A.4.1 Latch Identities

An additional latch or latches are required for each section that can have Aspect Restriction applied. The number of latches depends on the conditions needed for the release of Aspect Restriction. A simple section will only require one latch and this latch will be named after the axle counter section. In the case where the section has multiple release conditions a latch will be required for each part of the section with different release conditions, the latch will be generally named after the axle counter section and the points position. Where a section contains point ends, there may be a latch that applies to the common and normal or reverse part of the section, the latch for this common section will be named (LTXXXX(COMM)-R).

In all cases the latch will be set to apply Aspect Restriction.

The following additional identities are required.

Aspect Restriction Latch for a Section with One Release Condition

L<Track id>-R

e.g. LTKRTN-R

Aspect Restriction Latches for a Section with Multiple Release Conditions

L<Track id>(<Point id & Direction or Description>)-R

e.g. LTKRGG(KR665N)-R / Normal part of section.

LTKRGG(KR665C)-R / Common part of section.

LTKRGG(KR665R)-R / Reverse/Foul part of section.

or LTKRCC(KR609R)-R / Reverse/Foul part of section.

LTKRCC(COMM)-R / Combined common part of section

or LTKRBB(KR610N)-R / Normal part of section.

LTKRBB(COMM)-R / Combined common part of section

Aspect Restriction Latches for Diamond Crossings

L<Track id>(<Point id & F or Description>)-R

e.g. LTKRAD(COMM)-R / Combined common part of section

LTKRAD(KR620F)-R / Part of section foul of a flank route over 620 points

LTKRAD(KR621F)-R / Part of section foul of a flank route over 621 points

Route Aspect Restriction Latches

A latch is required for each route that has Aspect Restriction. Single button controlled signals will also be provided with a latch, even though there is no route associated with the signal. This latch will allow the Restriction data to be processed in the RSU data. This latch will be set when any track section that applies Aspect Restriction to that route is restored. This latch will not be provided for automatic signals.

L<Route id>-R / Route Aspect Restriction latch

e.g. LRKR3310A(M)-R

LR<Signal id>-R / Route Aspect Restriction latch for single

e.g. LRKR3306-R / button controlled signals

Where there is more than one class of route to the same destination and the Aspect Restriction requirements are the same, a common Route Aspect Restriction latch may be provided.

e.g. LRKR3310B(M/W)-R

Restricted Route Indication and Status Latches

Two latches are required for each signal that has a Restricted Route Indication. One is used to record the Restricted Route Status and one to control the Restricted Route Indication, if the route has been set, the signal reminder device has been set (if applicable) and the signal is ready to clear except for approach release conditions and Aspect Restriction.

L<Signal id>(RR)S / Restricted Route Status latch
 e.g. LSKR3310(RR)S
 L<Signal id>(RR)I / Restricted Route Indication latch.
 e.g. LSKR3310(RR)I

Mid Tunnel Latches

If there is a stop signal provided in a tunnel and the signalling system does not normally allow a train to stop at that signal then an additional latch will be provided for this signal. This latch is used to prove the train has been cautioned at the entrance signal. If the train has been cautioned at the entrance signal the mid tunnel signal will be allowed to clear to a proceed aspect.

L<Signal id>(CAU) / Train Cautioned latch
 e.g. LSKR3310(CAU)

A latch is also required to delay the Restricted Route Indication for the tunnel signal for one major cycle. This prevents a Restricted Route Indication being shown briefly on the tunnel and entrance signal at the same time.

L<Signal id>(RR)DEL
 e.g. LSKR3312(RR)DEL

A.4.2 Indication Identities

For each of the above latches, apart from the Route Aspect Restriction latch (LRKR3310A(M)-R) the Restricted Route Status latch (LSKR3310(RR)S) and the Mid tunnel latches; Train Cautioned latch (LSKR3310(CAU)) and the Restricted Route indication delay latch (LSKR3312(RR)DEL), a non-flashable indication will be required, the name format of this indication will be the same as above but with an 'I' instead of the leading 'L'.

e.g.

ITKRTN-R

ITKRGG(KR665N)-R
 ITKRGG(KR665C)-R
 ITKRGG(KR665R)-R

ITKRAD(COMM)-R
 ITKRAD(KR620F)-R
 ITKRAD(KR621F)-R

ISKR3310(RR)I

A.4.3 Indications

For a VDU controlled system, indications must be provided to aid testing on the DWS. These indications are provided for testing purposes only as the MMI will use the latches to control its own indications.

For an NX Panel controlled system, separate indications will be provided on the panel to show which section (or part of section) has aspect restriction applied and to show the restricted route status when a route is set over a section with aspect restriction applied and the signal is ready to clear except for approach release conditions and the aspect restriction. Aspect Restriction latches are provided for each part of a section that requires separate release of Aspect Restriction. These latches will drive indications that will show whether a

section or part of a section has Aspect Restriction applied. These indications are provided for testing purposes only as the MMI will use the latches to control its own indications. The Aspect Restriction indication will be illuminated when Aspect Restriction has been applied to the section or part of the section as shown below.

POD file:

Section with one release condition

```
if LTKRTN-R s then ITKRTN-R s else ITKRTN-R xs \
```

Section with multiple release conditions

```
if LTKRGG(KR665N)-R s then ITKRGG(KR665N)-R s else ITKRGG(KR665N)-R xs \
if LTKRGG(KR665C)-R s then ITKRGG(KR665C)-R s else ITKRGG(KR665C)-R xs \
if LTKRGG(KR665R)-R s then ITKRGG(KR665R)-R s else ITKRGG(KR665R)-R xs \
```

A Restricted Route Indication will be provided for each main controlled signal.

```
if LSKR3310(RR)I s
then ISKR3310(RR)I s
else ISKR3310(RR)I xs
\
```

Other indications may be provided to assist in the testing of the data, but as these are superfluous to the data needed to control and indicate Aspect Restriction they are not shown in this paper.

A.5 Aspect Restriction Application

A.5.1 Applying Aspect Restriction

To apply an Aspect Restriction to a track section, a command to set the Aspect Restriction latch is included with the axle counter restoration commands (shown below in bold). The Aspect Restriction is applied on successful restoration of the track section. The Route Aspect Restriction latches for the routes reading over the track section will also be set here. This will include all routes that traverse this track section (this does not include separate overlap track sections) and all routes that are restricted by a segment of the section (see Section A.8).

Data in DIS 112 Section A.3.9 is amended as follows: -

IPT file: (For VDU Controlled Systems)

```
*TKRTN(REST)I/P
  if L(04)(REST)2 s
  then if E(04)(REST)O/P > 12
        then L(04)(REST)FAILED s
        else if TKRTN c
              then LTKRTN(REST)1 xs
                  @(REST)I/P
                  LTKRTN-R s / (a)
                  <Route Aspect Restriction Latch(es) set> / (b)
```

```
\
\
\
```

IPT file: (For Panel Controlled Systems)

```
*TKRTN(REST)I/P
    if E(04)(REST)O/P > 12
    then L(04)(REST)FAIL s
    else if TKRTN c
        then @(REST)I/P
            LTKRTN-R s / (a)
            <Route Aspect Restriction Latch(es) set> / (b)
```

- (a) Additional controls may be required if the track section contains a point end. See Section A.8.
 (b) A Route Aspect Restriction latch is set for each route that is Aspect Restricted by track KRTN. See Section A.8.

A.5.2 EPR/STR Override of ARFR

Where a section could enforce ARFR, the following data is added to the axle counter restoration commands as shown below in bold. The control will prevent the setting of Aspect Restriction latch(es) following restoration if EPR or STR are applied to the track section.

Data in DIS 112 Section A.3.9 is amended as follows: -

IPT file: (for VDU Controlled Systems)

```
*TKRTN(REST)I/P
    if L(04)(REST)2 s
    then if E(04)(REST)O/P > 12
        then L(04)(REST)FAILED s
        else if TKRTN c
            then LTKRTN(REST)1 xs
                @(REST)I/P
                    if LTKRTN(EPR) xs / (a)
                    LTKRTN(STR) xs / (b)
                    then LTKRTN-R s / (c)
                    <Route Aspect Restriction latch(es) set> / (d)
```

IPT file: (for Panel Controlled Systems)

```
*TKRTN(REST)I/P
    if E(04)(REST)O/P > 12
    then L(04)(REST)FAIL s
    else if TKRTN c
        then @(REST)I/P
            LTKRTN(REST) xs
            if LTKRTN(EPR) xs / (a)
            then LTKRTN-R s / (c)
            <Route Aspect Restriction Latch(es) set> / (d)
```

- (a) Override of Aspect Restriction by Engineers Possession Reminder
- (b) Override of Aspect Restriction by Special Train Reminder. (Note STR for a panel controlled system is not covered by this document.)
- (c) Additional controls may be required if the track section contains a point end. See Section A.8.
- (d) A Route Aspect Restriction latch is set for each route that is Aspect Restricted by track KRTN. See Section A.8.

A.5.3 Aspect Restriction Following Interlocking Startup

No FOP file start-up data is required for Aspect Restriction latches.

A.6 Restriction Of The Signal Aspect

A.6.1 Main Controlled Signals and Position Light Signals Associated with a Main Aspect / Restricted Route Controls

The following additional data (shown below in bold) will maintain the aspect at red when Aspect Restriction is applied to relevant track sections in route. This data shall also be provided for single button controlled signals.

The first part of the data is positioned in the RSU section of the signal special to reduce the impact on timing constraints. The subroutine called from the RSU data should be positioned immediately below the relevant route control data. All Aspect Restriction latches for sections in the line of route need to be tested unset except for sections in the overlap of the signal ahead. Also foul parts of sections not directly in the route need to be tested unset. It is not necessary to test all segments of a section, by looking at how the latches are unset as trains move over the section it is possible to reduce the number of latches that need to be tested to one per section. This reduction in the number of latches tested will reduce the timing impact of the data.

If the signal has a current proved route indicator for the route then the Restricted Route Status latch needs to be tested unset in the Route/Junction Indicator (RJI) section otherwise the Restricted Route Status latch needs to be tested unset in the Aspect Sequence Data (ASD). If aspect restriction data and TORR data is provided in the ASD the TORR data construct should be nested so the LSxxxxTOR1 latch is only set when the signal is showing a proceed aspect. When the Restricted Route Status latch is tested this will restrict the signal to red and maintain the restriction until the route is cancelled.

The Restricted Route Indication will show that the route has been set, the signal reminder device has been set (for VDU controlled systems only) and the signal is ready to clear except for approach release conditions and Aspect Restriction.

Where Aspect Restriction is required for Position Light Signals associated with a Main Aspect, as detailed in Section A.3, the data will be the same format as detailed below for a Main Signal.

As a result of this data change, where the signal controls require a 'Ready to clear' condition the control tables will need to state either –

- i) *Route set, Aspect Restriction not applied in route and signal ready to clear except for approach release and temporary approach release controls.* This will equate to SKR3310 set ascon , LSKR3310(RR)S xs , SKR3310 clear bpull. This control will need to be tested in the ASD (or RJI where appropriate), to allow Restricted Route Indication for consecutive signals.
- or
- ii) *Route set and signal ready to clear except for Aspect Restriction controls applied in route, approach release and temporary approach release controls.* This will equate to SKR3310 set ascon.

\ . / ASD

When the route is cancelled by pulling the entrance button or by operation of a signal group replacement control (SGRC see SSI8003-56) the Restricted Route Status latch will need to be unset. The **QXS request** and the **SGRC request** for the signal should include the following data: -

SKR3310 set bpull
LSKR3310(RR)S xs / Restricted Route cancelled.

A.6.1.1 Warner Route- Inhibition of Stepping Up

If the route is a Warner class route and a Restricted Route has been set, route step up must be inhibited. The data for stepping up from a Warner to a Main route must be placed after the Aspect Restriction and modified as follows: -

OPT file:

```
if LRKR3310A(W)-R s / Only when Aspect Restriction has been applied to a section in
then @LRKR3310A(W)-R / route is the subroutine called.
\
```

```
if RKR3310A(M) a , S3310 set r+ascon
LSKR3310(RR)S xs
RKR3312A(M) s , S3312 set stick
TKRTR c , PKR642 cdn
then RKR3310A(W) xs , RKR3310A(M) s
OKRTR-BA l
\ . / RSU
```

A.6.1.2 Restricted Route Indication

An indication will be provided to show when the Restricted Route Indication has been set. This will be located adjacent to the relevant signal on an NX panel and is provided for testing purposes for a VDU controlled system. The data will be as follows.

POD file:

```
if LSKR3310(RR)I s then ISKR3310(RR)I s else ISKR3310(RR)I xs \
```

A.6.1.3 Restricted Route Approach Locking Controls

When the route is set the interlocking will decide whether the route is a normal or Restricted Route, if a Restricted Route is set a restricted route indication will illuminate on a NX panel or a red reminder indication will appear around the signal on the MMI display and the signal will become approach locked. The data to approach lock the signal is provided in the OPT file as shown below in bold. The data below to approach lock the signal will not be provided for single button controlled signals.

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OPT file:

*024

```
'SKR3310
  RKR3310A(M) s , @RKR3310A(M)
  RKR3310A(W) s , @RKR3310A(W)
  RKR3310B(S) s , @RKR3310B(S)
  G s 7
```

\$

```
if LSKR3310(RR)I s
then SKR3310 clear foal
\
```

/ (a)

. / end of tgm

(a) It is not necessary to provide this data to clear the foal bit when the signal has 'Conditional Double Red' controls. AMD05-01 section 9.4.3 (new SSI8003-85 section 2.3.2) requires that, where the "two reds rule" applies, the inner signal should be approach locked when the signal is ready to clear, by clearing the foal bit when the ACZ latch is set. If the signal also has axle-counter Aspect Restriction, then it is only necessary to clear the foal bit as per AMD05-01.

Where 'Conditional Double Red' applies, the outer signal should be allowed to clear unconditionally when the route from the inner signal is set and approach locked, even if the inner signal is Aspect Restricted following an axle-counter reset.

A.6.1.4 Inhibition of Auto Working

When a route is set and Aspect Restricted the automatic operation of the signal (if provided) will be inhibited. This is done in the PRR file in the automatic working request. The following data shown in bold should be added to the automatic working request.

PRR file:

```
*QAUKR3310      if RKR3310A(M) s , LRDAKR3310 xs
                  LRKR3310A(M) -R xs
                  LSKR3310(RR)S xs
                  then SKR3310 set auto
                  \ .
```

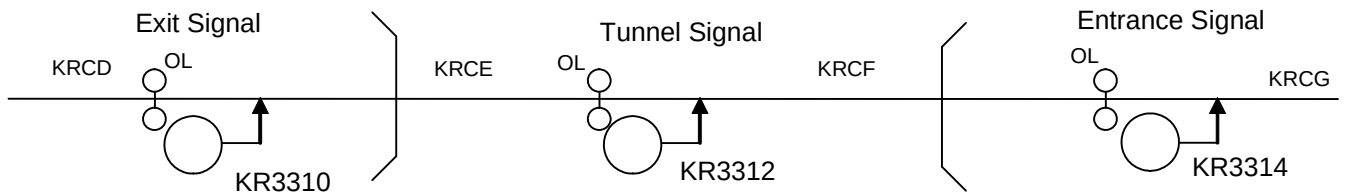
/ (a)

/ (b)

(a) Prevents 'Auto' bit setting if Aspect Restriction applied. This test is required to prevent Auto working being applied before the data is processed in the OPT file to set the Restricted Route Status latch.

(b) Prevents 'Auto' bit setting if Aspect Restriction removed but the 'Restricted Route' has not been cancelled.

A.6.2 Tunnel Signals



Where a stop signal is provided in a tunnel and the interlocking does not normally allow a train to stop at it then the Aspect Restriction controls will need to be modified. Restoration of an axle counter section in advance of the tunnel signal will require the entrance signal and the tunnel signal routes proved normal. Following restoration of an axle counter section in advance of a tunnel signal, the signal/route controlling entry to the tunnel shall be restricted to red. This restriction shall apply regardless of whether the track section in advance of the tunnel signal is actually within the tunnel or not.

Following restoration of an axle counter section in advance of a tunnel signal, if the driver of the train can be cautioned at the entrance signal then the tunnel signal will be released to a proceed aspect and a Restricted Route Indication will not be provided for the tunnel signal (a Restricted Route Indication will be provided for the entrance signal). The Tunnel signal will be limited to showing a maximum single yellow aspect by not allowing the exit signal to show a proceed aspect until the train has passed the Tunnel Signal. If it is not possible to caution the driver at the entrance signal then the tunnel signal shall be restricted to red and a Restricted Route Indication will be provided for the tunnel signal.

The changes needed to the data for the entrance and tunnel signal are shown below.

A.6.2.1 Entrance Signal.

The data provided for this signal will be the standard data with some additions to Aspect Restrict this signal to red and provide a Restricted Route Indication if Aspect Restriction has been applied to track sections in the route of the tunnel signal. As the entrance signal is Aspect Restricted when restriction is applied to the tunnel signal, when applying Aspect Restriction to a track section in the route of the tunnel signal the Route Aspect Restriction latch of the entrance signal needs to be set. Data in DIS 112 Section A.3.9 is amended as follows:

IPT file:

```
*TKRCE(REST)I/P
  if L(04)(REST)2 s
  then if E(04)(REST)0/P > 12
    then L(04)(REST)FAILED s
    else if TKRCE c
      then LTKRCE(REST)1 xs
        @(REST)I/P
        if LTKRCE(EPR) xs      / Override of ARFR by EPR or STR.
          LTKRCE(STR) xs
        then LTKRCE-R s
          LRKR3312-R s
          LRKR3314-R s        / Route Aspect Restriction latch
                               / for the entrance signal set.
```

The entrance signal should be maintained at red while a track section has an Aspect Restriction latch applied in either the entrance signal route or the tunnel signal route. If the tunnel signal is restricted then the entrance signal will provide a Restricted Route Indication as long as the route from the tunnel signal is set and ready to clear. Data is also provided to set the (CAU) latch if the entrance signal is showing a Restricted Route Indication.

OPT file:

Data in the RSU part

```

if LRKR3314-R s / Only when Aspect Restriction has been applied
then @LRKR3314-R / to a section in route is the subroutine called.
\ . / RSU

*LRKR3314-R
  if LTKRCF-R xs / All relevant restrictions removed inc. foul sections.
    LTKRCE-R xs / Aspect Restriction for tunnel signal removed see note i).
  then LRKR3314-R xs / Aspect Restriction on Restricted Route cancelled.
  \
    if SKR3314 clear bpull / Ensures that signal replacement cancels the Restricted Route
      / Indication and does not leave the signal flashing when the route
      / has released, using comprehensive look back.
      LRKR3314-R s / Route is Aspect Restricted.
      then LSKR3314(RR)S s / Restricted Route Status set.
        if LRDKR3314 s / Proves signaller has applied the entrance signal
          / reminder. (Not required for panel controlled systems.)
          SKR3314 set ascon / Aspect controls proven for Restricted Route.
          SKR3312 set ascon / Proves Tunnel Route set and ready to clear.
          then LSKR3314(RR)I s / Restricted Route Indication set.
            if LRKR3312-R s / If the tunnel signal is Restricted when the entrance
              TKRCG o / has RRI and is being passed by the train
              TKRCF o
              then LSKR3312(CAU) s / then allow the tunnel signal to clear.
              \
            else LSKR3314(RR)I xs / Restricted Route Indication cancelled.
          \
        else LSKR3314(RR)I xs
      \
    \
  \
\

```

i) It is important that when testing Aspect Restriction removed for the tunnel signal, to use the individual track latches rather than the Route Aspect Restriction latch. This overcomes the potential problem of KR3314 signals (RR)S latch remaining set after Aspect Restriction has been applied to KR3312 signal. This occurs because KR3312 signal will show a proceed aspect and hence could TORR before allowing the Aspect Restriction route latch to unset.

The entrance signal should not be allowed to clear if EPR has been applied to the tracks between the tunnel signal and its exit or STR has been applied and a train has travelled over the track section. The OPT data for the entrance signal needs to be altered to add in the tests for the EPR and STR, this change is shown below in bold. Also other changes are needed to the data to prevent signals prematurely clearing and to prevent irregular Restricted Route Indications, these changes are also shown below in bold.

PRR file:

```
*QRKR3312
  if LRDKR3312 xs , LRDEKR3312 xs
    LRDKR3310 xs , LRDEKR3310 xs
  then @RKR3312
  \ .
```

```
*QZR3312
  @RKR3312 .
```

```
*RKR3312
  if RKR3312 a , LSG(01) xs
  then if RKR3312 xs
    then LSKR3312(RR)S xs
    \
    RKR3312 s
    UKRCE-AB l
    SKR3312 clear bpull
```

```
\
```

When the train has passed the tunnel signal the Train Cautioned latch can be unset, as it no longer needs to be set to allow the tunnel signal to release to a single yellow. The Train Cautioned latch is unset in the RSU part of the opt data for the tunnel signal. Also for the tunnel signal the Restricted Route Indication should only be displayed when the signaller is required to caution the driver at the tunnel signal (when it has not been possible to caution the driver at the entrance signal). A delay of a major cycle is provided for the Restricted Route Indication on the tunnel signal to prevent the Restricted Route Indication for the tunnel and entrance signal briefly indicating at the same time.

.....

OPT file:

Data in the RSU part

```

if TKRCE o
then LSKR3312(CAU) xs           / Unsets the latch when the train passes through the route.
else LKR3312TOR1 xs
\
if LRKR3312-R s
then @ LRKR3312-R
\
. /RSU

*LRKR3312-R
  if LTKRCE-R xs
  then LRKR3312-R xs , LSKR3312(CAU) xs           / Unsets the latch if Aspect Restriction
  \                                           / no longer applied.
  if SKR3312 clear bpull
  LRKR3312-R s
  then LSKR3312(RR)S s
    if LSKR3312(RR)DEL s           / Minor cycle delay added to SKR3312 Restricted Route Ind.
    then LSKR3312(RR)I s
    \
    if LRDKR3312 s           / (Not required for panel controlled systems.)
    SKR3312 set ascon
    LSKR3314(RR)I xs
    LSKR3312(CAU) xs           / Only allows the Restricted Route Indication to be shown
    then LSKR3312(RR)DEL s       / if the driver needs cautioning at the tunnel signal.
    else LSKR3312(RR)I xs , LSKR3312(RR)DEL xs
    \
  else LSKR3312(RR)I xs , LSKR3312(RR)DEL xs
  \
\

```

A.6.2.3 Exit Signal.

If the driver has been cautioned at the Entrance signal and the Tunnel Signal is able to clear to a proceed aspect then this aspect should be limited to a maximum single yellow. This will be achieved by holding the Exit signal at danger until the train has passed the Tunnel signal. The Train Cautioned latch and KR3314 Restricted Route Indication latch will be used to do this, within the OPT data for KR3310. The data is shown below with the changes shown in bold

OPT data:

Route without a current proved route indicator

```

. / No RJI

G s 7 \
if LSKR3310(RR)S xs           / Aspect Restriction not applied
  KSKR3312(CAU) xs           / or driver cautioned at entrance signal.
  ( LSKR3314(RR)I xs or LRKR3312-R xs )
then SKR3308 seq 4 , G s 7654 / Normal unrestricted sequence.
  if TKRCE o                 / Nest the TOR1 latch so it is only set if the signal
  then LKR3310TOR1 s         / shows a proceed aspect.
  \

```

A.6.3 Automatic Signals

A.6.3.1 Restricting the Aspect

Automatic signals will have their Aspect Restricted to red when Aspect Restriction is applied to a relevant track section. A Route Aspect Restriction latch will not be provided for automatic signals and the Aspect Restriction latches will be tested directly in the aspect sequence data of the signal special. A Restricted Route Indication will not be provided for automatic signals, therefore Restricted Route Status and Indication latches are not required.

OPT file:

Data in the RSU part

. / No RSU

Data in the ASD part

. / No RJ1

```
G s 7 \
if LTKRTN-R xs , LTKRTP-R xs / Aspect Restriction not applied.
then SKR3314 seq 4 , G s 7654 / Normal unrestricted sequence.
\ / ASD
```

A.6.4 Position Light Ground Signals

A.6.4.1 Restricting The Aspect

Position Light Ground Signals are not normally Aspect Restricted. If Aspect Restriction is provided (see Section A.3) a Restricted Route Indication will not be provided; therefore a Restricted Route Indication latch is not required. The Restricted Route Status Latch will be used to Aspect Restrict the GPLS, this will ensure that the signal will remain Aspect Restricted until the route is cancelled by pulling the entrance button.

The data in Section A.6.1 will be modified as shown and approach locking as shown in Section A.6.1.3 will not be provided.

OPT file:

Data in the RSU part

```
if LRKR1210A-R s / Only when Aspect Restriction has been applied
then @LRKR1210A-R / to a section in route is the subroutine called.
\ . / RSU
```

```
*LRKR1210A-R
if LTKRTN-R xs / All relevant restrictions removed inc. foul sections.
LTKRTM-R xs
then LRKR1210A-R xs / Aspect Restriction on Restricted Route cancelled.
\
if SKR1210 clear bpull
LRKR1210A-R s
then LSKR1210(RR)S s / Status latch used to Aspect Restrict the GPLS.
\
```

\

Route without a current proved route indicator

```

G s 3 \
if LSKR1210(RR)S xs . / No RJI
then SKR1210 set s , G s 3 , G c 2 / Aspect Restriction not applied.
    if TKRTL o / Normal unrestricted sequence.
    then LSKR1210TOR1 s / Nest the TOR1 latch so it is only set if the signal
    \ / shows a proceed aspect
\ . / ASD

```

Route with a current proved route indicator

```

if TKRTV o \ . / TAC
if TKRTV o> 10
    LSKR1210(RR)S xs / Aspect Restriction not applied.
\
G s 1 . / RJI
G s 3 \
SKR1210 set s , G s 3 , G c 2
if TKRTL o
then LSKR1210TOR1 s
\ . / ASD

```

When the route is cancelled by pulling the entrance button the Restricted Route Status Latch needs to be reset, this is done in the route cancellation request in the PRR file. The following data shown in bold should be added to the route cancellation request.

PRR file:

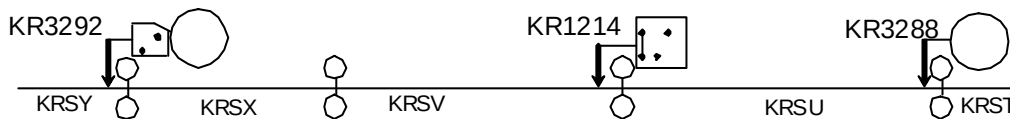
```

*QXSKR1210          SKR1210 set bpull
                    LSKR1210(RR)S xs . / Restricted Route cancelled.

```

A.6.5 Preset Shunts

A.6.5.1 Restricting the Aspect



This section will only apply to signal KR1214 in preset mode. It does not apply to a shunt route set from KR3292 to KR1214 or from KR1214.

If Aspect Restriction has been applied to a track section between signals KR3292 and KR3288 and then a route is set between these two signals it is necessary to restrict the aspect of signal KR1214 (as well as Aspect Restricting signal KR3292). The Route Aspect Restriction latch and Restricted Route Status latch for signal KR3292 will be tested in the ASD part of the OPT data for the preset signal. This data is shown below with the difference highlighted in bold.

As signal KR1214 is a position light ground signal the data for the (RR)S and the (RR)I latch will not be provided for this signal.

OPT file for KR1214 Preset route:

```
G s 3 \
if LRKR3292-R xs , LSKR3292(RR)S xs / Aspect Restriction not applied to presetting signal.
  ( SKR3292 clear bpull ( TKRSY o or SKR3292 set tac )
    or LKR1214(PS)OFF s
  )
then SKR1214 set s , G s 2 , G c 3 / Normal unrestricted sequence.
\ . / ASD
```

If the preset signal has a lamp-proved route-indicator, then the above controls will be in the RJ1 data.

Additional controls are required to prevent LKR1214(PS)OFF latch being set when the signal is in Restricted Route mode and it has been button replaced ahead of the train.

Data must be positioned before KR3292 signal special:

```
if LKR1214(PS)OFF xs , KRSY o , KRSX o , RKR3292 s
then @SKR1214(PS)OFF
\

*SKR1214(PS)OFF
  if SKR3292 set <r
  then LKR1214(PS)OFF s
  else if SKR3292 alt> 0 , LRKR3292-R xs (a)
    then LKR1214(PS)OFF s , SKR1214 set bpull+foal
  \
\
```

(a) Where there is more than one route the Aspect Restriction latch unset will need to be tested with the appropriate route set i.e.

(RKR3292A s , LRKR3292A-R xs or RKR3292B s , LRKR3292B-R xs).

A.6.5.2 Preset Shunt EPR/STR Controls

If KR3292 is held at red by the application of an EPR or STR then the preset signal shall not be allowed to clear. Although these controls are proved in SKR3292 set ascon, which is proved in SKR1214 aspect controls they also need adding in to the aspect control data individually. This ensures that if the preset shunt is replaced in an emergency after a train has entered the route (and is still on the approach side of the preset shunt signal) the application of an EPR or STR will prevent the preset shunt from re clearing if the route is re stroked.

OPT file for KR1214 Preset route:

```
if ( RKR3292 s , SKR3292 set ascon or LKR1214(PS)OFF s )
  TKRSU c
  LTKRSU(EPR) xs
  LTKRSU(STR)USED xs
  SKR3288 set lp \ . / ACD
```

A.6.6 Miscellaneous Considerations

A.6.6.1 Time of Clearance Controls

Where controls are required at the time of clearance (see SSI8003-10G section 1.2.4) consideration will need to be given to the 'Restricted Route'.

For example if a set of points are required at time of clearance only, additional controls may be required so that the points are also proved at the time of 'Restricted Route' indicating. The additional data is shown in bold.

```
( PKR382 cdn or SKR3320 set <r or LSKR3320(RR)I s )
```

A.6.6.2 TPWS –Approach Release Relief

If 'Approach Release Relief' controls are provided, they will require amending to allow the signal to display a proceed aspect up to a signal with a failed TPWS, if the signal ahead has a 'Restricted Route Indication'.

TPWS methods 1a and 1b for New Schemes (SSI8003-81 section 3.3.3) will be amended as follows:

```
( LSKR3379VFL xs
or SKR3379 set ascon , LSKR3379(RR)S xs , SKR3379 clear bpull / (a)
or LSKR3379(RR)I s / (b)
)
```

TPWS methods 1a and 1b for Retrofit Schemes (SSI8003-81 section 2.3.2.1) will be amended as follows:

```
*11VCT
if ES11VC > 4 / TPWS fault
then if ( S11 set ascon , LS11(RR)S xs , S11 clear bpull / (a)
      or LS11(RR)I s / (b)
      )
      then S11 clear foal
      else S11 clear lp
\
\
\
```

- (a) Controls to allow signal to clear when TPWS has failed – route set and approach locked and ready to clear.
- (b) Controls to allow signal to clear when TPWS has failed and it is in Restricted Route mode

A.6.6.3 Signal Replacement

There is no requirement to provide additional controls for the 'hold off' path for last wheel replacement. It is acceptable for all routes in 'Restricted Route' mode to be first wheel replaced as the signal is held at red and an indication of 'Restricted Route' is only provided on the MMI.

A.6.6.4 Two Reds Controls

Where conditional two reds controls are provided (see SSI8003-85) and the inner junction protecting signal is aspect restricted, it will be approach locked when a sweep train is traversing the route which will allow the signal in rear to display a proceed aspect. The signaller must cancel the 'Restricted Route' when the driver has confirmed the section is clear which will result in the signal in rear being replaced to danger.

The Signallers Axle Counter Failure Instructions should include details of which signals have 'Two Reds Controls' and advise the signaller that a route should not be set up to these signals when a sweep train is in route.

A.6.6.5 AWS Electro-Magnet Isolation

When a signaller calls a train past a signal at danger, with a permissive route set, the electro-magnet is not isolated. This will also be the case when the signaller calls a train past with a 'Restricted Route' set.

A.7 Removal of Aspect Restriction

A.7.1 Removing The Aspect Restriction, Principles

The following is a brief outline of requirements for Aspect Restriction removal, for full details, see Restriction Of Signal Aspects Following Axle Counter Restoration, Engineering Design Requirements No: 434/2014/045/SPE/005 Issue 2.1.

Plain Line Track Section

Aspect Restriction shall be removed as soon as the train has occupied the track section.

Track Section with Set Back Move

Aspect Restriction shall be removed when the train has been proven to traverse the entire track section or the driver is able to view the entire track section.

Track Section with Points

If there are points in the track section, there will be at least one part that is not in the line of route. Once a train has traversed the track section, the Aspect Restriction on the part or parts that relate to that train movement shall be removed. Also, Aspect Restriction may be removed from 'stubs' of the same track section that are within the drivers' sight line.

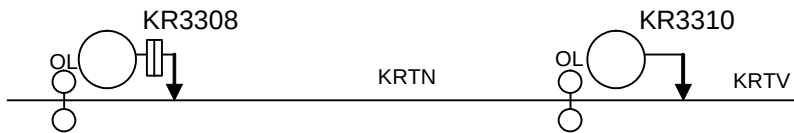
Foul Track

If an Aspect Restriction is foul of the route, it shall be removed when the track section is occupied that is contiguous with the fouling part.

If there is an engineering possession reminder on the section and the section has Aspect Restriction applied due to a previous restoration then the only condition needed to remove the Aspect Restriction is the occupation of the section. If the normal removal of Aspect Restriction is conditioned on anything other than the occupation of the section then modified data will be needed for this.

A.8 Aspect Restriction Examples

A.8.1 Plain Line Track Section



A.8.1.1 Applying Aspect Restriction (Auto Signal)

The Aspect Restriction is applied on successful restoration of the track section. For further details see Section A.5.1. If KR3310 is an auto signal the data will be as follows: -

```
*TKRTN(REST)I/P
  if L(04)(REST)2 s
  then if E(04)(REST)0/P > 12
    then L(04)(REST)FAILED s
    else if TKRTN c
      then LTKRTN(REST)1 xs
        @(REST)I/P
        if LTKRTN(EPR) xs
          LTKRTN(STR) xs
          then LTKRTN-R s
        \
      \
    \
  \
```

/ (a)

A.8.1.2 Applying Aspect Restriction (Controlled Signal)

If KR3310 is a controlled signal the data will be as follows: -

```
*TKRTN(REST)I/P
  if L(04)(REST)2 s
  then if E(04)(REST)0/P > 12
    then L(04)(REST)FAILED s
    else if TKRTN c
      then LTKRTN(REST)1 xs
        @(REST)I/P
        if LTKRTN(EPR) xs
          LTKRTN(STR) xs
          then LTKRTN-R s
            LKR3310-R s
        \
      \
    \
  \
```

/ (a)
/ (b)

- (a) Track Aspect Restriction latch set
- (b) Route Aspect Restriction latch set

A.8.1.3 Removing Aspect Restriction

To remove Aspect Restriction a sweep of the section at low speed is required to ensure the section is clear of any vehicle(s) and this is carried out by the signaller instructing the driver to pass the signal at danger, and examine the line in accordance with Rule Book Regulation 9.

For a track section on uni-directional plain line, without points, the Aspect Restriction can be removed when the track section is occupied.

For a track section on bi-directional line plain line, without points, the Aspect Restriction can be removed when the track section is occupied unless the signalling allows for a set back move to take place i.e. the train enters and leaves the track section at the same end. See Section A.8.2 for further details on set-back moves.

A data example now follows, using the above diagram.

The additional data is to be positioned below the axle counter restoration data for the same track section.

The data is provided after TKRTN track input special

```
if TKRTN o                / Train is passing over track section.  
then LTKRTN-R xs         / Aspect Restriction removed.  
\
```

No additional data is needed to modify the removal during an engineering possession as the removal is only conditioned on the section being occupied.

If an STR is provided for the section, the Aspect Restriction should be amalgamated with the STR data (See DIS-112 for details of STR controls). Typical data follows.

The data is provided after TKRTN track input special

```
if TKRTN o< 5  
then @TKRTN-REM  
\
```

```
*TKRTN-REM  
  if LTKRTN(STR) s        / Track occupied after STR applied  
  then LTKRTN(STR)USED s  / forces Signaller to remove the STR.  
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  LTKRTN-R xs  
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A.8.2 Set Back Movements

A.8.2.1 Principles

- A.8.2.1.1 For some track sections (or parts of sections) it is possible for a train to be signalled into and out of the section at the same end (i.e. a set back type move). In these circumstances, in accordance with NR/L2/SIG/30081 Section 6.7.3, operation of axle counter sections in association with directional controls shall be required to inhibit the possibility of the restriction being removed without the section being traversed.
- A.8.2.1.2 It is not necessary to prove the direction of a train if the track is not more than 100 metres long, measured from the turn back signal, and there is no permanent obstruction in the sight line. The distance of 100 metres may be extended with the agreement of the operators. In particular, it may be acceptable for a driver to examine a greater length of track in a station platform or depot where there is good illumination after dark or in fog. A site assessment will be required to confirm it is acceptable to omit set back controls; if this assessment has not been carried out the standard set back controls detailed in section A.8.2.1.3 shall be provided. Axle Counter Heads which form the boundary of this type of short section shall be annotated with a '@' on the scheme plan and a standard note shall state that '@ - Turn Back axle counter section to be no longer than 100m measured from turnback signal to the furthest detection point.'
- A.8.2.1.3 To prove a train exits the section in the required direction, the controls to remove Aspect Restriction shall either: -
- Require the exit signal aspect control set and the first track occupied (the two tests will be present momentarily before the track occupied control normalises the aspect control). Use of "aspect control set" rather than "signal off" allows the sequential control to function even when the signal is held at red by Aspect Restriction on a track section in advance of the signal.
- or
- Require the next track, in the direction of travel, occupied for less than 5 seconds (this ensures the track is occupied by the train traversing the section).
- Additional controls will be required where movements into an occupied section may take place.
- A.8.2.1.4 Bi-directional lines with 'Directional Controls' or SIMBIDS will only need to allow for set back movements from the exit signal of the bi-directional section.
- A.8.2.1.5 If there is no train detection beyond the section, it is not possible to prove the train has traversed the complete section. The removal of Aspect Restriction shall be as follows:
- For a terminal platform, the section nearest the buffer stops shall be proved occupied with no additional controls. The section can often be examined in advanced by platform staff, and any train approaching this section will be at low speed.
 - For a terminal platform, any sections away from the buffer stops shall be treated in accordance with Sections A.8.2.1.2 and A.8.2.1.3.
 - For a section wholly within a siding, the section shall be proved occupied with no additional controls. Any train entering the section will have received a shunt route and be travelling at a low speed.
 - For a section at the entry to a single line that does not have continuous train detection, the single line controls shall be used to prove a train has traversed the section.
- A.8.2.1.6 **The set back controls will need to allow for the longest length of train that may set back, information to be provided for each project by Network Rail. Where there are set back moves with back to back signals, Network Rail will need to advise if controls are required to allow for trains standing out.**