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# Operational Requirements Specification

## Aberdeen to Inverness Rail Improvement

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# 1 Version History

Issue Version	Date	Produced by	Comments
1.0	August 2010	J. Alexander	Initial Issue

## 2 Glossary

ARS	Automatic Route Setting
AWS	Automatic Warning System
CAL	Comprehensive Approach Locking
CBI	Computer Based Interlocking
DDA	Disability Discrimination Act
ELR	Engineer's Line Reference
ESOC	Emergency Signals On Control
FTN	Fixed Telecom Network
GRIP	Guide to Railway Investment Projects
GSM-R	Global System for Mobile Telecommunications – Railway
HMRI	Her Majesty's Railway Inspectorate
HST	High Speed Train
IVRS	Interim Voice Radio System
LED	Light Emitting Diode
MFC	Multi-functional Contractor
OLE	Overhead Line Electrification
PoSA	Proceed on Sight Aspect
PSR	Permanent Speed Restriction
RAMS	Reliability, Accessibility, Maintainability, and Safety
REB	Relocatable Equipment Building
RRI	Route Relay Interlocking
RSSB	Railway Safety and Standards Board
S&C	Switch & Crossing
SB	Signal Box
SC	Signalling Centre
SICA	Signalling Infrastructure Condition Assessment
SPAD	Signal Passed at Danger
SPT	Signal Post Telephone
SSI	Solid State Interlocking
SSSI	Site of Special Scientific Interest
WSSC	West Scotland Signalling Centre
TASS	Tilt Authorisation & Speed Supervision
TDM	Time Division Multiplexer
TENS	Trans European Network
TFM	Trackside Functional Module
TOC	Train Operating Company
TORR	Train Operated Route Release
TPWS	Train Protection Warning System
TRTS	Train Ready to Start
TSR	Temporary Speed Restriction
VDU	Visual Display Unit

## 3 Introduction

This document details the high level Operational Requirements for the Aberdeen to Inverness Rail Improvement scheme. The initial proposed requirements for this project shall be developed through several stakeholder review workshops and various correspondence produced thereafter. Review and input to this document shall include:

Grace Heath – Senior Commercial Scheme Sponsor  
Lynne Docherty – Project Development Manager  
Gordon Pringle – Senior Design Engineer  
Alan King – Signalling Design Group Manager (Glasgow)  
Stephen Muirhead – Route Asset Manager(S&T)  
Guy Whaley – Senior Renewals and Enhancements Engineer(Signals)  
Mike Hurst – Operations Manager  
John Day – Local Operations Manager(Inverness)  
Nigel Wunsch – Principal Route Planner  
Douglas McKay – Operations Signalling Scheme Specialist

### 3.1 Background

The Aberdeen to Inverness route is primarily single track with passing loops. This type of infrastructure is restrictive toward increasing traffic demands due to the requirement to pass trains at small loops not necessarily in their optimum position. The current journey times and irregular services do not provide an attractive alternative to road travel and therefore fail to encourage a modal shift toward rail. This does not support Transport Scotland's aspirations for future timetable and performance enhancements that will help promote sustainable economic growth throughout Scotland. This area is used predominantly by First ScotRail to operate passenger services on behalf of Transport Scotland.

The route is controlled by signalling technologies ranging from relay type interlocking at Aberdeen with intermediate Electro mechanical signalboxes through to computer based interlockings at the west end of the route. The following lists the signalling control points and the technology used within each area:

Inverness SB has an NX panel with Solid State Interlocking and VDU with RETB

Nairn SB has a WestCad control system with West Race Interlocking technology. Nairn has a unidirectional loop with bi-directional running on the mainline and operates track circuit block to Inverness with a key token section to Forres.

Forres SB is an electro-mechanical signalbox with unidirectional loops and operates Key Token working to both Nairn and Elgin. The station platform at Forres is just clear of the loops on the single line section toward Nairn.

Elgin SB is an electro-mechanical signalbox with a unidirectional Down loop arrangement with bi-directional running on the mainline and operates Tokenless block to Keith with a key token section to Forres.

Keith SB is an electro-mechanical signalbox provided with bi-directional loop and bi-directional running on the main line. Keith operates Tokenless Block working over the single lines to both Elgin and Huntly.

Huntly SB is an electro-mechanical signalbox with a bi-directional loop and bi-directional mainline provided through the station area. Huntly operates Tokenless Block working over the single lines to both Keith and Kennethmont signalboxes.

Kennethmont SB is an electro-mechanical signalbox with Tokenless Block working over the single line to Huntly and Absolute Block over the double line to Inch.

Inch SB is an electro-mechanical signalbox with Tokenless Block working over the single line to Inverurie and absolute block over the double line to Kennethmont.

Inverurie SB is an electro-mechanical signalbox with bi-directional loops provided through the station area. Inverurie operates Tokenless Block working over the single lines to both Dyce and Inch.

Dyce SB has recently been upgraded to control panel operation and operates with track circuit block over the single line to Aberdeen and Tokenless Block to Inverurie. The layout at Dyce has bi-directional loops provided through the station area. Raith's Farm sidings were also upgraded to include a shunter's panel and provided with arrival / departure lines from both directions.

Aberdeen SB operates with a push button panel with a Scottish Region Geographical Interlocking. Track circuit block working is employed to Dyce SB.

Existing Primary SICA surveys for each control area have revealed that the Interlockings have sufficient life left within them to sustain the new project aspirations. The majority of installations are classified as Green Plus which have a live expectancy of over 20 years. Inch, Kennethmont and Huntly are classified as Green with a life expectancy of 18 years although these assessments were carried out in 2006. The next assessment date for these signalboxes is during 2011 however the category of classification is unlikely to change.

## Project, Objectives and Targets

The project remit is to deliver a robust timetable that will allow an hourly end to end service between Aberdeen and Inverness with a journey time of 2 hours. This timetable is also required to deliver intermediate half hourly services between Aberdeen and Inverurie and also Inverness and Elgin. The intention is to provide this timetable with a more regularised train pattern.

New stations shall be provided at Dalcross and Kintore as part of the project.

The project is required to propose and ascertain the optimum railway infrastructure on the line of route that can deliver the timetable requirements. With these objectives in mind the project has decided to timetable model several layout options throughout the route to demonstrate efficiently where infrastructure changes must be provided. These changes may include double lining, loop extensions as well as the provision of new loops and shall take cognisance of the new stations that are being considered on the route. Elimination of cumbersome token exchange delays and other inefficiencies within the existing signalling systems shall be targeted as a key area where improvements can be delivered.

As areas requiring work are targeted the lineside assets requiring renewal or remedial work shall become apparent but could include the following:

- Introduction of new control centre(s) and closure of signalboxes
- Replacement of Token sections with Axle counter technology
- Provision of new loop arrangements
- Provision of new signals and associated route indicators
- New location cases
- New signalling power supplies
- Power operation of existing mechanically operated points
- Renewal of selected signal structures
- Renewal of existing track circuits with an appropriate train detection solution, sections of which are likely to incorporate axle counter technology.

The project where feasible, will minimise disruption to Signallers, Train Drivers, Station Platform Staff, TOC's, Travelling Public and Members of the Public. The project shall maintain current network capability with respect to the provision of train paths over and above the regular passenger services on the route (i.e. freight and charter traffic).

The aim of the project is to ensure the route can achieve the timetable aspirations by 2016.

## 4 Geographical Boundaries & Interfaces

The full geographic limit of the project runs from Aberdeen SB to Inverness SC. To satisfy the project remit it is not envisaged that any work requires to be carried out within the existing Aberdeen or Inverness interlocking areas (with exception of intrusion into single line section: Inverness to Nairn). The project shall target key areas within the route where efficiencies can be made therefore restricting the work to a much smaller area. These areas shall become more apparent as the project progresses but initial thoughts via some early timetable modelling are as follows:

- Provision of a new loop at Kintore which could be best achieved by extending the Inverurie loop.
- Loop extension (including provision of new platform) at Forres Signalbox toward Nairn.
- Replacement of the Key token section between Forres and Nairn
- Replacement of the key token section between Forres and Elgin
- Provision of a new loop at Dalcross although this may become part of a larger double lining from Nairn toward Inverness.

## 5 Interfaces with Other Projects

The project will need to liaise with the following projects to ensure consistent and compatible design, timescales and implementation strategies:

- Aberdeen North Bay Platform (likely to be re-introduction of platform 8)
- Highland Mainline
- GSM-R
- FTN
- DDA Station Compliance
- EGIP(rolling stock transfer)

## 6 Operations & Control Functionality

### 6.1 Operational requirements

FTN and GSM-R fitment within the project area are critical for technology upgrades that could be considered for this route. FTN cell planning for the route is in its development stage and as such early requirements from this project could help influence the plan. Any additional requirements that become apparent as the project progresses will require to be managed.

GSM-R rollout over this route is planned for 2015 and is a key requirement for newer technology implementation such as the provision of axle counters. With the introduction of GSM-R there may be an opportunity to relax the requirement for SPTs on any new signals provided by the project. Lineside telephony provision in areas where axle counters proposed for introduction may require to be considered – particularly in areas where existing lineside telephony provision is limited.



## 6.2 Signallers requirements

The mechanical signalbox areas within this route do not lend themselves to be easily re-controlled therefore these areas may remain largely unaltered unless it can be demonstrated that significant performance can be gained from an enhancement. Specific areas that have been targeted are the time consuming key token sections between Elgin to Forres and also between Forres and Nairn. It has been determined that the removal of the need to exchange key tokens at these locations is a pre-requisite to achieving the desired end to end journey time of 2 hours. Axle counter technology as part of track circuit block is considered the most appropriate replacement for this method of working. This technology has the added benefit of allowing for future signalling aspirations that may be considered throughout the route. Axle Counters require a reset/restore procedure following a failure which will require agreement with the operations department before implementation. GSM-R and FTN rollout are critical requirements to providing this type of technology and therefore must be fully implemented.

Another performance enhancement that shall be considered shall be the use of Tail Lamp Cameras at timetabled passing loops. This requirement shall be dependant on the layout and signalling technology used at the identified passing loops as well as the benefit obtained being commensurate with the specific objectives of the project.

## 6.3 TOC requirements

First ScotRail is the main user of the route and they utilise Class 158 and 170 type rolling stock primarily.

The objective is to run an hourly service between Aberdeen and Inverness. There are existing turnback facilities provided at Inverurie to return trains to Aberdeen and this facility allows the existing intermediate hourly service to / from Edinburgh to run presently. There is an Up siding and a Down yard at Inverurie which could be utilised to stable trains in the event of any traffic management problems that become apparent due to station dwell times.

There is also a turnback facility provided at Elgin to return trains to Inverness. It is proposed that this facility shall be used to provide the intermediate hourly service at the west end of the route. There is a disused yard area at Elgin that may have the potential (subject to permitted development rights?) to be upgraded and utilised to stable trains in the event of any traffic management problems that become apparent due to station dwell times. If this facility were to be considered part of the requirements could be the addition of a crossover to allow trains access to the down platform when exiting the yard. If not suitable signage to ensure correct choice would be required

Station area bi-directional signalling shall be investigated at all sites to ensure that there is a facility for passing trains under failure conditions or to allow through trains (freight) the fastest alignment through the loops.

Looping capability throughout the route shall be reviewed as there is an aspiration to ensure adequate loop lengths to accommodate 500 metre long intermodal trains.

Details of all signalling alterations will be briefed to drivers prior to commissioning.

## 7 Safety & Environmental

### 7.1 Safety

The project shall undertake Overrun Risk Assessments commensurate with the timetable selected for development in compliance with relevant standards. Alterations to the infrastructure will take account of prevention and mitigations of overrun risks where this is demonstrated to be reasonably practicable.

Resultant operational restrictions from any such control measures should be thoroughly reviewed and understood prior to their implementation during GRIP stage 4. TPWS (Train Protection and Warning System) shall be applied as appropriate to altered infrastructure.

Where agreement is reached with the Area Operations Manager and Network Rail Signalling Schemes Specialist, limited clearance lineside telephones may be removed in compliance with GE/RT8048, clause B 5.1.5. However, any telephones that must be located in areas with limited clearance are to be clearly labelled as such.

GSM-R will form the backbone of the communications system. Where justifiable lineside telephones will be provided.

Access to worksites shall be predominantly via station areas to minimise the requirement for red zone working. It is intended to situate, where possible, equipment within green zone areas, just off station platforms, or as close as possible to recognised access points.

### 7.2 Environmental

During the development of the project the GRIP processes for the Environmental requirements must be followed. The project must include recovery/demolition of any redundant structures on completion of the works. Removal of structures / buildings may involve asbestos / PCB removal.

The development phase must produce and maintain a hazard identification list and assign an action plan for dealing with and / or assessing the hazards arising.

Sites of Special Scientific Interest (SSSI) need to be identified and evaluated. Removal/ recycling of redundant equipment / strategic spares must be fully assessed. Assessment of local noise and other impacts on residents is to be undertaken. Assessment of vandalism and theft on the project is to be undertaken.

## 8 Timetable

The timetable on the route is relatively autonomous. The project shall undertake sufficient timetable modelling to optimise the crossing of trains at station loops to enable provision of regular services. The service frequency shall be an hourly service between Aberdeen and Inverness, a half hourly service provided between Aberdeen and Inverurie and a half hourly service provided between Inverness and Elgin. These requirements shall drive the production of the new timetable.

## 9 Line Speeds

Line speeds and turnout speeds shall be examined as the project progresses through GRIP 3 to ensure that we have the maximum benefit provided by the track arrangements. Where new loops are provided or existing loops are altered the design shall incorporate a requirement to ensure that junction speeds do not inhibit achieving the timetable goal.

## 10 Headway

The headway on the route is dictated by the section running time between signalboxes. Headway improvement on the route shall be achieved by increasing linespeeds, provision of new or extended loop arrangements and removal of cumbersome block section technology. Where appropriate, mid section or closing up signals may be introduced in areas where the proposed timetable will impact line capacity in order to enable occasional freight / sandite or miscellaneous services to run in accordance with Network Rail obligations.

## 11 Train Types

The principal TOC user of the route is ScotRail. ScotRail operate all local services around the area and use a combination of Class 158 and 170 rolling stock.

Part of the project remit is to ensure that there is a sufficient number of passing loops that can accommodate 500 metre long intermodal trains. It is not anticipated that freight train traffic will influence the quantity and location of additional loops.

## 12 Standages

### 12.1 Platform Standages

The table below indicates the maximum length of train which may use each platform as taken from the Rules of the Plan 2010 version 4.4.

Note: Aberdeen and Inverness left out for clarity as they are considered outwith the project area

Station	Down platform	Up platform
Nairn	240m	356m
Forres	168m	
Elgin	122m	125m
Keith	181m	
Huntly	183m	160m
Insch	130m	128m
Inverurie	172m	183m
Dyce	168m	162m

There are aspirations to provide new stations at Dalcross and Kintore. An additional platform shall be required at Forres to facilitate passing. Required platform lengths shall be agreed as the project progresses.

## 12.2 ScotRail Services

Class	Car Set & Total Length				
158	2 car at 47m				
170		3 car at 71m			

There is no scope in this project to increase the existing platform standages for the route. Any repositioning of signals following signal sighting recommendations, which result in platform standage changes, shall be fully investigated and discussed with all relevant parties.

## 13 Main Routes

It is not intended to alter the signalling arrangements in the signalbox areas where no project requirement has been identified. New signals shall be provided to operate new loop arrangements. Existing loops that are to be extended shall have the main signals renewed or repositioned respectively.

## 14 Shunt Routes

The existing shunt routes remain relatively unchanged for the scheme.

In addition, where redundant sidings and connections have been identified for removal under this scheme, any associated signals and routes specific to these abandonments will be permanently removed.

## 15 Warning Routes

Warning class routes will be provided if required to deliver the timetable requirements. It is unlikely that such routes will be extensively applied in this predominantly single line area.

## 16 Call on Routes/Permissive Working

There are no call on routes provided within the project area and it is not likely that any requirement will arise. Permissive working will be avoided unless it is demonstrated that this method of working offers the most reasonably practicable approach.

## 17 Comprehensive Approach Locking

The current electro-mechanical interlockings do not provide comprehensive approach locking controls. This feature will only be provided where it offers clear operational benefits on altered infrastructure.

## 18 Auto Working Facilities

There are no Automatic working facilities provided on the route and none anticipated.

## 19 Point Machines

It has been determined that it is not part of the remit of this project to renew the existing point arrangements. These point machines can be treated as consumable items and renewed individually when life expired.

Where new points are required to facilitate new or extended loop arrangements these shall be of the in bearer clamp lock type. Changes to type of point operation could be considered where an operational benefit can be demonstrated toward the project goals.

The project shall introduce disconnection boxes with plug coupled tail cables for all new points in the project area.

## 20 Separate Point Detection / Indication

Although not considered necessary where it can be demonstrated to provide safety and/or operational advantages within the business case, each end of a multiple ended set of points shall be detected and indicated separately. Demonstration of operational advantages must clearly show any availability improvements i.e. the signalling of trains over one end of a set of points when the other end has a detection failure, when taking into account all other controls e.g. flank protection. Any improvements shall be compared with the extra potential cost of implementing the proposals.

## 21 Point Numbering

Currently double ended crossovers are identified as “a” & “b” in the conventional manner.

As stated in section 20 above, where it can be demonstrated to provide safety and / or operational advantages, separate numbering of point ends will normally be applied for new installations.

## 22 Swinging / Preferred Overlaps

Swinging overlaps will be avoided wherever possible although may be applied in particular circumstances where there are conflicts between optimal positioning of signals and points.

## 23 Reversible Signalling

All single line sections on this route support bi-directional running.

There are also turn back facilities at Elgin back to Inverness and also Inverurie back to Aberdeen. The turnback facility requirements shall be fully investigated as the signalling options become apparent. There may be a stabling requirement at Inverurie and/or Elgin as part of this facility. Where new loops are provided, reversible signalling on each line will normally be provided as a standard feature. This will facilitate degraded forms of train service to run during inclement weather.

## 24 Signal Group Replacement

There are no Signal Group Replacements on this line of route and no requirement for this functionality under this project.

## **25 Hot Axle Box Detectors**

Due to the limited reduction of control points proposed, it is not envisaged that any Hot Axle Box Detectors will be provided.

## **26 Point Heating**

Electric point heating will be provided on all new or altered points mechanisms within the project area.

## **27 Signals to Facilitate Single line Working**

This route is primarily based on single line working systems. New loop areas shall be created or existing loops extended as part of this project. Where these are identified new signalling arrangements shall be required. Initial modelling has targeted a new loop at Kintore or an extension to Kintore of the existing Inverurie loop. A loop extension is required at Forres SB and a new loop is required at Dalcross. All these areas shall require new signalling arrangements to manage loop to adjacent single line operation.

All station areas shall be provided with bi-directional signalling to ensure the fastest route is available for through trains such as freight.

New signals may be required at Elgin signalbox to enhance the turnback facility.  
Tail lamp camera provision should be considered at Elgin for the Keith end of the station loop.

## **28 Proceed on Sight Signals**

There are currently no signals with Proceed on Sight Aspects (PoSA) and provision of this feature not anticipated.

## **29 Axle Counter Reset / Restore**

There are currently axle counter systems within the Dyce Signalbox area (toward Aberdeen). Axle counters shall be investigated for replacement of the Key token sections between Elgin and Nairn SB. The reset and restore procedure shall be fully investigated and reviewed with those directly involved i.e. Technicians, Signallers, Maintainers. An unconditional restore and reset facility is probably the most suitable for use between signalboxes where a signalman can confirm train complete with the adjacent signaller. This type of reset must be provided with an Engineering Protection Reminder(EPR) facility.

## **30 TASS (Tilt Authorisation & Speed Supervision)**

N/A

## 31 Occupational Safety Systems

Presently, no staff lockout systems exist in the project area. This facility will be provided on altered infrastructure where a reasonably practicable case can be made.

## 32 Level Crossings

Level Crossing census and risk assessments where required shall be carried out to determine whether any changes shall be required to the existing level crossing protection provided. Where linespeed increases are to be provided by the project each affected level crossing shall be altered to new strike in requirements and warning time

The new loop at Dalcross may require the UWC at Balspardon, Lower Culernie and Allanfean to be considered for additional mitigation measures to be added.

Rosarie AOCR obtained a Green SICA status returning a life expectancy of approximately 13 years although the control circuits and power supplies shall be life expired in 7 and 6 years respectively. There is an aspiration to close this crossing.

Dalcross AHB is currently life expired. The route asset department have produced a life extension specification although the current aspiration is to close the crossing.

If these crossings cannot be closed then this project must consider or agree the strategy to be adopted under the project.

## 33 Provision for Future Development

The introduction of FTN and GSM-R throughout this route will mean the opportunity to introduce new technology becomes more viable. Each mechanical signalbox cannot be readily re-controlled in its current form due to the older technologies still in use at each. Future introduction of an electronic interlocking could allow the progressive re-control of all signalboxes to a central point.

This project shall introduce axle counter technology which can be interfaced readily to all the signalling systems currently in use on the route and to a future electronic type interlocking.