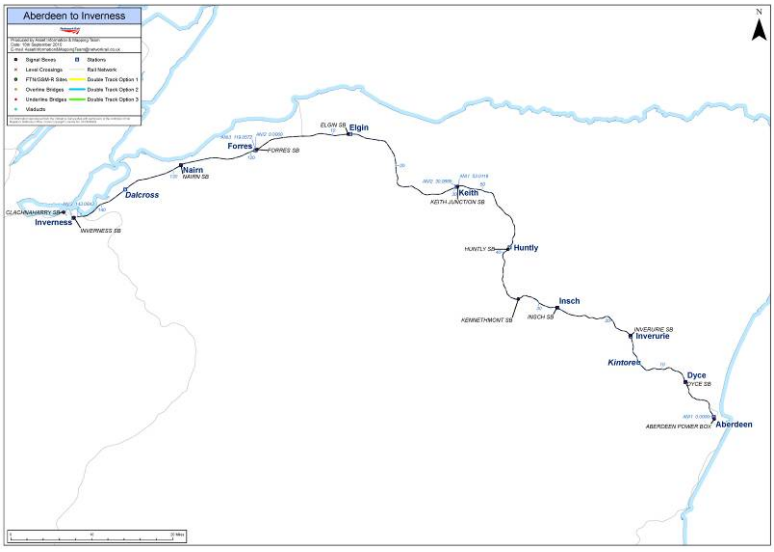
116647
Aberdeen to Inverness Rail Improvement

Network Rail GRIP Stage 2 Engineering Study

Aberdeen to Inverness Rail Improvement



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Abbreviations

Some abbreviations in common use throughout this document are described below for reference:

ALCRM	All Level Crossing Risk Model
ATOC	Association of Train Operating Companies
AHB	Automatic Half Barrier
CBI	Computer Based Interlocking
CSR	Cab Secure Radio
CWR	Continuous Welded Rail
DDA	Disability Discrimination Act
DI-SAC	Double insulated super armoured optical fibre cable
DMU	Diesel Multiple Unit
ELR	Engineers Line Reference
ESR	Emergency Speed Restriction
FTN	Network Rail Fixed Telecoms Network
GRIP	Governance for Railway Investment Projects
GSM-R	Global System for Mobile - Railways
Nestrans	North East Scotland Transport Partnership
NRN	National Radio Network
OB	Overbridge
RAMSAR	International agreement signed in Ramsar, Iran in 1971 for the conservation and good use of wetlands
RotR	Rule of the Route
S&C	Switches & Crossings
SAC	Special Area of Conservation
SDH	Synchronous Digital Hierarchy
SICA	Signalling Infrastructure Condition Assessment tool
SSI	Solid State Interlocking
STPR	Strategic Transport Projects Review
PCAT	Performance and Capacity Analysis Team
RotP	Rules of the Plan
RRAP	Road Rail Access Point
SRT	Sectional Running Time
TOC	Train Operating Company
TSR	Temporary Speed Restriction
UB	Underbridge

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Executive Summary

As part of the Network Rail CP4 funding settlement the ORR has allocated a “Tier 3 Development Fund” to allow for the development of a number of rail enhancement projects that could be implemented during the course of CP5.

This desktop study has been undertaken utilising current records with the aim of developing options to create a timetable and supporting infrastructure between Aberdeen and Inverness, to enable the introduction of additional train services on the route (hourly between Aberdeen and Inverness and half hourly services at each end of the route). The requirement also includes the need to reduce the end to end journey time to around 2 hours from the current average of 2 hours and 18 minutes. The route is predominantly single track with passing loops and carries mainly passenger services, although some sections of the route were originally double track.

The study examines nine specific objectives. The first two are core objectives regarding journey time reduction and timetable requirements. The remaining seven objectives are concerned with station infrastructure requirements, the location of dynamic loops and options to improve the A96 road alignment at Inveramsay.

The methodology adopted for the study was to examine the timetable options to deliver an hourly end to end train service, identifying crossing locations, looking in the first instance at the use of existing loop facilities and then to the creation of new loop locations. An analysis of existing track geometry was carried out to determine potential linespeeds and initial Vision modelling has been used to develop the section running times as the basis for the GRIP Stage 2 timetable model.

Three options have been identified that meet the core project objectives. The hourly service pattern was considered in the first instance to identify the key crossing locations and then the half hourly service from Inverness to Elgin and Aberdeen to Inverurie were overlaid.

Option 1 utilises the existing double track section between Insch and Kennethmont as a dynamic loop and requires four new loops and results in an uneven half hourly train service pattern and inefficient use of rolling stock.

Option 2 requires four new loops and demonstrates an inefficient use of rolling stock.

At this stage Option 3, crossing the hourly service at Huntly and Elgin offers the best overall train service pattern and more efficient utilisation of existing and new infrastructure. New loops are required at Kintore and Dalcross for the hourly service to cross and a further two loops between Aberdeen and Dyce and at Forres for the half hourly service.

The timetable development was underpinned by a high level examination of the infrastructure constraints e.g. location of viaducts in relation to crossing locations.

More detailed timetable modelling will be carried out through GRIP Stage 3 and will incorporate any updated requirements from GRIP Stage 2.

Each objective was examined around the concept of the preferred timetable Option 3 and the requirement that all trains will stop at all stations. These options form the agenda for further examination in GRIP Stage 3.

From examination of the track infrastructure it is known that a key factor in delivering the reduced journey time is that approximately 20% of the plain line track system will require to be renewed because of the limitations of the particular track systems. Other track works will be required and these will be further examined in GRIP Stage 3.

The signalling design for the route assumes that a fundamental requirement will be the elimination of the key token sections between Forres and Nairn and Forres and Elgin as the cumbersome exchange process causes journey time delay and additional stops on the route. The signalling design may also include the design of new loops and extension of existing, new signals, alterations to existing points and lineside equipment. The requirements will be clarified in the next GRIP Stage.

The study included the examination of the options to renew the bridge at Inveramsay on the A96 trunk road. This is a notorious bottleneck on the road and is a known bridge strike location. Options to partially reconstruct the bridge on its existing alignment and replace completely with a new larger structure have been investigated. The options will require the input of Transport Scotland and the highway engineers through GRIP Stage 3, to evaluate the road alignment issues in relation to the structure requirements.

Other engineering disciplines have been examined to identify the key factors to be taken forward or constraints to be examined at the next stage of development. This is on the basis that the timetable will drive the preferred option and the engineering design will validate and underpin the preferred direction.

An initial programme has been developed indicating that GRIP Stage 3, Option Selection report development will be carried out in 2011 and implementation works can be complete in 2016.

The estimated costs for delivering all objectives totals circa £203M and this is an all inclusive figure including a 35% contingency allowance and is to +/- 40% quality. The estimate has been prepared using appropriate rates within the Network Rail estimating database and this will be further refined in the next GRIP Stage.

GRIP Stage 3, Single Option Selection will examine the range of options in greater depth. The complexity will be in examining the inter-relationships and dependencies between the options to satisfy the objectives.

1 Introduction

The project involves the development of a timetable and supporting infrastructure enhancements between Aberdeen and Inverness, to enable the introduction of additional train services on the route and a reduced end to end journey time.

Aberdeen to Inverness is a Secondary route section of Route P Scotland East. This route is predominantly single track and carries mainly passenger services, some seasonal and special charter trains and occasional freight traffic.

A number of studies have previously been undertaken however the options identified have been considered either unaffordable or have failed to deliver acceptable solutions. The Project has undertaken Governance for Railway Investment Projects (GRIP) Stage 2 study to identify the options to be further developed to meet the remit requirements.

The proposal for the route is based on the Strategic Transport Projects Review (STPR) undertaken by Consultants on behalf of Transport Scotland to define the most appropriate strategic investments in Scotland's national transport network from 2012 onward. The investments are to support the Scottish Governments purpose of promoting sustainable economic growth by planning the next 20 years of transport enhancements for Scotland's rail and trunk road networks.

The STPR includes recommendations on a portfolio of land based interventions which will establish the basis for the ongoing development of Scotland's transport infrastructure. Priorities were based on the outcomes of the National Transport Strategy and these are:

- Improving journey times and connections, to tackle congestion and the lack of integration and connections in transport that impact on the potential for continued economic growth
- Reducing emissions, to tackle the issues of climate change, air quality and health improvement
- Improving quality, accessibility and affordability, to give people a choice of public transport, where availability means better quality transport services and value for money or an alternative to the car.

This project falls within the category Targeted Infrastructure Improvements, New infrastructure projects – to add to the network and increase capacity to meet future needs.

The existing train service fails to encourage significant modal shift and stifles opportunities for growth. To support modal shift to rail travel there are aspirations to open two new stations on the route. The lengthening of journey times incurred by the

extra stops being offset by the introduction of Class 170 rolling stock to the route and higher line speeds.

1.1 History

The Aberdeen to Inverness line was built in three parts:-

- Inverness and Nairn Railway between Inverness and Nairn opened on 5th November 1855.
- Inverness and Aberdeen Junction Railway between Nairn and Keith in 1858
- Great North of Scotland Railway between Keith and Aberdeen on 19th September 1854, the southern portion (between Port Elphinstone and Aberdeen Waterloo) was built over the route of the Aberdeenshire Canal, the remains of which are now designated as an Ancient Monument.

The first two merged to form the Highland Railway. The Highland Railway operated the line from Inverness to Keith and the Great North operated the line from there to Aberdeen. The Highland was grouped with other railways into the London Midland and Scottish Railway and the Great North was grouped into the London and North Eastern Railway by the Railways Act 1921, before eventually becoming part of British Railways in 1948.

Many intermediate stations were closed at various dates in the 1950s and 1960s to both passenger and goods traffic, however although the Beeching Report of 1963 recommended the closure of Inverurie and Insch stations these remain open. Dyce station, also closed in the mid 1960's was reopened in 1984 to serve Aberdeen Airport.

1.2 Geography

The Aberdeen to Inverness railway is approximately 108 miles (174 km) long between Aberdeen and Inverness Stations. The railway is mostly single track with passing loops and long single line sections. The current positioning of the loops with long single-line sections constrains the current timetable and future development opportunities.

It generally follows the same corridor as the A96 trunk road over the western section of the route from Inverness to Lhanbryde, east of Elgin, but follows an alternative alignment from Lhanbryde to Aberdeen, with the exception of a 3.5 miles (5.5 km) section to the north of Inverurie where the railway is adjacent to the trunk road.

1.3 Current Traffic

This route is predominantly single track and carries mainly passenger services, timetabled seasonal and special charter train services and occasional freight traffic

beyond Raiths Farm/ Kittybrewster Freight Terminal on the northern outskirts of Aberdeen.

The current passenger journey times and irregular service between Aberdeen and Inverness does not offer an attractive alternative to road travel. The journey times are presently in the range of 2 hours 12 minutes - 2 hours 28 minutes.

1.4 Assumptions

For this stage the following project assumptions have been made:

- Rolling stock to be used on the route will be Class 158 and 170 Diesel Multiple Units (DMU's)
- Class 170's are assumed to give marginally poorer performance and are therefore used to model the timetable in GRIP Stage 2 to illustrate the worst base case
- All trains travelling between Inverness and Nairn will call at Dalcross
- Timetable modelling assumes all trains stopping at Kintore to futureproof the evaluation of crossing locations and infrastructure considerations
- The location proposed within previous studies for Dalcross station will not alter significantly
- The location proposed within previous studies for Kintore station will not alter significantly
- Reasonable provision of freight capacity will be required but not during peak periods
- Seasonal Charter trains will continue to operate over the route
- No requirement to introduce longer trains/lengthen platforms other than specified
- Trains will call at all existing stations.

2 Project Objectives

This is based on robust analysis of the existing and proposed capabilities of the route and the proposed rolling stock on the route. Timetable modelling is required to ensure that infrastructure improvements collectively are the minimum required, least disruptive to implement and most affordable way to deliver the enhanced timetable while delivering a railway that is reliable and cost effective to maintain.

This GRIP Stage 2 report does not specify detailed engineering requirements. These will be more accurately defined at GRIP Stage 3 when further timetable modelling work and validation indicates the scope and location of the infrastructure works required to further develop the proposal. The project development to date is based on the objectives outlined in the sections below.

2.1 Objective 1: Journey time reduction

Journey time reduction of circa 20 minutes over existing end to end timings: replacing current Class 158 trains with Class 170 trains and maintaining all stops service at the additional new stations. The target end to end journey time is circa 2 hours. If the modelling indicates the train performance on the enhanced route cannot deliver the end to end journey time of 2 hours with the proposed stopping pattern, the project shall inform the sponsor as soon as is practicable.

The project shall determine the line-speed and other infrastructure enhancements required to deliver the specified journey times with the proposed classes of passenger train and stopping pattern for the route, including new stations. The project must ensure slower freight services can operate without delaying the passenger services.

2.2 Objective 2: Timetable

A timetable shall be produced which delivers the end to end journey times, pathing of specified train services and the specified frequency of trains on sections of the route using Class 170 trains in 3 car and 6 car formation. Robust iterative modelling against the proposed enhanced infrastructure will ensure the timetable is deliverable with pathing times and Rules of the Plan (RotP) agreed with the Train Operating Company (TOC). Sensitivity tests will be performed to ensure all infrastructure enhancements are required, with particular attention to flexing train departure times to minimise the requirement for additional passing loop provision.

The project shall ensure freight capacity is integrated into timetable modelling and that the route shall deliver the specified number of freight paths on the whole / part of route. The aspiration is to accommodate enhanced freight train capability c.500m trains.

The route is used as a potential diversionary route for Highland Main Line during winter weather and is also used by summer specials and charter trains. The project should ensure that the route will continue to be able to accommodate this traffic with the new timetable.

2.3 Objective 3: Dalcross Station

A new station will be provided at Dalcross. Previous work was carried out by consultants and is to be validated at this stage.

The station must accommodate 6 car Class 170 trains. A useable platform length of 150 metres is required with the provision of 20 metre sight line to any platform starter signals.

Timetable modelling will determine which option is required based on the following considerations:

- Dalcross Station - Single faced platform on North side of line
- Dalcross Station - Two opposing single faced platforms on a passing loop
- Proposed location for Dalcross Station is on ANI3 between:
    - East limit at overbridge - 136 miles 850 yards (136.38 miles.chains)
    - West limit - 136 miles 1014 yards (136.46 miles.chains)
    - The western limit to any track loop at Dalcross is identified as the level crossing at Dalcross 137 miles 373 yards (137.17 miles.chains)
- Any proposed single platform option must preserve the twin track bed for passive provision or future provision of second line. The currently redundant trackbed is located to the south of the line.

2.4 Objective 4: Kintore Station

Proposal for a new station on a greenfield site at Kintore**.**

The station must accommodate 6 car Class 170 trains. A useable platform length of 150 metres is required with provision of 20 metre sight line to any platform starter signals.

Timetable modelling will determine which option is required based on the following considerations:

- Kintore Station - Single faced platform on West (A96) side of railway (preserving twin track bed) or
- Kintore Station - Two opposing single faced platforms on a passing loop.
- Optimise potential for interchange with A96
- The project must take cognisance of proposed housing developments. The old station at Kintore is not to be reopened

- Proposed location for station at Kintore is on the ANI1 between
    - 13 miles 1297 yards (13.59 miles.chains) = north limit at overbridge
    - 13 miles 1133 yards (13.51 miles.chains) = south limit
- The spare trackbed is located to the east of line for passive provision or future provision of a second line.

2.5 Objective 5: Forres layout

Improve the track layout and signalling through Forres Station to combine dwell time at the platform with the crossing of trains if timetable modelling demonstrates that this is required.

The current layout has a curved single faced platform on the reversible single and not on the adjacent passing loop at Forres.

The options considered are as follows:

- Extension of the existing passing loop through the existing curved platform with an additional second curved platform on the loop. Reinstate the original two platform layout on a curved passing loop with improved gauge clearance
- Evaluate the benefits of improving the track layout by removing the tight reverse curvature and 20mph speed restriction through the station and approaches. This may be beneficial for through freight traffic, route capacity and reduced maintenance
- Realignment of the single track with single faced platform on the South side of the straight freight bypass alignment, preserving twin track bed
- Realignment of the track with two opposing single faced platforms on a passing loop using straight freight bypass alignment.

2.6 Objective 6: Keith layout

Improve the track layout and signalling through Keith Station to combine dwell time at the platform with the crossing of trains, if timetable modelling demonstrates that this is required.

The options considered are as below:

- Extension of a passing loop through single faced platform
- Extension of a passing loop through two opposing single faced platforms
- Relocation of the station with two opposing single faced platforms on the existing loop and partial demolition of the existing station. It should be noted that relocation of the station is an aspiration at this stage. Part of the station is used by the preserved Keith & Dufftown Railway, although it is not connected to the mainline.

2.7 Objective 7: Dynamic loops

Consideration is to be given to the provision of dynamic passing loops as necessary and considers the following:

- The design of Switches & Crossings (S&C) are to be optimised to deliver the maximum linespeed achievable by Class 170/ 158 trains entering or leaving the loop, whichever speed is higher, on the route between stations, or including existing station loops, sufficient to enable robust timetable operation.
- Robust timetable modelling must prove the requirement for any dynamic loop or loop extension by demonstrating that flexing departure times will not enable trains to cross in any existing loop.

It should be noted that the route between Aberdeen and Keith and also between Dalcross and Inverness were previously double track and the route between Keith and Dalcross was built as single track.

2.8 Objective 8: Inveramsay Bridge

Determine the feasibility and costs of providing an improved two lane carriageway to enable an improved A96 alignment underneath the railway. The minimum requirement is to provide improved clearance for HGV vehicles and the elimination of the road traffic lights and single file traffic. It should be noted that the existing masonry underbridge sustains bridge strikes from high vehicles and is a bottleneck on the A96 owing to the traffic lights and traffic chicane through tight bends.

The proposed railway alignment should not be degraded and passive provision for twin tracking should be retained. The options to be considered are as follows:

- Provide a new single track bridge structure rated to 100 mph: Full RU loading (BS 5400, or successor Eurocode) with passive provision for future double tracking. The bridge will enable the A96 to be improved and achieve compliance with highway design requirements and railway design standards.
- Provide a new double track bridge structure rated to 100 mph: Full RU loading (BS 5400, or successor Eurocode). The bridge will enable the A96 to be improved and achieve compliance with highway design requirements and railway design standards.

2.9 Objective 9: Kittybrewster Ground Frame

Evaluate automation of the ground frame at Kittybrewster to control the turnouts at Kittybrewster Yard leading to the Waterloo branch.

The following options are to be considered:

- Evaluate whether the automation of the ground frame at Kittybrewster is necessary to deliver the route capability to support the proposed train service frequency, timetable and journey times on the Aberdeen to Dyce section of the route
- Develop signalling and control options should automation of the ground frame be necessary.

3 Methodology

This section relates to Objectives 1 and 2.

The approach taken to the project in GRIP Stage 2 was to drive the initial development through consideration of the timetable options. The rationale behind this is that the infrastructure requirements will derive from the need to create the conditions required by the timetable. A high level examination of infrastructure elements was undertaken to support the timetable feasibility, to identify constraints with a view to underpinning the options with the required suit of infrastructure interventions in later development stages.

3.1 Vision Modelling

A review of the existing track geometry was undertaken to determine if any increased linespeed could be achieved. The output of this review was a 'track only' constrained route and this information was entered into the Vision Model. Vision is a computer based modelling tool that allows a proposal to be compared with the original route conditions. A more detailed explanation for the unconstrained track linespeed can be found in section 5.3.

The output of the Vision Model, utilising the increased linespeed profile, demonstrated that journey times of less than 2hrs were achievable between Aberdeen and Inverness.

3.2 Timetabling

The output generated by the Vision Model was used to determine section running times along the route to allow timetable modelling.

The timetable model was created by the Performance and Capacity Analysis Team (PCAT) and used to identify where dynamic loops would be required.

3.3 Identification of Dynamic Loops

An iterative process was followed to try to identify the optimum positions for the dynamic loops as follows:

- Decide on crossing point for the hourly Aberdeen-Inverness service
- This results in the hourly service crossing at two or three other locations. Identify these
- Refine dwell times to allow crossing points to utilise existing loops if possible
- Overlay Aberdeen-Inverurie half hourly services and refine start times to allow crossings at existing loops or at loops that were previously identified as being required for the hourly service

- Overlay Inverness-Elgin half hourly services and refine start times to allow crossings at existing loops or at loops that were previously identified as being required for the hourly service

The process was then followed again for a different crossing point for the hourly Aberdeen-Inverness service.

It should be noted that between Aberdeen and Inverness there is 4 ½ minutes of engineering time added in to support engineering works (ESR's etc) and these minutes can be spread across the route or allocated into one section.

Note – the Aberdeen to Inverness route covers three Engineers Line References (ELR's). Measurements will be given in kilometres from Aberdeen for consistency. The table below provides a quick reference to measurements across the route.

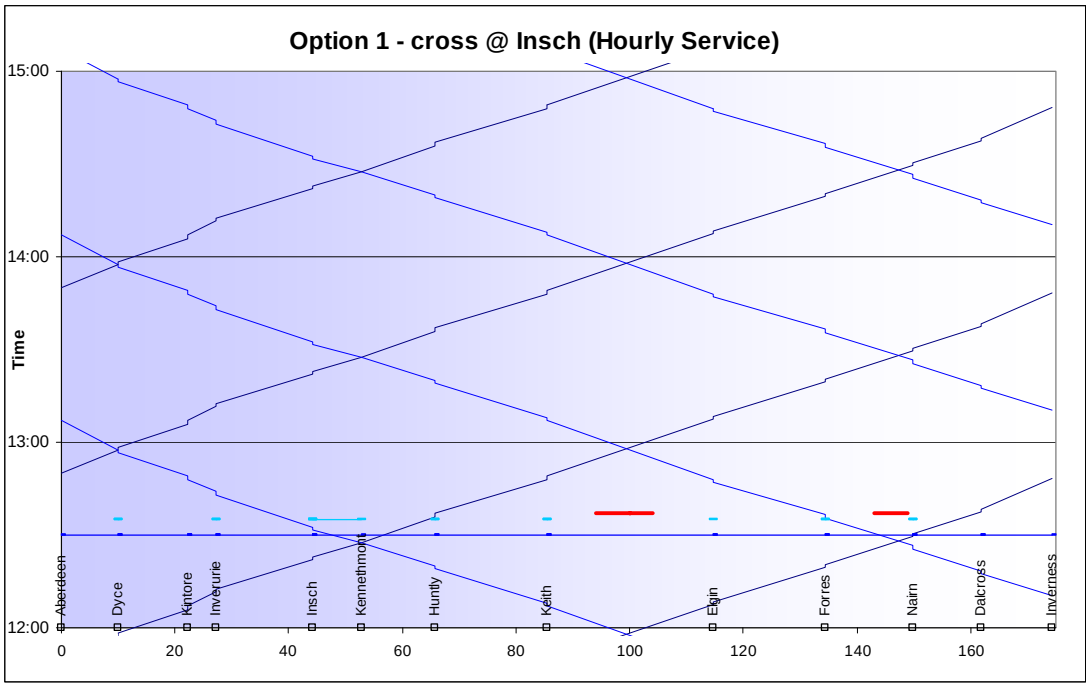
ELR	Miles	Chains	Kilometres from Aberdeen	Location
ANI1	0	0	0.00	Aberdeen
ANI1	6	20	10.06	Dyce
ANI1	13	29	21.50	Kintore
ANI1	16	72	27.20	Inverurie
ANI1	27	31	44.08	Insch
ANI1	33	4	53.19	Kennethmont
ANI1	40	67	65.72	Huntly
ANI1	53	5	85.40	Mileage change
ANI2	30	40	85.40	
ANI2	30	23	85.74	Keith
ANI2	12	18	114.81	Elgin
ANI2	12	33	114.50	Elgin Loop
ANI2	12	1	115.15	
ANI2	0	20	134.08	Forres Loop
ANI2	0	5	134.38	
ANI2	0	0	134.48	Forres
ANI2	0	0	134.48	Mileage change
ANI3	119	26	134.48	
ANI3	128	72	149.89	Nairn
ANI3	136	40	162.12	Dalcross
ANI3	142	78	172.54	Mileage change
HGL2	116	72	172.54	
HGL2	118	1	174.33	Inverness

The timetable models shown on the following pages can be viewed in full page format in Appendix B – Timetable Modelling.

3.3.1 Option 1 – Utilise Insch to Kennethmont double track section as dynamic loop

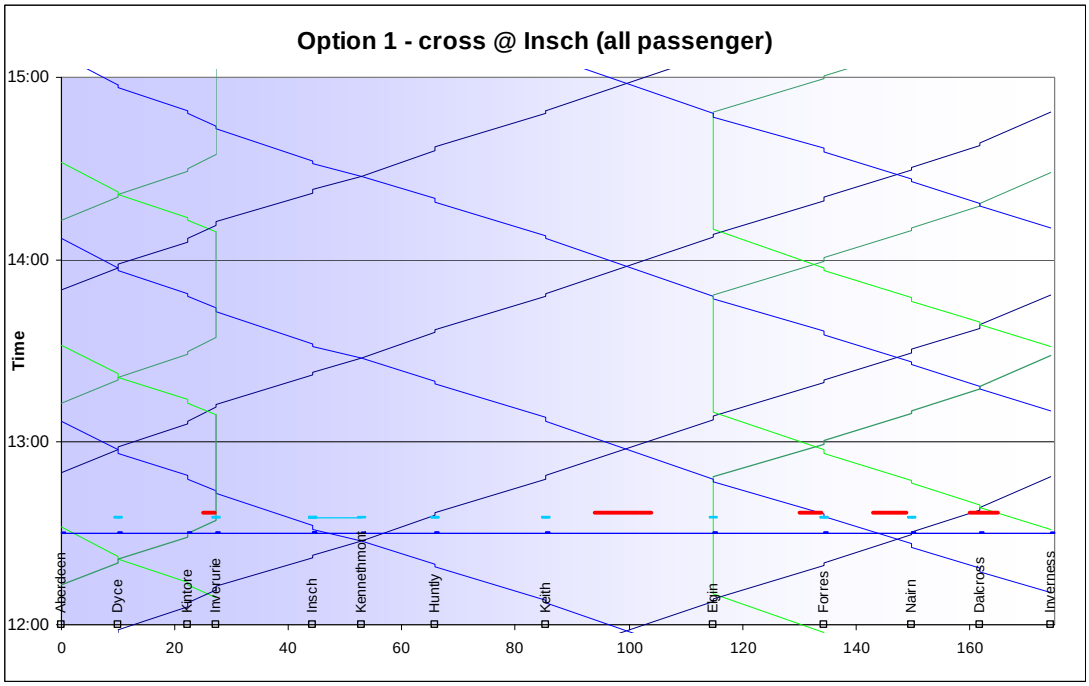
By crossing the Aberdeen-Inverness hourly service between Insch and Kennethmont, it results in the hourly service crossing itself at approximately:

- 10km (ANI1 – 6 ¼ milepost at Dyce)
- 51km (ANI1 – 31 ¾ milepost near Kennethmont)
- 97km (ANI2 – 23 milepost between Keith and Elgin)
- 147km (ANI3 – 127 milepost, east side of Nairn).



By adding the Aberdeen to Inverurie and Inverness to Elgin half hourly services additional loops are required at:

- 133km (ANI2 – ¾ milepost, east of Forres)
- 162km (ANI3 – 136 ½ milepost at Dalcross).



This option results in new loops being required at the following locations:

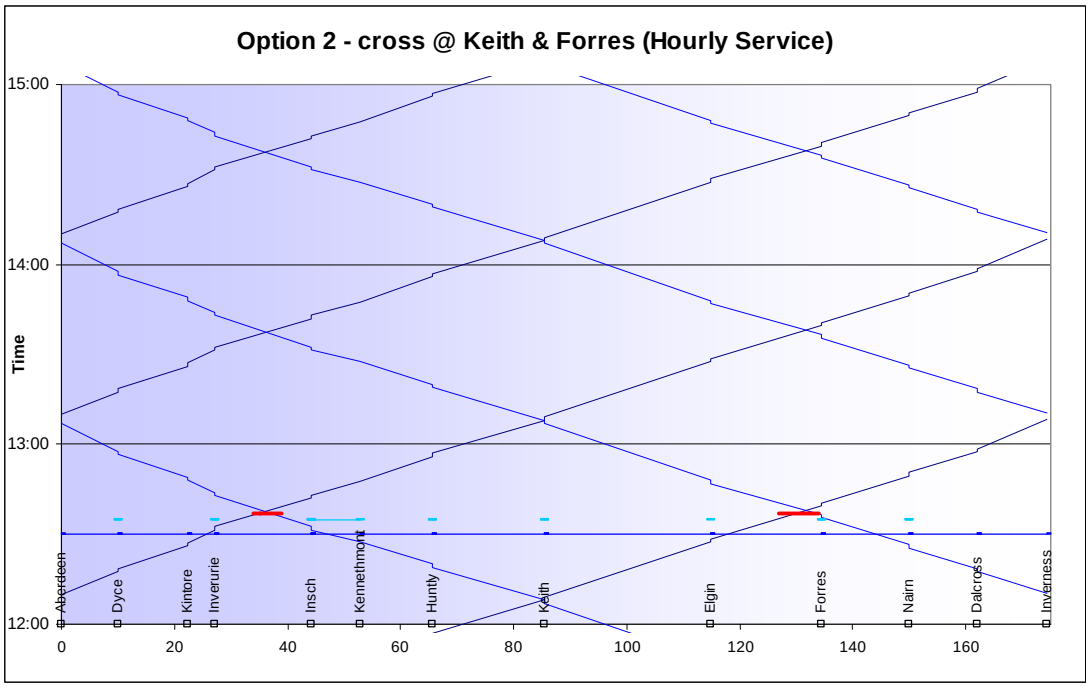
- 97km (ANI2 – 23 milepost between Keith and Elgin)
- 133km (ANI2 – ¾ milepost, east of Forres)
- 147km (ANI3 – 127 milepost, east side of Nairn)
- 162km (ANI3 – 136 ½ milepost at Dalcross).

There may also be the need to extend the loop at Inverurie east towards Aberdeen to allow ½ hourly services to cross at Dyce.

3.3.2 Option 2 – Pass hourly services at Keith and Forres

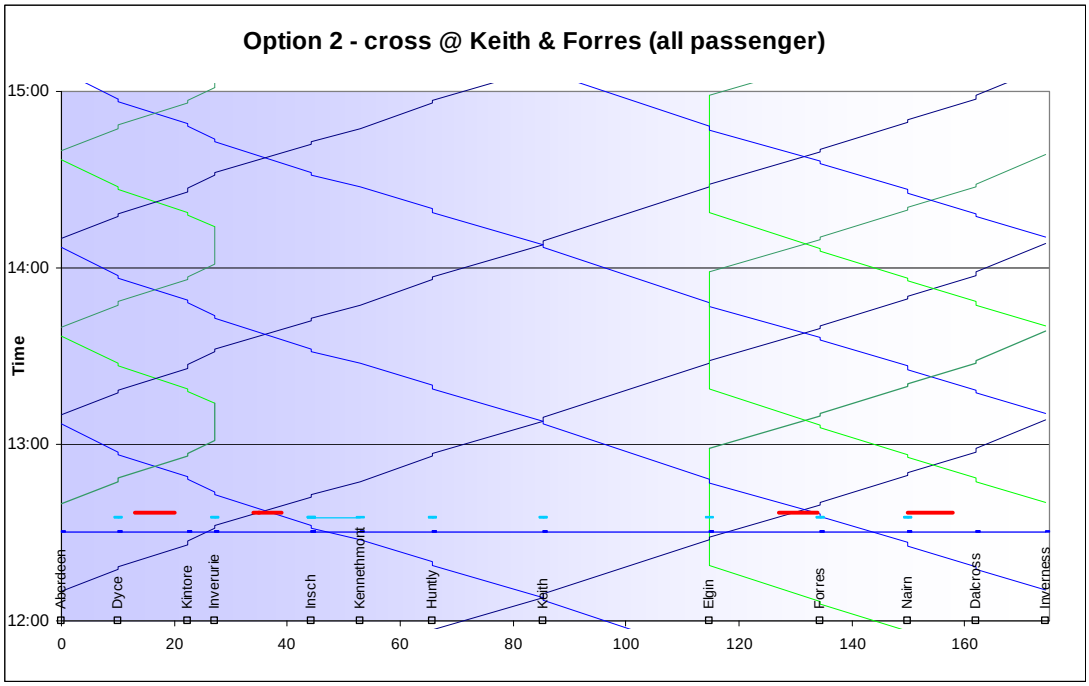
By crossing the Aberdeen-Inverness hourly service at Keith, it results in the hourly service crossing itself at approximately:

- 36km (ANI1 – 22 milepost between Inverurie and Insch)
- 86km (ANI2 – 30 ¼ milepost at Keith)
- 133km (ANI2 – ¾ milepost, east of Forres).



By adding the Aberdeen to Inverurie and Inverness to Elgin half hourly services additional loops are required at:

- 17km (ANI1 – 10 ½ milepost between Dyce and Kintore)
- 154km (ANI3 – 132 milepost between Nairn and Dalcross).



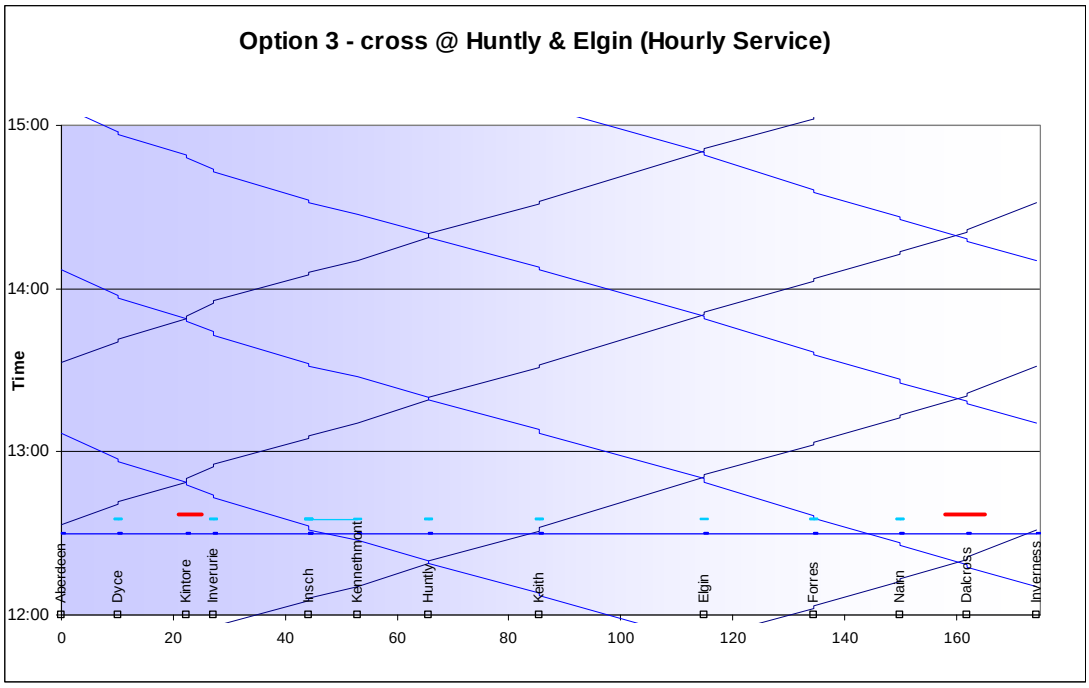
This option results in new loops being required at the following locations:

- 17km (ANI1 – 10 ½ milepost between Dyce and Kintore)
- 36km (ANI1 – 22 milepost between Inverurie and Insch)
- 133km (ANI2 – ¾ milepost, east of Forres)
- 154km (ANI3 – 132 milepost between Nairn and Dalcross).

3.3.3 Option 3 – Pass hourly services at Huntly and Elgin

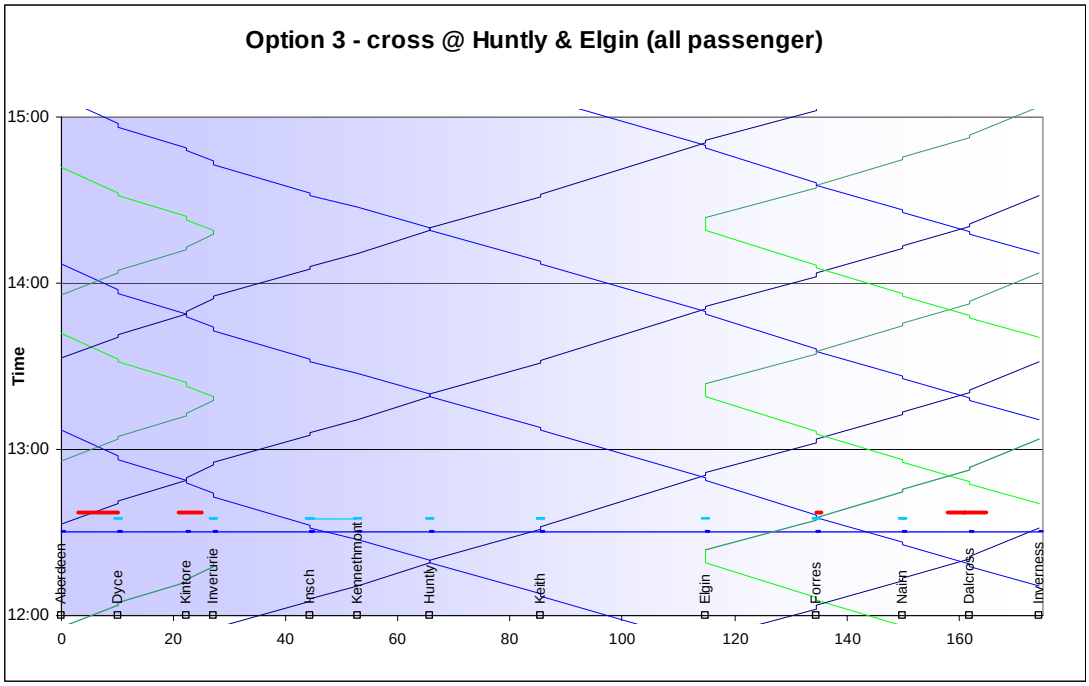
By crossing the Aberdeen-Inverness hourly service at Huntly, it results in the hourly service also crossing at Elgin. The hourly service crosses itself at approximately:

- 22km (ANI1 – 13 ½ milepost at Kintore)
- 66km (ANI1 – 40 ¾ milepost at Huntly Station)
- 115km (ANI2 – 12 ¼ milepost at Elgin Station)
- 160km (ANI3 – 135 milepost to east of Dalcross Station).



By adding the Aberdeen to Inverurie and Inverness to Elgin half hourly services additional loops are required at:

- 5km (ANI1 – 3 milepost between Aberdeen and Dyce)
- 135km (ANI3 – Forres Station to 119 ¾ milepost east of Findhorn Viaduct).



This option results in new loops being required at the following locations:

- 5km (ANI1 – 3 milepost between Aberdeen and Dyce)
- 22km (ANI1 – 13 ½ milepost at Kintore)
- 135km (ANI2 – 0 milepost at Forres Station)
- 160km (ANI3 – 135 milepost to east of Dalcross Station).

3.4 Provision for Freight

The timetable model was further developed to include a freight service in each direction, making some assumptions regarding SRTs. This review indicated that additional freight specific loops are required to provide a freight path from end to end or if there is no additional infrastructure provision, freight will require to be held for significant periods of time in available loops to allow passenger services to progress.

These additional loops have not been shown on the timetable charts in this report, as it was felt that further consideration will require to be given to freight requirements and this may include pathing freight traffic at times when the ½ hourly services had stopped or review the requirement for passenger paths to allow freight to run during the day.

If freight paths are required while the full Aberdeen to Inverness hourly service and the ½ hourly services from/to Inverurie and Elgin are running, then these can be modelled during GRIP Stage 3.

3.5 Conclusion for Loop Positions

By passing the Aberdeen – Inverness hourly service at Huntly and Keith a symmetrical half hourly service can be achieved for Inverurie to Aberdeen and Elgin to Inverness. As such the feasibility of loops positioned as per section 3.3.3 should be prioritised.

Where services are timetabled to pass at stations, the preferred solution is to extend existing loops through the station if they do not do so already. This will allow services from either direction to dwell in the station and not outside it.

3.5.1 Single Line Constraints

To underpin the timetable development work, an initial review of structures on the route has been carried out and these will be further examined in GRIP Stage 3. During the GRIP Stage 2 review, some structures have been identified that would require costly infrastructure interventions to re-double.

Two of these locations are as follows:

3.5.1.1 Findhorn Viaduct, ANI3 – 120.0000 (136km)

Findhorn Viaduct lies less than a mile to the west of Forres Station and is Category A listed. Replacement of this structure would be cost prohibitive.

3.5.1.2 O/B 291/082-1 – A96 Trunk Road, ANI3 – 133.0200 (157km)

The A96 Trunk Road was constructed over the railway with a span which will only support a single track. Replacement of this structure would be difficult.

3.5.1.3 Level Crossings

See section 9.3 for more information regarding level crossing installations.

3.6 Additional Opportunities to improve Section Running Times (SRT's)

The linespeed through Forres Station is modelled on 25mph. The construction of a new station on natural straight section would result in an improved linespeed on approach to the station and allow freight services to pass through at increased speed.

4 Specific Infrastructure Considerations

4.1 Dalcross Station

This section relates to Objective 3.

A study was undertaken in 2008 by Scott Wilson on behalf of the Highland Rail Partnership into options for the provision of a station at Dalcross. The options considered were on the assumption that this would be an interchange station with Inverness airport. This report is available as a separate document.

4.1.1 Dalcross Station Options – ANI3 136 ½ milepost/

The options considered by this report are on the assumption that the new station will have a passing loop and 2 platforms with an operational length of 147m for 6 car sets. There were 4 options considered in the previous report and are summarised as follows:-

4.1.1.1 Option 1: utilise OB 291/087 for platform access

- Track lower and slue (approx 150mm) at OB 291/87, no alterations to bridge
- OB 87 to be used for access across track for station with 1:20 ramps
- Platforms positioned 35m west of OB 291/87.

4.1.1.2 Option 2: demolish OB 291/087 and provide new footbridge and lifts

- Demolish OB 291/87, no track lower or slue to existing mainline
- New footbridge and lifts.

4.1.1.3 Option 3: replace OB 291/087

- New bridge superstructure to OB 291/87
- OB 87 to be used for access across track for station with 1:20 ramps
- Platforms positioned immediately west of OB 291/87.

4.1.1.4 Option 4: utilise new OB 291/087-1

- Utilise new road bridge for cross track accessibility
- 1:20 ramps
- Demolish OB 291/087
- Platforms located to suit car park and access point.

As part of this study a review of the options presented above was undertaken and no major issues were identified. However the following points will have to be considered further at GRIP Stage 3 in refining the options prior to selection:

- The need for 2 platforms is to be reviewed. This will be dependent on whether a loop is required if trains need to pass at Dalcross. If no passing facility is required a 5th option for a single face platform is to be developed
- The platform widths will be determined at a future stage and will allow for mobility impaired passengers to alight from the trains
- If the access road and parking facilities are to be provided by this project, the car parking facilities indicated in the Scott Wilson report are to be curtailed with the option to extend in the future. The required amount of car parking including disabled spaces is to be confirmed for each option at the next stage of this project. The need for a taxi rank is also to be reconsidered albeit passive provision for it is to be made
- The type of platform construction is to be reviewed to minimise disruption to the operational railway and any requirements for Temporary Speed Restrictions (TSRs). This will be of particular relevance if only a single platform is to be provided
- Establish land take requirements for all options.

4.1.2 Further Considerations

In GRIP Stage 3 the options previously considered will be combined with the additional considerations noted below and evaluated in more detail.

4.1.2.1 Option 1: utilise OB 291/087 for platform access

- Ground investigation required to identify foundation levels for OB291/87 to ensure that the substructure can accommodate the track lowering requirements
- Potential drainage issues with track lowering
- Implications of track lowering on track gradients through proposed station site
- Tangential gradients on vertical road profile across OB 291/087 will have to be confirmed to ensure they are shallower than or equal to 1:20
- Implications of future electrification on OB 291/087 (being utilised as a footbridge) and proposed connecting ramps to new platforms
- Consider whether the gradient of access ramps can be increased to 1:20 to reduce the linear distance required and construction costs.

4.1.2.2 Option 2: demolish OB 291/087 and provide new footbridge and lifts

- Does projected station usage warrant the provision of lifts

- Appropriate Ground Investigation including boreholes to allow foundation type for lift shafts to be determined
- Investigate further the requirements for service diversions to facilitate the demolition of OB 291/087 and establish size of services
- Investigate reconfiguring stairs and lift shaft to reduce footbridge span.

4.1.2.3 Option 3: replace OB 291/087

- Determine span and vertical clearance required for new footbridge spanning OB 291/087 substructure
- Requirements to accommodate existing services within new footbridge structure
- Extents of earthworks/retaining works required to tie proposed platform access ramps into new raised footbridge and consider steel ramps if significant
- Consider options to rationalise access ramp layout to proposed platform 2 in accordance with Department for Transport Code of Practice for Accessible train and Station Design.

4.1.2.4 Option 4: utilise new OB 291/087-1

- Due to the potential dangers from road traffic to passengers using the new bridge as a crossing between platforms and vehicles stopping on the bridge to drop off/pick up passengers. It is recommended that this option should not be pursued any further.

4.1.3 Signalling

Signalling works will be determined by the location of any dynamic loops during GRIP Stage 3.

4.1.4 Telecoms

It is anticipated that the following systems will be required:

- Customer Information System
- CCTV and Help Points
- Long Line Public Address
- Public Telephone facility.

Telecom connectivity will be required from a 3rd Party Provider (BT, Virgin Media, etc) to support the CCTV and CIS facilities. Any public telephony service would also be supported by a 3rd Party Provider.

Connectivity may also be required via Network Rail telecom infrastructure to support any LLPA solution.

An environmentally controlled communications cabinet would normally be provided within the station boundary to locate all telecom equipment.

The following Network Rail Standards shall be met for each system:

- NR/L2/TEL/30130 – Electronic Visual Customer Information Systems - Minimum Requirements
- NR/L2/TEL/30134 – Design and Installation Requirements for Public Announcement, Voice Alarm and Long Line Public Announcement Systems
- NR/L2/TEL/30135 – Technical Requirements for Security CCTV Systems on Network Rail Infrastructure.

4.1.5 Power & Lighting

A review will require to be undertaken in GRIP Stage 3 of the future power and station lighting requirements relating to the options identified.

4.1.6 Dalcross Automatic Half Barrier (AHB) Level Crossing

The AHB Level Crossing is located within ¾ mile of the anticipated location of the new station. As such, consideration will need to be given to the future operation of the crossing. If this area is double tracked as part of these works then significant alterations will be required to the installation.

The construction of overbridge OB 291/087-1 to provide access to Inverness Airport may expedite the closure of this crossing.

4.2 Kintore Station

This section relates to Objective 4.

A study was undertaken in 2009 by Faber Maunsell on behalf of the North East of Scotland Transport Partnership (Nestrans) into options for the provision of a station at Kintore.

The options considered by this report are based on the following assumptions:

- station platform capacity for 6 car sets
- 100 car parking spaces
- Shelter to be provided
- Disability Discrimination Act (DDA) access
- LLPA, CIS, CCTV and Help Points to be provided.

4.2.1 Kintore Options

Based on these assumptions, 2 options have been considered and are summarised as follows:

- Option 1 – Single platform to the south of the railway on the northwest fringe of the village.
- Option 2 – Double platform with a passing loop at the same location.

As part of this study a review of the options presented above was undertaken and no major issues were identified. The station location was reviewed and a proposed location to the north of underbridge UB 293/062 has been confirmed as the optimum site. The following factors were considered in reaching this conclusion:-

- Available land for station location and further development
- Proximity to town
- Location not directly adjacent to residential properties
- Good access to road network including A96 trunk road.

4.2.2 Further Considerations

In GRIP Stage 3 the options previously considered will be combined with the additional considerations noted below and evaluated in more detail.

4.2.2.1 Number of platforms

The need for 1 or 2 platforms is to be confirmed by the infrastructure requirements for the service pattern. This will be dependent on whether a loop is required if trains need to pass at Kintore.

4.2.2.2 Platform Design

The platform design will be developed in more detail at GRIP Stage 3 and the following factors shall be considered:

- The platform widths will be determined at a future stage and will allow for mobility impaired passengers to alight from the trains
- Platform length to consider all operational requirements at this station
- The track gradient and radius at the proposed station location is to be checked for compliance with standards
- The type of platform construction is to be determined to minimise disruption to the operational railway and any requirements for TSRs. This will be of particular relevance if only a single platform is to be provided
- Number and size of passenger shelters is to be reviewed and agreed with First ScotRail and will depend on predicted passenger numbers.

4.2.2.3 DDA access to station and between platforms

A footbridge with stair access is to be provided for the double platform option as a baseline. The following options are to be considered for DDA access between the platforms:-

- The pedestrian access ramp option using UB 293/062 as shown in the Faber Maunsell report is to be reviewed to determine if the retaining walls are required. It is considered that the requirement for retaining walls to support the tracks for this ramp will render this option uneconomical
- Potential security issues will require to be considered if an underpass is provided
- Depending on patronage, lifts in conjunction with the footbridge are to be considered for DDA access between the platforms. The whole life cost of providing lifts will need to be considered for this option
- Provision of DDA compliant ramps from platforms to access footbridge span.

4.2.2.4 Car Parking and access

If parking facilities are to be provided by this project, the car parking facilities indicated in the Faber Maunsell report are to be further reviewed for adequacy, with an option to extend in the future. The required amount of car parking, including disabled spaces is to be confirmed for each option at the next stage of this project. The need for a taxi rank is also to be considered and passive provision made.

4.2.2.5 Land take requirements

The land take requirement will be evaluated as an integral part of GRIP Stage 3.

4.2.3 Signalling

Signalling works will be determined by the location of any dynamic loops during GRIP Stage 3.

4.2.4 Telecoms

The telecom solution for Kintore Station is likely to be similar to that for Dalcross. Refer to section 4.1.4 for more information.

4.2.5 Power & Lighting

A review will require to be undertaken in GRIP Stage 3 of the future power and station lighting requirements relating to the options identified.

4.2.6 Boat of Kintore AHB

The Automatic Half Barrier (AHB) Level Crossing is located within ½ mile of the anticipated location of the new station. As such, consideration will need to be given to the operation of the crossing. If this area is double tracked as part of these works then significant alterations will be required to the installation.

4.3 Forres Station

This section relates to Objective 5. Appendix C shows an aerial view of the station with the various options highlighted.

The existing station comprises a single platform with a ticket office and is located to the south of the track. There are car parking facilities (approx 30 spaces) and the station site is adjacent to the A96. There is also a bus interchange at the station.

The existing operational platform has an overall length of 177m. The structure is a traditional backfilled construction comprising corbelled brickwork walls and precast concrete copes.

There was a crossing loop with two platforms in the station and the redundant east bound platform, to the north of the track, is still in existence. The overall length of the platform is 168m and is of the same construction and condition as the operational platform. At the east end, the supporting wall for the original canopy remains.

4.3.1 Infrastructure Requirements

There are 2 scenarios to be considered and will depend on whether the options for the train service pattern require trains to cross at Forres.

4.3.2 Scenario 1 Trains crossing at Forres

If the timetable modelling requires trains to pass at Forres, the existing passing loop should be extended through the station or a new dynamic loop provided to suit operational requirements. This would enable trains to cross at the station rather than at the existing loop to the east.

4.3.2.1 Platforms

Crossing trains at the station would require the redundant platform to be brought back into service. As the track radius is less than 1000m, derogation from Railway Group Standard GI/RT7016 will be required. Given that the existing operational platform is also not compliant with this standard, there may be a reasonable case to support this if stepping distances and clearances can be demonstrated to be acceptable. This will require to be further examined during GRIP stage 3.

As the redundant platform is both sited on the curve and the straight, there is the option to refurbish the straight section and the curved section where track radius is

less than 1000m. The straight section of the platform can be extended west to achieve the required operational length. The extent of the refurbishment will be developed in GRIP stage 3.

4.3.2.2 DDA Access

As the refurbished platform is land locked by the railway, a DDA compliant footbridge will be required to provide access between the platforms and the station access. The footbridge will have stair access with DDA compliant access being provided by either lifts or ramps. The choice of DDA access to the footbridge should be investigated at the next stage of the project. The issues highlighted for Kintore and Dalcross stations are also to be considered in relation to Forres Station.

4.3.3 Scenario 2 Trains not crossing at Forres

If timetabling options do not require trains to cross at Forres, no additional infrastructure works shall be required. However, the existing loop to the east of the station should be retained for freight or perturbed working.

4.3.4 Forres - Alternative Location

Objective 5 requires the evaluation of the benefits of improving the track layout at Forres by removing the tight reverse curvature and 20 mph speed restriction through the station and approaches on the basis that this may be beneficial for through freight traffic, route capacity and reduced maintenance. This means that a new station will be constructed on the alignment of the old freight bypass. This would allow the existing chicane in the track geometry to be removed and a straight dynamic loop to be constructed on the redundant freight formation.

Initial analysis would suggest that this option would offer no operational advantage as all trains will be timetabled to stop at Forres. Therefore, for the timetable options examined, the linespeed limitations associated with the track geometry at this location are not considered to be a constraint.

However, if there were future aspirations to consider express services on the route that would not call at Forres, the current alignment would be a constraint to increasing the line speed at this location. The construction of a new station on the alignment of the freight bypass would eliminate this. Any new station would require to comply with all relevant standards.

The relocation of the station would also offer the opportunity to create park and ride facilities to accommodate future potential passenger growth. The relocation also creates a potential commercial opportunity to sell the vacated land to the south of the freight alignment, once the existing track has been recovered and the existing station demolished.

4.3.5 Platform Design

The platform design will be developed in more detail at GRIP Stage 3 and the following factors shall be considered:

- The platform widths will be determined at a future stage and will allow for mobility impaired passengers to alight from the trains
- Platform length to consider all operational requirements at this station
- The track gradient and radius at the existing or proposed station location is to be checked for compliance with standards.
- The type of platform construction is to be determined to minimise disruption to the operational railway and any requirements for TSRs.
- Number and size of shelters is to be reviewed and agreed with First ScotRail and will depend on anticipated patronage.

4.4 Elgin Station

This section relates to Objective 2 and the requirement to accommodate 6 car Class 158 and Class 170 trains. A table of platform lengths is included in section 6.5.

The existing platforms at Elgin require to be lengthened to accommodate 6 car Class 158 and Class 170 trains. The simplest solution will be to extend the platforms towards Inverness.

All existing systems (lighting, retail telecoms, etc) shall be extended to cover the extended platforms.

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.

The nearby freight yard is currently leased to a freight operator and would be considered as a Supplementary Strategic Freight Site if the lease was to be surrendered. However, subject to the necessary consents there may be potential to upgrade and utilise an area of the yard to stable trains in the event of any traffic management problems. 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. This will be further examined in GRIP Stage 3.

4.5 Insch Station

The existing platforms at Insch require to be lengthened to accommodate 6-car Class 158 and Class 170 trains. A table of platform lengths is included in section 6.5.

Platform 1 is constrained to the east by the Down Refuge Siding. It may therefore be necessary to extend the platform towards Inverness or to consider the removal of the Down Refuge Siding (DRS) to extend the platform.

Platform 2 is constrained to the west by Insch MCB Level Crossing. It will therefore be necessary to extend the platform towards Aberdeen.

All existing systems (lighting, retail telecoms, etc) shall be extended to cover the extended platforms.

4.6 Keith Layout

This section relates to Objective 6.

A number of options are to be considered for Keith.

The timetable modelling makes some options more essential than others. Appendix D shows an aerial photograph of the area with the various options.

4.6.1 Extension of passing loop through existing single platform

A review of Omnicom video suggests that there is sufficient land within the railway boundary to extend the existing loop west through the station towards Inverness. Whilst this is possible it would provide limited operational benefits as passenger services would still need to sit on the Aberdeen side until an Inverness service had cleared the single line section from Elgin.

A track arrangement with a single line through the station and a passing loop on either side would allow a passenger service from either Aberdeen or Inverness to sit in the station waiting for the other service to approach. The trains would then cross beyond the platform.

This option would require minimal alterations to the station infrastructure to support the track arrangement.

4.6.2 Extension of passing loop through two opposing single faced platforms

A review of Omnicom Video suggests that land purchase would be required for a new platform located opposite the existing station platform.

Additional review of aerial photographs, indicate that the ideal track alignment would be through Keith Junction Signal Box. This would result in considerable alterations to the signalling arrangements including probable re-control to a different signal box, offering operational benefits.

At present the options are considered in the context of all trains stopping at the station. If however the track works were to be considered in relation to minimising the interface to the Keith & Dufftown Railway, who use part of the station but are not connected to the main line, then a ‘dog leg’ alignment could be developed. The impact of this option on the possible linespeed through the station will be examined at GRIP Stage 3.

4.6.3 Construction of new station

4.6.3.1 On existing loop

Review of Omnicom Video suggests that there is sufficient available land to relocate the station to the Aberdeen side of Keith Junction.

This would result in the following configuration:

- Staggered platforms due to restricted space caused by OB 293/186 Newmill and No.15 points
- Access to new platforms would need to come from OB 293/186
- No.15 points would need to be motorised to allow the channel rodding to be recovered to facilitate the platform construction
- This option would require the re-alignment or recovery of the Down Siding
- Signal K8/11 would need to be relocated.

A simpler track arrangement could be provided if No.15 points were able to be recovered. Consideration of the impact to freight facilities should be considered at future GRIP Stages.

Relocating the station to an area outwith the town centre is based on the resultant best infrastructure fit from a desktop analysis. This will be further developed in GRIP stage 3 and take cognisance of existing trail routes to and from the town in identifying an optimum location for the proposed station. The new station location will require land purchase for the station car park. A full assessment of the overbridge would also be required if traffic flows are to be altered.

4.6.3.2 New location west of existing station

There appears to be sufficient land within the railway boundary to facilitate the construction of a new station to the west of the existing station between OB 294/069 Haugh's Road at ANI2 29.1580 and UB 294/071 Isla Bridge at 30.0265.

This option would require a 2nd bridge deck to be re-instated to UB 294/071 over the river to facilitate the extension of the existing loop.

Land purchase would be required for the station car park, however aerial photographs indicate farm land adjacent to the whisky bond. There may also be sufficient land within the whisky bond itself.

Access to the station would be via OB 294/070 Tarmore Road.

4.7 Port Elphinstone

This section relates to Objective 7.

The site is currently leased to a freight operator and would be considered as a Supplementary Strategic Freight Site if the lease was to be surrendered. It is understood that the developers of the adjacent paper mill site are considering future freight use for the facility. This will be further examined in the next GRIP stage.

Should double tracking be necessary to support the timetables, access in and out of Port Elphinstone will require to be considered.

4.8 Inveramsay Underbridge - UB 293/084

This section relates to Objective 8.

The project objective outlines the requirement to determine the feasibility and costs of providing an improved two lane carriageway A96 alignment underneath the railway at Inveramsay. The minimum requirement is improved clearance for HGV vehicles and the elimination of the road traffic lights and single file traffic. This review has considered options for improving the A96 road alignment through UB 293/084 at Inveramsay to the west of Inverurie and considered the future provision of an upgrade of the A96 to a dual carriageway in this location.

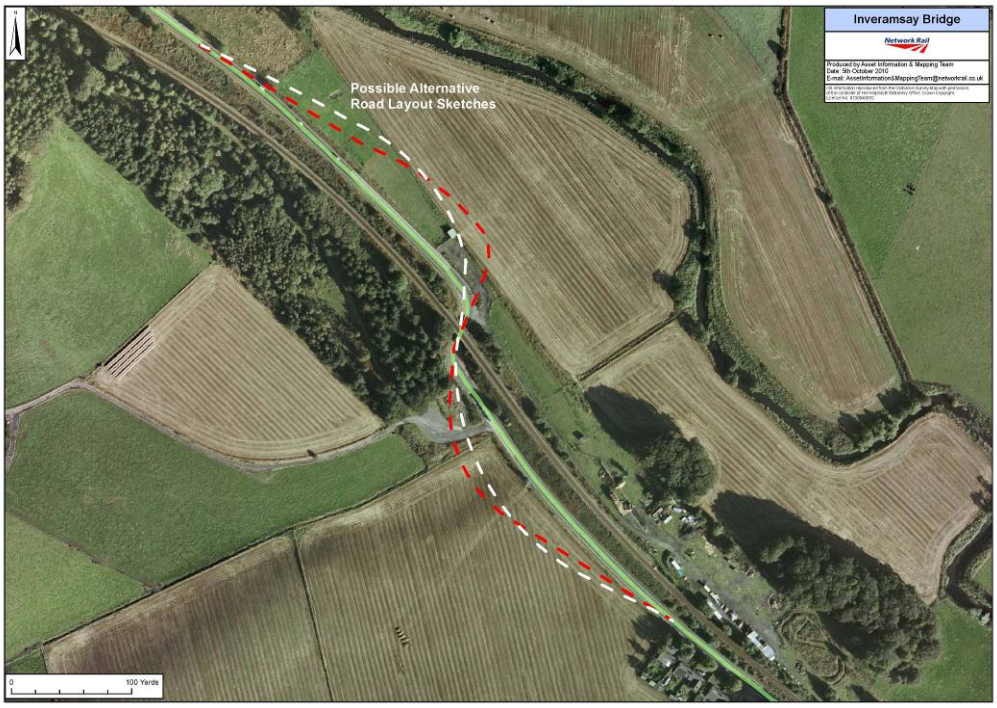


Photo: Aerial view showing existing and proposed A96 road alignment

The railway underbridge (UB 293/084) is a significant constraint to the alignment of the A96 at this location and currently facilitates one lane of traffic through the structure at a time, controlled by traffic signals.

The A96 is a single carriageway road which effectively runs parallel to the railway in the vicinity of the structure. The carriageway runs on the south side of the railway on the approach from Inverurie and then passes through the structure and continues on the north side of the railway.

The structure is a masonry arch underbridge, originally designed for two tracks although it currently carries a bi-directional single line. From photographs, it appears that the original UP line from Inverness has been lifted and the remaining line is close to its original alignment on the south side of the structure.

In considering the requirements for the proposed project, the live load capacity and track alignment are, at GRIP Stage 2, not considered to be constraints to increasing the linespeed to 100mph at this location.

Photo: view through UB 293/084 in direction from Aberdeen to Inverness (DN direction)

The arch is constructed on a skewed alignment restricting the clear width through the bridge and the headroom at the central point of the arch is signed at 4.65m.

Records show that there have been three bridge strikes in the past two years. Although not a high number of strikes, the impact upon train performance is significant, due to the length of time taken by engineers to respond to an incident, because of the outlying location of the structure. There is an additional complication in reopening the line to traffic in that it is now difficult to establish new bridge strike damage from old.

In addition the restricted traffic flow causes significant traffic congestion on the A96 and was referred to recently in a House of Commons Westminster Hall debate, 13th July 2010 as the notorious bottleneck at Inveramsay Bridge. In order to mitigate against bridge strikes and road traffic accidents, traffic management arrangements at this structure restrict vehicle movements to a single carriageway under the centre of the structure.

4.8.1 Benefits of Reconstruction

Reconstructing this underbridge would offer a number of benefits to stakeholders. A new superstructure would be designed to provide sufficient headroom to reduce the likelihood of bridge strikes and give future opportunity for double tracking.

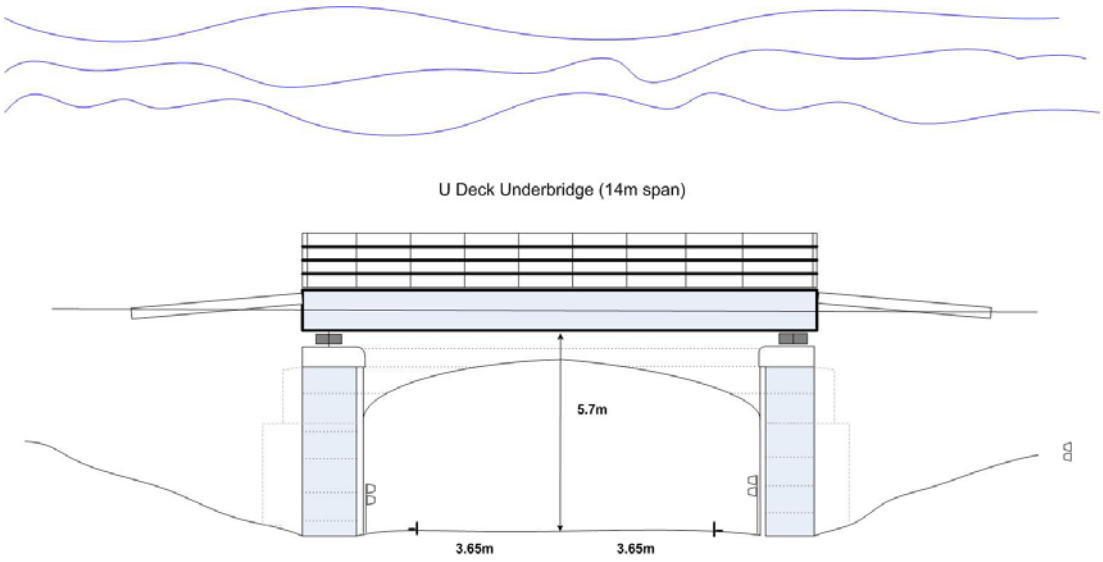
A reconstructed bridge would remove the need for the single lane traffic management constraint; depending on the extent of the reconstruction, the new span and skew dimensions and a realignment of the highway.

4.8.2 Options for reconstruction

There are 3 key options that have been considered for replacing the superstructure of UB 293/084, based on a single carriageway. These are as follows:

- Replace superstructure on built up abutments (sketch included)
- Construct entire new underbridge
- Construct entire new underbridge off line

4.8.2.1 Replace superstructure on built up abutments



Inveramsay Bridge OB 293/084
Option 1 – Replace superstructure on built up abutments

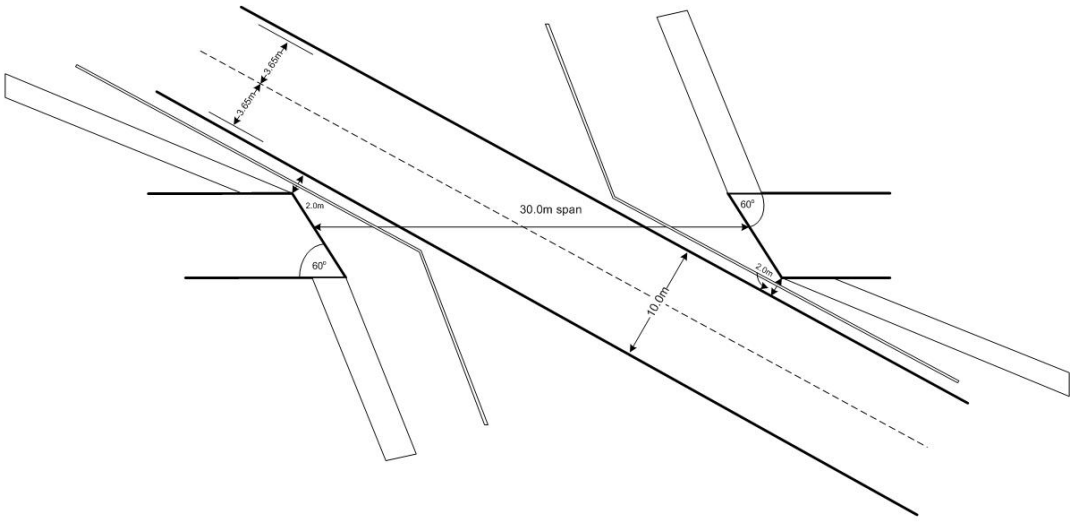
This option would involve the demolition of the existing arch and the installation of precast abutment units, new sills and a new deck. The design will not preclude the future redoubling of the line.

An addition to this option would be to improve the road alignment on the approaches to this structure by extending the straight section of road on either side and sweeping new curves back into the existing alignment as indicated by the red line in the photograph in page 38. The extent of the road realignment works will be significant given the constraints that the existing substructure creates.

The design of the new deck and other elements will require future liaison with and input from Transport Scotland regarding options for road alignments.

4.8.2.2 Construct New Underbridge

This option would afford the opportunity to improve the road alignment through the new structure by increasing the span of the new bridge. As there are numerous variants on the proposed span which will allow the relative skew angles between the road and rail alignment to be reduced it is proposed to consider the maximum practicable single span for steel under bridges. This typically will be in the order of 40m for box type underbridges, although spans exceeding 45 to 50m have been used in the past. The proposal is to design the new structure with a clear span of 30m.



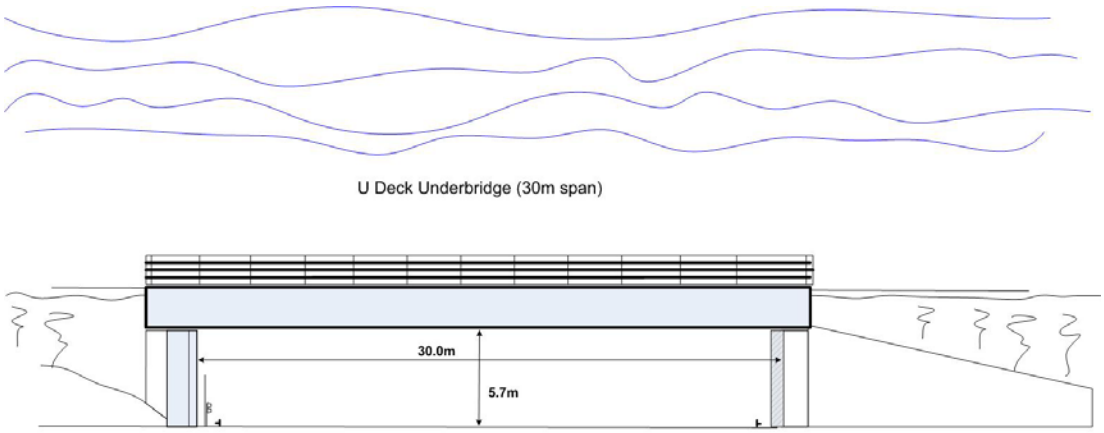
Inveramsay Bridge OB 293/084
Option 2 & 3 – Plan of new large span underbridge

The skew of the new substructure can be increased to afford further improvement in the road alignment. This is indicated by the White line in the photograph in page 38.

It can be seen that this will offer significant improvements over the first option, especially with enhanced approach alignments.

The proposed design would support a single track and would have abutments and superstructure elements designed to enable provision of a parallel deck for double tracking at a future date.

The design would intend to provide headroom of 5.7m, however this may also require works to alter the existing road levels and will require future liaison with and input from Transport Scotland.



Inveramsay Bridge OB 293/084
Option 2 & 3 – Construction of new large span underbridge

4.8.2.3 Construct New Underbridge off line

This would essentially be the same end solution as the option 4.8.2.2 but would considerably reduce the disruption to the railway. Having considered the current horizontal alignment of the track and the reverse curve to the north west, the preferred location for the new structure would be to the north side of the existing. This would allow for an improved track alignment to be provided.

This option would require land take and a significant amount of earthworks/retaining works for the realigned track. It would also require both temporary and permanent road realignments as the new track formation would encroach on the A96 on the north side of the line. Again this option will afford the same opportunities for improving the road alignment through the new underbridge.

4.8.3 Cable Routes and Service Diversions - Rail

The demolition of the existing structure and reconstruction of a new deck or structure may involve significant cable re-routing works both temporary and permanent

including disconnection, rerouting, replacement and reconnection. This will be further evaluated in future stages and will inform the further development of the methodology of the preferred solution. The scope and complexity of the works is not quantified at this stage.

4.8.4 Cable Routes and Service Diversions - Road

The demolition of the existing structure and reconstruction of a new deck or structure may affect existing services within the road and outwith Network Rail ownership. It is likely that there will be a requirement to alter or divert services in the road on a temporary or permanent basis. The requirements will be further evaluated in future stages and will inform the further development of the methodology of the preferred solution. This will include liaison with Transport Scotland, public utilities e.g. electricity, drainage, telecommunication and landowners regarding the location of services within the road and affected surrounding area.

4.8.5 A96 Dual Carriageway

If the potential upgrade of the A96 to dual carriageway is to be considered, it is likely that the construction of an underbridge at this location or in the vicinity will not be a practical option due to the relative alignment and skew between the road and the railway and the increase in spans and headroom required. The scale of the demolition and infill works and the increase in road levels to provide necessary track clearance would result in a structure c.12m in height.

The volume and extent of proposed earthworks and road realignment works required would be disproportionately costly when compared with other options. For this reason the option has not be given further consideration in this report.

If a future requirement is identified for upgrading the A96, any crossing for a new dual carriageway is likely to be an overline structure located either to the east or west of the present location of UB 84.

4.9 Kittybrewster Ground Frame

This section relates to Objective 9.

The solution to automate the function of the ground frame at Kittybrewster would depend on whether any of the existing single line between Dyce and Aberdeen is to be double tracked or not.

If the entire line is left single track then the alterations would be limited to the following:

- Upgrade of S&C to motorised points
- Conversion of signal A98R to controlled signal with junction indicator
- Alterations to signal in rear of A98R

- Panel and interlocking alterations at Dyce.

If the Aberdeen North Bay Platform works have not been implemented by the time that these works are being planned, consideration should be given to undertaking the works together, as both projects will affect the signalling interlocking and panel layouts.

If works are to be undertaken to double track the section of line between Dyce and Aberdeen there are various options which could improve access to the Waterloo sidings as well as supporting the proposed timetable.

Some of the potential options are as follows:

- Double track between Dyce and Kittybrewster utilising existing connection from single line into Waterloo sidings. This option could either retain the existing headshunt or absorb the headshunt into the new double track section
- Double track from Dyce, through Kittybrewster towards Hutcheon Street Tunnel where it will revert to single line
- Demolish redundant Kittybrewster station platform walls and provide a connection from Aberdeen into the sidings. This would eliminate the need for freight services to propel back in to Kittybrewster.

All options should consider the method by which freight services access the Waterloo sidings and seek to minimise occupation of the mainline associated with run round moves.

5 Track

The route involved in this study is 108¼ miles long and comprises 10 elements based on the station/loop locations:-

- 6 miles of the main route from Aberdeen to Dyce
- 10 ¾ miles from Dyce to Inverurie
- 10 ½ miles from Inverurie to Insch
- 5 ½ miles from Insch to Kennethmont
- 7 ¾ miles from Kennethmont to Huntly
- 12 ½ miles from Huntly to Keith
- 18 miles from Keith to Elgin
- 12 ¼ miles from Elgin to Forres
- 9 ¾ miles from Forres to Nairn
- 15 ¼ miles from Nairn to Inverness.

Between Stations the line is entirely single-track except for 5½ miles from Insch to Kennethmont, which is effectively a dynamic loop.

The track system is fit-for purpose for the current traffic and maximum line speed of 75mph, however there are 32 discrete lengths of plain line totalling approximately 20 miles i.e. about 20% of the track mileage over which the line speed can not be raised unless the track system is renewed. This comprises track types such as:-

- Bullhead jointed
- Flat-bottom jointed with elastic-spike fastenings
- Bullhead Continuous Welded Rail (CWR) track on concrete sleepers
- Early Flat-bottom CWR track with obsolete fastenings
- Track on Longitudinal timbers at underbridges.

None of these track systems are permitted to run at a line speed exceeding 75mph and many of the 32 locations are already at that speed.

The specification for an ‘entire’ track renewal deals with ballast, rail and sleepers. On this route the policy has been to scarify the ballast due to its general good quality, lay steel sleepers and install 113lb flat-bottom CWR. This system enables the line speed to be raised to a maximum of 95mph, subject to curvature, gauge clearance and suitability of signalling as well as the integrity of structures and earthworks. A significant length of the route has been renewed in this fashion over the past 12 years and provides high track quality coupled with reduced inspection and maintenance needs. It is also entirely suitable for general freight traffic of up to 25-tonne axle-weight

running at a maximum speed of 60mph or trains of container traffic of lower axle-weight running at up to 75mph, again subject to suitability of curvature, gauge clearance, signalling, structures and earthworks.

5.1 Engineers Line References (ELR)

- Aberdeen to Keith is ANI1
- Keith to Forres is ANI2
- Forres to Inverness is ANI3.

5.2 Switches and Crossings (S&C)

S&C exists on the route at all the locations listed above plus Kittybrewster Jn., serving the Waterloo Goods Branch, Port Elphinstone, serving a paper mill and Alves Jn., serving the Burghead Branch and, excluding hand operated points within sidings, comprises a total of 33 units.

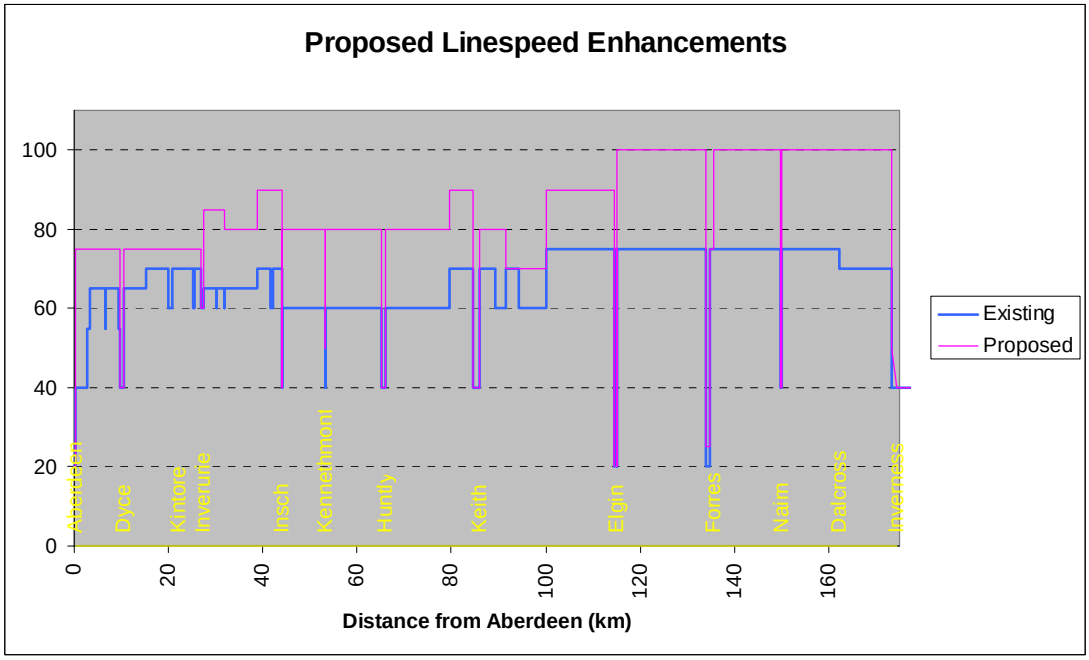
Renewals have recently taken place at Kittybrewster, Raiths Farm Freight Terminal and at Nairn. No other entire renewals are currently proposed but a programme of partial renewals and refurbishment of S&C is planned over the next 5 years and these will be identified and the impact evaluated in GRIP Stage 3. Apart from Alves Jn the condition of the S&C is satisfactory to enable all aspects of the Journey Time Improvement to take place. At Alves Jn. the current line speed of 75mph is limited by the design and cannot be raised to the potential of 90mph available on each side without renewal of the S&C.

5.3 Method of selecting potential line speed

The potential line speed for the route was created using data from contemporary track recording runs and applying an analysis technique which links the actual geometry measured with the curving rules set out in Network Rail Standards. The method enables the impact of features such as stations, level crossings, structures, earthworks and signal positions to be overlaid on a linear representation of the route.

When coupled with an analysis of achievable train performance using a computer based modelling tool such as ‘Vision’, the optimum line speed can be selected and compared with existing line speed. Consideration of the track type and condition enables an assessment to be made of whether speed can be raised with or without physical work which may range from minor tamping to improve track geometry to entire renewal of the track system as described in 5 above.

In this study the potential line speed analysis has been based on applying a ‘differential speed’ regime to the route which will permit only Class 158 & 170 DMUs to operate at speeds above existing.



5.4 Assumptions in Existing Loops

The existing line speed has been retained within most loops as an all-stations stopping pattern is understood to be required, except at Keith Loop where an improvement is already proposed and on the Insch to Kennethmont double-track 'dynamic' loop where significant benefits can be obtained.

5.5 Proposed New Stations and Loops

This study is considering new Stations at Kintore and Dalcross where from a track point of view the existing track system could be retained, particularly if all passenger trains are scheduled to stop. If a single-platform option is progressed then the existing track should be adjusted to an optimal geometry by implementing a co-ordinated design scheme. This will enable the platform to be built in such a way that any future track renewal does not require the platform to be altered.

Should a loop be provided at either of the new stations or required at a discrete location then a typical track specification for the new construction would be:-

- 200mm ballast depth to Plain Line, 300mm to S&C on a prepared formation with appropriate geotechnical treatment informed by a Ground Investigation
- steel or concrete sleepers
- CWR with 113lb rail
- 113lb vertical S&C using shallow-depth switches on concrete bearers, fully welded construction.

The required length of loops and type (size/hand) of S&C should be considered at GRIP Stage 3.

5.6 Fencing

The existing Boundary Fencing will generally continue to be satisfactory subject to an ongoing compliant inspection regime and risk assessment of locations where change occurs due to neighbours, trespass and vandalism. As part of the Journey Time Improvements the associated line speed increases and/or increase in tonnages will lead to a systematic review of the Track Category. If the category changes then fencing and other boundary measures will re-assessed in accordance with Network Rail Standards.

6 Civil Engineering

There are over 200 retaining structures on the Aberdeen to Inverness Route either retaining earthwork cuttings or the track formation itself. The majority of the structures are of masonry construction with gabion baskets being adopted for repairs of low height walls and these are varied conditions.

Although the route is now predominantly single track, the original formation for the route was double track between Aberdeen/Dalcross and Dalcross to Inverness. The formation between Elgin and Dalcross has always been single track.

6.1 Implications to Earthworks and retaining walls

6.1.1 Infrastructure Considerations

The required increase in line speed and potential redoubling may have some effects on any retaining structures and earthworks supporting the railway. The dynamic and radial effects of increased speeds for specific traffic types of traffic will have to be considered on affected structures.

6.1.2 Retaining Structures

Where new loops are being provided, a full condition assessment will be required for any supporting retaining structure even if the track is being reinstated on the line of the original formation. Structures supporting the formation which are close enough to carry live load effects are to be identified during the next stage of the project and appropriate assessments undertaken.

If these assessments identify any concerns with either the condition or capability of the retaining structure in question, options for remedial works, including strengthening, are to be considered during the next stage.

6.1.3 Earthworks

Generally, it is only embankments that will be affected by increases in speed. Both embankments and cuttings may be affected by changes in track alignment. Where new loops are to be provided, cuttings are usually unaffected if the proposed track alignment follows the original formation.

If embankments are redoubled on their original alignment, there could still be issues if there are significant ballast and shoulder requirements. This can raise the track outwith the embankment support area and increase the loading beyond acceptable levels. If the original formation is well below the existing track level track lowers may have to be considered to mitigate the risks when redoubling.

Any changes to horizontal alignment may also move the track outwith the original embankment support zone and the effects of this will have to be considered to mitigate against slope failure.

Earthworks are categorised as serviceable, marginal or poor. When considering sections of line where speed increases are proposed, sections where the slope is categorised as marginal or poor will require risk assessments to be undertaken to determine if any remedial works will be required.

6.2 Implications to Overline Structures

There are numerous types of overline structures on the route and the definition includes overbridges, footbridges and a pipebridge. There are 98 overbridges and 2 footbridges over the full route between Aberdeen and Inverness. The overbridges are typically of flat deck or masonry arch construction.

In order to meet the requirements of the remit, it will be necessary to both increase line speeds over certain sections and provide dynamic loops in other areas and both of these factors may have implications to the overbridges and viaducts on the route. The main areas of concern are available clearances and vehicle incursion. The change in use scenarios are discussed below:

6.2.1 Increase in linespeed

As mentioned previously the maximum line speed is currently 75mph and in order to achieve a 2 hour journey time it has been necessary to increase the line speed above this value and over certain stretches up to 100mph.

The increase in line speed will possibly affect the passing clearances at certain structures and will affect the risk score for vehicle incursion risk assessment.

The next stage of the project should identify which overbridges are within sections where the line speed is to be increased and consider the following:-

- Identify overbridges with tight clearances and run clear route analysis
- Undertake or rescore vehicle incursion risk assessments for affected overbridges.

6.2.2 Provision of dynamic loops

Where dynamic loops are being provided, effectively doubling single line sections of the route, clearances and incursion risk assessments will have to be revisited for all overline structures affected.

Clearances for redoubling may be problematic at masonry arch overbridges where the track has been slewed to the centre of the arch to optimise clearances.

The published clearance for this route is W7 although W8 with special restrictions is permitted between Aberdeen and Elgin. To maintain this clearance, it is likely that track lowering will be required at arch overbridges when redoubling. It should be noted that at certain sites, track lowering may be impracticable due to the extents or issues with drainage and deck reconstruction may be required.

The next stage of the project should identify the overbridges on proposed loop sections where there are clearance problems and identify the best option to remedy this. In addition, vehicle incursion risk assessments will have to be undertaken or revisited for all overbridge structures on proposed loop sections. Remedial measures resulting from these assessments are to be identified during the next stage of the project.

6.3 Implications to Underline Structures

There are 150 underbridges, 177 culverts and 6 viaducts over the full route between Aberdeen and Inverness.

The existing route is classified as having RA10 capability and the maximum current line speed is 75mph. Whilst RA10 is usually assessed for line speeds of 60mph, certain structures on the route have been assessed as RA10 at 75mph.

In order to meet the requirements of the remit, it will be necessary to both increase line speeds over certain sections and provide dynamic loops in other areas. Both of these factors have implications to the existing culverts, underbridges and viaducts on the route. The main areas of concern are the assessed capability of the structures and their condition. The change in use scenarios are discussed below:

6.3.1 Increase in Linespeed

As mentioned previously, the maximum line speed over the route is currently 75mph. In order to meet the 2 hour journey time it is necessary to increase the line speed above this value over certain stretches, up to 100mph.

The assessed capability of a structure is its ability to carry the dynamic loads imposed upon it. As the dynamic factors are directly related to line speed, any increase in line speed will increase the dynamic loading from a particular vehicle on a structure. It will therefore be a requirement to check the assessed capability of all underline structures where line speed is increased. As freight services are not permitted to exceed 75mph on the UK network, there shall be no requirement to check RA ratings for freight traffic on these sections of route.

The increased loadings for the passenger traffic cleared to use the route need only be checked against the assessed underbridge capacities. Please note passenger traffic is varied and can range from lightweight DMUs, through HST sets, to locomotive hauled passenger trains. It is thought unlikely, at this stage, that the increased dynamic

factors applied solely to DMU stock will have a governing effect on the assessed capability of the majority of underline structures on the route.

Apart from any dynamic RA restrictions related to speed increases, underbridge structures with waybeams have an automatic permanent speed restriction of 75mph irrespective of the dynamic capacity of the rest of the structure. These structures either have to be considered as a constraint for calculating the section running times or modified to remove the waybeams.

A typical solution is to provide new deck elements and ballasted track or some form of slab track solution, either way this will lead to an increase in dead loading and the structure will have to be re-assessed to determine its load carrying capacity for the required traffic types. Should this be insufficient, options for strengthening or deck replacement will have to be considered.

The next stage of the project should identify which underbridges are affected and identify if there will be an issue with capacities as a result of increased dynamic factors. The options for structures identified with inadequate capacity for line speed increases are typically as follows:

- Consider DMU stock only in evaluation and introduce differential speeds
- Undertake more detailed assessment to try and enhance capacity
- Identify strengthening measures to achieve required capacity
- Consider structure as a constraint for calculating section running times.

6.3.2 Provision of Dynamic Loops

As discussed in section 3.3, it will be necessary to provide dynamic loops in order to deliver the timetable and these loops may be up to 10 km long and involve providing double sections of track over the required lengths. Once the required loop locations have been identified, the underbridges will have to be assessed for redoubling, this will involve both a capacity and condition assessment and will also consider the requirement to increase the line speed. The original sections of the route were double track between Aberdeen / Keith and Elgin / Inverness with the Keith Elgin section being single track. Where possible, dynamic loops should be positioned on the original double track sections to avoid significant formation works and land take issues.

It is known that several underbridges on the double track sections have been replaced with single track structures and options for redoubling these structures will have to be considered at the next stage of this project.

6.4 Implications to Neighbourhood Sites

There are numerous locations where road traffic runs parallel to the railway on this line of route and currently approximately 106 locations have been identified between Aberdeen and Inverness.

6.4.1 Vehicle Incursion Risk Assessments

At neighbourhood sites where it is proposed to increase the line speed, provide a dynamic loop or both, vehicle incursion risk assessments will have to be undertaken or revisited.

The next stage of the project should identify such sites and highlight remedial measures resulting from these assessments.

6.5 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.

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

Note: Aberdeen and Inverness are considered outwith the project area a this stage

There are aspirations to provide new stations at Dalcross and Kintore and an additional platform shall be required at Forres to facilitate passing. The required platform lengths shall be agreed as the project progresses into the next GRIP stage.

7 Signalling

The project is required to propose and ascertain the optimum railway infrastructure on the line of route capable of delivering the proposed timetable and station stop requirements.

The infrastructure changes may include double track, loop extensions, the provision of new loops and shall also take cognisance of the proposed new stations.

Elimination of cumbersome token exchange delays and other sources of delay within the operation of the existing signalling systems shall also be targeted as a key area where the required journey time improvement can be delivered.

Existing primary Signalling Infrastructure Condition Assessment (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 life expectancy of over 20 years. Insch, 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 signal boxes is during 2011, however the category of classification is unlikely to change.

7.1 Existing Assets

The route is controlled by signalling technologies ranging from relay type interlocking at Aberdeen with intermediate Electro mechanical signal boxes 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 signal box 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 signal box 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 signal box 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 signal box 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 signal boxes.
- Kennethmont SB is an electro-mechanical signal box with Tokenless Block working over the single line to Huntly and Absolute Block over the double line to Insch.
- Insch SB is an electro-mechanical signal box 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 signal box with bi-directional loops provided through the station area. Inverurie operates Tokenless Block working over the single lines to both Dyce and Insch.
- 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. Raiths 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.

7.2 Control Centre Technology

Whilst no work is currently planned, the recommended Control Centre strategy in the medium term is to move toward Inverness SC controlling as far as Elgin (inclusive) and Aberdeen SB controlling toward Keith (inclusive). The control strategy is linked with the projected local service provision at each end of the route.

For the purposes of this project it is envisaged that this shall involve the following:

- Inverness control area shall extend to encompass the new Dalcross loop / station arrangements.
- Forres SB area shall be extended in line with any proposed loop extension and shall also incorporate Axle Counter Equipment required to replace the key token sections to the adjacent signal boxes. A new interlocking may be a requirement at Forres depending on the extent of alterations deemed necessary as the project is developed. The existing space in Inverness Signalling Centre could be utilised for this purpose. In this scenario

Inverness would pass control to Nairn for eastbound movements and receive control again of such movements beyond Nairn.

- Elgin SB may require signalling alterations to facilitate a stabling capability as part of the turnback. This will be dependent on the dwell time of the turnback trains.
- Keith SB shall have minor signalling alterations to extend the loop arrangements through the station area. Alterations may become more extensive though in the event it becomes necessary to realign the track in the vicinity of the signal box.
- Insch SB shall have minimal alterations for the fringe toward Inverurie.
- Aberdeen control area shall be extended to encompass the Dyce and Inverurie SB areas with enough capacity to include an extension to Keith at a future date. Inverurie and Dyce signal boxes shall be closed under this arrangement.

Within the context of the timetable Option 3, it is envisaged that there shall be no signalling work required at Kennethmont and Huntly signal boxes.

7.3 Interlocking Technology

The interlocking technologies currently in use at Inverness and Nairn shall be retained with track circuit block being introduced to replace the key token sections between Nairn and Elgin. The TCB provision shall be achieved utilising axle counter technology with the equipment located at Forres SB.

It is anticipated that the interlocking for the proposed Dalcross loop shall be achieved by extension of the existing Solid State Interlocking (SSI) at Inverness with associated panel alterations.

Alterations to the existing Westrace Interlocking at Nairn shall be avoided where possible.

New signalling arrangements and interlocking may be a requirement at Forres dependent on the extent of alterations required. This could be achieved by a re-control of the Forres area to Inverness although this would drive an upgrade of Waterford L.C. to control by CCTV.

Alterations to the existing Electro-mechanical signal box arrangements shall be carried out to accommodate any stabling requirements in connection with the turnback facility at Elgin.

A new Computer Based Interlocking (CBI) and workstation shall be provided at Aberdeen SB to control Dyce to Inverurie. This provision shall incorporate the alterations envisaged to recontrol Kittybrewster ground fame and provide the passing loops between Kittybrewster and Insch (exclusive). The new interlocking

arrangements would also improve the interface with the freight facility at Raiths Farm. The CBI and workstation would be required to have future capacity to control as far as Keith. The existing relay interlocking at Dyce shall be recovered as part of these works along with the mechanical frame at Inverurie SB.

7.4 Train Detection Technology

The default choice of train detection where alterations are required for this project shall be axle counters.

7.5 Point Operation/Detection Technology

Hy-drive points shall be introduced for all new point arrangements. Existing point arrangements shall be retained unless a performance gain can be proved as beneficial toward achieving the project goals.

7.6 Lineside Cable Route and Housings

It is proposed to use existing cable routes as far as practicable. New cable routes shall be installed where required for the new loop arrangements. A detailed cable route survey shall be carried out to fully assess the works required for the project.

7.7 Power Supplies

Power supplies at each site shall be assessed for capacity purposes. UPS equipment will be a requirement where axle counters are being introduced.

7.8 Development of Signalling Solutions

Appendix E – Initial Project Specification and Appendix F – Operational Requirements Specification have been developed at GRIP Stage 2 on the assumption in GRIP Stage 2 that Option 3 (crossing Aberdeen – Inverness hourly services at Huntly and Elgin) is the preferred option. If a different option becomes preferred then these signalling deliverables will be updated as required.

8 Telecommunications

8.1 Existing Assets

There is very limited copper cable infrastructure across the route. Generally islands of copper cabling are present around each signal box to support local lineside telecoms (signal post telephones, level crossings).

Level crossings located more remote from the signal box are supported via BT Direct Connect services.

Retail Telecom assets are present at each station and are explained in more detail below.

8.2 NR Fixed Telecoms Network/ Global System for Mobile – Railways FTN/GSM-R

8.2.1 GSM-R

Network Rail has embarked on a programme to replace its analogue Legacy Cab Radio systems, National Radio Network and Cab Secure Radio (NRN and CSR) with a new digital GSM-R System. The timing of the introduction of GSM-R is driven by a number of factors, not least the revocation of the licence to radiate NRN frequencies in Great Britain.

In addition, introducing GSM-R now mitigates the fact that the technology on which existing systems are based is reaching life expiry and is becoming progressively more difficult and expensive to maintain. GSM-R will also satisfy the requirements of a number of incident inquiry safety recommendations to enable the GB railway to comply with European interoperability legislation to mitigate the impact of withdrawal of frequency licences and capitalise on the benefits of modern technology and the significant safety and performance improvements that it can bring. With the arrival of GSM-R the GB railway will, for the first time, have access to a single national system of driver to signaller radio communications designed to cater for the needs of a modern railway.

The introduction of GSM-R into GB operation is being rolled out in a series of geographically based packages or Completion Areas, determined principally by the range of operation of specific Vehicle fleets and constrained by the scale of the resultant exercise to bring the system into operation. An ATOC led, cross industry team has been established within the GSM-R Programme organisation to manage the direct involvement of individual Train Operators in the National Rollout exercise and to provide co-ordination with the Network Rail led elements of the Programme. This team will assist each Train Operator to establish a detailed programme of activities in

respect of train fitment, driver training, operational introduction, etc to align with and support the overall rollout plan. For the introduction of GSM-R to be a success, it will require an industry common purpose, focus and determination. Only a completely conjoined programme with the backing of all industry parties will succeed.

8.2.2 Fixed Telecom Network

Network Rail's FTN is primarily based on Synchronous Digital Hierarchy (SDH) transmission over optical fibre cables using ring topology, and employs discrete transmission nodes connected by optical fibre and copper cables. This design provides a suitable degree of resilience by ensuring that all critical elements can be dual fed, and so the network is less vulnerable to common mode failures.

Network Rail's FTN will deploy fibre only cabling to connect transmission nodes to the SDH transmission network.

Nodes on the Aberdeen to Inverness route will be supported by Double Insulated Super Armoured Optical Fibre cable (DI-SAC). This cable is designed to be deployed on routes without a suitable concrete troughing route. The cable is scratch buried and anchored at regular intervals.

Copper islands occur when the proliferation of services to be supported typically occurs near to a transmission node and there is no requirement for copper connectivity through the cable section. In these instances the requirement for a continuous copper cable through the cable section is discarded and the transmission nodes form copper islands although they will still be optically connected through a fibre cable.

On the Aberdeen to Inverness route there is no plan to deploy copper cabling and as such the existing copper islands will be connected to FTN by the installation of copper tie cables.

The FTN/GSM-R design has not been completed for the route yet and as such the proposed signalling solution may be able to influence the final FTN/GSM-R system.

8.3 Cable Route

Islands of cable route exist at either side of each signal box. The routes generally extend to the distant signals on the approach to each signal box.

The FTN project will not deploy any additional cable route. Any requirement for additional cable route to support any signalling or telecom solution will require the installation of new cable route.

8.4 Retail Telecoms

Retail Telecom Systems are installed at each station as follows.

Station	CIS	CCTV	LLPA
Dyce	Yes	Yes	Yes
Inverurie	Yes	Yes	Yes
Insch	Yes	Yes	No
Huntly	Yes	Yes	Yes
Keith	Yes	Yes	Yes
Elgin	Yes	Yes	Yes
Forres	Yes	Yes	Yes
Nairn	Yes	Yes	Yes

Where platforms are extended or new platforms constructed, the existing retail telecom systems shall be extended to support the new operational platform area.

If there is a need to significantly increase the number of CCTV cameras at any site then the existing recording devices is likely to need to be upgraded and replaced.

9 Level Crossings

9.1 Existing Level Crossings

There are 61 level crossings across the route as shown in Table 1.

Crossing Type	ELR			Total
	ANI1	ANI2	ANI3	
AHB Automatic Half Barrier	3	1	3	7
AOCR Automatic Open Crossing Remotely Monitored		1		1
MCB Manually Controlled Barrier	1	2	1	4
MWL-V Miniature Warning Lights – Vehicle	1			1
PED - Pedestrian	3		4	7
UWC – User Worked Crossing	4	2		6
UWCP User Worked Crossing Pedestrian	13	15	7	35
Grand Total	**25**	**21**	**15**	**61**

Table 1 - Level Crossings

9.2 Linespeed Enhancement

A desktop review has been undertaken of all level crossings along the route to assess if an increase in linespeed is achievable. There appear to be no significant issues with any level crossing with the proposed increase in linespeed. As the project progresses into GRIP Stages 3 and 4 each specific crossing will need to be assessed to determine if sufficient sighting is achievable and identify appropriate remedial works.

9.3 Proposed Double Track Locations

Initial evaluation of the proposed double track sections and the impact on existing infrastructure would indicate that significant alterations may be required to Automatic Half Barrier (AHB) level crossing installations located within these sections. The impact of the double tracking and the magnitude of the changes required will be examined in GRIP Stage 3, as well as considering moving the double track section to a location beyond the operational boundary of the particular level crossing.

At GRIP Stage 2, based on consideration of timetable option no.3, some of the crossings that may be affected by double tracking are:

- Boat of Kintore AHB – ANI1 12.1700
- Oyne LC – ANI1 24.1100
- Kinloss LC – ANI2 2.1636
- Waterford LC – ANI2 0.0515
- Dalcross AHB – ANI3 137.0371.

9.4 Double Track Assessment

The Level Crossing assessment has not specifically looked at any works which would be necessary if the section of line at the crossing is double tracked.

The necessary assessments will be undertaken on all crossings that will require the user to traverse an additional line using the All Level Crossing Assessment Risk Model (ALCRM) tool. Typical works required to facilitate the increased linespeed and/or double tracking are:

- Improve sighting by vegetation clearance
- Installation/moving of whistle boards
- Re-positioning of AHB treadles
- Improved crossing signage
- Robust briefing process for users.

10 Access to Track and Staff Safety

Significant changes will be made to the infrastructure between Aberdeen and Inverness and the creation of an operations and maintenance strategy will commence in the next GRIP Stage. It will be necessary to consider and make provision for, the safe access to and maintenance of all lineside infrastructure and assets and this will develop as more detailed requirements and information become available.

10.1 Access Arrangements

There is currently a wide range of vehicle and pedestrian access points available throughout the Aberdeen to Inverness route, however the location and suitability of each is largely a matter of history rather that part of an overall strategy.

Few of the vehicle access points have permanent Road-Rail Access Point (RRAP) compatible surfaces. The requirement for vehicle access with appropriate gates, parking and provision of RRAPs to support the delivery of this project and to facilitate future maintenance requirements once the line speed is raised over various sections and the frequency of trains' increases should be identified.

10.2 Staff Safety

In relation to staff safety, the impact of any increase in line speed and frequency of traffic will require to be assessed in relation to current methods of inspection and maintenance and appropriate measures identified to manage the changed risk. This may include the provision of additional access points, cess walkways, signage, improved sighting by vegetation clearance and Automatic Warning Systems. Appropriate updating of the Hazard Directory will be essential and briefing materials developed with stakeholders.

Consideration of the type, frequency and optimum location of Access Points plus mitigation of impact on staff safety including designing to maximise the capacity to work in a Green Zone environment should be taken forward as part of GRIP Stage 3.

10.3 Standards, Rules & Regulations

The requirements for updating any relevant standards rules, regulations and other publications will be collated in conjunction with the relevant stakeholders.

10.4 Asset Data

The details of all new and modified assets, and assets made redundant will require to be provided for inclusion into asset information systems to ensure appropriate maintenance arrangements are in place when the changes are scheduled to take place.

11 Environmental & Planning

A desk top evaluation of the rail corridor from Aberdeen to Inverness has been undertaken to identify potential environmental considerations. Along the route there are Listed Buildings and structures and these are identified in Appendix G.

Overall, there are a number of environmental constraints along the rail corridor between Aberdeen and Inverness that need to be taken into careful consideration to minimise any significant adverse environmental impacts. The main ecologically sensitive receptor is the Moray Firth, which is a Special Area of Conservation (SAC) and Ramsar Site, a wetland of international importance.

The impact of the proposals will be further considered in GRIP Stage 3 where options will be evaluated in more detail.

11.1 Environmental Appraisal

An initial Environmental Appraisal has been carried out as part of this GRIP Stage 2 study. It is intended to identify potential environmental issues and risks that may arise during the design and construction stages of the project.

This document will develop as the options are evaluated, the project becomes better defined and environmental effects become more accurately understood, new issues emerge and/or existing effects are eliminated through the project design. The Environmental Appraisal (EA) will ensure that actions are taken through the design stages to manage these aspects. The EA document is available as a separate document to the report.

11.2 Initial Town Planning Report

The Network Rail Town Planning team has undertaken an initial desktop appraisal at GRIP Stage 2 of the potential foreseeable planning constraints which may need to be considered in satisfying the objectives for the project as set out in the Engineering Deliverables report dated 28 June 2010.

Whilst planning strategy will develop with the progression of the GRIP stages, this report also provides initial advice on necessary town planning consents or required actions as a result of any proposed works directly effecting these planning constraints.

11.2.1 Identified Planning Constraints

The table in Appendix G – Planning Constraints and accompanying map set out identified potential planning constraints and existing environmental designations along the Aberdeen to Inverness route. The table also sets out consents or likely actions required as a result of any works which may impact on these constraints/ designations.

11.2.2 Engineering Deliverables – Planning Constraints

This section specifically assesses whether there are any potential planning issues with the proposed engineering deliverables as set out in the Engineering Deliverables report dated 28 June 2010. It also sets out what town planning consents will likely be required.

- Objective 1: Journey Time Reduction – not applicable
- Objective 2: Timetable – not applicable
- Objective 3: Dalcross Station

Works on Network Rail land will either be permitted development or in the case of a new station, will require the Council's Prior Approval. Planning Permission will not be required. Works outwith Network Rail owned land will require planning permission.

- Objective 4: Kintore Station

Planning permission will be required for proposed works out with our land ownership. The emerging Aberdeenshire Local Plan identifies a potential new station at Kintore and thus any proposals here will have confirmed Policy support.

- Objective 5: Forres Layout

Works on Network Rail land will either be permitted development or in the case of a new station, will require the Council's Prior Approval. Planning Permission will not be required. Works out with Network Rail owned land will require planning permission.

- Objective 6: Keith Layout

Works on Network Rail land ownership will be permitted development. Works out with Network Rail land will require a planning application. Keith Station is a designated Strategic Freight Site and consultation will be required re proposals for future usage. The land around the station is also contaminated and consultation with SEPA may be required.

- Objective 7: Dynamic Loops

Any land take and proposed works out with Network Rail land ownership will require planning permission. The type of planning application will depend on length of new track and Town Planning will have to advise as this objective progresses. As the location of loops has not been determined yet, the table in Appendix G and the map can assist with identified potential planning constraints.

- Objective 8: Inveramsay Bridge

From an initial review the works would all be within Network Rail land and therefore prior approval would be required but planning permission would not be required. This will require further consideration when more detailed information regarding the options are available.

11.2.3 Planning Development

As the project progresses through GRIP Stage 3, a more detailed examination will be made of the town planning issues that will be applicable to the selected timetable options and a response will be prepared with relevant planning strategies and option appraisal.

12 Risk Management

A risk identification workshop was held in July 2010 to bring together key internal stakeholders to discuss GRIP Stages 1-3 related threats previously identified at a workshop in GRIP Stage 1 and to identify additional threats to the delivery of the objectives.

Key risks to project progress have been identified as:

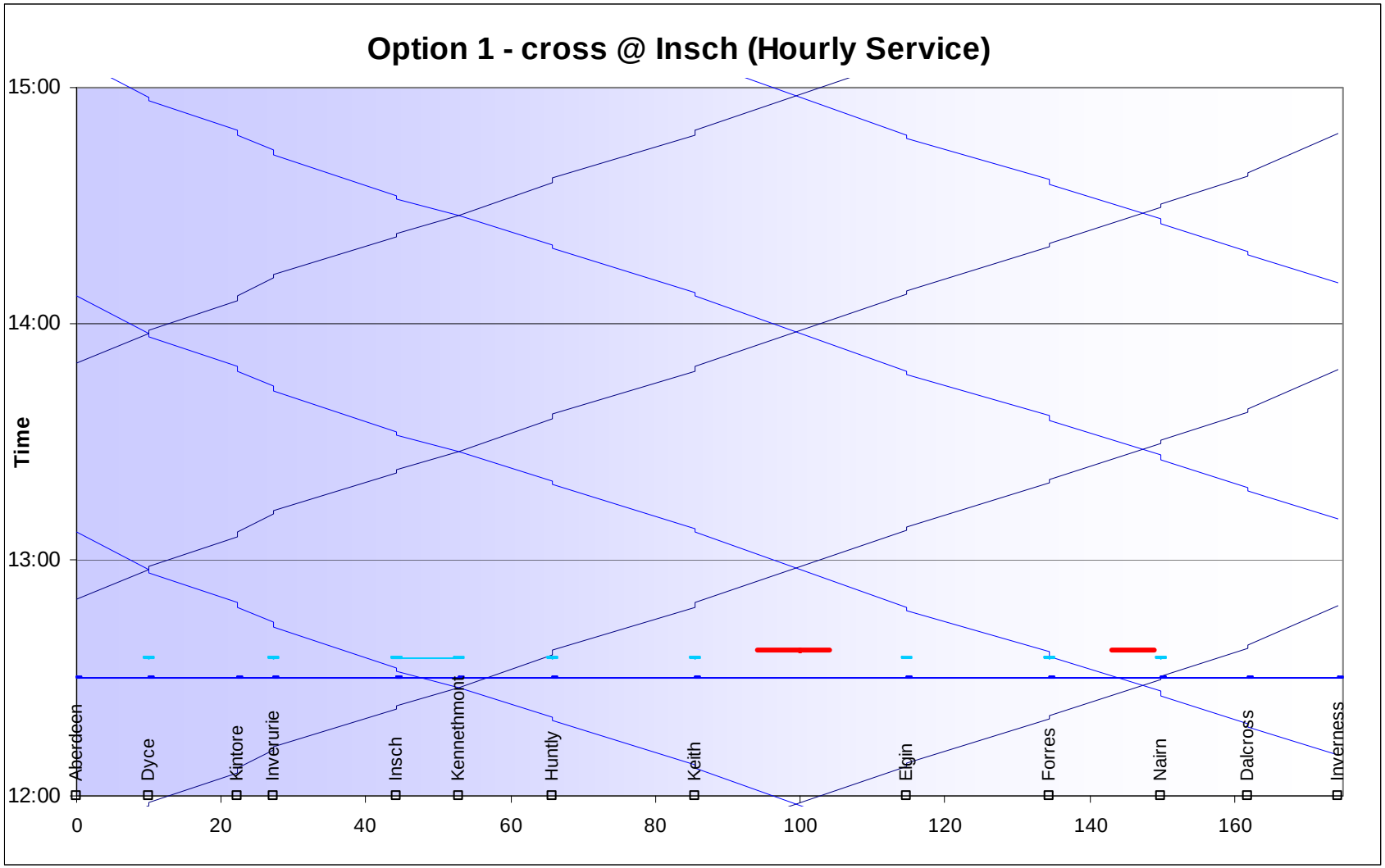
- The engagement of design resources to enable the study to progress to programme
- The interface between the timetable modelling and other work streams, as PCAT are based in Milton Keynes.

The workshop attendees also identified opportunities related to the passing loops and the signalling design. The opportunity to reduce bridge strikes at several of the route locations was also identified.

A quantified assessment of the likelihood of occurrence and the severity of impact of these threats will be undertaken in GRIP Stage 3 with the support of the Risk & Value Team. A similar assessment of the likelihood of realisation and the benefits gained associated with the identified opportunities will also be undertaken.

Appendix A – Route Map

Appendix B – Timetable Modelling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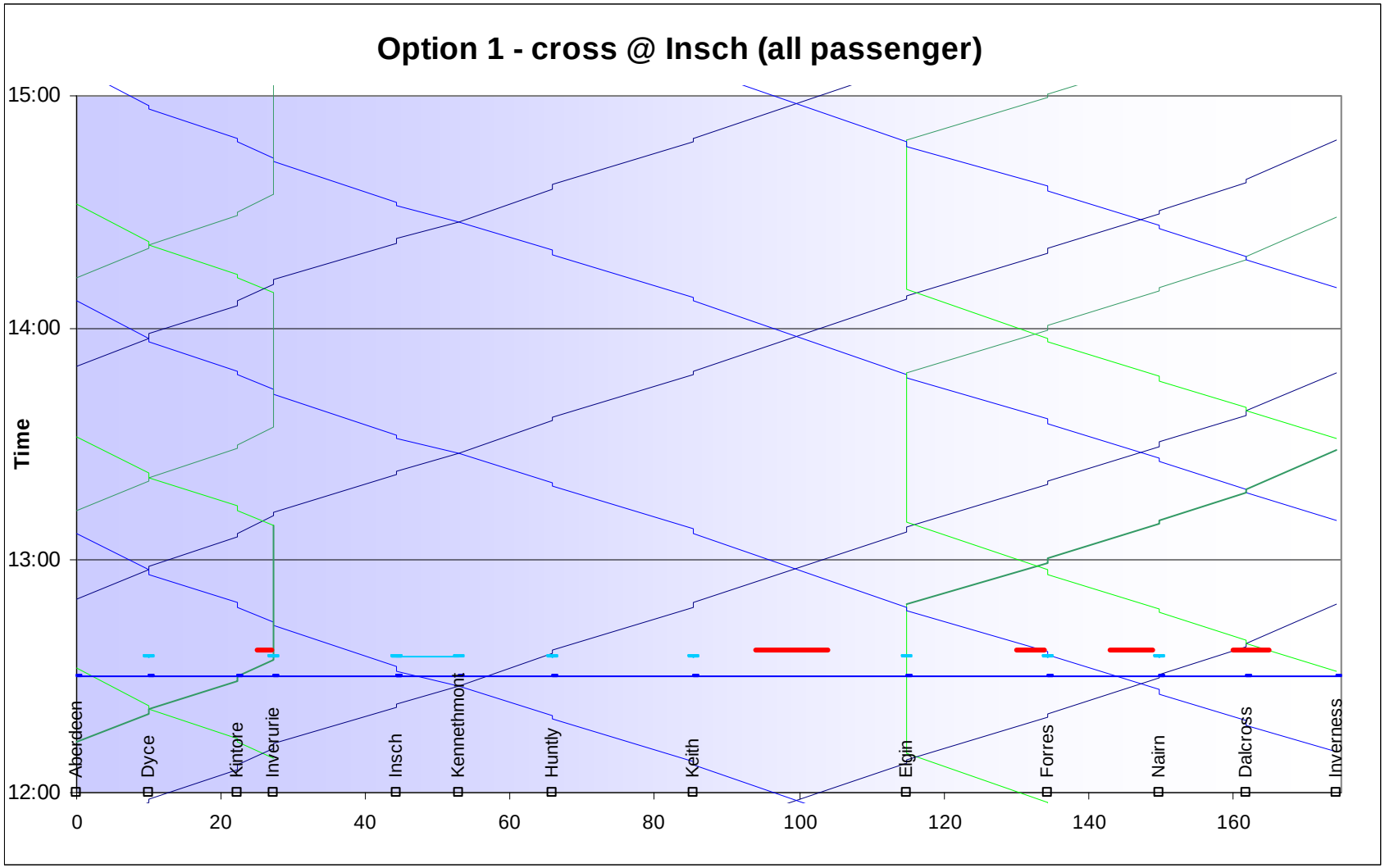
Time
15:00
14:00
13:00
12:00
Aberdeen
Dyce
Kintore
Inverurie
Insch
Kennethmont
Huntly
Keith
Elgin
Forres
Nairn
Dalcross
Inverness
0
20
40
60
80
100
120
140
160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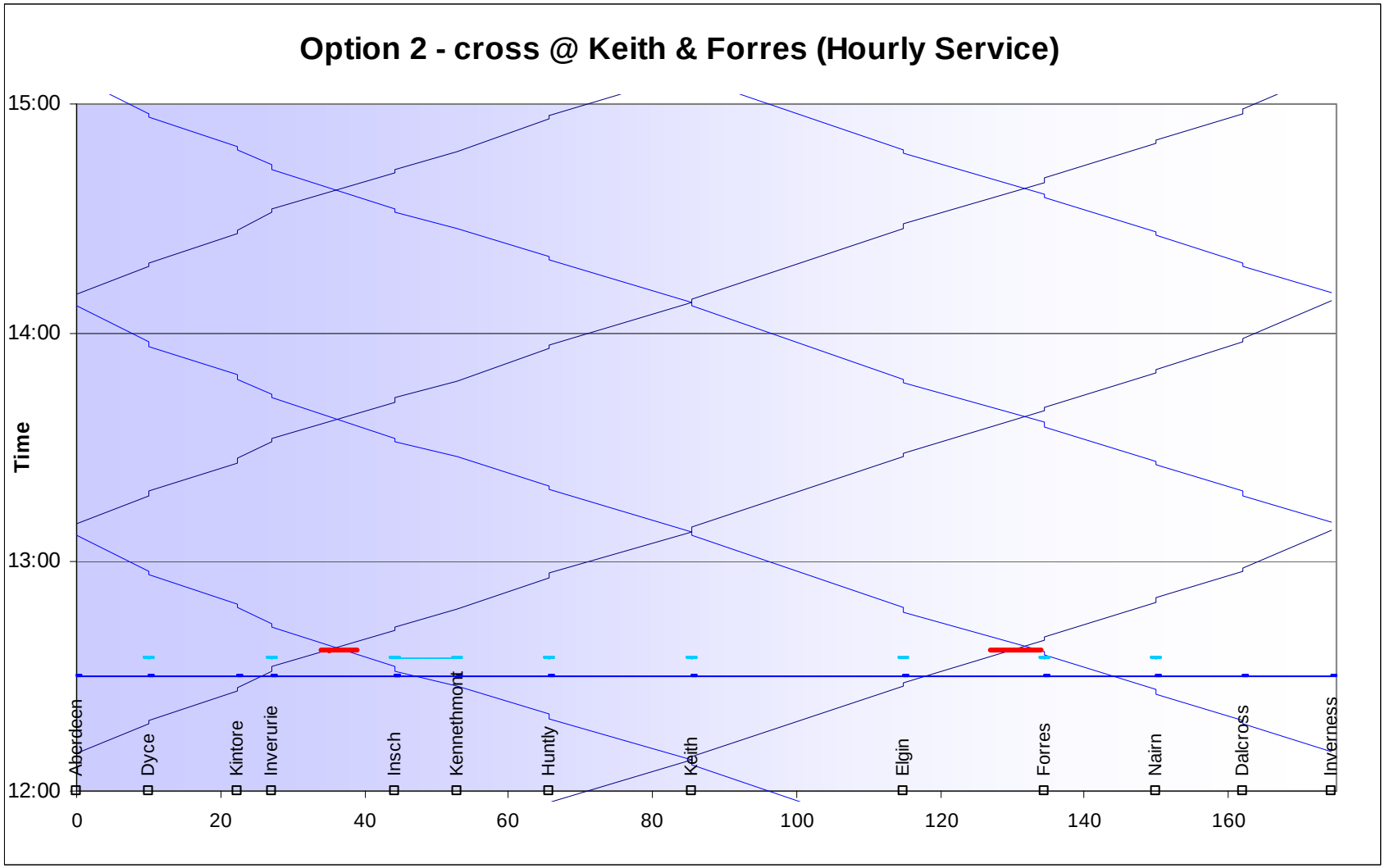
Time
15:00
14:00
13:00
12:00
Aberdeen
Dyce
Kintore
Inverurie
Insch
Kennethmont
Huntly
Keith
Elgin
Forres
Nairn
Dalcross
Inverness
0
20
40
60
80
100
120
140
160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Time
15:00
14:00
13:00
12:00
Aberdeen
Dyce
Kintore
Inverurie
Insch
Kennethmont
Huntly
Keith
Elgin
Forres
Nairn
Dalcross
Inverness
0
20
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140
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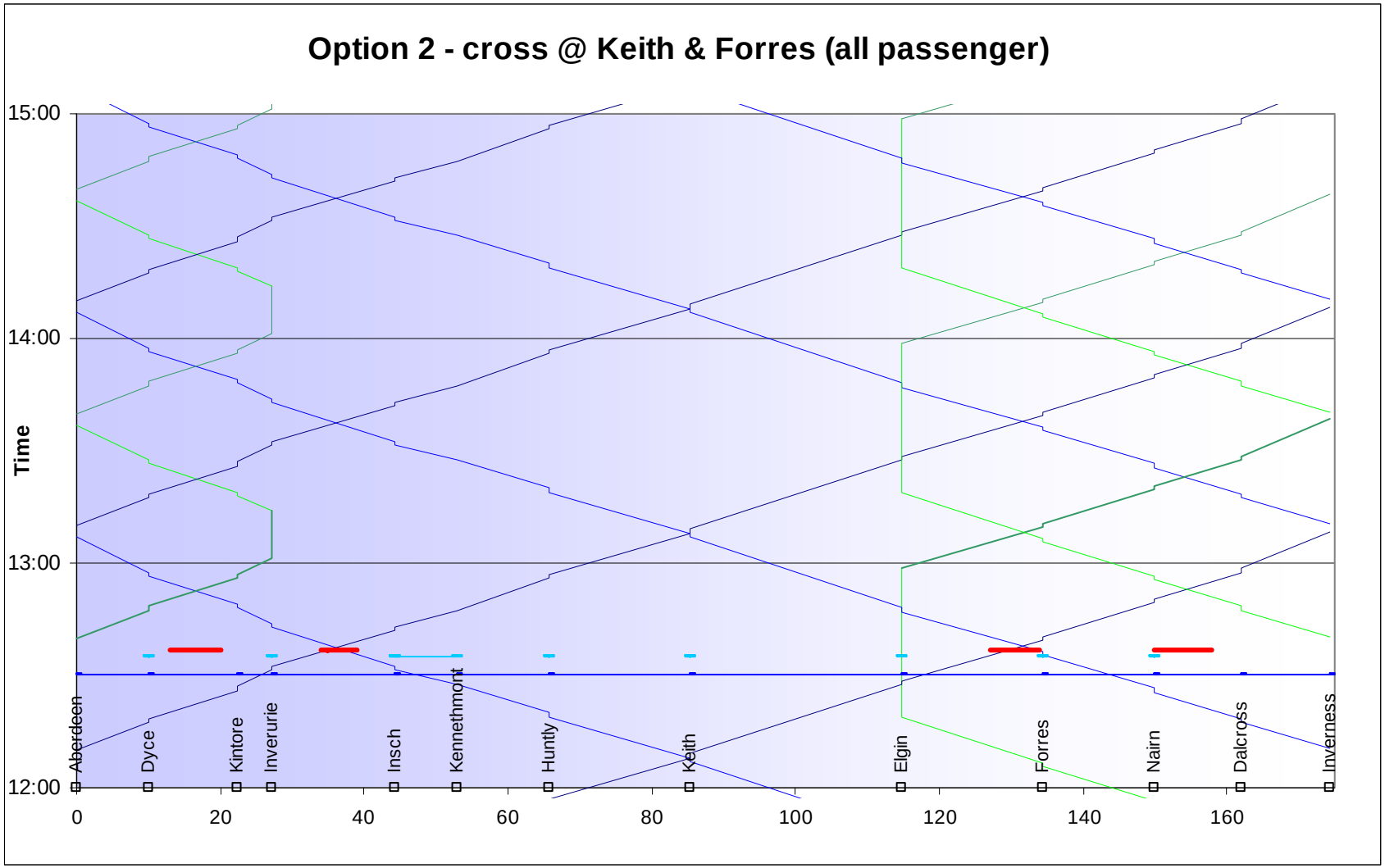
Option 2 - cross @ Keith & Forres (all passenger)
Time
15:00
14:00
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Aberdeen
Dyce
Kintore
Inverurie
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Kennethmont
Huntly
Keith
Elgin
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Nairn
Dalcross
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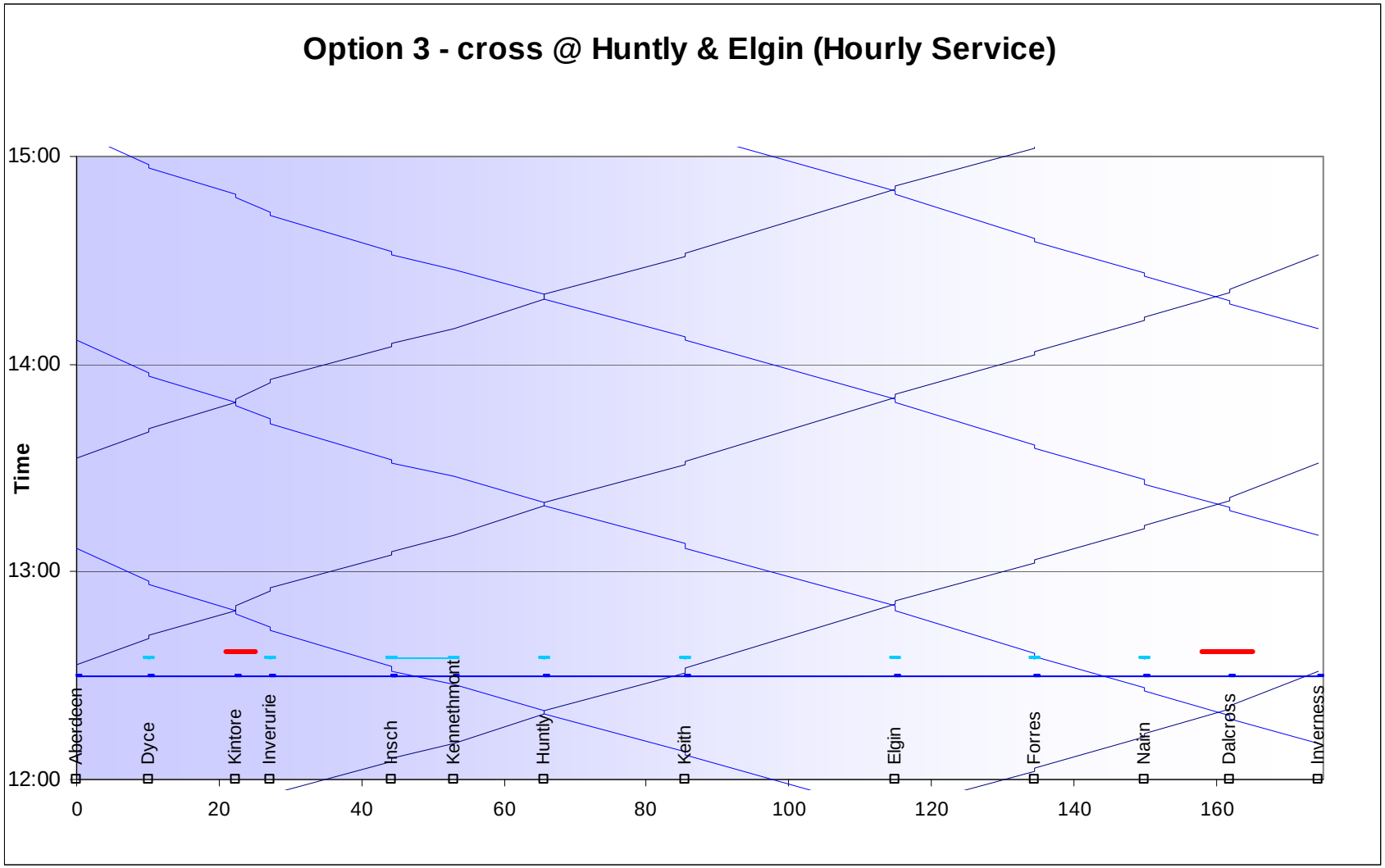
Option 3 - cross @ Huntly & Elgin (Hourly Service)
Time
15:00
14:00
13:00
12:00
Aberdeen
Dyce
Kintore
Inverurie
Insch
Kennethmont
Huntly
Keith
Elgin
Forres
Nairn
Dalcross
Inverness
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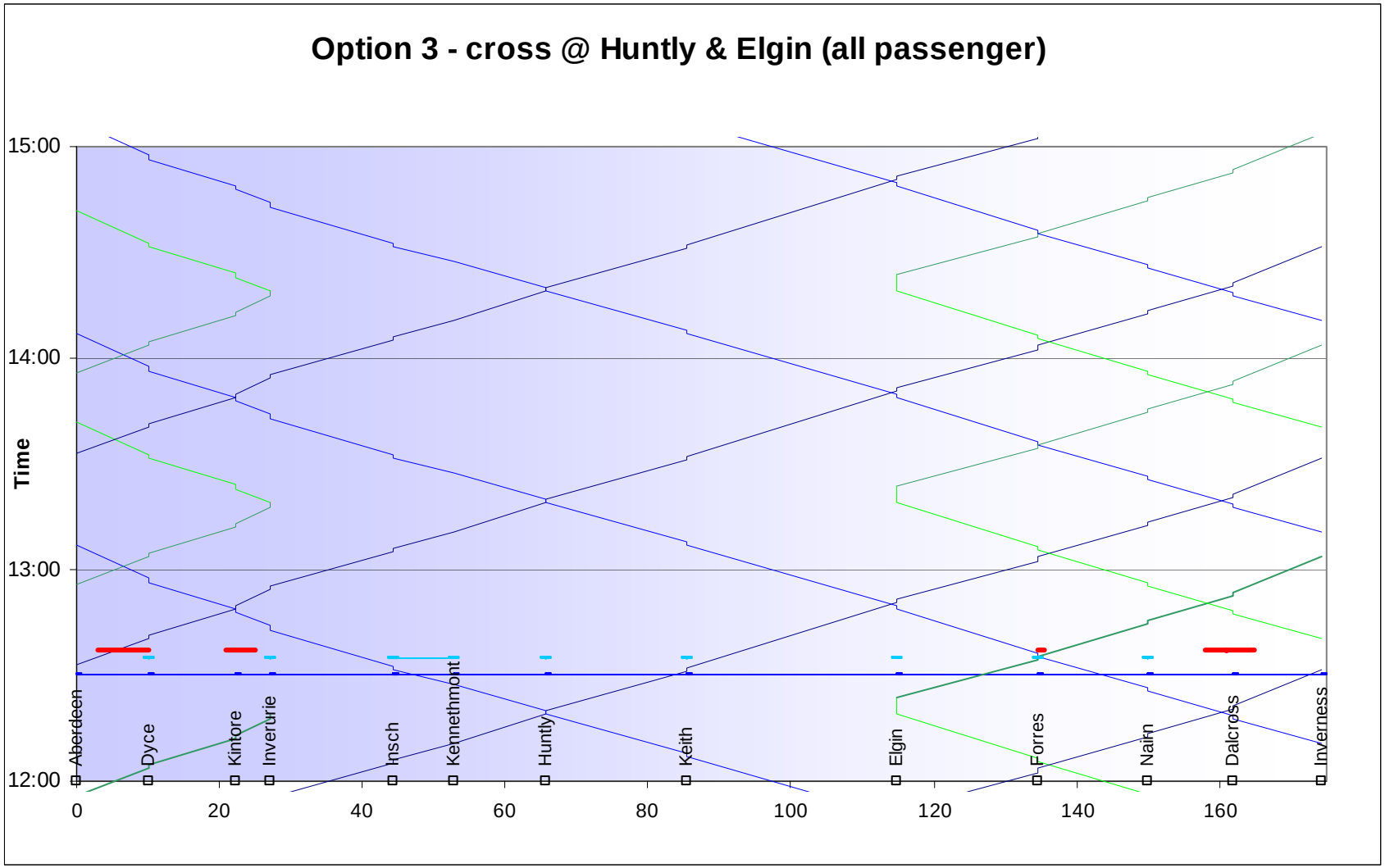
Option 3 - cross @ Huntly & Elgin (all passenger)
Time
15:00
14:00
13:00
12:00
Aberdeen
Dyce
Kintore
Inverurie
Insch
Kennethmont
Huntly
Keith
Elgin
Forres
Nairn
Dalcross
Inverness
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160

Appendix C – Forres Layout

Appendix D – Keith Layout

Appendix E – Initial Project Specification

Appendix F – Operational Requirements Specification

Appendix G – Planning Constraints

Appendix H – GRIP Stage 2 Estimate

Appendix I – Programme