

Extended Tay Estuary Rail Study

Engineering & Operations Report

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CONTENTS

1	INTRODUCTION	1
2	EXISTING STATIONS	2
	Introduction	2
	Stirling	2
	Bridge of Allan	2
	Gleneagles	6
	Perth	10
	Invergowrie	10
	Dundee	11
	Broughty Ferry	11
	Balmossie	12
	Monifieth	13
	Barry Links and Golf Street	14
	Carnoustie	14
	Arbroath	15
	Montrose	17
3	POTENTIAL NEW STATIONS	19
	Bannockburn	19
	Dunblane North	34
	Greenloaning	40
	Blackford	41
	Dundee West	46
4	OTHER INFRASTRUCTURE WORKS	53
	Arbroath Turnback Operation	53
	Headway Improvements - Barnhill Example	55
5	TIMETABLE DEVELOPMENT	57
	Phase 1 of all packages -Glasgow to Perth	57
	Package 1 - Phase 2 (Glasgow - Perth service with two hourly extension to Arbroath)	60
	Packages 2, 3 and 4 - Phase 2 (Separate Glasgow - Perth and Perth - Arbroath services)	62
	Package 3 - Phase 3 (Combined Aberdeen - Glasgow & Edinburgh Express Services)	63
	Package 1 and 4 - Phase 3 (Glasgow - Arbroath Hourly Service)	65
	Package 2 - Phase 3 (Perth - Aberdeen Hourly Service)	66

Package 1 and 4 - Phase 4 (Glasgow - Aberdeen “all stations” Hourly Service)	66
6 OPERATING COST ESTIMATES	67
Stations	67
Train Services	67

FIGURES

Figure 2.1	Bridge of Allan Station – existing layout	2
Figure 2.2	Bridge of Allan station – car park sites	3
Figure 2.3	Bridge of Allan Station - General Views	4
Figure 2.4	Dunblane station - aerial view	5
Figure 2.5	Dunblane Station - General views	5
Figure 2.6	Gleneagles Station - Aerial View	6
Figure 3.1	Original station site at Bannockburn	19
Figure 3.2	View of original Bannockburn station looking north	20
Figure 3.3	Bannockburn Station - Site 1	20
Figure 3.4	Bannockburn Site 1 - General views	21
Figure 3.5	Bannockburn Station Site 1 - Feasibility Design	22
Figure 3.6	Bannockburn station site 1 - signalling arrangements	24
Figure 3.7	Bannockburn Station Site 1 – Budget cost estimate	25
Figure 3.8	Bannockburn station - site 2	26
Figure 3.9	Bannockburn Station Site 2 - General views	27
Figure 3.10	Bannockburn Station Site 2 - signalling arrangements	29
Figure 3.11	bannockburn station - site 3	30
Figure 3.12	Bannockburn Station Site 3 - General views	31
Figure 3.13	Bannockburn Station Site 3 - Signalling arrangements	32
Figure 3.14	Extract from draft EGIP timetable	33
Figure 3.15	Dunblane North - Site 1	35
Figure 3.16	Dunblane North station Site 1 - General Views	35
Figure 3.17	Dunblane North Station - Signalling arrangements	38
Figure 3.18	Dunblane North - Site 2	39
Figure 3.19	Dunblane North Station Site 2 - General Views	40
Figure 3.20	Greenloaning - original station site	40
Figure 3.21	Greenloaning Station - General Views	41
Figure 3.22	Blackford - Sites 1 and 2	42
Figure 3.23	Blackford Station feasibility design	43

Figure 3.24	Blackford Station - General Views	44
Figure 3.25	Blackford Station - Budget Cost estimate	45
Figure 3.26	Invergowrie station	46
Figure 3.27	Dundee West - Proposed Location	47
Figure 3.28	Dundee West Station - General Views	48
Figure 3.29	Dundee West – Budget cost estimate	49
Figure 3.30	Dundee West Station - Feasibility Design	50
Figure 3.31	Dundee West - Signalling arrangements	52
Figure 4.1	Arbroath CCTV tail light camera	54
Figure 4.2	Barnhill - Signalling Headway Improvements	56
Figure 5.1	Timetable Development Process	57
Figure 5.2	Draft timetable for combined Aberdeen - Glasgow & Edinburgh service	65
Figure 6.1	Train service operating cost estimates	72

TABLES

TABLE 2-1	INVERGOWRIE STATION - BUDGET COST ESTIMATE FOR RENEWAL & ENHANCEMENT WORKS	11
TABLE 5-1	GLASGOW - PERTH TIMETABLE	58
TABLE 5-2	OPERATING COST ESTIMATE - GLASGOW -PERTH SERVICE	59
TABLE 5-3	GLASGOW - ARBROATH TIMETABLE	61
TABLE 5-4	OPERATING COST ESTIMATE GLASGOW - PERTH WITH TWO HOURLY EXTENSION TO ARBROATH	61
TABLE 5-5	PERTH - ARBROATH TIMETABLE	63
TABLE 5-6	OPERATING COST ESTIMATE: GLASGOW - PERTH AND PERTH - ARBROATH	63
TABLE 5-7	OPERATING COST ESTIMATE: PERTH - ABERDEEN HOURLY SERVICE	65
TABLE 6-1	ESTIMATES OF STATION OPERATING COSTS	68
TABLE 6-2	TRAINCREW REQUIREMENTS FOR EACH SERVICE PACKAGE	71

APPENDICES

TIMETABLE CONFLICTS IDENTIFIED BY RAILSYS AND PROPOSED SOLUTIONS
FULL TIMETABLES FOR PACKAGES 1, 2 AND 3
RAILSYS MODELLING REPORT
LAND OWNERSHIP DETAILS FOR PROPOSED GLENEAGLES ACCESS ROAD

1 Introduction

- 1.1 The purpose of the Engineering and Operations report is to provide a single reference document collating all of the technical inputs developed for the Appraisal Report.
- 1.2 This document complements the Appraisal Report produced as part of this commission, providing a further level of detail on deliverability of the preferred option.
- 1.3 This report is set out as follows:

Chapter 1	Introduction
Chapter 2	Existing Stations
Chapter 3	Potential New Stations
Chapter 4	Other Infrastructure Works
Chapter 5	Timetable Development
Chapter 6	Operating Cost Estimates

2 Existing Stations

Introduction

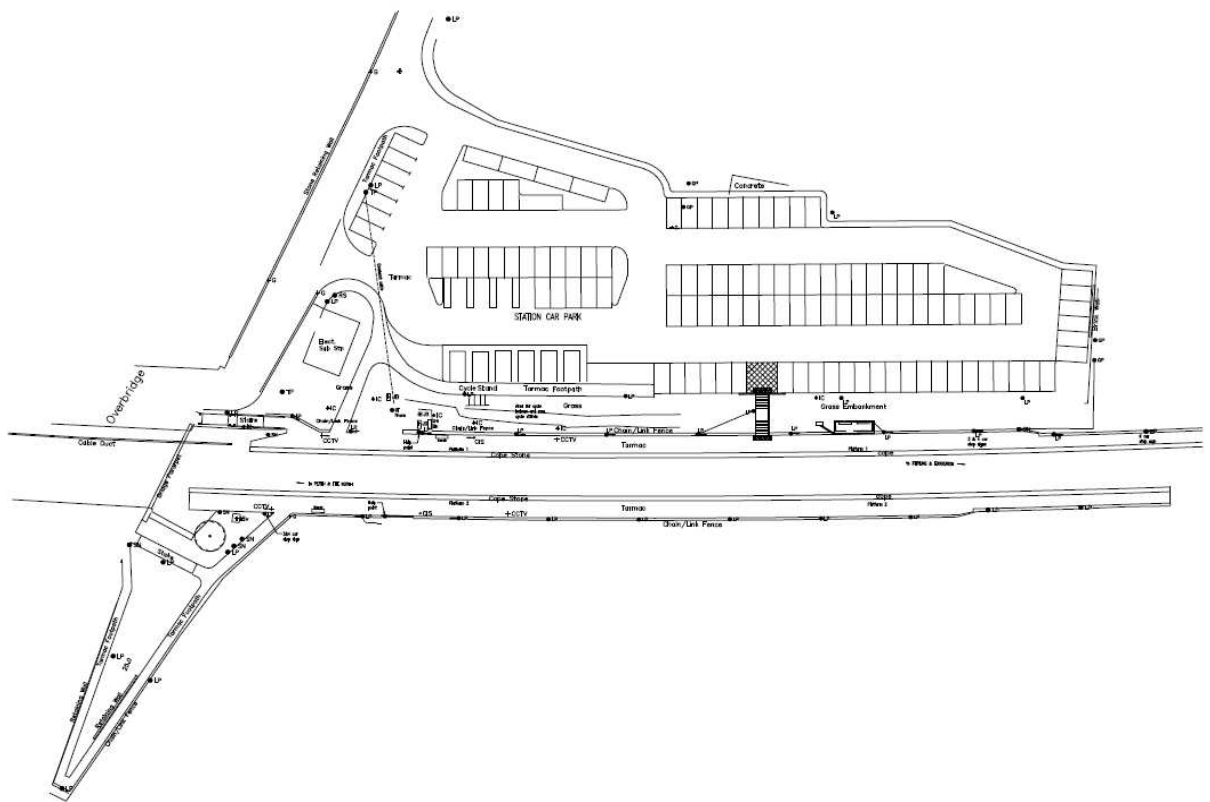
- 2.1 All existing station in the corridor were surveyed to identify works which would encourage patronage if new train services were provided.

Stirling

- 2.2 Existing interchange station and no works required to accommodate the potential additional services.

Bridge of Allan

FIGURE 2.1 BRIDGE OF ALLAN STATION - EXISTING LAYOUT



- 2.3 Bridge of Allan Station is accessed via Station Road from Henderson Road (A9). The directional signage to the station is poor. Station Road has vehicles parked along the road indicating overflow from the recently enlarged station car park. The station car park has 122 spaces including 6 blue badge bays and 3 parent and child bays and a drop off area for 2 vehicles. 6 cycle lockers are installed at the station in addition to 5 cycle hoops. There is a possibility of a further small number of car parking spaces being constructed at the south end of the car park in railway land. Further car parking options are in decking the existing car park as proposed by Arup in a feasibility carried out for First Scotrail or in developing the fields to the west of the railway, north and south of the A9, as these are within reasonable walking distance (200m) of the station. The site to the south of the A9 would provide level access to the northbound platform.

FIGURE 2.2 BRIDGE OF ALLAN STATION - CAR PARK SITES



- 2.4 This is an unstaffed station with CIS, full CCTV and help points. There is a ticket machine and public telephone on the southbound platform. There is a 3x5 shelter and a 1x4 shelter on the southbound platform and a 3x2 shelter on the northbound platform.
- 2.5 Platform to platform access is by way of the Road bridge. The southbound platform is fully accessible but the ramped access to the northbound platform is not fully compliant. Stairs lead directly from the platforms to the road bridge.
- 2.6 A budget cost for providing a new car park and a compliant footbridge and lifts is estimated at £3.5million.

FIGURE 2.3 BRIDGE OF ALLAN STATION - GENERAL VIEWS



Car park at Bridge of Allan



Car park at Bridge of Allan



Land for extending car park

Dunblane

- 2.7 There is limited signage to the station from the main road, B8033. The station is accessed through a one way road system. There is limited car parking at the station; the station car park has 7 spaces including two blue badge spaces. There is a taxi stance at the station. There are a number of other parking areas around the station within Stirling Council's control. This includes 19 spaces along Stirling Road, 14 spaces behind the station building and a pay and display car park to the east of the railway. This car park has 67 spaces including 2 blue badge spaces. This car park has the potential to be decked with the upper deck at road level (level with the Tesco car park) and the lower deck as existing at railway level. This could create an additional 50 spaces. 3 cycle lockers and 5 cycle hoops are provided at the station with a further 5 cycle hoops in the council car park. On street parking is provided along the B8033 with 87 spaces provided between the station and the roundabout to the north. These spaces are all occupied showing high demand for park and ride facilities in this area.
- 2.8 This is a staffed station. There is a ticket office but this has a fixed height ticket counter and is therefore not fully accessible. There is a heated waiting room on platform 1. There is CIS, CCTV to the station and a help point on platform 2/3. There is a ticket machine on the southbound platform. There is both a traditional footbridge with stair access and a stepped ramped footbridge between platforms. The modern footbridge also gives access to the Council Car Park. Neither of these footbridges provides compliant access to the island platform.

FIGURE 2.4 DUNBLANE STATION - AERIAL VIEW

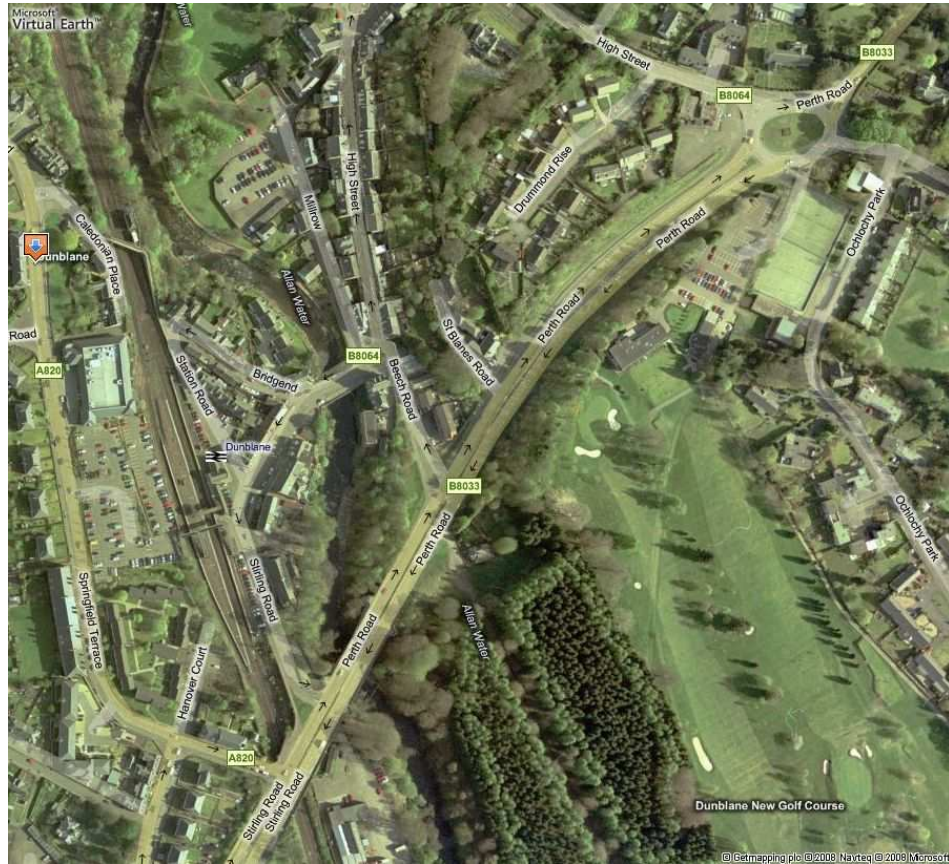


FIGURE 2.5 DUNBLANE STATION - GENERAL VIEWS



Station Car Park



Council Pay and Display Car Park



Stepped, ramped footbridge



Traditional footbridge

Gleneagles

- 2.9 Gleneagles Station is accessed from the A9. There is a right turn lane from the northbound carriageway to access the road that is of obvious concern should station usage increase. There is a small existing station car park for 28 spaces including 2 blue badge spaces and 5 cycle hoops. The Category B-listed station buildings are kept locked with facilities for passengers limited to a public telephone and shelter restricted to the areas under the canopies. There are no heated waiting areas or shelters and no CIS or CCTV. Access from the car park to the station buildings by stepped ramp is not compliant with current standards. Platform to platform access is by covered stairwells leading to an open footbridge.

FIGURE 2.6 GLENEAGLES STATION - AERIAL VIEW



- 2.10 This station, although remote from any walk-in catchment, is well located for drive-up passengers from both nearby and more remote communities. This could be enhanced with the creation of a link road (7.3m carriageway) between the station and the A823 which has full slip road access to the A9 both north and southbound. The road would be located on the solum of the original Crieff branch line at the station then rise up the slope to cross over farmland parallel to the railway with a new junction formed at the A823. There is an application for planning approval under consideration by Perth and Kinross Council for junction improvements at Loaninghead. This application proposes the creation of separate on and off slips to

the southbound carriageway from the A823 to the A9. A consultation on funding for developer contributions to Loaninghead junction improvements is ongoing. This proposes funding for the improvements be sourced from developer contributions in addition to Transport Scotland funding. There is an embargo on new development in the wider Auchterarder area until junction improvements are in place.

- 2.11 Gleneagles presently receives a limited regional service, plus two London and Inverness intercity services. The poor road access and perceived security would constrain the potential patronage if an hourly service to Perth and Glasgow was provided.
- 2.12 There is scope for increasing the size of the station car park to facilitate a park and ride function although land acquisition would be necessary for more than approx 150 spaces. The lack of CCTV and CIS is of significant concern to existing station users, the remoteness of the station meaning there is no physical surveillance of the station buildings. Provision of these facilities together with the introduction of heated waiting spaces will significantly enhance customer satisfaction.
- 2.13 The lack of compliant access can be resolved with a new ramp constructed up to the station buildings/ platforms and installation of lifts to serve the footbridge. Neither of these proposals is considered to have an adverse impact on the listed buildings.
- 2.14 The feasibility design developed is shown in Figure 2.8.

FIGURE 2.7 GLENEAGLES STATION - GENERAL VIEWS



Route for link road to A823



Stair access to footbridge

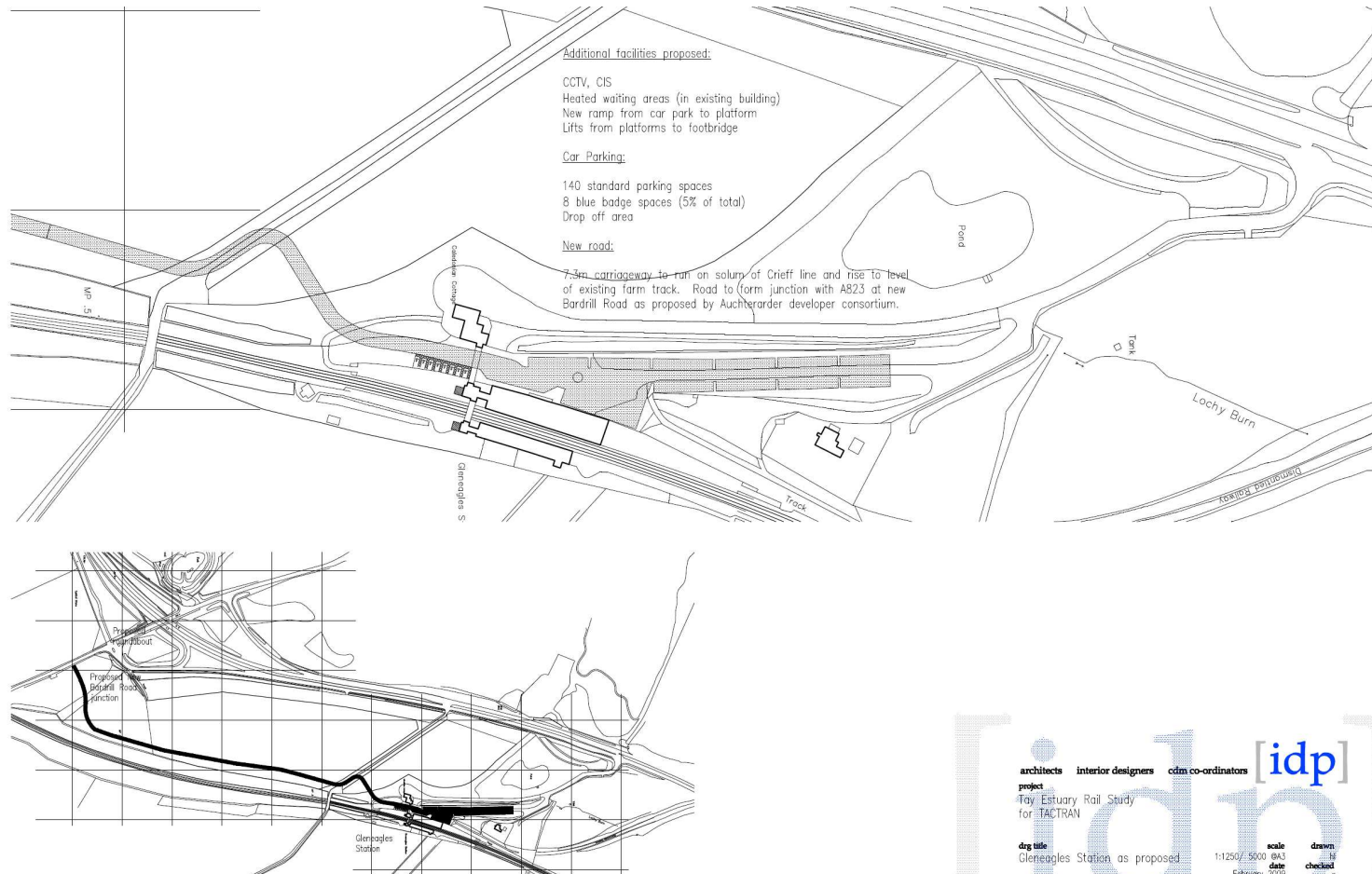


Platforms looking north



Stepped ramp access to platform

FIGURE 2.8 GLENAGLES STATION - FEASIBILITY DESIGN



[gleneagles station as proposed]

architects interior designers cdm co-ordinators [idp]

project
Tay Estuary Rail Study
for TACTRAN

draw title
Glenagles Station as proposed

scale
1:1250/ 5000

date
February 2009

checked
H

approved
WJ

draw no.
09009 03

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- 2.15 The budget estimate for enhancement works to improve road access and provide step free access within the station, CCTV and customer information systems is £3.7m.

FIGURE 2.9 GLENEAGLES STATION - BUDGET ESTIMATE FOR ENHANCEMENT WORKS

Station Construction Costs	Quantity	Unit	Rate	Total	Comments
Single story modular building - floor area	0.00	m2	1,750	0	
Platforms	0	m2	660	0	2 platforms * 150m long * 4m wide
Platform lighting	0	m2	70	0	
Platform drainage/ducts and access	0	m2	70	0	
Platform signage	0	m2	10	0	
Platform fencing	0	m	100	0	
Platform shelter & seating	0	No	50,000	0	
LLPA / CIS / CCTV / Help Points	1	item	150,000	150,000	Assumes available trackside FTN
Overbridge	0	item	250,000	0	
MIP Lifts	2	No	225,000	450,000	
DDA ramped overbridge (no lifts)	0	item	425,000	0	
<u>External Works to Station</u>					
Footpaths	0	m2	50	0	
Access road 7.3m wide (inc pavements)	740	m	1,200	888,000	
Car Park (including lighting, marking, drainage)	140	space	2,500	350,000	
Traffic light controlled junction	0	item	120,000	0	
Landscaping	0	sum	150,000	0	
Total Base Cost - Gleneagles Station				1,838,000	

Non Construction Costs	% of Base	Unit	Rate	Total	Comments
Contractor preliminaries	15.00%			275,700	
GRIP stages 1-4 development	5.00%			91,900	
GRIP stage 5 design	5.00%			91,900	
Project Management	10.00%			183,800	
Possession management	15 shifts		£ 1,500	22,500	
TOC Compensation	0.00%			-	
Land	2.00	Ha	£ 30,000	60,000	* need to check local values
Total Non Construction Cost				725,800	

Sub Total				2,563,800	
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Risk and Optimum Bias	44.00%			1,128,072	
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TOTAL				£ 3,691,872	
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Cost base is Q1 2009

- 2.16 A land registry search was undertaken to clarify ownership of the ground identified as a potential solum for the new access road. Details are contained in Appendix D.

Perth

- 2.17 Existing interchange station. Proposal to provide step free access between platforms and improve customer information systems are presently under development.

Invergowrie

- 2.18 Invergowrie Station has very limited facilities, reflecting the restricted service it presently receives. Access to the station is by a stair flight from the road to the non-compliant footbridge with stairs from footbridge to both platforms. A second compliant on grade access is located at the northern end of the northbound platform. There is a shelter located on the northbound platform with a public telephone. There is a bench seat on the southbound platform and a brick and timber seat on the northbound platform.
- 2.19 The two-car length platforms are non compliant having no tactiles and a number of trip hazards.
- 2.20 The station is located on a cycle route and has 3 cycle hoops. Signage to the station is poor, and there is no car park or taxi rank. A bus stop is located at the station, with one bus/hour.
- 2.21 There is an underpass to the A85 Riverside Road from Invergowrie which is on the cycle route leading from the station.

FIGURE 2.10 INVERGOWRIE STATION - GENERAL VIEWS



View from footbridge of platforms



View of footbridge



Compliant platform access

- 2.22 There is very limited scope at the current location for enhancing the station: in

particular there is no land available for car parking. In order to accommodate more services than the few per day presently calling at the station, a mix of maintenance and enhancement works may be required. First ScotRail have “grandfather” rights to operate 3 car units at the station, however this is subject to demonstration of a safe system of operation. The logical proposal would be to use Selective Door Operation, ie. all passengers board and disembark the train from a single set of doors under the local control of the train conductor. Further work would be required to determine if this resulted in an acceptably low level of risk. In such an instance, only minor renewal works would be required at the station and this should be funded through Network Rail renewals. However to reflect the worst case, a cost estimate has been provided to undertake a full scope of enhancement and renewal works at Invergowrie, including extending the platforms to 3 car length. This has been included in the appraisal as a capital cost for 2011. It is stressed this is a cautious provision and opportunity exists to avoid any capital expenditure at Invergowrie which is attributable to the project. The total estimate for these works is shown in Table 2-1 below.

TABLE 2-1 INVERGOWRIE STATION - BUDGET COST ESTIMATE FOR RENEWAL & ENHANCEMENT WORKS

Element	Description	Cost
Construction Cost	Platform extensions for 3 car unit	£71,000
	Lighting improvements	£42,000
	CIS, CCTV and Help Point	£150,000
	Waiting shelter & seating	£100,000
Non Construction Costs	Prelims, design, project management and possessions	£191,000
44% Optimism Bias		£243,000
TOTAL		£798,000

Dundee

- 2.24 Existing interchange station. Proposals to improve the station have been developed in order to provide an improved station environment and better integration with the Dundee Waterfront development.

Broughty Ferry

- 2.25 Broughty Ferry Station is a listed building which has been recently upgraded. There is no station car park however, there is a Council owned pay and display car park adjacent to the station which is currently underutilised. There is only a small pedestrian sign indicating the station from Queen Street. There is a level crossing on Gray Street which provides compliant platform to platform access in addition to an underpass served by stairs. The platforms do not have tactiles but are in reasonable repair. There are no heated shelters or waiting rooms at the station

however, the building canopies provide a level of protection. There is a single bench seat on each platform. The station facilities include CCTV, Help Points, public phone and LLPA. There is no CIS at the station.

FIGURE 2.11 BROUGHTY FERRY STATION - GENERAL VIEWS



View to north



View of access and shelter



Level crossing on Gray Street

Balmossie

- 2.26 This is a small station located at the end of a residential cul-de-sac. There is no car park or drop off area with no potential land for these to be provided. The platforms are timber structures with approximately 2 car length. The platforms have been recently resurfaced but do not have tactiles.
- 2.27 There is a steeply ramped pedestrian overbridge which is non-compliant for platform to platform access. There is a timber shelter on the south bound platform with a perch seat. There is a timber bench on both platforms.
- 2.28 LLPA is provided at the station.
- 2.29 There is little scope for enhancing this station.

FIGURE 2.12 BALMOSSIE STATION - GENERAL VIEWS



View of footbridge



View of shelter



View of station platforms

Monifieth

- 2.30 This is an elevated station with a small car park for 4 vehicles (no designated blue badge spaces). There is no signage from the main road to this station. There is level access from the car park to the platform. Platform to platform access is by a non-compliant footbridge. A secondary access can be achieved using the road underpass (6'2" headroom) and a ramp to the southbound platform. The ramp is of reasonable gradient but does not have handrails. There is a small shelter and a timber bench on each platform. The platforms have no tactiles and have a number of trip hazards.
- 2.31 LLPA is provided at the station and a customer assistance freephone and public telephone are located in the platform 1 shelter. There is little scope for enhancing this station but it is in reasonable condition to accept more frequent services than it presently receives.

FIGURE 2.13 MONIFIETH STATION - GENERAL VIEWS



View of platform 1



View of platform 2 and car park



View of underpass and footbridge



View of ramp

Barry Links and Golf Street

- 2.32 Both stations require significant refurbishment if service levels were to increase above the current.

Carnoustie

- 2.33 There is good signage to this station from the high street. There is a small station car park with 17 spaces including 2 blue badge spaces. There is a 10 hoop cycle shelter.
- 2.34 There is level access from the car park to the platform with compliant access down to the level crossing from the northbound platform. The ramp to the southbound platform is non compliant (gradient). Both platforms, 6 car length, have been resurfaced and have tactiles and good surfacing and surface water drainage.
- 2.35 There are shelters on both platforms with a 2x5 shelter northbound and a 1x4 shelter to the southbound platform. There is a ticket machine in the northbound shelter. There are Help points, CIS, CCTV and LLPA at the station.
- 2.36 The ramp to the southbound platform could be altered to give compliant access which we understand First Scotrail is currently assessing.

- 2.37 An overspill car park could be constructed in the disused sidings area behind the original station building. This would have capacity for approximately 30 vehicles.

FIGURE 2.14 CARNOUSTIE STATION - GENERAL VIEWS



View of ramp to south bound platform



View of car park and facilities



View of platforms

Arbroath

- 2.38 This is a staffed station with level access to the ticket office from the drop off/ bus stop. The ticket office is located at an upper level and has access to the platforms by stair or lift. The platforms are both at least 6 car platforms with reasonable surfaces but no tactiles
- 2.39 There is good signage to this station from the main road. There is a small pay and display station car park with 18 spaces including 3 blue badge spaces. There is a 10 hoop cycle shelter next to the car park. There is level access from the car park to the southbound platform.
- 2.40 There are heated waiting rooms on both platforms with a number of benches on the platforms. There is a ticket machine on the southbound platform. There are Help points, CIS, CCTV and LLPA at the station. There are public toilets. A raising and lowering counter is being installed in the ticket office to give a fully compliant service at this station.

- 2.41 There is limited scope for further enhancing this station with the exception of improved car parking. There are two options for development of car parking. The first is to extend the existing car park into land located behind the Angus Training Group located on Catherine Street. This would require either a ramped road access from the existing car park. A much larger car park could be achieved in the area of the existing sidings and the vacant land adjacent, many of which appear disused. Access can be obtained from Helen Street to this area and a new pedestrian access created from the car park to the platform.

FIGURE 2.15 ARBROATH STATION - GENERAL VIEWS



View of platforms



View of car park



View of ticket office (before upgrading)



View of sidings



View of Angus Training Group land

Montrose

- 2.42 This is a staffed station with facilities reflecting the higher numbers of train services using the station. There is a 50 space car park including 6 blue badge spaces. Step free access is provided to the ticket office and platform 1. A proposal is presently under development to provide lifts to extend this access via the footbridge to platform 2. No improvements would be required to accommodate additional services proposed through the TERS project.

3 Potential New Stations

3.1 The options for potential new station sites are detailed below.

Bannockburn

3.2 Three sites were considered for a possible station location, building upon earlier work undertaken for Stirling Council. The rail industry has concerns regarding the performance impacts of a potential station at Bannockburn both on the current and proposed timetables. The performance impacts are discussed in paragraph 3.39. Stopping existing services at a new station would increase journey times for those users of the service, creating a dis-benefit. Lastly it is recognised that a Bannockburn station will abstract patronage from existing rail stations, principally Stirling.

FIGURE 3.1 ORIGINAL STATION SITE AT BANNOCKBURN

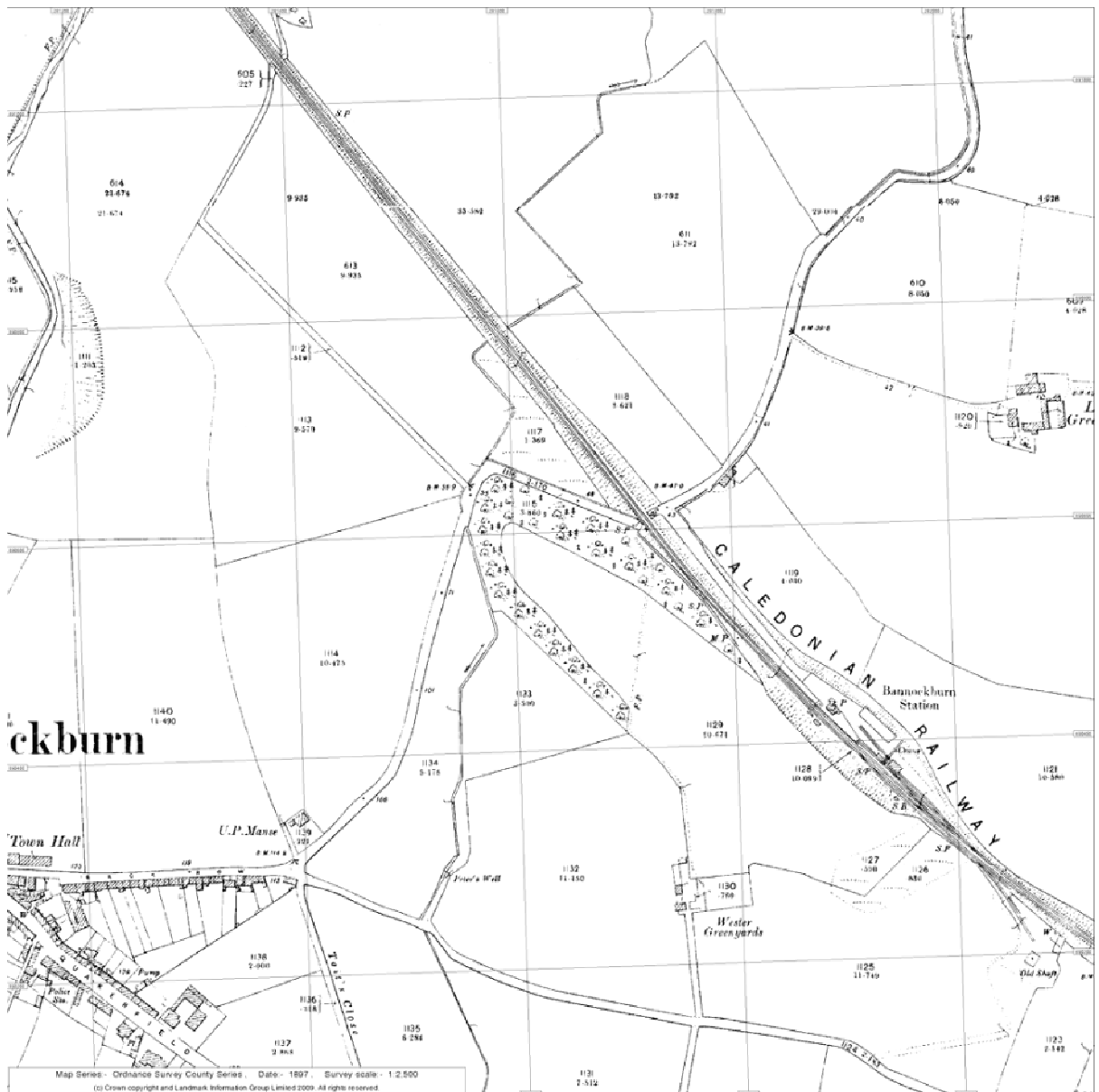
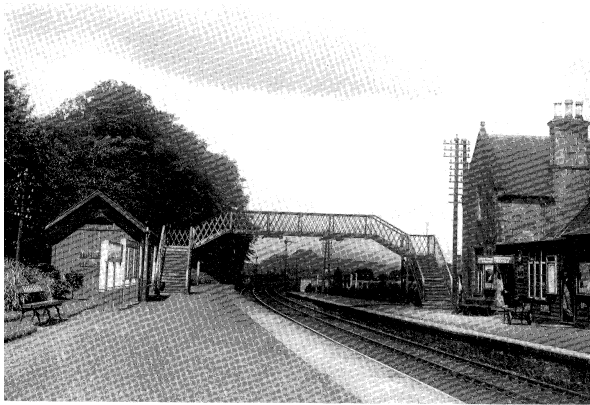


FIGURE 3.2 VIEW OF ORIGINAL BANNOCKBURN STATION LOOKING NORTH

**Site 1**

- 3.3 Site 1 is well situated for road access and is located approximately 350m along Pike Road from the roundabout on the A91. The road capacity would accommodate peak flow traffic accessing the station site and road geometries allow a new junction to access the station site. The existing embankment along Pike Road would need to be cleared to provide level ground for car parking. A linear car park could be provided to serve at least 200 cars with provision for extension and drop off to a north bound platform. Further car parking could be located to the south of Pike Road in the area which appears to form part of flooding control. There is no road access to the southbound track which would prevent any form of drop off facility. There is an existing local bus service running along Pike Road.

FIGURE 3.3 BANNOCKBURN STATION - SITE 1



- 3.4 The site is bounded by residential neighbourhoods and Greenbelt. This creates reasonable walk-in catchment potential for the station. It is assumed a station in this location would be considered favourably by Planning although immediate neighbours are likely to raise objections.
- 3.5 It is understood there is a proposal under EGIP to create a rolling stock servicing depot at this site location, this suiting operational requirements and the site being within Network Rail ownership.
- 3.6 There is an existing rail underpass to the east of the site, which serves a local path next to a burn running parallel to the A91. The footpath is almost at the level of the burn, with insufficient headroom to facilitate platform to platform access. Consequently, a new footbridge would need to be constructed to provide platform to platform access. Likely footfall would need to be assessed to establish viability of lifts between platforms and the footbridge in lieu of extensive accessible ramps.

FIGURE 3.4 BANNOCKBURN SITE 1 - GENERAL VIEWS



Existing underpass



Pike Road Embankment



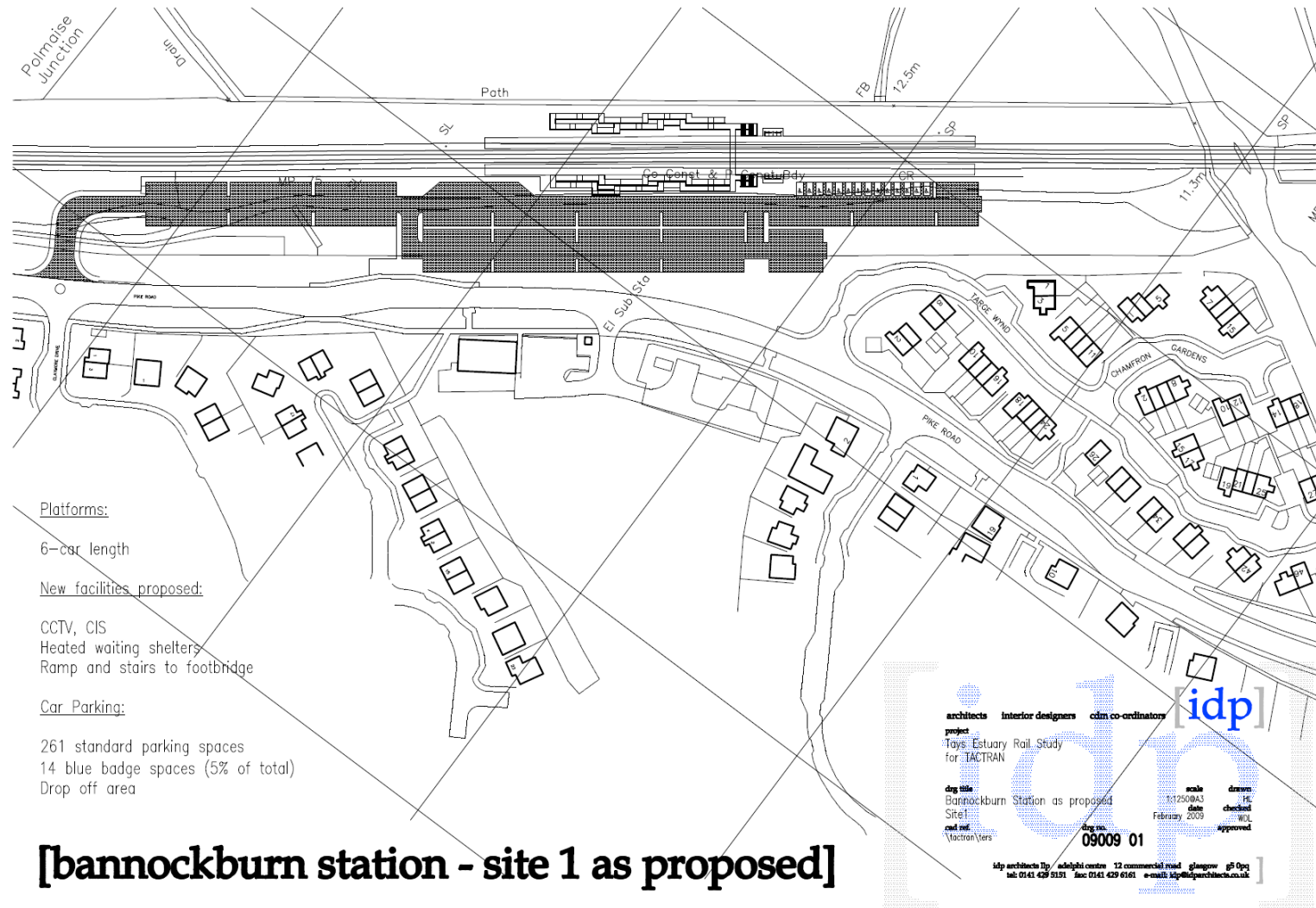
View of site from embankment



View of site along northern boundary

- 3.7 A feasibility design for a station in this location has been developed and is shown in Figure 3.5.

FIGURE 3.5 BANNOCKBURN STATION SITE 1 - FEASIBILITY DESIGN

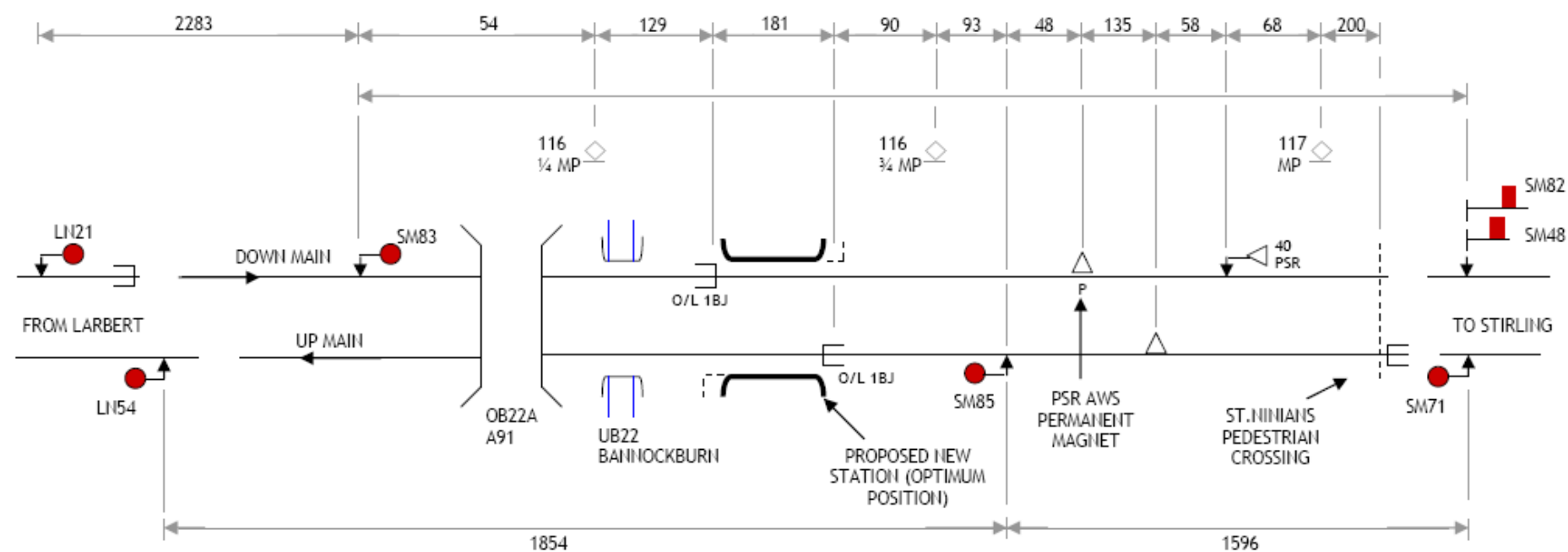


Signalling issues

- 3.8 The distances shown on the option sketches were obtained from Signalling Scheme Plan Number 06 - SC - 0018 / ST.2 and are in metres.
- 3.9 This site is located between over bridge 22A (A91 Trunk Road) and St.Ninians pedestrian crossing.
- 3.10 This particular site occupies the former Polmaise sidings and is predominantly Network Rail operational property. It should also be noted that this site on the Down Side is the preferred site for the E.G.I.P. Light Maintenance Depot. There is also a possible issue with planning approvals in view of the close proximity to a residential area.
- 3.11 The optimum position is shown on the Option 1 sketch. This location provides the best train performance option since a stationary train in either the Down or Up Platform will be clear of the overlap Insulated Block Joints (IBJ) for Signals SM83 or SM85 respectively. This will allow trains to be signalled to Signals SM83 and SM85 since the trains in either the Down or Up Platform respectively are clear of their overlaps. The Down Platform can be extended at the Stirling end or the Up Platform extended at the Larbert end if insufficient space is available.
- 3.12 There are however disadvantages to this location which must be considered if future development of this proposal is to proceed. They are as follows:-
- The consequences (rear end collision) of a SPAD at Signals SM83 or SM85 whilst a train is stopped in the station is increased. It is likely that TPWS (TSS) will be recommended at Signals SM83 and SM85.
 - A SPAD trap may be created for trains stopping in the station.
 - *Down Trains.* After passing SM83 at Yellow the train stops in the platform. Conductor closes doors and signals to driver to proceed. Train accelerates towards Stirling. SM82 / 48 not visible due to curvature approaching Stirling. The 40mph PSR AWS Permanent magnet will give a warning which will alert the driver of the approach to Stirling Station.
 - *Up Trains.* After passing SM85 at Yellow the train stops in the platform. Conductor closes doors and signals to driver to proceed. Train accelerates towards Larbert. Signal LN54 is not visible however acceleration away from the station will be restricted in view of the 1:156 / 1:118 rising gradient towards LN54. The speed of the train should not be high and the LN54 AWS warning should be sufficient to stop the train at the signal.
- 3.13 Signalling arrangements for the station in this location are shown in Figure 3.6.

FIGURE 3.6 BANOCKBURN STATION SITE 1 - SIGNALLING ARRANGEMENTS

This option is located between Over Bridge 22A and St. Ninians pedestrian crossing, in the vicinity of 116 ¾ Mile Post



- 3.14 The capital cost estimate for provision of a station at this site is £5.5m including 44% optimism bias. A breakdown of the cost estimate is shown in Figure 3.7 below. The estimated operating costs for this site are £65k per annum.

FIGURE 3.7 BANNOCKBURN STATION SITE 1 - BUDGET COST ESTIMATE

Station Construction Costs	Quantity	Unit	Rate	Total	Comments
Single story modular building - floor area	0.00	m2	1,750	0	
Platforms	1,200	m2	660	792,000	2 platforms * 150m long * 4m wide
Platform lighting	1,200	m2	70	84,000	
Platform drainage/ducts and access	1,200	m2	70	84,000	
Platform signage	1,200	m2	10	12,000	
Platform fencing	400	m	100	40,000	
Platform shelter & seating	2	No	50,000	100,000	
LLPA / CIS / CCTV / Help Points	1	item	150,000	150,000	Assumes available trackside FTN
Overbridge	0	item	250,000	0	
MIP Lifts	0	No	225,000	0	
DDA ramped overbridge (no lifts)	1	item	425,000	425,000	
<u>External Works to Station</u>					
Footpaths	100	m2	50	5,000	
Access road 7.3 wide (inc pavements)	60	m	1,200	72,000	
Car Park (including lighting, marking, drainage)	261	space	2,500	652,500	
Traffic light controlled junction	0	item	120,000	0	
Landscaping	1	sum	200,000	200,000	
Total Base Cost - Bannockburn Station				2,616,500	

Non Construction Costs	% of Base	Unit	Rate	Total	Comments
Contractor preliminaries	15.00%			392,475	
GRIP stages 1-4 development	5.00%			130,825	
GRIP stage 5 design	5.00%			130,825	
Project Management	12.00%			313,980	
Possession management	50	shifts	£ 2,000	100,000	
TOC Compensation	3.00%			78,495	
Land	1.50	Ha	£ 30,000	45,000	Mostly on railway land
Total Non Construction Cost				1,191,600	

Sub Total				3,808,100	
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Risk and Optimum Bias	44.00%			1,675,564	
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TOTAL				£ 5,483,664	
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Cost base is Q1 2009

Site 2

- 3.15 This site is identified in the Stirling local plan as a potential station site. It is accessed from the A91 Stirling Bypass. A new junction will be required to access the station where there is an existing junction with Station Road. It is likely a roundabout would be located at this junction.

FIGURE 3.8 BANNOCKBURN STATION - SITE 2

- 3.16 The A91 is slightly more elevated than the railway, however, the majority of the land between the tracks and A91 is approximately 4-5m below the tracks. This land would need to be part in-filled to give access to station platforms and minimise flooding within a station car park. There is scope for extensive car parking with an initial 200 space proposed. Alternatively, the land gusseted between Station Road and the tracks is closer to grade with the tracks and a smaller car park with blue badge parking and drop-off could be located here with the northern end of the platforms being of elevated construction.
- 3.17 There is limited potential for walk-in catchment: the A91 forming a barrier between this site and local residential areas. An existing footpath connects the end of Station Road, Bannockburn to the A91 and this could be developed with appropriate crossing controls/ footbridge to give pedestrian access to the station.
- 3.18 The existing Station Road is single track through the rail underpass but has potential for a 2m footpath to be constructed in addition to the single lane roadway. This road could provide platform to platform access without the requirement for a new footbridge. The private farm road to Skeoch Farm would require development to locate a drop-off zone and disabled parking at the southbound platform. Secondary pedestrian platform to platform access could be created using the existing farm underpass to the north of the site.

FIGURE 3.9 BANNOCKBURN STATION SITE 2 - GENERAL VIEWS



View from Station Road



View of Skeoch Farm Road



View from Station Road

- 3.19 The estimated capital cost is £7m including 44% optimism bias. The estimated operating costs for this site are £85k per annum, due to the requirement for permanent de-watering to be undertaken at the site.

Signalling arrangements

- 3.20 The distances shown on the option sketches were obtained from Signalling Scheme Plan Number 06 - SC - 0018 / ST.2 and are in metres.
- 3.21 This site is located between Under Bridge 23 (Skeoch Farm) and Under Bridge 24 (Bannockburn Station Road). (It is possible that UB23 has been permanently closed off, but the structure still exists.)
- 3.22 This particular site is close to Bannockburn Station Road and its position may be anywhere between Under Bridge's 23 and 24. There is an existing 11Kv overhead power line close to the Down Main line.
- 3.23 The Up and Down Platforms will require a land purchase. The Up Platform may require re-routing of the access road to Skeoch Farm. The position of a station located anywhere between Under Bridges 23 and 24 will have a train performance impact and signal sighting issues as follows :-

3.24 Up Direction:

- The worst case would be a station located near Under Bridge 23. When an Up Train is stopped in the station a following train would be held at Signal SM85. This signal will not be able to show a proceed aspect until the overlap track circuit for signal LN54 has cleared. A train departing from the station will be faced with a 1:118 rising gradient over a distance of approximately 1350 metres before the Overlap IBJ is cleared. When an Up Train is stopped in the station a following train would be held at Signal SM85.
- Consider a driver forgetting the aspect of Signal SM85 after stopping at the station and restarting.
- A train departing from the station may not have visibility of Signal LN54. This should not be a problem as the trains acceleration will be poor in view of the rising gradient. It is considered that LN54 AWS will be sufficient warning for a train to stop at this signal.

3.25 Down Direction:

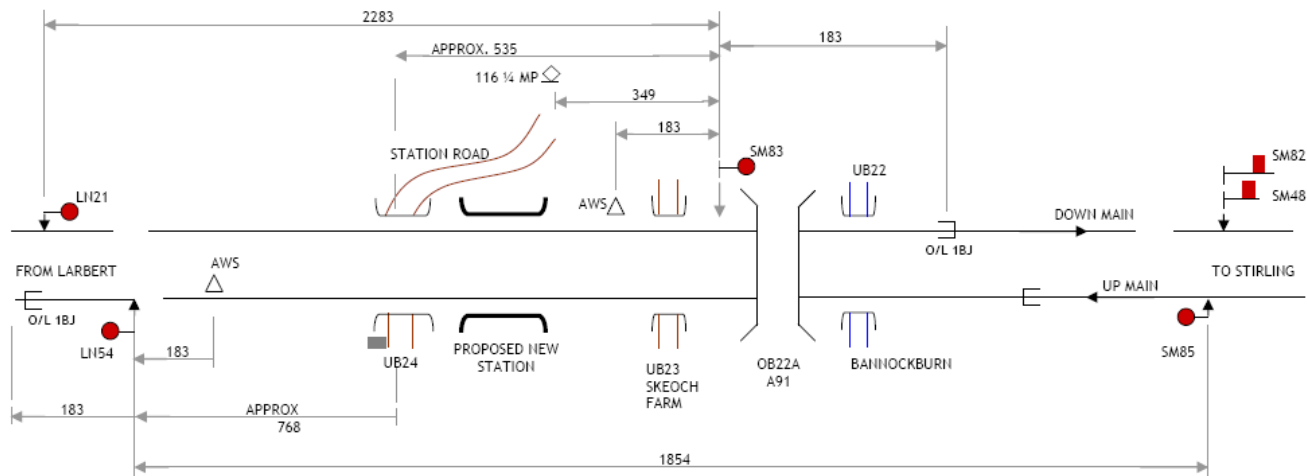
- The worst case would be a station located near Under Bridge 24. When a Down Train is stopped in the station a following train would be held at Signal LN21. This signal will not be able to show a proceed aspect until the overlap track circuit for signal SM83 has cleared. A train departing from the station will face a favourable 1:118 and then 1:156 falling gradient over a distance of approximately 500 metres before the Overlap IBJ is cleared.
- Consider a driver forgetting the aspect of Signal LN21 after stopping at the station and restarting. Irrespective of the location of the station between Under Bridges 23 and 24, Signal SM83 will be visible from the platform and will probably be classified as a 'Platform Starting Signal' or a 'Remote Platform Starting Signal' for train despatching purposes by the TOC.

3.26 A Signal Overrun Risk Assessment must be carried out in accordance with GI/RT7006 'Prevention and Mitigation of Overruns - Risk Assessment'.

3.27 In summary there are train performance issues but it is unlikely that there will be any significant signal sighting issues. The signalling details for this option are shown in Figure 3.10 Bannockburn Station Site 2 - signalling arrangements.

FIGURE 3.10 BANNOCKBURN STATION SITE 2 - SIGNALLING ARRANGEMENTS

This option is located between Under Bridge 23 (Skeoch Farm) and Under Bridge 24 (Bannockburn Station Road)



Site 3

- 3.28 This is the location of the original Bannockburn Station with access taken from the A91. The existing junction at the bus depot would require to be upgraded and a new road constructed to the station. A pedestrian and cycle over bridge to the A91 would also be required to allow for safe pedestrian access to the station from Bannockburn. The A91 is significantly elevated above the rail tracks at this location. The land between the A91 and the tracks has been in-filled in a series of terraces. The quality and possibility of contamination of this fill is not known and would require further investigation. A number of options exist for locations of platforms at this site with the further south the location the less the possibility of contaminated in-fill being encountered in the development. There is difficulty in accessing down to the tracks at the western end of the site.
- 3.29 A new footbridge would need to be constructed to provide platform to platform access. Likely footfall would need to be assessed to establish viability of lifts between platforms and the footbridge in lieu of extensive accessible ramps.

FIGURE 3.11 BANNOCKBURN STATION - SITE 3



- 3.30 This site location is the closest to the proposed new village of Durieshill located between the M9 and A80 as included in the Stirling Local Plan and has reasonable access form Cowie.
- 3.31 This site has the same operational disadvantages as site 2. The capital cost is estimated as £8m including 44% optimism bias. The estimated operating costs for this site are £65k per annum.

FIGURE 3.12 BANNOCKBURN STATION SITE 3 - GENERAL VIEWS



View of upper level of infilled land



View of tracks from upper level



View of eastern end of site

Signalling arrangements

- 3.32 The distances shown on the option sketches were obtained from Signalling Scheme Plan Number 06 - SC - 0018 / ST.2 and are in metres.
- 3.33 This site is located to the South of Under Bridge 24 (Bannockburn Station Road) on the site of the former Bannockburn Station. This particular site is close to Bannockburn Station Road and its position may be anywhere within the boundary of the former station. There is road vehicle access from station road on the Up side of the main line. The land on each side of the line may still be under Network Rail ownership. This will be subject to verification. There is an existing 11Kv overhead power line close to the Down Main line.
- 3.34 The position of a station located within this site will have similar train performance issues as detailed in Option 2, however the following issues associated with this site should be noted.
- 3.35 Up Direction:
- When an Up Train is stopped in the station a following train would be held at Signal SM85. This signal will not be able to show a proceed aspect until the overlap track circuit for signal LN54 has cleared. A train departing from the station will be faced with a 1:118 rising gradient over a distance of approximately 750 metres before the Overlap IBJ is cleared.
 - Consider a driver forgetting the aspect of Signal SM85 after stopping at the station and restarting.

- A train departing from the station is likely to have visibility of Signal LN54. This signal will probably be classified as a Remote Platform Starting Signal.

3.36 Down Direction:

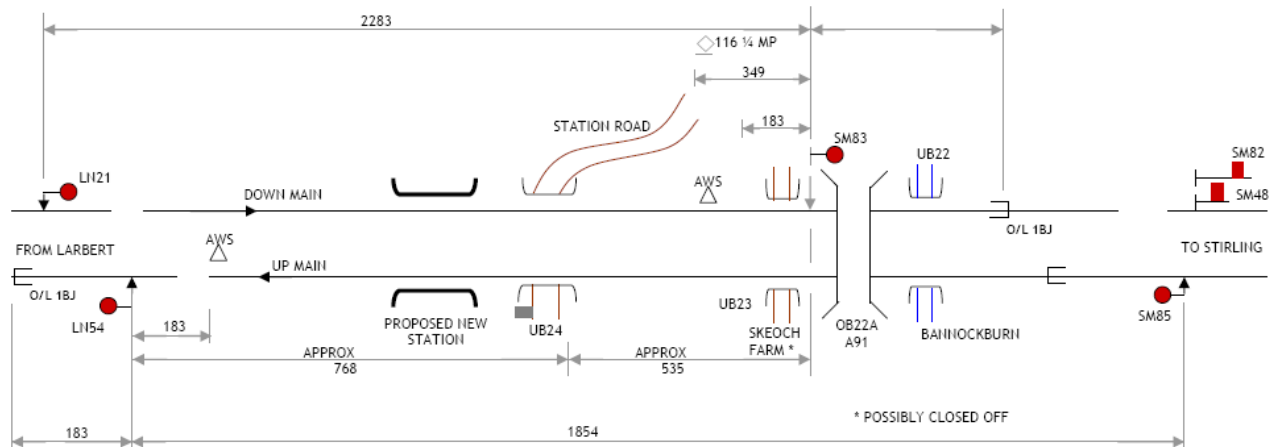
- When a Down Train is stopped in the station a following train would be held at Signal LN21. This signal will not be able to show a proceed aspect until the overlap track circuit for signal SM83 has cleared. A train departing from the station will face a favourable 1:118 and then 1:156 falling gradient over a distance of approximately 750 metres before the Overlap IBJ is cleared.
- Consider a driver forgetting the aspect of Signal LN21 after stopping at the station and restarting. It is likely that Signal SM83 will be visible from the platform but will not be classed as a 'Remote Platform Starting Signal'. The train after departure from the station will encounter SM83 AWS within approximately 460 metres which will be sufficient warning for the train to stop at the signal.

3.37 A Signal Overrun Risk Assessment must be carried out in accordance with GI/RT7006 'Prevention and Mitigation of Overruns - Risk Assessment'.

3.38 In summary there are train performance issues but it is unlikely that there will be any significant signal sighting issues.

FIGURE 3.13 BANNOCKBURN STATION SITE 3 - SIGNALLING ARRANGEMENTS

This option is located approximately 200 meters south of Under Bridge 24 (Station Road) on the site of the former Bannockburn Station.



Performance implications of a proposed station at Bannockburn

3.39 Railsys modelling was used to understand the impacts of stopping a train at Bannockburn. This identified 1min 30sec to 1min 40 sec would be added onto every journey time through braking to a standstill and then accelerating again. On top of this the train will be stationary for around 45 seconds. In timetabling terms, a Bannockburn stop would add 2½ to 3 minutes (depending on the direction of service and rounding used) to existing journey times between Dunblane / Alloa and Glasgow / Edinburgh. Site 1 gives a slightly improved performance compared with sites 2 or 3 due to its location with respect to the existing signalling system.

- 3.40 This section of the rail corridor is scheduled to be electrified through the Edinburgh - Glasgow Improvements Programme in 2016. The modelling indicates the higher accelerating electric rolling stock can accommodate the $2\frac{1}{2}$ to 3 minutes required for an additional station stop without a severe impact on the performance of main line services between Edinburgh and Glasgow.
- 3.41 However, under EGIP, more services than the current will be deployed on the main line, resulting in the need to completely recast the timetable for this route. Due to the greater levels of traffic, timings of services arriving onto and departing from the main line at Greenhills and Polmont junctions are critical. A relevant extract from the current work in progress of the EGIP timetable was provided by Transport Scotland and is shown below:

FIGURE 3.14 EXTRACT FROM DRAFT EGIP TIMETABLE

	360 Qst	170 Qst - Pth	360 Glv	360 Qst	170 Qst-Abd	360
Carmuir E Jn		(1)	10/37		(1)	11/07
Carmuir W Jn	10/23	10/30		10/53	11/00	
Larbert Jn	10/23½	10/30½	10/38	10/53½	11/00½	11/08
Larbert	10a25½		10a40	10a55½		11a10
Stirling	10e37	10c39½	10a48	11e07	11c09½	11a18
Cambus	10/X42			11/X12		
Alloa	10 47			11 17		
Bridge of A		10 44	10 51½		11/14½	11 21½
Dunblane		10a49	10 55			11 25
		DM	DPL			DPL

	360 QST	360 EDN	170 PTH/INS	360 QST	360 EDN	170 ABD
Dunblane		10 00	10a06		10 30	10/38
Bridge of A		10 03	10a09½		10 33	
Alloa	09 36			10 06		(1)
Cambus	09cX43			10cX13		
Stirling	09a51	10a07	10a14	10a21	10a37	10a44
Larbert	09a59	10a15		10a29	10a45	
Larbert Jn	10/00	10/16	10/22	10/30	10/46	10/52
Carmuir W Jn	10/00½	(2)	10/22½	10/30½	(2)	10/52½
Carmuir E Jn		10/19			10/49	

- 3.42 Modelling based on this draft timetable identified the following issues:
- The proposed 5 minute turnaround time at Dunblane would be breached requiring at least one further unit at an annual lease cost of £500-600k, in order to maintain the timetable; and
 - The existing 4 minute headway would be compromised on a number of occasions if an additional station stop adding $2\frac{1}{2}$ to 3 minutes to the journey time was added in this track section.
- 3.43 From the draft EGIP timetable, the constraints on the main line mean that heading north, each hour, express services arrive at Larbert twice each hour 7 minutes behind a local stopping train which it will pass at Stirling. Heading south, the gap is 6 minutes difference between a local service heading to Edinburgh and an express going to Glasgow. These services divert onto separate lines at Larbert Junction.

- 3.44 The signalling system between Larbert and Stirling requires trains to be 4 minutes apart. Therefore with the station stop, the local service would definitely clash on the southbound services and regularly clash with the northbound services when day to day disruption is factored in, even with making the best use of the existing signalling system through the station location.
- 3.45 To reduce the headways or gaps between trains from 4 to 3 minutes on the corridor between Carmuir and Stirling will require the signalling system to be upgraded from the current mix of semaphore and 3 aspect colour light to 4 aspect colour light. The cost for the resignalling work will be greater than the cost of the station.
- 3.46 In summary, unless the existing signalling system is renewed in order to provide a 3 minute headway, stopping the existing commuter rail services at a new Bannockburn station is likely to have a severe performance impact on the enhanced central belt services proposed under EGIP.

Dunblane North

- 3.47 In addition to the “known” potential new station locations, a further option was developed in order to understand the benefits and costs of providing a station close to the junction between the A9 and M9 at Dunblane. This ostensibly could provide a good park and ride interchange with rail.

Site 1

- 3.48 This site is located adjacent to the existing B8033 over bridge to the A9, with access to and from both north and south carriageways of the A9. The junction of the slip roads to the north bound A9 and the B8033 has the potential to be upgraded to a roundabout to give access to the station site. A new road carriageway would be required, with a reasonable extent of earthworks to access the station across the existing uneven ground. The rail tracks at this location are west of the Allan Water but are approximately level with the ground to the east of the Allan Water where the station car park etc is proposed. A bridge across the Allan Water would be required to give level access to platforms. There is no scope in progressing vehicular access from the west of the site as the existing road is single track and bounded by a number of residential properties through Auchenlay. Extensive engineering works are associated with this option.
- 3.49 The site has sufficient capacity to provide a significant park and ride facility serving 300-400 vehicles. A new footbridge would need to be constructed to provide platform to platform access.
- 3.50 There are no operational issues associated with this site due to it being the terminus for services. The estimated capital cost for this site, including signalling and OLE works is £16m including 44% optimism bias. The estimated operating costs for this site are £75k per annum for the station and £200k pa for the new infrastructure.
- 3.51 The site is a Greenfield site which will have planning implications for use as a station site.

FIGURE 3.15 DUNBLANE NORTH - SITE 1



FIGURE 3.16 DUNBLANE NORTH STATION SITE 1 - GENERAL VIEWS



View from B8033 towards Allan Water and Station site



View of proposed site



View from site to B8033



Junction of B8033 and A9 slip road

Signalling arrangements

- 3.52 The location of any new station to the north of Dunblane is likely to be in the area between Laighills Park and Ashfield. The options considered will cater for termination and turnback of the existing Dunblane to Edinburgh and Glasgow trains and will take into consideration the current EGIP project requirements.
- 3.53 The existing Dunblane layout is shown in Sketch No.1. It is assumed that if development of the new north station proceeds some rationalisation of the current infrastructure at Dunblane will take place. It is also assumed that provision of a new Dunblane North Station will be associated with a comprehensive signalling upgrade between Stirling and Blackford (Greenloaning).
- 3.54 Two primary options have been considered each with three platforms. Each option makes provision for an extended Bay Platform and main line signals with extended overlaps of 225 metres to comply with Robust Train Protection requirements. A reduction of Bay Platform and or Overlap lengths may have an impact on the operational flexibility of the layout.
- 3.55 Each option also includes an additional enhancement to allow all three platforms to be used for turnback of trains. These enhancements are shown dotted and referred to as Option 1A and 1B.

OPTION 1 : BAY PLATFORM ON DOWN SIDE

- 3.56 This option provides a new Bay Platform on the Down Side and is a shared 'island' platform with the Down Main. An Up Platform is also provided. A single crossover is provided for Up trains departing from Platforms 2 or 3.
- 3.57 This option has the advantage that Down terminating trains can access Platform 3 without any conflict with trains on the Up Main line.
- 3.58 Platform 2 is provided with a turnback facility.
- 3.59 It is assumed that trains in any Platform will be attended at all times and trains will not be stabled in Platform 3. Although there is a significant falling gradient towards Dunblane, trapping protection in Platform 3 will not be provided if the preceding criteria is met.
- 3.60 The Bay Platform line is extended a sufficient distance to ensure that the TPWS (TSS) at Signals 13, 15 and 16 will effectively stop a 'start against' SPAD before the point of conflict. If the Bay Platform 3 line has to be shortened because physical constraints, this may have an impact on the operational flexibility of the layout.
- 3.61 Intermediate signals have been shown between Dunblane North and Blackford on the assumption that they would replace Greenloaning Signal Box. Track Circuit Block will apply between Dunblane and Blackford.
- 3.62 Option 1A is shown dotted and provides an additional crossover to give access from the Down Main to Platform 1. A fixed red Signal No.6 will be required.
- 3.63 It will be possible to signal a train from Signal No.2 to Platform 1 and accept an Up train to Signal No.12.

OPTION 2 : BAY PLATFORM ON UP SIDE

- 3.64 This option provides a new Bay Platform on the Up Side and is a shared 'island' platform with the Up Main. A Down Platform is also provided. A single crossover is provided for Down trains arriving in Platforms 1 or 2.

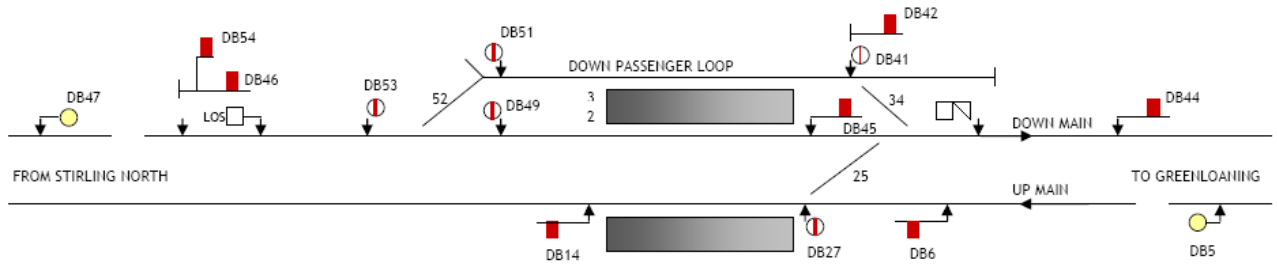
- 3.65 This option has the disadvantage that Down terminating trains which have to be clear of the main lines will have to cross the Up Main line to access Platform 1.
- 3.66 Platform 2 is provided with a turnback facility.
- 3.67 It is assumed that trains in any Platform will be attended at all times and trains will not be stabled in Platform 1. Although there is a significant falling gradient towards Dunblane, trapping protection in Platform 1 will not be provided if the preceding criteria is met.
- 3.68 The Bay Platform line is extended a sufficient distance to ensure that the TPWS (TSS) at Signals 13, 15 and 16 will effectively stop a 'start against' SPAD before the point of conflict. If the Bay Platform 3 line has to be shortened because physical constraints, this may have an impact on the operational flexibility of the layout.
- 3.69 Intermediate signals have been shown between Dunblane North and Blackford on the assumption that they would replace Greenloaning Signal Box. Track Circuit Block will apply between Dunblane and Blackford.
- 3.70 Option 2A is shown dotted and provides a turnback facility from Platform 3. An additional Signal No.15 will be required.
- 3.71 It will be possible to signal a train from Signal No.2 to Platform 1 and accept an Up train to Signal No.12.

Dunblane Station and Signalling

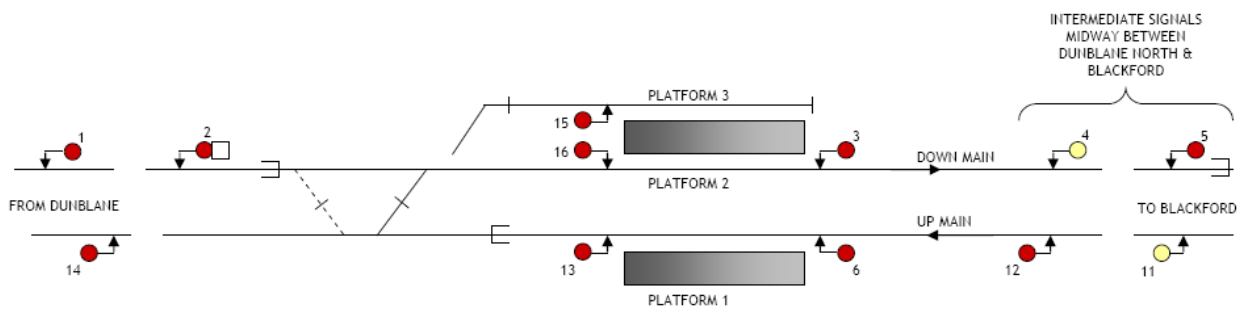
- 3.72 As previously stated it is assumed that there will be complete re-signalling between Stirling and Blackford and it would be appropriate to consider rationalisation of the existing Dunblane infrastructure if the new Dunblane North Station proceeds. The following rationalisation should be considered :-
 - Remove No.25 crossover.
 - Remove CE Siding
 - Remove Down Passenger Loop (Additional car parking possible).
- 3.73 (Note that consideration may be required for freight / local passenger refuges along the route. Possible retention and extension of the existing loops at Greenloaning.)
- 3.74 It should be noted that Dunblane North Option 1 (1A) layout could be applied to Gleneagles Station if EGIP includes electrification to Gleneagles Station.

FIGURE 3.17 DUNBLANE NORTH STATION - SIGNALLING ARRANGEMENTS

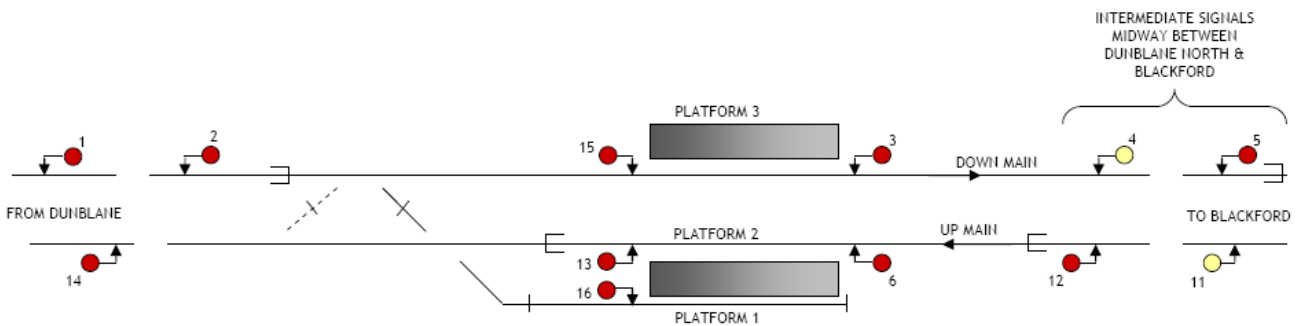
EXISTING DUNBLANE SIGNALLING LAYOUT



OPTION 1 : DOWN SIDE BAY PLATFORM



OPTION 2 : UP SIDE BAY PLATFORM



Site 2

- 3.75 This is located further north along the B8033 from the A9, at the settlement of Ashfield. The road connections are consequently less immediate to Dunblane and the Strathearn/ Strathallan area. An existing local bus service operates between Ashfield and Kinbuck/Stirling. A new on-grade road carriageway would be required, with earthworks to access the station across the existing ground. The tracks are within a cutting as the railway passes Ashfield but are on-grade at the proposed site. A 90mph speed limit exists at this location.

FIGURE 3.18 DUNBLANE NORTH - SITE 2

- 3.76 The site has sufficient capacity to provide a significant park and ride facility serving 300-400 vehicles. A new footbridge would need to be constructed to provide platform to platform access. Alternative access could be achieved from the village of Ashfield with is served by a single track road from the B8033. The station would allow a small walk-in catchment from Ashfield.
- 3.77 There are no operational issues associated with this site due to it being the terminus for services and that costs for resignalling the section have been included in the capital cost.
- 3.78 The site is a Greenfield site which will have planning implications for use as a station site. The estimated capital cost for this site, including signalling and OLE works is £15m including 44% optimism bias. The estimated operating costs for this site are £65k per annum plus £200k for the additional infrastructure.

FIGURE 3.19 DUNBLANE NORTH STATION SITE 2 - GENERAL VIEWS



View of site from Ashfield

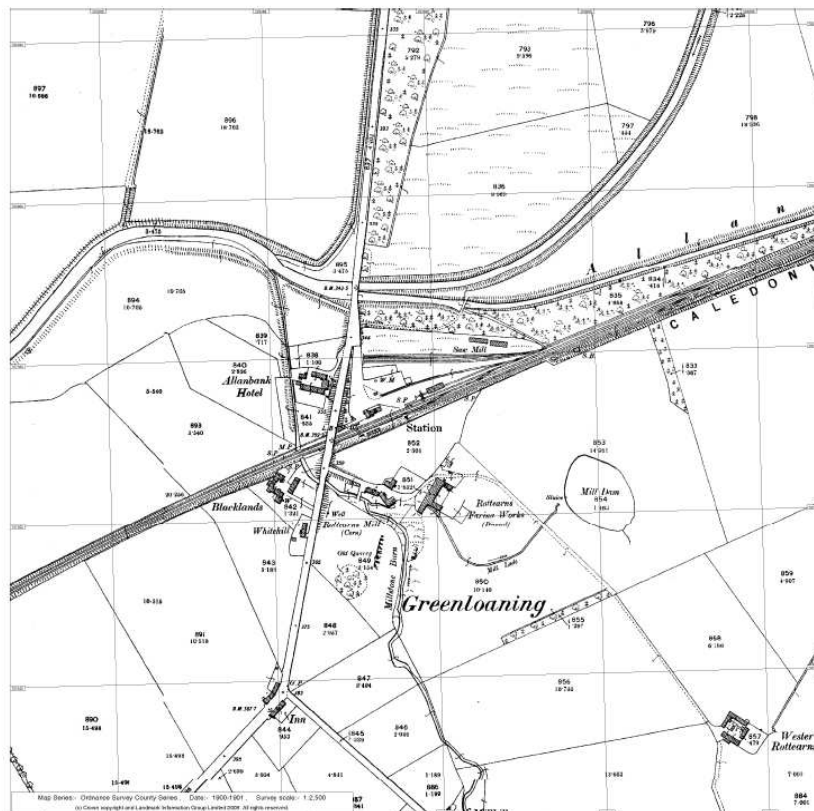


View of railway in cutting at Ashfield

Greenloaning

- 3.79 A possible station site is located at the down passing loop north of the original station site and where the sidings from both up and down lines are relocated. Detailed topographical surveys would be required to ascertain if the platforms could be installed without modification to the existing tracks, however this is believed to be unlikely and modification of the track layouts would be required. In both cases unless the station was only on one side of the down and up loop then an island platform between the loop and the main line and a platform on the up line siding, modified to a loop, would be required. These platforms would only be accessed from the sidings area. The over bridge at the existing station site is too narrow to allow for platforms to extend southwards.

FIGURE 3.20 GREENLOANING - ORIGINAL STATION SITE



- 3.80 There is restricted access from the main road with most projected station traffic approaching through Greenloaning. There is limited scope for a station car park in this location with the original access road junction not to current standards and the area of the original station being in private ownership. The land between the railway and the Allan Water is occupied by the waste water treatment works.
- 3.81 The sidings at Greenloaning are used by Network Rail for stabling engineering trains and have been identified in the STPR as having the potential to be extended in order to provide refuges for freight services in future. Greenloaning signal box would require to be staffed if a station was to be provided. The station location is also within the longest signalling block section on the study corridor. A stop within this block section would increase signalling headways resulting in a reduction in capacity of the main line.
- 3.82 The capital cost estimate for a new station at Greenloaning is £5m including 44% optimism bias. The estimated operating costs for this site are £65k per annum.

FIGURE 3.21 GREENLOANING STATION - GENERAL VIEWS



View looking towards Signal Box

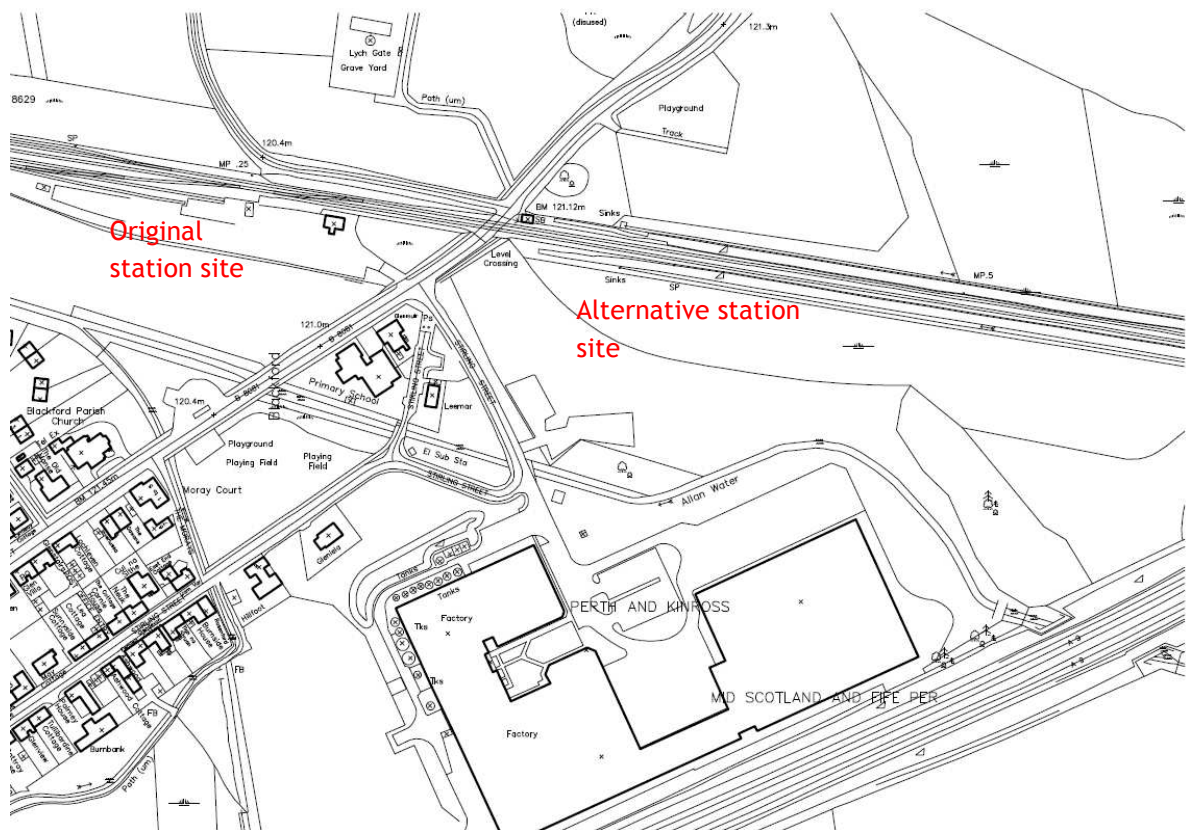


View looking towards Station Building

Blackford

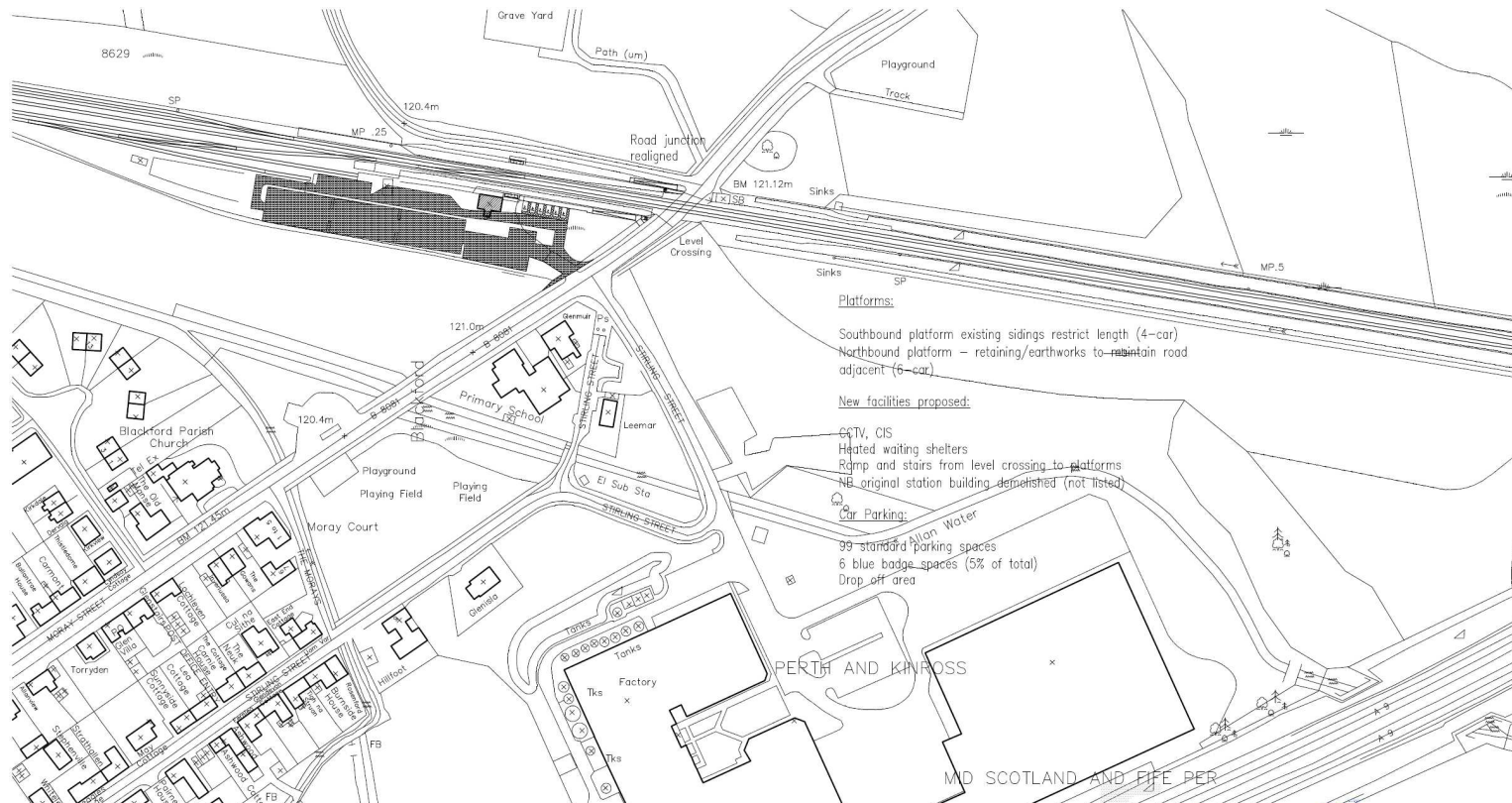
- 3.83 Two potential sites were identified in Blackford for a proposed station. Both are accessed through Blackford along the B8081 from the A9. The B8081 crosses the railway at a level crossing adjacent to a signal box. The original station was located west of this road and this provides an option for a re-opened station as does the site east of the B8081 bounded to the south by the Highland Spring Plant. Although the B8081 connects with the A9 northbound, north of Blackford, this junction does not allow traffic from the southbound A9 to access the B-road. All traffic from the north accessing the station site will have to travel through Blackford. The site of the original station is proposed the preferred location as feasibility studies are underway to provide a rail freight depot to the east of the B8081 for Highland Spring.

FIGURE 3.22 BLACKFORD - SITES 1 AND 2



- 3.84 At the original station site there is limited scope for a down platform. The land rises steeply behind the tracks at the western end and there is a single track road approximately 9m from the running line. The single track road would require to be realigned to ensure a safe junction if the platform is constructed in this location. The up platform is constrained to 4 car length unless the existing sidings (owned by Highland Spring) are recovered or relocated. Platform to platform access is proposed via the level crossing.
- 3.85 All new stations constructed recently have been specified with 6 car platforms as a minimum. Blackford station is located on a main rather than branch line where 6 car trains can operate to both Aberdeen and Inverness. It would therefore seem impracticable to construct a new station in this location with platforms of less than 6 car length. However, it is assumed intercity services would continue to call at Gleneagles and 200m platforms are not required
- 3.86 The alternative station site has no constraints on platform length or impact on other infrastructure.
- 3.87 There is an existing Perth-Stirling bus service has a stop 160m south of the level crossing in a lay-by off the road. There is land available at both locations to construct a car park.
- 3.88 A design for Blackford station has been prepared and is shown in Figure 3.23.

FIGURE 3.23 BLACKFORD STATION FEASIBILITY DESIGN



[blackford station as proposed]

architects interior designers cdm co-ordinators [idp]

project
Tay Estuary Rail Study
for TACTRAN

draw title
Blackford Station as proposed

scale
1:25000

date
February 2009

checked
all

drawn
all

approved

cad ref.
/tactran/ters/drawings

drawn no.
09009 02

idp architects llp | adolphus centre | 12 commercial road | glasgow | g5 0pq
tel: 0141 429 5151 fax: 0141 429 6161 e-mail: idp@idparchitects.co.uk

FIGURE 3.24 BLACKFORD STATION - GENERAL VIEWS



View of original station site



View of alternative site



View of road adjacent to original station site

- 3.89 There are no significant operational issues for a station at Blackford. The estimated capital cost is £4.5m including 44% optimism bias. A breakdown of the estimate is shown below. The estimated operating costs for this site are £60k per annum.

FIGURE 3.25 BLACKFORD STATION - BUDGET COST ESTIMATE

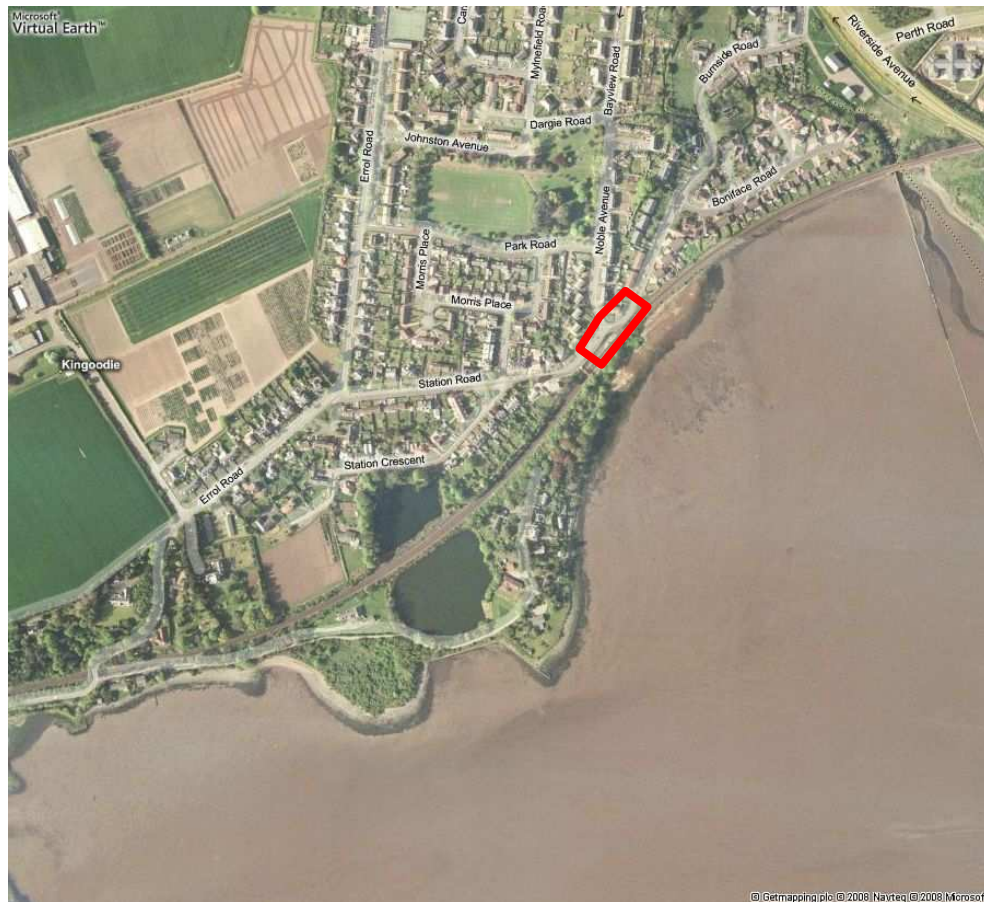
Station Construction Costs	Quantity	Unit	Rate	Total	Comments
Single story modular building - floor area	0.00	m2	1,750	0	
Platforms	1,200	m2	660	792,000	2 platforms * 150m long * 4m wide
Platform lighting	1,200	m2	70	84,000	
Platform drainage/ducts and access	1,200	m2	70	84,000	
Platform signage	1,200	m2	10	12,000	
Platform fencing	400	m	100	40,000	
Platform retaining wall	225	m2	400	90,000	Assume 1.5m high for 150m
Platform shelter & seating	2	No	50,000	100,000	
LLPA / CIS / CCTV / Help Points	1	item	150,000	150,000	Assumes available trackside FTN
Overbridge	0	item	250,000	0	Level crossing to be used for access between platforms
MIP Lifts	0	No	225,000	0	
DDA ramped overbridge (no lifts)	0	item	425,000	0	
<u>External Works to Station</u>					
Footpaths	150	m2	50	7,500	
Access road 7.3m wide (inc pavements)	20	m	1,200	24,000	
Car Park (including lighting, marking, drainage)	99	space	2,500	247,500	
Traffic light controlled junction	0	item	120,000	0	
Road junction works	1	item	100,000	100,000	
Landscaping	1	sum	150,000	150,000	
P/Way recoveries	1,000	m	150	150,000	
Signalling recoveries	1	sum	100,000	100,000	
Total Base Cost - Blackford Station				2,131,000	
Non Construction Costs	% of Base	Unit	Rate	Total	Comments
Contractor preliminaries	15.00%			319,650	
GRIP stages 1-4 development	5.00%			106,550	
GRIP stage 5 design	5.00%			106,550	
Project Management	12.00%			255,720	
Possession management	60 shifts		£ 2,000	120,000	Increase due to track recoveries
TOC Compensation	3.00%			63,930	
Land	0.00	Ha	£ 30,000	0	
Total Non Construction Cost				972,400	
Sub Total				3,103,400	
Risk and Optimum Bias	44.00%			1,365,496	
TOTAL				£ 4,468,896	

Cost base is Q1 2009

Dundee West

- 3.90 As described in paragraph 2.18 there is very limited scope to develop Invergowrie station.
- 3.91 Alternative station locations in the Invergowrie area were considered, including behind the housing at Red Cliffs, Kingoodie and at the overbridge leading into Kingoodie. There is insufficient land to construct platforms in these locations without major engineering works or land purchase and walk-in catchment decreases the further south the station is located. There is no access to the railway possible from Burnhouse or Boniface Roads located the east of the current station.

FIGURE 3.26 INVERGOWRIE STATION



- 3.92 Sites further to the west become constrained by poor road infrastructure in close proximity to the railway line and by the long single block signalling section which runs from Barnhill to Errol. The review failed to identify a suitable location to the west of Invergowrie which would support a viable station - all required significant road or rail infrastructure works to support provision of a new station.
- 3.93 A site to the east of Invergowrie was identified as being suitable for a station. This site is located south of Ninewells Hospital to the west of Dundee airport, approximately 700m east of Invergowrie Station. The site is adjacent to the A85, Riverside Avenue, providing good access to Dundee city centre and surrounding areas. A new road junction would require to be formed to give access to the station site. To the east of the station site there is an existing pedestrian underpass to the

railway which gives access to Perth Road with nearby bus stops for local bus services and with a fairly laborious walk to Ninewells Hospital. This pedestrian route would require to be developed with new surfacing and lighting.

- 3.94 A long linear car park can be created in this location with capacity for at least 300 vehicles. The site is adjacent to a main Scottish Water sewer and consents would be required prior to developing this option further.
- 3.95 There is limited space for the northbound platform with a degree of retaining likely to be required along the back of the platform. The southbound platform construction would be elevated due to the existing ground topography but would have level access from the car park/ access road. A new footbridge would need to be constructed to provide platform to platform access.
- 3.96 To minimise journey time penalties and operating costs, it would be proposed that this station replaces Invergowrie station. Station closure is a difficult process but is generally made easier when a replacement (and improved) facility is provided close by. The walk-in distance from Invergowrie is between 500 and 1000m.

FIGURE 3.27 DUNDEE WEST - PROPOSED LOCATION



FIGURE 3.28 DUNDEE WEST STATION - GENERAL VIEWS



View of proposed car park site



View of tracks from south (note signal at this location)



View of existing pedestrian underpass



View of pedestrian route from Perth Road

- 3.97 The station and car park development at Dundee West would cost circa £5.3m including 44% optimism bias. Assuming that Invergowrie station is closed, the estimated *additional* operating costs for Dundee West are £35k per annum.

FIGURE 3.29 DUNDEE WEST - BUDGET COST ESTIMATE

Station Construction Costs	Quantity	Unit	Rate	Total	Comments
Single story modular building - floor area	0.00	m2	1,750	0	
Platforms	1,200	m2	660	792,000	2 platforms * 150m long * 4m wide
Platform retaining wall (down side)	225	m2	400	90,000	Assume 1.5m high for 150m
Platform raising (up side)	600	m2	100	60,000	
Platform lighting	1,200	m2	70	84,000	
Platform drainage/ducts and access	1,200	m2	70	84,000	
Platform signage	1,200	m2	10	12,000	
Platform fencing	400	m	100	40,000	
Platform shelter & seating	2	No	50,000	100,000	
LLPA / CIS / CCTV / Help Points	1	item	150,000	150,000	Assumes available trackside FTN
Overbridge	0	item	250,000	0	
MIP Lifts	0	No	225,000	0	
DDA ramped overbridge (no lifts)	1	item	425,000	425,000	
External Works to Station					
Footpaths	120	m2	50	6,000	
Access road 7.3m wide (inc pavements)	70	m	1,200	84,000	
Car Park (including lighting, marking, drainage)	140	space	2,500	350,000	Land available for 394 spaces - assume incremental expansion
Traffic light controlled junction	0	item	120,000	0	
Landscaping	1	sum	150,000	150,000	
Sewer protection works	1	sum	100,000	100,000	
Total Base Cost - Dundee West Station				2,527,000	

Non Construction Costs	% of Base	Unit	Rate	Total	Comments
Contractor preliminaries	15.00%			379,050	
GRIP stages 1-4 development	5.00%			126,350	
GRIP stage 5 design	5.00%			126,350	
Project Management	12.00%			303,240	
Possession management	50	shifts	£ 2,000	100,000	
TOC Compensation	3.00%			75,810	
Land	1.50	Ha	£ 30,000	45,000	Confirm local values and ownership
Total Non Construction Cost				1,155,800	

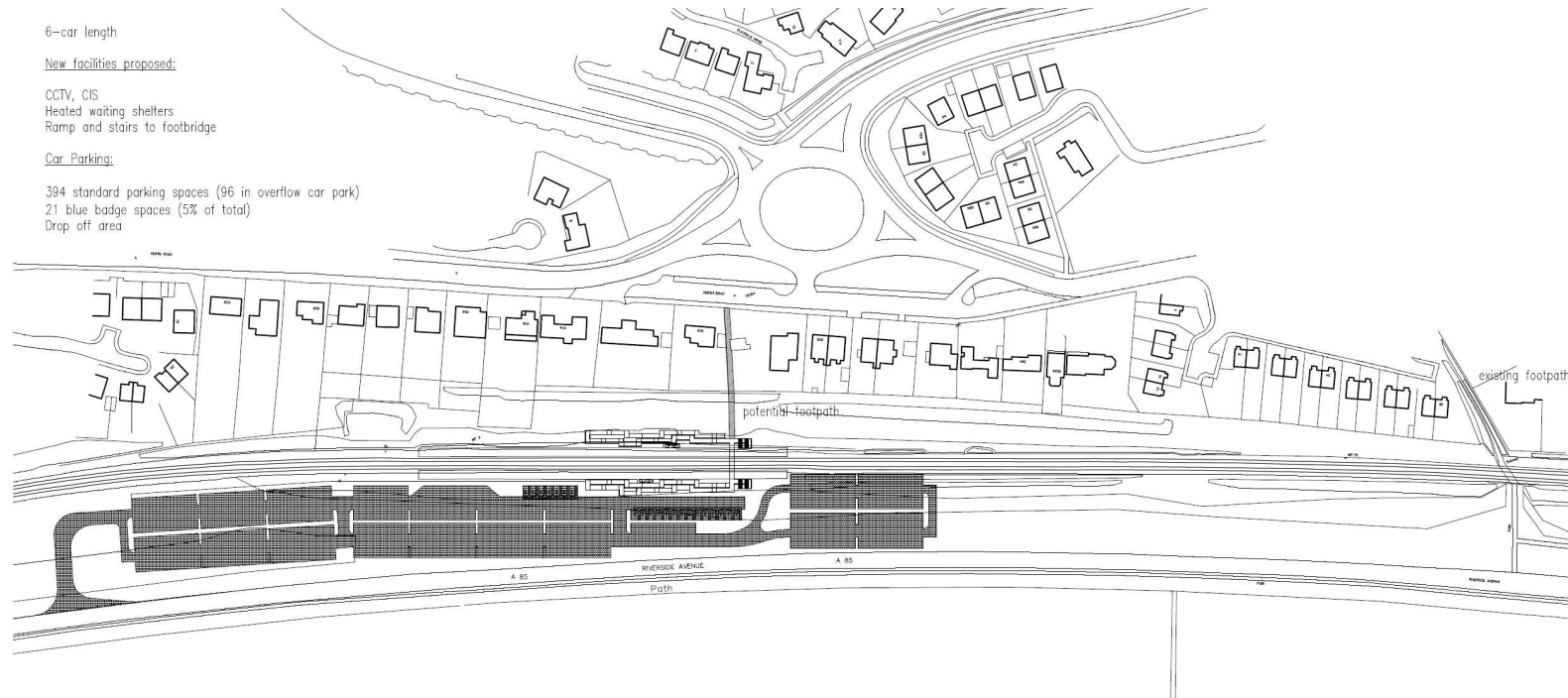
Sub Total				3,682,800	
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Risk and Optimum Bias	44.00%			1,620,432	
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TOTAL				£ 5,303,232	
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Cost base is Q1 2009

FIGURE 3.30 DUNDEE WEST STATION - FEASIBILITY DESIGN



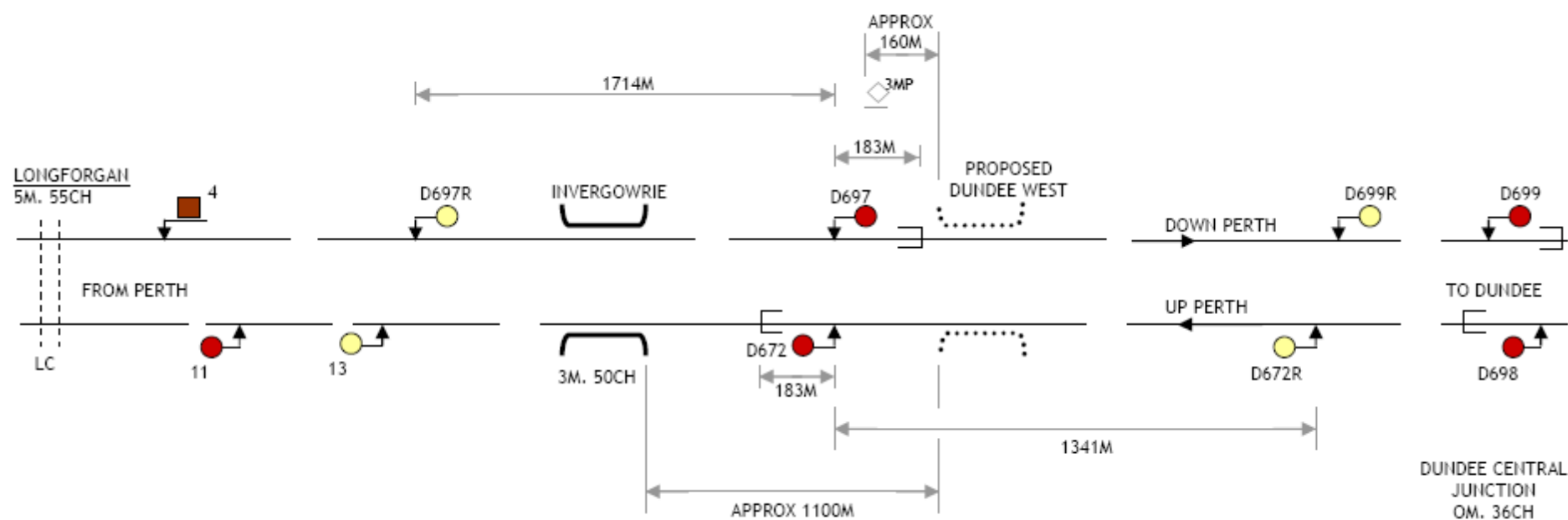
[dundee west station as proposed]



Signalling arrangements

- 3.98 Details are shown in Figure 3.31.
- 3.99 The Down and Up Perth Lines between Longforgan and Dundee are worked under Track Circuit Block regulations. Down trains from Longforgan (Signal No.4) to Signal D697 are controlled by Longforgan Signal Box. Up trains from Dundee (Signal No.D698) to Invergowrie Signal D672 are controlled from Dundee Signal Box. The line speed of Down and Up Perth Lines at the proposed Dundee West Station is 75 mph.
- 3.100 The preferred site for the proposed Dundee West Station is in the vicinity of 3 Mile Post between the existing Invergowrie Station and Dundee Central Junction. The station should be ideally situated clear of the overlap for Signal D697. This would allow Longforgan SB to send an Up train up to Signal D697 whilst the Down Platform of Dundee West station is occupied.
- 3.101 Up trains stopped at the new Dundee West station will enforce following trains to be held at Signal D698 until the train has departed from the station and cleared the overlap track circuit for Signal D762.
- 3.102 The consequences (rear end collision) of a SPAD at Signal D697 whilst a train is stopped in the new station is increased. It is likely that TPWS (TSS) will be recommended at Signals D697 and possibly Signal D698.
- 3.103 There is not likely to be any signal sighting issues for Down trains.
- 3.104 Signal D672 will be visible to a train stopped in the Up Platform and may be classified as a 'Remote Platform Starting Signal'. There may however be a signal sighting issue for non-stopping Up trains in the new station. Signal D672 may be obscured by the new station platform shelter / furniture and lighting. The worst case would be provision of a banner repeating signal on the approach to the Up Platform.
- 3.105 A Signal Overrun Risk Assessment must be carried out in accordance with GI/RT7006 'Prevention and Mitigation of Overruns - Risk Assessment'.
- 3.106 Relevant Mileages :-
- Dundee Central Junction : 0 miles 36 chains
 - Invergowrie Station : 3 miles 50 chains
 - Longforgan : 5 miles 55 chains
 - Errol : 10 miles 39 chains
 - Perth PSB : 20 miles 64 chains

FIGURE 3.31 DUNDEE WEST - SIGNALLING ARRANGEMENTS



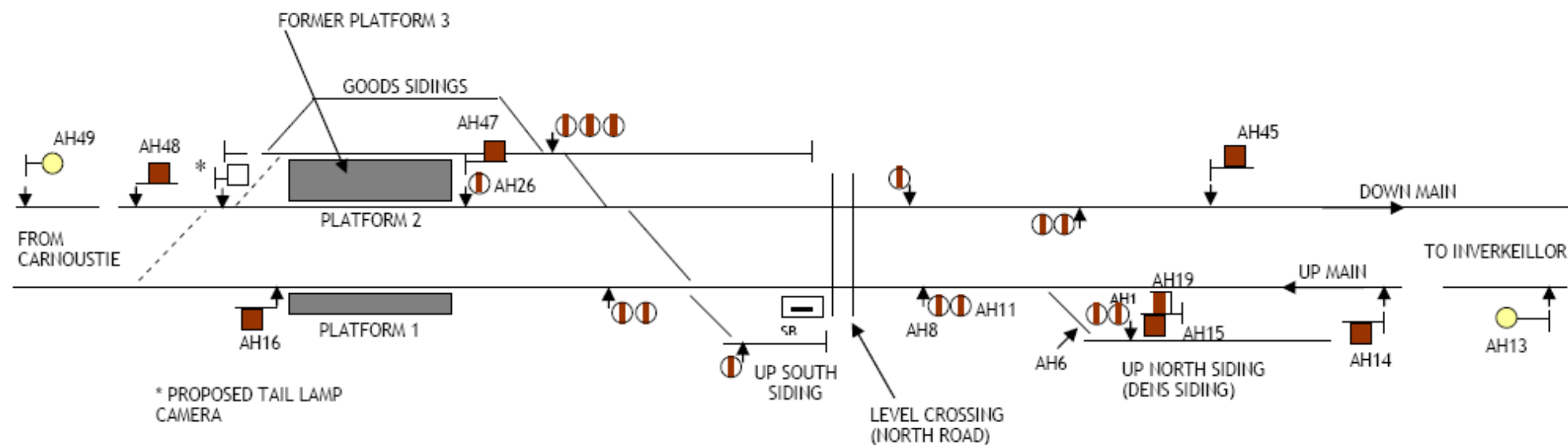
4 Other infrastructure works

- 4.1 The infrastructure works associated with existing and proposed stations are detailed in Chapters 3 and 4 respectively.
- 4.2 Two other elements of infrastructure works of benefit to TERS services were also developed.

Arbroath Turnback Operation

- 4.3 The railway infrastructure at Arbroath has undergone some significant rationalisation over the past 20 years. The most significant change was the closure of Arbroath South Signal Box (SB) and removal of the connections to Platform 3. Arbroath North SB was retained and renamed 'Arbroath' and controls the existing signalling and level crossing. The line speed through the station is 20 mph.
- 4.4 Absolute Block Regulations apply from Arbroath to Carnoustie and Inverkeillor.
- 4.5 There is currently one train per day from Dundee which terminates and turns back at Arbroath. The train on arrival at Arbroath and after passengers have disembarked is signalled from Signal AH26 to Signal AH8 and then to the North (Dens) Siding. The train is then signalled from Signal AH1 to the Up Main when ready to depart. The timetables developed for this study will use the same means of turning services back at Arbroath.
- 4.6 Since the closure of the South SB the signaller at Arbroath cannot accept another down train from Carnoustie until the tail lamp of the previous train has been observed after passing the Signal Box. Provision of a Tail Lamp Camera would allow the signaller to clear back (and accept another train) after observing the tail lamp of a train arriving in Platform 2. A Down train from Carnoustie could therefore be signalled up to Signal AH48 when a train is stopped at Platform 2. Signal AH48 is motor operated and is fitted with TPWS Train Stop Sensor (TSS).
- 4.7 The CCTV tail light camera will help mitigate the performance impact of this operation on the express services in this section of route. This modification to the existing infrastructure is therefore a pre-requisite before running any proposed new services and turning back at Arbroath. Costs for the provision of a Tail Lamp Camera and associated cable route and signal box works are estimated as £240k including 44% optimism bias. Timescales for delivery are estimated as 18 months from commencement of design to commissioning. The location of the CCTV camera is shown in drawing in Figure 4.1.
- 4.8 There is no major renewal of the S&C in the foreseeable future. It is understood that the Goods Sidings are currently out of use although this has not yet been published in the PON / Sectional Appendix.

FIGURE 4.1 ARBROATH CCTV TAIL LIGHT CAMERA



- 4.9 Consideration may be given at a later date to re-instatement of the former Platform 3. This would involve provision of a new trailing crossover between the Down and Up Main Lines just south of the station and a new half connection on the Down Main Line. This half connection would provide the access to the former Platform 3. The proposed connections are shown dotted on the sketch. The Platform 3 Line could retain a north end connection to the Down Main Line or Buffer Stops could be provided. The existing trailing crossover to the north of the level crossing could be removed. It would be prudent to retain a facing and trailing crossover for Single Line Working. It would also be possible to rationalise the number of sidings. Significant signalling alterations would be required.

4.10 Relevant Mileages :-

- Dundee Station : 59 miles 14 chains
- Broughty Ferry Station : 3 miles 38 chains
- Carnoustie SB : 10 miles 29 chains
- Arbroath Station : 16 miles 45 chains
- Arbroath SB : 16 miles 60 chains
- Inverkeillor SB : 23 miles 10 chains
- Usan SB : 28 miles 48 chains
- Montrose South SB : 30 miles 37 chains

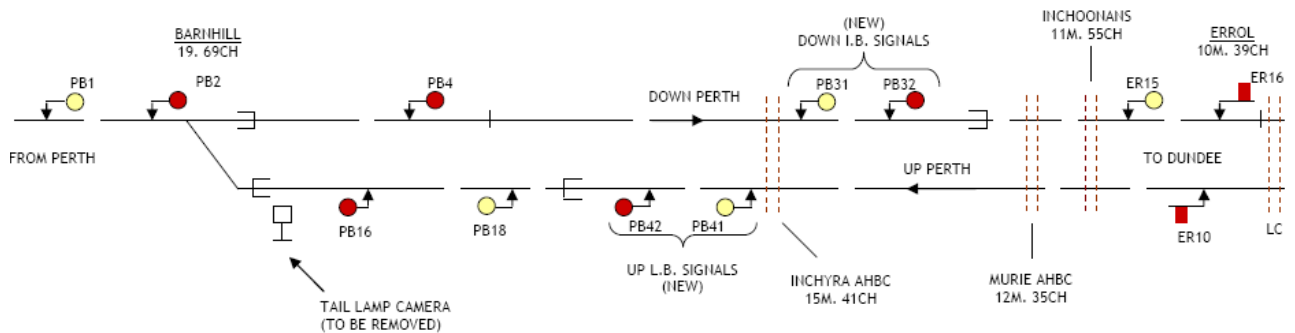
Headway Improvements - Barnhill Example

- 4.11 Refer to the sketch shown in Figure 4.2. Signal Numbering is for illustration only.
- 4.12 The sketch assumes that Barnhill Signal Box has been eliminated under Network Rail's Project 40 initiative. Under this project Absolute Block will be retained between Barnhill (Perth PSB) and Errol. A Tail Lamp camera will be provided for Up Perth trains arriving at Barnhill to enable the Up Perth Block to be cleared back to Errol Signal Box once a train has cleared the overlap Track Circuit of Signal BH16 and the Tail Lamp observed on the CCTV.
- 4.13 To improve the headway between Perth (Barnhill) and Errol it is proposed to provide Intermediate Block signals on the Down and Up Perth Lines as shown on the sketch. The positions of the new intermediate signals should be carefully determined to avoid any requirement to alter the controls of Inchyra, Murie or Inchcoonans Automatic Half Barrier Crossings. The stop signals should not be placed within the 37 second 'strike in' points. The distant signals should where practicable, not be placed within the 37 second 'strike in' points as this could lead to extended barrier down times before the train passes the crossing. The positioning of Signal PB32 (and PB31) must be carefully considered in relation to the Down 37 second strike in point for Murie AHBC. Even if PB32 is clear of the 37 second 'strike in' a train moving off after being stopped at this signal will possibly not attain anything near the line speed and is very likely to increase the timing cycle for Murie AHBC. This will require a full assessment of the impact of the new signals on Murie AHBC.

- 4.14 It is assumed that Axle Counters will be used for Train Detection between Barnhill and Errol. It is recommended that the Absolute Block between Perth (Barnhill) and Errol is converted to 'Track Circuit' Block which will eliminate the need to provide new Tail Lamp cameras.
- 4.15 The existing Track Circuits for the AHBC's will be retained primarily for the control of the level crossings and will not be indicated as part of the Track Circuit Block Section proving.
- 4.16 It should be noted that there is an aspiration to close the road at Inchyra AHBC.
- 4.17 Relevant Mileages :-
- Errol : 10 miles 39 chains
 - Inchcoonans AHBC : 11 miles 55 chains
 - Murie AHBC : 12 miles 35 chains
 - Inchyra AHBC : 15 miles 41 chains
 - Barnhill (SB) : 19 miles 69 chains
 - Perth PSB : 20 miles 64 chains

FIGURE 4.2 BARNHILL - SIGNALLING HEADWAY IMPROVEMENTS

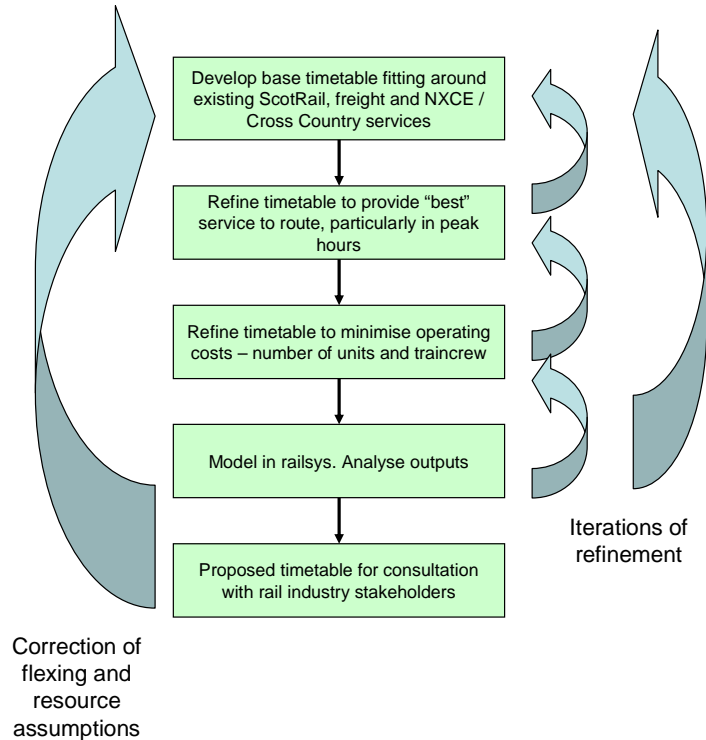
Assumes that Barnhill Signal Box has been eliminated under a Network Rail Rationalisation Project



5 Timetable development

- 5.1 The iterative process described in Figure 5.1 (below) was followed in order to develop timetables for the short and medium term phases for each option package.

FIGURE 5.1 TIMETABLE DEVELOPMENT PROCESS



Phase 1 of all packages -Glasgow to Perth

- 5.2 A preliminary timetable was constructed around the existing 10.11, 16.11, 17.12 and 18.11 services from Glasgow to Perth and / or Inverness. This is relatively straightforward as these paths are mostly available in the off-peak.
- 5.3 The timetable developed provided departures from Glasgow at XX.11 and from Perth back to Glasgow at XX.37. The assumed stopping pattern was Stirling, Dunblane, Gleneagles (or Blackford) and Perth with a typical journey time of 1 hour and 8 minutes.
- 5.4 However there are conflicts with following freight services using this path between Stirling and Perth:
- 6A65 - conflicts with a proposed 08.11 Glasgow - Perth service;
 - 4A66 - conflicts with a proposed 09.11 Glasgow - Perth service; and
 - 6S60 - conflicts with a proposed 15.11 Glasgow - Perth service.
- 5.5 On the up direction the following conflicts occur on the XX.45 path to Glasgow Queen Street:
- 4N71 - conflicts with a proposed 15.37 Perth - Glasgow service;
 - 6D83 - conflicts with a proposed 17.37 Perth - Glasgow service;

- 4N81 - conflicts with a proposed 18.37 Perth - Glasgow service; and
 - 4N83 - conflicts with a proposed 19.37 Perth - Glasgow service.
- 5.6 In general the freight paths on this corridor are inefficient both for the infrastructure operator and the freight operating company. This reflects the fact that most services operate irregularly and not every day. The two most efficient paths are the daily DRS workings from Grangemouth to Aberdeen - 4A13 and 4N69. We avoid conflict with these paths. Where we have flexed freight services, we have sought to try and replicate the efficiency of these core paths.
- 5.7 Modelling through railsys has demonstrated the flexed freight services continue to arrive at their destination within a reasonable tolerance of their current booked arrival. The revised timings will have to be agreed with the freight operating companies, Network Rail, Transport Scotland and First ScotRail during the timetable bid process at the point Glasgow - Perth services are being considered for introduction.
- 5.8 In order to future proof the timetable for Highland Main Line services, the draft timetable assumes the Glasgow - Perth service will run through to Inverness every second hour, ie. 08.11, 10.11, 12.11, 14.11 and so on.
- 5.9 It was then assumed an Edinburgh - Inverness service to run in the alternate hours with departures from Perth at 07.47, 09.50, 11.53, 13.53 and so on. This does not give an hourly service from Perth to Inverness, but instead a service every 30 and 90 minutes. This issue is understood and is currently under development by the Highland Main Line project.
- 5.10 The draft timetable provides turnaround times of 25 minutes at Glasgow Queen Street and 15 minutes at Perth.
- 5.11 In summary the developed timetable is:

TABLE 5-1 GLASGOW - PERTH TIMETABLE

		Inverness	Through services ex Perth at 11.37, 13.37, 15.37..... Connections at 08.47, 09.55, 13.0.1	
Glasgow	XX.11		Perth	XX.37
Stirling	XX.42		Gleneagles / Blackford	XX.52
Dunblane	XX.51		Dunblane	XX.06
Gleneagles / Blackford	XX.03		Stirling	XX.14
Perth	XX.19		Glasgow	XX.45
Through services ex Perth at 09.19, 11.19, 13.19 .. Connections at 07.47, 09.50, 11.53 ...		Inverness		

- 5.12 In conjunction with the Glasgow - Aberdeen express services, this timetable provides Perth with a two trains per hour service to Glasgow.
- 5.13 In the December 2008 WTT, the services between Glasgow and Perth in our proposed timetable are operated in the peak hours. It has therefore been assumed that the fixed costs for providing this service, ie. rolling stock and train crew, are funded within the existing franchise contract. The variable costs to be attributed to the project are fuel, Variable Track Access and cleaning/ servicing. The cost of running between Perth and Inverness is also excluded from our estimate:

TABLE 5-2 OPERATING COST ESTIMATE - GLASGOW -PERTH SERVICE

Perth - Glasgow round trip mileage	Additional round trips per week (assume 7 day service)	Annual mileage	Variable Costs per mile <ul style="list-style-type: none"> Fuel (£0.68) VTA (£0.25) Servicing (£0.51) 	Staff Costs <ul style="list-style-type: none"> Driver (£55k) Guard (£40k) 	Rolling Stock lease costs £242k per unit
125	70	455,000	£655,000	Nil	Nil
TOTAL					£655,000

- 5.14 The outputs from the railsys model are recorded in Appendix C. The modelling has identified a number of issues. It is felt that all are resolvable but will require further work when the final timetables are developed during the bid process:
- Limited platform space at Glasgow Queen Street. With some re-platforming and minor re-timings, this does look achievable;
 - Conflicts with ECS and freight services in the Stirling - Glasgow corridor;
 - There are a lot of large conflicts at Dunblane caused by terminating trains using platform 2. Moving these to platform 3 would resolve this problem; and
 - Greenloaning signal box may require to be staffed.
- 5.15 It should be recognised the proposed Glasgow - Perth service uses the one remaining free path out of Glasgow Queen Street and as such consumes the spare capacity which existing operations have relied on to recover during periods of perturbation. Railsys modelling predicts that running this service will increase overall delay by 178 minutes (27.3%) from the base of the December 2008 Working Timetable.
- 5.16 This causes punctuality for First ScotRail services arriving within 0 to 5 minutes of their booked time to fall from 95.9% to 95.1%. However First ScotRail are confident the timetable conflicts in the Glasgow Queen Street area which result in the majority of the modelled delays can be managed to an acceptable resolution.

Package 1 - Phase 2 (Glasgow - Perth service with two hourly extension to Arbroath)

- 5.17 Once comfort was obtained regarding the reliability of the base Glasgow - Perth timetable, it was developed to allow the service to extend to Arbroath. The service could not extend to Arbroath in those hours it anticipated to run through to Inverness.
- 5.18 The following additional conflicts were identified with freight services in the Perth to Arbroath corridor:
- 4N79 - conflicts with a proposed 15.54 Arbroath - Glasgow service; and
 - 4N81 - conflicts with a proposed 17.40 Arbroath - Glasgow service.
- 5.19 The freights were flexed into the next available path and modelling through railsys has demonstrated they continue to arrive at their destination within a reasonable tolerance of their current booked arrival. The revised timings will have to be agreed with the freight operating companies, Network Rail, Transport Scotland and First ScotRail during the timetable bid process at the point services were being considered for introduction.
- 5.20 A summary of the developed timetable is shown in Table 5-3. The key points are:
- One service in the morning peak in each direction departing Arbroath at 07.45 and Perth at 08.05;
 - A service on each shoulder of the evening peak departing Arbroath at 15.54 and 17.40 and Perth at 16.20 and 18.25;
 - 10-15 minute connection time at Arbroath for services to Aberdeen;
 - Service has to wait in Perth station for 5 minutes in the up direction in order to align with path into Glasgow. Dwell time at Perth in the down direction is 1 minute. The dwell time in the up direction could potentially be reduced;
 - Service starts getting caught down by Glasgow - Aberdeen express around Carnoustie therefore the potential exists for some detrimental performance impact. This will also restrict the number of stations the service can call at;
 - Turnaround time at Arbroath is an average of 35 minutes; and
 - In the medium term the viability of this timetable is dependent upon how Highland Main Line services evolve. In its current status it is reliant on “sharing” the Glasgow - Perth section of route with these every other hour.
- 5.21 The developed timetable was then used to produce preliminary rolling stock diagrams and crew resourcing requirements. A further two units were identified as being required along with eight drivers and eight guards / ticket examiners. The estimated increase in operating cost over the base Glasgow - Perth service is shown in Table 5-4.

TABLE 5-3 GLASGOW - ARBROATH TIMETABLE

Glasgow	XX.11	Arbroath	XX.44
Stirling	XX.42	Carnoustie	XX.50
Dunblane	XX.51	Monifieth	XX.56
Gleneagles / Blackford	XX.03	Broughty Ferry	XX.00
Perth	XX.19	Dundee	XX.07
Invergowrie / Dundee West	XX.37	Invergowrie / Dundee West	XX.15
Dundee	XX.44	Perth	XX.33
Broughty Ferry	XX.51	Gleneagles / Blackford	XX.52
Monifieth	XX.55	Dunblane	XX.06
Carnoustie	XX.01	Stirling	XX.14
Arbroath	XX.07	Glasgow	XX.45

Table 5-4 OPERATING COST ESTIMATE GLASGOW - PERTH WITH TWO HOURLY EXTENSION TO ARBROATH

Perth - Arbroath round trip mileage	Additional round trips per week (assume 7 day service)	Annual Mileage	Variable Costs <ul style="list-style-type: none"> Fuel (£0.68) VTA (£0.25) Servicing (£0.51) 	Staff Costs <ul style="list-style-type: none"> Driver (£50k) Guard (£40k) 	Rolling Stock Lease Costs £240k per unit
75.5	56	220,000	£317,000	£720,000	£480,000
Sub total					£1,517,000
Cost of Glasgow - Perth service					£655,000
TOTAL					£2,172,000

5.22 The conflicts identified by the Railsys model are detailed Appendix C. The modelling predicts this service will add a further 24 minutes (4.1%) of delay onto the 178 minutes forecast for the base Glasgow - Perth hourly service. This causes punctuality for First ScotRail services arriving within 0 to 5 minutes of their booked time to fall further from 95.1% to 94.8%. The base for the December 2008 WTT is 95.9%

Packages 2, 3 and 4 - Phase 2 (Separate Glasgow - Perth and Perth - Arbroath services)

- 5.23 Using the base Glasgow - Perth timetable described earlier in the section, a timetable for a separate shuttle between Perth and Arbroath was developed. This timetable has the following advantages over extending the Glasgow - Perth service:
- More flexibility to find paths throughout the day avoiding conflict with other services. This however results in slightly varying departure times each hour; and
 - Separation from development of the Highland Main Line project.
- 5.24 No further conflicts with freight services were identified compared with those already listed in the Glasgow - Perth section.
- 5.25 A summary of the developed timetable is shown in Table 5-5. The key points are:
- Morning peak is serviced by trains departing Arbroath at 07.45 and 08.37 and departing Perth to head northwards at 07.35 and 08.25;
 - Evening peak and shoulder periods are serviced by trains departing Arbroath at 16.33, 17.40 and 18.40 and departing Perth to head northwards at 16.25, 17.25 and 18.25;
 - 7 minute connection at Perth for services to Glasgow and Arbroath;
 - 20 minute connection time at Arbroath for services to Aberdeen;
 - Opportunity to timetable direct Arbroath - Glasgow services at 07.45, 15.53, 17.40 and 19.40;
 - Opportunity to timetable direct Glasgow - Arbroath services at 15.11, 17.12 and 19.11; and
 - Runs behind Glasgow - Aberdeen express service so reduced risk of performance impact;
- 5.26 The developed timetable was then used to produce preliminary rolling stock diagrams and crew resourcing requirements. Two units were identified as being required along with ten drivers and ten guards/ ticket examiners. The estimated increase in operating cost over the base Glasgow - Perth service is shown in Table 5-6. A risk exists this service may require three additional units rather than two due to diagram interactions with Edinburgh - Perth services. The performance impact of this service is at its lowest when three units are used because the TERS service can be pathed between existing express and freight services with less impact.

TABLE 5-5 PERTH - ARBROATH TIMETABLE

Perth	XX.25	Arbroath	XX.40
Invergowrie / Dundee West	XX.40	Carnoustie	XX.47
Dundee	XX.46	Monifieth	XX.53
Broughty Ferry	XX.53	Broughty Ferry	XX.57
Monifieth	XX.57	Dundee	XX.05
Carnoustie	XX.03	Invergowrie / Dundee West	XX.12
Arbroath	XX.10	Perth	XX.30

TABLE 5-6 OPERATING COST ESTIMATE: GLASGOW - PERTH AND PERTH - ARBROATH

Perth - Arbroath round trip mileage	Additional round trips per week (assume 7 day service)	Annual Mileage	Variable Costs <ul style="list-style-type: none"> Fuel (£0.68) VTA (£0.25) Servicing (£0.51) 	Staff Costs <ul style="list-style-type: none"> Driver (£50k) Guard (£40k) 	Rolling Stock Lease Costs £240k per unit
75.5	98	385,000	£554,000	£900,000	£480,000
Sub total					£1,934,000
Cost of Glasgow - Perth service					£655,000
TOTAL					£2,589,000

- 5.27 The conflicts identified through the railsys modelling are detailed in Appendix C. The modelling predicts this service will add a further 21 minutes (3.7%) of delay onto the 178 minutes forecast for the base Glasgow - Perth hourly service. This package does not have any further impact to punctuality for First ScotRail services arriving within 0 to 5 minutes of their booked time - they remain at 95.1% as for the base Glasgow - Perth service. Overall this is the least disruptive of the proposed new services to the rail network.

Package 3 - Phase 3 (Combined Aberdeen - Glasgow & Edinburgh Express Services)

- 5.28 This option has proven extremely difficult to develop. At face value the service appears reasonable operationally however strategically it results in an increased journey time for the Aberdeen - Glasgow service of between 7 and 12 minutes.

This increase could be reduced if stopping patterns north of Dundee were reduced, for example, operating non-stop between Aberdeen and Dundee. However this provides a significant loss of connectivity to the intermediate stations, from the present and would conflict with the study planning objectives.

- 5.29 Two separate timetable variants to provide the “connecting” service between Perth and Aberdeen have been developed using the same path developed for the two hourly Glasgow - Arbroath service (refer to table 5-3). In both directions this fits very close to the path of the original fast service and therefore provides good levels of confidence that suitable paths though Usan will be available;
- A two hourly “all stations” service from Glasgow to Aberdeen; and
 - An hourly “all stations” service from Perth to Aberdeen.
- 5.30 The draft timetables have been developed using the following assumptions:
- The xx.41 departure and xx.15 arrival at Glasgow QS must remain as now.
 - In both directions, the paths of the current fast and stopping services between Edinburgh and Dundee can be swapped - ie the current xx.30 path from Edinburgh becomes the stopping service for Fife, and the xx.00 can become the new express service; the xx.27 arrival becomes the stopping service, and the xx.57 can becomes the new fast.
- 5.31 An extract from the timetable is shown in Figure 10-2. The key points for this service, other than the increased express journey time to Glasgow are:
- A few separate express services can still operate each day;
 - Stopping patterns of the new combined services between Dundee and Aberdeen follow the pattern of the service that is being replaced at around the same time (in almost all cases this is the current Glasgow service);
 - The same conflicts identified with freight services in the Glasgow - Arbroath two hourly service remain;
 - A minimum of 6 minutes to be allowed for coupling, and 3 minutes for uncoupling; and
 - No changes have been made to Cross Country or National Express East Coast services.
- 5.32 Demand forecasting has provided strong evidence this option would suppress demand over the present and therefore would not be economically viable.
- 5.33 For development of operating costs, five additional units were estimated as being required to provide a new Perth - Aberdeen service along with 15 drivers and 15 guards/ ticket examiners. The same number of units and as currently used will be required to operate the combined express service between Aberdeen and Dundee. The operating costs are the same for this option (Package 3 - Phase 3) and for Package 2 - Phase 3 as the additional service element is identical, ie. Perth - Aberdeen.
- 5.34 No further development was undertaken on this timetable because:
- It has a poor strategic fit due to increased express journey times;

- It is forecast to generate lower demand than other options; and
- From a preliminary review, it clearly has many more timetable conflicts than Packages 1, 2 and 4.

FIGURE 5.2 DRAFT TIMETABLE FOR COMBINED ABERDEEN - GLASGOW & EDINBURGH SERVICE

Aberdeen	08:42	08:45	09:07	09:29	09:37	10:30	10:38	10:41
Arbroath	09:32	09:44	10:00	10:21	10:29	11:20	11:28	11:44
Carnoustie	09:39	09:50			10:36			11:50
Monifieth		09:56						11:56
Broughty Ferry		10:00						12:00
Dundee	09:52	10:07	10:15	10:44	10:52	11:44	11:52	12:07
Dundee	09:52	10:08	10:17	10:47	10:52	11:47	11:52	12:08
Dundee West		10:15						12:15
Barnhill		10:29						12:29
Perth	10:14	10:33			11:14		12:14	12:33
Inverness					09:xx			
Perth	10:14	10:37	11:29	10:57	11:14	11:37	12:14	12:37
Edinburgh Waverley				12:17	11:57	12:57		
Gleneagles		10:52			11:52			12:52
Blackford		10:57			11:57			12:57
Dunblane		11:06	11:13		12:06	12:13		13:06
Bridge of Allan			11:16		12:16			
Stirling	10:43	11:14	11:21		11:43	12:14	12:21	12:43
Glasgow Queen St	11:15	11:45	12:02		12:15	12:45	13:02	13:15

KEY	
Black	= Retained current
Blue	= Proposed
New combined service	
service withdrawn	
→	split/join

TABLE 5-7 OPERATING COST ESTIMATE: PERTH - ABERDEEN HOURLY SERVICE

Perth - Aberdeen round trip mileage	Additional round trips per week (assume 7 day service)	Annual Mileage	Variable Costs	Staff Costs	Rolling Stock Lease Costs
			<ul style="list-style-type: none"> Fuel (£0.68) VTA (£0.25) Servicing (£0.51) 	<ul style="list-style-type: none"> Driver (£50k) Guard (£40k) 	£240k per unit
184	98	938,000	£1,351,000	£1,350,000	£1,200,000
Sub total					£3,901,000
Cost of Glasgow - Perth service					£655,000
TOTAL					£4,556,000

Package 1 and 4 - Phase 3 (Glasgow - Arbroath Hourly Service)

- 5.35 This is effectively a theoretical timetable as the required paths into Glasgow Queen Street do not exist to accommodate this and proposed Highland Main Line services. The timetable developed assumes the existing XX.11 Glasgow - Perth service extends through to Arbroath and Inverness trains are slotted into a different path. Operating costs for this option have been assumed to be the same as for the separate shuttle services either side of Perth, but with the requirement for an additional two units, ie. making four in total. Train crew requirements are estimated as 12 drivers and guards in addition to the base Glasgow - Perth service. Fuel, servicing and track access costs are the same for both options. Total operating cost is estimated as **£3,511,000**.

Package 2 - Phase 3 (Perth - Aberdeen Hourly Service)

- 5.36 This is effectively a theoretical timetable as the required paths through Usan do not exist at present to accommodate this. However the timetable and annual operating costs of **£4,556,000** are identical to those developed for Package 3 - Phase 3 (Combined Aberdeen to Edinburgh and Glasgow express services)

Package 1 and 4 - Phase 4 (Glasgow - Aberdeen “all stations” Hourly Service)

- 5.37 This is effectively a theoretical timetable as the required paths into Glasgow Queen Street do not exist at present to accommodate this and proposed Highland Main Line services. The timetable developed assumes the existing XX.11 Glasgow - Perth service extends through to Aberdeen and Inverness trains are slotted into a different path.
- 5.38 This option is estimated to require 6 additional units, 18 drivers and guards over the base Glasgow - Perth service. Annual operating costs are estimated as **£5,327,000**.

6 Operating cost estimates

Stations

- 6.1 Operating costs for stations are formed from two sources:
- Long term lease charges - paid by the Train Operating Company (TOC) to Network Rail to provide for renewal costs; and
 - Annual charges incurred by the TOC for light maintenance, (eg. graffiti removal, cleaning, platform de-icing in winter, changing of lightbulbs etc) CCTV monitoring and utility costs.
- 6.2 From consultation with First ScotRail and Transport Scotland, we have assumed annual long term lease charges of £35k pa. payable to Network Rail and annual operating costs of £30k pa. for the TOC.
- 6.3 This is based upon an unstaffed station with two platforms and footbridge accessed by DDA compliant ramps.
- 6.4 Gleneagles is the only exiting station where enhancements are proposed which would result in a significant cost increase for both Network Rail and the TOC. The main operating costs would be for CCTV monitoring, operation and maintenance of the lifts.
- 6.5 Table 6-1 shows the operating costs allocated to each station as a result of works proposed.

Train Services

- 6.6 Costs for the provision of train services fall into two distinct categories:
- Fixed - the lease charge for rolling stock is incurred irrespective of how many services are run; and
 - Variable - costs relating to the frequency and type of service, eg. staff, track access charges, fuel and cleaning and servicing.
- 6.7 The Phasing of each package of options has been built around other projects which either provide resources for the TERS project or make significant changes to the existing infrastructure or timetables. At the present time, all rolling stock available to First ScotRail, other than those on planned maintenance, is fully utilised in the morning and evening peaks.
- 6.8 Phase 1 of each train service package is a stand alone Glasgow - Perth service. This is presently resourced in the peak - services currently depart Glasgow at 16.11, 17.12 and 18.11.
- 6.9 The timetable developed for the Glasgow - Perth element of service has a journey time of just under 1 hour 10 minutes. With a turnaround of 15 minutes, the train can be back at Glasgow approximately 2 hours 35 minutes after stating its journey. In order to maintain this frequency of service, three additional units will be required.
- 6.10 First ScotRail and Transport Scotland have confirmed that it is reasonable to assume three units are available in the off peak to provide an hourly Glasgow - Perth service

Rolling stock lease costs have therefore not been included for this element of the service. In this specific case, train crew are also assumed to be available to cover new off peak services. Therefore the costs incurred for provision of the Glasgow - Perth element of service are fuel, cleaning & servicing and track access charges.

TABLE 6-1 ESTIMATES OF STATION OPERATING COSTS

Station	Annual Lease Charge (£k)	Annual Operating Cost (£k)	Comments
Gleneagles	10	20	Operating and maintenance charge for lifts, car park and CCTV. Estimated increase to current operating costs.
Bannockburn Site 1	35	30	Operating costs of a typical new unstaffed station.
Bannockburn Site 2	45	40	Additional costs due to permanent dewatering requirement.
Bannockburn Site 3	35	35	Operating costs of a typical new unstaffed station.
Dunblane North Site 1	40	35	Additional costs due to pedestrian bridges over Allan Water and flood protection.
Dunblane North Site 2	35	30	Operating costs of a typical new unstaffed station.
Greenloaning	35	30	Operating costs of a typical new unstaffed station.
Blackford	30	30	Slightly from reduced from typical as no footbridge.
Dundee West	35	30	Operating costs of a typical new unstaffed station. Estimated annual operating cost of Invergowrie is £30k therefore net increase if Dundee West replaces Invergowrie on the network is £35k pa.

- 6.11 Rolling stock lease costs have been included for all other phases of each package because the stock required even if available within the franchise could theoretically be taken off lease if not required to provide a peak hours service. The rolling stock lease costs are effectively attributed to the service making use of the trains in the peak hours, in order to ensure these costs are only counted once.
- 6.12 Lease costs of £240k pa have been assumed for a class 158 diesel multiple unit. These are the vehicles which will be displaced from Edinburgh - Bathgate services in

December 2010 with the opening of the new Airdrie - Bathgate route. This type of rolling stock is suitable for the proposed services.

- 6.13 The following costs have been assumed through information provided by First ScotRail and Transport Scotland:

- Class 158 cleaning and serving - £0.51 per unit per mile;
- Class 158 fuel - £0.68 per unit per mile;
- Class 158 variable track access charge - £0.25 per unit per mile;
- Driver - £50,000 per annum; and
- Guard / Ticket examiner - £40,000 per annum.

- 6.14 Rolling stock is rotated between routes on a daily basis in order to make most efficient use of the entire fleet available, ie. balancing out mileage etc. Rolling stock on the Glasgow - Perth section of route in particular has a high level of interdependency with proposed Highland Main Line services. Introduction of EGIP services in Dec 2016 will also make significant changes as to how diesel rolling stock is rotated between services.

- 6.15 Accordingly it is not possible at this stage in the project to work out a full set of rolling stock diagrams. We have therefore calculated what each of the services ought to "cost" if they were standalone.

Package 1 - Phase 2 (Two hourly extension to Arbroath)

- 6.16 This could theoretically be undertaken at a "cost" of one additional unit, but to give some degree of comfort, two units have been assumed as required, in addition to the three required for the base Glasgow - Perth service.

Package 1 & 4 - Phase 3 (Hourly Glasgow - Arbroath service)

- 6.17 This service has a two hour end to end journey time. Four units are therefore in traffic at any one time and at least two will be required to accommodate required turnaround times at each end. Due to the almost certain requirement to link with Aberdeen - Edinburgh and Aberdeen - Glasgow express service diagrams as well as Highland Main Line, it has been assumed a further unit will be required, Therefore this service assumes four additional units on top of the base Glasgow - Perth service.

Package 1 & 4 - Phase 4 (Hourly Glasgow - Aberdeen service)

- 6.18 This service has a three hour end to end journey time. Six units are therefore in traffic at any one time and a minimum of two will be required to accommodate required turnaround times at each end. Due to the almost certain requirement to link with Aberdeen - Edinburgh and Aberdeen - Glasgow express service diagrams as well as Highland Main Line, it has been assumed a further unit will be required, Therefore this service assumes six additional units on top of the base Glasgow - Perth service.

Package 2, 3 & 4 - Phase 2 (Hourly Perth - Arbroath shuttle)

- 6.19 In reality, this service will not work on a standalone basis - it needs to be integrated with Edinburgh - Perth at one point. This service is either an efficient two unit operation or a very inefficient three unit operation. Ultimately the interface with Edinburgh - Perth and Highland Main Line services will determine the final requirement. We have assumed, for present, this service will require two additional

units. If three were required, annual operating costs would increase by circa 10% to accommodate the extra lease charge. No additional staff or variable costs would be incurred. The timing of this phase would not be affected as it has been programmed for Dec 2011 when it is assumed three units will have been redeployed following commencement of Airdrie - Bathgate services.

Package 2 and 3 - Phase 3 (Hourly Perth - Aberdeen service)

- 6.20 This service has an end to end journey time of just under two hours. Four units are therefore in traffic at any time. A further unit will be required to maintain turnaround times. It is therefore assumed this service will require five additional units on top of the base Glasgow - Perth service.
- 6.21 Note - combining the Aberdeen to Glasgow and Edinburgh express services as proposed by Package 3 does not free up any additional units. It has been assumed the combined train would operate as a 6 car set from Aberdeen to Dundee and then split into two x three car sets to travel onward to Glasgow and Edinburgh. This uses the same resource as the current separate express services to each destination.

Traincrew

- 6.22 Allocation of traincrew to diagrams varies between train operating companies. For the purposes of the appraisal we have assumed a seven day service with traincrew available to be rostered on a seven day basis.
- 6.23 For phase 2 of all packages, we have developed timetables for northbound services commencing at 06.45 (Perth - Arbroath) and running through to 21.11 (Glasgow - Arbroath). Southbound services commence at 07.45 (Arbroath - Glasgow) and finish with the 21.40 (Arbroath - Glasgow). For the purposes of the appraisal we assumed services would close with the 20.11 Glasgow departure and 19.40 Arbroath departure. This gives a working day of 16 hours.
- 6.24 With rest periods, booking on and off, it is assumed drivers undertake driving duties for 5.5 hours per shift. Each diagram therefore requires 3 drivers per day.
- 6.25 Table 6.2 below shows the assumed requirement of drivers for each service option.

TABLE 6-2 TRAINCREW REQUIREMENTS FOR EACH SERVICE PACKAGE

Service	Diagrams	Drivers	Comments
Glasgow - Perth with two hourly extension to Arbroath	2	6	8 used in appraisal to cover for training, leave, etc.
Glasgow - Arbroath hourly	4	12	12 used. This service is more integrated than short term services so more efficient use assumed of staff for leave, sickness cover.
Glasgow - Aberdeen hourly	6	18	18 used. This service is more integrated than short term services so more efficient use assumed of staff for leave, sickness cover.
Perth - Arbroath shuttle	2	8	10 used in appraisal to cover for training, leave, etc.
Perth - Aberdeen shuttle	5	15	15 used. This service is more integrated than short term services so more efficient use assumed of staff for leave, sickness cover.

- 6.26 It is assumed that requirement for additional guards/ ticket examiners is the same as for drivers.
- 6.27 The full calculation for train service operating costs is shown in Figure 6.1.

FIGURE 6.1 TRAIN SERVICE OPERATING COST ESTIMATES

				Round trip distance	Additional Round Trips per week day	Additional round trips per Sat	Additional round trips per Sun	Weekly mileage	Annual mileage	Additional Class 158 units required	Annual Lease Cost	Driver cost	Guard / Revenue Protection	Cleaning & Servicing	Fuel (£0.68) + VTA (£0.25)	Total cost	Comments	
											£ 240,000	£50,000	£40,000	£ 0.51	£ 0.93			
Package 1																		
Phase 1		Dec-10	Glasgow	Perth	125	10	10	10	8750	455000	0	Inc	Inc	Inc	232,050	423,150	£ 655,200	Units and staff are available within the current franchise
Phase 2	Hourly to Perth & 2 hourly to Arbroath	Dec-11	Glasgow	Arbroath	125	10	10	10	8750	455000	0							
					75.5	8	8	8	4228	219856	2	480,000	400,000	320,000	344,177	627,616	£ 2,171,793	Phase 2 total
									674856	2								
Phase 3	Post timetable recast	Glasgow	Arbroath	200.5	14	14	14	14	19649	1021748	4	960,000	600,000	480,000	521,091	950,226	£ 3,511,317	Phase 3 total
Phase 4	Post Usan doubling	Glasgow	Aberdeen	309	14	14	14	14	30282	1574664	6	1,440,000	900,000	720,000	803,079	1,464,438	£ 5,327,516	Phase 4 total
Package 2																		
Phase 1		Dec-10	Glasgow	Perth	125	10	10	10	8750	455000	0	Inc	Inc	Inc	232,050	423,150	£ 655,200	Units and staff are available within the current franchise
Phase 2		Dec-11	Glasgow	Perth	125	10	10	10	8750	455000	0							
			Perth	Arbroath	75.5	14	14	14	7399	384748	2	480,000	500,000	400,000	428,271	780,966	£ 2,589,237	Phase 2 total
									839748	2								
Phase 3	Post Usan doubling	Glasgow	Perth	Aberdeen	125	14	14	14	12250	637000	0							
					184	14	14	14	18032	937664	5	1,200,000	750,000	600,000	803,079	1,464,438	£ 4,817,516	Phase 3 total
									1574664	5								
Package 3																		
Phase 1		Dec-10	Glasgow	Perth	125	10	10	10	8750	455000	0	Inc	Inc	Inc	232,050	423,150	£ 655,200	Units and staff are available within the current franchise
Phase 2		Dec-11	Glasgow	Perth	125	10	10	10	8750	455000	0							
			Perth	Arbroath	75.5	14	14	14	7399	384748	2	480,000	500,000	400,000	428,271	780,966	£ 2,589,237	Phase 2 total
									839748	2								
Phase 3		Glasgow	Perth	Aberdeen	125	14	14	14	12250	637000	0							
		Dec-16			184	14	14	14	18032	937664	5	1,200,000	750,000	600,000	803,079	1,464,438	£ 4,817,516	Phase 3 total
									1574664	5								
Package 4																		
Phase 1		Dec-10	Glasgow	Perth	125	10	10	10	8750	455000	0	Inc	Inc	Inc	232,050	423,150	£ 655,200	Units and staff are available within the current franchise
Phase 2		Dec-11	Glasgow	Perth	125	10	10	10	8750	455000	0							
			Perth	Arbroath	75.5	14	14	14	7399	384748	2	480,000	500,000	320,000	428,271	780,966	£ 2,509,237	Phase 2 total
									839748	2								
Phase 3	Post timetable recast	Glasgow	Arbroath	200.5	14	14	14	14	19649	1021748	4	960,000	600,000	480,000	521,091	950,226	£ 3,511,317	Phase 3 total
Phase 4	Post Usan doubling	Glasgow	Abderdeen	309	14	14	14	14	30282	1574664	6	1,440,000	900,000	720,000	803,079	1,464,438	£ 5,327,516	Phase 4 total

APPENDIX

A

TIMETABLE CONFLICTS IDENTIFIED BY RAILSYS AND PROPOSED SOLUTIONS

A1. REFER TO SEPARATE FILE NOTE FOR APPENDIX A

APPENDIX

B

FULL TIMETABLES FOR PACKAGES 1, 2 AND 3

- B1. PACKAGE 1 TIMETABLE**
Refer to separate file
- B2. PACKAGE 2 TIMETABLE**
Refer to separate file
- B3. PACKAGE 3 TIMETABLE**
Refer to separate file

APPENDIX

C

RAILSYS MODELLING REPORT

C1. REFER TO SEPARATE FILE

APPENDIX

D

LAND OWNERSHIP DETAILS FOR PROPOSED GLENEAGLES ACCESS ROAD

D1. REFER TO SEPARATE FILE

CONTROL SHEET

This Control Sheet should not be removed as it provides a reference for the structure of the Report

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