Invergowrie Station Relocation

Outline business case

Report

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CONTENTS

1 INTRODUCTION 1

2 BACKGROUND 3

Introduction 3

Proposed Assessment 4

Invergowrie Station – existing 4

Dundee West – proposed 4

Scottish Stations Fund (SSF) 5

3 POLICY CONTEXT AND PLANNING OBJECTIVES 7

Introduction 7

Proposed National Planning Framework 3 (NPF3) 8

Scotland's National Transport Strategy 9

Strategic Transport Projects Review (STPR) 10

Rail 2014 Control Period 5 - High Level Output Specification (CP5 HLOS) 12

Network Rail Strategic Business Plan for Scotland, January 2013 12

TACTRAN Regional Transport Strategy 12

TACTRAN Regional Sub-Strategies 13

TAYplan Strategic Development Plan 2012 – 2032 14

TAYplan Strategic Development Plan Action Programme June 2012 14

Dundee Local Development Plan 2014 15

Perth & Kinross Local Development Plan 2014 16

Tay Estuary Rail Study Planning Objectives 16

4 DEVELOPMENT AND LAND USE PLANNING 21

Introduction 21

Invergowrie 21

Dundee West 21

5 DEMAND FORECASTING 23

Introduction 23

Catchment analysis 24

Demand forecast based on catchment analysis 28

Overlay producer demand from Western Gateway 29

Forecast attractor demand 30

Constraining Invergowrie Demand 33

Appropriate growth 35
6 CAPITAL COSTS 37
Introduction 37
Dundee West 37
Invergowrie 38
Modular Stations 39
7 APPRAISAL 41
Introduction 41
Appraisal against TERS objectives 41
Appraisal against Government objectives 41
8 CONCLUSIONS 51

FIGURES

Figure 2.1 Invergowrie Station and Proposed Dundee West Station Location Map 5
Figure 3.1 Policy Context Hierarchy 8
Figure 5.1 Station Catchment Areas to Glasgow (May 2012, TERS with Invergowrie, Ters with Dundee West) 25
Figure 5.2 Station Catchment Areas to Aberdeen (May 2012, TERS with Invergowrie, Ters with Dundee West) 27
Figure 6.1 Location of Dundee West Station 37
Figure 6.2 Dundee West Station Ramped Footbridge 38

TABLES

Table 3.1 Fit Of TERS Planning Objectives With Wider Objectives 19
Table 5.1 Assumed GJTs to Glasgow Queen Street 25
Table 5.2 Base Demand (2011/12 Journeys) 28
Table 5.3 Producer Demand Forecast for Dundee West and Invergowrie Stations (2011/12 Journeys) 29
Table 5.4 Overlay Producer Demand Forecast For Western Gateway 'Villages' 30
Table 5.5 Access to Local Demand Attractors 31
Table 5.6 Estimate of Attractor Trips 32
Table 5.7 Total (2011/12) Demand Forecasts 33
Table 5.8 Total (2011/12) Revenue Forecasts 33

Table 5.9 Constrained Producer Demand Forecast for Invergowrie Station 33

Table 5.10 Total (2011/12) Demand Forecasts with Invergowrie Constraint..... 34

Table 5.11 Total (2011/12) Revenue Forecasts with Invergowrie Constraint 34

Table 5.12 Underlying Demand Growth Forecast 35

Table 7.1 Annual Time Savings (2011/12 Minutes) for Producer Demand for existing population 44

Table 7.2 Annual Time Savings (2011/12 Minutes) for Producer Demand for Western Gateway villages 44

Table 7.3 Annual Time Savings (2011/12 Minutes) for Attractor Demand 44

Table 7.4 Annual Passenger Miles (2011/12) for Producer Demand for existing population . 45

Table 7.5 Annual Passenger Miles (2011/12) for Producer Demand for Western Gateway villages 45

Table 7.6 Annual passenger miles (2011/12) for Attractor Demand..... 45

Table 7.7 Main Case TEE Table (2010 prices)..... 47

Table 7.8 Summary of Results of Sensitivity Tests..... 49

APPENDICES

A CAPITAL COSTS

B OBJECTIVES APPRAISAL

1 Introduction

1.1 Steer Davies Gleave was appointed by Tayside and Central Scotland Transport Partnership (TACTRAN) to prepare an Outline Business Case for the relocation of Invergowrie Railway Station to Dundee West.

1.2 The Extended Tay Estuary Rail Study (TERS) STAG type appraisal was undertaken by Steer Davies Gleave on behalf of TACTRAN in 2009. It proposed a package of stopping services in the TACTRAN area, complementary to Option 23 (Rail Service Enhancements between Aberdeen and the Central Belt) of the Strategic Transport Projects Review (STPR) and was based on an understanding of the Highland Mainline (HML) proposals at the time. In 2011, Steer Davies Gleave updated the TERS Business Case to reflect timetable, demand and operating forecast changes in other rail services with which TERS interfaces: as such the original TERS economic appraisal was updated.

1.3 Since then, TACTRAN has continued to engage with the rail industry and key stakeholders to further progress the study outputs towards delivery.

1.4 The relocation of Invergowrie Station to Dundee West was appraised as one of a number of station 'overlay' options to the rail service options in the original TERS appraisal, and performed strongest in terms of economic returns, integration and community accessibility. The study concluded that this option was only compatible with an hourly stopping service and that "*further work is required to fully understand the demand potential and locations from which patronage would be attracted*".

1.5 This Outline Business Case constitutes the first phase of that "further work" and provides a robust assessment of the passenger demand potential of relocating Invergowrie Station to Dundee West, as well as confirming the overarching design and locational principles for the relocated station.

1.6 This Outline Business Case Report is structured as per below:

- Chapter 1 – Introduction
- Chapter 2 – Background
- Chapter 3 – Policy context
- Chapter 4 – Development and land-use planning
- Chapter 5 – Demand forecasting
- Chapter 6 – Capital Costs
- Chapter 7 – Appraisal
- Chapter 8 – Conclusions

2 Background

Introduction

2.1 TACTRAN's Regional Transport Strategy (RTS) published in 2008 identified the need to develop Tay Estuary Rail Study (TERS) proposals to enable an additional hourly service between Arbroath -Dundee - Perth - Stirling - Glasgow with the potential for additional stations at locations such as Dundee West, Blackford and Greenloaning.

2.2 In 2008/2009 the Strategic Transport Projects Review (STPR) set out the Scottish Government's 29 transport investment priorities for the next 20 years. Of most relevance to this work, there are specifically targeted infrastructure improvements under STPR 23 for 'Rail Service Enhancements between Aberdeen and the Central Belt'. STPR 23 includes:

- one express train an hour to Glasgow (2¼-hour journey);
- separate stopping services for intermediate stations; and
- Phase 2 proposals for the double-tracking of the line at Usan near Montrose.

2.3 In 2009, Steer Davies Gleave was commissioned by Tactran to develop options and undertake a STAG type appraisal for enhanced stopping rail services in the Arbroath to Glasgow rail corridor. The Extended Tay Estuary Rail Study (2009) recommended short, medium and long term options to give an hourly stopping service between Glasgow/Perth and Arbroath, ultimately extending out to Aberdeen. It also recommended further investigation of improvements to Gleneagles station and the potential relocation of Invergowrie Station to Dundee West.

2.4 In early 2011 Steer Davies Gleave was commissioned to update the TERS Business Case following the announcement of more frequent services to Dundee as part of the Highland Mainline improvements for the December 2011 timetable change. The objective of this study was to investigate how TERS-type services could be built on the Dec 2011 enhancements while minimising additional operating cost. This study identified a preferred option that required one additional unit, which ultimately was not available in the short term. It also identified a long term option providing a broadly hourly service between Arbroath and Perth/Glasgow.

2.5 In June 2011 the "TERS-Lite" study took forward some of the principles of the Updated Business Case work, and made the case for additional stops at Broughty Ferry to Network Rail and ScotRail. This work has resulted in an incremental approach that has seen a number Glasgow to Perth services extended through to Dundee in 2011, together with additional calls at Broughty Ferry, Invergowrie and Carnoustie in 2011 and 2012 timetables, as well as further calls at Gleneagles in both those years and an increase in calls at Monifieth in the December 2013 timetable. The additional services to Dundee and these additional station calls are contributing towards the gradual emergence of a local service, but requires further development to achieve the proposed hourly TERS service in the earlier 2009 work.

2.6 As described above, the relocation of Invergowrie Station to Dundee West was appraised as one of a number of station 'overlay' options to the rail service

options in the original TERS appraisal, and performed strongest in terms of economic returns, integration and community accessibility. In order to progress the relocation of Invergowrie Station to Dundee West, an Outline Business Case is required to provide a robust and impartial assessment of the passenger demand potential of relocating the station, whilst instilling confidence in the Steering Group (TACTRAN, Transport Scotland, First ScotRail and Network Rail) that the viability and deliverability of the option has been appropriately considered and is complementary to local, regional and national land use planning and transport policy.

2.7 Although considered a relocation of Invergowrie Station to Dundee West, the legal procedure required for this type of proposal based on the distance between Invergowrie Station and the proposed Dundee West site is for a formal station closure and opening. Further references to the 'relocation' should be considered in this context.

Proposed Assessment

2.8 The following describes the proposal being assessed and the two alternative station locations and Figure 2.1 shows the station locations and key sites in the surrounding area.

2.9 As outlined above the proposal to relocate Invergowrie Station to Dundee West originated from the TERS 2009 study which concluded that the relocation was only compatible with an hourly stopping service at the station.

Invergowrie Station – existing

2.10 Invergowrie railway station is an unstaffed rail halt serving Invergowrie and the western periphery of the City of Dundee, located on the north side of the Firth of Tay. Despite its proximity to Dundee, it is located in Perth and Kinross Council area. The station is currently accessed from Station Road at the southern end of Invergowrie. Any strategic vehicular access from the east would be taken from the A85 Riverside Avenue via Burnside Road/Station Road or Bayview Road/ Noble Avenue and from the A90 to the west via Main Street and Errol Road/ Station Road.

2.11 Invergowrie station facilities are limited. The station is at a lower grade than Station Road and is accessed by a flight of stairs from the road to the northbound platform, although an at-grade footway is located at the north end of the northbound platform. The north and southbound platforms, which are two car lengths long, are connected by a footbridge that does not meet Disability Discrimination Act standards. The footbridge also provides a right of way from Invergowrie to the shore of the River Tay. There is no dedicated parking at the station. Station Road is a narrow residential street and whilst some on-street parking and drop-off may occur, there is insufficient space to accommodate higher levels of parking demand, nor space locally to provide a suitable car park. The opportunities for enhancing the existing station and its facilities are limited.

Dundee West – proposed

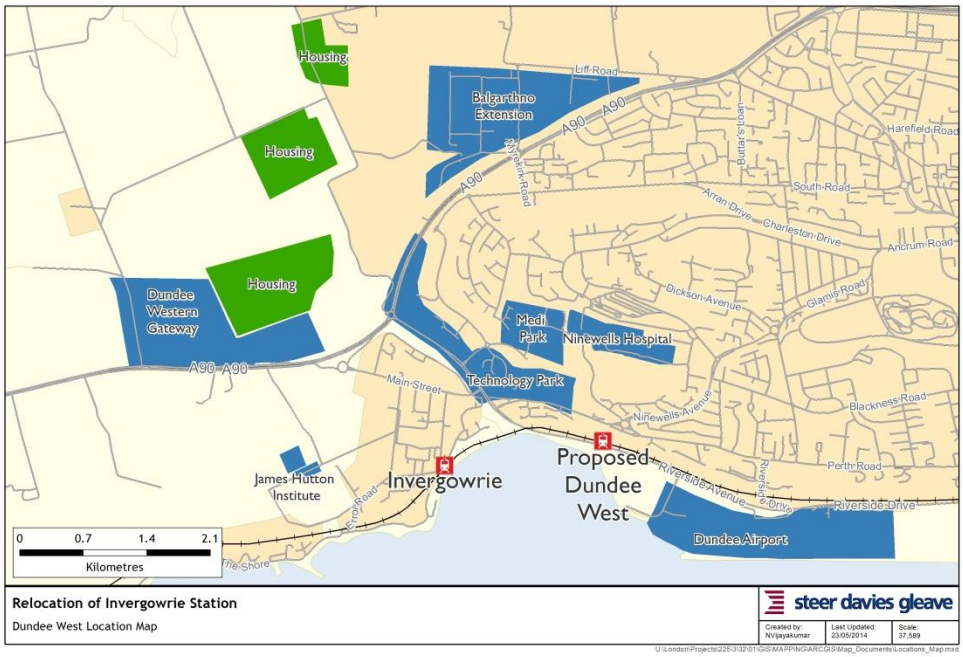
2.12 The Dundee West site for the proposed relocation of Invergowrie Station is to the north of the A85 Riverside Avenue, directly south of Ninewells Hospital and to the west of Dundee Airport. An off-road cycleway runs immediately south of the site,

adjacent to the A85 Riverside Avenue. This site is located within the Dundee City Council boundary.

2.13 The station location has been designed to facilitate access to Dundee Western Gateway, a planned expansion of integrated housing and employment to the north west, the Balgarthno extension to an existing employment area, the Dundee Technology Park, Medi Park, Ninewells Hospital and the wider residential area, including Invergowrie. This means that the proposed new station could have a wider residential, commercial and employment catchment area.

2.14 This assessment compares an hourly stopping service calling at Dundee West station with the existing Invergowrie station, with a theoretical year of opening of 2019. The work identifies whether the relocation of the station makes it more accessible to the surrounding existing and potential residential, commercial and employment catchment area (as shown in Figure 2.1) and whether this, together with the extra facilities (e.g. car park) provided by Dundee West, results in the relocated station performing better in terms of a business case and assessment against TERS and Scottish Government objectives.

FIGURE 2.1 INVERGOWRIE STATION AND PROPOSED DUNDEE WEST STATION LOCATION MAP



Scottish Stations Fund (SSF)

2.15 The new Scottish Stations Fund (SSF) from 2014 provides an opportunity for funding new stations and station improvements, subject to an appropriate transport appraisal meeting the SSF requirements. The SSF encourages use of third party investment (e.g. RTP's, Local Authorities and developer contributions). Proposals are developed in partnership with Transport Scotland, relevant RTPs, Local Authorities and other third parties before being ultimately submitted to Network Rail for submission to the rail industry.

3 Policy context and planning objectives

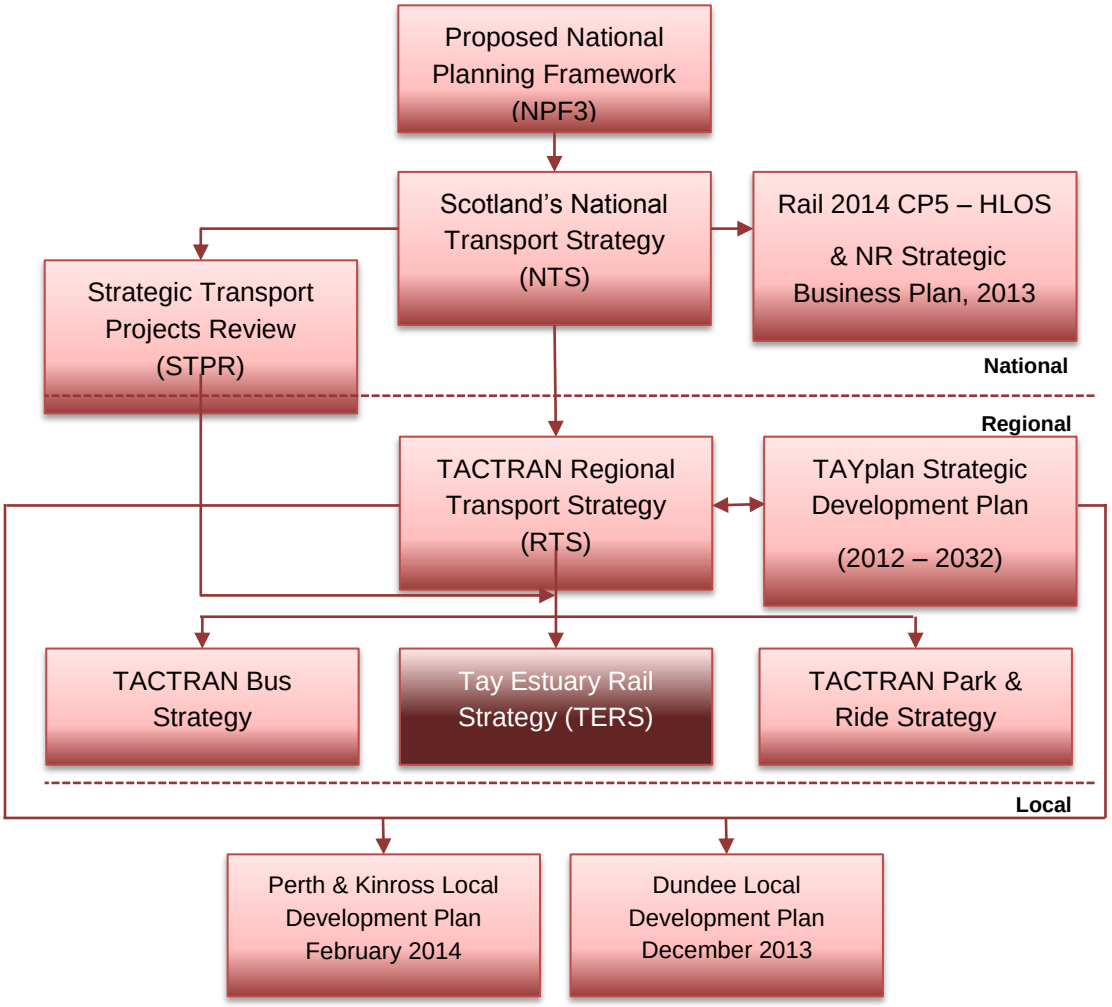
Introduction

3.1 The proposal to relocate Invergowrie Station to Dundee West sits within the context of the overarching planning objectives for TERS. This will be discussed in this section which considers national, regional and local policy documents of relevance to the proposal to relocate Invergowrie Station to Dundee West:

- Scotland's Third National Planning Framework (NPF3);
- Scotland's National Transport Strategy (NTS);
- The Strategic Transport Projects Review (STPR);
- Control Period 5 – High Level Output Specification (CP5 HLOS);
- Network Rail Strategic Business Plan, January 2013;
- TACTRAN Regional Transport Strategy (RTS);
- TACTRAN Regional Sub-Strategies;
- TAYplan Strategic Development Plan;
- TAYplan Strategic Development Plan Action Programme;
- Dundee Local Development Plan;
- Perth & Kinross Local Development Plan; and
- The Tay Estuary Rail Study (TERS).

3.2 The hierarchy of planning and transport policies and strategies is presented in Figure 3.1, below. There are linkages to the Strategic and Local Development Plans and Community Planning Partnerships' Single Outcome Agreements, in addition to key linkages with other regional strategies such as the Regional Bus Strategy and the TACTRAN Park & Ride Strategy.

FIGURE 3.1 POLICY CONTEXT HIERARCHY



Scotland's Third National Planning Framework (NPF3)

3.3 The National Planning Framework (NPF) sets the context for development planning in Scotland and provides a framework for the spatial development of Scotland as a whole. It sets out the Government's development priorities over the next 20-30 years and identifies national developments which support the development strategy.

3.4 The first and second National Planning Frameworks (NPF1 and NPF2) were published in 2004 and 2009 respectively and each set out a long term strategy for future development in Scotland.

3.5 Scotland's Third National Planning Framework (NPF3), published in June 2014, is the spatial interpretation of the Government Economic Strategy. NPF3 sets out the Government's ambition for Scotland to become: a successful, sustainable place; a low carbon place; a natural, resilient place; and a connected place.

3.6 NPF3 sets out a spatial strategy for Scotland aimed at achieving a vision for Scotland which is:

- **a successful, sustainable place**. We have a growing low carbon economy which provides opportunities that are more fairly distributed between, and within, all

our communities. We live in high quality, vibrant and sustainable places with enough good quality homes. Our living environments foster better health and we have reduced spatial inequalities in well-being. There is a fair distribution of opportunities in cities, towns and rural areas, reflecting the diversity and strengths of our unique people and places.

- **a low carbon place.** We have seized the opportunities arising from our ambition to be a world leader in low carbon energy generation, both onshore and offshore. Our built environment is more energy efficient and produces less waste and we have largely decarbonised our travel.

- **a natural, resilient place.** Natural and cultural assets are respected, they are improving in condition and represent a sustainable economic, environmental and social resource for the nation. Our environment and infrastructure have become more resilient to the impacts of climate change.

- **a connected place.** The whole country has access to high-speed fixed and mobile digital networks. We make better use of our existing infrastructure, and have improved internal and international transport links to facilitate our ambition for growth and our commitment to an inclusive society.

Scotland's National Transport Strategy

3.7 Scotland's National Transport Strategy was published in December 2006 and sets out, for the first time, the long-term future for transport in Scotland. The strategy adopts the vision and objectives for transport in Scotland as set out in the 2004 Transport White Paper "Scotland's Transport Future".

3.8 The vision is one of "*an accessible Scotland with safe, integrated and reliable transport that supports economic growth, provides opportunities for all and is easy to use; a transport system that meets everyone's needs, respects our environment and contributes to health; services recognised internationally for quality, technology and innovation, and for effective and well-maintained networks; a culture where fewer short journeys are made by car, where we favour public transport, walking and cycling because they are safe and sustainable, where transport providers and planners respond to the changing needs of businesses, communities and users, and where one ticket will get you anywhere*"

3.9 The objectives for transport are set out below:

- **promote economic growth** by building, enhancing managing and maintaining transport services, infrastructure and networks to maximise their efficiency;

- **promote social inclusion** by connecting remote and disadvantaged communities and increasing the accessibility of the transport network;

- **protect our environment and improve health** by building and investing in public transport and other types of efficient and sustainable transport which minimise emissions and consumption of resources and energy;

- **improve safety** of journeys by reducing accidents and enhancing the personal safety of pedestrians, drivers, passengers and staff; and

- **improve integration** by making journey planning and ticketing easier and working to ensure smooth connection between different forms of transport.

3.10 To support the vision and objectives for transport in Scotland, the NTS sets out three strategic outcomes. These will have wider benefits and will contribute to the delivery of a number of other key priorities including health improvement, social inclusion and regeneration:

- **improve journey times and connections**, to tackle congestion and the lack of integration and connections in transport which impact on high level objectives for economic growth, social inclusion, integration and safety;
- **reduce emissions**, to tackle the issues of climate change, air quality and health improvement which impact on high level objective for protecting the environment and improving health; and
- **improve quality, accessibility and affordability**, to give people a choice of public transport, where availability means better quality transport services and value for money or an alternative to the car.

Strategic Transport Projects Review (STPR)

3.11 The STPR is focussed on delivering a strategic transport network which will benefit the whole of Scotland and deliver on the priorities set out in the Government Economic Strategy, the National Transport Strategy, the National Planning Framework and the Scottish Climate Change Bill. It identifies improvements on the national rail and road network in Scotland to meet the challenges faced from 2012 and beyond.

3.12 The focus of the STPR is on those interventions that contribute to the three key strategic outcomes identified in the National Transport Strategy (as above). National objectives have been set under each of the key strategic outcomes, taking account of both policy context and the issues identified as part of the STPR's assessment of the strategic transport network.

3.13 National STPR objectives with particular relevance to the relocation of Invergowrie Station include:

- reduce inter-urban journey times on public transport;
- promote journey time reductions between the central belt and Aberdeen/ Inverness primarily to allow business to achieve an effective working day when travelling between these centres;
- Maximise the labour catchment area in city regions where economic evidence demonstrates that this is required (favouring public transport and high occupancy vehicles and balancing with other policy measures that promote reduction in the need to travel i.e. planning policy);
- support the development and implementation of relevant proposed national development;
- reduce CO_2 emissions per person km;
- promote seamless travel;
- improve the competitiveness of public transport relative to the car; and
- improve overall perceptions of public transport.

3.14 The STPR sets out a number of specific objectives for: urban networks; strategic nodes; and corridors. Those of relevance to the relocation of Invergowrie Station to Dundee West are:

- to improve bus/ rail interchange opportunities;
- to improve the public transport accessibility and competitiveness to Dundee West;
- to promote continuing reduction in accident rates and severity rates across the strategic transport network;
- to promote journey time reductions, particularly by public transport, between the central belt and Aberdeen primarily to allow business to achieve an effective working day when travelling between these centres; and
- to improve the public transport competitiveness between Aberdeen and Dundee (and hence onwards to the central belt).

Investment packages

3.15 The STPR identifies a total of 29 investment packages, developed using a three-tiered approach: maintain and safely operate existing assets; make better use of existing capacity; and targeted infrastructure improvements. The following investment packages are identified as being most relevant to the relocation of Invergowrie Station to Dundee West.

2. Maintaining and safely operating Scotland's rail network

3.16 Nationwide, on-going process planned to continue through the STPR period. £3bn funded over 10 years through £300m annual direct grant.

6. Further electrification of the strategic rail network

3.17 This intervention supports the NPF2 and 'Scotland's Railways' to work towards an electrified rail network across the strategic routes in Scotland. It also contributes to a number of objectives relating to emissions and rail operations.

12. Enhancing rail system capacity through targeted improvements

3.18 This intervention covers relatively small scale infrastructure measures to address areas operating at, or close to capacity during peak periods across Scotland's rail network. The benefits include reduced conflict between services, improved efficiency, reduced journey time variability, improved reliability and resilience and providing room for growth.

23. Rail Enhancements between Aberdeen and the Central Belt

3.19 This intervention supports the objectives to improve public transport competitiveness between Aberdeen and the Central Belt and provide enhanced opportunities to move freight by rail. It would involve:

- recasting of the passenger timetable on the Aberdeen — Dundee — Edinburgh / Glasgow corridors to provide express and stopping services;
- providing one express train per hour to Glasgow (two hour fifteen minute journey time);
- providing one express train per hour to Edinburgh (two hour journey time); and
- no stops at intermediate settlements for express services.

Control Period 5 - High Level Output Specification (CP5 HLOS)

3.20 Under powers and functions transferred to the Scottish Ministers under the Railways Act 2005, the CP5 HLOS specifies what the Scottish Government require the rail industry in Scotland to achieve for the period 2014 to 2019 (CP5).

3.21 The HLOS document is succinct and sets out the requirements of the Scottish Ministers under 11 broad headings. Those of relevance to the Invergowrie Station relocation proposal include:

- improving journey times;
- a greener Scotland;
- the required capacity and capability of Scotland's rail network;
- ensuring a high performing rail network;
- maintaining Scotland's railway stations;
- safety on Scotland's railways;
- increasing the capacity and capability of the Scottish network;
- flexible, opportunity led improvements to the Scottish network; and
- future network developments.

Network Rail Strategic Business Plan for Scotland, January 2013

3.22 The Strategic Business Plan for Scotland sets out what Network Rail plan to do as a business to deliver better service and value for customers and stakeholders, from April 2014 to March 2019 (CP5) and beyond. It is a key input in to the Office of Rail Regulation's (ORR's) periodic review for CP5 and as such, aims to deliver the HLOS outputs and other commitments safely, sustainable and efficiently.

3.23 The Strategic Business Plan sets out Network Rail's outputs, activities and expenditure for CP5 consistent with their vision and the HLOS for Scotland, as well as longer-term projections of activities and expenditure, reflecting an approach to managing the network on a sustainable, whole-life cost basis. The key outputs of the Plan that are relevant to the Invergowrie Station relocation proposals include: delivering continuous improvements in safety; and enhancing the capacity and capability of the railway across Scotland. The key outcomes identified as being of particular relevance to Scotland include safety, sustainability, asset management, capacity and performance management, project development and delivery, people, and funding and affordability and are largely reflective of the HLOS headings listed above.

3.24 Following the Office of Rail Regulation's (ORR) final determination on the Strategic Business Plan for Scotland, Network Rail published their CP5 Delivery Plan in March 2014.

TACTRAN Regional Transport Strategy

3.25 The TACTRAN RTS sets out a vision and strategy for improving the region's transport infrastructure, services and other facilities over the period 2008 to 2023, in accordance with the Transport (Scotland) Act 2005.

3.26 The vision of the strategy is to deliver, "a transport system, shaped by engagement with its citizens, which helps deliver prosperity and connects communities across the region and beyond, which is socially inclusive and

environmentally sustainable and which promotes the health and well-being of all". The key themes of the strategy are:

- delivering economic prosperity;
- connecting communities and being socially inclusive; and
- delivering environmental sustainability, health and well-being.

3.27 The RTS sets out six overarching objectives for the region within which sit 18 sub-objectives:

- **Economy**: to ensure transport helps to deliver regional prosperity;
- **Accessibility, Equity and Social Inclusion**: to improve accessibility for all, particularly for those suffering from social exclusion;
- **The Environment**: to ensure that the transport system contributes to safeguarding the environment and promotes opportunities for improvement;
- **Health and Well-Being**: to promote the health and well-being of communities;
- **Safety & Security**: to improve the real and perceived safety and security of the transport network; and
- **Integration**: to improve integration, both within transport and between transport and other areas.

TACTRAN Regional Sub-Strategies

3.28 TACTRAN's Bus Strategy, Park & Ride Strategy and Walking & Cycling Strategy all have some overlap with TERS in relation to improved integration. For example, the Bus Strategy includes the following objective regarding integration between public transport modes, which could be facilitated by improved accessibility through relocating Invergowrie Station to Dundee West:

- to increase connectivity between road based passenger transport services and between different modes of transport.

3.29 In the case of the Park & Ride strategy, there is specific recognition of rail in achieving Park & Ride actions. This is found in action NPR10 and EPR 5:

- **NPR 10**: support the development of new rail stations at Dundee West and Bannockburn through the Tay Estuary Rail Study and/or other opportunities and ensure the provision of parking space is sufficient to match the anticipated parking demand; and
- **EPR5:** support the provision of additional car parking at Dunblane and/or Bridge of Allan stations and at other stations where demand warrants.

3.30 NPR10 and EPR 5 are both set as a high priority in the strategy and NPR10 also relates back to the STPR investment packages.

3.31 The Park & Ride Strategy also includes an action to develop and implement proposals for a new bus-based Park and Ride site in the Dundee Western Gateway area (Action NPR3).

TAYplan Strategic Development Plan 2012 – 2032

3.32 The Strategic Development Plan (TAYplan) considers strategic land use planning issues, in particular issues of cross-boundary significance.

3.33 TAYplan is the Strategic Development Plan for 2012-2032 covering Dundee City, Angus, Perth & Kinross and North Fife and sets out policies for where development should be over the next 20 years and how to shape better quality places by the location, design and layout of development from the outset.

3.34 The TAYplan Proposals Map indicates proposals for how the region will develop over the 2012-2032 period. In particular, the map refers to the "Proposed relocation of Invergowrie Railway Station to west Dundee", and strategic development areas, including Dundee Western Gateway and James Hutton Institute, both within the area of influence of Invergowrie Station and the proposed Dundee West relocation site.

3.35 Policy 1 Location Priorities identifies where the focus for the majority of development in the region's principal settlements will be, and how it will be prioritised for release using a sequential approach. In particular, it notes that, "Tier 1 settlements have the potential to accommodate the majority of the region's additional development over the plan period and make a major contribution to the region's economy - Dundee Core Area: (Dundee City, **Dundee Western Gateway, Invergowrie**, Monifieth, Tayport/Newport/Wormit, Birkhill/Muirhead) and, - Perth Core Area: (Perth, Scone, Almondbank, Bridge of Earn, Oudenarde, Methven, Stanley, Luncarty, Balbeggie, Perth Airport)."

3.36 Policy 4 Strategic Development Areas states that, "Locations near to the region's universities and their relationships with business have potential benefits through the establishment of a science park at St. Andrews **and land for research facilities near The James Hutton Institute at Invergowrie**." It adds, "Some of the Strategic Development Areas will make a major contribution to the housing offer and competitiveness of the region with employment land integrated, such as Dundee Western Gateway..."

3.37 Policy 4 identifies strategic development areas that will contribute to the region's economic success. Table 1 sets out specific sites for the Strategic Development Areas and allocates land (as well as types and an indicative scale of development) for the identified key uses:

- Dundee Western Gateway – 750+ homes and 50ha of employment land; and
- The James Hutton Institute - 5 to 10ha of employment land for food/ agricultural research.

TAYplan Strategic Development Plan Action Programme June 2012

3.38 The Action Programme to accompany the TAYplan Strategic Development Plan is a requirement under Section 21 of the Planning (Scotland) Act 2006, to set out the strategic actions and partnership required to shape the Development Plan and crucial to the long-term achievement of the strategy. Many of the actions in the Programme are taken from existing proposals contained within the National Renewables Infrastructure Plan (NRIP), Strategic Transport Projects Review (STPR) and the Regional Transport Strategies (RTS's). Of note, the proposal "Improving

rail infrastructure and connectivity regionally and nationally" is detailed in the Action Programme Schedule and "Progress a business case for the potential for relocating Invergowrie Rail Station to Dundee West (TACTRAN)" is listed in the phasing of actions. The proposal is given high/ medium priority.

Dundee Local Development Plan 2014

3.39 The Dundee Local Development Plan 2014, which was adopted in December 2013, sets out the land use strategy that will guide development across Dundee up to 2024 and beyond. It is consistent with TAYplan and contains polices and proposals covering the principal land use issues in the City and will provide the context in which decisions on planning applications will be made.

3.40 Sustainable Economic Growth is one of six key themes of the Local Development Plan. Chapter 5, Sustainable Economic Growth notes that TAYplan identifies the Dundee Western Gateway (with 50 hectares) of employment land as a Strategic Development Area: one that demonstrates that the region is business ready and offers a competitive and quality place for people and businesses to be. Sites are safeguarded in the Plan for future growth opportunities in key sectors with the exception of the Western Gateway. This is a long term (Post 2024) allocation in TAYplan and as such is not included in the figures for effective employment land in the Local Development Plan. A smaller area of employment land (9.7 ha) has been included as the Balgarthno Extension, for development pre-2024.

3.41 The strategy for identifying additional housing land necessary to meet the identified build rate has been to give priority to the reuse of brownfield land within the existing urban area and to focus the limited greenfield land release to the Strategic Development Area (Policy 4 TAYplan Strategic Development Plan) identified at the Western Gateway.

3.42 Substantial public and private investment in infrastructure provision has been put in place to remove constraints and facilitate the development of the housing sites at the Western Gateway.

3.43 Chapter 10 of the Plan, Sustainable and Accessible Transport discusses the Riverside Park and Ride and notes that "In addition, to the Park and Ride facilities the Regional Transport Strategy Delivery Plan and TAYplan Action Programme identify the potential to improve the rail infrastructure within the City with the potential relocation of Invergowrie rail station to Dundee West. It is intended to progress a business case to further investigate the potential for this relocation option. The area of Dundee being considered for the potential relocation of Invergowrie Station is along Riverside and likely to be in close proximity to the proposed Park & Ride facility."

3.44 Proposal 1: Riverside Park & Ride Transport Interchange states that "the City Council supports the establishment of Park & Ride facilities on land to the east of the Nature Park at Riverside Drive. In addition, the Council supports the further investigation, including the preparation of a business case, for the potential relocation of Invergowrie Rail Station to Dundee West."

Perth & Kinross Local Development Plan 2014

3.45 The Proposed Perth & Kinross Local Development Plan, which was adopted in February 2014, is the Council's statutory document that guides all future development and use of land within Perth and Kinross. The Plan is of relevance given that Invergowrie Railway Station is located within Perth & Kinross area.

3.46 Chapter 5 of the Plan covers the Perth Area Spatial Strategy and, as per TAYplan, notes the James Hutton Institute at Invergowrie as a Strategic Development Area providing 5 to 10 ha of employment land for food/ agricultural research.

3.47 Invergowrie is considered specifically in Section 5.23 which describes the area. With a population of 1,800, Invergowrie lies 18 miles east of Perth and 2.5 miles west of Dundee city centre. The village grew up along the old road between Perth and Dundee and was famous for stone quarrying and paper making. More recent development has extended along Invergowrie Bay to Kingoodie. There is a good range of amenities and services and two major employers are located in the village: Scottish Water and the James Hutton Institute.

3.48 Although Invergowrie is within Perth & Kinross Council area, due to its proximity to Dundee, TAYplan classifies it as a principal settlement within the Dundee Core Area. It is also located within Dundee's Housing Market Area. No housing sites have been identified for the village as it is constrained by the James Hutton Institute, the Tay and the A90. The Plan notes that TAYplan contains a proposal to relocate Invergowrie railway station to serve the Dundee West development.

Tay Estuary Rail Study Planning Objectives

3.49 Using the issues and wider RTS objectives as a backdrop, and taking into account wider national and regional strategies including the Strategic Transport Projects Review, National Transport Strategy and the Scottish Climate Change Act the following planning objectives were developed for the TERS study:

Economy

- Ec1: ensure that rail provides and supports economic growth by connecting key business & employment sectors where possible;
- Ec2: improve the efficiency, reliability and integration of rail services in the Tay Estuary study area specifically where this will benefit key business and employment sectors;

Accessibility

- Acc1: increase accessibility to key service destinations in the TACTRAN area (e.g. employment, health and education sites) and to/from key external destinations by rail without compromising wider inter-regional rail connectivity;

Environment/Health & well-being

- Env1: contribute to national greenhouse gas emission reductions through rail-based interventions where possible;
- Env2: contribute to the management of air quality in the TACTRAN area, particularly the AQMA's across Perth and the Dundee City Council area;

Safety and security

- Sec1: maintain or improve real and perceived levels of safety and personal security on the rail network;

Integration

- Int1: ensure that rail is fully integrated with relevant land-use and planning projects;
- Int2: ensure the rail network is integrated with the wider public transport network.

3.50 From the policy review it is considered that these objectives remain relevant to the proposal for relocating Invergowrie station to Dundee West.

3.51 The table below illustrates the fit between the TERS planning objectives and the higher level objectives set out in Scotland's National Transport Strategy, the Regional Transport Strategy and the Strategic Transport Projects Review.

TABLE 3.1 FIT OF TERS PLANNING OBJECTIVES WITH WIDER OBJECTIVES

Theme	Scotland's National Transport Strategy	Strategic Transport Projects Review Urban Network, strategic Node and Corridor Objectives	TACTRAN Regional Transport Strategy	Tay Estuary Rail Study
Economy	Promote economic growth by building, enhancing managing and maintaining transport services, infrastructure and networks to maximise their efficiency.	Promote journey time reductions, particularly by public transport, between the central belt and Aberdeen/ Inverness primarily to allow business to achieve an effective working day when travelling between these centres. To reduce journey time and increase opportunities to travel between Inverness and Perth (and hence onwards to the central belt). Address current and forecast rail overcrowding into Glasgow.	Ensure transport helps to deliver regional prosperity.	Ec1: Ensure that rail provides and supports economic growth by connecting key business & employment sectors where possible. Ec2: Improve the efficiency, reliability and integration of rail services in the Tay Estuary study area, specifically where this will benefit key business and employment sectors.
Accessibility Equity and Social Inclusion	Promote social inclusion by connecting remote and disadvantaged communities and increasing the accessibility of the transport network.	Improve public transport accessibility and competitiveness to Dundee West. Improve public transport competitiveness between Aberdeen and Dundee (and hence onwards to the central belt).	Improve accessibility for all, particularly for those suffering from social exclusion.	Acc1: Increase accessibility between key destinations in the TACTRAN area and to/from key external destinations by rail without compromising wider inter-regional rail connectivity.

Theme	Scotland's National Transport Strategy	Strategic Transport Projects Review Urban Network, strategic Node and Corridor Objectives	TACTRAN Regional Transport Strategy	Tay Estuary Rail Study
Environment Health and Well Being	Protect our environment and improve health by building and investing in public transport and other types of efficient and sustainable transport which minimise emissions and consumption of resources and energy.	Contribute to reducing emissions per person kilometre.	To ensure that the transport system contributes to safeguarding the environment and promotes opportunities for improvement. To promote the health and well-being of communities.	Env1: Contribute to national greenhouse gas emission reductions through rail-based interventions where possible. Env2: Contribute to the management of air quality in the TACTRAN area, particularly the AQMA's across the Dundee City Council area and Perth.
Safety & Security	Improve safety of journeys by reducing accidents and enhancing the personal safety of pedestrians, drivers, passengers and staff.	Promote continuing reduction in accident rates and severity rates across the strategic transport network. To reduce the severity of accidents to the national average.	To improve the real and perceived safety and security of the transport network.	Sec1: Maintain or improve real and perceived levels of safety and personal security on the rail network.
Integration	Improve integration by making journey planning and ticketing easier and working to ensure smooth connection between different forms of transport.	Improve bus/rail interchange opportunities.	To improve integration, both within transport and between transport and other areas.	Int1: Ensure that rail is fully integrated with relevant land-use and planning projects. Int2: Ensure the rail network is integrated with the wider public transport network.

4 Development and land use planning

Introduction

4.1 The regional and local land use planning policy documents are summarised for their relevance to the Invergowrie Station relocation in Chapter 3 above. Discussions have been held regarding the actual and current land use and development planning changes occurring in the immediate and surrounding areas of relevance to the existing and proposed station locations with the relevant Dundee City Council (DCC) and Perth & Kinross Council (P&KC) planning officers.

Invergowrie

4.2 A key employment land use of relevance to the relocation proposals is the James Hutton Institute, located immediately on the western outskirts of Invergowrie and approximately 500m as the crow flies from the existing Invergowrie Rail Station. The James Hutton Institute was formed in 2011 when the Macaulay Land Use Research Institute (MLURI) and Scottish Crop Research Institute (SCRI) joined forces to create a world leading research institute for land, crops, water and the environment. As mentioned, both TAYplan and the Perth and Kinross LDP refer to five to ten ha of employment land for food/agricultural research at the James Hutton Institute as a strategic development area, but detailed plans have yet to be developed, including a masterplan.

Dundee West

4.3 The key land and development uses / sites of relevance to relocating Invergowrie station within the Dundee City Council area include:

- Western Gateway and Balgarthno;
- Ninewells Hospital;
- Dundee Airport;
- Technology Park;
- Medi Park; and

Western Gateway and Balgarthno

4.4 The Western Gateway is a major development site within Dundee. In terms of housing, 150 of the allocated 750 residential units have been delivered, leaving 600 units still to be constructed across three smaller individual sites. These 600 units are expected to have a five-year build-out period, meaning the full residential potential of the site could be realised by 2019.

4.5 Within the Balgarthno Estate, adjacent to the A90 and close to both the Wester Gourdie Industrial Estate and Dundee Technology Park, the Dundee LDP allocates 9.7 ha of employment known as the Balgarthno Extension. This is assumed to be occupied before 2024. Details of a potential 50ha employment development at the Western Gateway Business Park are undetermined at this time and assumed to come after 2024.

Ninewells Hospital and Medi Park;

4.6 Ninewells Hospital is an acute teaching hospital and is one of the largest teaching hospitals in Europe, with strong links with Dundee University's Medical School. Ninewells has 862 acute beds and a 31-bed medical assessment unit and provides services including accident and emergency, critical care, palliative care, and cancer care. The Ninewells Medipark is a joint venture between Scottish Enterprise Tayside and Ninewells Teaching Hospital, adjacent to Ninewells Hospital. It provides biomedical, biotech or medical device companies the opportunity to develop laboratory, production and office space on a greenfield site close to the local biosciences research community.

Technology Park

4.7 Dundee Technology Park is one of Scotland's premier business parks designed for companies in the high growth technology sector. It provides a campus style environment and is home to companies including Axis-Shield and W.L Gore.

5 Demand forecasting

Introduction

5.1 This section summarises the demand forecasting exercise that has been undertaken for the study. The key focus in developing these forecasts is not on a forecast for the proposed new TERS service, but rather the relative levels of demand between the two possible station sites.

5.2 This forecasting exercise uses the following assumptions, which are consistent with the study as a whole:

- A full TERS service is assumed to be running and this is assumed to be an hourly service between Glasgow and Arbroath, stopping at key stations (Stirling, Dunblane, Gleneagles) to Perth, then Invergowrie/Dundee West, Dundee, Broughty Ferry, Monifieth and Carnoustie. Timings have been taken from timetable development work from previous TERS studies.
- Forecasts have been developed as if the stations were to be open today. 2011/12 demand levels have been used and are scaled up. In the subsequent appraisal, described in Chapter 7, these have had underlying growth applied from 2011/12 and ramp up applied from the appropriate opening date, assumed to be December 2019 to tie in with Control Period 5 and Dundee Local Development Plan timeframe.
- Dundee West station has been assumed to be located directly south of the roundabout on the Perth Road, and assuming new pedestrian access to the Perth Road. Further development may lead to a change to the optimum location, given possible synergies with the airport and pedestrian access under the railway to the Perth Road. From a railway infrastructure point of view, there is some flexibility in the location of this station because the next signal for travel toward Dundee, eastwards from this location is some 1.2 miles beyond this location, approximately half a mile to the east of the airport entrance, allowing station movements to not interfere with Dundee Central Junction.
- The forecasts are based on the current population distribution in the area, but also take account of anticipated development in housing in the Western Gateway area. The population of this development area is assumed to be additional in the immediate area of the station catchment, rather than transferring within the area.
- The forecasts are based on the current employment in the area, and the anticipated development at the Balgarthno extension. As employment development in the Western Gateway Business Park is considered a long term allocation beyond 2024, it has been included as a sensitivity test.
- A proposal to develop a bus based Park & Ride facility to the west of Dundee Airport at Wright Avenue was refused Planning Permission by Dundee City Council in October 2013. Currently discussions are continuing with Dundee City Council, Tactran and Transport Scotland as to the future of bus based Park and

Ride at Dundee. As such, the provision of a bus based Park & Ride facility in proximity to the proposed Dundee West Rail Station location has been included as a sensitivity test to the main case.

5.3 The demand forecasting approach consists of four key stages:

- Forecast producer trip end demand using catchment analysis.
- Overlay housing development producer demand.
- Forecast attractor demand for destinations in immediate area.
- Apply appropriate growth from the fixed base year.

Catchment analysis

5.4 Rail demand from the Dundee area is not dominated by a single destination. However, the demand forecasting has focussed on key destinations for which accessibility is improved by better services to the west of Dundee. Initially the analysis has focused on trips to Glasgow, Perth and Aberdeen, which would be served by the proposed TERS service (albeit with an interchange to Aberdeen), rather than Edinburgh and stations in Fife, that would not and would require an interchange at Dundee.

5.5 In addition demand from the area to stations between Dundee and Arbroath has not been considered. Demand between Dundee and these stations is assumed to be largely attracted to Dundee as a destination, rather than from Dundee. Instead demand on these flows is covered in the attractor analysis below.

5.6 So rather than consider demand to and from the three key corridors, this has been simplified by focussing on what is assumed would be the larger of the two directions and assumed that explicitly calculating the other direction would not significantly change the overall forecast.

5.7 Steer Davies Gleave has developed in-house software which uses a combination of rail generalised journey times (GJTs[1]) from stations in the area to key destinations and access times to these stations from a grid of 500m radius hexcells to create station catchment areas. The access times are calculated as a combination of drive times and walk times nearer the stations. Drive times have been limited to 10 minutes, where there is no competing station, demand accessing rail beyond this is assumed to be relatively insignificant.

5.8 This travel time information is overlaid with up-to-date population data weighted for propensity to use rail using our in house TravelStyle market segmentation.

5.9 In this case the GJTs for the May 2012 timetable have been taken from MOIRA. Future GJTs have been derived by overlaying a high level timetable for the hourly TERS stopping service, consistent with that used in earlier TERS studies. Resulting GJTs for Glasgow are shown in Table 5.1. Times for Dundee West have been taken as 2 minutes closer to Dundee than Invergowrie.

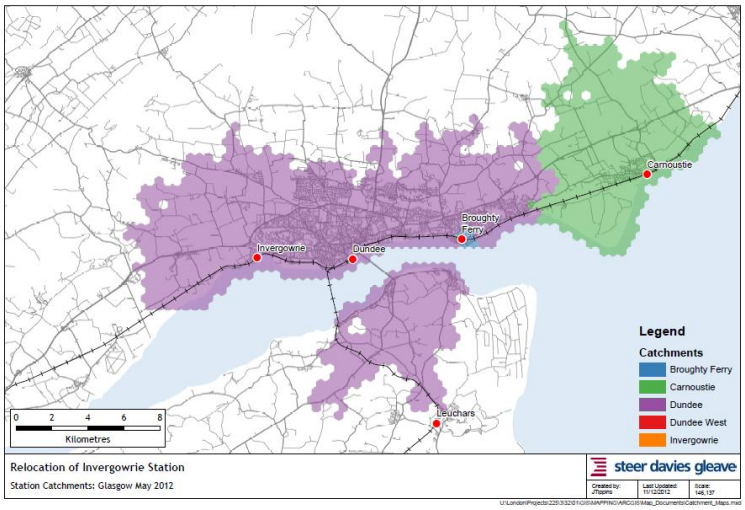
[1] GJTs represent the full timetable and are the sum of the journey time, a service frequency penalty and an interchange penalty between two stations.

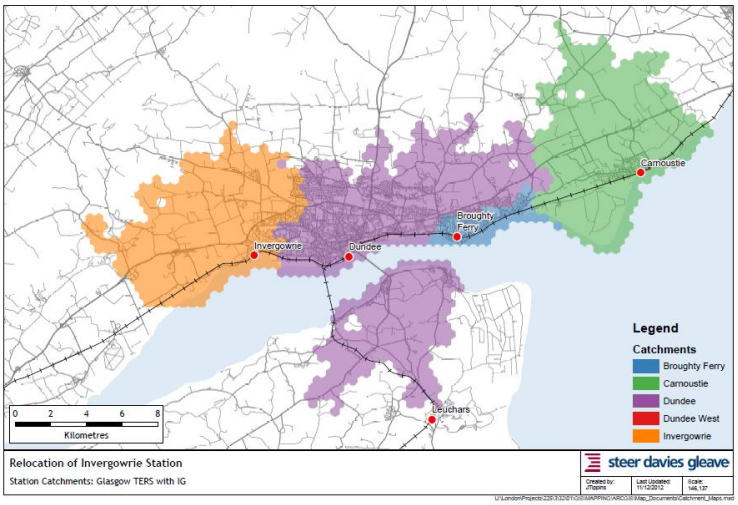
TABLE 5.1 ASSUMED GJTS TO GLASGOW QUEEN STREET

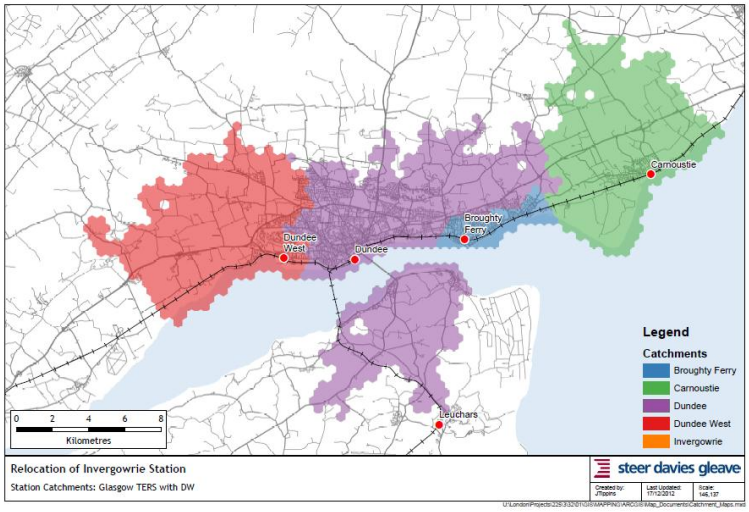
	May 2012	TERS Hourly Service with IG	TERS Hourly Service with DW
Perth	85	82	82
Invergowrie	189	122	
Dundee West			124
Dundee	110	110	110
Broughty Ferry	173	139	139
Monifieth	364	143	143
Carnoustie	137	137	137
Arbroath	132	132	132
Leuchars	170	170	170

5.10 The resulting catchment areas for Glasgow are shown in Figure 5.1. The catchment areas for Perth are similar, albeit not extending as far along the A90, so have not been included here. The catchment populations shown for Invergowrie and Dundee West are 21,200 and 23,700 respectively. Walk-in catchment populations are 5,000 and 7,300 respectively.

FIGURE 5.1 STATION CATCHMENT AREAS TO GLASGOW (MAY 2012, TERS WITH INVERGOWRIE, TERS WITH DUNDEE WEST)

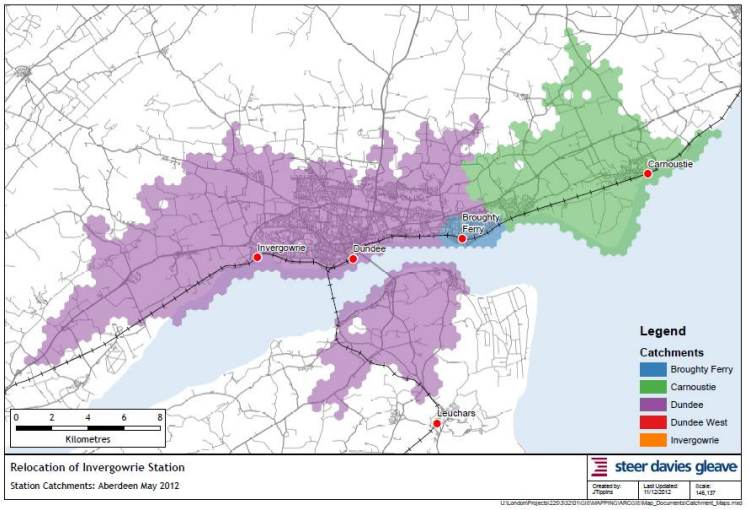


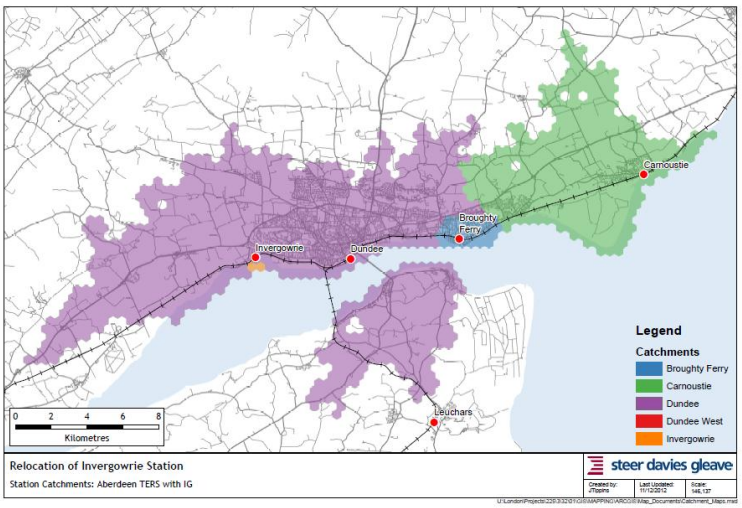


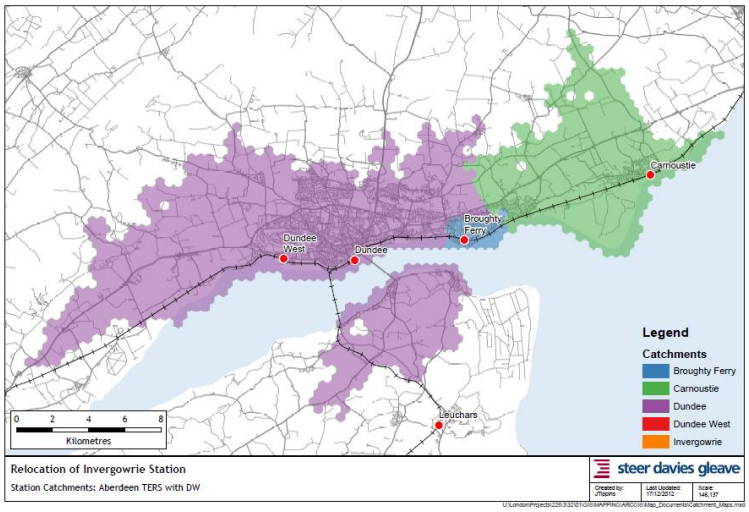


5.11 The catchment analysis for Aberdeen does not give a future catchment area for Dundee West / Invergowrie, because the need for an interchange from these stations means that driving to central Dundee is more attractive, as shown in Figure 5.2. With a long term solution to the constraint at Usan it would be possible for the hourly service to extend beyond Arbroath which would improve the attractiveness of Dundee West / Invergowrie for those travelling to Aberdeen. This possible upside has not been included in the demand forecast.

FIGURE 5.2 STATION CATCHMENT AREAS TO ABERDEEN (MAY 2012, TERS WITH INVERGOWRIE, TERS WITH DUNDEE WEST)







5.12 Figure 5.2 shows that the demand to stations north of Arbroath from Dundee West and Invergowrie is forecast to be insignificant, so the following analysis just considers Perth and Glasgow. Also from Figure 5.1 note that Dundee West and

Invergowrie catchment population is largely allocated from the existing Dundee catchment area. These catchment areas indicate that the focus of this stage of the demand forecasting should be on demand to stations in the Perth – Glasgow corridor.

Demand forecast based on catchment analysis

5.13 The demand forecast is based on the current level of demand from Dundee and Perth to Glasgow and Dundee to Perth. The assumed introduction of the TERS hourly stopping service does also have an impact on demand between Dundee / Broughty Ferry and Perth and this is factored into the analysis below, using an elasticity to GJT improvement. The current demand levels are as detailed in Table 5.2.

TABLE 5.2 BASE DEMAND (2011/12 JOURNEYS)

	To/from Glasgow	To/from Perth
Perth	241,837	
Invergowrie	120	1,053
Dundee	158,599	224,257
Broughty Ferry	1,105	1,337
Carnoustie	3,886	4,480

5.14 The forecasting process is to distribute this existing demand across the catchment areas representing the current timetable using an inverse distance relationship and the TravelStyle weighted population data. In this way a base level of demand is allocated to each of the hexcells.

5.15 This allocated demand is then reallocated by station using the new catchment areas for the new service. This gives a fair representation of abstracted demand. In addition, this allows the difference in total travel time to the destination between the base and new cases to be calculated for each hexcell. This explicitly gives the time savings for a user benefit calculation, but also a way of calculating demand generation for each hexcell, using the GJT change and a standard GJT elasticity of -0.9.

5.16 This process has been undertaken for both new cases, with either Dundee West or Invergowrie stations. This has resulted in the producer demand forecast shown in Table 5.3 for Invergowrie and Dundee West to the key destinations of Glasgow and Perth. These results have then been scaled up to represent other destinations on the Perth – Glasgow axis, such as Dunblane and Stirling, as well as stations beyond Perth and Glasgow, requiring a further interchange.

TABLE 5.3 PRODUCER DEMAND FORECAST FOR DUNDEE WEST AND INVERGOWRIE STATIONS (2011/12 JOURNEYS)

	Dundee West			Invergowrie		
To	**Abstracted**	**Generated**	**Total**	**Abstracted**	**Generated**	**Total**
Glasgow	22,400	2,800	25,200	20,500	2,600	23,100
Perth	39,800	17,800	57,600	42,500	15,600	58,100
Other	21,100	7,000	28,000	21,300	6,100	27,500
Total	83,300	27,500	110,800	84,300	24,300	108,700

5.17 As expected from the catchment mapping, the resulting forecasts are very similar for both stations at around 110,000 journeys per annum, with around 25% of this demand new to rail. The Dundee West forecast is slightly higher, and generates 10% more new demand. As a sense check, this demand equates to under 200 passengers per day, which might equate to around 50 passengers per peak train, and less than 10 per off-peak train. This does not seem unreasonable.

5.18 Another sense check is that both the catchment population and the abstracted demand represent approximately 15% of the Dundee total. This is consistent with the figure for the stated origin summarised as "Dundee West" of those surveyed in the 2009 TACTRAN Rail O&D Survey, which was also 15%.

Overlay producer demand from Western Gateway

5.19 One of the potential drivers for additional demand in this area is the proposed housing development in the Western Gateway development area. The above analysis is based purely on current population, so demand due to the Western Gateway development is explicitly overlaid and can be applied in an appropriate year in the appraisal. Population in this area is assumed to be additional and not just moving from other housing in the area.

5.20 The three proposed housing 'villages' in this area (see Fig 2.1) have been associated with specific hexcells. Numbers of households (totalling 600) and, therefore, population has then been allocated to these hexcells, with an appropriate Travelstyle segmentation and propensity to use rail as high as any in the Dundee area assumed. It was also necessary to check that existing drive access times are appropriate for what will be in place when the development is complete. Demand in these hexcells is assumed to be beyond the walk time catchment area.

5.21 Producer demand has then been generated using the same trip distribution function as has been derived elsewhere in the catchment, described above. The resulting development overlay has been summarised in Table 5.4.

TABLE 5.4 OVERLAY PRODUCER DEMAND FORECAST FOR WESTERN GATEWAY 'VILLAGES'

	Dundee West			Invergowrie		
To	Abstracted	Generated	Total	Abstracted	Generated	Total
Glasgow	2,300	200	2,500	2,300	200	2,500
Perth	3,200	1,300	4,600	3,200	2,200	5,500
Other	1,900	500	2,400	1,900	800	2,700
Total	7,400	2,000	9,400	7,400	3,200	10,700

5.22 This overlay only adds about 10% to demand levels. This is perhaps not surprising given the relatively small population of less than 2,000. Again, there is little difference between the forecasts for the two stations.

Forecast attractor demand

5.23 In addition to forecasting producer demand from the station location to the west of Dundee, there will be some demand for the station as a destination, or attractor, for trips. Forecast attractor demand has been identified by the likely key attractor locations in the area and an approximation of rail's likely mode shift.

5.24 The key attractors that have been identified are as follows, and are shown in Figure 2.1, and described in more detail in Chapter 4:

- James Hutton Institute, to the west of Invergowrie, and possibly additional employment development land adjacent to this;
- Ninewells Hospital, to the north of the proposed location for Dundee West station;
- the Medi Park, immediately adjacent to the hospital;
- the Technology Park to the north of the A85 just east of the A90 Landmark Roundabout; and
- the proposed Balgarthno Extension, which is assumed to be developed prior to 2024.
- the proposed Western Gateway Business Park is included as a sensitivity test, and so is only assumed to start being developed from 2024, and to continue to attract new business over 10 years.

5.25 For each of these locations both the commuting market and visitors have been considered, be they business trips or hospital visits. For all attractors there is likely to be a limited market, given an hourly rail service with the requirement for a longish walk or an interconnecting bus. Table 5.5 summarises likely access to these areas from the alternative station locations, including a maximum walk distance of 1 mile or 20 minutes.

TABLE 5.5 ACCESS TO LOCAL DEMAND ATTRACTORS

	Invergowrie		Dundee West	
	Walk	**Bus**	**Walk**	**Bus**
James Hutton Institute	10 mins	None	Too far	None assumed
Ninewells Hospital	Too far	9 mins (exists)	16 mins	A service assumed
Medi Park	19 mins	5 mins (exists)	12 mins	A service assumed
Technology Park	12 mins	4 mins (exists)	16 mins	A service assumed
Balgarthno Extension	Too far	None	Too far	Poor
Western Gateway Business Park	Too far	Poor	Too far	A service assumed

5.26 The table shows that Invergowrie is located within walking distance of both the James Hutton Institute and the Technology Park. The 19 minute access walk to the Medi Park is at the limits of an acceptable walking distance. Access from Dundee West to the Medi Park is estimated at 12 minutes, although this is uphill, Ninewells Hospital and the Technology Park are also walkable, but could also be accessed via a bus service as described below.

5.27 Invergowrie station is currently reasonably well served for onward travel to these key destinations. It has been assumed that bus frequencies would increase to match the increase in the train service. Equally it has been assumed that the site of Dundee West would have similar bus services frequencies to Ninewells Hospital via the Tech and Medi Parks. Therefore, combined with generally shorter walk distances and its location adjacent to a main arterial route, for the longer access connections, such as to the Balgarthno Extension and Western Gateway Business Park, Dundee West is assumed to be as well or better connected for inbound commuting.

5.28 Trip rates generated by TRICS have been used to estimate the total number of trips for each employment area, based on estimates of number of employees, or floor space, whichever is more readily available. These daily trip rates cover both visitors and journeys to work. A conservative rail mode split assumption has been made based on Table 5.5, and loosely based on the Scottish national average of 3.5%, and the Dundee City average of 0.7%, ranging from 0% to 2.5%. The assumed mode splits are based on a combination of bus/walk access and the degree of suitability for rail access – eg office workers more likely than hospital (shift) workers for commuting. Multiplying these assumptions and annualising gives the forecast detailed in Table 5.6.

TABLE 5.6 ESTIMATE OF ATTRACTOR TRIPS

	Daily Trips	Annualise Factor	Annual Trips (000)	Rail Mode Split		Annual Rail Trips (000)	
				IG	DW	IG	DW
James Hutton Institute	900	250	225	2.50%	0.00%	5.6	0
Ninewells Hospital	21100	300	6,330	0.25%	0.75%	15.8	47.5
Medi Park	3300	250	825	0.50%	1.25%	4.1	10.3
Technology Park	9300	250	2,325	1.25%	0.75%	29.1	17.4
Existing Total	34,600		9,705			54.6	75.2
Balgarthno Extension	3700	250	925	0.00%	0.10%	0.0	0.9
Western Gateway Business Park	18,600	250	4,650	0.10%	0.25%	4.7	11.6

5.29 These trips are assumed to be additional to existing trips as they are all facilitated by the new hourly service. As such they are assumed to originate in the Glasgow-Arbroath axis. As described above, the simplifying assumption has been that the generated producer trips are to destinations between Perth and Glasgow and the generated attractor trips from stations between Dundee and Arbroath. In practice there will be some overlap, which could be estimated using additional LENNON data, but the assumption is that this will largely cancel out in total journeys terms.

5.30 As a sense check the total for existing attractors at Dundee West is around 125 passengers per day. This will represent a mix of commuters and visitors, but would still largely be in the peak and therefore might equate to 30 passengers per peak train. This may seem a little high for a single train, but it is worth noting that this is only one train per hour.

5.31 An examination of Ninewells staff survey data reveals that 11% of staff live within a mile of either Arbroath, Carnoustie, Monifieth or Broughty Ferry stations, and are definitely therefore within scope of such a service. This, combined with the high demand for limited parking availability at the hospital, leads to the conclusion that its mode split assumptions could be considered conservative. Therefore, an additional sensitivity test has been undertaken using 0.5%/1.5% in place of the 0.25%/0.75% in Table 5.6.

Total Demand and Revenue

5.32 The demand forecasts detailed above have been converted to revenue forecasts using appropriate base yield figures. Total demand and revenues from each stage of the forecasting are summarised in Table 5.7 and Table 5.8.

TABLE 5.7 TOTAL (2011/12) DEMAND FORECASTS

	Dundee West			Invergowrie		
	Abstracted	**Generated**	**Total**	**Abstracted**	**Generated**	**Total**
Existing Producer	83,300	27,500	110,800	84,300	24,300	108,700
Western Gateway Producer	7,400	2,000	9,400	7,400	3,200	10,700
Existing Attractor		75,200	75,200		54,600	54,600
Balgarthno Extension		900	900		0	0
Main Case Total	**90,700**	**105,600**	**196,300**	**91,700**	**82,100**	**174,000**
Western Gateway Attractor		11,600	11,600		4,700	4,700

TABLE 5.8 TOTAL (2011/12) REVENUE FORECASTS

	Dundee West			Invergowrie		
	Abstracted	**Generated**	**Total**	**Abstracted**	**Generated**	**Total**
Existing Producer	888,100	248,700	1,136,800	878,000	221,300	1,099,400
Western Gateway Producer	82,200	17,600	99,800	82,200	28,100	110,300
Existing Attractor		255,800	255,800		185,800	185,800
Balgarthno Extension		3,100	3,100		0	0
Main Case Total	**970,300**	**525,200**	**1,495,500**	**960,200**	**435,200**	**1,395,500**
Western Gateway Attractor		39,500	39,500		15,800	15,800

Constraining Invergowrie Demand

5.33 The above forecasts make standard access assumptions for Invergowrie station. In practice the site is constrained and very little, if any, car parking will be available. To correctly compare the two station sites in the appraisal the demand forecast in Table 5.3 has been scaled down to only represent those assumed to access the station by foot. The resulting forecast is shown in Table 5.9.

TABLE 5.9 CONSTRAINED PRODUCER DEMAND FORECAST FOR INVERGOWRIE STATION

To	Abstracted	Generated	Total
Glasgow	5,579	1,921	7,500
Perth	9,136	8,481	17,618
Other	4,975	3,517	8,492
Total	19,690	13,919	33,609

5.34 In addition, none of the demand from the Western Gateway residential development can be assumed to use Invergowrie station, as that is assumed to access the station by car. However, it will still be possible for the forecast attractor demand to use Invergowrie station, as these passengers will access the station by foot or bus.

5.35 The impact on the total demand and revenue forecasts is shown in Table 5.10 and Table 5.11.

TABLE 5.10 TOTAL (2011/12) DEMAND FORECASTS WITH INVERGOWRIE CONSTRAINT

	Dundee West			Constrained Invergowrie		
	Abstracted	**Generated**	**Total**	**Abstracted**	**Generated**	**Total**
Existing Producer	83,300	27,500	110,800	19,700	13,900	33,600
Western Gateway Producer	7,400	2,000	9,400	0	0	0
Existing Attractor		75,200	75,200		54,600	54,600
Balgarthno Extension		900	900		0	0
Main Case Total	**90,700**	**105,600**	**196,300**	**19,700**	**68,500**	**88,200**
Western Gateway Attractor		11,600	11,600		4,700	4,700

TABLE 5.11 TOTAL (2011/12) REVENUE FORECASTS WITH INVERGOWRIE CONSTRAINT

	Dundee West			Constrained Invergowrie		
	Abstracted	**Generated**	**Total**	**Abstracted**	**Generated**	**Total**
Existing Producer	888,100	248,700	1,136,800	213,200	130,200	343,400
Western Gateway Producer	82,200	17,600	99,800	0	0	0
Existing Attractor		255,800	255,800		185,800	185,800
Balgarthno Extension		3,100	3,100		0	0
Main Case Total	**970,300**	**525,200**	**1,495,500**	**213,200**	**316,000**	**529,200**
Western Gateway Attractor		39,500	39,500		15,800	15,800

5.36 Given that the demand for Invergowrie is being constrained by the lack of car parking space it is appropriate to check that the design for Dundee West has sufficient car parking space to allow for the demand forecast assumed to be produced there. An upper bound for this figure can be calculated by assuming all that are not in the walk in catchment area drive to the station. The total annual producer demand calculated in this way is 78,700, which equates to a maximum weekday daily car park requirement of 131, or around 109 at any one time. Even with the growth described below this should mean that the car park capacity of 140 is sufficient, with space for expansion in future, if required.

Appropriate growth

5.37 Future year forecasts have been developed using a representation of the standard Passenger Demand Forecasting Handbook guidance on exogenous demand drivers, which includes changes to population, employment and the economy. Annual fare changes have been assumed in line with those set out in the recent ITT for the ScotRail franchise, that is RPI+0% for Anytime and Season ticket fares and RPI-1% for Off-Peak fares. Beyond the current franchise the long term fares policy has been assumed to see all fares increase by RPI.

5.38 In addition, the approach used by Network Rail in the Scotland RUS (Generation Two) has been adopted with the development of a second "continuing rail competitiveness" scenario in which the degree to which actual growth has outstripped forecast growth in the last few years is extended forward to the next 10 years. Table 5.12 below details the proposed forecast scenarios.

TABLE 5.12 UNDERLYING DEMAND GROWTH FORECAST

	Continuing rail competitiveness		Base	
From 2011/12 to	**Jnys**	**Revenue**	**Jnys**	**Revenue**
2020/21	34.1%	29.9%	19.1%	15.3%
2032/33	59.7%	51.9%	41.8%	34.9%

5.39 This growth compares favourably with the declared journeys growth for ScotRail as a whole of 2.7% between 2011/12 and 2012/13. This helps to suggest that the "continuing rail competitiveness" scenario is the more plausible, and given that other factors have not been explicitly modelled, it is recommended that this forecast is used.

6 Capital costs

Introduction

6.1 This section summarises the work that has been done to provide updated capital costs for the construction of a proposed Dundee West station and the upgrading of the existing Invergowrie station to receive more frequent services. By revisiting the original cost estimates, costs reflecting recent station developments, such as those on the Airdrie-Bathgate line, have been provided. The summary of the costs breakdown is provided in Appendix A.

Dundee West

6.2 The capital costs for Dundee West station have been based on the design work undertaken by idp architects for the 2009 TERS study, with costs updated to reflect more recent station developments. The location of this station is shown in Figure 6.1.

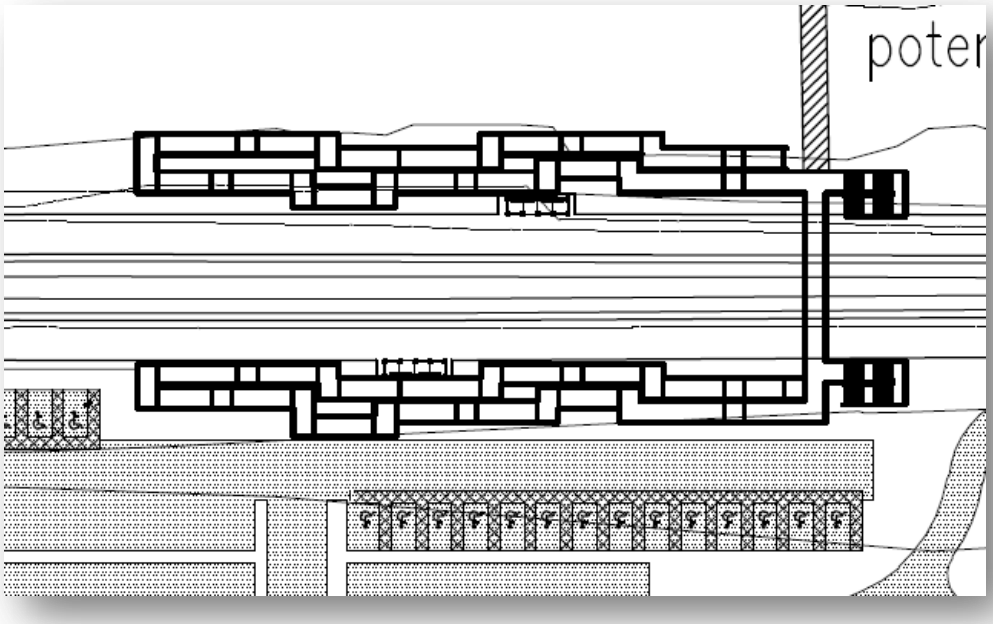
FIGURE 6.1 LOCATION OF DUNDEE WEST STATION

6.3 The following key assumptions have been made in determining the need for works:

- existing trains are 158s at 23.21m per car and in future, they will run as three-car units, with the total length of about 70m.
- following this, an allowance of 3m stopping tolerance gives a required platform length of 73m;

- the proposed ramped footbridge will be provided, as shown in Figure 6.2 as an extract from the architect's drawing:

FIGURE 6.2 DUNDEE WEST STATION RAMPED FOOTBRIDGE



- suitable platform passenger shelters and seating will be provided;
- total land requirement for car parking is approximately 10,500m^2, but the preliminary phase will only provide for 140 spaces which at 25m^2 per space gives 3,500m^2.

6.4 The estimated cost is £6.90 million. This includes 44% Optimism Bias, which is consistent with the OB level adopted for the 2009 TERS study where the estimate including OB was £5.30 million. The base cost derived from each capital cost estimate (i.e. the total excluding optimism bias) has been cross referenced with the out-turn costs of recent similar projects. The variances between actual out-turn cost and our estimates were +/- 15%. In accordance with the optimism bias guidance, a 44% uplift has therefore been applied rather than 66% in order to reflect higher levels of confidence in the base estimate. This level is in accordance with the Green Book Guidance on Optimism Bias.

Invergowrie

6.5 The capital costs for upgrading Invergowrie station include a new ramped footbridge and platform extensions. There was no suitable location for a car park available immediately adjacent to the station and some consideration was given to providing a remote car park. However, this has not been included as a suitable car park location could not be found close enough to the station and it is more likely that demand at Invergowrie will be limited to those accessing the station without car access.

6.6 The following key assumptions have been made in determining the need for works:

- the existing (listed Grade C) footbridge will be replaced by a fully accessible ramped footbridge;
- existing trains are 158s at 23.21m per car and in future they will run as three-car units, with the total length of about 70m. Making an allowance of a 3m stopping tolerance gives a required platform length of 73m. The current length of the platform is approximately 63m, and the DOWN platform is 69m.

6.7 The summary costing work is shown in Appendix A.

6.8 The estimated cost is £2.67 million. This includes 44% Optimism Bias, as explained above.

Modular Stations

6.9 "Network Rail encourages the adoption of modular station designs, which are being developed to be cost effective, sustainable and easily maintainable. The standardised designs look smarter, are easy to use and run and are safe and environmentally sound. The design is flexible, enabling easy application to individual sites. Network Rail's programme approach to procurement is designed to reduce unit costs providing greater value for money."[2]

6.10 It is fair to say that the ability for the modular station design concept to reduce station costs is still unproven. However, developments such as the modular GRP railway station platform are beginning to deliver cost savings and savings of up to 30% on unit costs and additional savings in design have been mentioned. The costs detailed in this chapter do not include such a benefit, however a sensitivity test which includes a reduction of 20% on all station capital costs has been included in the appraisal chapter.

[2] Network Rail. Investment in Stations. A Guide for Promoters and Developers. May 2011.

7 Appraisal

Introduction

7.1 This section considers the proposal to relocate Invergowrie Station to Dundee West against government objectives for transport and the TERS planning objectives, as set out in more detail in Appendix 2. The appraisal looks solely at the case for the relocation against providing the same service from Invergowrie station. In both cases there is assumed to be an hourly stopping service between Glasgow and Arbroath already in place, with associated operating costs.

Appraisal against TERS objectives

7.2 Performance of the station relocation against the TERS study planning objectives are shown below on a seven point scale ranging from major negative ('---') to neutral ('n') to major positive ('+++').

	Ec1	Ec2	Acc1	Env1	Env2	Sec1	Int1	Int2
Relocation of Invergowrie to Dundee West	++	n	+	+	+	n	++	+

Appraisal against Government objectives

Environment

7.3 Considering all environmental criteria, relocating Invergowrie station to Dundee offers some positive impacts in terms of reduced emissions from private car transport, owing to its superior position in relation to current transport provision, existing and future planned development. There is likely to be minor negative impacts for noise and vibration during construction, biodiversity, landscaping and visual amenity, but much of this can be mitigated.

Air quality

7.4 In terms of air quality the scheme will have a minor positive impact. The improved road access to the station could expect to achieve a modal shift to train from private car and thus reduce area wide local CO2, PM10 and N02 emissions. Also by abstracting trips from Dundee Rail station this will assist in alleviating traffic congestion in the city centre where there are known AQMA hotspots. Conversely, there may be some localised increase in emissions from the greater activity around the station site.

Noise and vibration

7.5 Given the requirements for construction works to enhance the station and additional traffic generated around the site, noise and vibration levels received a minor negative rating. The construction timeframe for the station is not likely to be lengthy, and mitigations would be put in place, as required, during that time. During operations the increase at Dundee West would be offset by the decrease at Invergowrie location.

Water quality, drainage and flood defence

7.6 The station did not present any issues with regards to water quality, drainage or flood defence.

Biodiversity

7.7 Given the land take required for the new station and access road and larger car park area it can be expected that there will be some marginal impacts to flora and fauna on the site. Thus biodiversity received a minor negative rating.

Landscape

7.8 Due to the provision of a new car park and station at the Dundee West site, the proposal has a minor negative impact on the landscape.

Visual amenity

7.9 The enhanced station has a minor negative impact on visual amenity. The conversion of green land into hard infrastructure and car park area is generally less appealing to onlookers; the impact of this would be mitigated through screening and environmental enhancement.

Agriculture and soils

7.10 No impact has been noted in the station appraisal with regards to agriculture and soils, hence a neutral impact score has been awarded.

Cultural heritage

7.11 No impact has been noted in the station appraisal with regards to agriculture and soils, hence a neutral impact score has been awarded.

Safety

Accidents

7.12 The proposal will provide a minor positive effect on personal injury accidents through attracting greater modal shift from the private car and reducing traffic generated on local roads around the existing station.

Security

7.13 The proposal is expected to have a neutral impact to security as both station locations would benefit through the installation of CCTV, lighting, seating, and greater pedestrian footfalls through increased demand, creating create human surveillance.

Integration

Transport integration

7.14 Analysis of transport integration scored a minor positive because of the improved access to the railway station and rail services, positioning the station near the airport, and adjacent to the Green Circular walk/cycle route. The new road access will promote the Government's objective to join up public transport journeys.

Transport land-use integration

7.15 The proposal scored a moderate positive effect on integrating different land uses. The relocation better fits the existing developments and offers greater potential

demand for rail services. Improved parking and road access enables cars and buses to access the station more efficiently to serve new development, particularly housing in the Western Gateway and employment at Balgarthno areas.

Policy integration

7.16 Impacts on policy integration were all considered to be minor positive as proposals fit well with national transport strategy, TACTRAN Regional Transport Strategy, Local Development Plan documents and TAYplan's SDP. The relocation enables more people to use rail transport more freely and increases accessibility to the wider geographical regions, key TACTRAN objectives.

Accessibility and Social Inclusion

Community accessibility

7.17 The relocation is assessed to have a minor positive impact on community accessibility, offering greater potential for more travellers to access other Scottish cities. Additional parking provision will give greater capability for people to use the station's services. The walk in catchment area is also higher for Dundee West than for Invergowrie.

Comparative accessibility

7.18 For comparative accessibility and social inclusion, the station scored a minor positive. Both station locations would provide an upgrade to accessible standards, meaning disabled users would benefit, but in addition to this at Dundee West better access to the station by road for cars and buses, and parking provision will allow improved access for disabled groups and vulnerable road users.

Economy

7.19 The more detailed economic appraisal heavily draws on the demand and revenue forecasts and capital costs outlined in the previous sections, and other user and non-user benefits described below.

User benefits

7.20 As described above, demand has been forecast in four key areas:

- producer demand from existing markets based on catchment analysis. Invergowrie demand is constrained to the walk-in catchment area only;
- producer demand from Western Gateway residential development based on trip rates from catchment analysis for Dundee West only;
- attractor demand to existing local employment; and
- attractor demand to Balgarthno Extension, assumed to be built up prior to 2024.

7.21 Time savings for the first two areas have been calculated explicitly using the catchment analysis for the key destinations of Perth and Glasgow and then expanded up to the whole market as described for demand. Table 7.1 shows the forecast time savings for producer demand for existing markets. Time savings are calculated both for existing rail users and those generated by the new service and/or station.

TABLE 7.1 ANNUAL TIME SAVINGS (2011/12 MINUTES) FOR PRODUCER DEMAND FOR EXISTING POPULATION

	Dundee West			Invergowrie		
To	**Existing**	**New**	**Total**	**Existing**	**New**	**Total**
Glasgow	236,300	35,000	271,300	145,700	35,400	181,100
Perth	698,600	241,900	940,500	367,700	182,200	549,900
Other	316,100	93,600	409,700	173,600	73,600	247,200
Total	1,251,000	370,500	1,621,500	687,000	291,200	978,200

7.22 Table 7.2 is the equivalent for the Western Gateway residential areas

TABLE 7.2 ANNUAL TIME SAVINGS (2011/12 MINUTES) FOR PRODUCER DEMAND FOR WESTERN GATEWAY VILLAGES

	Dundee West			Invergowrie		
To	**Existing**	**New**	**Total**	**Existing**	**New**	**Total**
Glasgow	24,300	1,900	26,300	0	0	0
Perth	57,000	18,200	75,200	0	0	0
Other	28,200	6,800	35,000	0	0	0
Total	109,500	27,000	136,500	0	0	0

7.23 Attractor demand has not been modelled explicitly. User benefit per journey figures from the above producer analysis have been used to approximate the time savings for the attractor demand. It has been assumed that 100% of the attractor demand is new to rail for the main case. The results of this analysis are shown in Table 7.3.

TABLE 7.3 ANNUAL TIME SAVINGS (2011/12 MINUTES) FOR ATTRACTOR DEMAND

	Dundee West	Invergowrie
Existing	1,106,000	809,000
Balgarthno Extension	12,000	0

Non-user benefits

7.24 Non-user benefits, or externalities, have been calculated in the standard way outlined in WebTAG 3.13.2, as referenced by STAG. These are benefits derived from the replacement of car journeys by journeys which are new to rail. These benefits include decongestion, accident savings, local air quality, noise and CO_2 emissions. . These are calculated as a forecast of vehicle miles taken off the road and a set of factors given in WebTAG. The forecast of vehicle miles is calculated as

a function of passenger miles and an assumption of the proportion of trips that are new to rail (termed generated in Chapter 5), which would have otherwise been undertaken as a car trip – using the standard WebTAG assumption of 26% for this proportion, which is derived as a UK national average from the National Transport Model. The passenger mile forecasts that have been made are shown below in Table 7.4.

TABLE 7.4 ANNUAL PASSENGER MILES (2011/12) FOR PRODUCER DEMAND FOR EXISTING POPULATION

	Dundee West			Invergowrie		
To	**Existing**	**New**	**Total**	**Existing**	**New**	**Total**
Glasgow	1,878,100	231,300	2,109,400	468,700	159,000	627,700
Perth	840,300	375,700	1,216,000	192,000	179,400	371,400
Other	3,380,700	1,117,000	4,497,700	803,000	562,100	1,365,100
Total	6,099,100	1,724,000	7,823,100	1,463,700	900,500	2,364,200

7.25 Table 7.5 is the equivalent for the Western Gateway residential areas

TABLE 7.5 ANNUAL PASSENGER MILES (2011/12) FOR PRODUCER DEMAND FOR WESTERN GATEWAY VILLAGES

	Dundee West			Invergowrie		
To	**Existing**	**New**	**Total**	**Existing**	**New**	**Total**
Glasgow	193,300	12,800	206,100	0	0	0
Perth	68,500	28,300	96,800	0	0	0
Other	301,700	81,100	382,800	0	0	0
Total	563,500	122,300	685,800	0	0	0

7.26 Passenger miles forecasts for the attractor demand have been estimated using an assumed miles per journey figure for the Arbroath – Dundee corridor from which the majority of demand has been assumed to come, as shown in Table 7.6.

TABLE 7.6 ANNUAL PASSENGER MILES (2011/12) FOR ATTRACTOR DEMAND

	Dundee West	Invergowrie
Existing	1,324,000	962,000
Balgarthno Extension	16,000	0

7.27 There are further non-user benefits from the abstraction of existing trips from Dundee City Centre. Although this is not quantified here, there is some potential for the reduction of congestion and associated air quality impacts relating to some

trips towards and around Dundee Station. Further impacts include the reducing demand on city centre car parking, providing the potential for releasing a proportion of high value land utilised for existing parking capacity.

Full appraisal

Appraisal assumptions

7.28 Up-to-date STAG economic appraisal assumptions have been adopted, as described in the online Technical Database:

- all financials in 2010 prices;
- all NPVs discounted to 2010, discounted at 3.5% pa for first 30 years, and then 3% pa;
- appraisal period of 60 years from opening;
- cap demand, revenue (and operating cost, if there were any) growth at 2032 levels; and
- using standard STAG rail values of time, journey purpose splits, and value of time growth.

7.29 In addition, the following assumptions have been made for the Main Case of the appraisal representing the incremental cost-benefit analysis between stopping the TERS stopping service at Dundee West compared to Invergowrie:

- stations and service opens in December 2019. At this time Western Gateway residential areas are assumed to be completed and fully occupied;
- no difference in operating costs of either the service, or the stations;
- attractor demand at both stations assumed to be 100% new to rail;
- demand ramps up 40%, 70%, 100% over three years after opening for existing markets;
- use of the 'continuing rail competitiveness' demand growth scenario;
- construction cost inflation of 1.5% pa in real terms; and
- optimism bias on the construction costs of 44%, as described in the capital costs chapter.

TEE table

7.30 The full economic appraisal is summarised in the Transport Economic Efficiency (TEE) table. The full table for the Main Case described above is included as Table 7.7.

7.31 This TEE table shows that the Main Case generates a BCR of 2.31:1 and an NPV of £2.5m. This shows that in economic terms the relocation from Invergowrie to Dundee West gives a moderate positive benefit.

TABLE 7.7 MAIN CASE TEE TABLE (2010 PRICES)

Model version 1.1

Economic Efficiency of the Transport System (TEE)

Figures Shown are in Market prices in £000s			PD	RU	TR
Extended Tay Estuary Rail Study		TOTAL	PEDESTRIANS	ROAD USERS	TOTAL RAIL
User benefits - Consumers					
Travel Time		**4,650**	-	821	3,829
Vehicle Operating Costs		-	-	-	-
User Charges		-	-	-	-
During Construction & Maintenance		-	-	-	-
NET CONSUMER IMPACT	(1)	**4,650**			
User benefits - Business					
Travel Time		-	-	-	-
Vehicle Operating Costs		-	-	-	-
User Charges		-	-	-	-
During Construction & Maintenance		-	-	-	-
Sub Total	[2]	-			-
Private Sector Provider Impacts					
Revenues		**1,993**	-	-	1,993
Operating & Renewal Costs		-	-	-	-
Investment (Capital) Costs		**(3,899)**	-	(8)	(3,891)
Grant/Subsidy		**1,907**	-	8	1,898
Revenue Transfer		-	-	-	-
Sub Total	(3)	-	-	-	-
Other Business Impacts					
Private Developer Contribution	(4)	-	-	-	-
NET BUSINESS IMPACT	(5) = (2)+(3)+(4)	-			
TOTAL PVB	(6) = (1)+(5)	**4,650**			

Public Account

Local Government Funding					
Revenues		-	-	-	-
Operating & Renewal Costs		-	-	-	-
Investment (Capital) Costs		-	-	-	-
Developer and Other Contributions		-	-	-	-
Grant/Subsidy payments		-	-	-	-
Revenue Transfer		-	-	-	-
NET LOCAL GOVERNMENT IMPACT	(7)	-	-	-	-
Central Government Funding					
Revenues		-	-	-	-
Operating & Renewal Costs		-	-	-	-
Investment (Capital) Costs		-	-	-	-
Developer and Other Contributions		-	-	-	-
Grant/Subsidy payments		**1,907**	-	**8**	**1,898**
Revenue Transfer		-	-	-	-
NET CENTRAL GOVERNMENT IMPACT	(8)	**1,907**	-	**8**	**1,898**
TOTAL PVC	(9) = (7)+(8)	**1,907**			

Noise (E.I.)		**9**	-	9	-
Local air quality (E.I.)		-	-	-	-
Greenhouse gases (E.I.)		**69**	-	69	-
Journey ambience		-	-	-	-
Accidents		**122**	-	122	-
Consumers	(1)	**4,650**			
Business Users and Providers	(5)	-			
Reliability		-	-	-	-
Option values		-	-	-	-
Interchange		-	-	-	-
Indirect tax revenues		**(444)**	-	(178)	(266)
Present Value of Benefits (PVB)		**4,407**			
Public Accounts		1,907			
Present Value of Costs (PVC)		**1,907**			

OVERALL IMPACTS	
Net Present Value (NPV)	**2,500**
Benefit to Cost Ratio (BCR)	**2.31**

Sensitivity Tests

7.32 To test the robustness of this Main Case a number of sensitivity tests of key assumptions have been undertaken, the results of which are detailed in Table 7.8.

1. reducing the assumed construction cost inflation of 1.5% to 0% in real terms;
2. reducing the capital cost of station construction (for both stations) by 20% due to the improved efficiency of the modular station design concept;
3. assuming a higher mode shift to Ninewells Hospital, 1.5% for Dundee West and 0.5% for Invergowrie;
4. increasing attractor demand to Dundee West Station due to bus based P&R providing a frequent shuttle bus service to Ninewells Hospital, Technology Park and Medi Park;
5. the addition of demand attracted to the proposed Western Gateway Business Park, by assuming this does go ahead;
6. removing the use of the continuing rail competitiveness higher underlying growth forecast until 2019, and reducing to a base forecast which is lower than currently observed; and
7. the assumption that 100% of attracted demand is new to rail, by using a rate of 75% new to rail.

7.33 The table does show that, in all cases there is a positive case for the relocation, with the BCR ranging between 1.21 and 7.07. These tests highlight the sensitivity of the results to key assumptions, particularly those regarding the growth in demand and costs, given the proposed opening of the station is in at least five years' time.

7.34 If the Western Gateway Business Park demand is added to the Main Case demand beyond 2024, the BCR increases to 2.73. If a bus based Park & Ride is located close by Dundee West the BCR increases to 5.08, due to a shuttle bus providing better accessibility to Ninewells Hospital, Technology Park and Medi Park. There is potential for a significantly positive BCR of 7.07, if a slightly less conservative, but still robust, mode shift for Ninewells Hospital is assumed.

TABLE 7.8 SUMMARY OF RESULTS OF SENSITIVITY TESTS

	Main Case	1 0% construction cost growth	2 20% lower modular station costs	3 Higher Ninewells mode shift	4 With bus-based Park and Ride	5 With Western Gateway Business Park	6 Base demand growth	7 25% attractor abstraction
Rail User Benefit	3,829	3,829	3,829	5,459	5,054	4,090	2,682	3,557
Non-user Benefit	1,021	1,021	1,021	1,451	1,343	1,104	718	948
Indirect Tax	(444)	(444)	(444)	(656)	(602)	(480)	(300)	(408)
PVB	4,407	4,407	4,407	6,254	5,794	4,714	3,099	4,097
Revenue	(1,993)	(1,993)	(1,993)	(3,018)	(2,760)	(2,171)	(1,328)	(1,819)
Capital Costs	3,899	3,437	3,662	3,903	3,902	3,900	3,897	3,899
Operating Costs	-	-	-	-	-	-	-	-
PVC	1,907	1,444	1,669	885	1,142	1,729	2,569	2,080
NPV	2,500	2,962	2,738	5,369	4,653	2,985	531	2,017
BCR	2.31	3.05	2.64	7.07	5.08	2.73	1.21	1.97

8 Conclusions

8.1 This Outline Business Case considers the relocation of Invergowrie Railway Station to Dundee West, building on the Tay Estuary Rail Study (TERS) STAG type appraisal previously developed in 2009 and 2011. The proposal assumes an hourly stopping service and compares relocating to Dundee West station with developing Invergowrie station at its existing location to a standard suitable for the increased demand associated with an hourly service.

8.2 The demand forecasting analysis indicates that providing an hourly service and relocating the station to Dundee West would result in a demand forecast of 196,300 trips per year (before applying growth), in comparison to 88,200 trips per year, if the hourly service was to continue to call at an improved Invergowrie station at its current location.

8.3 Much of the difference in demand is due to the provision of a car park at Dundee West, thus allowing both a walk and drive in catchment, compared to the constrained Invergowrie location which has no space for a car park and therefore is limited to a walk in catchment only. The walk in catchments of both locations are similar in total, albeit covering a slightly different geographical area.

8.4 The Dundee West location overall offers improved access opportunities to business, health, commercial and employment organisations in the area, notably Ninewells Hospital and the potential Western Gateway Business Park, albeit the move away from Invergowrie will reduce accessibility benefits for employment uses associated with the existing James Hutton Institute and proposals for the Institute's expansion.

8.5 The capital cost of providing a relocated station at Dundee West is estimated at £6.9m (including 44% optimism bias) in comparison to £2.7m for upgrading the existing Invergowrie station to a suitable standard for an hourly service. These costs do not include potential savings due to Network Rail's drive to reduce unit cost through the use of modular station design.

8.6 The proposal has been shown to support the TERS objectives and therefore the overarching objectives of the National Transport Strategy, Strategic Transport Projects Review (STPR), and Tactran Regional Transport Strategy (RTS). More specifically, the relocation of Invergowrie to Dundee West outperforms the base reference case to upgrade Invergowrie station in the appraisal of Government and TERS objectives, showing more positive impacts.

8.7 Furthermore, the Dundee West proposal has synergies with the regional Park & Ride sub strategy EPR 5 to provide additional demand for car parking where demand warrants, supporting new and existing development with easier access than the existing Invergowrie site which is too constrained to offer sufficient parking capacity.

8.8 Dundee West location supports a more integrated transport network located on the area's main road network and green circular cycle path and in proximity to the airport . This in turn can help promote the use of enhanced rail services serving the area, stimulating peak demand for commuters and business travellers.

8.9 The economic appraisal concludes that the relocation presents a moderate positive business case, with a BCR of 2.31:1 and an NPV of £2.5m.

8.10 However, the business case and objective appraisal relies on a couple of "givens" to allow the proposal to relocate Invergowrie station to Dundee West to reach its potential:

- An hourly stopping service between Arbroath and Glasgow;
- Western Gateway residential villages occupied.

8.11 The case is supported by additional demand generated from Ninewells Hospital and the Medi Park which is better met through the Dundee West location than the existing Invergowrie station location. The sensitivity testing indicates that the objective appraisal and positive business case is improved to 5.08:1 if a bus based P&R is located nearby the Dundee West site. The positive business case is improved to 7.07:1 if less conservative, but still robust, assumptions are made about rail mode share at Ninewells Hospital. Cost savings due to improvements in modular station design improves the business case BCR to 2.64:1. The demand forecasting sensitivity tests also show the case would be improved by the Western Gateway Business Park being developed post 2024.

8.12 This initial work demonstrates the proposal to relocate Invergowrie Station to Dundee West has the potential for a positive business case and a positive assessment against TERS and Scottish Government transport objectives.

APPENDIX

A

CAPITAL COSTS

APPENDIX TABLE A.1 DETAILED CAPITAL COSTS FOR DUNDEE WEST STATION (Q1 2013 PRICES)

Station Construction Costs	Quant	Unit	£ - Rate	£ - Total	Comments
Single story modular building - floor area	0.00	m2		0	Assumed not required
Excavation (part rock) & site prep	600	m2	100	60,000	
Platforms	600	m2	1,500	900,000	2 platforms * 75m long * 4m wide
Platform retaining wall (down side)	0	m2		0	Assume retaining wall not required due to ground conditions
Platform raising (up side) - ???	320	m2	200	64,000	Allowance
Platform lighting - 2nr x 75m platforms @ 10m crs	16	nr	3,000	48,000	
Platform shelter & seating	2	No	20,000	40,000	Macemain
LLPA / CIS / CCTV / Help Points	1	item	60,000	60,000	PA & CCTV fixed to lighting towers. PA = 4nr x £1k, CIS = 2nr x £8k, CCTV = 4nr x £3k, Help Points = 1nr x £8k. Plus £20k Control Units & Cabling
DDA ramped overbridge (no lifts) - 196m x 2m - Inc bridge/ramp lighting	392	m2	2,500	980,000	Assume demolition and removal of existing lattice footbridge. Replacement with steel frame DDA ramped overbridge (no lifts, no stairs). Note main span extended across to Station Road for access. See separate design and construction commentary
Platform Access	1	item	50,000	50,000	
Signalling:- 1nr ~ 3-Aspect Signal (inc mast & found) at the end of each new platform	2	No	85,000	170,000	Inclusive of TPWS, AWS, Track Circuit, IBJ + 50% x Location Case
External Works to Station					
Footpaths	120	m2	100	12,000	
Access road 7.3m wide (inc pavements)	70	m	1,520	106,400	To A85
Car Park (including lighting, marking, drainage) - Phase 1	3,500	m2	150	525,000	Land available for 394 spaces - assume incremental expansion. Cost is for 140 spaces
Traffic light controlled junction	0	item		0	Assumed not required
Car Park Fencing - Post & Rail	300	m	40	12,000	
Signage - A85 to Car Park	1	sum	10,000	10,000	
Sewer protection works	1	sum	25,000	25,000	No Details
Culvert works for swale	1	sum	25,000	25,000	Crossing/Pipejack of A85
Swale construction	2,000	m2	50	100,000	
Drainage Culvert under A85 to Swale	1	sum	20,000	20,000	
Temporary RRAP + Warning Lights	1	sum	20,000	20,000	
Total Base Cost - Dundee West Station				**3,227,400**	

Non Construction Costs	% of Base	Unit	Rate	Total	Comments
Contractor preliminaries	20.00%			645,480	
GRIP stages 1-4 design development	3.50%			112,959	Inc Signalling
GRIP stage 5 design + 6 to 8 Attendance	5.50%			177,507	Inc Signalling
NR Project Management + Sponsor	8.00%			258,192	
Possession Management - PICOP + Handsignalmen (2nr) - 45nr x 8hr shifts	45	shifts	1,500	67,500	
TOC Compensation	2.00%			64,548	Major works carried out in Mid Week Nights/Weekend booked possessions. :. Minimal
Land	1.00	item	£ 150,000	150,000	a) Permanent:- Car Park (Phase 1) + New Footbridge (north ramp) + North Platform + Access pathway from Perth Road + Swale to south of the A85 requirements = approx 2acres x £50k/acre ?? - Say £150k inc fees
Ticket Vending Machines (TVM's):- a) Station & b) Car Parks	1	item	35000	35,000	a) Station = £35k/nr x 1nr
Power Supply to Station & Car Park	1	item	50,000	50,000	Allowance
Total Non Construction Cost				**1,561,186**	
Sub Total				**4,788,586**	
Optimism Bias	44.00%			**2,106,978**	
TOTAL				**£ 6,895,564**	

APPENDIX TABLE A.2 DETAILED CAPITAL COSTS FOR INVERGOWRIE STATION (Q1 2013 PRICES)

Station Construction Costs	Quant	Unit	£-Rate	£-Total	Comments
Single story modular building - floor area	0.00	m2		0	Assumed not required
Platforms (extend to 3 car) - inc site prep	90	m2	1,500	135,000	(10m + 4m platform extension + 2 x 4m ramps) x 4m wide = 88m
Platform lighting towers - 2nr x 75m Platforms @10m crs	16	nr	3,000	48,000	Improve existing lighting: 70m plats x 3m wide x 2No. = 420 x 20% for bridge ramps and station access = 500m2
Platform shelter & seating	2	No	20,000	40,000	Macemain
LLPA / CIS / CCTV / Help Points	1	item	60,000	60,000	PA & CCTV fixed to lighting towers. PA = 4nr x £1k, CIS = 2nr x £8k, CCTV = 4nr x £3k, Help Points = 1nr x £8k. Plus £20k Control Units & Cabling
DDA ramped overbridge (no lifts) - 196m x 2m - Inc bridge/ramp lighting	392	m2	2,500	980,000	Assume demolition and removal of existing lattice footbridge. Replacement with steel frame DDA ramped overbridge (no lifts, no stairs). Note main span extended across to Station Road for access. See separate design and construction commentary
Demo of existing footbridge	1	item	15,000	15,000	
External Works to Station					
Footpaths	5	m2	100	500	Assume minor mods to the North end - dropping the kerb primarily.
Access road 7.3 wide (inc pavements)	0	m		0	Assumed not required
Total Base Cost - Invergowrie Station				**1,278,500**	**Net Direct Works Cost**

Non Construction Costs	% of Base	Unit	Rate	Total	Comments
Contractor Preliminaries + Overheads & Profit	20.00%			255,700	
GRIP stages 1-4 development	3.00%			38,355	
GRIP stage 5 design + 6 to 8 Attendance	5.00%			63,925	
NR Project Management + Sponsor	8.00%			102,280	
Possession Management - PICOP + Handsignalmen (2nr) - 30nr x 8hr shifts	30	shifts	1,500	45,000	See separate design and construction commentary
TOC Compensation	2.00%			25,570	Major works carried out in Mid Week Nights/Weekend booked possessions. :. Minimal
Land	1.00	item	10,000	10,000	a) Permanent:- New Footbridge (south ramp) requirements = approx 1acre x £50k/acre ?? - Say £10k inc fees
Ticket Vending Machines (TVM's):- a) Station & b) Car Parks	1	item	35000	35,000	a) Station = £35k/nr x 1nr
Power Supply to Car Park					
Total Non Construction Cost				**575,830**	
Sub Total				**1,854,330**	
Risk (not Optimum Bias)	44.00%			**815,905**	
TOTAL				**£ 2,670,235**	

APPENDIX

B

OBJECTIVES APPRAISAL

B1 OBJECTIVES APPRAISAL

APPENDIX TABLE B.1 DUNDEE WEST TERS OBJECTIVES

TERS Objectives	Performance against objective
EC1. Ensure that rail provides and supports economic growth by connecting key business & employment sectors where possible	Moderate Positive – a relocated station would encourage a greater switch to rail travel for the surrounding catchment. The new location would assist in encouraging more travellers to/from local business locations to access the station and thus lead to an increase in demand for rail services. Improved access to services and destinations would support economic growth at both local and regional levels.
EC2. Improve the efficiency, reliability and integration of rail services in the Tay Estuary study area specifically where this will benefit key business and employment sectors	Neutral – the relocated station itself will not improve this objective.
ACC1. Increase accessibility to key service destinations in the TACTRAN area (e.g. employment, health and education sites) and to/from key external destinations by rail without compromising wider inter-regional rail connectivity	Minor Positive – the enhanced station would facilitate improved access to Ninewells Hospital, Medi Park and the Balgarthno Extension development site. Improved parking supply at the station will increase accessibility to those who would like to park and travel by rail and will increase the potential for buses to access the station.
ENV1. Contribute to national greenhouse gas emission reductions through rail based interventions where possible	Minor Positive – the improved parking facilities, supported by a linking bus service for the additional rail services are likely to encourage a modal change from road to rail. There may be some further benefits from the abstraction of car trips to Dundee City Centre for Dundee Station and any associated congestion.
ENV2. Contribute to the management of air quality in the TACTRAN area, particularly the AQMA's across the Dundee City Council area and Perth	Minor Positive – significantly more journeys are forecast to be abstracted from Dundee Station for Dundee West, thereby reducing traffic congestion and improving air quality in Dundee city centre, where there are identified AQMA hot spots. Conversely, there are risks of some localised build-up of traffic around the station car park , potentially affecting local air quality.

TERS Objectives	Performance against objective
SEC1. Maintain or improve real and perceived levels of safety and personal security on the rail network	Neutral – both stations will be equipped with lighting, CCTV, shelters and seating which would enhance the levels of safety and personal security.
INT1. Ensure that rail is fully integrated with relevant land-use and planning projects	Moderate Positive – the project is supported by existing trip generators from Ninewells Hospital and the Medi Park, as well as demand from Balgarthno Extension identified in Dundee Local Development Plan. From a land use perspective, the relocated station offers a more integrated transport solution, matching transport provision with planned spatial development.
INT2. Ensure the rail network is integrated with the wider public transport network	Minor positive – improved integration between airport, bus services and green circular walk/cycle route, combined with new development and existing trip generators offer greater potential for modal shift.

APPENDIX TABLE B.2 DUNDEE WEST AND SCOTTISH GOVERNMENT OBJECTIVES

Objectives	Assessment summary	Supporting information
ENVIRONMENT	Air quality = minor positive	Air Quality –improved road access and increased car parking provision could expect to achieve a modal shift to train from private car and therefore improvements to air quality at a strategic level. Also abstracting trips from Dundee city centre and alleviating know AQMA hotspots
	Noise and vibration = minor negative	Noise and Vibration – at the new site, some impacts could be expected from traffic travelling to and from the station. Additional impacts would be during the construction process for which mitigation measures will be put in place in accordance with industry standards.
	Water quality, drainage and flood defence = neutral	Water Quality, Drainage and Flood Defence - no change
	Biodiversity = minor negative	Biodiversity – loss of green space for car park expansion will reduce biodiversity on and around the site.
	Landscape = minor negative	Landscape - alterations to the landscape may comprise existing conditions for residents in the immediate vicinity of the proposed site.
	Visual amenity = minor negative	Visual Amenity – the conversion of green land to car park spaces and a new road access is less appealing visually, albeit the impact of this would be mitigated through screening and environmental enhancements.
	Agriculture and soils = neutral	Agriculture and Soils – no issues identified, but a more detailed assessment of the site would take place prior to implementation
	Cultural heritage	Cultural Heritage – no issues identified
SAFETY	Accidents = minor positive	Accidents – encouraging trips on the major road network and away from the local roads around the existing site could reduce the risk of road accidents. Promoting a greater likely shift from road to rail will also reduce the number of possible collisions on the trunk road network.
	Security = neutral	Security – At both station locations CCTV and lighting will improve the areas security level. With an increase of pedestrian footfall, human

Objectives	Assessment summary	Supporting information
		surveillance is created.
ECONOMY	Transport Economic Efficiency (TEE) = moderate positive	TEE – the enhanced station has a positive business case and will therefore contribute positively to economic efficiency. The likely use of additional rail services will be supported by existing and planned employment and housing development.
	Economic Activity and Location Impacts = moderate positive	EALI - the station facilitates access to employment opportunities.
INTEGRATION:	Transport Integration = minor positive	Transport Integration – provides potential for a rail/airport transport hub, improved access to walk/cycle network and allows improved access to rail and onward services from other stations.
	Land-use transport integration =- moderate positive	Land-use Transport Integration – option should have a positive effect on business / employment across the region, with a better catchment area than Invergowrie station.
	Policy integration = minor positive	Policy Integration –proposals fit well with the TACTRAN Regional Transport Strategy, local development documents, TAYplan, and Scottish Government's National Transport Strategy and Strategic Transport Projects Review.
ACCESSIBILITY AND SOCIAL INCLUSION	Community Accessibility = minor positive	Community Accessibility – the enhanced station would enhance the attractiveness of rail to the public and will have benefits for those with restricted or no access to the private car. This is balanced against the loss of a station in close proximity to households in Invergowrie.
	Comparative Accessibility = minor positive	Comparative Accessibility – high quality new station design and nearby parking will allow access to disabled groups and those with restricted access to the private car. This will come to full effect if suitable public transport links to and from the station are implemented.

CONTROL SHEET

Project/Proposal Name	Invergowrie Station Relocation
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Client Contract/Project No.	Click here to enter text.
SDG Project/Proposal No.	22533201

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REVIEW

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