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EDINBURGH TRAM NETWORK

STAG2 Report : **Line Two**

September 2004

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TRANSPORT INITIATIVES EDINBURGH

EDINBURGH TRAM LINE 2

STAG REPORT

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ISSUE 2

FABER MAUNSELL

Edinburgh Tram Line Two
Executive Summary

Introduction
This STAG Report summarises the work that has been undertaken in developing the case for a Tram Line in West Edinburgh. Initially the case for a network of Tram Lines was established within the Integrated Transport Initiative for Edinburgh and South East Scotland, which was examined as part of a package aimed at addressing the congestion problems in Edinburgh. This together with the North Edinburgh Rapid Transit Solution Feasibility Study and the Edinburgh LRT Masterplan study confirmed the priority of developing a new high quality Tram in West Edinburgh. Considerations that led to the selection of light rail as the preferred solution for North Edinburgh also apply to the West Edinburgh corridor. Subsequently FaberMaunsell and their sub-consultants have developed a Preferred Route and Operating System for the Edinburgh Tram Line Two. During this time the engineering feasibility, environmental impact and revenue/patronage forecasting has been undertaken for a variety of options seeking to provide a first class public transport system from the city centre to the western edge of the city.

This work has concluded that the introduction of a tram into West Edinburgh is consistent with the objectives of the City Council and will contribute to the realisation of the Vision for Edinburgh.

Planning Objectives
The Planning Objectives for this work were established from a review of the City of Edinburgh Council's own aims and objectives for transport contained within their Local Transport Strategy. The planning objectives have been used consistently throughout the process and are as follows:

- **To improve accessibility** – improvements, particularly for people without access to a car, on low incomes or whose mobility is impaired are fundamental to the achievement of both the social inclusion and economic development elements of the transport vision. Specific objectives are:
  - To improve access to the public transport network;
  - To improve access to employment opportunities: and
  - To support economic development.

- **To reduce pollution and environmental damage caused by traffic** – this is fundamental to the achievement of the environmental / sustainability aspiration and will contribute to the achievement of the safety element of the transport vision. Specific objectives are:
  - To increase the proportion of journeys made by public transport, walking and cycling;
  - To improve local air quality; and
  - To reduce emissions of greenhouse gases

- **To reduce traffic congestion** – this is fundamental to the achievement of economic development and environmental aims. Specifically the scheme should:
  - Reduce the number of private vehicle kilometres; and
  - Reduce traffic volumes and key routes.

- **To make the transport system safer and more secure for both users and non-users** – this is fundamental to the achievement of the safety and community elements of the vision and will contribute towards achieving the environmental and social inclusion elements. Specific objectives are to:
  - Reduce the number of road traffic accidents; and
  - Improve personal security when using the transport system.

Problems and Opportunities in West Edinburgh
Edinburgh's economic success as a growing region for employment and increasing population has led to many pressures arising in its transport networks. This together with increasing demands for new developments, particularly in the West Edinburgh area, will mean that this congestion is likely to increase further.

It has been estimated that traffic levels in Edinburgh will grow by 20% over the 20 years. Traffic delays, however, grow at a disproportionate rate and as a result the time lost in traffic due to congestion is expected to double. The most serious problems are expected in West Edinburgh, which has been shown to account for almost half of the additional congestion. There is a concern that the competitiveness and, thus, the dynamism of the Edinburgh and Lothian's economy will be reduced if the region's strengths are not further developed and this would have a negative impact upon Scotland as a whole. Traffic congestion is causing problems for all road users through delays to commercial vehicles, private car and bus. Traffic congestion can impede effective business and discourage the location of new or expanding businesses in or near the city. As a consequence, congestion is harming the local economy and the environment.

Project History (Option Generating, Sifting, Development and AST1 work)
Development work on the ITI initially began in the late-1990s. This final strategy contains a Vision for Edinburgh and was submitted to the Scottish Executive in September 2002. This was approved in principle and therefore provided the initial justification for a package of schemes, together with congestion charging,

as the way forward to tackle the problems expected to face the City. This package included a network of Tram Lines serving the North, West and South East of the City.

This network was explored further in the LRT Masterplan study undertaken by Arup, which confirmed that the Northern Loop should receive the highest priority followed by the Western and South-Eastern lines. In addition, the Feasibility Study for a North Edinburgh Rapid Transit Solution undertaken by Andersen examined the wide range of different technologies available in the Public Transport market before concluding that LRT or Tram based technology was the best solution for a network in Edinburgh.

These studies form the basis of the STAG Part 1 Appraisal and the Part 1 Appraisal Summary Tables are included in Appendix A to this main report.

The West Edinburgh Corridor

The starting point for FaberMaunsell's more detailed work was to choose a Preferred Route Corridor for the West Edinburgh Tram route (or Edinburgh Tram Line Two as it had become known). From a wide selection of options a "Central" corridor based largely on the previous CERT corridor was chosen using the following criteria:

- Engineering;
- Traffic and Transportation;
- Safety;
- Environment;
- Economy/Development;
- Accessibility; and
- Integration.

Throughout the course of this work consultation with third parties was undertaken and key issues were fed into the corridor selection process. In some areas it was difficult to identify the preferred route within the corridor so options were carried forward in key areas such as the city-centre, from Roseburn to Carrick Knowe, near Gogar roundabout and at the Airport.

Consultation

The Preferred Corridor together with the local options was then the subject of an extensive public consultation process. This informed major stakeholders and the residents of Edinburgh about the proposals and it provided the opportunity to comment in a variety of ways.

The results of the consultation show that there is broad support in Edinburgh for the tram proposals and preferences for each of the options presented was expressed. Further technical work and focussed consultation was undertaken to address specific issues arising from the consultation before the Preferred Route was determined.

Scheme Description

The Preferred Route begins at St Andrew Square before travelling along Princes Street and Shandwick Place to Haymarket. It then runs parallel to the main Edinburgh to Glasgow railway line, initially on the north side but crossing over the railway to run on the south side as far as the new Edinburgh Park Rail Station.

From this point it crosses the rail line once more and runs northwards through the Edinburgh Park and Gyle Shopping Centre. After crossing under the A8 to the east of Gogar roundabout, the Tram passes close to the new Royal Bank of Scotland Headquarters (albeit on the other side of the A8) before reaching the new Park and Ride site at Ingliston. At this point the line swings northwards to Edinburgh Airport where it will terminate.

A second Line (the Newbridge branch) will run between the Ingliston Park and Ride stop westwards towards Ratho Station and the new developments at Newbridge where it will terminate. The point of termination has been chosen to allow for future extension of the line. This line to Newbridge was introduced as a branch line, instead of a direct extension of the main route, as a result of the patronage estimates and planning difficulties arising from uncertainties regarding the future expansion of the Airport and its impact on Royal Highland Showground land, however it could be utilised as the main route should the operator wish.

The frequency of both the main line and the Newbridge brance will see 6 trams running in each direction in each hour during the peak. Each tram will have a capacity of up to 300 passengers giving an overall capacity for the system of 1,800 passengers per hour in each direction. It is proposed that the Tram depot will be located at Gogar and there will be stops located at the following locations:

Main Line
St. Andrew Square
Princes Street
Shandwick Place
Haymarket
Murrayfield
Balgreen Road
Saughton Road North
South Gyle Access
Edinburgh Park Station
Edinburgh Park
The Gyle
Gogarburn
Ingliston Park & Ride
Airport

Newbridge Branch
Ingliston Park & Ride (interchange with the main line)
Ingliston West
Ratho Station
Newbridge South
Newbridge North

STAG Part 2 Appraisal
The Scottish Executive STAG appraisal guidelines have been used throughout the process. The notable issues arising from the Part 2 appraisal of the preferred Option are summarised below.

Environment
The assessment identifies a number of positive environmental benefits associated with Edinburgh Tram Line Two. It will have a minor positive impact on air quality with reductions in CO_2 emissions of 3% and 9% in 2011 and 2026 respectively. Accordingly, the planning objective of reducing the omissions of greenhouse gases is met.

In terms of local air quality, greater benefits are expected along Haymarket Terrace and Morrison Street. Other benefits are predicted along Saughton Road. The scheme is shown to have a beneficial impact on Oxides of Nitrogen and Particulate Matters and therefore the objective of improving local air quality is met overall.

Landscape and ecological benefits would occur along some segregated sections of the route where new planting would be undertaken. The tram would also have a number of negative impacts. The construction phase will result in short term-localised disruption to residents and businesses. Vegetation including trees will be lost in several locations including land behind Baird Drive and within the greenbelt. However, replacement planting is proposed in these areas.

The main impacts are associated with the presence of tram infrastructure within Edinburgh's World Heritage site and in the greenbelt. Negative heritage, landscape and visual impacts are predicted within these sensitive areas. Heritage impacts would also occur at Gogar and Huly Hill in Newbridge. Operational noise impacts would be negligible along much of the route but negative impacts are predicted at residential properties at Balbirnie Place, Baird Drive, and Ratho Station. A Design Manual has been produced and additional mitigation measures proposed to integrate the tram into the landscape and townscape. This will mitigate more localised impacts and, where appropriate, will enhance the local landscape structure.

The tram would also result in a loss of some high quality agricultural land and run through an area of importance for flood control south of Edinburgh Airport.

Safety
The personal security concerns of many individuals when using public transport will be dealt with through the design of mitigating facilities within the tram development. For example, Edinburgh Tram Line Two will have stops fitted with high quality lighting and closed circuit television. In addition it is possible to provide emergency help phones if necessary. Similarly, on board the modern tram it is possible to design a safe and secure environment. Thus it is fair to assume that Edinburgh Tram Line Two will provide a degree of improved security for potential patrons and system employees, meeting the improved security objective.

In terms of road user accidents it is not envisaged that there will be any significant change in the number of road accidents occurring during the early years of operation. General background economic development over the assessment period of 30 years however, leads to a net increase in car use and accidents. The tram scheme results in a change in the modal split between public transport and cars, attracting patronage from both cars and existing public transport users. On the basis of the forecast background growth in demand, the tram gives rise to a net decrease in car use and accidents and the scheme meets the overall objective of improving road safety. However, second order effects of the tram lead to further economic development and an associated increase in demand for travel. This in turn gives rise to a small net increase in car use and minor accidents in the later years of the scheme life. This issue would need to be addressed by other appropriate policy measures.

Economy
As required by STAG, this report includes consideration of the economic welfare impacts of the proposal (Transport Economic Efficiency, TEE). This appraisal provides a review of what users are willing to pay in order to use the tram line; the financial impact on private sector transport providers; and impacts arising from land use or other impacts of the tram line.

The benefits and costs of this tram project have been calculated over a 30-year period and are summarised below.

The Benefit Cost Ratio of the Preferred Route was calculated as 1.40. This means that the overall benefits of the scheme exceed the costs by 40% and therefore represents good value for money in economic terms

In addition, an assessment has been made of the economic activity and location impacts (EALIs), including quantification of the impacts in terms of employment gains and losses, as well as income / GDP.

Integration
The integration of the Tram with transport, land-use and wider policies has been reviewed within this report. In terms of transport integration the tram route will provide rail interchange opportunities at Waverley, Haymarket and the new station at Edinburgh Park. Bus interchange opportunities will also be possible at the Gyle Shopping Centre and at other locations.

The Finalised Edinburgh and Lothians Structure Plan 2015 makes clear that the delivery of a tram system is crucial for the successful delivery of the plan's development strategy. The Finalised Rural West Edinburgh Local Plan states that the routing of the Tram to Newbridge, and eventually beyond, is crucial to delivering a sustainable development solution in the Newbridge/Kirkliston/Ratho area.

The tram route will connect well with the Park and Ride facilities at Ingliston, ensuring that an alternative choice can be provided for motorists.

The Preferred route integrates well with land-use as it connects residential areas well with major employment, leisure and transport hubs thus contributing to sustainability and reducing the need to travel by public transport. In addition there is also greater scope for development opportunities resulting from the eventual routing of the tram route.

In terms of policy integration the tram is shown to contribute to wider Government policies on Disability, Health and Social Exclusion

Accessibility
The proposed tram line is expected to increase accessibility by public transport with key benefits realised by those who do not own a private car and by the socially disadvantaged. The higher reliability of tram, relative to bus, will particularly benefit these groups and will, in practice, increase accessibility of the public transport network. There are a number of socially deprived wards in and around the proposed route of the tram in which the tram will provide increased accessibility to employment opportunities.

In terms of access to local services it is considered, since the tram mainly runs off street, that it will have only minor adverse impacts on local accessibility.

Overall, the analysis demonstrates a general improvement in accessibility with some very significant benefits for certain movements. There are, however, some disbenefits, mainly as a result of reduced highway capacity in the city centre. In general, access to local services is improved as a result of the scheme and the more deprived areas within the corridor share in the benefits. Overall, the objective of improving accessibility is met.

Costs
The costs developed for this study include capital costs, operating costs and life cycle costs.

Capital cost estimates for Edinburgh Tram Line Two have been prepared using a combination of benchmarking, previous experience and engineering judgement.

The capital costs are estimated at £320.9M (including 25% optimism bias), based on 2Q 2003 prices. Costs have been derived from a comprehensive database compiled from analyses of costs for the infrastructure works of completed and proposed LRT schemes throughout the UK, currently advised prices from vehicle manufacturers and preliminary diversionary works estimates obtained from utilities companies. The resulting estimates take account of the prevailing factors influencing this particular scheme including location, relative complexity, environment and anticipated programme.

Operating costs, which include the cost of operating the system, maintenance and lifecycle costs and management fee, are expected to be around £7.8 million pounds per annum.

Summary of Cost-Benefit Appraisal

Present Value of Benefits (PVB)	£288 million
Present Value of Costs (PVC)	£206 million
Net Present Value (NPV)	£82 million
Benefit Cost Ratio (BCR)	1.40

Patronage and Revenue

The Tram is expected to carry around 5 million passengers in the opening years, which will grow to around 7 million passengers some 15 years later. The revenue expected from this level of demand will be £6 million in the early years, growing to over £8 million. These figures assume an allowance for fare evasion and a variety of ticket types.

Risk and Uncertainty

One of the critical success factors for Edinburgh Tram Line Two is the identification and mitigation of the risks inherent in a project of this nature. In order to manage risk in a structured manner, **tie** has appointed a full-time Risk Manager to develop and apply a framework of risk analysis and evaluation to assist in decision-making, and achieve the following prime objectives:

- Mitigate all identified risks to a 'medium' significance or less;
- Pass all identified risks to the best parties capable of managing the risk;
- Creation of a culture of risk awareness and management;
- Delivery within budget and on time;
- Provide a fully functioning operational service; and
- Obtain support from all key stakeholders.

tie has developed clear and active processes to identify and mitigate project risks in accordance with industry best practice. The **tie** Board takes ultimate responsibility for risk, with responsibility delegated to the Project Director.

Monitoring and Evaluation

There are five phases of the project which require consideration during the monitoring and evaluation process, namely:

- Scheme development;
- Infrastructure procurement;
- Construction;
- Testing and Commissioning; and
- Operations.

The STAG requirements for monitoring and evaluation are principally associated with the operational phase, following scheme implementation. However, it is also necessary to assess and re-appraise the project during phases prior to implementation.

tie has been, is, and will continue to take steps to validate and evaluate the scheme (both before and after implementation) and to monitor its performance in the operational phase.

Conclusions

The Integrated Transport Initiative was developed by **tie** to address the problems that currently exist, and those that are forecast to exist in the future, on Edinburgh's transport networks. It identified that failure to provide an effective solution would be detrimental to the vibrant and dynamic economy of both the city and the wider region.

At the heart of the solution identified was a network of tram routes serving the city. This was found to best meet the objectives identified in the Part 1 Appraisal process. These objectives have been used further to identify the Preferred Route for the West Edinburgh route or Edinburgh Tram Line Two. The appraisal has identified that this route from St Andrew Square to the Airport and via the branch line to Newbridge best meets the planning objectives in that:

- It enhances the accessibility of key areas within the city thereby improving access to employment and social opportunities, especially for those without private transport;
- Local air quality is expected to improve and greenhouse gas emissions reduce as a result of the introduction of the trams. This is a fundamental requirement of the environmental/sustainability aspiration of the city;
- Traffic congestion is reduced as illustrated by the economic benefits arising from the introduction of the scheme; and
- The tram itself will provide a safe and secure environment both on board and at the stops. There will be no increase in the number of accidents in 2009 as a result of the introduction of the tram.

It is therefore concluded that the introduction of the tram into west Edinburgh is consistent with the objectives of the City Council and will contribute well to the realisation of the Vision for Edinburgh.

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Disclaimer Notice

The contents of this report have been produced for **tie** for submission to the Scottish Executive and the City of Edinburgh Council. It should only be used in association with the development of the Edinburgh Tram Line Two project for **tie**.

The projections of demand and revenue contained within this document represent the author's current best estimates. While they are not precise forecasts, they do represent, a reasonable expectation for the future, based on the most credible information available as of the date of this report.

The estimates contained within this document do however rely on assumptions and judgements and which are influenced by external circumstances that can change quickly and could in certain circumstances affect the results.

It has been necessary to base much of this analysis on data collected by third parties. This has been independently checked whenever possible. However, **tie** and their advisors do not guarantee the accuracy of any third party data.

1 INTRODUCTION



1. Introduction

1.1. Background

1.1.1. The Integrated Transport Initiative

The City of Edinburgh Council (CEC) is examining ways of providing the city with the transport system necessary to promote and support a growing local economy and creates a healthy, safe and sustainable environment. In order to address the need for sustainable investment in transport in and around Edinburgh, CEC has developed the Integrated Transport Initiative for Edinburgh and South East Scotland (ITI). CEC is working in cooperation with other local authorities in South East Scotland to deliver this £1.5 billion strategy. Transport Initiatives Edinburgh Ltd **(tie)** has been established by CEC as a vehicle to deliver the ITI.

The ITI strategy includes road user charging and investment to create a high quality public transport system. As a key component of the strategy for public transport investment in Edinburgh, CEC is proposing to develop a network of modern Light Rapid Transit (LRT), or tram, routes. **tie** is currently promoting 3 urban tram lines, with further lines and extensions envisaged in the longer term. The three lines currently being developed are:

- Line 1 – Northern Loop, linking the City Centre with Granton and Leith;
- Line 2 - West from the City Centre to serve Edinburgh Park and the Airport; and
- Line 3 – From the City centre to South-Eastern Edinburgh.

Each line is being developed and approvals sought independently with a separate, but parallel, network study providing the over-arching framework for the development of the tram system in Edinburgh. On this basis, separate Scottish Transport Appraisal Guidance (STAG) appraisals and Parliamentary Bills are being submitted for each line. Accordingly, this report relates to the impacts of Line 2 only. A parallel report deals with the impacts of Line 1 and a full STAG report for Line 3 will be completed during 2004. FaberMaunsell was appointed in October 2002 to undertake all technical work associated with Edinburgh Tram Line 2.

It should be noted that proposals for a modern rapid transit system in Edinburgh have a long history. Since the closure of the Edinburgh tramway network in 1956 there have been a number of attempts to reinstate a tramway system. In 1987, a two-line 'light metro' was proposed, with a significant part of the North-South Metro route underground, but was not progressed beyond the design stage because of the high cost. In 1993, the Edinburgh Tram Company was formed by Forth Ports, which was keen to develop its redundant acres in Leith, Newhaven and Granton, by building a tramway from Haymarket to Newhaven via Princes Street. At the same time, the City of Edinburgh Rapid Transit (CERT) scheme was developed to provide a kerb-guided busway from near the Airport to the edge of the city centre. This scheme was developed as a Private Finance Initiative project and reached Preferred Bidder stage. However, it proved impossible to reach agreement on the funding arrangements on a basis that provided good value for money to the public sector. Although CERT has been abandoned, an award has been made by The Scottish Executive for the West of Edinburgh Busways Scheme (WEBS), which would incorporate two stretches of guideway from Edinburgh Park to Stenhouse.

The current proposal for LRT in North Edinburgh to link the Granton waterfront with the city centre resulted from a study commissioned by Waterfront Edinburgh Ltd. The Waterfront Edinburgh Study examined a wide variety of appropriate technologies such as Guided Bus, Conventional Bus and LRT. This study concluded that light rail (or tram) technology was most suited to meet the particular needs of Edinburgh.

CEC commissioned Arup in December 2001, to undertake the "Edinburgh LRT Masterplan Feasibility Study". This study was designed to identify a viable network of LRT routes and to provide sufficient data for the overall assessment and prioritisation of routes within the ITI. The study reported in January 2003 and confirmed that the three lines currently being progressed should be the highest priorities for development.

This study provided the basis for the Public Transport Fund bid for the further development of the tram routes. Arup's work also confirmed that light rail was the preferred solution for West Edinburgh. The study made the case for light rail, building on the benefits of the West Edinburgh Busway Scheme (WEBS). This has been further confirmed in the appraisal set out below.

1.1.2. Line 2: The Western Route

Edinburgh Tram Line 2 will run from Edinburgh City centre to Edinburgh Park, Edinburgh Airport and Newbridge. Extensions of Line 2 to Livingston and Queensferry are possible.

Tram Line 2 commences at St Andrew Square and will run on-street through the City Centre to Haymarket. This section of the route is shared with Tram Line 1. From Haymarket to Edinburgh Park the line will operate off-street, generally adjacent to the alignment of the main Edinburgh-Glasgow railway line, passing through residential areas.

Before leaving the railway alignment, Tram Line 2 will serve existing industrial areas at South Gyle and Sighthill. Tram Line 2 leaves the rail alignment to the west of the new Edinburgh Park heavy rail station and turns to the north, passing through the Edinburgh Park development. The Edinburgh Park and South Gyle sections of the route will serve a major concentration of office and industrial developments. A large amount of new office space is planned, particularly in the south of this area. This should both increase the potential usage of the tram and should also contribute to the attractiveness of existing and proposed developments in the area.

Edinburgh Tram Line Two will also serve Edinburgh Airport. The Airport is an important market and demands high quality connections to Edinburgh Park, the city centre and elsewhere in Edinburgh.

Due to operational constraints, the service from Ingliston to Newbridge will be operated as a separate branch line shuttle service, calling at the Royal Highland Showground, Ratho Station and terminating at Newbridge. There are a small number of businesses in the vicinity of the Royal Highland Showground, but these businesses produce negligible demand for Edinburgh Tram Line Two. However, a Royal Highland Showground station will cater for the large shows which take place approximately six times a year and which generate a large demand, mainly outside the peak demand periods for the other sections of Edinburgh Tram Line Two.

There are few land developments in the area between the Royal Highland Showground and Newbridge, although plans are in place for new office developments in the area of Ratho Station and there are a number of residential areas in the vicinity of Ratho Station, which will benefit from Edinburgh Tram Line Two.

There are a number of industrial units in Newbridge, but the nature of this area is projected to change and a number of high quality office developments, together with the Edinburgh Interchange, are planned.

1.2. STAG Appraisal

1.2.1. General

STAG is the official appraisal framework to aid transport planners and decision-makers in the development of transport policies, plans, programmes and projects in Scotland. It has been designed in the belief that good planning and consistent, comprehensive appraisal lead to good decision making in relation to transport policy and investment proposals.

The philosophy behind STAG is summarised in the guidance through the following 5 themes:

- **Objective-led** – all activities and decisions should arise from the established aims of the planning organisation with respect to transport and associated policy areas;
- **Open-minded** – the Guidance suggests working up possible projects or policies on the basis of defined objectives supported by a thorough understanding of the problems and opportunities in the area, rather than seeking to fit an existing proposal retrospectively to planning objectives:
- **Pragmatic** – work done should reflect the relative need for accuracy, the scale and expected impacts of proposals and their costs;
- **Auditable** – it must be possible to see clearly how planners have got from objectives to their final conclusion; and
- **Inclusive** – effective involvement of stakeholders is not presented as a chore but as a crucial required input to arriving at a final proposal, which meets, expectations and which can be delivered.

In this report we seek to show that the appraisal of Edinburgh Tram Line 2 has been undertaken fully in accordance with these themes.

STAG has two parts:

- Part 1 (AST1): initial appraisal and broad assessment of impacts, designed to decide whether a proposal should proceed, subject to meeting the planning objectives and fitting with relevant policies; and
- Part 2 (AST2): detailed appraisal against the Government's objectives.

STAG Part 1 appraisal of Edinburgh Tram Line 2 was undertaken during the Arup feasibility study. This study concluded that an LRT solution on the Western route is the preferred option and offers the greatest benefits. In addition, the scheme was considered to contribute to achieving local and national transport objectives. Further details of the STAG Part 1 appraisal are contained in Chapter 4.

The main focus of this report is on the STAG Part 2 appraisal. It contains a detailed assessment of Edinburgh Tram Line 2 against national and local objectives in order to confirm that the scheme, as currently developed, is both justified in its own right and is the preferred solution for the corridor. The appraisal takes full account of the recent release of STAG Version 1.0 (Scottish Executive, 2003).

While Edinburgh Tram Lines 1 and 2 have been developed independently by separate technical teams, a consistent basis for technical development, modelling and appraisal has been developed and agreed by the two teams. Furthermore, the appraisal of the shared route section between St Andrew's Square and Haymarket has been undertaken by the Line 1 technical team and has been adopted by the Line 2 team. This ensures that the STAG appraisal of the 2 lines is fully consistent.

1.2.2. Princes Street

Full consultation has been undertaken during the development of the scheme to ensure all relevant parties and stakeholders views and principles have been taken into account during the design of the scheme. Within the timescale of this STAG appraisal process there have been several material revisions to the scheme design along Princes Street.

The current design, which is reflected in the qualitative appraisal throughout this STAG2, assumes the removal of westbound traffic on Princes Street and a central public transport lane provided in both directions, with tram and bus sharing this lane. A second discontinuous lane is provided in both directions to accommodate bus stopping and limited amounts of bus running. At key points, where the second lane is discontinued, widened pavements are provided to provide tram stops, reduced length pedestrian crossings and improved pedestrian circulation space.

Earlier designs retained the westbound traffic, with segregated tram running on central lanes and a bus lane in each direction, making five lanes in total. The roadway width was greater than that currently occupied and resulted in the loss of a narrow strip of Princes Street Gardens to accommodate it. Whilst robust from a transport viewpoint, the townscape impact and the wider aspirations for Princes Street precluded this option. Due to the long lead times and complexity of the transport modelling, the assessment and quantitative analysis of the route (noise and air quality, transport economic efficiency and accessibility) is based on the earlier five lane solution. The local transport effects along Princes Street have been subsequently reviewed on the basis of the revised configuration using a detailed micro-simulation model (VISSIM) to ensure that the tram and bus run times are not penalised. As part of the revised configuration the two stops on Princes Street were rationalised into one more centrally located stop. From this work it can be concluded that the net impact of the design changes on the operational performance of the scheme will be negligible.

CETM was approved after the current tram appraisal had begun and therefore was not specified within the original scope of the work specified for this stage. Its impact on the current design of appropriate integrated layouts is under high-level review. No detailed consideration of CETM is taken into account within the current reports.

1.3. Objectives And Structure Of This Report

This report sets out the findings of the STAG appraisal for Edinburgh Tram Line 2. It sets out the planning objectives for the scheme, describes the problems and opportunities that exist in West Edinburgh and then sets out the process of scheme development appraisal in detail.

After this introduction the report is laid out as follows:

- Chapter 2 – Planning objectives;
- Chapter 3 – Problems and opportunities in West Edinburgh;
- Chapter 4 – Project History – Option Generation, Development and AST1 Appraisal;
- Chapter 5 – The West Edinburgh Corridor;
- Chapter 6 – Consultation;
- Chapter 7 – Scheme Description;
- Chapter 8 – AST 2 appraisal;
- Chapter 9 – Risk and uncertainty;
- Chapter 10 – Monitoring and evaluation; and
- Chapter 11 – Conclusions.

This report is accompanied by 14 Appendices. These are bound separately in 5 volumes. The appendices are as follows:

- Appendix A - AST1 Tables;
- Appendix B - AST2 Tables;
- Appendix C - Environmental Worksheets;
- Appendix D - Preferred Route Scheme Drawings (bound separately);
- Appendix E - Consultation and Route Development Scheme Drawings (bound separately);
- Appendix F - Scheme Cost Report;
- Appendix G - Risk Matrix;
- Appendix H - Demand Modelling;
- Appendix I - Glossary of Terms;
- Appendix J - Bibliography;
- Appendix K - Preferred Route Corridor Report and Addendum (bound separately);
- Appendix L - Route Development Report Part A - Design Pause (bound separately);
- Appendix M - Route Development Report Part B – Route Finalisation (bound separately); and
- Appendix N - Literature Review.

2 PLANNING OBJECTIVES



2. Planning Objectives

2.1. Introduction

The aim of this chapter is to summarise national, regional and local policy objectives relevant to Edinburgh Tram Line 2, leading to the development of specific planning objectives for the project. Subsequent chapters of this report describe the contribution of the scheme in meeting these objectives. It is the starting point for demonstrating that the appraisal meets the requirements of being objective-led, open-minded and auditable.

2.2. National Policy

2.2.1. Introduction

The national policy framework for transport is set out in the White Paper, Travel Choices for Scotland (TSO, 1998); Scotland's Transport – Delivering Improvements (Scottish Executive, 2002); and more specifically in relation to planning and transport and in the National Planning Policy Guideline 17 (NPPG17). The over-arching transport and planning policy for Scotland is, therefore, highlighted in the three policy papers outlined below.

2.2.2. Transport White Paper – Travel Choices for Scotland

The July 1998 Transport White Paper sets out the overall aims of Government transport policy. These are to contribute to achieving:

- A strong economy;
- A clean environment; and
- An inclusive society.

The White Paper recognises that:

"A sustainable environment requires, above all, an effective and integrated transport policy at UK, Scottish and local level that will provide genuine choice to meet people's transport needs."

The Government's transport policies seek to achieve improved integration:

"Within and between different modes of transport, to promote genuine choice, so that each mode contributes its full potential and people can move easily between different modes;

"With environmental aims and policies, so that transport choices do not conflict with the achievement of environmental objectives;

"With land use planning at national, regional and local level, so that the two work together to reduce the need to travel and support more sustainable regional travel choices;

"With Government policies on education, health, economic growth and the objective of a fairer, more inclusive society."

The White Paper states the development of a sustainable transport system can contribute to meeting economic, environmental and social inclusion goals, but in doing so a number of issues need to be addressed:

- Rising traffic levels, but there is a recognition that simply providing more roads is not a viable solution to congestion problems;
- Key blockages on the trunk road network that have negative economic impacts;
- Traffic related local air pollution; and
- The need for the transport network to counter social exclusion.

In this context, the Government has established 5 key appraisal criteria for the assessment of transport schemes:

- Environment;
- Safety;
- Economy;
- Integration; and
- Accessibility and social inclusion.

STAG seeks to assess the impact of projects in relation to these criteria.

2.2.3. Scotland's Transport – Delivering Improvements

The Transport Delivery Report was published by the Scottish Executive in March 2002 and sets out the transport vision for Scotland. This document was subsequently updated with the progress report "Building Better Transport" in 2003. The Scottish Executive's vision directly addresses the challenge of tackling congestion in and around Scotland's major metropolitan areas, through modernising, improving and

promoting public transport and encouraging more walking and cycling. The document outlines a number of key issues, which are recognised by the Scottish Executive, thus:

"delivering an efficient, safe transport system which meets the needs of all in society - individuals and businesses, car and public transport users, cyclists and pedestrians - without threatening our environment...tackling years of neglect by very substantially increasing investment in our transport infrastructure...delivering transport solutions which will work for the long term, but which extend choice and improve accessibility now.

Key priorities include tackling congestion in our urban areas by promoting attractive alternatives to the car, improving transport networks, delivering readily accessible and accurate information for transport users, and maintaining the affordable lifeline links so vital to the economic and social well-being of remote and rural areas.

A sustainable, effective, safe and integrated transport system lies at the heart of our economic development and underpins so much of our daily lives, whether through the journey to work, the distribution of goods and services, access to social and leisure facilities or simply visiting friends or relatives.

The projected growth in traffic is not sustainable in the long term and action is required now to prevent rising carbon dioxide emissions from road transport, localised air pollution (particularly nitrogen dioxide (NO_2) and particles) and social exclusion."

The document states that the Scottish Executive is committed to "delivering a transport system for Scotland fit for the 21st century".

2.2.4. Scottish Executive Partnership Agreement
This was a joint statement by Labour and Liberal Democrats of agreed policy initiatives and how these will be implemented. On transport, the Agreement states:

"The Scottish people and the Scottish economy need reliable, efficient transport. An effective transport system is central to a thriving economy and strong communities.

We will put in place an integrated transport system that gets goods to market quickly and efficiently, and gets people to work safely and on time.

We must connect the whole country and be connected to the rest of the world. Our aim is an accessible Scotland, with a modern, safe, efficient and sustainable transport system.

Our transport system should be sustainable, minimising impacts on our environment, particularly by greater use of public transport."

The Agreement lists a number of "high level commitments" including *"investing in a tram network in Edinburgh".*

2.2.5. National Planning Policy Guideline NPPG17 - Transport and Planning
The aim of this planning guidance is to develop the integrated land use and transport planning elements proposed in the White Paper policy package.

On the whole, the guideline is primarily concerned with how new developments can support a sustainable transport system. It is noted that:

"Local authority support for bus services, passenger rail services or proposals for associated facilities should be consistent with the location policies in development plans. Such support could be conditional on careful planning of routes, timetables, and patterns of service".

Within NPPG17, land use planning is stated as an important tool in:
- Reducing the need for travel by relating land use to transport facilities;
- Enabling access to local facilities by walking and cycling;
- Encouraging public transport access to developments; and
- Supporting essential motorised travel.

As stressed in NPPG17, the general hierarchy of priorities for individual travel accessibility to development should be walking, cycling, public transport and then private cars. NPPG17 suggests that access to employment and facilities across the wider urban area should be a prime consideration. Accessibility of new developments is an important issue, and one that has historically been difficult to measure definitively.

2.3. Regional Policy

CEC forms part of SESTRAN, the South East Scotland Transport Partnership. Transport between the city and the wider region is an important issue, as the high value property market increasingly pushes commuters out to the surrounding areas. The Transport Partnership has adopted a number of overall policy principles:

- Reduce dependence on the private car and minimise the need for travel especially by car for regional journeys within South East Scotland;
- Maximise public transport provision and achieve public transport integration and inter-modality;
- Promote and develop travel awareness and information, encourage walking/cycling, promote better health and fitness and encourage the use of public transport;
- Improve safety for all road and transport users;
- Reduce the environmental impacts of travel;
- Enhance community life and social inclusion, and
- Encourage the use of the most economic, effective, environmentally friendly and efficient modes for freight transport.

The draft Regional Transport Strategy (RTS) promotes a vision for a transport system that "provides all citizens of south east Scotland with a genuine choice of transport which fulfils their needs and provides travel opportunities for work and leisure on a sustainable basis". The draft RTS has the vision that people "should have the ability to move into and out of Edinburgh by a choice of modes of transport, with an increased use of public transport".

The RTS sets the target of reducing the proportion of single car commuting into Edinburgh by 10%, relative to 2001, by 2022. It notes that this "will only be possible if the appropriate improvements to public transport are implemented".

SESTRANS has a delivery target to implement a series of schemes listed in the RTS, including West Edinburgh tram.

2.4. Local Policy

2.4.1. Local Planning

The statutory development plan for Edinburgh is comprised of the Lothian Structure Plan (1994) and the local plans. CEC, together with West Lothian, Midlothian and East Lothian Councils are currently working together to prepare a new Structure Plan, which seeks to ensure that a sustainable future can be built in West Edinburgh and the wider area. This Plan is near to being finalised. It incorporates a development strategy based on Core Development Areas including two of direct relevance to Tram Line 2: Edinburgh Park/South Gyle/Sighthill and Newbridge/Kirkliston/Ratho, both of which are proposed for business land uses. The Structure Plan stresses the important of improving accessibility to these areas and West Edinburgh Tram is cited as a means of achieving this. The Structure Plan safeguards land for West Edinburgh Tram.

Key principles related to regeneration and social inclusion in line with general objectives include:

- Combating social exclusion by ensuring access between disadvantaged local communities and subsequent new employment opportunities;
- The need to ensure access to affordable transportation networks for all parts of the local community and particularly those in disadvantaged areas, such as West Edinburgh and West Lothian; and
- Support for controlled development and re-use of existing buildings and vacant, derelict and Brownfield sites where regeneration potential will be maximised.

The local and regional planning context is set within national guidance and particularly reflects priorities for sustainability and integration. The West Edinburgh Planning Framework (April 2003), prepared by the Scottish Executive, provides policy guidance on planning, development and growth in West Edinburgh. A key element is that adequate transport provision, in the form of a fixed rapid transit, is essential to enable any additional development in the area. The following statements from the West Edinburgh Planning Framework are particularly relevant:

"The Scottish Ministers regard West Edinburgh as a unique opportunity in Scotland to create an international business location, capable of attracting world class companies and headquarters opportunities". (para 13)

"The national interest in West Edinburgh can therefore be defined as being the:

- *Need to improve public transport accessibility to established development sites and reduce congestion;*
- *Realisation of opportunities for airport expansion and better surface access;*
- *Need to reinforce the strategic role of Edinburgh's Green Belt;*
- *Incorporation of sustainable development principles into planning and enhancement of environmental quality;*
- *Need to safeguard accessibility and a strategic reserve of land for the realisation of additional high quality economic development potential in the longer term (post 2020) served by a high quality transport system" (para 15)*
- *Public transport serves part of the area but is primarily bus-based, and subject to traffic congestion. The road and rail network is either at or near maximum operating capacity, or is poorly integrated. The anticipated improvements in the short-term are modest compared to the large amounts of committed development. This points to the need for an early and sustained step change in levels of transport investment to contain existing level of traffic congestion in line with national and local targets,*

safeguard accessibility and provide a long-term sustainable solution to existing transport problems. The promotion of a safer transport system and better[provision for walking and cycling are other important considerations". (para 18)

Key policy objectives highlighted in the Framework include introducing tram networks and there is an overall presumption against new development until strategic public transport improvements are committed.

2.4.2. Local Transport Strategy 2001 – 2004

The Local Transport Strategy (LTS) produced by CEC sets the key framework for the City's transport strategy. This strategy has recently been updated to cover the period 2004 – 2007. Within the context of the strategy, CEC has set out its policies and programmes, and has highlighted key issues and trends.

CEC has concerns over car use and car ownership in Edinburgh, both of which are growing. The growth in car use is a consequence of rising ownership levels and of changing land-use patterns: more out-of-town destinations, the decline of older industries in central parts of the city, as well as changes in expectations for personal mobility. In particular, traffic levels outside the city centre and in off-peak hours have grown, compared to stabilised levels at peak periods into the city centre. Walking and public transport still make up significant proportions of travel, while rail remains important for medium-long distance travel.

Lack of access to facilities and services are significant contributors to high levels of social exclusion. Particularly vulnerable are the elderly and disabled, as well as those with low incomes, children, women and parents with young children. To reduce social exclusion, CEC has identified good public transport, less traffic and lower speeds, better land use planning and transport integration, and accessible services as required.

CEC views congestion as affecting the economy in the city centre, but congestion is also seen to be affecting the outskirts of the city. The LTS stresses that all major centres of activity need to be accessible by public transport, foot and cycle. Future major travel generating development should be steered to areas that are well served by public transport, and local centres need to be supported by planning policies.

CEC's LTS has five key aims:

- To improve safety for all road users and transport users;
- To reduce the environmental impacts of travel;
- To support the local economy;
- To promote better health and fitness;
- To reduce social exclusion (to enhance social inclusion).

These aims reflect the five key government criteria for transport policy: Economy, Environment, Safety, Accessibility and Integration. To help meet their aims, CEC has adopted a number of objectives and targets for their transport strategy:

- To reduce congestion on all modes of transport;
- To increase the proportion of journeys made on foot, by cycle by powered two wheelers (PTW) and by public transport;
- To reduce the need to travel, especially by car;
- To reduce the adverse impacts of travel, including road accidents and environmental damage;
- To maximise the community role of streets, as places where people can meet, shop, and in appropriate circumstances, children can play;
- To improve the ability of people with low incomes or mobility impairments to use the transport system; and
- To ensure that the road, footway and cycle network are of a standard suitable for safe and comfortable movement.

For a transport proposal to be successfully promoted in the City, it must be shown to contribute to meeting the objectives outlined above.

2.5. The Planning Objectives

At the outset of the development of the Edinburgh Tram Line 2 project, four principal planning objectives were developed:

- To improve accessibility;
- To reduce pollution and environmental damage caused by traffic;
- To reduce traffic congestion; and
- To make the transport system safer and more secure for both users and non users.

These objectives were originally defined when the ITI was developed. In line with the more detailed appraisal required as part of STAG2, it is appropriate to disaggregate these broad aims into more specific objectives. These are summarised below:

(i) **To improve accessibility**: Improvements, particularly for people without access to a car, on low incomes or whose mobility is impaired are fundamental to the achievement of both the social inclusion and economic development elements of the transport vision. Specific objectives are:

- To improve access to the public transport network;
- To improve access to employment opportunities; and
- To support economic development.

(ii) **To reduce pollution and environmental damage caused by traffic**: this is fundamental to the achievement of the environmental/sustainability aspiration and will contribute to the achievement and the safety element of the transport vision. Specific objectives are:

- To increase the proportion of journeys made by public transport, walking and cycling;
- To improve local air quality;
- To reduce emissions of greenhouse gases

(iii) **To reduce traffic congestion**: this is fundamental to the achievement of economic development and environmental aims. Specifically the scheme should:

- Reduce the number of private vehicle kilometres; and
- Reduce traffic volumes on key routes.

(iv) **To make the transport system safer and more secure for both users and non users**: this is fundamental to the achievement of the safety and community elements of the vision and will contribute to achieving the environmental and social inclusion elements. Specific objectives are to:

- Reduce the number of road traffic accidents; and
- Improve personal security when using the transport system.

Table 2.1 maps these objectives against national, regional and local policy aims and demonstrates they are wholly consistent with these aims.

It is important to recognise that the success of the scheme in improving accessibility and supporting economic development will tend to counter-act the benefits under the other three objectives. Additional development stimulated by the project will lead to additional travel, some of which will be made by car. This will reduce the benefits under the remaining headings above. It is therefore important to distinguish between the primary benefits of the scheme and the results of consequent economic development. This issue is addressed further in Chapter 8.

Table 2.1 Planning Objectives and National, Regional and Local Policy

Planning Objective	National Policy	Regional Policy	Local Policy
Improve Accessibility • Improve access to public transport network. • Improve access to employment opportunities • Support economic development	Accessibility and social inclusion Strong economy through improving transport infrastructure and accessibility in West Edinburgh	Reduce dependence on car Encourage use of public transport Promote better health and fitness	Support the local economy Reduce social exclusion
Reduce Pollution and Environmental Damage • Increase proportion of journeys by public transport walking and cycling • Improve land air quality; • Reduce emissions of greenhouse gases	Environment Integration	Reduce dependence on car Encourage use of public transport Encourage walking/cycling Promote better health and fitness Reduce environmental impact of travel	Reduce the environmental impacts of travel Promote better health and fitness
Reduce Traffic Congestion • Reduce number of private vehicle kilometres • Reduce traffic volumes on key routes	Transport economic efficiency Environment	Reduce dependence on private car Reduce environmental impact of car	Reduce the environmental impacts of travel
Make the Transport System Safer for Users and Non-Users • Reduce number of road traffic accidents • Improve personal security when using the transport system	Safety	Improve safety for all road and transport users	Improve safety for all road and transport users

3 PROBLEMS AND OPPORTUNITIES IN WEST EDINBURGH



3. Problems and Opportunities in West Edinburgh

3.1. Introduction

This chapter considers relevant problems in West Edinburgh that could be mitigated through transport investment and highlights opportunities for improved public transport.

The chapter is laid out as follows:

- Section 3.2 considers the socio-demographic characteristics of the corridor;
- Section 3.3 describes current transport issues;
- Section 3.4 discusses environmental issues;
- Section 3.5 considers future development proposed in the corridor and its impacts; and
- Section 3.6 summarises the problems and opportunities in the corridor.

3.2. Socio-Demographic Profile Of West Edinburgh

3.2.1. General

Edinburgh and the Lothians is a dynamic Scottish region, experiencing growth across a range of socio-economic indicators. This is demonstrated by the fact that whilst only 15% of Scotland's population live in the area, the Lothians' GDP accounted for almost one fifth of Scotland's total in 1998, and 18% of Scottish jobs are in the area. This growth, however, presents many challenges.

3.2.2. Population

Lothian is one of Scotland's most densely populated regions, accounting for only 2% of Scotland's land area but 15% of its population. The baseline population for Lothian was 779,290 in 2002, and this is projected to increase to 802,350 in 2006 and 818,455 in 2011.

The baseline population for the City of Edinburgh was 448,080 in 2002, and this is projected to increase to 459,148 in 2006 and 464,579 in 2011. This increase is expected to occur largely through in-migration. In Edinburgh, over 90% of population growth is expected to be as a result of in-migration. Over this timescale the national population is expected to experience a small but steady decline.

The total population of the West Edinburgh area (defined as the area covered by the Edinburgh West Local Development Committee) was estimated to be some 80,684 people at the time of the 2001 Census, representing 18% of the total City population. Table 3.1 shows that the area has enjoyed significant population growth between 1991 and 2001, with 10 of the 14 wards within the corridor experiencing growth rates higher than for the City of Edinburgh as a whole.

The population and population density of individual wards falling within or adjoining the West Edinburgh corridor are also detailed in Table 3.1. This indicates that although the overall population size within each ward is similar, there is a noticeable difference between some wards in respect to the level of the density of population. Population levels in West Edinburgh wards are also shown in Figure 3.1 at the end of this Chapter.

Table 3.1 Population and Population Density (persons per ha)

Ward	Population	Area (Ha)	Population Density	Population Change 1991-2001 (%)
New Town	7,128	130	54.8	15.9
Dean	7,324	134	54.7	13.8
Tollcross	6,802	127	53.6	27.9
Fountainbridge	6,557	40	163.9	13.2
Dalry	8,024	91	88.2	31.7
Shandon	7,708	67	115.0	10.8
Moat	7,659	197	38.9	12.2
Stenhouse	8,099	211	38.4	2.5
Murrayfield	7,797	345	22.6	14.9
SE Corstorphine	7,942	178	44.6	2.1
NE Corstorphine	7,685	205	37.5	(1.7)
Sighthill	8,542	544	15.7	21.3
Gyle	8,704	308	28.3	22.4
Dalmeny & Kirkliston	7,808	7,533	1.0	1.6
City of Edinburgh	448,624	26,383	17.0	7.1

Source: 2001 Census

Dalmeny and Kirkliston, perhaps unsurprisingly, has the lowest population density of 1.0 person per hectare. In contrast, a number of more established inner city wards (i.e. Fountainbridge and Shandon) have particularly high density figures, reflecting the profile of high rise, tenement and flatted development in these localities. In general, as one travels westwards away from the City Centre the density of population tends to decrease reflecting the lower housing and other development densities.

It should be noted that as the average population density for the City of Edinburgh was estimated at 17.0 people per hectare at the time of the 2001 Census, all but two of the wards identified above (Dalmeny & Kirkliston and Sighthill) exceed this density.

Relatively high population densities represent a market opportunity for high frequency and high capacity public transport options. Growth in population over the last 10 years in the corridor indicates increasing market potential.

Table 3.2 shows the age distribution of the population in the corridor at a ward level.

Table 3.2 Age Distribution of Population

Ward	Population by Age (%)				
	0-15	16-24	25-44	45-59	60+
New Town	8.26	20.96	41.34	16.5	12.95
Dean	10.13	12.35	41.25	16.94	19.25
Tollcross	5.38	40.22	36.61	9.03	8.76
Fountainbridge	6.92	27.68	43.6	9.9	11.89
Dalry	8.46	25.2	46.7	9.86	9.78
Shandon	8.87	18.16	50.62	12.32	10.02
Moat	12.69	11.72	32.85	16.33	26.4
Stenhouse	17.02	7.71	27.9	16.67	30.69
Murrayfield	14.82	9.56	32.58	18.55	23.09
SE Corstorphine	18.35	9.21	30.13	17.85	24.43
NE Corstorphine	17.51	11.23	23.91	20.27	27.09
Sighthill	18.43	25.96	29.46	14.98	11.16
Gyle	17.99	8.45	31.8	18.77	23.49
Dalmeny & Kirkliston	21.46	8.9	29.59	21.86	18.18
City of Edinburgh	16.34	14.37	32.19	17.27	19.82

The table shows marked differences in population distribution and in particular the proportion of children and elderly people who are especially dependent on public transport. At one extreme Stenhouse ward has 48% of residents in these groups, while at the other Tollcross ward has only 14%. Relative to the City of Edinburgh as a whole the following wards have above average proportions of residents under 16 or over 60: Moat, Stenhouse, Murrayfield, South East Corstorphine, North East Corstophine, Gyle and Dalmeny & Kirlistin. Accordingly 50% of wards in the corridor have above average numbers of people in age groups which are particularly dependant on public transport.

In summary, the relatively dense and growing population in the corridor represents an opportunity for public transport. The high proportion of people, in half the corridor wards, in age groups particularly dependant on public transport represents both a problem if services are inadequate and a market opportunity for high quality services.

3.2.3. Car Ownership

Figure 3.2 show the proportion of non-car owning households in the West Edinburgh area. Overall 40.1% of households were in this category in 2001, very similar to the Edinburgh average of 39.5%. However, the proportions vary considerably between wards. In particular, the ward in the Southern part of the corridor have a much higher proportion of non-car owning households than those in the Northern part, making them far more dependant on public transport accessibility.

3.2.4. Employment

Edinburgh is the seat of Scotland's administrative power and is also the location of the country's financial, legal, medical, and insurance centre. It is also becoming more important for accommodating important nuclear and electronics research. Due to the historical significance of the City and its status as a World Heritage Site, tourism is one of its strongest industries.

A total of 219,228 people were in employment in Edinburgh in 2002, the majority of which are employed by the service sector. Edinburgh is the UK's largest financial centre outside London and the fourth largest in Europe. Claimant unemployment in Edinburgh stood at 2.2% in April 2002, which is well below the Scottish average of 4.0% (April 2002).

The local economy is very buoyant and well placed for future growth, reflecting the employment bias towards the service sector, particularly financial services. Forecasts show an overall increase between 2000-2015 of 34,500 jobs in Edinburgh (12%). Although the traditional sectors are projected to decline, the service sector is expected to increase by 53,500 jobs.

Indicators of the region's economic success include:

- Average disposable income in Edinburgh is amongst the highest in the UK (Henley Centre);
- GDP per capita in Edinburgh is 147% (Lothians 117%) of the UK average;
- Edinburgh is the city with the fastest growing economy in the UK (Cambridge Econometrics June 2000, August 2001);
- Edinburgh's world ranking as a conference venue rose from 22nd in 1996 to 12th in 2001 (ICCA);
- Output from the Lothians' financial services sector is predicted to expand by a quarter by 2008 (BSL 1999);
- Amongst Scottish local authority areas, average gross weekly earnings in Edinburgh are the second highest (New Earnings Survey 2000);
- Edinburgh's per capita spending on personal goods is 12% above the national average (CACI, Sept. 2000);
- Edinburgh is the UK's second largest overseas tourist destination after London; UK visitor bednights in Edinburgh have grown by 16% since 1996 (ONS).

However, traditional employment sectors (primary, manufacturing and construction) all continue to decline, although Midlothian is expected to experience continued growth in biotechnology industries.

Levels of unemployment in the West Edinburgh study area are displayed in Figure 3.3 at the end of this Chapter.

This shows a similar picture to the car ownership data above, with higher levels of unemployment in the southern part of the corridor. While unemployment is below the Scottish average in all wards it is clear that some are not fully sharing in the buoyancy of the City's economy. Improved accessibility would contribute to addressing this problem. Given the low levels of unemployment in Edinburgh, employers need staff to have the flexibility to seek a range of jobs if labour shortages are to be avoided, with a consequent impact on the development of the City's economy.

3.2.5. Social Grade

Table 3.3. shows the distribution of population by social grade (as defined in the register General's statistics) within the study area.

Table 3.3 Population by Social Grade

Ward	Social Grade (%)					
	AB	C1	C2	D	E	Total
New Town	43.54	35.59	4.25	8.60	8.01	100
Dean	46.73	34.46	3.96	6.79	8.07	100
Tollcross	23.21	36.18	6.54	20.15	13.92	100
Fountainbridge	25.66	36.56	6.22	17.48	14.09	100
Dairy	25.42	36.66	7.49	16.56	13.88	100
Shandon	29.89	39.75	8.15	12.61	9.60	100
Moat	14.10	32.62	10.95	17.71	24.61	100
Stenhouse	15.98	28.38	11.21	15.51	28.92	100
Murrayfield	48.51	34.75	3.48	4.78	8.49	100
SE Corstophine	24.35	35.87	10.87	13.73	15.18	100
NE Corstophine	37.29	30.99	7.44	8.32	15.96	100
Sighthill	11.50	26.97	18.05	24.46	19.03	100
Gyle	30.51	33.07	11.77	9.83	14.81	100
Dalmeny & Kirkliston	25.47	28.45	14.46	15.74	15.87	100
City of Edinburgh	27.23	31.91	9.35	14.28	17.23	100

This indicates below average numbers of people in the higher classifications A, B and C1 (managerial, professional and office workers) in Moat, Stenhouse, Sighthill and Dalmeny & Kirkliston wards.

3.2.6. Deprivation

The wards that fall within the West Edinburgh area are detailed in Table 3.4, below.

Table 3.4 Summary of Scottish Index of Multiple Deprivation at Ward Level

	SIMD Rank
Dean	1220
Murrayfield	1219
New Town	1205
Gyle	1170
SE Corstorphine	1153
NE Corstorphine	1144
Shandon	1068
Dalmeny/ Kirkliston	875
Fountainbridge	836
Tollcross	660
Moat	517
Sighthill	502
Dalry	432
Stenhouse	399

The Scottish Indices of Multiple Deprivation (SIMD) was examined to identify those, which rank poorly and therefore may benefit from better accessibility to jobs and services. Of the wards within the West Edinburgh study area, Stenhouse scores the lowest SIMD ranking of 399 and the lowest in terms of income. The SIMD ranking was also revealed to be low in Dalry, Sighthill, Moat, Tollcross and Fountainbridge. These trends of relative deprivation highlight the need to encourage greater levels of social inclusion. While these wards are not among the most deprived in Scotland, relative deprivation is important in the context of determining residents' ability to be social included in a generally prosperous city.

Figure 3.4 at the end of this Chapter shows SIMD patterns within the West Edinburgh area.

3.2.7. Education
Table 3.5 shows levels of educational attainment by ward.

Table 3.5 Educational Attainment by Ward

Ward	Qualifications (%)				
	None	Standard Grade SVQ 1 & 2	Higher Grade SVQ 3	HND, SVQ 4 & 5	Degree
New Town	7.07	7.42	22.79	5.25	57.48
Dean	8.27	9.87	15.71	6.66	59.49
Tollcross	11.75	8.9	31.37	6.58	41.39
Fountainbridge	12.71	10.46	25.69	8.03	43.11
Dairy	16.76	12.87	20.49	8.21	41.66
Shandon	12.55	15.63	20.07	8.96	42.8
Moat	33.99	25.73	15.76	6.75	17.77
Stenhouse	37.58	25.73	13.43	5.08	18.17
Murrayfield	9.7	11.88	14.64	5.96	57.83
SE Corstophine	21.72	29.5	19.74	6.51	22.53
NE Corstophine	19.84	20.31	20.34	6.06	33.46
Sighthill	29.42	26.54	24.66	5.27	14.1
Gyle	20.38	26.39	19.5	7.56	26.18
Dalmeny /Kirkliston	28.52	25.77	16.06	5.96	23.69
City of Edinburgh	22.89	19.94	18.64	6.04	32.48

It indicates that residents at Moat, Stenhouse, Sighthill and Dalmeny and Kirliston wards are more likely to have no formal qualifications than residents of Edinburgh as a whole. Not surprisingly they are also less likely than average to be educated to degree level. This is also true of South East Corstophine and Gyle residents. As the structure of Edinburgh's economy changes, high levels of educational attainment will be important to take advantage of the new employment opportunities being created. Those without qualifications will find themselves increasingly disadvantaged in the job market. It is therefore important that they find it easy to gain access to the widest possible range of those opportunities, that are available to them.

3.2.8. Overall Assessment of Problems and Opportunities

The discussion above has shown that the West Edinburgh corridor has a relatively high population density and a growing population, creating favourable conditions for high quality public transport.

Forty per cent of households do not have access to a car and are therefore dependant on public transport to gain access to employment shopping and leisure facilities. While this is similar to the Edinburgh average, low car ownership is concentrated in the Southern part of the corridor, South of the Glasgow-Edinburgh railway line. This area, particularly Moat, Stenhouse and Sighthill wards, also experiences high level of deprivation, low levels of educational attainment, relatively high unemployment and below average numbers of people in white collar occupations. This indicates that these areas are not fully sharing in the overall success of Edinburgh. The provision of high quality public transport would improve accessibility and assist in overcoming social exclusion and improved access to a wider range of employment opportunities.

3.3. Transport

3.3.1. Highway Network

The West Edinburgh area is served by three principal radial corridors:

- A8 Glasgow Road;
- A90 Queensferry Road; and
- A71 Calder Road/Gorgie Road.

These routes have experienced significant traffic growth over the past 20 years as shown below.

Table 3.6 Traffic Growth on Major Roads in West Edinburgh 1980-2000

Location	AM Peak Inbound	PM Peak Outbound	All Day
A90 at Edge of City	+40%	+41%	+62%
A8 at Edge of City	+25%	+42%	+35%

It should be noted that the M8 Extension opened during this period, removing significant volumes of traffic from the A8.

This growth is part of a more general trend of rapid traffic growth in Edinburgh and surrounding areas during recent years, including:

- A 10% rise in the number of private cars and light goods vehicles registered to Lothian residents, in the four years between 1996 and 2000;
- More new vehicle registrations in Edinburgh than in any other Scottish local authority (2000);
- A 7.5% increase in motor vehicle journeys on Lothian's motorways and A-class roads, in the four years from 1995 to 1999;
- A 72% increase in levels of daily commuting into Edinburgh, in the twenty years from 1981 to 2001;
- A steady increase in the amount of traffic on the City Bypass, with a daily average of more than 65,000 vehicles at Dreghorn;
- An 18% growth in traffic levels on the M8 motorway, in the three years between 1996 and 1999; and
- A 19% growth in traffic levels on the M9 motorway, in the three years between 1996 and 1999.

Work undertaken during the development of the West Edinburgh Planning Framework estimated that daily demand on the M8 Motorway east of Junction 1A was 86,500 vehicles compared to a capacity of 64,000.

The A8 Glasgow Road which runs through the centre of the West Edinburgh corridor is one of the key radial routes in Edinburgh. It serves a significant area of suburban Edinburgh and major land uses such as Edinburgh Airport, Edinburgh Park, The Gyle Centre and Murrayfield. It is a major route into the city from West Lothian and beyond. It feeds into the City of Edinburgh Bypass at Gogar and parallels the main Edinburgh to Glasgow railway to Haymarket. The A8 is also one of Edinburgh's Greenways, offering bus priorities through various traffic management measures and provision of dedicated roadspace.

Currently the volume of eastbound traffic on the A8 at the edge of the city centre (Haymarket Terrace) is around 1,600 vehicles in the peak hour. Average car occupancy on the A8 derived from monitoring surveys is around 1.3. This means that there are in excess of 2,000 people travelling into Edinburgh City Centre by car in the morning peak hour on Glasgow Road alone.

Car journey times along the corridor vary significantly between peak, inter-peak and off-peak periods. As would be expected there is increased congestion throughout the corridor in the peak periods, particularly around Gogar Roundabout and along Roseburn Terrace and West Coates approaching Haymarket. The main congestion hotspots are:

- **South Gyle Broadway** - from the Gogar Roundabout to the Gyle Roundabout is generally operating at capacity during the AM peak period.
- **Gogar Roundabout** – operates at capacity during the peak hours.

- **Gyle Roundabout** - junctions within Edinburgh Park & South Gyle Park are congested during the peak periods with significant delays. During the AM peak period queues along South Gyle Broadway back onto the A8 in both directions.
- **South Gyle Crescent** - delays during the PM peak period as traffic accessing South Gyle Broadway backs up.
- **Edinburgh Park** - congestion linked to the queuing experienced at the Gyle Roundabout.
- **Hermiston Gait Roundabout/Cultins Road** – heavy traffic flows during peak periods, queuing at the junction with the A71.
- **Railway Corridor (Bankhead Drive to Stenhouse Drive)** - queuing from Bankhead Avenue during peak periods. Congestion in the PM peak period along Broomhouse Drive.
- **Stenhouse/Stevenson** - queues during morning and evening peaks in excess of 500m back from the Stevenson Drive/Balgreen Road junction.
- **Balgreen Road/Westfield Road** - queues along Balgreen Road North and halfway along Stevenson Road during the AM peak.
- **Western Approach Road** - congestion occurring in the AM peak at the junction with Lothian Road, with traffic backing up beyond the Morrison Link.

Work carried out as part of the West Edinburgh Planning Framework suggests that committed development, together with increases in base traffic, could encourage a further 90,000 vehicles (2 way trips) per day into West Edinburgh. This is estimated to equate to a further 12,000 vehicles per hour during both the weekday AM and PM peaks, as outlined in Table 3.7.

As Table 3.7 indicates, key developments such as Edinburgh Park, Edinburgh Airport expansion and the Royal Bank of Scotland HQ will significantly contribute to increased traffic levels in West Edinburgh. The combined impact of these increases in traffic levels for the strategic and distributor road network will be very significant, as highlighted in Tables 3.8 and Table 3.9, below.

Table 3.7 Vehicle Trips Generated By Committed And Proposed New Development In West Edinburgh

	Development	Development Type	Development Related Vehicle Trips (2-way)		
			AM Peak	PM Peak	Daily Total
1.	Grampian Foods, Newbridge (TA)	Office — 56,670m^2	1230	912	7800
2.	Edinburgh Gate, Newbridge (TA)	Office — 74,322m^2	1663	1210	10450
3.	Edinburgh Exchange, Newbridge (TA)	Storage / Distribution16,191m^2	70	65	533
4.	Edinburgh Airport (FM/JMP)	Airport Expansion	1735	1787	17350
5.	Royal Highland Showground (FM/JMP)	Mixed	371	319	N/A
6.	Proposed RBS HQ, at former Gogarburn Hospital (TA)	HQ — 57,500 m^2	1700	1655	12200
7.	Edinburgh Park (TA)	Business Park — 324,903 m^2	5500	5400	39650
8.	Sighthill / South Gyle (CEC/JMP)	Change to Office100,000m^2	574	170	2700
9.	Newbridge 'Core Dev. Area' (CEC/ JMP)	Mixed	Negligible additional traffic flow		
Total			**12,843**	**11,518**	**90,683**

Source: West Edinburgh Planning Framework: Background Papers (2003)

Table 3.8 Implications of Traffic Growth on Operational Performance

Evaluation of Traffic Demands	Assessed Capacity	2001		2015	
Link Name		Demand Flow	RFC	Demand Flow	RFC
Rural Links (Annual average daily traffic)					
M8 — West of Junction 1a (M8 Extension)	64600	92685	1.43	115300	1.78
M8 — East of Junction 1a	61000	86470	1.42	107600	1.76
A8 — East of Newbridge Roundabout	47400	39675	0.84	49400	1.04
A8 — West of Gogar Roundabout	47100	44015	0.93	54800	1.16
Urban Links (peak hour traffic volumes)					
M9 — South of Newbridge Roundabout	4000	2831	0.71	3522	0.88
A8 — East of Maybury Junction	2100	2110	1.00	2625	1.25

Source: West Edinburgh Planning Framework: Background Papers (2003)

Table 3.9 Implications of Traffic Growth on Operational Performance of Key Junctions

Evaluation of Traffic Demands	Junction		Operational Performance	
Junction Name	Form	Type	2001	2015
M8 / A8 Newbridge	Grade Separate	Roundabout	At Capacity	Over Capacity
M8 / A720 Terminal Junction	Grade Separate	Roundabout	Below Capacity	At Capacity
A8 / Edinburgh Airport	Grade Separate	Roundabout	Below Capacity	Below Capacity
A8 / A720 Gogar	Grade Separate	Roundabout	At Capacity	Over Capacity
A8 / A902 Maybury	At grade	Traffic Signals	At Capacity	Over Capacity
A720 / A71 Calders	At grade	Traffic Signals	Over Capacity	Over Capacity
A90 / A902 — Barnton	At grade	Traffic Signals	Over Capacity	Over Capacity

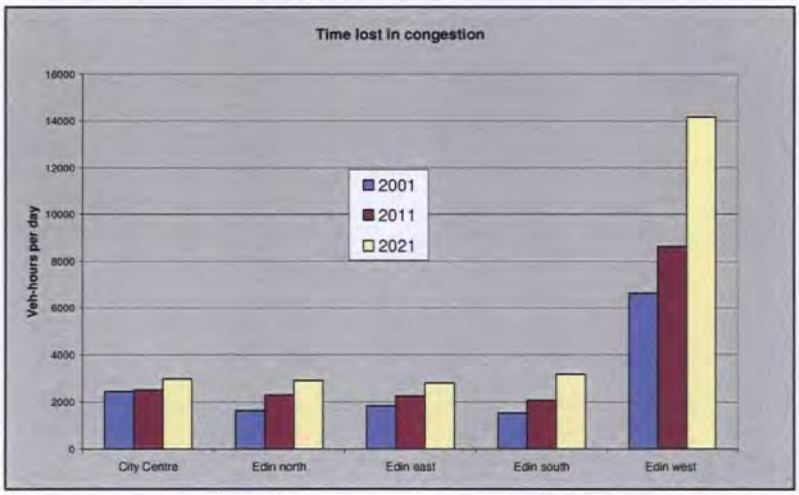
Source: West Edinburgh Planning Framework: Background Papers (2003)

As can be seen from Tables 3.8 and Table 3.9, it is anticipated that the many of the key road links and major junctions in West Edinburgh will operate above efficient operating capacity. As a result of further development, growth at Edinburgh Airport and a forecast 24% increase in background traffic there will be a significant increase in congestion by 2015.

The work undertaken as part of the West Edinburgh Planning Framework suggests that in order to contain existing levels of traffic, and achieve travel patterns comparable with sustainable development objectives, major improvements in public transport accessibility will be required.

The existing and forecast levels of traffic congestion in West Edinburgh are highlighted within the draft City of Edinburgh Local Transport Strategy. The LTS illustrates the time lost due to congestion across the local authority area. This data is reproduced below as Figure 3.5, which graphically illustrates that approximately 7000 hours are lost to existing congestion (2001) in West Edinburgh. This is comparable to the levels of congestion across the other four areas of the city combined.

Figure 3.5 Time Lost In Congestion, City Of Edinburgh, 2001-2021



Source: City of Edinburgh Draft Local Transport Strategy (2004-2007)

By the year 2021, time lost to travel congestion in West Edinburgh is forecast to have doubled to approximately 14000 hours, which is well in excess of the levels of congestion across the other four areas combined.

This demonstrates the need to reduce the number of vehicle kilometres on the highway network to reduce congestion, accidents and the environmental impacts of road traffic. It would also make walking and cycling more attractive.

3.3.2. Public Transport Network

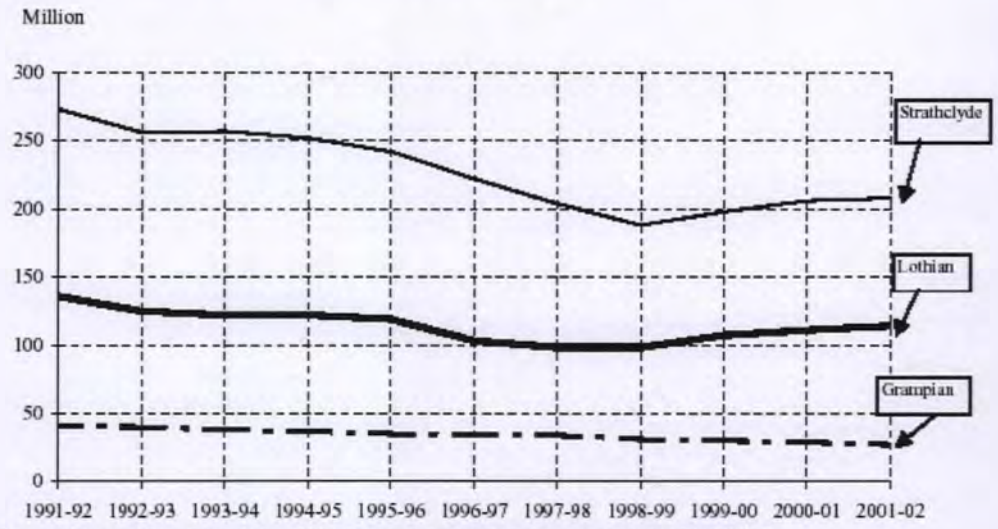
3.3.2.1 Bus Network

Within Edinburgh, public transport carries more than 100 million passenger journeys per year. The City is served by over 200 local bus services using over 800 buses which call at 2,000 stops. There are seven railway stations within the City area, and the rail network is important for medium and long distance travel to the city centre. However bus is the overwhelmingly dominant public transport mode used for local trips within Edinburgh. In 1999, over 18% of all trips made by Edinburgh residents were made by public transport (LTS), one of the highest rates of bus use per person in Britain. Public transport is therefore crucial in maintaining the accessibility and economy of the city centre.

Set against the backdrop of a UK and Scottish decline in bus passenger journeys per head between 1991-2001, the Lothian area has encountered a similar drop off in passenger journeys as indicated in Figure 3.6. Indeed, over the 20 years to 1991, commuting by bus in Edinburgh fell by 39% and the number of bus passengers fell from 171 million in 1981 to 135 million in 1992 (City Plan for Edinburgh, 1999).

However, since 1998-99, passenger journeys in Lothian have reversed this trend and have shown year-on-year rises up to 2001-02.

Figure 3.6 Estimated Passenger Journeys On Local Bus Services



Source; Bus and Coach Statistics: 2001-02, Statistical Bulletin Transport Series Trn/2003/2

Bus surveys of outbound evening peak buses at Haymarket Terrace show over 2,000 passengers in the two-hour period from 1600 hours to 1800 hours. This corresponds to over 1.25 million two-way peak period passengers per annum.

Current bus services in West Edinburgh are operated largely by Lothian Buses. Existing services run predominantly on radial routes from the city centre. As many services cross the city centre, there are problems of congestion affecting journey times and reliability. The A8 and A71 are the principal bus corridors to the west. Possible interchange points are at Haymarket Station, Edinburgh Park, The Gyle shopping centre, Ingliston Showground and the Airport.

Nine services operate on the A71 corridor and five services on the A8 corridor. All of these services operate at frequencies of two to six buses per hour, seven days a week. A further route is served by a night bus only, and this route runs parallel to the A71 through Stenhouse, Saughton and South Gyle.

Both the A71 and A8 operate as Greenways. These are dedicated bus routes which improve bus travel, especially to and from the city centre, The Gyle, Edinburgh Park areas and the Airport, through various traffic management measures and provision of dedicated roadspace. Low floor buses are being introduced on many routes as the fleet is renewed. However, traffic congestion in the corridor is reaching the point where the effectiveness of the Greenways is being undermined, and this problem is likely to worsen in future as traffic volumes increase further. The West Edinburgh Planning Framework defines a key objective as being "the need to improve public transport accessibility to established development sites and reduce congestion".

The proposed WEBS has been developed as the logical next step in the development of public transport in the corridor. It comprises a series of bus priority measures at junctions, bus lanes on key lengths of the main radial corridor and a guideway section parallel to the main Edinburgh to Glasgow railway line. In total, the scheme includes 3 kilometres of guideway, 7 kilometres of bus lanes and more than 20 priority measures at junctions. WEBS will directly serve Edinburgh Park and The Gyle area and support further development at Edinburgh Park, South Gyle and Sighthill. It will provide interchange with the new railway station at Edinburgh Park and will enhance the public transport system for existing residential areas of South Gyle, Broomhouse, Carrickknowe and Saughton. While WEBS will lead to a significant improvement in the quality of the bus network in the short term, there is a significant risk that this could be undermined by increasing traffic congestion over time. This will make it more difficult to maintain a high level of priority for WEBS services, because the majority of the route will be on-street, especially given that buses have a smaller capacity than, for example, trams and more vehicles are therefore needed to provide a given capacity.

3.3.2.2 Rail Network

Rail services have, to date, played only a limited role in serving the needs of the corridor. Until recently the only station within the corridor, outside the City Centre, was at South Gyle on the Fife line. This provides a useful railhead for medium to long distance trips to and from the area, but the service is not sufficiently frequent for it to contribute significantly to movements within the corridor.

Stations are located at Wester Hailes, Kingsknowe and Slateford on the southern edge of the corridor. These are served by an hourly stopping service from Edinburgh to Glasgow in Shotts. Its role in catering for the needs of the corridor is also limited.

The recently opened Edinburgh Park station on the Edinburgh-Glasgow line can be expected to play a similar role to South Gyle, but will generate a need for high quality local public transport as a feeder to the station.

In March 2002, the Scottish Executive identified the provision of a rail link to Edinburgh Airport as being a key priority. In March 2003, the Scottish Executive announced the preferred option for the Airport and committed funding for the further development work. This work will be incorporated into Private Bill submissions to obtain Parliamentary Powers for the construction and operation of the rail link.

The preferred option is a station beneath the terminal building, and a northwest-southeast railway tunnel under the runway, providing direct rail connection to Edinburgh and Fife and (among many other destinations) Aberdeen, Dundee, Glasgow, Inverness, Northeast England, and Stirling. The new route will provide a potential ten trains per hour connecting to the Airport.

The lodgement of the Bill and accompanying documentation is to be undertaken by 2005, with construction in 2006 with a view to opening the line by 2010.

This important project, being developed by **tie**, will improve public transport access to the airport from a wide area. It will offer faster journey times than other public transport between the airport and the city centre, albeit with worse accessibility within the central area than bus or tram services would provide. It may therefore abstract some demand potential from local public transport services. However this would be counteracted by 3 factors, which present opportunities for local public transport:

- Improved accessibility will support the further growth of the airport, attracting more trips from throughout its catchment area – not simply locations served by the rail link;
- The growth of the airport will result in increasing employment. In the absence of high quality local public transport a high proportion of work trips are likely to be car-based causing congestion and environmental problems. Residents from low income areas would also be disadvantaged in seeking work at the airport; and
- The airport station can be expected to develop as a railhead for the whole of West Edinburgh, imposing a need for improved public transport distributor services to Edinburgh Park and other locations in the corridor.

3.3.3. Mode Split

Table 3.7 shows mode split for the journey to work or education for wards in West Edinburgh, from the 2001 Census. The table show that a high proportion of residents in the city centre area wards walk to work, ranging from 29% in Dalry to 47% in Fountainbridge. Walking is also high in Sighthill, accounting for 35% of trips. This may indicate that residents are focussing on job opportunities within a limited area, possibly due to accessibility constraints. Bus accounts for over one-third of trips from Dalry, Shendon, Moat and Stenhouse wards, again demonstrating a strong base public transport demand on which to build and perhaps a lack of choice.

Table 3.7 Mode Split for Journey to Work or Education, 2001

Ward	Mode of Travel (%)									
	Car Driver or Motor-cyclist	Car Pass-enger	Bus	Train	Taxi	Cycle	Walk	Other	PT Users in Household	
									With Car	No Car
New Town	22.79	2.2	15.53	2.51	0.51	2.89	42.14	1.33	49.53.	50.47
Dean	30.81	3.72	16.43	2.26	0.56	2.98	34.41	1.19	54.74	45.26
Tollcross	12.77	2.28	23.92	1.81	0.36	5.01	47.19	0.54	29.47	70.53
Fountainbridge	20.98	2.53	28.2	1.45	0.25	6.14	34.87	0.54	33.68	66.32
Dalry	19.62	2.74	34.13	3.17	0.4	3.52	31.38	0.69	29.12	70.88
Shandon	30.87	4.03	39.26	1.48	0.15	4.65	15.23	0.67	40.78	59.22
Moat	33.36	4.83	40.66	0.71	0.51	2.19	13.86	0.53	45.95	54.05
Stenhouse	38.84	4.63	37.89	0.47	0.72	1.95	10.53	0.59	55.19	44.81
Murrayfield	38.7	4.34	22.34	2.72	0.3	2.95	19.41	1.21	68.23	31.77
SE Corstophine	45.74	5.75	28.26	0.33	0.73	1.87	11.83	0.49	73.14	26.86
NE Corstophine	25.55	5.03	25.02	0.53	0.35	1.99	12.9	1.01	80.6	19.4
Sighthill	26.58	4.15	22.39	1.04	0.52	1.2	35.12	0.54	48.64	51.36
Gyle	51.25	4.4	20.3	4.32	0.51	1.82	12.56	0.55	80.22	19.78
Dalmeny/Kirkliston	56.81	7.36	16.24	1.01	0.38	1.42	9.18	0.61	77.7	22.3
City of Einburgh	36.61	4.79	26.24	1.34	0.47	3.25	20.81	0.68	55.48	44.52

Source 2001 Census

3.3.4. Impact of Congestion Charging

Congestion charging is proposed as part of the ITI package of transport improvements covering the City of Edinburgh and south-east Scotland. The aim of the congestion-charging scheme, which is proposed to start in 2006, would be to impact directly on traffic levels and reduce congestion in and around Edinburgh. It is anticipated that the congestion charging proposals could deliver around £60 million net revenue annually, all of which will be used to fund integrated transport improvements.

Under the current proposals, congestion charging would involve the introduction of two charging cordons: one around the city centre to approximately the World Heritage Site boundary; and one inside the City Bypass. A proposed charge of £2.00 would be payable only once per day, regardless of how often one or both cordons are crossed in that day. The city centre cordon would operate Monday to Friday from 0700 hours to 1830 hours, and the outer cordon would operate Monday to Friday from 0700 hours to 1000 hours and from 1600 hours to 1830 hours. Emergency vehicles, motorcycles, local buses, licensed taxis, and vehicles used by disabled vehicles (blue badge) would be exempt.

The introduction of congestion charging is likely to assist in encouraging the uptake of public transport amongst those people who currently travel in and around Edinburgh by car. However, the public acceptability of the congestion charging proposals is likely to be heavily influenced by the quality of the public transport alternatives that would be available.

3.3.5. Summary of Problems and Opportunities

The success of Edinburgh's economy in recent years has led to rapid growth in travel demand by car. This is leading to rising levels of traffic congestion and delay to road users with associated impacts on the efficiency with which the transport network operates, emissions of pollutants and transport safety.

The existing and forecast levels of traffic congestion in West Edinburgh will require major improvements in public transport accessibility in order to maintain an operational and sustainable transport network, which contributes to the continuing economic success of the corridor.

Despite significant investment in bus priority measures, the bus network has not shared in the growth in travel demand and bus use has fallen significantly in the past 20 years. While there are some indications that bus use is now rising, this could be undermined by increasing traffic congestion, despite the investment in priority measures. This in turn, would reduce accessibility for those without access to a car, increasing social exclusion.

Heavy rail has a significant role to play in catering for longer distance trips to and from West Edinburgh but is not suited to playing a major role in meeting the demand for travel within the corridor. The new Edinburgh Park station and proposed Edinburgh Airport Rail Link are likely to increase the need for high quality local public transport within the corridor.

The proposed congestion charging scheme presents an opportunity to achieve modal transfer from car to high quality public transport alternatives. Indeed the public acceptability of the scheme may be affected by commitment to invest in public transport alternatives.

3.4. Environmental Problems

The relevant baseline environment conditions for each of the environmental sub-objectives are summarised in Chapter Eight of this report (with additional and supporting information presented in Appendix C). This Section on existing and potential problems therefore focuses on particular issues of significance for the environment in the vicinity of the West Edinburgh corridor.

In relation to STAG, the key environmental sub-objective which can be identified as an existing problem is city centre air quality. This has been specifically identified since air quality can be related to quantitative standards (air quality objectives) such that exceedences of these standards (or predicted future exceedences) would constitute environmental 'problems'. Air quality is also an issue, which receives public and media attention (it is therefore also a 'perceived problem'), particularly in terms of health implications, and one which is very clearly related to issues of city centre traffic growth and congestion in Edinburgh.

As a requirement of Part IV of the Environment Act 1995, local authorities have been required to complete a review and assessment of air quality to determine whether the air quality objectives are likely to be met, and where necessary designate Air Quality Management Areas (AQMAs). The review and assessment of the air quality report for Edinburgh recommended that a single AQMA be declared which centres on the New Town and links directly to the other locations in order that an integrated action plan can be prepared.

Edinburgh City Centre has been declared an AQMA on the basis that the nitrogen dioxide objectives for the annual and hourly mean are likely to be exceeded in 2005. Studies in Edinburgh have shown that 88% of nitrogen oxides come from road transport with the remaining 12% coming from domestic heating and Edinburgh Airport. This is likely to worsen in future as a result of the predicted growth in road traffic.

Road traffic clearly makes the principal contribution to air pollutant emissions in Edinburgh, and the measures included in the proposed CEC Action Plan for the AQMA are directly related to the cause of the problem. These are:

- Reducing the amount of traffic; and
- Easing traffic congestion.

These objectives are clearly relevant to the overall planning objectives for the proposed scheme, which are addressed in Chapter Two of this report.

Problems relating to other environmental sub-objectives are discussed in Chapter Eight. These include water quality in parts of the Gogar Burn (near the Airport) and areas prone to flood near Murrayfield and in the vicinity of Edinburgh Airport. Current ambient noise levels have been determined in residential areas including Baird Drive (which experiences noise from heavy rail and traffic).

In summary the key environmental problems are air quality and, to a lesser extent, noise. Both of these issues are associated with current volumes of road traffic and could be mitigated by traffic reductions.

3.5. Future Development

3.5.1. Opportunities for Future Development in West Edinburgh

Newbridge
Within Newbridge there are increasing potential development opportunities for a range of uses comprising offices, industrial and distribution activities. A number of development sites continue to be available in terms of both currently zoned and vacant land, and also the potential recycling of a number of existing facilities including the vacant former tyre plant, and potentially the release of Marshall's chicken factory. This area benefits from its existing accessibility to the motorway network and proximity to Edinburgh Airport.

Ratho Park
A new office development has recently been completed at Ratho Park, which is strategically situated on the A8, with access to both the motorway network and proximity to Edinburgh Airport. This extends to c2,787 sq m (30,000 sq ft) of high quality open-plan accommodation, and is currently vacant. It might be expected that further recycling of old or obsolete buildings to the rear of this industrial area will occur with greater pressure for development and occupation in the wider West Edinburgh and A8 corridor area.

Edinburgh Airport and Highland Showground
It is anticipated that the current growth trend in passenger numbers at Edinburgh Airport will continue for the foreseeable future. The recent White Paper on "The Future of Air Transport" forecast that demand at Edinburgh Airport would exceed 20m passengers pa by 2030. It identified the need for additional terminal capacity and a requirement for a second runway in around 2020. Given that in 2000, some 5.5m passengers used the Airport there will be substantial growth in airline-related facilities, support services, terminal facilities and in employment. For example, BAA Linton is believed to be interested in developing high quality warehousing for Edinburgh Airport which may initially total some 20,900 sq m (225,000 sq ft) of accommodation.

Gogarburn
The planned development at the former Gogarburn Hospital site for the Royal Bank of Scotland (RBoS) Group Headquarters has now commenced, and once completed is expected to accommodate a total of 4,650 staff on site. The headquarters will comprise 57,600 sq m (620,000 sq ft) of office accommodation and provide a range of other support facilities and amenities including leisure centre, crèche, training and conference facility, and other local amenities such as a shop and banking.

Edinburgh Park
The 58 hectare Edinburgh Park is already established as one of the top business parks in the UK, with 16 of the country's top performing companies located there, occupying over 100,000 sq m of office accommodation. There are currently around 7,000 employees on Edinburgh Park. The ongoing development programme spans a further 10 to 15 years with the latest development phase occupying the most prominent site to date, Lochside View, adjacent to the Gogar interchange and the Gyle shopping centre. Although the original master plan allowed for the creation of space for a further 8,000 people at the southern extension site, the revised plans could allow for up to 20,000. This will continue to act as the focus for prime office development in West Edinburgh for the foreseeable future.

However, a report in the Herald for 11th March 2004 suggested that "congestion, together with poor quality public transport, shortage of parking facilities and sheer lack of supporting infrastructure, was having a seriously depressing effect on take-up of space in the area".

Gyle Shopping Centre
The Gyle shopping centre is celebrating its tenth anniversary this year and is shortly due to progress its planned second phase of development, providing up to an additional 5,575 sq m (60,000 sq ft) of shopping mall retail space, in addition to the existing 27,870 sq m (300,000 sq ft). The new retail space will be predominantly occupied by the new Next flagship store due to open in late 2004.

Hermiston Gait
Although we understand that previous applications seeking to extend the Hermiston Gait Retail Park have so far been unsuccessful, the improved access provided by the Edinburgh Park rail station and interchange may improve the attractiveness and acceptability of further limited development in the future.

South Gyle and Sighthill
There is anticipated to be a continuation of site redevelopment in the South Gyle and Sighthill areas primarily as a result of redevelopment opportunities, which may come forward over time, whether in the form of industrial or commercial activity.

One particular opportunity exists at Sighthill Court/Calder Road where the Sighthill Campus of Napier University is thought to have been declared surplus to long term educational requirements and could therefore be sold for redevelopment, most likely for commercial, industrial or perhaps residential purposes.

Murrayfield Stadium and Surrounding Environs
The possible relocation of Hearts FC from Tynecastle Park to Murrayfield Stadium (for matches) and Riccarton Football Academy (for training and administrative functions), would release Tynecastle Park and the adjacent training pitch for redevelopment and enhance the usage of Murrayfield Stadium. Ensuring movement and access of spectators for these games can prove problematic at present and Corstorphine Road/Roseburn Terrace/West Coates are heavily congested on match days when bus services are at a standstill due to 'grid-lock'. For international rugby match days, an improved link between the Stadium and Edinburgh Airport would be a major boost to accessibility.

Further, the Scottish Rugby Union (SRU) and others have mooted proposals for the redevelopment of the area surrounding Murrayfield Stadium to the west and north, including the Murrayfield Ice Rink, for some time.

Westfield Road and Tynecastle Park
The area largely bounded by the Western Approach Road/Westfield Road to the North, Westfield Road and the railway embankment to the West, tenement residential property on Wheatfield Street and Tynecastle Park to the South, and McLeod Street/Russell Road to the East, offers one of the last remaining areas of 'lower value use' within relative proximity of, and to the West of, the City Centre. In the medium to longer term this area may gradually become available for redevelopment.

The current key 'fixes' of Tynecastle Park and the pharmaceutical plant on Westfield Road may in the longer term be relocated and their current sites become available for redevelopment. This would be likely to act as the catalyst for wider redevelopment in the area, including the existing adjacent bonded warehouse area on Westfield Road, the CEC's Roads Depot on McLeod Street, together with a variety of semi-warehousing, obsolete office/industrial accommodation, and bulk retail uses around the junction of Westfield Road and Westfield Avenue. These together may offer immense future development potential for higher value uses, located at the westernmost point of the Western Approach Road.

The current development of a major office block on Westfield Road is an illustration of the property market's awareness of this area's development potential, largely as a result of the area's accessibility – through the road network at present – and proximity to the City Centre. Higher value redevelopment of land to the west of the City Centre has generally resulted in either residential or retail development. Therefore, depending upon the constraints of local plan policy, and indeed any area development framework, this might well represent the majority of any redevelopment, which occurs in this area. However, equally, should this area result in a mixed-use redevelopment with a significant business or office floorspace element, this will become new employment in what is currently a very 'tight' labour market. The availability of high quality public transport access may be critical to the acceptability of more intensive land uses in this area.

Haymarket
The area around Haymarket is well established in respect of residential and commercial use, and there are very few further identifiable development opportunities in the short-to-medium term, excluding any unforeseen windfall opportunity sites, which may subsequently come forward.

The only real commercial properties within the West Edinburgh study area are those located at the Haymarket section from the railway station to Roseburn.

Recent development including Citypoint, modern high quality office accommodation at Haymarket Terrace, provides evidence of continuing interest and demand for development when sites come forward. For example, the planned redevelopment of the Donaldson's College for Deaf Children at West Coates, provides a significant and high profile development opportunity situated along one of the City's main arterial routes to and from the City Centre. Due to the importance of the building in terms of historical and heritage value, the site is perhaps most likely to be redeveloped for residential apartments.

There remains a prominent and significant major development opportunity site off Morrison Street, bounded to the East of Dalry Road. The site is at present earmarked for a range of development uses (i.e. residential, offices and hotel) within the adopted Central Edinburgh Local Plan (1997). The area also falls within an area of mixed activity where emphasis is placed upon the promotion of appropriate land uses which will contribute towards, and add to the character and vitality of, the surrounding local area. Part of the site that is formally allocated in the local plan has now been developed as a Travel Inn Lodge hotel, with the remainder currently being used as a temporary car park. To the South, recent housing development has been constructed along with a relatively new link road creating direct access from Morrison Street to the Western Approach Road.

The site occupies a former railway yard, which is thought to still be in CEC ownership, and there are known to be railway tunnels at the northern most part of the site, which may act as a constraint to future site development. Despite all this, the site has significant potential to enhance both the overall amenity and environment of the surrounding Haymarket area, in addition to contributing to the ongoing economic development of the City. Furthermore, with the site's close proximity to existing transportation interchange at Haymarket station (railway and bus) as well as accessibility to the Western Approach Road and other key arterial roads, there is significant potential for the creation of a high profile, gateway development at Morrison Street.

3.5.2. Impacts Of Future Development
The review of future development opportunities set out above demonstrates that there is very significant potential for development throughout the West Edinburgh Corridor.

In the absence of improved public transport it is likely to lead to a significant worsening of road traffic conditions in West Edinburgh as discussed above. Recent modelling work shows that, in a baseline scenario with the West Edinburgh Busway, total car traffic in the area covered by the transport model would increase by 19% in the AM peak hour between 2001 and 2011 and by 51% by 2026. This would result in significant increases in journey times. Some examples are shown in Table 3.8.

Table 3.8 Increase in AM Peak Journey Times

Route	2001 Time (Mins)	2011 Time (Mins)	2026 Time (Mins)
Sighthill-Haymarket	16.6	20.5	32.3
Gyle-Haymarket	22.4	27.7	43.3
Newbridge-Haymarket	28.4	38.7	62.2

These problems represent a significant opportunity for enhanced public transport in alleviating congestion and its associated environmental and safety impacts. In addition, the underlying growth in travel demand created by further development and increasing propensity to travel (itself driven by growing prosperity) provide increasing market potential for public transport.

3.6. Summary Of Problems And Opportunities

The analysis above has shown that there are significant opportunities for improved public transport in the corridor. It has a relatively high population density and a growing population. There are also major employment centres in the City Centre and at the western end of the corridor (Sighthill, Gyle, Edinburgh Park and Edinburgh Airport). There is considerable potential for further development in the corridor. This provides opportunities for relatively balanced flows by direction at peak periods. Improved public transport would also play a role in distributing trips from major transport interchanges including the airport and rail stations at Edinburgh Park and Ride in the City Centre.

A high quality public transport system providing improved access and capable of attracting car users to switch mode, would also assist in resolving the following transport problems, highlighted above:

(i) Poor accessibility and social exclusion affecting the southern part of the corridor, particularly Moat, Stenhouse and Sighthill wards. It would improve access to the public transport network and wider employment opportunities;

(ii) Potential loss of economic growth to other areas as a result of access difficulties. This would reduce opportunities for residents of the more deprived wards in the corridor and there is a risk that development could relocate to areas which are more difficult to serve by public transport;
(iii) Increasing traffic congestion resulting from general traffic growth and additional development;
(iv) Poor air quality, especially in the City Centre, resulting mainly from road traffic. In the absence of a transfer to public transport this is likely to worsen as traffic volumes increase;
(v) Rising noise levels, again associated with road traffic; and
(vi) Additional road traffic accidents resulting from increasing traffic volumes.

Accordingly, improved public transport has the potential to contribute to achieving each of the planning objectives set out in Chapter 2.

EDINBURGH TRAM LINE TWO
Environmental Statement

Area: Hectares

Density: Person per Hectare

Figure 3.1

Population Density by Ward

FABER MAUNSELL
In association with: Roger Tym & PARTNERS

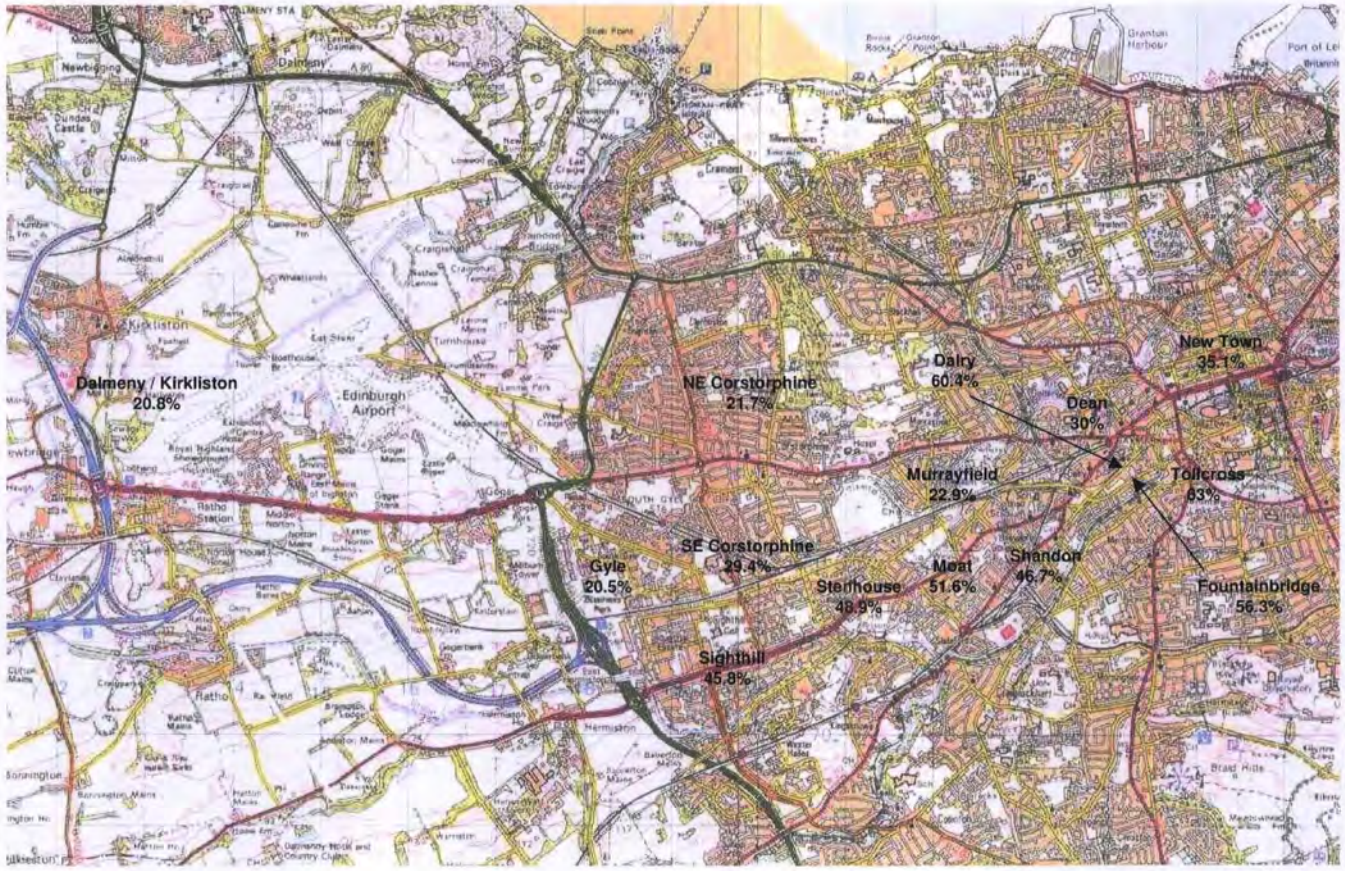


Figure 3.2

Households with no car

FABER MAUNSELL
In association with: Roger Tym & PARTNERS

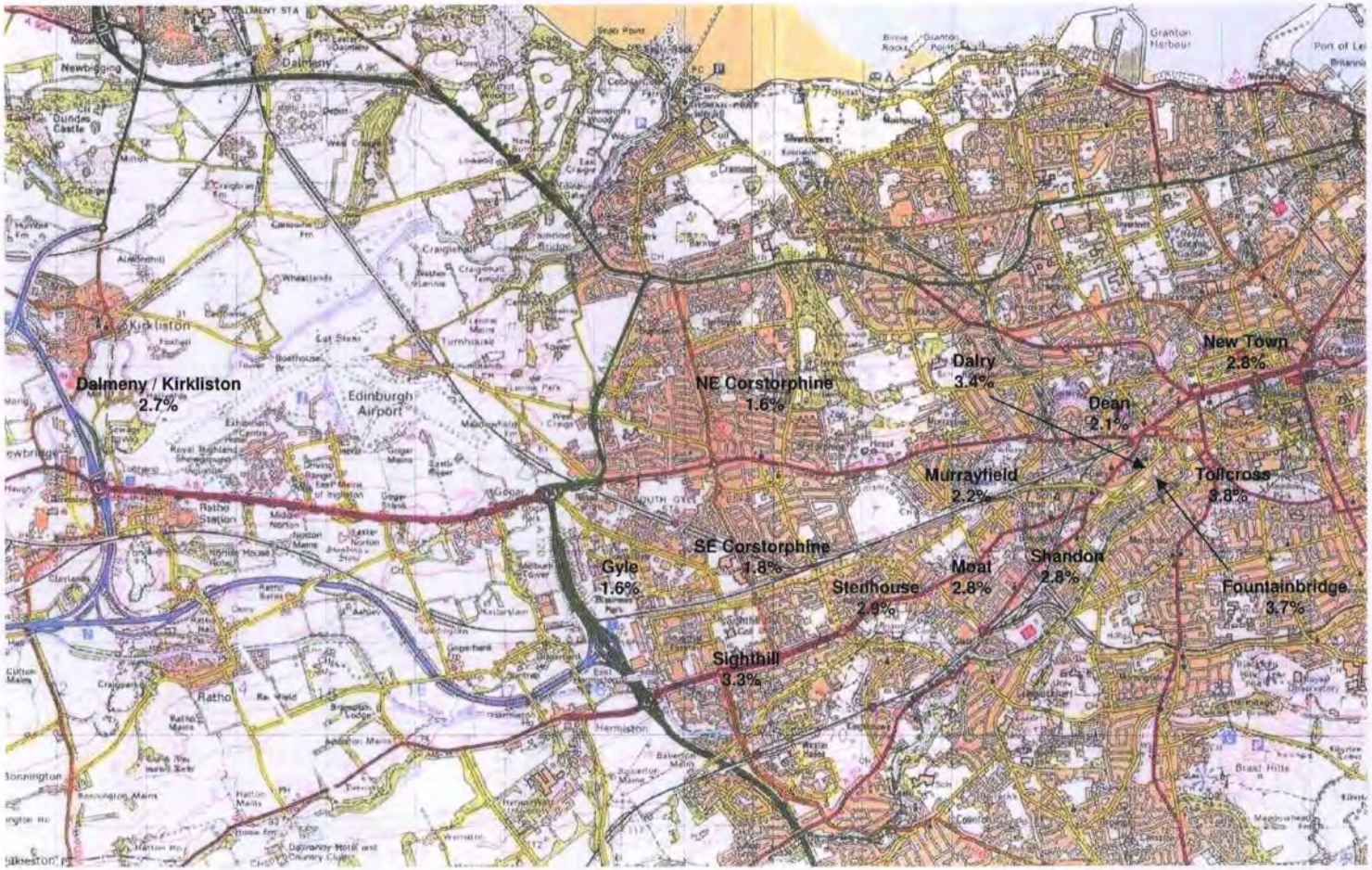


Figure 3.3

Unemployment Level by Ward

FABER MAUNSELL
In association with: Roger Tym & PARTNERS

EDINBURGH TRAM LINE TWO
Environmental Statement

- SIMD ranking
- Income ranking
- Employment ranking
- Education ranking
- Health ranking
- Access ranking

Figure 3.4

Scottish Indices of Multiple Deprivation by Ward

FABER MAUNSELL
In association with: Roger Tym & PARTNERS

4 PROJECT HISTORY – OPTION GENERATING, SIFTING DEVELOPMENT AND AST1 APPRAISAL



4. Project History – Option Generating, Sifting, Development and AST1 Appraisal

4.1. Introduction

As noted in Chapter 1, the case for re-introducing trams or light rail to Edinburgh has been examined in a number of studies dating back to 1987. However, the current scheme was first developed and appraised in outline as part of the Integrated Transport Initiative for Edinburgh and South East Scotland. This was developed further during the Feasibility Study for a North Edinburgh Rapid Transit Solution and also by the Edinburgh LRT Masterplan Feasibility Study and the Prospectus for the West Edinburgh Tram. The key points arising from each piece of work are summarised below, demonstrating that a robust approach was adopted in selecting the tram solution.

4.2. Integrated Transport Initiative (ITI) For Edinburgh And South East Scotland

The ITI contains a Vision for Edinburgh and was submitted to the Scottish Executive in September 2002. This document summarises the options, which were examined as part of the appraisal process and assesses their performance against the Planning Objectives, which are set out in Chapter Two. The work was particularly concerned with assessing the justification for congestion charging and examining how it might be developed. However it was recognised that charging needed to be accompanied by investment in public transport and facilities for walking and cycling to provide improved alternatives to the private car.

As a result of this work **tie** recommended a single preferred congestion charging and investment package to take forward to the next stages of development of the ITI. Key features of this package included:

- Road user charging;
- A new tram network;
- Major improvements to bus service levels and quality;
- Rail network enhancements;
- Investment in public transport customer care;
- Park and ride investments;
- Increased spending on road maintenance;
- Providing a network of pedestrian routes;
- Improved cycle facilities; and
- A comprehensive range of traffic and environmental measures to enhance the City Centre environment.

The tram network identified in the ITI comprised the three lines currently being developed.

The Part 1 Appraisal Summary Tables (AST) arising from this work are reproduced in Appendix A. This indicates that the preferred package will meet the planning objectives.

The Preliminary Business Case indicated that it would be possible for the Preferred Package to achieve the following (costs at 2002 prices).

- North and West tram lines operational by 2009 (total capital cost £355M);
- South East tram operational by 2013 (capital cost £123M);
- A contribution to rail schemes in Edinburgh of £35M between 2008 and 20015;
- Another £140m available to fund a contribution towards rail or light rail outside the City boundary. This would come in two phases, £40M in 2014-2019, and £100M in 2022-2028;
- The orbital bus scheme linking South Gyle and the New Edinburgh Royal Infirmary completed in two phases, firstly £17M in 2006-2008, secondly £55M in 2015-2017;
- City Centre Enhancements undertaken between 2006 and 2015 at a total value of £40M;
- A total spend on public transport revenue projects averaging approximately £39M per annum; and
- Maintenance expenditure over the period of £188M over the life of the project, £6.9M per annum on average.

This report, and its subsequent endorsement by the Scottish Executive, formed the basis of establishing the justification for a network of high quality LRT routes in Edinburgh.

4.3. The Feasibility Study For A North Edinburgh Rapid Transit Solution

This feasibility study was undertaken by Andersen and reported in July 2001. Although the focus of the study was, as the title suggests, essentially into providing an enhanced public transport system for the North Edinburgh, work was undertaken which was relevant to the proposed Edinburgh network as a whole.

During the course of the study a range of transportation technologies were reviewed and their suitability considered.

Of the available technologies, *Traditional Bus, Monorail, Guideways, Magnetic Levitation (MAGLEV) and Peoplemovers* were discounted at an early stage for a variety of reasons. Monorails, Guideways and MAGLEV are generally more suited to end to end journeys along wholly segregated routes. They would not afford the same opportunities as other modes for future expansion into a broader Edinburgh network, which is one of the key objectives of that scheme. Traditional bus services would not promote the desired

high quality segregated solution with the performance required to attract investors. Peoplemovers cannot provide the necessary capacity for the transport link.

The remaining technologies assessed in detail were broadly split between light rail and guided bus. Both systems are high quality and offer the potential to act as a catalyst for development. They also offer the flexibility for future expansion.

Of the guided bus options, the review concentrated on the tried and tested technology provided by kerb guidance, since it was essential that the technology can be delivered on time. Other systems such as electronic guidance have failed to perform in practice and could pose an unacceptable risk to the overall project. It was suggested that a review of developments in these technologies should be undertaken as the scheme develops, as they may with time gain greater acceptance and become proven in practice.

Overall it was concluded that for the North Edinburgh loop the light rail system should be adopted but that advanced Guided Bus developments should be monitored. The considerations that led to the selection of light rail as the preferred solution for North Edinburgh also apply to the West Edinburgh corridor.

Alternative light rail technology such as the LR55 was noted. However, it is recommended that the scheme be developed based on proven technologies. *Quality Bus* technology should be considered as a possible interim measure to meet the short-term transport demands of the development site, prior to the final solution being implemented.

These recommendations, together with ITI work undertaken as part of the preferred package, resulted in Light Rail (or Tram) technology being adopted for the Edinburgh network. This resulted in the LRT Masterplan Feasibility Study being commissioned by CEC in December 2001.

4.4. The Edinburgh LRT Masterplan Feasibility Study

This study was undertaken by Arup and reported to CEC in January 2003. Its objective was to identify a viable network of LRT routes which, in conjunction with other modes, would best meet LTS and other project objectives. It was also to provide sufficient data on LRT routes for use in overall assessment and prioritisation of schemes with the ITI.

The study looked at potential LRT corridors throughout Edinburgh as well as possible extensions beyond the city (the SESTRAN Extensions). It identified the main corridors of movement within Edinburgh, which have the potential to justify investment in high quality public transport. These are all radial to the City Centre and are as follows:

- Silverknowes;
- Newhaven/North Leith;
- Leith;
- Corstorphine/Murrayfield;
- South Gyle/Stenhouse;
- Moredan/The Inch; and
- Portobello.

Edinburgh Tram Line 2 would serve the Corstorphine/Murrayfield and South Gyle/Stenhouse to city centre movements as well as providing other links to the city centre and within West Edinburgh. This analysis demonstrated that the West Edinburgh corridor should be a priority for investment. It also revisited the available technologies and, like the Andersen study, concluded that LRT (or Tram) was the appropriate choice for a city of Edinburgh's size.

This study recommended that the North Edinburgh Loop be accorded highest priority among the corridors tested and that the Masterplan should include both the West (Edinburgh Tram Line Two) and the South East (Edinburgh Tram Line Three) lines as high priority schemes.

The Part 1 Appraisal Summary Tables (AST) arising from this work are reproduced in Appendix A.

By the time that Arup's work was completed the West Edinburgh Busway scheme was committed. Accordingly Arup considered whether further investment in tram was worthwhile. They concluded that the tram would generate significant additional performance and reliability benefits and would lead to a significant further modal shift from car to public transport. While not part of this appraisal, Arup also highlighted the potential integration benefits of providing a network of tram routes. They also pointed out that the on-street bus priority measures that are a key feature of WEBS would remain after conversion of the guideway element to tram.

The order of implementation was not determined by technical issues or clear performance ranking. However, there was a strong case for considering the West Edinburgh Line next because of development pressure, the availability of alignments and traffic congestion. The study found that the three lines work well as a network, based on the core Haymarket-Princess Street alignment. This would achieve important economies, reducing the forecast capital cost from £528M to £466M, and improve the financial case for all lines.

There was found to be potential for further development of all three lines: inner area branches of the North Edinburgh Loop, including to Davidson's Mains, a branch off South East Edinburgh towards Liberton. However, a branch off the West Edinburgh line to Hermiston Gait was not recommended.

Extensions into the SESTRAN area were also found to be possible but the case for these required more detailed consideration. None of these is likely to be attractive as stand-alone schemes and all should be considered as extensions of Edinburgh core lines. Extensions of the West Edinburgh line to West Lothian (Broxburn/Livingston) and of the Southeast line to Dalkeith appeared to have the greatest potential, followed by Musselburgh via the Portobello/Joppa corridor, but this depended on the case for the latter which needs further investigation.

4.5. West Edinburgh Tram Propectus

In addition to the overall Masterplan Study, Arup prepared a document entitled "West Edinburgh Tram: Prospectus to Scottish Executive" in April 2002. This set out the arguments for building WEBS first and subsequently developing West Edinburgh Tram:

"The consideration of the short-term deliverable WEBS and a tram for the medium to long term would give a staged improvement in public transport provision in West /Edinburgh. The progression from a bus guideway to a tramway ultimately delivers a high quality reliable and attractive system.... whilst providing real benefits to the travelling public at the earliest opportunity".

This work showed that the benefits from tram were significantly greater than those of WEBS, but that the benefits of the latter were sufficient to cover the capital costs within 4 years.

Overall Arup concluded that there was a strong case for West Edinburgh tram as the second stage of development of public transport in the corridor. The prospectus was accepted by the Scottish Executive as the basis for offering PTF funding for the further development of the tram scheme.

4.6. Conclusions

When FaberMaunsell was appointed by **tie** in October 2002 the justification for a Tram route through the West of Edinburgh had been established. This justification was made through a series of different studies which have been summarised in this Chapter. AST1s were produced as part of the ITI submission and on this basis the Scottish Executive awarded the CEC £375M to cover the capital costs of the first two tram routes.

The case for Tram in Edinburgh had therefore been made in principle. The considerations that led to the selection of light rail as the preferred solution for North Edinburgh also apply to the West Edinburgh corridor. This report looks at the corridor through West Edinburgh in more detail to determine the precise route alignment. This is summarised in the following Chapters of this report and is reported formally in the AST2s in Appendix B.

Notwithstanding this, it is necessary to demonstrate during the Part 2 Appraisal that tram is not only justified in its own right but it is the best public transport option for the corridor. In practice the only realistic alternative is a guided busway, for the reasons set out above. As WEBS is already being developed it was included in the baseline for this study. Accordingly the critical test is whether the tram option performs better than the baseline, or Do-Minimum, in the appraisal. The results of this appraisal are set out in detail in Chapter 8.

5 THE WEST EDINBURGH CORRIDOR



5. The West Edinburgh Corridor

5.1. Introduction

Once the case had been made in principle for Edinburgh Tram Line Two, the starting point for this, more detailed, stage of the work was to examine and select the Preferred Route Corridor through West Edinburgh.

During this phase of the study, over thirty route options were defined and three basic corridors identified as follows:

- North – along the A8;
- Central – a similar corridor to that used for the City of Edinburgh Rapid Transit generally following the heavy rail line from West Edinburgh to the city; and
- South – following the A71 and Western Approach Road.

Each corridor and option was subject to review as outlined in the sections below. This work was originally reported in the Preferred Route Corridor Report and Addendum (See Appendix K) and a summary of this work is contained below.

5.2. Methodology

At an early stage in the commission, the key team members undertook a general site inspection to view the constraints and opportunities for route alignment options, keeping the principle scheme objectives in mind. Confirmation walk-over visits followed to establish specific local route characteristics as possible alignments were considered in more detail.

In a workshop environment, a number of route options were developed using as a guiding principle "possible until proved impracticable". Subsequently these options were discussed with **tie** representatives taking into account previous work. As a result some adjustments were made and some new options were added.

A total of about 30 alignment options were drawn up with a very large number of combinations being possible from these. In some stretches of the route (for example from Newbridge to Gogar Roundabout) the options were similar but on slightly different alignments. Between Gogar Roundabout and the city centre there were distinctly different choices to be made between 'corridors' (for example a northerly corridor along the A8, a second 'central' corridor generally following the Edinburgh-Glasgow railway and previously developed CERT corridor, and a third southerly one following in part the A71). It was essential to reduce the options and combinations to a manageable number for onward analysis towards a preferred route.

The results of this sifting process are summarised in the Sections below. Further details can be found in the accompanying Preferred Route Corridor Report and Addendum.

5.3. Options Appraised

All 30 alignment options were appraised using the following criteria:

- Engineering;
- Traffic and Transportation;
- Safety;
- Environment;
- Economy/Development;
- Accessibility; and
- Integration.

The methods adopted for appraisal purposes were generally based on STAG although a number of adaptations and simplifications to the STAG approach were adopted. All impacts were based on professional judgement informed by previous experience of similar schemes. Impacts were described on a seven-point scale as indicated below:

	Negative	Positive
Major	---	+++
Moderate	--	++
Small	-	+
No Impact	0	

The full scope of this appraisal and outline of methods used can be found within the Preferred Route Corridor Report and Addendum (see Appendix K).

Overall, the intention was to provide a relative comparison between options for the purpose of selecting a preferred route and therefore the results do not represent a definitive assessment of the impacts of the options. Results of this process are summarised in Table 5.1 below.

Table 5.1 Options Progressed from Appraisal

Option Number	Extremities (East to West)	Progressed to AST2	Summary
1 (Part)	From Newbridge Roundabout to Airport terminal	x	Serves the Showground and provides a direct route. No access to Newbridge.
1b	From Highland Showground to Option3	✓	Avoids conflict with Airport expansion.
2 (Part)	From Newbridge roundabout to Airport terminal	✓	May lose demand from the Showground and does not serve Ratho development.
3 (Part)	From Gogar roundabout to Airport terminal	✓	Serves Airport well and potentially RBoS.
4 (Part)	From Gogar roundabout to Airport terminal	✓	Serves Airport well and potentially RBoS.
5	From Airport terminal to Gogar roundabout	x	Serves Airport well and potentially RBoS.
6	From Gogar roundabout to South Gyle access / Bankhead drive junction	✓	Serves Edinburgh Park well, plus existing demand, potential for interchange.
7	From Gogar roundabout to South Gyle access / Bankhead drive junction	x	Serves Edinburgh Park less well than 6, but existing demand better. Less potential for interchange and all on street.
8	From Corstorphine Road / Riverside Crescent to Gogar roundabout	x	Most direct route from the Airport but all on street and subject to congestion. Does not serve Edinburgh Park well.
9	From Broomhouse Road / Bankhead Drive junction to South Gyle Access / Bankhead Drive junction	✓	No major impact.
10	From Broomhouse Road / Bankhead Drive junction to South Gyle Access / Bankhead Drive junction	x	No major impact.
11	From Broomhouse Road / Bankhead Drive junction to South Gyle Access / Bankhead Drive junction	x	No major impact.
12	From Stenhouse Drive pedestrian bridge to Broomhouse Road / Bankhead Drive junction	✓	Segregated running allowing for a fast section of the journey but does not directly serve major patronage generators.
13	From Stenhouse Drive / Stenhouse Drive junction to Broomhouse Drive / Bankhead Drive junction	x	High patronage, very socially inclusive, but potential to lose demand from Newbridge and the Airport.
14	From Balgreen Road / Saughton Drive junction to Stenhouse Drive pedestrian bridge	✓	Segregated running allowing for a fast section of the journey but does not directly serve major patronage generators.
15	From Corstorphine Road / Saughton Drive junction to Balgreen Road / Saughton Drive junction	x	Leads to a congested area where delays likely through low density housing.
16 (Part)	From Roseburn Street / Roseburn Terrace junction to Balgreen Road / Saughton Drive junction	✓	Serves Murrayfield well. On street section likely to result in increased journey times hence this element has been dropped.
16b	On Baird Drive	x	As 16, but may increase journey times further. Additional residential property impact.
17	From Stenhouse Drive / Stenhouse Drive junction to Stenhouse Drive pedestrian bridge	x	No major impact.
18	From Riverside Crescent / Corstorphine Road junction to Balgreen Road / Saughton Drive junction	x	Convoluted and slow path picking up little extra patronage.
19	From Roseburn Terrace / Roseburn Street junction to Riversdale Crescent / Corstorphine Road junction	x	A congested road section likely to incur delays regularly without adding to patronage significantly.
20	From Princess Street / Lothian Road	x	Serves major areas of demand

Option Number	Extremities (East to West)	Progressed to AST2	Summary
	junction to Stenhouse Drive / Stevenson Drive junction		but likely to be slow speeds for much of its length.
21	From Haymarket Station to Roseburn Terrace / Roseburn Street junction	x	Potential for high patronage and links with Haymarket but slow journey times.
22	From Edinburgh Park to North side of A8 to Airport	x	Missed opportunity to link with Railway but segregated route might improve journey times.
23 (Part)	From South Gyle access / South Gyle Crescent roundabout to Gogar roundabout	✓	Does not serve Edinburgh Park well. Hence revised to go through Gyle Centre.
24	From Roseburn Street to Russell Road and connecting to Edinburgh Tram Line One	✓	No major impact.
25	On Roseburn Street / Roseburn Terrace junction	x	Delays at junction may increase journey times.
26	Gogar Roundabout	✓	At grade crossing may result in delays.
27	From Edinburgh Tram Line One to Roseburn Street	✓	Restricted access between lines 1 and 2. Network Rail impact.
28	Stevenson Road to CERT alignment.	x	Quicker than 16 but does not serve Murrayfield as well.
29	From Haymarket to West approach road	x	Serves major areas of demand but likely to be slow speeds for much of its length.
30	From Balgreen Road to Stenhouse Drive	✓	Segregated running allowing for a fast section of the journey but does not directly serve major patronage generators.
31	Western Extension Highland Showground to Newbridge	✓	Provides access across the Motorway to Newbridge.

5.4. Preferred Route Corridor

5.4.1. Background

5.4.1.1 Route

The preferred route corridor arising from this work and which was taken forward to public consultation is the central corridor, which broadly follows the alignment of CERT. A drawing folio showing the route options, which were taken to public consultation, can be found in Appendix E. Further details of the option appraisal can be found in the accompanying Preferred Route Corridor Report and Addendum.

The Preferred Route Corridor can be described as follows:

5.4.2. St Andrew Square to Roseburn

Edinburgh Tram Line Two services will run from St Andrew Square, along Princes Street, Shandwick Place to Haymarket and then onwards towards Roseburn.

5.4.3. Roseburn to Carrick Knowe

The preferred route corridor includes three sub-options along the length from Roseburn to Carrick Knowe:

- Option A – a route along the south of the railway embankment;
- Option B – a route along the north of the railway embankment; and
- Option C – a hybrid of Options A and B. This option is initially south of the railway between Russell Road and Balgreen Road and then crosses back to the north to utilise the reserve created for the CERT project.

5.4.4. WEBS / Edinburgh Park

From Carrick Knowe the preferred corridor assessment identified that the best route would be for the tram to supersede the WEBS guideway, which is to be formed in the grass reserve between the railway line and Stenhouse, Broomhouse, and Bankhead Drives respectively. Options 6, 9 and 12 form the alignment in this region. This decision was not challenged through either public or stakeholder consultation and was acceptable to the Client Group.

5.4.5. Gogar Junction

Following early consideration of a number of options at Gogar Roundabout, stakeholder and Client Group consultation defined two options for the preferred route:

- Option A – directly across the roundabout with signalisation providing priority for the tram (option 26);
- Option B – passing through the Gyle car park before crossing under Glasgow Road (the A8) east of Gogar Roundabout.

5.4.6. Gogar Burn

The alignment that was subsequently taken forward to public consultation was a hybrid of the previous options. The alignment ran parallel to the A8 as far as Gogar village, headed north then west to join the CERT route

5.4.7. Airport/Ingliston

The preferred route corridor identified a solution, which looped north to the Airport serving the Royal Highland Showground via an alignment either to the north or to the south (options 1 and 2).

5.4.8. Newbridge Branch

The western ends of two of the earlier options were ruled out due to difficulties crossing the motorway and the development of the Airport branch alignment. The preferred option within Newbridge presented for public consultation consists of a loop around the village. Starting from Ingliston Park and Ride, the route would cross Eastfield Road at-grade before reaching a stop at the Royal Highland Showground. The route would then pass the Showground along its southern boundary, beyond which a route via Ratho Station would be taken to reach Newbridge.

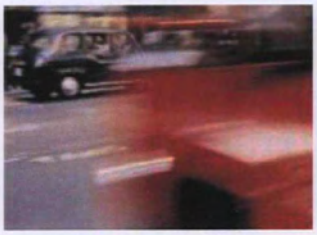
5.5. Summary

Following a STAG based appraisal process, the central corridor was shown to perform significantly better than the North and South corridors in six of the seven main categories and was therefore adopted as the preferred corridor. This, therefore was the corridor that was presented to the public at an extensive consultation process. During the consultation the public were asked to comment on sub-options of the corridor at:

- Princes Street/George Street;
- The Roseburn to Carrick Knowe section;
- Gogar Roundabout; and
- Near to the Airport.

The following Chapter will outline the findings from the Consultation process, which was used to appraise the preferred options, and depot sites.

6 CONSULTATION



6. Consultation

6.1. Introduction

Extensive consultation was undertaken in respect of Edinburgh Tram Line Two. **tie** appointed a specialist advisor, Weber Shandwick, to develop and implement an overall strategy for public relations and communications, including for example, the organisation, monitoring and reporting of a major public consultation exercise carried out covering both Edinburgh Tram Line One and Edinburgh Tram Line Two. In addition, there was wide-ranging consultation with the client group (**tie** and CEC) and with major stakeholders affected by one or both Lines. The consultations sought the views and comments on several route options presented by the advisors. This Chapter provides an overview of the consultation process and summarises the principle findings.

STAG sets out the requirements and the benefits of participation and consultation as well as providing details on scope and methods for this work. The strategy for participation and consultation was based upon the following attributes:

- It should be open so that those taking part understand the process and can see how their views are being taken into account;
- It should start as early as possible in the planning exercise and continue throughout to maximise ownership;
- It should involve stakeholders both in the identification of problems and the development of solutions; and
- It should provide feedback to contributors wherever possible.

6.2. Objectives

6.2.1. Consultation Objectives

The main objectives of the consultations were to inform stakeholders about the proposals, and to allow stakeholders to express their views on the proposals and therefore contribute to the assessment and preparation of final route designs. The consultation process also aimed to raise awareness, interest and understanding of the proposals amongst stakeholders, and build support where possible. In addition, the consultation process enabled any misconceptions and negative perceptions amongst stakeholders and the wider public to be addressed.

6.2.2. Consultation Process

The consultation process involved three key components, as outlined below.

- Client Consultation

There was continual consultation with the client group (**tie** and CEC) throughout the study. This included Steering Group consultations and monthly progress meetings with **tie**. Further meetings were held with CEC Transport and Planning divisions and the Scottish Executive as required.

- Stakeholder Consultation

"Stakeholders" were defined as a person or organisation that has an interest in the project proposals other than as a member of the public.

The stakeholder consultation undertaken for Edinburgh Tram Line Two involved a variety of methods and actions. In the first instance, the team reviewed the range of stakeholders and placed them into the following broad categories:

- Statutory;
- Council;
- Environmental;
- Heritage;
- Transport;
- Community;
- Business;
- Public Utility;
- Emergency Services;
- Disability; and
- A further category of 'technical' consultees was identified although this is strictly not a stakeholder category.

Extensive stakeholder consultations have been undertaken on an on-going basis during the development of the route corridor options. Stakeholders with whom consultations have been undertaken include the following:

- Network Rail;
- Historic Scotland / Edinburgh World Heritage Trust;
- Her Majesty's Railway Inspectorate;
- Scottish Rugby Union;

- City of Edinburgh Council (Murrayfield Flood Defence);
- Scottish Equitable;
- British Telecom;
- Edinburgh Park Management Limited / New Edinburgh Limited;
- The Gyle Management Company Ltd. / Drivers Jonas;
- Royal Bank of Scotland;
- New Ingliston Ltd.;
- BAA;
- Royal Highland Showground; and
- Edinburgh Gate.

A further list of consultees can be found in the Environmental Statement report, under separate cover.

The consultations aimed to inform stakeholders about the proposals and enabled stakeholders to express their views on the proposals. Feedback from the stakeholder consultations has assisted in generating and refining the route options.

- Public Consultation

Public consultations were undertaken during May and June 2003 and included consultations with political representatives, community organisations and the general public. The consultations involved a number of methods to achieve an inclusive approach along the length of the proposed tram corridor, and details of the exact methods employed are outlined in the Sections below.

6.3. Public Consultation Process

6.3.1. Methodology

A number of methods were used to raise awareness of the consultation and to involve the stakeholders and the wider public in the process, and these are summarised below:

- Media Launch

Media representatives were briefed at an official consultation launch.

- Leaflets

A leaflet was produced containing information on the proposals and the timetable for exhibitions and public meetings. The leaflet also included route maps and a self-completion questionnaire.

- Website

A dedicated website was set up and this included background information and the questionnaire, in addition to downloadable maps and documents and hyperlinks to other sites of interest. The website was promoted through the media.

- Freefone number

This was advertised in the local press, and was available to those who wished to request a consultation leaflet or further information on proposals and / or the consultation process.

- Consultation with Political Representatives and Community Organisations

MPs, MSPs and community council representatives were sent leaflets and a letter from **tie**'s Chief Executive. These stakeholders were invited to one of two events to discuss the proposals, and **tie** made representations or presentations at community council meetings, which were also open to the general public.

- Wider Stakeholder Consultation

A database of stakeholder organisations was compiled. These stakeholder organisations were sent leaflets with a covering letter from **tie**'s Chief Executive inviting comments, and key organisations were invited to one of two meetings.

- Exhibitions

A static exhibition was erected in the City Centre from 21 May 2003 to 25 June 2003 and was manned by staff from Weber Shandwick, Mott MacDonald and FaberMaunsell. In addition, a number of touring exhibitions were arranged at venues adjacent to the proposed tram route, and were also manned by staff from Weber Shandwick, Mott MacDonald and FaberMaunsell. The exhibitions provided detailed information on the proposals and an opportunity for the public to make comments. Comment books were available at all exhibitions and leaflets were distributed.

- Public Meetings

Public meetings were held at venues along the route. All public meetings and exhibitions were advertised in a prominent position (page 3) in the Evening News during the first week of the consultation. Radio advertising supported the public meetings, and additional publicity was achieved via press coverage at the consultation launch.

Members of the public could respond to the consultation in the following ways:
- Returning the pre-paid response slip from the leaflet or filling in the on-line response form;
- Writing to the Freepost address or by e-mail;
- Calling a Freefone number;
- Attending an exhibition or public meeting.

As noted earlier, the consultation strategy is to provide feedback to consultees where possible. This was achieved in a number of ways. Where questions were asked at the public exhibitions these were answered directly by the professional advisors present at the time. For some stakeholder consultees, several meetings were held to clarify issues, exchange views and report back changes to the scheme to accommodate concerns. Consultations with other groups began with meetings and a dialogue is expected to continue as the project progresses. Specific questions raised through correspondence and web-site enquiries have been answered in a similar manner.

6.3.2. Coverage and Response

The level of coverage and response rate to each stage of the consultation is described below.
- 107,000 leaflets were mailed directly to households and businesses in the vicinity of the tramlines.
- 9,100 leaflets were distributed to libraries, supermarkets, shopping centres and public buildings.
- 5,000 leaflets were distributed via exhibitions and public meetings.
- 450 leaflets were mailed directly to individuals on request.
- All businesses in the city centre, other major businesses, and third party groups were sent a leaflet, and additional leaflets were sent to city centre businesses on request.
- 676 people in total attended the public meetings (seven meetings); and a total of 67 people attended the wider stakeholder meetings.
- The website was the most popular means of information access, gaining between 30,000-50,000 hits per week.
- The overall number of responses received prior to the end of the consultation was 3,023. There were 74 duplications leaving the number of responses as **2,949**. These were distributed as follows:
- 1,929 of responses were received via the leaflet questionnaire;
- 481 responses were received through the online response form on the website;
- The remaining 539 were received by letter, email, phone, comment book, comment cards, and at exhibitions.

Further details relating to the consultation process can be found within Weber Shandwick's Consultation Report.

6.3.3. Main Findings

General

84% support the concept of the tram in Edinburgh

Recurring issues people commented on related to the route options, the design of the trams and pylons, expected noise levels, proximity to residential properties, disruption during construction and the environmental impact of the tram. The main issues raised are discussed in the following sections.

Edinburgh Tram Line Two

86% supported the route of Edinburgh Tram Line Two, and 14% did not support the route.

The main reasons given for supporting the Edinburgh Tram Line Two route were:
- Provides vital link to the Airport;
- Links with existing public transport;
- Will alleviate congestion in West Edinburgh;
- Provides good link to Gyle Centre, business parks, RBoS and Royal Highland Showground; and
- Will benefit the tourist industry.

The main objections to the Edinburgh Tram Line Two route were:
- Proximity to residential properties;
- Requirement for Compulsory Purchase Orders (CPOs) in some areas;
- No need to extend to tram to Newbridge (perception there would be few users in this area); and
- The route does not cover some heavily populated areas where likely tram users reside. For example Gorgie, Dalry and Corstorphine.

Tram stops

86% supported the proposed stops on Edinburgh Tram Line Two, whereas 14% had some objections to the stop locations.

The main reasons given for supporting the Edinburgh Tram Line Two stops were:
- They (the stops) are thought to be well placed; and
- Good balance between accessibility and speed.

The main objections to the Edinburgh Tram Line Two stops were:
- Too few stops; and
- Concern over increased parking at stops.

Route Options
Table 6.1, below, shows the support for each Edinburgh Tram Line Two route option.

Table 6.1 Support for Edinburgh Tram Line Two Route Options

Option	Line 2 Section		
	Ingliston	Gogar	Roseburn/ Carrick Knowe
Option A	40.8%	14.5%	13.2%
Option B	36.0%	76.8%	38.3%
Option C	-	-	27.3%
Don't Know	23.2%	8.8%	21.2%

There was no clear preference for the Ingliston options between Option A, the Royal Highland Showground route, and Option B, running east of the Showground. The most popular of the Gogar options was Option B, which avoids Gogar roundabout.

Option A, south of the railway line, was the least popular option for Roseburn/Carrick Knowe, however there was not an overwhelming majority for either Option B (north of the railway line) or Option C (a hybrid of options A and B). Local analysis showed that the majority (72%) of residents of Whitson Road and Stenhouse Avenue West, and of Baird Drive (63%), favoured Option C for Roseburn/Carrick Knowe.

The reasons given for the preference of one option over another were as follows:

Ingliston

The main reasons given for supporting Option A, the Royal Highland Showground route, were:
- Would be quicker and easier to construct than other options;
- Avoids disruption of re-routing the A8 that Option B would require;
- More direct route than other options;
- Better access to the Royal Highland Showground;
- Would not have a detrimental impact on private residential properties;
- Airport expansion unlikely to happen or feeling that it is not vital; and
- Allows Park and Ride facility.

The main reasons for supporting Option B, which runs east of the showground, were:
- Essential to have a stop at the Royal Highland Showground south;
- Serves South Gyle and North Gyle/Maybury area better than other options;
- Future expansion of the Airport should not be compromised;
- More likely to be approved by planners;
- Will result in the upgrade of the A8 which would be a good additional benefit; and
- Faster journey times between the Airport and the city are more important than beyond the Airport.

Gogar

The main reasons given for supporting Option A, which crosses the Gogar roundabout, were:
- If congestion gets worse on the roundabout car users might be encouraged to switch to the tram;
- Option B may result in more vandalism and teenage loitering near the current railway bridge; and
- Faster journey times are a priority – trams should have priority over traffic.

The main reasons given for supporting Option B, which avoids Gogar roundabout, were:
- Less disruption to traffic;
- Serves the Gyle better than other options; and
- Safer than having trams running on Gogar roundabout, and causes less congestion.

Roseburn/Carrick Knowe

The main reasons given for supporting Option A, which runs South of the railway line, were:

The main reasons given for supporting Option B, which runs North of the railway line, were:
- Better access to Murrayfield;
- Faster journey times;
- Keeps trams away from the roads – less impact on existing infrastructure;
- Best long-term solution;
- Safer for children as it is away from Balgreen Primary School;
- Will ease traffic congestion and parking problems in the Murrayfield area; and

- Keeps trams away from housing.

The main reasons given for supporting Option C, which is a hybrid of Options A and B, were:

- Has least effect on properties whilst providing good service to local area;
- Serves a number of potential users;
- Combines the best of both routes;
- More scenic;
- Does not encourage yet more development at Murrayfield; and
- Will not infringe on the green belt as much as other options.

6.4. Stakeholder Consultations

Extensive consultation has taken place with the Client Group and with major stakeholders, the key elements of which are summarised below. Further details can be found in specific comprehensive reports lodged by **tie**'s advisors.

Several of the consultants within the team were allocated categories of stakeholder with whom they would undertake consultation. This was generally arranged to take account of the consultant's discipline and role within the project team.

The consultations were undertaken by letter, telephone or meetings and often by a combination of these. The consultations were followed up by notes of meetings and issues raised were brought to the attention of the project team.

6.4.1. Client Group

The Client Group is the City of Edinburgh Council (CEC) Transport and Planning divisions and Transport Initiatives Edinburgh Limited (**tie**).

Regular meetings and communication with the client group has been undertaken. Meetings have included Steering Group consultations and monthly progress meetings with **tie**. Further meetings with CEC Transport and Planning divisions and the Scottish Executive on "as required" basis have been held.

6.4.2. Network Rail

Regular meetings have been held with Network Rail (NR) throughout the development of the project and generally, Network Rail approved of the principle of Edinburgh Tram Line Two. However, they raised a few concerns that will need to be addressed and are summarised here.

- Haymarket Station – independent consultants have been engaged by **tie** to consider development opportunities creating an interchange facility
- Haymarket Depot – Edinburgh Tram Line Two proposals will restrict access from Russell Road and Roseburn Street and affect diesel tanks at Roseburn St
- Bridge construction – at Russell Road and Balgreen Road 'disruptive' possession is necessary for an underbridge and 'rules of the route' for overbridge construction
- Immunisation issues - with the OHLE and tram corridor in close proximity definitive areas need to be agreed

6.4.3. Her Majesty's Railway Inspectorate

HMRI had been consulted on a regular basis, both through meetings to discuss the scheme as a whole and through e-mail exchanges to obtain their views on key design issues throughout the development of the project. The issues raised are summarised here.

- Bridge construction – at Russell Road and Balgreen Road. Requirement to improve vertical clearances to OHLE through restricted headroom structures, management of other road users and pedestrians in relation to tram and OHLE, impact on heavy rail above;
- Gogar Depot – feasibility of locating the main line depot adjacent to the Airport, beneath the flight path for the "crosswind" runway. Issues over electromagnetic compatibility, lighting, OHLE and buildings interface with safety flight envelope, ensuring no "credible" risk of collision between aircraft and depot;
- Derailment containment – on structures and other sections of elevated tramway, in locations parallel to heavy rail where heavy rail and tram are at differential levels;
- Paralleling Heavy Rail – derailment containment, "shielding" (ensuring no risk of tram or train driver confusion/misinterpretation of signals);
- Tram / road / pedestrian interface – issues over management of vehicle and pedestrian movements, sight lines, safe clearances;
- Immunisation issues – stray current control, electrical isolation from heavy rail; and
- Driver visibility for line-of-sight operation.

6.4.4. Historic Scotland/Edinburgh World Heritage

A series of meetings were held with Historic Scotland and the Edinburgh World Heritage Trust aimed at ensuring that the proposals for the section of tram line in the city centre were acceptable. These meetings have taken various formats from the presentation of information through to workshops. The main concerns of these groups related to the tram scheme fitting into the streetscape with minimum impact, with specific concern as to the impact of overhead power infrastructure, cables, fixings and supports. This consultation has been a significant factor in the identification of the preferred route corridor between St. Andrew Square and Haymarket, running along Princes Street and Shandwick Place. Additionally this consultation has fed

into the development of the Design Manual which sets out the general specification which is to be applied to the development of the tram.

6.4.5. Murrayfield

6.4.5.1 Scottish Rugby Union (SRU)

The SRU expressed positive views for the introduction of the tram system. However, they indicated that tram movements will have an impact on crowds during major events at Murrayfield Stadium.

The SRU pointed out that tram movements would only affect crowds about a quarter of an hour before kick-off and half an hour after the match ends. There are approximately 14 major events annually.

If the SRU back pitches are required for the Edinburgh Tram Line Two route, any losses in land area would need to be recovered elsewhere. The pitches are liable to flooding. The SRU indicated that flood protection walls would be required if the back pitches were to be used for tram stabling.

6.4.5.2 CEC Murrayfield Flood Defence

CEC outlined that the north option would run over a flood retention area of approximately 300m in length. The tram route would need to be designed to ensure that flood capacity of this retention area is not reduced.

Cross sections of the tram in this area have been presented to CEC for consideration.

6.4.6. Edinburgh Park Limited / New Edinburgh Limited

The overall view from Edinburgh Park was positive. The representatives pointed out that it would be desirable for the tram to run as close to the adjacent highway as possible to allow for landscaping to be provided between the tram and Edinburgh Park buildings. The stop location in the middle of Edinburgh Park would be required to be of a high quality architecturally and in keeping with the surroundings.

6.4.6.1 Scottish Equitable

Generally, there was positive feedback from Scottish Equitable on the introduction of trams, as Edinburgh Park is currently lacking public transport. The bulk of Scottish Equitable is located in the south east of Scotland, so a link between Edinburgh Park and the Airport could be beneficial.

About 50% of their staff currently use public transport to get to work. Scottish Equitable mentioned that their only concern regarding the introduction of a tram system is the physical visual impact.

6.4.7. British Telecom (BT)

BT expressed positive views for the introduction of the tram as Edinburgh Park lacks public transport at present. The main concerns from BT were over the depth of construction and thus the likely impact on buried services, plus the visual impact of the tram on Edinburgh Park.

6.4.8. The Gyle Centre

Very positive views were expressed by the Gyle Management Company Ltd (GMC) as the tram stop at the Gyle Centre would facilitate access for both staff and customers.

The option which crosses South Gyle Broadway and passes through the Gyle Centre would have an impact on the Gyle car park, as the trams are currently proposed to run across the car park area. Although the stop location would be adjusted to minimise impacts on vehicle movements, it is clear that no option could completely avoid impacting parking provisions. Any options running through the Gyle Centre would also create traffic management issues in the vicinity.

The GMC pointed out that the Gyle Centre area is already very congested, and it may be preferable to reconfigure bus movements instead of trying to bring the tram to the current bus interchange. The Gyle Centre are already looking to reconfigure the public transport hub, and this could be structured to suit the introduction of the tram. The GMC would be very keen to work closely with the tram team to develop a mutually beneficial solution.

6.4.9. Gogar Burn

6.4.9.1 Royal Bank of Scotland (RBS)

RBoS welcomed the opportunity to be involved in the options appraisal stage. There were two issues of concern to RBoS: broad-brush route alignment issues and specific issues in relation to the bridge over A8. It was suggested that discussion should proceed on a high level between **tie** Board Chair and top bank officials, between Alex Macaulay and John Reade in relation to Network issues and at project level between site design engineers and Tram consultants.

6.4.10. Airport Area

6.4.10.1 New Ingliston Ltd

New Ingliston Ltd indicated that they are positive about a possible introduction of a tram in the west of Edinburgh.

6.4.10.2 BAA – Edinburgh Airport
In essence, BAA generally approved of the principle of Edinburgh Tram Line Two but had some specific concerns.

The proposed tram route running to and from Newbridge via the Airport raises a general concern over the interface between two-way tram movements, pedestrian movement between the Airport and trams and buses, and the general interaction of tram movements with the movements of road vehicles. Also, if a through-route for the tram is to be pursued, the alignment of the tram could affect the very likely future expansion of the terminal building and the ensuing rearrangement of the Airport forecourt.

BAA pointed out that terminal building expansion details are still being developed as part of their long term development strategy, therefore, a preferred route would possible not be finalised within the timescale of the preparation of the Parliamentary Bill for Edinburgh Tram Line Two. A Government White Paper detailing the preferred expansion option will only be published late 2003 / early 2004.

BAA's development plans have allowed for a terminus for the tram and indicated that FM's preference for a through-route would be difficult to accommodate. BAA mentioned that the likely future boundary between the Airport and the Royal Highland Showground would also rely on the White Paper.

BAA pointed out the difficulties that would arise if the OHLE was to foul the flight envelope. This issue has been allowed for in the subsequent appraisal of routing options. Further BAA indicated that any tram proposals should be consitent with, and not constrain, their future expansion plans .

6.4.10.3 Royal Highland Showground (RHASS)
The Showground receives 1.2 million visitors each year and the RHASS are keen to see the introduction of the tram scheme to help offset the loss of land and parking facilities (that are required for events) by transporting customers to and from the city centre. RHASS also noted that their preference is for the North option, however, they would like to see it moved further north to what is presently the central access along the car park, which they felt could form a boundary between the Airport and showground and a potential western access road for the Airport.

6.4.11. Newbridge

6.4.11.1 Edinburgh Gate
Edinburgh Gate is a development site in Newbridge, formerly Continental Tyres. Although the proposed tram route does not impact the development of new offices proposed on this site, which covers 61 acres of land next to the Newbridge bus interchange, a consultation session had been held.

A representative from Edinburgh Gate expressed positive support for the introduction of trams. It was felt that the route via Ratho station could serve the Edinburgh Gate development. It was also suggested that due to space restrictions in certain locations and the fact that the tram would have to run shared on street, a one-way system for the Newbridge loop could be considered.

6.4.12. Impacted Property Report
As part of the community and business consultation process, the advisors embarked on identifying residents and businesses that may be affected in some way by the preferred corridor. Once identified, each property was visited and consultation began with tenants and/or landowners. These visits and communication by other means, such as telephone or email, were registered in the 'Impacted Property Report'.

The major consequence from these consultations is concerted opposition by residents' groups in Baird Drive and Whitson Road to those options which would most closely affect their properties.

6.5. Focused Consultation

Following from the public consultation exercise there were a number of areas of the route which had not been fully defined or where additional alignment options or queries had arisen. These areas were subsequently subjected to a further round of consultation and engineering scrutiny to ensure that the route taken forward complied with the scheme requirements and objectives.

The sections which fell into this category are:
- Russell Road overbridge;
- Baird Drive;
- Depot;
- Gogarburn; and
- Newbridge.

Considering these in turn the following commentary outlines the issue, main constraints and findings of the further work undertaken.

6.5.1. Russell Road
Within the Public consultation there were three alignments between Roseburn and Carrick Knowe. It was identified that of these Options, A and C, which pass directly under the railway along Russell Road, both

limit the scope for interface between tram lines one and two by only facilitating east / west movements. Option B, which stays to the north of the railway however, could facilitate a higher level of interface, with a link from Edinburgh Tram Line Two north to Granton being a possibility by implementing a full delta junction. The consultation alignment started with a moderate to steep grade down to street level before following Russell Road west. This gradient would make it very difficult to achieve a full delta between the two lines. As a result the possibility of amending the vertical alignment to incorporate a bridge over Russell road has been developed. This work is detailed in the *Route Development Report Part B – Route Finalisation.*

Consultation with CEC and the business owners has been undertaken with respect to this option. Although this increases the capital cost of the scheme and incurs a more direct impact on local business (requiring the purchase of the vehicle sales yard and office), it offers vastly enhanced operational benefits.

As a result the preferred alignment takes the tram over Russell Road, with a widened bridge which can support the relevant infrastructure for a full delta junction between the two lines.

6.5.2. Baird Drive

The public consultation exercise returned considerable concern about the high environmental impacts of an alignment along the railway embankment. The residents' main objections concern the visual intrusion, the noise generated, the disturbance during the construction period and the loss of vegetation (especially mature trees) on the Network Rail embankment. As a result **tie** directed the design team to develop an alternative vertical alignment which would introduce an engineered cutting to protect the residents from these tram impacts.

The development of this alternative was completed, with further consultation with Network Rail as part of ongoing monthly meetings, further discussions with HMRI and discussions with the residents themselves. Resident consultation consisted of both formal and informal meetings.

The design team developed three options for the Northern alignment in response to these concerns.

1. High Level alignment (as per the consultation alignment)
2. Alignment dropping to Baird Drive level before rising again to bridge over Balgreen Road
3. Alignment dropping to Baird Drive level to cross Balgreen Road at street level.

These three options are fully assessed in the *Route Development Report Part B – Route Finalisation.* The following table presents a summary of advantages and disadvantages.

Table 6.2 Summary of Advantages and Disadvantages

Option	Advantages	Disadvantages
1	Grade separation with Balgreen Rd Tramway noise barrier also shields Baird Drive houses from NR noise. Final profile similar to existing profile Comfortable vertical alignment	Full height retaining wall required along entire length Bridge required over Balgreen Rd NR maintenance track to be switched to the south side Loss of mature vegetation on Railway embankment
2	Grade separation with Balgreen Rd Visual intrusion reduced in central portion Reduction in retaining wall and filling	Reduced comfort due to vertical alignment Bridge required over Balgreen Rd Loss of mature vegetation on Railway embankment
3	Saves cost of bridge over Balgreen Rd Visual intrusion reduced in central & western portions Retaining walls and fill volumes minimised	Reduced comfort due to vertical alignment At-grade crossing of Balgreen Rd Loss of mature vegetation on Railway embankment

Option 2 would only be beneficial to a limited number of Baird Drive dwellings. However, the constraints on engineering, cost and comfort more than outweigh the benefits. This option is therefore discarded.

Options 1 and 3 were put forward for further evaluation which resulted in Option 3 being favoured. Despite the fact that the tram will cross Balgreen Road at street level this safety risk is mitigated by the alignment and the fact that the tram speed will be reduced for it to serve the Balgreen stop. The major benefit of this option is that it enhances the potential mitigation options for the noise and visual impacts of the tram.

As a result of this work the Baird Drive alignment developed will cross the Water of Leith at a high level before dropping down to ground level to the south of the Baird Drive property boundary. This will require excavation of some of the embankment however cross sections shown in *Route Development Report Part B – Route Finalisation* demonstrate that this can be achieved without encroaching on the railway support zone.

6.5.3. Depot

Prior to the Public Consultation two depot options were being considered: one located on the site of the present CEC cleansing depot on Russell Road and the other adjacent to the RHASS grounds (Newbridge).

With the development of the preferred alignment, to include Option B which stays to the north of the railway at Roseburn, the Russell Road option is not attractive. Indeed it would require a spur line to be constructed along the alignment of options A or C beneath Russell Road railway bridge solely for accessing the depot. Hence the option of a depot at Russell Road would be very expensive and operationally difficult.

Whilst the RHASS option remains viable, it is sub-optimal in operational terms being so near the end of the alignment. To develop a depot in this location would require an additional road crossing of the eastbound carriageway of the A8. Additionally the use of this site would constrain any ability to construct the route in stages (i.e. initially to the Airport followed by later construction of the Newbridge branch).

As both of these locations had been shown to have significant constraints an alternative option was considered. This alternative option is adjacent to Gogar roundabout and has been developed in close consultation with CEC (Transport and Planning). An outline depot layout has been developed for the site and an indicative cross section drawn up. It is believed that this location provides the best option for Edinburgh Tram Line Two if developed in isolation (a separate study is investigating joint facilities for operation of all lines as a network). Full details of this site and its assessment compared with the earlier options is documented in the *'Edinburgh Tram Line Two – Depot Report'*.

Gogarburn

The preferred route presented to the public consultation took the tram line along the A8 to the Royal Bank of Scotland (RBoS) overbridge before striking north with a stop for RBoS employees. The alignment then turns west along the corridor which had previously been defined for the City of Edinburgh Rapid Transit (CERT). During the consultation period a number of additional environmental constraints came to light concerning archaeological remains which may be encountered in this area. As a result the design team were requested to reassess the alignment options in this area. This revision defined two route options for consideration:

Option A: To run parallel to the A8, within the north verge, through the RBoS access road,
Option B: To run parallel to the A8 as far as Gogar village, striking north then west to join the CERT route (a refinement of the consultation alignment).

Option A

The viability of option A depended entirely on being able to find a workable solution to negotiate the RBoS access road (which is elevated) and the entry / exit slips to this road (which are at-grade rising away from the surrounding ground level). Three designs were initially considered which were

A1: To cross under the access road (using the space provided within the A8 overbridge structure) and ramp up to bridge over the access slips;
A2: To cross the access road at-grade and the access slips via an overbridge; and
A3: To cross under the access road (using the space provided within the A8 overbridge structure) and cross the access slips at-grade.

Analysis of these options showed that a solution could only be found by modifying the RBoS access road i.e. Option A3. Details of this analysis are contained in Annex 1 to this paper.

Option B: A8 / CERT hybrid

There were two possible solutions for an A8 corridor – CERT hybrid route. They both parallel the A8 between Gogar Roundabout and Gogar village, turning north then west to follow the CERT corridor to Ingliston Park and Ride. The options differ in that one passes Gogar village to the east (Option B1), and the other to the west passing between Gogar Church and Gogar Burn (Option B2).

Option B1 offers straightforward construction, negligible traffic impacts and minimal safety concerns, as there are only very minor highways interfaces and no interface with the RBoS access. By passing Gogar village to the east, this route also avoids the archaeological issues surrounding Gogar Church, the medieval village and the Scheduled Ancient Monument west of Gogar Burn. However, this option would fail to deliver in terms of accessibility and policy integration, as it would locate the tram stop at too great a distance from the RBoS access bridge, so pedestrian access would be impeded as would be the potential for interchange with buses.

Option B2, though more environmentally contentious, offers accessibility to the RBoS site comparable with the alternatives under Option A. It was appraised in comparison with Option A3 Details of the appraisals are included in '*Route Development Report Part B – Route Finalisation*'

From the work and consultation carried out, there is a clear indication that Option B should be the preferred route as it out-performs Option A in four of the seven criteria, and is equal in two of the remaining three. It is clearly less favourable in terms of environmental impact, however none of the options studied achieve negligible or positive environmental impacts.

6.5.4. Newbridge

At public consultation the alignment put forward included a single track loop through the village of Newbridge. No major objections were received to this route. However this alignment has been reviewed with respect to its ability to achieve the two objectives outlined for this Newbridge section:

1. The provision of access to the two key development sites;
2. Potential for future expansion of the tram west to Livingston or North to Kirkliston.

Key elements of this review included patronage studies and further stakeholder consultation. This work is reported in '*Route Development Report Part B – Route Finalisation'.*

The main consultation in development of this section was with CEC Planning and CEC Transport. Their directive has been that the route should serve both proposed development sites of Edinburgh Gate (former Continental Tyres plant) and the former Grampian Foods site.

The alignment went through a number of design iterations, including a double track and terminus at Old Liston Road, that each attempted to address the issues identified above. Also considered in more detail was how best to achieve a route between the Edinburgh Gate site and the former Grampian Foods site. The revised alignment which has been defined can be outlined as follows:

This option remains in broad terms as per the original alignment via Ratho Station and passing under the M8 / M9 link in Harvest Road. Beyond Harvest Road, the route differs from the consultation alignment in that it will continue as twin track into Newbridge. A stop will be provided at Newbridge South to serve Edinburgh Gate, after which the route will turn to the east to run adjacent to Old Liston Road, looping round Huly Hill on its eastern side before crossing the A89 to the Grampian Foods site. Here the route will terminate, with a stop at Newbridge North

This alignment gives a good linkage to the two development sites, providing stops to both the north and south of Newbridge village. Additionally, ending with a terminus with west facing track alignment on the north of the A89 gives excellent scope for further extension at a later date.

6.6 Final Route Proposals

The results of the public consultation have been taken into consideration to make the following refinements to the proposed routes.

6.6.1. Ingliston

The public consultation showed that neither of the two options was favoured over the other. BAA, which operates Edinburgh Airport, need to ensure passengers are served in the best possible way.

The proposals take into account BAA's concerns regarding a through route for the tram towards Newbridge. Proposals now terminate the main tram route at the Airport Terminal building, with any service to Newbridge being provided by a shuttle service from Ingliston.

6.6.2. Gogar

Option B, which avoids Gogar roundabout and is the most popular option, has been recommended as the final proposal. This minimises disruption at this busy roundabout and serves the Gyle Shopping Centre. Key stakeholders in the vicinity also support this option.

6.6.3. Roseburn / Carrick Knowe

tie is proposing Option B (north of the railway line), in line with the response to the public consultation. Further consultation has been carried out with local residents in this area, whose properties the tram will run in close proximity to. Various mitigation measures are proposed.

6.6.4. Airport Alignment

The alignment for this section of the route, between Ingliston Park and Ride and Newbridge, was developed through extensive consultations. The two key stakeholders were BAA and RHASS.

The study team initially developed several route options past the airport and showground to Newbridge. This considered both RHASS and BAA requirements, expansion plans and operations. The options provided a route past the airport and showground (a through route). The RHASS stated a clear preference for the option which passed to the north of the showground, whereas BAA preferred a spur or branch (terminus) option as previously considered by the design team.

It was thus clear that a single preferred route could not be established prior to public consultation. It was agreed in consultation with **tie** and CEC to promote two loop options (through routes) through the Public Consultation process (see Route Development Report Part A – Design Pause in Appendix L), whilst retaining scope for the terminus option at the Airport.

Responses to the Public Consultation indicated no clear preference for either option from the public, however BAA's formal response strongly stated their objection to a loop option. RHASS formally responded that their preference is for a loop route on their northern boundary. As the preferences of the two key stakeholders were mutually exclusive, to progress this matter, a STAG-based appraisal of a loop

(through-route) versus spur or branch (terminus) to the Airport was undertaken. The STAG appraisal concluded that the route serving the airport should be a branch (terminus) rather than a loop (through route) for the following reasons:

A service terminating at the airport allows a premium fare to be charged to airport passengers, offering significant benefits to revenue potential:

- The branch option minimises potential impact on the future expansion plans for the Airport
- The branch option minimises disruption to both stakeholders during construction and operation.
- Proposing Newbridge as a separate shuttle service allows for a "staged" construction, if it is necessary to delay the implementation of the Newbridge section.
- Journey times for Newbridge passengers accessing the city is not expected to increase as a result of having to change trams, as their journey would by-pass the Airport.

Thus the preferred route alignment is a principal service terminating at the airport, connecting at Ingliston Park & Ride with a shuttle service to Newbridge.

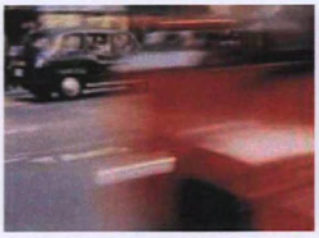
6.6 Conclusion

The consultation process has informed major stakeholders and the residents of Edinburgh about the proposals to introduce trams to Edinburgh, and it has provided the opportunity to comment in a variety of ways.

The results of the consultation show that there is broad support in Edinburgh for trams, and broad support for Edinburgh Tram Line Two. The main concerns are in relation to the impact trams will have on properties in close proximity to the route, and the requirement for CPOs in certain areas. Other concerns related to the disruption caused by the construction of the tram infrastructure, the environmental impact and destruction of local wildlife, and the impact of the tram on local traffic and parking.

There was further technical work undertaken which, together with the consultation outcomes, influenced the Final Route proposals.

7 SCHEME DESCRIPTION



7. Scheme Description

7.1. Introduction

The preceding Chapters have described the route corridor selection process, the consultation and the subsequent refinements to the route alignment. This Chapter now presents a description of the overall scheme which has emerged from this process.

The line of the route is to connect St Andrew Square to West Edinburgh terminating at Edinburgh Park, the Airport or Newbridge. Whilst the design aspiration is to run the tram as far west as possible it is essential that a robust business case be developed for the full route presented in the Parliamentary Bill. Ahead of the tram development the public transport provision in this corridor will be improved through the West Edinburgh Busways (WEBS) project. As WEBS and Edinburgh Tram Line Two share a common alignment in part, operation of the guideway section of WEBS will cease when tram construction starts.

The proposed Edinburgh Tram Line Two is 17.8km of double track tram. This comprises a main line extending from the St. Andrew Square to the Airport (some 13.6 km) and an additional branch line from the Park and Ride at Ingliston to Newbridge via Ratho Station (4.2 km). Within the city centre (St Andrew Square to Roseburn, much of the alignment will be on street. From Roseburn West the majority of the alignment is off street, until short lengths of street running are required to fit with the tight constraints at the Airport and Newbridge termini.

The route comprises 18 Stops, with fourteen on the main alignment to the Airport. The Newbridge branch will have five stops, with the most easterly of these being common to the Airport line, providing interface. Journey time has been estimated between St Andrew Sq and the Airport as thirty-two minutes and for the branch ten minutes. The frequency on each line is anticipated to be 6 trams per hour (headway of 10 minutes) during the peak periods.

7.2. Final Preferred Route Alignment

The following text outlines the preferred route which has emerged from the technical, operational and environmental assessment. This description follows the route alignment from St Andrew Square in the City centre, through Roseburn, Carrick Knowe, and Edinburgh Park to The Gyle. Passing Gogar Roundabout and the preferred Depot site the route continues west via Gogarburn to a Park and Ride facility at Ingliston before splitting. The main line continues to the Airport whilst the branch line goes to Newbridge. This route is shown in the plans contained in Appendix D.

7.2.1. St Andrew Square to Roseburn

A single track will be constructed around a loop consisting of St Andrew Sq West (South and North St David Street), Queen St, St Andrew Sq East (North and South St Andrew Street), and Princes Street. Being a one-way loop there will be two stops one serving eastbound and one west bound passengers.

From the junction of South St David Street and Princes Street the tram will continue east along Princes Street, as double track, on a specially developed Public transport route closed to all other traffic. There will be a single stop located between Frederick Street and Castle Street. At the West End the route will continue on a central alignment along Shandwick Place with a stop located centrally between Atholl Crescent and Coates Crescent. Continuing towards Haymarket a contraflow tram and bus facility will be implemented before the tram leaves the street along Haymarket Terrace. A stop is proposed at this location to interface with Haymarket heavy rail station.

West of this stop the alignment will make its way round Rosebery and Elgin House to run parallel to the heavy rail track alongside Balbirnie Place. It is at this location that a junction would be required to cater for Edinburgh Tram Line One if that was constructed.

7.2.2. Roseburn to Carrick Knowe

Edinburgh Tram Line Two would continue parallel to the railway line to bridge over Russell Road. From here the tram line would skirt round the northern boundary of the ScotRail depot. This will be generally at the level of the railway constructed above the existing embankment slope and will impact a number of Business properties to a greater or lesser degree. A stop is proposed immediately opposite the Murrayfield turnstiles which will service both the area and the stadium.

The tram will bridge over Roseburn Street and continue along the rail embankment past the Rugby stadium before crossing the back pitches on a viaduct with the provision of a siding to ensure operational flexibility to enable the tram to better service special events occurring at the stadium. From the viaduct the tram would bridge directly over the Water of Leith, continuing generally at the same level as the railway. To the west of the Water of Leith however the vertical alignment will begin to drop to the surrounding ground level. This will require amendments to the railway embankment and initial alignment development has considered network rail constraints and requirements to ensure integrity is maintained. The intention of this vertical alignment is to enable the line to be dropped into an engineered cutting to shelter the residents of Baird Drive from visual and noise intrusion arising from the tram. The tram level would reach the ground level of the adjacent gardens and continue west to cross Balgreen Road at street level.

Immediately to the West of Balgreen Road a stop will be provided before the alignment rises to follow the dedicated transport corridor along the south of Carrick Knowe Golf Course. At the west end of the golf course the tram would rise to bridge over the railway.

7.2.3. WEBS / Edinburgh Park

From Carrick Knowe the preferred corridor assessment identified that the best route would be for the tram to supersede the WEBS guideway which is to be formed in the grass reserve between the railway line and Stenhouse, Broomhouse, and Bankhead Drives respectively. This decision has been carried forward to the preferred route alignment.

At the eastern end the existing pedestrian access to the bridge over the railway will be amended to provide a tram crossing, and the building which houses the Air Training Corps will be relocated. There will be a stop located adjacent to the bridge which is proposed to carry the tram over Saughton Road North. This location provides access to housing north of the railway line via Saughton Road North. A similarly located stop adjacent to South Gyle access will provide access to the surrounding houses (north and south of the rail line) as well as businesses and the local tertiary educational establishments (Napier and Stevenson)

Where the proposed WEBS structure ends at South Gyle Access the tram will rise to bridge over the road before progressing west to Edinburgh Park Station. A stop located at this point provides for high quality interface for passengers between light and heavy rail.

The tram alignment will then turn north bridging over the heavy rail once again to then pass through Edinburgh Park on an alignment previously defined for the City of Edinburgh Rapid Transit (CERT - forerunner of WEBS). Within this alignment a stop is defined in a location central to the finalised development.

7.2.4. Gogar Junction

The tram alignment diverges from the CERT alignment when it reaches South Gyle Broadway. At this location it will cross the road at a new signalised crossing to enter the Shopping centre car park within which a stop will be located to provide both good access to the shopping centre and good public transport interchange with the bus network.

The Tram will then pass under the A8 with a new structure being constructed through the embankment leading to the proposed depot site.

7.2.5. Depot

A depot site has been identified between the Fife Rail Line and Gogar Roundabout. This utilises a small triangle of waste ground and some agricultural land at the edge of the greenbelt. An indicative layout of a potential depot has been generated to identify the ability to fit the depot. Key constraints for this have been ground levels to ensure that the facility (power supports and buildings) can be constructed without fouling the flight envelope from the adjacent runway, whilst minimising the visual impact at this gateway to Edinburgh.

7.2.6. Gogarburn

Progressing westward a key tram objective has been to service the Royal Bank of Scotland's new International headquarters at Gogarburn. The alignment achieves this by continuing parallel to the A8 to a new stop as close as possible to the approach embankment for the new Royal Bank bridge over the A8. From here it turns to strike north and rejoin the CERT alignment where it swings west again, across the burn. There are a number of environmental constraints in this area which have defined a very specific alignment, to minimise impact on expected archaeological remains, the setting of listed buildings and a scheduled ancient monument, along with the ecological issues along the burn itself.

To the west of Gogar burn there are a number of badger setts which impact the chosen line as it approaches the Ingliston Park and Ride site where the next stop is to be located.

7.2.7. Ingliston and Airport

Extensive consultation was carried out regarding the alignment between the Park and Ride and the Airport as well as to points further west. The alignment resulting from these discussions and various engineering studies has defined a route to the Airport with a separate line heading west.

The Airport line will turn north to cross the fields before running alongside the Gogar Burn, through a hotel car park and along Burnside Road to a stop immediately outside the terminal building where existing public transport facilities are located.

Travelling west the tram is to be on a separate line which will cross Eastfield road at a signalised intersection (which may be linked with the Park and Ride access/egress). It will then pass between the various parking facilities linked to the Airport. An additional stop would be located near to the eastern gates of the Royal Highland and Agricultural Society of Scotland (RHASS).

7.2.8. Newbridge

Leaving the Ingliston West stop the tram alignment will cross the eastbound carriageway of the A8 to then run along the central reserve. Once the tram has reached the west end of RHASS it will turn south

crossing the westbound carriageway and striking across agricultural land to approach Ratho Station where the next stop will be located, adjacent to the heavy rail line at the top of Station Road.

The route then passes some private properties where the existing retaining wall at the foot of the gardens will require to be strengthened. The tram will then join Harvest Road and run on street to pass beneath the motorway into Newbridge itself. The route will then go through Newbridge industrial estate (on an off street) with a stop located near the existing bus stop serving the development site of Edinburgh Gate (previously Continental Tyres). The route then continues to the previous Grampian foods site in the verge of Old Linston Road (travelling counter clockwise round Huly Hill) before crossing the A89 to reach the final stop.

7.2.9. Summary

The preferred route alignment for Edinburgh Tram Line Two can be summarised as follows and is shown on drawings 30894/MMH/C108 and 30894/MMH/C119 contained in Appendix D.

The preferred route runs from St. Andrew Square through Haymarket to Roseburn. From Roseburn it continues off-street round the ScotRail depot past Murrayfield and along the back of Baird Drive in a false cutting (an area which is subject to further focused local consultation). Bridging over Balgreen Road the alignment continues along the north of the heavy rail corridor past Carrick Knowe golf course before bridging over the railway to join the WEBS alignment as far as Edinburgh Park station. A second major bridge of the railway will take the tram north where the alignment will follow the reserve identified for CERT through Edinburgh Park business park. North of Lochside Avenue the tram will then cross South Gyle Broadway at-grade into the Gyle Centre, where the external layout and facilities will need to be adjusted to accommodate a stop. The alignment proceeds beneath the Glasgow Road to the east of Gogar roundabout, turning west to Gogar Burn. West of Gogar Burn the tram will follow the CERT reservation to the proposed Park and Ride on Eastfield Road before turning north to terminate at the Airport. Additionally a branch line will extend from the Park and Ride through to Newbridge passing through Ratho Station and under the motorway at Harvest Road.

7.3. Technology

7.3.1. Vehicle

A range of potential vehicle types exist and have been examined in an earlier stage of scheme development. The work undertaken for the Edinburgh Loop showed that for the level and type of passenger service being targeted a mass transit system was required. Trams also satisfy a number of other criteria including environmental aspects, speed, safety, reliability and quality. Such qualities are believed to have been found to provide a more attractive form of public transport than others (to the extent of attracting additional passengers from private cars) and providing accessibility for all members of the community including the Mobility Impaired. These aspects are clearly in line with the Objectives of the City of Edinburgh Council.

There are three main categories of LRVs/trams currently available which are based upon the height of the tram floor relative to the running surface: *High Floor, Partial Low Floor and Low Floor.* These descriptions also reflect the evolution of tram design, although none of these categories are obsolete and each has its own relative merits which are set out below. All three of these types can be further classified as single or articulated. The articulated vehicles can be single-, double-, triple- or multiple-articulated. Both single and articulated trams can be operated as single units or assembled into pairs or trains according to the required capacity and stop facilities.

7.3.1.1 High Floor Trams

High floor trams are mainly suited for use in segregated corridors, in sub-urban areas, on disused heavy rail lines or on lines used commonly by trains and trams, where high speed is required. They require high boarding platforms, typically 850-1000mm and therefore on lines not ready equipped with high platforms the civils works required to accommodate these trams are usually more expensive than trams with lower floors.

The advantage of these vehicles, come from their simple construction, high riding quality, speed (90-120km/h is attainable), easy equipment inspections, easy passenger accessibility and low purchasing costs.

If it is necessary to provide step wells for boarding the tram from low level tram stops this results in poor accessibility for mobility impaired travellers. These factors mean that high floor trans are not generally suited to the urban environment when high platforms cause physical obstacle and strong visual impact.

7.3.1.2 Partial Low Floor

These trams offer high and low floor sections with the principal aim of improving accessibility, especially for mobility impaired travellers. They are mainly suited suite for use in urban and sub-urban areas where high speed is also required. They provide good riding quality and can attain speeds up to 80-100km/h. The low floor sections usually make up approximately 50-70% of the floor area and are generally at the doors. Internal access to high floor sections of the tram must be negotiated by steps.

7.3.1.3 Continuous Low Floor Trams

These are the most modern available trams and provide the most accessible passenger vehicles, facilitating kerb boarding for users of all levels of mobility and age. These trams are mainly suited for use in urban environments where low visual impact is required. These vehicles offer fewer limitations on operations and can be easily customised internally to accommodate special requirements, for example, cycles and wheel chairs. Some are capable of negotiating very tight curves (radii 18m). On straight segregated track they can operate at speeds of 70-80km/h.

The disadvantage of low floor trams is that the on-board auxiliary equipment must be accommodated on the body roof. At present they are more expensive than the partly low floor types.

7.3.1.4 General LRV Specifications

Currently no particular light rail vehicle (LRV) or tram has been chosen for use on the Edinburgh system. However, it is understood that **tie** is seeking to implement a high quality low floor system. The following, therefore sets out to provide a guide on the range of vehicle characteristics currently available on the market and define an outline specification utilised for the engineering assessment and design.

Table 7.1 provides indicative characteristics of the Design Vehicle.

Table 7.1 Design Vehicle

Parameter	Value	Comment
Vehicle Length	40m	Maximum
Platform Length	40m	
Vehicle Width	2.65m	Maximum
Vehicle Height	3.20m – 3.40m	Excluding pantograph
Floor Height	300 - 350mm	Low floor sections
Track Gauge	1435mm	Standard
Doorway Width	1200 – 1300mm	
Seating Capacity	65 – 80	
Standing Capacity	100 – 230 200 – 320	Normal Load 4/m^2 Max. Service Load 6/m^2
Line Voltage	750V D.C.	
Maximum Operating Speed	80 km/h	
Maximum Design Speed	85 km/h	
Minimum Horizontal Radius	25m 30m	Absolute Desirable
Minimum Vertical Radius	500m 1000m	Absolute Desirable
Expandable Vehicle	Yes	
Multiple Unit Operation	Yes	Only in event of breakdown / emergency
Bi-Directional	Yes	
Maximum Gradient	6.5 % 6 %	Absolute Desirable
Maximum Acceleration Rate	1.0 – 1.3 m/s^2	
Maximum Braking Rate	1.1 – 1.3 m/s^2 3.0 m/s^2	Service Emergency
Operational Acceleration / Braking	0.9 m/s^2	
Design Life	30 years	

A number of tram vehicles have been considered in the compilation of this set of assumptions including Ansaldo Transporti, Firema T68, the Alston Citadis tram and the Adtranz Incentro. Further it has been assumed that geometric design must comply fully with the requirements of Railway Safety Principles and Guidance 1996 published by HMSO.

7.4. Tram Infrastructure

7.4.1. Rails, Trackform and Surfacing

The nature of tramway support and surfacing is entirely dependent upon its environment. For on-street areas, the trackform must provide sufficient strength to support both traffic and tram loads together with appropriate stray current protection, and the surfacing must be appropriate for road vehicle traffic. Steel rails are embedded within a reinforced concrete trackslab, and encapsulated in a non-conductive material, with the final road surfacing laid to suit the rail level. The trackslab may also be designed to mitigate ground-borne noise and vibration. For off-street sections, the trackform can either comprise slab track (where the rails are directly fixed) or ballast (where the rails are supported on sleepers). Ballasted track provides the lower cost solution and is proposed where practicable for off-street sections of Edinburgh Tram Line Two. It is not proposed for areas where the visual impact of the tramway is high, where there is the risk of misuse of ballast material by members of the public (i.e. vandalism) or where the tramway horizontal alignment precludes its use. Slab track is proposed for these locations, and a variety of finishes such as grass track can be applied to slab track where required to minimise visual impacts.

The extent of surfacing works will cover:

- Surface finishes to reflect the location and the requirements of the Design Manual within the swept path.
- Opportunities outwith the swept path to provide betterment or to upgrade existing finishes.

7.4.2. Trackside Equipment

The provision of trackside equipment, required for the safe and efficient operation and maintenance of the tram system, will be designed to satisfy the requirements of the tram whilst ensuring that it is visual impact is minimised and in keeping with the surrounding environment. Trackside equipment will include:

- Power supply sub-stations – spaced along the route to minimise the numbers required whilst meeting the power requirements of the system;
- Overhead Line Equipment;
- Stop platforms and equipment rooms;
- Communications and signalling, including telephones and emergency help points;
- Track Control boxes;
- Signage and Lighting;
- Stop furniture – shelters and seating, ticket machines, CCTV, PA systems;
- Cycle Facilities; and
- Rubbish Collection / Disposal.

7.4.3. Cycle Facilities

Demand for cycle provisions on trams depends on the terrain, access to adjacent attractive areas and the general numbers of cyclists in the area. In Edinburgh much work has been done to promote cycling. The cycle routes appear popular and suggests that a large and local cycling population exists. Consequently, allowing cyclists to use Edinburgh Tram Line Two will provide added value to the existing cyclist facilities. Moreover, access into the suburbs by cycle could increase patronage.

There are a variety of reasons why cyclist provision on trams will attract patronage. Provision for cyclists trams is useful for longer routes or where the terrain is difficult, offering the possibility of breaking the journey, providing alternatives to other modes of travel. Many cyclists travelling on more secluded lines outside normal hours, also prefer to cycle at either end of their trip to offer them added security.

Much of the demand to integrate the tram with cyclists may be satisfied in alternative ways. The provision of secure cycle storage at tram stops would accommodate travellers who only require to cycle at one end of their journey and would remove the need to take bicycles on the tram. Similarly, provision of cycle hire facilities at selected tram stations (most probably major transport interchanges such as Waverley or Haymarket) also increases the systems flexibility; such schemes are common in European cities and are particularly attractive option for tourists wishing to use public transport but explore areas beyond the network.

Within Edinburgh Tram Line Two a section of new footpath and cycling is proposed to be added to new facilities being proposed as part of WEBS.

Practicalities

1. Vehicle

In the terms of statutory position on this issue, it is our understanding the HMRI have no objection to the inclusion of cycles on trams but consider the decision to be one for the operator. It remains the responsibility of the operator to demonstrate to the Inspectorate that the cycle facilities can be implemented safely.

Allowing bicycles on trams may cause inconvenience to other passengers. Cycles can block access and be wet, dirty and oily. Loading cycles onto the tram has the potential to increase dwell times at stops and therefore overall journey times. This will be dependent upon actual numbers of bicycles on individual trams and in particular the number during peak periods. However, experience form other European systems suggest that actual numbers may not be large and careful design can accommodate cycles safely and efficiently.

Where systems employ conductors there would be a clear advantage in the ways which cycles could be managed. Regulations or Bye-Laws permitting cycle use must be clear, covering for example, permitted times of use, fares, placing and securing of cycles, the hierarchy of user priorities and where cyclists must give way to the mobility impaired (i.e. disabled and families). The penalties for misuse of the system must also be clear and enforceable.

One frequently raised concern regards the impact cycle inclusion has on safety during emergency stops since modern trams have powerful braking systems. The solution will be in the interior design of the vehicles, with the use of specified cycle bays for bikes next to the entrance with provision for restraint. Alternatively, cycles could be restricted to certain sections of the vehicle and cyclists require to stay with their bicycle for the journey to ensure they remain secure. As outlined above, the cycle proposals will require the approval of the HMRI.

2. Platforms

There are a number of design issues relating to platforms as well as the trams themselves. Cyclists have the potential to cause a nuisance on platforms and around stops. The design should discourage riding of bikes onto or through the facilities. Again, this requires clear guidance, markings, signs and penalties for misuse. Where the vehicles will restrict access to particular tram doors, this will need to be indicated in a similar manner to disabled access.

3. Control of Demand

Various tools can be used either to help control the demand or to manage cycle accommodation. The hours of use can be restricted to off peak hours, or routes can be restricted to counter the direction of peak flow passenger traffic. Allowing bicycles on the tram is also a means of generating additional revenue during off-peak hours. The payment method and its level can be used to control the numbers of cycles on the tram. For example, some systems require cyclists to purchase travel permits in advance of using the tram. This indicates to the operator the likely demand allowing him to plan and manage operations. Monitoring the numbers of cycles, time of use, compliance with regulations, relative numbers of cyclists to wheelchairs, prams and pushchairs provide particularly useful information regarding the necessity and development of control procedures.

8 AST2 APPRAISAL



8. AST2 Appraisal

8.1. Introduction

A considerable body of work has been undertaken during the option sifting, AST1 and consultation processes. The output from these exercises has provided a clearly defined route alignment for the majority of the Edinburgh Tram Line Two corridor.

This Chapter provides a detailed appraisal of the preferred route options in terms of the Government's five objectives. It also demonstrates how the scheme meets the Planning Objectives set out in Chapter 2.

AST2 tables for the options appraised are contained within Appendix B. The Sections below focus in turn on each of the objectives of Environment; Safety; Economy; Transport Integration; Accessibility and Social Inclusion; and Cost to Government. Key assumptions relating to the detailed costings of each option are set out in Appendix F.

8.2. Environment

8.2.1. Approach to EIA and STAG Appraisal

The appraisal of Edinburgh Tram Line Two has been undertaken using the STAG 'project' level approach and is based on the results of Edinburgh Tram Line Two Environmental Statement (ES) which has been prepared as part of the Parliamentary Bill process. The approach to the ES was initially set out in the Edinburgh Tram Line Two Scoping Report (FaberMaunsell, 2003) and amended where necessary following comments received from statutory organisations. The table below identifies where the assessment varies from the recommended STAG methodology, and for cross referencing purposes, identifies the location of both the detailed assessment chapters of the ES and the relevant STAG Worksheets.

Table 8.1 Summary of Environmental Appraisal Chapters and Worksheets

STAG Topics	Chapter of ES	STAG Worksheet Number (see Appendix C)	Variations on STAG Recommendations
Noise and vibration	Chapter 13 Noise and Vibration	Worksheet N2	Vibration included in ES (no method is incorporated within STAG, nor in any STAG Worksheet)
Global air quality – carbon dioxide (CO_2)	Chapter 14 Air Quality	No Worksheet specified	No variation from STAG
Local air quality (PM_{10} and NO_2)	Chapter 14 Air Quality	Air Quality Worksheet for PM_{10} and NO_2	Detailed dispersion modelling undertaken rather than DMRB at the request of CEC. Due to number of links worksheets have been modified and presented as spreadsheets.
Water quality, drainage and flood defence	Chapter 10 Surface Water Quality. Chapter 7 contains information on effects on ground water, particularly from contamination.	Worksheet W1	No variation from STAG
Geology	Chapter 7 includes sections on geology.	Worksheet G1	No variation from STAG
Biodiversity	Chapter 9 Ecology and Nature	Worksheet B1 Baseline Information Worksheet B2 Impact Assessment	No variation from STAG
Landscape	Chapter 8	No worksheet specified in STAG although one has been prepared – Worksheet L1	No variation from STAG
Visual amenity	Chapter 8	No worksheet specified in STAG although one has been prepared – Worksheet VA1	No variation from STAG

STAG Topics	Chapter of ES	STAG Worksheet Number (see Appendix C)	Variations on STAG Recommendations
Agriculture and soils	Agricultural impacts are included in Chapter 6 Land Use, and soils are covered in Chapter 7 Geology, Soils and Contaminated Land	Worksheet AG1 Baseline Information Worksheet AG2 Assessment Score (Permanent and Temporary Impacts)	No variation from STAG
Cultural heritage	Chapter 11	Worksheet CH3 Baseline Information Worksheet CH4 Assessment Worksheet CH5 Assessment Score	No variation from STAG

In essence, the text contained within this STAG report is a summary of the results of the ES. However, the STAG Worksheets recommend that information is set out in a particular way and in some instances this differs from the manner in which it is presented in the ES. Irrespective of these differences the conclusions of the STAG Worksheets are identical to the conclusions of the ES.

Summaries of the appraisals for each of the topic headings are provided below. These summaries are supported by the following figures, which can be found at the end of this Chapter:

- Figure 8.1 to 8.10 Environmental Summary Plans
- Figure 8.11 Landscape Character
- Figure 8.12 Visual Envelope (During Operation)

8.2.2. Noise and Vibration

8.2.2.1 Approach

STAG recommends that the noise appraisal follows the approach set out in Guidance on Methods for Multi-Modal Studies (GOMMMS) section 4.3.27. The STAG appraisal considers operational noise only, and is based on both changes in traffic flows and the effects of introducing the tram system. The appraisal aims to estimate the change in the population annoyed by noise for a do-minimum strategy compared with the proposed option. The approach is to estimate the total number of people exposed to different noise levels and, using the annoyance response curve data provided in GOMMMS, calculate the change in the number of people likely to be 'annoyed'.

A different approach was used for the ES to calculate the impacts of the tram, as set out in Chapter 13 of the ES. The calculation method used was that recommended in the technical memorandum `Calculation of Railway Noise' (CoRN) 1995. The memorandum is used to determine noise from all guided transport systems where the guidance system is based on a dual running rail. The method consists of determining the reference noise level generated by an individual vehicle passage (defined as Sound Exposure Level, SEL in CoRN) and by then modifying these values to take account of factors such as distance, screening and number of vehicles.

Noise monitoring was undertaken at locations selected in consultation with CEC. Existing ambient noise sources were measured or calculated and compared with predicted noise levels likely to arise when Edinburgh Tram Line Two becomes operational. Relevant national legislation and local planning documents informed the assessment. Based on the results of the assessment mitigation measures were incorporated into the scheme design including noise barriers.

A method for assessing vibration is not included within either GOMMMS or STAG. Chapter 13 of the ES includes an assessment of the vibration effects that are predicted to result from the construction and operation of the tram. The impact of vibration on buildings and the risk of superficial damage was assessed according to BS7385: 1993. The likelihood of annoyance due to vibration and disturbance to occupiers was assessed according to the methodology of BS6472:1984 from which levels of vibration dose values were predicted.

8.2.2.2 Key Features

A number of sensitive properties and areas lie adjacent to the route. These include residential properties at Balbirnie Place, Baird Drive, Gogar and Ratho Station. There is also a school in Ratho Station. Noise monitoring was undertaken at each of these locations and others agreed with CEC. Between St Andrew Square and Haymarket the tram runs on-street where traffic noise dominates and ambient levels tend to be high during the daytime. On segregated sections ambient noise levels tend to be lower, although the route between Haymarket and Edinburgh Park Station (currently under construction) runs close or directly adjacent to a mainline railway. Ambient noise levels at Balbirnie Place and Baird Drive are dominated by the railway.

Vibration measurements were also undertaken at Roseburn Maltings, Baird Drive, Middle Norton, Edinburgh Park and Station Road in Ratho Station.

8.2.2.3 Summary of Impacts and Mitigation Measures

Construction Noise and Vibration and Mitigation

Construction noise varies considerably during any building project. Properties within 50 to 100m of such works can be disturbed. The character of construction noise varies during the project depending on the activities being undertaken. For tram routes, initial phases can involve road breaking, demolition work or earth moving followed by clearance and levelling. These activities can produce high levels of noise and vibration but would be of limited duration. Compaction and base laying can also be noisy but finishing phases of track construction and electrical installations tend to be low noise operations. Predicted construction noise is likely to exceed 80 LAeq,12hr Major negative short-term impacts are therefore predicted to occur at locations in close proximity to construction works including Balbirnie Place and Baird Drive.

Vibration is predicted to occur within 10m of works during construction and could result in Moderate adverse impacts for short periods, meaning that vibration may be perceptible but there would be no effect on the structure of properties.

As well as providing a calculation methodology, BS5228 also gives detailed advice on methods of minimising nuisance from construction noise. This can take the form of reduction at source, control of noise spread and in areas of very high noise levels, insulation at receptors. It should be a requirement of any construction contract for the contractors to comply with the recommendations in this standard in order to achieve specific noise limit criteria for each site. A code of construction practice or environmental management plan would be prepared by the contractor and this would include the following provisions at locations where noise is likely to be a problem:

- Sites would be surrounded with fencing or other barriers, where appropriate, and continuous running plant would be housed in acoustic enclosures.
- Use of electrical items of plant instead of diesel plant in especially sensitive locations.
- Exhaust silencing and plant muffling equipment would be maintained in good working order.
- Night time working would be kept to an absolute minimum and the normal working day would be used wherever possible.

In general, good public relations and extensive consultation with local authorities would be necessary to help to minimise the impact of construction work.

8.2.2.4 Operational Noise and Vibration and Mitigation

The STAG Worksheet summarises the number of people affected by change in noise and the number of these likely to be annoyed. The results suggest that the change in the number of people annoyed by traffic noise would be negligible. Similar results have been calculated for rail noise where an additional 4 people will be annoyed. However, an additional 76 people will experience an increase in noise of more than 3 dB(A) as a result of the introduction of the tram. It should be noted that there are large margins of error associated with an assessment of this nature.

The methods used in the ES to provide a more accurate prediction of changes in noise levels at specific locations. The assessment concludes that with mitigation in place impacts would be Moderate negative (an increase in noise of between 5 dB(A) and 9 dB(A)) at one location (Balbirnie Place) and Minor negative (an increase of between 2dB(A) and 4dB(A)) at several other locations including Baird Drive.

Mitigation of operational noise would take the form of an acoustic barrier located as close as possible to the tram track at selected locations. These locations are adjacent to housing at Balbirnie Place, Baird Drive, Hillwood Rise and Station Road at Ratho Station.

Vibration is predicted to be Neutral along much of the route. However, in a few locations where properties lie within 15m of the route e.g. Baird Drive. Additional vibration isolation measures would be considered at these properties, depending on the sensitivity of the buildings.

8.2.3. Global Air Quality – $C0_2$

8.2.3.1 Approach

The global air sub-objective in accordance with STAG has been undertaken using the DMRB Volume 11, Section 3, Part 1. This sub-objective was assessed by determining the impact on CO_2 emissions and using this gas as a proxy for all greenhouse gases. Both the impacts due to the change in road traffic flows and the CO_2 produced indirectly by the power consumption of the trams have been accounted for. CO_2 emissions for each link in the road network have been assessed. The assessment compares an existing baseline case based on current traffic flows with the opening year (2011) and the design year (2026) with and without the tram system.

8.2.3.2 Key Features

CO_2 emissions will be discussed in relation to the Government's target to reduce emissions nationally by 2010.

8.2.3.3 Summary of Impacts and Mitigation Measures

The impact of Edinburgh Tram Line Two on greenhouse gases has been assessed by predicting the effect on CO_2 emissions. The total CO_2 emissions for the whole study area are listed in the Table 8.2.

Table 8.2 The Impact of Edinburgh Tram Line Two on CO_2 Emissions

Year	CO_2 Emissions (Tonnes/year)
Existing Baseline (2001)	236300
Do-Minimum (2011)	245131
Line 2 (2011)	236792
Do-Minimum (2026)	284942
Line 2 (2026)	260030
	Percentage Differences
Line 2 (2011) as % of Existing Baseline (2001)	100%
Line 2 (2011) as % of Do-Minimum (2011)	97%
Line 2 (2026) as % of Existing Baseline (2001)	110%
Line 2 (2026) as % of Do-Minimum (2026)	91%

Table 8.2 indicates that Edinburgh Tram Line Two will have a minor positive impact, as defined by STAG, on air quality, with reductions in CO_2 emissions of 3% and 9% in 2011 and 2026, respectively. Accordingly the objective of reducing the emissions of greenhouse gases is met. It should be noted, however, that due to increased numbers of vehicles in the future years and only minor predicted improvements in vehicular CO_2 emissions, the implementation of Edinburgh Tram Line Two will result in a neutral impact relative to the Existing Baseline, whereas in 2026 the corresponding impact will be a 10% increase in emissions.

Mitigation measures would require improved energy efficiency for both road vehicles and the trams used.

8.2.4. Local Air Quality (NO_2 and PM10)

8.2.4.1 Approach

The local air quality sub-objective was assessed by determining concentrations of nitrogen dioxide (NO_2) and particulate matter smaller than 10 mm (PM10). Following consultations with CEC it was agreed that FaberMaunsell would undertake a detailed regional dispersion modelling appraisal of the effects from Edinburgh Tram Line Two. This type of appraisal is a more comprehensive assessment than the DMRB approach recommended in STAG and GOMMMS, but it has been undertaken in a manner which is compatible with STAG and GOMMMS requirements (i.e. the number of properties experiencing change in air quality within specified distance bands has been calculated). The AAQuIRE 6.1 regional air quality model was used to predict NO_2 and PM10 concentrations for an existing baseline (2001) and two future years (the opening year (2011) and design year (2026)). The opening and design year scenarios were both run for a Do-Minimum case and a Do-Something case.

8.2.4.2 Key Features

CEC has designated part of central Edinburgh as an Air Quality Management Area (AQMA) due to predicted exceedences in NO_2 levels. The AAQuIRE 6.1 model has been used to provide the detailed assessment required in such areas. The impacts have been considered based on traffic flows over an 18 hour day.

8.2.4.3 Summary of Impacts and Mitigation Measures

An estimate of the number of properties affected by Edinburgh Tram Line Two scheme was determined by predicting roadside concentrations for the two future year scenarios. Table 8.3 indicates the number of properties exposed to improvements and degradations in air quality.

Table 8.3 The Number of Properties Affected by the Edinburgh Tram Line Two Scheme

Year	Number of Properties		
	With an Improvement in Air Quality	With a Degradation in Air Quality	With Unchanged Air Quality
2011	175,893	101,315	1,226
2026	165,425	105,842	7,167

This Table demonstrates that there are a greater number of properties predicted to observe improvements in air quality than those showing a deterioration in air quality.

A more detailed indication of the impact of the Edinburgh Tram Line Two scheme is achieved by the calculation of the local air quality indices. These indices provide an assessment of the change in exposure to air quality over the whole study area. This assessment combines the change in roadside concentrations with the number of properties affected. A negative value indicates that the scheme is predicted to have a beneficial impact on air quality; a positive value indicates a detrimental impact. Table 8.4 summarises the impacts.

Table 8.4 Air Quality Indices for Edinburgh Tram Line Two Scheme

Year	NO_2 Index	PM_{10} Index
2011	-47,669	-11,334
2026	-39,193	-17,780

These indices predict that the scheme will lead to a moderate positive impact on local air quality in both 2011 and 2026. This impact was due to a reduction in vehicle kilometres, especially in the more populated areas of the City. The 2011 NO_2 index is equivalent to 47,669 properties seeing a reduction in NO_2 concentrations of 1 µg/m3. Overall, the objective of improving local air quality is met.

The greatest benefits are found along Haymarket Terrace and Morrison Street. Lesser disbenefits were predicted along Saughton Road and Queensferry Road.

Mitigation measures include the increased usage of the trams and other modes of public transport. Further improvements could be made by restricting road traffic through the City or by encouraging the use of non-polluting vehicles.

8.2.5. Water Quality, Drainage and Flood Defence

8.2.5.1 Approach

The assessment of impacts on the water environment is concerned with the effects of the development on the quality and hydrology of surface and ground waters. A baseline desk study of the surface water environment along the route incorporated the river classifications from the Scottish Environment Protection Agency (SEPA) for water bodies within 500m of the proposed route. Classifications reflect the status of the watercourse in terms of chemical, biological, aesthetic quality and toxicity assessment.

Information on flooding and land drainage, as well as known contaminated sites within the area of the proposed route was provided by CEC and from consulting historical Ordnance Survey plans held at the National Library of Scotland to ascertain former land uses along the route. In addition, information on geology and groundwater was collected from maps published by the British Geological Survey (BGS). Where available, site investigation records were also consulted.

Based upon the approach set out in Chapters 7 and 10 of the ES the effect on the water environment has been assessed by predicting the changes that would be caused by the construction and operation of Edinburgh Tram Line Two.

8.2.5.2 Key Features

There are three main watercourses in the vicinity of Edinburgh Tram Line Two that could potentially be affected by the scheme. These are: the River Almond, the Gogar Burn and the Water of Leith.

Approximately 100m to the West of the western terminus of the route (near the M9/A8 junctions) at Newbridge the River Almond flows in a northerly direction. The Gogar Burn is a tributary of the River Almond and, after passing beneath the A8, it flows northward to the Airport boundary, where it flows westwards before entering a culvert near the Airport terminal building to pass beneath the runway and into the River Almond.

The Gogar Burn is known to cause flooding in areas to the south of the Airport and surrounds and an Area of Importance for Flood Control has been defined in this location. A section of the route for the scheme between the Airport and Ingliston Park and Ride stops would run close to the burn. New crossings of the Gogar Burn would be required close to the Gogarburn and Edinburgh Park stops. In addition, a number of smaller un-named water courses or ditches in the vicinity of the Area of Importance for Flood Control would be crossed.

Under SEPA's River Classification scheme in 2001 stretches of the Gogar Burn have been assessed as Class B (Fair), with the stretch close to the Airport assessed as Class C (Poor). East of the Gogar Roundabout the route runs alongside the recently created Loch Ross, formed by widening the Gogar Burn at this point to create a water feature within Edinburgh Park.

Progressing eastwards the route would then continue alongside the existing heavy rail corridor. A new crossing of the Water of Leith would be required immediately west of the Murrayfield Rugby Ground. The practice pitches here are also designated as Areas of Importance for Flood Control. The Water of Leith is Class B (Fair) at this location and in recent times the river has caused severe flooding of the Rugby Ground and the surrounding area.

Underlying bedrock generally comprises rocks of moderate to weak permeability and hydrogeological conditions are similar throughout the proposed route. Bedrock is fractured or potentially fractured and does not have a high permeability, or other formations of variable permeability. Although these formations seldom produce large quantities of water for abstraction, they are important for local supplies and in supplying base flow to rivers. Shallow groundwater may be present within superficial deposits both within sand and gravel deposits and overlying the low permeability clays.

There are no official records regarding groundwater abstractions in Scotland and the presence of abstraction points is therefore not known along the route. Groundwater flow is generally not known although shallow groundwater flow is likely to be towards local watercourses. Groundwater quality is likely to vary depending on potential sources of pollution in the area. Groundwater Source Protections Zones do not yet exist in Scotland and although there are two Nitrate Vulnerable Zones in Scotland, the nearest one is in Fife.

Areas of contaminated ground are present along the Edinburgh Tram Line Two route. Main issues included disused railway land around Ratho, Baird Drive, Roseburn and Haymarket, as well as areas of made ground close to the Gogar Burn near Castle Gogar (a possible former landfill for demolition material). Further information on contaminated land is provided below in Agriculture and Soils.

8.2.5.3 Summary of Impacts and Mitigation Measures

Worksheet W1 covering Water Quality, Drainage and Flood Defence has been drafted and is included in Appendix C.

The construction of Edinburgh Tram Line Two would involve works, such as bridge construction and temporary disturbance, which would have a direct temporary impact on the channel and banks of the Water of Leith and the Gogar Burn. It would also be necessary to construct a culvert over a minor unnamed watercourse, which is a tributary of the Gogar Burn. There would also be a number of land-based activities associated with the construction works, which could potentially have an impact on surface waters in the vicinity.

Proposed mitigation would comprise the following:

- Construction activities would take place in accordance with all relevant legislation, codes of practice and Pollution Prevention Guidelines for protection of ground and surface water, with submission of an environmental method statement to SEPA.
- Temporary site drainage and/or treatment (e.g. settlement lagoons) would be put in place to manage site run-off and accidental spills of fuel, etc., during construction
- Identification of potential risks from possible contaminated land that would be disturbed by the proposed development.
- Temporary and permanent works would be designed to minimise disruption to water courses and loss of flood plains.
- The route drainage system would be designed to avoid pollution of watercourses and groundwater during operation though installation of interceptors, settlement tanks, etc.

The potential impacts to surface water, associated with the construction of Edinburgh Tram Line Two, would be minor and would be largely due to the temporary works associated with the construction of two new crossings of the Water of Leith and the Gogar Burn.

Assuming effective mitigation, in general the permanent impacts during operation of Edinburgh Tram Line Two would be neutral to minor, however an overall rating of moderate has resulted from the assessment. This is due to there being uncertainty at this stage as to whether or not the possible impact of Edinburgh Tram Line Two crossing the Area of Importance for Flood Control associated with the Gogar Burn could be entirely mitigated.

Further assessments during the detailed design stage would establish the required mitigation in detail. Mitigation could involve the provision of adequate compensatory floodwater storage volume equal to that taken up by the placement of the embankment and Edinburgh Tram Line Two infrastructure in the Area of Importance for Flood Control.

Assuming that adequate and well designed drainage is put in place that would collect and/or treat any contaminated run off and/or spills and that an effective management system and training is implemented to prevent inappropriate disposal or spills, potential impacts to groundwater from the proposed scheme would be Neutral.

Appropriate risk assessment of potential risks from contamination would be necessary to inform the site environmental management planning and development of appropriate mitigation measures for contaminated land risks. With these mitigation measures in place this would ensure that contact between potential contaminants and any identified receptors is minimised and the risk reduced to acceptable levels. The overall impact is assessed as being Minor.

8.2.6. Geology

8.2.6.1 Approach

Baseline geological information was obtained by means of a desk study combined with a walkover survey to visually inspect the route corridor. No fieldwork was carried out to confirm the findings of the desk study.

Geological information was determined from geological maps published by the British Geological Survey (BGS). In addition, where available, borehole records held in the BGS library were consulted. Information

on the presence of geological SSSIs and Regionally Important Geological Sites (RIGS) was sought from SNH.

SEPA was also consulted regarding holders of Waste Management Licences and existing and former waste management sites in the route corridor. The waste management implications of removing and disposing of areas of potentially contaminated soil within the Limits of Deviation (LODs) and Limits of Land to be Acquired or Used (LLAUs) have been considered. Local Plans and BGS maps were consulted to determine the presence of active or potential mineral resources underlying or close to the Edinburgh Tram Line Two route.

The significance of potential impacts on geology that may be affected by the development is based on assessment criteria as detailed in the ES Chapter 7. The main issues for impacts on geology include damage to areas designated for their geological interest or zones where the development may affect active or potential mineral extraction activities and potential sterilisation of mineral reserves. In addition, issues associated with waste management of potentially contaminated soils have been assessed.Key Features

Superficial geological deposits comprise mainly glacial till overlain in places with mounds of glacio-fluvial sands and gravels, lacustrine deposits associated with various former lochs and weak alluvial soils near the Gogar Burn and the Water of Leith. There are pockets of made ground in places. Superficial deposits are generally more than 10 metres thick.

A major fault, the Middleton Hall Fault, is recorded to outcrop through the centre of Newbridge, running west to east, extending towards Edinburgh, down throwing the strata to the north. To the south of the fault line the Lower Oil Shale Group, which is similar in stratification to the Upper Oil Shale Group, is recorded to outcrop at rockhead. These are both of Carboniferous age.

The village of Ratho Station, located to the east of Newbridge lies upon a Quartz Dolerite intrusion. A further Quartz Dolerite intrusion is present at Maybury, to the north of the Gogar Roundabout. The intrusions comprise a black, fine-grained igneous rock, which is locally known as 'whin', which has historically been quarried at a number of sites in the Newbridge area.

Based on initial screening of historical information and assessment of previous industrial activities, a number of potentially contaminated sites have been identified within 500 metres of the Edinburgh Tram Line Two route corridor and in areas that may be used for depots, etc.

Consultation with SNH indicates that there would be no geological SSSIs or RIGS within or adjacent to Edinburgh Tram Line Two. However, the Castle Rock SSSI (Edinburgh Castle) is close to the route at Princes Street, albeit on the far side of the main railway line west from Waverley Station.

Local Plans do not indicate any active or proposed mineral extraction activities within or close to the route. However, an active whinstone quarry (Hillwood Quarry) is present approximately 100 metres south of the proposed route near Ratho Station. There is no evidence of undermining under any part of the route.

There are no licensed or formally licensed waste management sites actually within the LODs or LLAUs although a number of sites with waste management licences (mainly scrap yards, etc. have been identified near the route). However, there is an area near Gogar that is likely to have been used as a landfill for demolition waste prior to introduction of the current waste management-licensing regime.

Waste management issues would be associated with areas of potentially contaminated land within the route and from which material may need to be disposed of during construction of Edinburgh Tram Line Two and associated infrastructure. In addition, fly-tipped waste deposited on certain areas of the LODs and LLAUs would have to be disposed of during construction of the scheme. A number of sites where non-hazardous waste may be present were identified.

Summary of Impacts and Mitigation Measures

No impacts on designated geological sites such as SSSIs and RIGS are predicted from the construction and operation of Edinburgh Tram Line Two. In addition, no impacts on active or mineral resources are predicted. Both of these impacts have therefore been assessed as Neutral.

Issues relating to contaminated land have been addressed in the Water, Drainage & Flood Defence and Agriculture & Soils sections.

During construction there will be the requirement to dispose of material from within the route as required by the detailed design. It is possible that some of this waste material would come from areas that are potentially contaminated. Particular issues would include known areas of made ground such as railway embankments, former railway or industrial and the area of former landfill at Gogar, in addition to fly-tipped waste.

In general, waste material is likely to comprise Inert and Non-Hazardous waste, although there is the possibility of encountering material that could be classed as Hazardous Waste, for example drums of chemicals or paint, etc. Appropriate handling and disposal of this waste would be required. Measures will be put in place to ensure that as much of the excavated material as possible generated through construction is re-used on other areas of the development.

In addition, construction activities themselves would generate waste. Most of this would be Inert Waste, however, Hazardous Waste including waste oils, solvents, etc., may also be generated. These wastes would have to be disposed of in accordance with the appropriate Waste Regulations and Duty of Care in order to avoid impacts on the environment. As part of the Environmental Management Plan for construction sites, waste minimisation measures would be put in place. The impact from waste during construction is assessed as Minor.

Waste would also be generated during operation of the scheme. This would be handled and disposed of according to current Waste Management legislation. The impact from waste management issues is therefore assessed as Minor.

Worksheet G1 in Appendix C summarises the impacts on Geology.

8.2.7. Biodiversity

8.2.7.1 Approach

The approach to the ES and STAG appraisal, including the evaluation of specific taxonomic groups, including plants, birds and mammals follows that contained within the Guidelines for Ecological Impact Assessment: Amended Pilot, November 2002 published by IEEM. However, due note and reference has also been made to: DMRB Vol 11 Environmental Assessment – Section 3, Part 4 Ecology and Nature Conservation and GOMMMS specifically Section 4.10 'The Biodiversity sub-objective'.

Survey methodology complies with that published in the Guidelines for Baseline Ecological Assessment, 1995 published by the Institute of Environmental Assessment (now the Institute of Environmental Management and Assessment). In the first instance, a desk study and an extended Phase 1 survey, based on the methodology outlined by the Nature Conservancy Council in A Handbook for Phase 1 Habitat Survey, 1990 was carried out. Further species-specific survey work was subsequently carried out.

8.2.7.2 Key Features

Worksheet B1 provides a summary of baseline ecological conditions including designated sites, habitats of interest and protected species.

No national or international nature conservation designations are in place along the proposed tram route. However, within the 2km corridor of the proposed tram route there are two national designated areas, Castle Rock SSSI and Calton Hill SSSI.

Non-statutory designated areas along the route include Roseburn Railway Urban Wildlife Site (UWS), Water of Leith UWS, Gogar Burn Site of Interest for Nature Conservation (SINC) and UWS. In addition, Carrick Knowe Golf Course is a Neighbourhood Nature Area (NNA).

Through consultation with various consultees including the Lothian Wildlife Information Centre, a total of eight notable flora species were identified in the 2km wide route corridor. However, of these species none are encountered along the actual route of the tram.

Protected mammal species known to be present within the route study area include badgers, bats and otters.

A number of habitats are found along the proposed route including extensive areas of low value amenity and improved grassland, tall ruderal, introduced shrub, arable land and field boundaries have been identified along the tram route. Habitats of note include:

- Woodland – Various classifications of woodland have been identified along the tram route. These include broadleaf woodland of plantation origin, mixed woodland of plantation origin along with scattered and dense scrub. No Ancient Woodland or long established woodland of plantation origin has been identified along or immediately adjacent to the tram route.
- Watercourses – Two main watercourses are present along the route of the tram. These being the Gogar Burn and the Water of Leith. The Gogar Burn has been modified and extensively culverted with little of the semi natural alignment left. Both areas are regarded as being important wildlife corridors.

When assessed in isolation many of the habitats along and adjacent to the proposed tram route are of low ecological value. However, when assessed along the length of the route the value of many habitats increases due to linear linkages and the ecological continuum of habitats. This occurs adjacent to the existing main Edinburgh/Glasgow railway line. Where this occurs the value of the habitat increases to medium.

8.2.7.3 Summary of Impacts and Mitigation Measures

Worksheet B2 in Appendix C provides a summary of the results of the assessment.

Disturbance, killing and injury are the greatest potential impacts to wildlife along the Edinburgh Tram Line Two corridor. These may occur through clearance of vegetation, demolition and the use of plant,

destruction of foraging and or sheltering habitat, trapping and/or poisoning of animals by materials left on site and disturbance and disruption to successful breeding. The predicted impacts are summarised below:

Table 8.5. Impacts on Biodiversity

Impacts on Designated Sites		
The disused railway UWS	Loss of habitat	Minor negative impact
Water of Leith UWS	Disturbance	Minor negative impact
Gogar Burn SINC	Break in integrity and habitat loss	Minor negative impact
Entire route	Loss of habitat along various sections of the route. Ranging from loss of amenity grassland and isolated low value introduced shrub to loss of broadleaf plantation woodland	Range from Neutral to Moderate impact
The disused railway line (Roseburn)	Loss of habitat of low value	Minor negative impact
Main Edinburgh /Glasgow Railway line Roseburn to Bankhead drive)	Loss of habitat adjacent to Baird Drive	Minor/Moderate negative impact
Gogar Burn	Disturbance and temporary loss of vegetation	Minor negative impact
Water of Leith	Disturbance and very limited temporary loss of vegetation	Minor negative impact
Badgers	Disturbance during construction and operation	Moderate to Major negative impact
Otters	Disturbance during construction.	Minor negative impact
Bats	Disturbance, loss of foraging areas during construction.	Minor negative impact

The contractor would be required to work under a strict code of practice. This would incorporate wildlife and habitat protection best practice including: requirements to erect hoardings to restrict the working area, standards of dust control to protect adjacent habitats, and suitable precautions to prevent entry of pollutants into any bodies of water. Protected species surveys would also be required prior to work commencing.

Replacement planting along the route corridor would be undertaken within the LODs. While detailed proposals would be worked up prior to construction of the Edinburgh Tram Line Two, the ES includes plans of indicative mitigation proposals. These plans identify areas along the route of the tram where replacement planting would take place. Replacement planting would include woodland, scrub, amenity planting and areas for habitat creation. The replacement planting proposals have been prepared in tandem with the landscape mitigation strategy. The strategy aims to ensure that ecological impacts are minimised and opportunities are identified to provide ecological benefits. With respect to protected specifies, such as badgers, discussions have been held with Scottish Natural Heritage (SNH) to identify appropriate measures to protect these animals.

8.2.8. Landscape

8.2.8.1 Approach

In accordance with good practice and the requirements of STAG the assessment of landscape effects has been undertaken following the Design Manual for Roads and Bridges Volume 11 Section 11.3.5 with reference to the following documents:

- Landscape & Visual Assessment Supplementary Guidance (LVASG)(Scottish Executive; 2002);
- Guidelines for Landscape and Visual Impact Assessment (GLVIA)(Institute of Environmental Management and Assessment: IEMA; 2002);
- Cost Effective Landscapes: Learning from Nature (CEL:LfN) (The Scottish Office; 1998);
- Planning Advice Note (PAN) 58; Environmental Impact Assessment (Scottish Executive 1999); and
- The Lothians Landscape Character Assessment dated 1998 (Scottish Natural Heritage Review Number 91.

Detailed landscape assessment methods are set out in Chapter 8 of the ES. The approach involved a review of published documentation (including development plans, current and historical Ordnance Survey mapping, aerial photographs and data on conservation interests within the area) combined with site surveys in order to describe and evaluate the existing components, character and quality of the landscape of the study area. All relevant designated sites were included within the assessment.

The study area was broken down into a series of distinct landscape character areas and the effects on each area assessed. In order to assess the significance of impacts, the sensitivity of the landscapes to change and the likely magnitude of change have been considered. Impacts of moderate and above have been considered significant, as this is the level at which the changes to the landscape would be clearly perceived. The assessment year has been taken as year 15 after scheme completion.

The assessment has been based on an exemplar engineering design, which for the purposes of this assessment, forms the basis upon which both the assessment and the indicative landscape mitigation is founded. Further details with regard to the assumptions, which have been made during the landscape assessment process about the various scheme components are set out in Chapter 8 of the ES.

8.2.8.2 Key Features

Edinburgh Tram Line Two runs through very diverse landscape character types from St Andrew Square in the heart of the New Town, along Princes Street and the West End to Haymarket on the edge of the New Town and the World Heritage Site, out past Murrayfield and through mixed residential, industrial and recreational landscapes to peripheral commercial and retail developments along the western built edge of Edinburgh bounded by the City Bypass to more urban fringe greenbelt landscapes typified by rolling arable farmland and traditional estate planting.

Central Edinburgh contains one of the largest areas of Georgian architecture in Europe and almost the entire city centre has been designated as a World Heritage Site due to its unique architectural heritage and distinctive townscape. Conservation areas cover about one third of the city.

Between Roseburn and Newbridge there are no landscape designations within the immediate tram corridor, although the section of route from Gogar roundabout to the Airport would run to the north of an Area of Great Landscape Value (AGLV) at Gogar. There is a Designed Landscape (Millburn Tower) to the south west of the corridor route and a designed landscape (Newliston House) to the north of Newbridge terminus, both of which would be entirely unaffected by the tram proposals as there would be little intervisibility between the landscapes and the proposed tram route. The section of tram corridor from Gogar roundabout to the east of Newbridge falls within Green Belt designated land of which the local landscape character, under local plan policy is to be protected, maintained and enhanced. The tram corridor would also run adjacent to various areas of open space identified and protected under local plan policy.

Areas of particular sensitivity include the New Town landscapes, of St Andrew Square, Princes Street and Shandwick Place, localised residential areas and urban green space and the more open, rural landscape structure associated with Greenbelt areas west of Gogar roundabout.

The Character Areas fall into four categories, which in broad terms, radiate outwards from the city centre;

A: Historic City Core;
B: Urban and Suburban Residential with Urban Green Space;
C: Landscape dominated by large- scale business and office- related developments
D: Urban Fringe Character Greenbelt dominated by infrastructure

These in turn have been sub-divided into a number of smaller recognisable character areas which are described in more detail in Chapter 8 of the ES. These character areas are identified on Figure 8.11. Worksheet L1 is included in Appendix C.

8.2.8.3 Summary of Impacts and Mitigation Measures

The main sources of landscape impact would be the overhead infrastructure (OHLE) – wires and supports, new and altered structures – such as bridges, the tram depot and substation buildings and the tram stops with their associated shelters, seating etc. The tram signalling equipment and additional traffic signalling and signage would generally have small effects but they would add clutter to the streetscape and may in sensitive locations raise the overall landscape impact above a significance threshold. The tram vehicles themselves would have an impact particularly in areas not currently trafficked, such as the disused railway corridors and the more open landscape to the west of Gogar roundabout.

The tram would be a new element in the city, clearly visible to all. The degree of impact is entirely dependent on the design of the system thereby underlining the principle of ensuring that the various new and altered elements are appropriately designed and integrated into the fabric of the city. A Design Manual has been produced which sets out the principles of urban design and detailing. General mitigation commitments arising from the Design Manual have been identified in Chapter 8 of the ES.

Additional landscape mitigation principles have been identified to further integrate the proposed scheme into the landscape and townscape, thereby mitigating more localised impacts and where appropriate enhancing the local landscape structure using the following components and techniques:

- Planting;
- Mounding;
- Earth shaping;
- Restoration of hedge patterns and other rural and urban boundaries; and
- Creation of habitats for ecological interest.

A: Historic City Core
The introduction of the tram into the World Heritage Site and this historic core would have moderate to major negative landscape impacts. The OHLE and stops would have a significant negative landscape impact through this section of particularly sensitive and very high quality landscapes, particularly on the various designed vistas including from South St David Street to the Scott Monument, and the iconic tourist views from Princes Street such as the Castle and Old Town skyline. The use of poles in Princes Street would be particularly sensitive as there are no existing permanent vertical elements in the street. The OHLE and the Shandwick Place stop would impact negatively on the character of Shandwick Place and adjoining crescents in the West End area, which form an architecturally coherent extension of the New Town.

The introduction of the tram into Haymarket would have a moderate to major negative landscape impact. This busy junction and thoroughfare is particularly weak in townscape terms with poor enclosure to the junction, which would be exacerbated by the demolition of the Caledonian Ale House. However the tram route and stop would visually widen the road at Haymarket Terrace so that Roseberry House would appear to be the natural building line where at present it appears incongruously set back.

B: Urban and Suburban Residential with Urban Green Space
Moderate negative landscape impacts in this character area would be restricted to the low density villa suburbs and amenity open space around the footbridge crossing at Carrick Knowe and the disused railway corridor at Roseburn. The direct impact of the tram line overbridge and OHLE as it crosses the railway at Carrick Knowe and Russell Road at Roseburn would negatively impact these character areas. The loss of the mature tree screen to the railway between Balgreen Road and the Water of Leith crossing would have a moderate negative impact on the more immediate local landscape character of this low density villa suburb area.

Overall the introduction of the tram into this wider character area, including the committed mitigation would have minor negative to neutral landscape impacts, primarily arising from the OHLE and the localised removal of mature tree planting. Localised minor positive landscape impacts would arise particularly for the housing areas bounding Broomhouse and Stenhouse Drives due to the proposed mitigation planting along the tram corridor and the mixed woodland screen planting between the railway and tram corridors.

C: Landscape dominated by large scale business and office related developments
This character area comprises large business related developments including the modern office development at Edinburgh Park set in spacious, attractive landscape grounds contrasting with the more traditional large office developments often located closer to the city centre. These landscape character areas are generally less sensitive to change and are relatively ordinary landscapes with the exception of Edinburgh Park and the adjacent business areas. They are therefore more able to accommodate developments with generally only minor or negligible landscape impacts.

Consequently only minor negative or neutral landscape impacts would result in this character area with occasional minor positive impacts as a result of the mitigation planting. Negative landscape impacts for example would be associated with the tram line running through the landscape corridor in Edinburgh Park and the introduction of the overbridge at Hermiston Gait.

D: Urban fringe character Greenbelt dominated by infrastructure
This character area is relatively rural but with a strong urban fringe character and comprises large scale- and infrastructure- related developments and corridors, to the west of the City Bypass. The Airport and the Royal Highland Showground and Ingliston market areas dominate the landscape to the west of the City Bypass which largely defines the western urban limit of Edinburgh with major infrastructure corridors crossing this whole area. This character area comprises areas, which are generally highly sensitive and very attractive to good quality landscapes, characterised by the rural matrix of predominantly arable farmland subtle topographic and woodland features with the traditional estate planting together with agricultural shelterbelts creating a strong and positive influence on the appearance of the landscape.

The introduction of the tram would have direct landscape impacts on the historic setting of Gogar Church resulting in moderate negative impacts. Generally however, minor negative landscape impacts would result with the mitigation planting proposals enabling the intrusive linearity of the tram proposals to fit into the existing landscape framework and where possible enhance the existing landscape structure. Minor beneficial landscape impacts would result in the landscape character at the Airport and sections of infrastructure corridors where the mitigation planting would enhance the existing landscape framework.

8.2.9. Visual Amenity

8.2.9.1 Approach
In accordance with good practice and the requirements of STAG the assessment of visual amenity has also been undertaken based the Design Manual for Roads and Bridges Volume 11 Section 11.3.5 with reference to the following documents:

- Landscape & Visual Assessment Supplementary Guidance (LVASG)(Scottish Executive; 2002);
- Guidelines for Landscape and Visual Impact Assessment (GLVIA)(Institute of Environmental Management and Assessment: IEMA; 2002);
- Cost Effective Landscapes: Learning from Nature (CEL:LfN) (The Scottish Office; 1998);

- Planning Advice Note (PAN) 58; Environmental Impact Assessment (Scottish Executive 1999).

Detailed landscape assessment methods are set out in Chapter 8 of the ES.

Landscape and visual impacts are closely related issues with considerable overlap between the two assessments. Visual amenity is defined as the pleasantness of the view or outlook of an identified receptor or group of receptors. The visual impact assessment determines the degree of anticipated change to visual amenity, considering buildings, areas of public open space, roads and footpaths that would occur as a result of the proposed scheme. The buildings, open spaces, roads and footpaths that would yield views of the tram development are collectively referred to as 'receptors'.

Desk studies combined with detailed site surveys were undertaken. Key components of the assessment of visual amenity included:

- The identification of the zone of visual influence or visual envelope (the extent to which the proposed development could potentially affect people's views of the landscape within the wider area surrounding the development).
- Field assessment and analysis of affected receptors. Receptors or groups of receptors were visited and surveyed using a standardised checklist to enable visual evaluation of sensitivity and magnitude of change leading to assessment of potential impacts.
- An analysis was undertaken of change in receptors' views, and the potential composite change in identity engendered by the development proposals.
- An evaluation was undertaken of the effects of the proposed change in views from receptors.

Impacts of moderate and above have been considered significant, as this is the level at which the changes would be clearly perceived. The assessment year has been taken as year 15 after scheme completion.

Like the Landscape assessment, the visual assessment has been based on an exemplar engineering design which for the purposes of this assessment, forms the basis upon which both the assessment and the indicative landscape mitigation is founded. Further details with regard to the assumptions, which have been made during the visual assessment process about the various scheme components are set out in Chapter 8 of the ES.

8.2.9.2 Key Features

The extent to which the proposed scheme would be seen and is intervisible with the surrounding landscape varies considerably along the length of the tram route. In common with many urban corridors located in densely developed urban and suburban areas, the visual envelope is defined by the buildings fronting onto or adjacent to the proposed tram line and in the instances of shared running, existing road. There are, however, areas of space, which open views and extend the influence of the tram line. There are also views available through gaps in the built fabric which frame development and of the overhead wires and poles inherent in the tram development which extend the influence of the tram proposals beyond the clearly recognisable framework of houses and planting.

Figure 8.12 illustrates the visual envelope for the operation of the tram system. The visual envelope clearly demonstrates that the visual awareness of the tram corridor is much more contained in the eastern city centre sections of the study area compared with the westerly, more sub urban and urban fringe areas, where the visual awareness of the tram corridor is more extensive.

The visual envelope for much of the section from St Andrew Square to Haymarket is relatively narrow. Along much of this section of route the tram and its infrastructure would be seen from a comparatively restricted area; from buildings facing directly onto the tram line and from streets that cross the line. The buildings that form the streets generally block views from further afield. The exception to this is where the tram runs along Princes Street where the visual envelope widens to the south. Receptors along this section of the tram corridor would include visitors, employees, shoppers and residents of the various shops, offices, commercial buildings and properties which lie adjacent to and /or have views of the route corridor.

From Haymarket west the visual envelope is contained in sections by localised planting and buildings but generally forms a relatively wide corridor contained by flats and the railway corridor to the south and open to the north extending across Carrick Knowe golf course towards Corstorphine Hill. The envelope from Carrick Knowe west remains wide although largely defined by the railway corridor to the north and by buildings to the south. Principal receptors along this section of corridor include, properties which lie adjacent to and/or have views overlooking the route corridor; employees working in offices and of the various industrial and commercial premises located adjacent to and/or with views of the route and users of the various footpaths and open spaces which either cross, run adjacent to or have views of the tram route.

From Gogar Roundabout west the visual envelope is more open and extensive. The envelope although often contained to the south by landform and woodland planting is open encompassing large areas to the north with localised built developments, occasional landform and pockets of planting restricting views. Receptors along this section include residents of the various scattered properties and pockets of concentrated development such as at Ratho Station and Newbridge, users of the Airport and visitors to the showground, travellers using the various infrastructure corridors including the A8 and various footpaths

and cycle ways which have views of the tram route and employees of the various industrial units at Newbridge and Ratho.

8.2.9.3 Summary of Impacts and Mitigation Measures

Visual impacts would be created by the tram infrastructure the OHLE, poles, signals, stops and shelter, by the tram vehicles themselves, by the buildings associated with the tram such as the depot and substations and by construction of new structures and alterations to existing. Due to its vertical dimension the OHLE and poles would have the most significant impact on the landscape, which for the most part cannot be screened or hidden. The mitigation for these, to which **tie** has committed through the design manual, which sets out the principles of design and detailing, is to design them well so that they fit comfortably into the scene as far as possible. Points in the Manual, which are specifically intended to reduce the visual impact of the tram system as a whole, are described in Chapter 8 of the ES. Visual impacts would also be mitigated by the landscape mitigation commitments, which are described earlier in this Chapter under the Landscape Character section. Specific measures to mitigate visual impacts at individual receptors / receptor groups are provided in the ES.

The likely impacts of the proposed scheme on each receptor or group of receptors (buildings, open spaces, roads, rail and footpaths) are presented in detail in Appendix 8.4 of the ES and are summarised in Worksheet VA1 in Appendix C. The reference numbers identified in the worksheets relate to the receptor and receptor groups identified in the visual assessment for the ES.

In certain locations within the study area the existing outlook for receptors is on occasion focussed on neglected corridors of land. Whilst the introduction of the tram system would form a negative intrusion into existing views, the landscape mitigation planting would enhance what was a neglected landscape and help to minimise the visual intrusion of the tram. In such locations the assessment results would be an order of benefits and disbenefits, which would be neutral in effect.

In terms of buildings the majority of receptor groups, which directly front the tram corridor or with immediate views towards it would experience minor negative or neutral visual impacts as a result of the intrusion of the tram system into their views. However, moderate negative visual impacts would be limited to the following receptor groups by virtue of their immediate orientation towards the tram alignment and visual proximity to new structures, OHLE and poles:

- End properties on Balbirnie Place;
- Flats on Russell Road;
- Properties on southern side of Baird Drive;
- The Fairways flats at Carrick Knowe footbridge;
- Offices and part of waterside landscape corridor at Edinburgh Park;
- Castle Gogar Lodge House;
- Property at junction of A8 and Ingliston Road (this would incur major negative impacts as the tram alignment would immediately pass the property and run through the receptor's garden).

The following building receptors and receptor groups would experience minor to moderate negative impacts which for the purposes of this assessment have been determined as significant and negative:

- Majority of buildings which front the alignment between St Andrew Square to Haymarket;
- Some of the office/commercial premises in the Haymarket Yard area which immediately front the alignment;
- Gogar Church; and
- Ingliston Park Lodge;

Visual impact on Open Space would not be significant and negative other than from the Scott Monument and adjacent gardens, Prince Mall plaza, at Huly Hill and a section of the waterside landscape corridor at Edinburgh Park.

Visual impacts would only be moderate negative for localised sections of the following footpaths and roads where the tram proposals would either fundamentally change the visual amenity experienced along the paths or adversely impinge on the iconic vistas and long views currently experienced from various streets in the New Town, including:

- North/south axis of St Andrew Square;
- Princes Street; and
- Sections of footpaths along the disused railway corridors at Roseburn, Balgreen and to the South of Ratho Station.

The only positive visual impact in the tram corridor would be at Edinburgh Airport with minor beneficial impacts experienced as a result of the assumed high quality amenity planting and hard landscape to the tram stop and terminus in line with the Airport Landscape Strategy.

The overall assessment for Visual Impact is that impacts would be moderate negative and significant for localised sections of the tram corridor, but elsewhere would not be significant.

8.2.10. Agriculture and Soils

8.2.10.1 Approach

This component of the STAG appraisal covers the loss or severance of agricultural land and the potential for soil contamination, including the identification of existing contaminated land areas.

The approach to assessment for agriculture involved identifying and contacting land owners and/or farming tenants with the intention of determining, from an individual farming perspective, the expected impacts resulting from the Edinburgh Tram Line Two alignment across fields currently used for agricultural purposes. The agricultural impacts are summarised on Worksheets AG1 and AG2 provided in Appendix C.

Potentially contaminated sites on or close to the route were identified through a review of historical Ordnance Survey maps together with data collected from CEC and SEPA. The impact assessment for potentially contaminated land uses a risk-based approach following the source-pathway-receptor methodology promoted by SEPA.

8.2.10.2 Key Features

The alignment of Edinburgh Tram Line Two will travel across ten fields, which are currently used for arable cultivation or under "set aside". Ownership and tenancy details as well as access and the agricultural use of the land has been summarised in Section 6 of the ES. All fields are classified as Class 2 agricultural land i.e. high quality. Typically, tenant farmers hold short-term leases. Further information is provided in Worksheet AG1 in Appendix C. Potentially contaminated sites are identified on Figures 8.1 - 8.10 and described in Chapter 7 of the ES. The main types of contaminated land that would be disturbed by the construction of Edinburgh Tram Line Two are listed below:

- Former or existing railway land, particularly at Haymarket, Roseburn, Murrayfield, Baird Drive and west of Balgreen Road, plus Gogar Roundabout and Ratho Station.
- Former factory adjacent to Gogarburn Roundabout (Depot Site).
- Site of former smithy at Gogar.
- Former unlicensed landfill adjacent to the Gogar Burn.
- Made ground on eastern bank of the Gogar Burn.

8.2.10.3 Summary of Impacts and Mitigation Measures

Temporary:

Agricultural Land

Worksheet AG2: Temporary Impacts, summarises the potential impacts on specific agricultural fields. Temporary agricultural impacts are related to the construction compounds being situated on fields currently being used for agricultural purposes. Proposed mitigation measures include:

- Care during construction. This would require possible stripping and storage of top soils to prevent soil structure damage during construction and repair and replacement of agricultural drains.
- Reinstatement of agricultural fields to enable continued farming practices.
- Maintained access to agricultural fields during construction.

In all cases, a Neutral Impact for the significance assessment has been assigned. This is based on the assumption that mitigation measures relating to care during construction, maintenance of access and reinstatement would be carried out correctly and that construction works would be limited to the Edinburgh Tram Line Two corridor and construction compounds.

Soils

In relation to the general management of soils throughout Edinburgh Tram Line Two route alignment, mitigation would include ensuring that soils are adequately protected and/or temporarily removed during construction works, then restored/replaced after construction works have been completed. Neutral impact.

Contaminated Land

During construction any materials encountered that may be contaminated would be tested for potential chemical contaminants associated with known past uses of the site. In addition, all standard health and safely measures would be followed to ensure the minimum contact between site workers and members of the pubic and potential contaminants. Measures would be put in place to ensure that run-off from sites is prevented and that dust and aerosol generation is minimised. Areas of significant contaminated that may impact on construction materials would be removed or isolated to avoid contact with any sensitive materials. The residual impact has been assessed as Minor.

Permanent:

Agricultural Land

Worksheet AG2: Permanent Impacts, specifies the location of agricultural fields and the specific potential impacts on the future agricultural use of the field as a result of the Edinburgh Tram Line Two alignment.

For all agricultural, the common permanent residual impact is the loss of agricultural farming ground required for the operation of the tram line, within LODs. Edinburgh Tram Line Two would also result in

areas of land being unsuitable for further agricultural use because the remaining field area (between the field boundary and the Edinburgh Tram Line Two alignment) is considered too small for viable farming use. This assessment was based on discussions with the individual farmers.

Proposed mitigation measures for agricultural land areas include:

- Level crossings with warning lights will be built across access roads and fields to enable safe crossing of the tram line to enable continued agricultural use
- Compensation has been assumed for the area of agricultural land which is no longer viable for farming use.

In all cases the impact significance assessment has assigned a Minor Negative Impact for individual farming plots, because the area of land take is small in terms of the scale of the farming operations. However, because of the combined effect of land take of Class 2 agricultural land, a Moderate negative Impact has been assigned overall.

Contaminated Land

Mitigation in terms of contaminated land would prevent and/or contain spills so that land within the scheme, particularly at depots, is not contaminated by operational activities. Design of infrastructure would take into account potentially contaminated land so that structures would be protected from aggressive ground conditions and/or gas protection measures put in place to prevent ingress/migration of landfill gas if present. Monitoring and or venting of gas may be required.

It is likely, however, that the level of contamination present in each of these areas will not be significant because the areas involved are not extensive and the uses themselves are not likely to have generated large quantities of contaminated material. The impact has been assessed as Minor negative.

8.2.11. Cultural Heritage

8.2.11.1 Approach

The assessment of the impacts of the proposed scheme on cultural heritage in and adjacent to the scheme has considered:

- Scheduled Ancient Monuments;
- Other sites and areas of archaeological significance;
- Listed Buildings and other features of architectural or historic interest;
- Conservation Areas and other important historic townscape features;
- Gardens and Designed Landscapes;
- Edinburgh World Heritage Site.

The variable character of the townscape / landscape along the proposed tram route influenced the width of the baseline study corridor.

- Along the proposed shared section of Edinburgh Tram Line One and Edinburgh Tram Line Two, within the urban environment between St Andrew Square and Roseburn, baseline information was collated by the Edinburgh Tram Line One Environmental Assessment team within a corridor defined by the Limits of Deviation of the scheme. Information was also collated on Listed Buildings with a frontage on the route or in its immediate vicinity (for example Princes Street Gardens). This data has been verified as accurate by the Edinburgh Tram Line Two team and included in this assessment.
- Between Roseburn and Newbridge baseline information was collated for features present within 200m of proposed development locations, although to the west of Gogar Roundabout baseline information was collated on sites with statutory and non-statutory designations present within 500m of proposed scheme features.

Baseline information was collated from a range of archival and documentary sources, including the Statutory List of Buildings of Special Architectural or Historic Interest, the National Monuments Record of Scotland, Local Plans, An Inventory of Gardens and Designed Landscapes in Scotland, historic maps and aerial photographs. Information was also obtained through consultations with Historic Scotland and the City of Edinburgh Council Archaeology Service. Reconnaissance field survey was undertaken along the accessible parts of the proposed tram route to locate and record the current condition of known heritage features and any further features not detected from the desk studies, and to assess the potential impacts of the proposed development upon heritage resources.

8.2.11.2 Key Features

In total, 272 archaeological and heritage sites have been identified within the assessment corridor. The heritage features can be categorised as follows:

- Scheduled Ancient Monuments = 3
- Other sites of archaeological interest = 36
- Listed Buildings = 173
- Other sites of architectural interest = 54
- Conservation Area = 3
- Inventory Status Gardens and Designed Landscapes = 3
- World Heritage Site = 1

Of these 2 Scheduled Ancient Monuments (Gogar Mains fort; Lochend Standing Stone) and 25 other sites of archaeological interest, 11 Listed Buildings, 1 Conservation Area, 2 Gardens and Designed Landscapes (Millburn Tower; Newliston), and 51 features of architectural interest, all located within the wide corridor between Roseburn and Newbridge, would undergo no impacts as a result of the proposed scheme. These unaffected sites are not considered further in this assessment and are excluded from the worksheets (Appendix C) supporting this summary assessment, although they are included in the baseline information presented in Chapter 11 of the Edinburgh Tram Line Two Environmental Statement.

The route corridor can be divided into three sections on the basis of broad differences in townscape / landscape character, which have a considerable influence on the character, extent and importance of the cultural heritage present within each section. These are:

- St Andrew Square – Haymarket: a townscape of international historic and architectural importance;
- Haymarket – Gogar Roundabout: a townscape of predominantly 20th century housing and industrial developments on the west side of Edinburgh;
- Gogar Roundabout – Newbridge: semi-rural landscape considerably fragmented by major transport corridors, Edinburgh Airport, housing and industrial development at Newbridge.

Between St Andrew Square and Haymarket the assessment corridor runs entirely within the Edinburgh World Heritage Site, New Town Gardens Designed Landscape, and Conservation Areas (New Town / West End). There are also 140 Listed Buildings spread densely along the whole of this route section (44 Category A, 76 Category B, 18 Category C(s) and 2 non-statutory C). 29 Listed Buildings are present along the corridor between St Andrew Square and Princes Street, around St Andrew Square; 64 Listed Buildings are present along Princes Street and in East and West Princes Street Gardens; and 47 Listed Buildings are present at the West End, between Princes Street and Haymarket. These designations reflect the recognition of the New Town as a distinctive part of the Edinburgh's status as an internationally important cultural and architectural asset and townscape. St Andrew Square and Princes Street form key formal elements of the grid pattern design of the New Town, both now containing buildings of various dates. The West End forms part of an architecturally coherent extension of the New Town in the period up to 1880. No sites of purely archaeological interest have been identified between St Andrew Square and Haymarket, although Edinburgh Castle is protected as a Scheduled Ancient Monument.

A number of views and viewpoints are particularly important in Edinburgh because of the designed vistas in the New Town. Examples are the views down Princes Street towards Calton Hill, down St David Street to the Scott Monument, down Castle Street towards the Castle, and along George Street to St Andrew Square. There are also highly important views from Princes Street across Princes Street Gardens to Edinburgh Castle and the Old Town skyline, and views from the Castle across the New Town. Where possible, these views have been taken into account in the indicative design.

Between Haymarket and Gogar Roundabout only a scatter of cultural heritage features would be in any way potentially affected by the proposed scheme. These comprise four Listed Buildings (1 Category A, 3 Category B), in particular the Category B Jenners Depository on Balgreen Road; and three sites or areas of limited archaeological interest including the remains of a 19th century field boundary and the former site of Gogar Loch. The potential of this route section to contain currently unidentified archaeological remains is mostly low or negligible.

Between Gogar Roundabout and Newbridge potentially affected cultural heritage resources include 1 Scheduled Ancient Monument and 8 other sites of archaeological interest, and 18 Listed Buildings (3 Category A, 6 Category B, 9 Category C(s)). The Scheduled Ancient Monument comprises the prehistoric barrow and standing stones at Huly Hill. The more important non-scheduled archaeological sites are features recently discovered adjacent to Huly Hill; the site of a medieval and later village at Gogar; and a WWII pillbox located on the edge of Edinburgh Airport. The potential of this route section to contain currently unidentified archaeological remains is moderate or high in areas of agricultural land. Most of the Listed Buildings potentially affected are associated with a series of former country residences set within landscaped grounds to either side of the Glasgow Road (now the A8 trunk road). These include buildings associated with Castle Gogar, Gogarburn House, Gogar Park, Norton Estate and Ingliston House. Those listed structures closest to the proposed tram route are Castle Gogar Lodge, Gogar Parish Church, Ingliston House Lodge, Middle Norton cottages and Norton House Hotel, North Lodge.

8.2.11.3 Summary of Impacts and Mitigation Measures

The preferred mitigation strategy is to preserve in situ and in an appropriate setting all cultural heritage resources. The preferred alignment has been designed to avoid all direct effects wherever possible and to minimise potential indirect effects.

Between St Andrew Square and Haymarket potential direct effects may occur on a range of Listed Buildings and other features of architectural interest. At Haymarket the Caledonian Alehouse (Category C(s)) would be demolished and the Heart of Midlothian War Memorial (Category C(s)) may require to be relocated. Both would form minor adverse effects. 16 Listed Buildings lie within the Limits of Deviation, and might be directly affected by the proposed scheme. These structures mostly comprise historic street furniture associated with 10 Category A and 3 Category B Listed Buildings, mainly around St Andrew Square but also at St John's Church and at the West End. The magnitude of any such impacts are uncertain, although direct effects on Category A listed features are likely to major and adverse, and those on Category B listed features minor and adverse. Any physical effects on the Monument to John, 4th Earl

of Hopetoun (Category A) and a police call box at West Princes Street Gardens (Category B) would both likely be major and adverse. Three unlisted railings may be affected, leading to minor adverse effects.

A mitigation strategy has been proposed for all potential direct effects in this route section. Detailed standing building survey and salvage is proposed in relation to the Caledonian Alehouse, and also for the Heart of Midlothian War Memorial if it cannot be preserved. Detailed standing building survey is proposed should a direct effect on the police box at West Princes Street Gardens be unavoidable. For all other sites a detailed photographic record is proposed in the event of physical impacts being anticipated, although depending upon the precise nature of the development works further mitigation responses might be necessary.

Between St Andrew Square and Haymarket visual effects would occur on the setting of the World Heritage Site, New Town Gardens Designed Landscape, New Town and West End Conservation Areas, and the 140 Listed Buildings present along the assessment corridor within those Conservation Areas. The effects would arise mainly through the introduction of the overhead line equipment and tram stops into the streetscapes, and this change would be particularly significant where there are no existing permanent vertical elements in the street. Their presence would affect some key views, such as Edinburgh Castle and the Old Town skyline seen from Princes Street and the Category A Scott Monument seen from South St David Street. The worksheets (Appendix C) do not assess the indirect effects of the proposals on individual Listed Buildings. However, cumulatively the indirect effect of the scheme upon the cultural heritage of the assessment corridor within the New Town would be major and adverse.

The mitigation for these impacts is to design the tram system well, so that it fits comfortably into the townscape as far as possible. A Design Manual is being progressed which sets out the principles of design and detailing to be followed in the final design, including within the whole of the World Heritage Site. Points in the Manual that are specifically intended to reduce the visual impact of the tram include:

- Careful design of the overhead line equipment to simplify the layout and minimise the size of the wiring;
- Use of visually appropriate methods of overhead line equipment support, including designing a bespoke support column, designed to be attractive in its own right;
- Integration of the overhead line equipment supports with other vertical elements in the street (lighting and signing poles) as far as possible, and coordination of the spacing of new and existing poles, replacing existing lighting columns where appropriate;
- Simple alignment of the tram track to avoid as far as reasonably possible the need for complex overhead line equipment, including straight alignments along the city centre streets to respect the formality of urban design of the New Town. The Princes Street stop would be located so that it does not affect the view from Castle Street, and stops in St Andrew Square would not impact on views of the square from George Street.

Between Haymarket and Newbridge potential effects would be much more localised, reflecting the more fragmentary nature of cultural heritage resources. A moderate adverse effect would occur to the character and setting of Huly Hill Scheduled Ancient Monument. Up to 11 other sites or areas of archaeological significance may, taking into account mitigation proposed below, undergo moderate adverse (1 no), minor adverse (3 no), neutral (2 no) or uncertain (5 no) effects. Those sites of particular importance to be potentially affected are the site of Nether Gogar village, a site of schedulable quality and national importance; regionally important remains discovered close to Huly Hill at Edinburgh Road, Newbridge; and a WWII pillbox at Edinburgh Airport. Of the remainder, three sites lie off-line but within the Limits of Deviation, and it is not known what survives of two others. Buried and currently unidentified remains of archaeological significance might be disturbed by the construction of the tram, particularly in the areas of agricultural land between Gogar Roundabout and Newbridge. Key mitigation measures proposed in relation to these potential effects include:

- A watching brief to be conducted during ground breaking works at selected locations between Murrayfield and Edinburgh Park, including Carrick Knowe golf course;
- A photographic record to be made of the remains of Ratho Station Low Level Station; and photographic survey and building recording of the Edinburgh Airport pillbox if necessary;
- A programme of archaeological recording, through prior excavation or watching briefs as appropriate, of all known archaeological remains that would be directly affected. Such sites include the affected parts of Huly Hill and environs, and the site at Edinburgh Road, Newbridge;
- Archaeological evaluation of areas of agricultural land along the proposed development corridor between Gogar Roundabout and Newbridge, with further mitigation responses (excavation, watching briefs) conducted as appropriate to the results of the evaluation;
- Preservation in situ of the buried remains of Nether Gogar village. The tram route would be built on made ground above the existing ground level; a prior archaeological field evaluation would assess the character and condition of the remains, to allow an appropriate engineering solution to be adopted that avoids compression or distortion of the archaeological remains to be buried beneath the tram line;
- All archaeological mitigation works to be detailed in a Written Scheme of Investigation approved in advance by City of Edinburgh Council and/or Historic Scotland as appropriate. Provision would be made for post-excavation analyses, publication of the results and archiving of the project materials and records.

Between Haymarket and Newbridge indirect visual effects would occur on 3 Category A, 6 Category B and 9 Category C(s) Listed Buildings. A direct effect would occur on the Jenners Depository (Category B

listed) to accommodate a tram stop, although with sensitive realignment northwards of that part of its southern boundary railing to be impacted the effect would be neutral. Norton House Hotel North Lodge lies within the Limits of Deviation of the proposed scheme; direct effects could occur, although their magnitude and significance cannot presently be assessed. Where Listed Buildings lie close to the proposed route, the overhead line equipment where possible would be spaced to minimise visual intrusion into their settings. The introduction of sensitive screening in some cases may assist in mitigating the increased traffic noise and visibility experienced by adjacent Listed Buildings. Taking into account this mitigation, the indirect effects on Listed Buildings would be neutral apart from a likely moderate adverse effect at Gogar Church, and likely minor adverse effects upon Castle Gogar Lodge, Castle Gogar, Ingliston House Lodge and Middle Norton cottages.

The cumulative effects of the proposed scheme on cultural heritage would be:

- St Andrew Square – Haymarket: major adverse
- Haymarket – Gogar Roundabout: minor adverse
- Gogar Roundabout – Newbridge: moderate adverse.

8.3. Safety

The following sections discuss the impacts of the proposal on the two safety sub-objectives; Accidents and Security. The discussion of Accidents is considered under the headings of the impact on Road Traffic Accidents and the specific issue of accidents involving trams.

8.3.1. Road Traffic Accidents

Traffic accidents are a major transport concern and impose high costs on society; therefore any new proposal must be reviewed in relation to its anticipated impact on the frequency and severity of accidents. Whilst the study of traffic accidents is not an exact science some general considerations hold true including the fact that greater segregation between vehicles will reduce the risk of accidents occurring. This is particularly true where the vehicle follows a controlled path such as that followed by a tram on its tracks.

8.3.1.1 Change in Annual Personal Injury Accidents

The assessment of the changes in the number of road accidents and associated casualties has been made quantitatively, considering the changes in total vehicle distance travelled on the highway network. Standard methodologies are based on accident rates and casualty rates (per vehicle-kilometres) per road type. The rates set out in the NESA manual (DMRB Volume 15) for the year 2000, but changing over time to reflect technological improvements in safety, have been adopted.

The recommended approach uses input data taken from the highway transport model. It takes the total number of road traffic vehicle-km both for the Do-Minimum and Do-Something scenarios for years 2011 and 2026, broken down to a range of standard road types.

The Detailed Assignment Model extends over much of Central East Scotland, but only Edinburgh and its environs are modelled in detail. The impact on highway use extends beyond Edinburgh and is reflected in the model results. The model predicts reduced highway mileage outside Edinburgh which leads to accident savings benefits. However, the ability of the model to quantify changes outside Edinburgh and Newbridge is not as good as for Edinburgh itself. It was therefore decided to take only half accident benefits for the non-Edinburgh/Newbridge Area. This was also done to be more consistent with the Transport Economic Efficiency where External-External benefits were excluded from the analysis.

The scheme reduces the number of peak hour car vehicle trips but the economic regenerative effect of the scheme increases off peak highway trips. During the peak, the modal transfer to tram outweighs the effect of increased economic activity. However this is not the case in the off peak, when congestion levels are lower This decrease and increase almost cancel each other out in the initial years, but by 2026 there are extra highway trips. So in the later years there is an increase in vehicle kilometres and vehicle accidents.

In 2011 the changes in highway flows are small, with an increase on urban roads leading to a slight increase in damage only accidents, while decreases on some other roads leads to a slight decrease in accidents overall. In 2026 there is a significant increase in highway flows on urban links, which leads to an annual increase in accidents of 113 in 2026. This includes fatal, severe, slight and damage only accidents.

Current Government advice suggests that accidents on rail-based systems are negligible and so need not be considered (except when shared running by rail and other modes is felt to be likely to increase accident rates).

8.3.1.2 Change in Balance of Severity

Standard accident rates are available by severity level: fatal, severe, slight and damage. Thus, it is possible to estimate the change in the balance of levels of severity, particularly if traffic distribution changes according to road types (e.g. deviation from one road type to another). The number of accident savings per severity level was estimated as show in Table 8.6 below.

Table 8.6 Number of Accidents Saved per Severity Level

	2011	2026
Damage	-0.2	-107.2
Slight	0.2	-4.8
Serious	0.1	-0.7
Fatal	0.0	0.0
Total	**0.1**	**-112.7**

This shows that accidents are not expected to change in 2011 but increase by 2026 because the improved transport links have increased highway trips as well as PT trips. If damage only accidents are excluded, there is a reduction of 0.6 accidents per annum in 2011 and an increase of 3.1 accidents in 2026. There is no predicted change in fatal accidents and only 1 additional serious injury accident every 3 years in 2026 conditions

8.3.1.3 Total Discounted Savings

Using standard valuations for casualties, accidents and damage to property by severity level (Monetary Values from NESA Manual, DMRB15, Section 6 -1998 prices and values) and the accident saving estimations summarised above, the undiscounted monetary valuation of annual accident savings are estimated as shown in Table 8.7, below.

Table 8.7 Undiscounted Valuation of Accident Savings

	Valuation of Annual Changes in Accidents	
Type	**2011**	**2026**
Accident Costs		
Damage	£2,586	-£214,900
Slight	£976	-£12,693
Serious	£463	-£3,130
Fatal	£208	-£74
Sub –total	£4,233	-£230,798
Casualty Costs		
Slight	£4,854	-£112,219
Serious	£10,827	-£95,110
Fatal	£19,579	-£11,466
Sub-total	£35,260	-£218,795
Total	**£39,492**	**-£449,593**

The total savings as a result of reduced traffic on the road network has been calculated at £39,492 per year for 2011. Even Damage accidents, of which there are an overall increase in 2011 leads to a saving, because the increase in urban damage only accidents is more than off-set by a reduction in more expensive urban rural and Motorway accidents.

With more accidents in 2026, the scheme leads to a negative saving of -£499,593 per annum.

Feeding this valuation through the accident calculations framework, which discounts the annual valuations to a present value, the NPV of these savings represent -£2.9 million (NPV), over the project lifetime. Casualty costs represent approximately half of the total costs (the remainder are accounted for by accident costs).

General background economic development over the assessment period of 30 years leads to a net increase in car use and accidents. The tram scheme results in a change in the modal split between public transport and cars, attracting patronage from both cars and existing public transport users. On the basis of the forecast background growth in demand, the tram gives rise to a net decrease in car use and accidents and the scheme meets the overall objective of improving road safety. However, second order effects of the tram lead to further economic development and an associated increase in demand for travel. This in turn gives rise to a small net increase in car use and minor accidents in the later years of the scheme life. This issue would need to be addressed by other appropriate policy measures.

8.3.2. Tram Accidents

Rail Systems generally have very low accident rates and, for segregated route sections, it is normal practice to assume that the accident rate is effectively zero. Even when not segregated from other traffic, trams have many safety advantages. They can decelerate faster than most other vehicles; indeed the main constraint on braking rate is the safety of passengers and following vehicles. The vehicles are large with a high profile and move on clearly defined predictable paths. Cab design and mirrors ensure excellent visibility for the driver. As a result there should be a lower risk of accidents than with buses. However, the risk of accidents cannot be wholly eliminated. Unfortunately directly comparable tram and bus accident statistics are not available, while the accident rates for tramways vary with the degree of segregation from other traffic and the age of the system – newer systems in general appear to have lower accident rates.

In assessing the case for Edinburgh Tram Line 2, it has been assumed that most bus services remain as at present. However, the West Edinburgh Busway services are replaced by trams. Both WEBS and Edinburgh Tram Line 2 will operate at 10 minute headways. However, the segregated sections of WEBS

are much shorter than for Edinburgh Tram. Each single trip between West Edinburgh and the city centre on WEBS involves 8.5 kms of on-street running as compared with 3.4 kilometres for the tram. Accordingly the total number of vehicle kilometres of on-street running, and therefore the accident risk, will be reduced when Edinburgh Tram Line 2 replaces WEBS. The analysis of impacts on road traffic accidents outlined above does not take account of the withdrawal of WEBS services so there is no double counting of benefits.

Accordingly, the risk of accidents associated with the West Edinburgh transit system would be reduced by the replacement of WEBS with Edinburgh Tram Line 2.

8.3.3. Security

The popular perception about travelling by public transport is that specific groups in society are at greater risk than others, for example, women are at greater risk of sexual attack and the elderly more likely to be targeted by muggers. This perception results in lower proportions of these user groups travelling by public transport, as they feel at greater risk and more susceptible to attack. Remote and isolated public transport stops require to incorporate good design to mitigate feelings of insecurity.

Collaboration with private business and/or community groups can help to provide a 'human presence' within or around public transport facilities. Unstaffed stops should be constructed to take account of passenger safety and security, with lighting, CCTV and open areas, where waiting passengers are visible from neighbouring roads or streets.

The preferred central route corridor is generally off-street and will allow in most instances an open and bright aspect, although there will be limited background activity levels along the segregated parts of the route. As Edinburgh Tram Line Two is advanced a careful review will be undertaken of the street environment in the vicinity of potential stops/interchanges. Lighting and street furniture will be designed to provide maximum safety and security. This may involve 'more than bright lights' but will have the objective of providing street environments that are pleasing, attractive and calming in every sense. Stops and cycle parking facilities should be located where there is, as far as possible, plenty of human activity to avoid feelings of isolation; and, for cyclists, to minimise the risk of cycle theft.

Provision of an attractive waiting facility is part of a package approach towards making stops welcoming to the individual. Location is crucial, and whilst safety in traffic terms is also important, locating stops in places where there is human activity deserves equal emphasis. This is especially so where stops are unstaffed, as in off-peak periods.

Staffing tram stops is not economically viable and the use of closed circuit television cameras is now widespread. However, there can be no single technical solution to the problems of ensuring complete passenger safety. CCTV is perceived by many as 'reactive' (that is, it may help convict an attacker but is not a great deal of help to the victim). An interchange with prominently located signs, citing the presence of discreetly positioned 'see in the dark' cameras, may however have a stronger deterrent effect. Panic buttons and PA links/help lines are possibly more reassuring for a passenger waiting alone at a remote suburban tram stop on a dark morning or night.

It is important to undertake extensive consultation, through a combination of market research and discussion with consumer bodies, about questions of safety and security. As discussed in Chapter Six, there has been wide ranging consultation associated with Edinburgh Tram Line Two – the information gathered during the consultations to date alongside further feedback from public and statutory bodies will allow the genuine concerns of users to be understood, especially those who may be vulnerable.

In summary, the personal security concerns of many individuals when using public transport can be dealt with in the provision of mitigating facilities designed into the tram development. For example, Edinburgh Tram Line Two will have stops fitted with high quality lighting and closed circuit television. In addition it is possible to provide emergency help phones if necessary. Similarly, on board the modern tram it is possible to design a safe and secure environment. Thus it is fair to assume that Edinburgh Tram Line Two will provide a degree of improved security for potential patrons and system employees, meeting the improved security objective.

8.4. Economy

8.4.1. Transport Economic Efficiency

The Transport Economic Efficiency (TEE) appraisal addresses the economic welfare impacts of the proposals. This includes a review of what users are willing to pay in order to use the tram line; the financial impact on private sector transport providers; and impacts arising from land use or other impacts of the tram line.

The TEE analysis has utilised DfT's Transport Users Benefit Appraisal (TUBA) software. TUBA is compliant with STAG and with the Guidance on the Methodology for Multi-Modal Studies (GOMMS), though output must be restructured for input to STAG. The input data is summarised in Table 8.8.

Table 8.8 TUBA Inputs

TUBA Input	Units	Comments
Highway journey times	Minutes	
Highway distances	Kilometres	
Car trips (non-working time)	Vehicles	CSTM3 Edinburgh vehicle occupancy figures used to convert to person trips
Car trips (working time)	Vehicles	
LGV trips (non-working time)	Vehicles	
LGV trips (working time)	Vehicles	
OGV1 trips (working time)	Vehicles	
OGV2 trips (working time)	Vehicles	
City Centre parking charges	£2001 prices	0.94 factor to 1998
Public Transport Generalised time (excluding fares)	Generalised minutes	Calibrated assignment parameters used
Public Transport Fares	£2001 prices	0.924 to factor to 1998 prices (fares index of 121.8 (1998) and 131.8 (2001) for Scotland (source Transport Statistics of GB 2002)
Public Transport Demand	Persons	

As per DfT advice, default TUBA economic parameters are used, except where local data is available. Edinburgh household data showed that 2.6% of public transport (PT) trips are in-work trips and 9.1% of car trips are in-work, as opposed to default values of 0.2% and 15.1% respectively. As in-work trips have a higher value of time, this implies that travel time changes will have a greater economic impact on Edinburgh PT trips and a lesser impact on Edinburgh car trips than is the case in most of the rest of the UK.

Car occupation figures were derived from Edinburgh CSTM3a, as shown in Table 8.9.

Table 8.9 Car Occupancy

Period		Occupancy	Purpose
AM	Non-work time	1.184	Home based work
	Work time	1.277	Non-home based employers business
Off peak	Non-work time	1.612	Home based other
	Work time	1.530	Non-home based employers business
PM	Non-work time	1.371	Home based work
	Work time	1.655	Non-home based employers business

An exception is the Park and Ride Model. This uses two car occupancy values. The first value is 1.25, the TRAM model average, and is used to convert the input car matrix into a person trip matrix. The second value is 1.8 derived from UK-wide P&R surveys and a couple Aberdeen P&R surveys in particular. These surveys show that P&R users have a higher car occupancy than average. This second value is used to calculate the number of residence to park site car trips back into the car ride matrix.

Annualisation factors were derived from Edinburgh household data and are shown in Table 8.10.

Table 8.10 Annualisation Factors

Period	Public Transport	Car
AM Peak	557	585
Inter peak	2425	2288
PM Peak	563	656

8.4.1.1 Parking Revenue

Estimates of the impact on city centre parking have been taken from the TRAM model. Parking charges have not changed, so the impact on users is nil, what changes is the number of cars parking in the city centre. This decreases in the peaks but increases in the off peak periods. The TRAM model provides an estimate of on-street parking, which is predominantly public-sector supply, and off-street parking which is predominantly private sector supply. VAT is deducted from this revenue.

8.4.1.2 Public Transport Revenues

PT revenue is calculated by the public transport Detailed Assignment Model (PT DAM) model on the assumptions that full adult single fare is paid on buses and tram and that half the return fare is paid for Airlink bus and heavy rail. There are no return bus fares in Edinburgh City, but there are a variety of passes available. The number of period passes sold and Day Travel tickets sold by period was provided by Lothian Region Transport and an estimate was made of the fare reduction due to pass usage. There will also be some fare evasion. The impact is summarised in Table 8.11

Table 8.11 PT Revenue Adjustment

	AM	OP	PM
Loss due to use of passes	8.0%	13.0%	13.0%
Loss due to fare evasion	5.0%	5.0%	5.0%
Cumulative loss	12.6%	17.3%	17.3%

Revenue for the PT modes was extracted from PT DAM, which calculates fare based on boardings and ride distances compared to a distance-based fare scales.

The 20 year revenue profile is derived by interpolating the 2011 and 2026 DAM results, these being the first and last modelled years in the LUTI model. The years 2009 and 2010 were extrapolated from these results, taking account of ramp-up where it is assumed that take up of the new service is only partial for the first three years (75%, 85% and 95% respectively). Patronage and revenue is assumed to be constant after 2026, as it would be unreliable to extrapolate 2011 to 2026 trends indefinitely.

8.4.1.3 Scheme Costs and Price Base

The scheme costs within the TEE are as follows (2003 Q2 prices):

- Construction cost of £320.911 million, which includes:
  - £30.263 million for land;
  - £ 8.603 million for design; and
  - 25% optimism bias as per Green Book recommendations.
- Construction costs are spread over the years 2006 to 2009 based on the cost profile provided with the estimate. The design costs are spread over 2004 to 2006.
- Included in the land cost is £4.8 million of land owned by the Scottish Executive, the City of Edinburgh and New Edinburgh Limited.
- Annual Operating cost of £6.01 million, which includes management fee and operator profits.
- Lifecycle costs of £51.672 million allocated over the 30 years operation period as required for replacement and overhaul of items reaching the end of their lifecycles. This has been included in the operating costs rather than the investment costs.

It is not intended that bus or rail services be withdrawn in response to Edinburgh Tram Line Two, therefore there is no saving in bus or rail operations.

Costs were discounted to 1998 market prices using an RPI value for 2003 Q2 of 181.3 in comparison to 162.8 for 1998. An RPF factor of 0.98 was used for the construction costs (excluding land, preparation and design) to correct for long term trend prices. Operating costs are assumed to inflate at 0.5% over the RPI due to the estimated impact of salary increases. The costs are summarised in Table 8.12.

Table 8.12 Costs

Cost Element	Current Price (2003 Q2)	1998 PV Market Prices
Construction	£320.911 million	£208.227 million
Operating Costs	£ 6.097 million p.a.	£ 78.145 million over 30 years
Lifecycle Costs	£ 51.672 million	£ 18.945 million

8.4.1.4 User Benefits

Table 8.13 Presents the TEE analysis.

Table 8.13 TEE Table and Safety (£'000s Present Value)

	STAG	TOTAL	Cars	Freight	PT
Safety					
Accident savings	PV1	**-2906**	-2906		
User benefits – consumers					
Travel Time		**205502**	50203		155299
User charges		**-25898**	-4		-25895
VOC		**-15946**	-15946		0
net consumer benefits		**207558**	**34253**		**129404**
User benefits – business					
Travel Time		**37015**	18455	6263	12297
User charges		**-836**	0	0	-836
VOC		**1737**	473	1264	0
net business benefits		**37916**	**18928**	**7527**	**11461**
User benefits – TOTAL					
Travel Time	PV2	**242517**	68658	6263	167596
User charges	PV3	**-26735**	-4	0	-26731
VOC	PV4	**-14209**	-15473	1264	0
net user benefits		**201573**	**53181**	**7527**	**140865**
Private Sector Provider Impacts					
Investment costs	PV5				
Operating costs	PV6				
Bus/rail revenue		86528			86528
Forth Bridge revenue		-485	-485		
City centre parking		3088	3088		
Net revenue	PV7	**89130**	**2603**		**86528**
Grant/subsidy	PV8				
net private sector impacts		**89130**	**2603**		**86528**
Present Value of Benefits	**PVB**	**287798**			

Issues to note include:

- In line with STAG practice a negative number is a cost and a positive number is a benefit;
- Total PT benefits of £140.9 million;
- Total highway benefits of £60.7 million;
- Despite a transfer of trips to tram, bus and rail revenue also increases due to a shift to PT, which includes longer trips which use train/tram or bus/tram journeys, and a generation of new trips due to increased accessibility and economic activity; and
- A small increase in city centre off street parking giving increased revenues of £3.1 million.

8.4.1.5 Spatial Benefits

The Detailed Assignment Models employed in the TEE analysis have 345 zones, including external zones. The PT assignment has an additional 7 external zones for external rail connections. Tables 8.14 and 8.15 aggregate the travel time savings to 10 Edinburgh sectors and 3 sectors external to Edinburgh. Figures 8.13 and 8.14 illustrate the sectors used for this analysis.

Table 8.14 PT Time Benefits By Sector (£'000s Present Value)

	Origin	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
1	City Centre	-188	1434	1092	138	-174	538	601	3614	3331	18242	568	2080	3897	**35173**
2	Haymarket	32	-9	-298	40	-6	33	154	141	742	5690	620	601	1037	**8777**
3	Leith Walk/ Leith	-422	-194	132	123	-75	25	183	1136	58	3556	116	-50	930	**5518**
4	Granton	-92	-16	91	-27	197	19	37	-28	45	748	15	38	47	**1074**
5	N. Edinburgh	-642	-25	119	159	-7	-2	-1	-21	163	3151	144	90	248	**3376**
6	Leith Docks	30	38	30	21	7	0	64	308	159	1118	2	68	122	**1967**
7	Railway corridor	-383	-45	40	40	32	29	97	-208	80	2413	138	-29	115	**2319**
8	S. Edinburgh	-2333	488	531	5	-108	287	33	76	813	3902	236	720	1137	**5787**
9	E. Edinburgh	839	552	2550	205	360	784	133	1117	525	6115	91	337	471	**14079**
10	W. Edinburgh inc Newbridge	14726	7826	2847	358	2363	393	3523	3993	4258	26278	1005	4780	1863	**74213**
11	Ext. North	1259	95	444	18	-10	47	59	94	287	712				**3005**
12	Ext. West	1817	386	372	-4	231	15	-182	-11	184	4252				**7060**
13	Ext. South/ East	1661	404	215	-23	55	45	35	552	329	1970				**5243**
	TOTAL	**16304**	**10934**	**8165**	**1053**	**2865**	**2213**	**4736**	**10763**	**10974**	**78147**	**2935**	**8635**	**9867**	**167591**

Note: External to external benefits have been excluded – see text for explanation

Not surprisingly, the largest PT benefits are movements to and from West Edinburgh, with the greatest benefit to a single flow being between West Edinburgh and the city centre. The total value of benefits for

this movement, taking both directions of travel together, is £33.0 million. The next greatest benefit is for trips within West Edinburgh, with a benefit of £26.3 million. There is a broad spread of PT benefits across the rest of the modelled area, some due to the tram being used as part of a longer journey. However, the broadest effect is the impact of reduced highway traffic, particularly in the peaks. While this is due to a switch from car to PT, it increases highway speeds in general benefiting many other movements. Overall, £102.6 million (61%) of the benefits accrue to trips to, from and within West Edinburgh.

The main areas to suffer from the impact of tram is the City Centre and, to a lesser extent, Haymarket. This is where the tram takes capacity from the highway network and potentially reduces bus speeds. Ideally, PT measures would be taken to mitigate the adverse impact on bus speeds, though this may have to be at the expense of other highway traffic.

The modelling of the External areas is not as detailed as the rest of the network. The model forecasts Public Transport benefits in the external areas due to increased bus speeds from increased use of Public Transport to Edinburgh. It was felt that the level of detail within this part of the model is less and may not be as robust as elsewhere within the model. An overall economic conservative economic assessment has resulted from the decision to omit these benefits (see zero cells in Tables 8.14 and 8.15) from this area.

Table 8.15 Highway Time Benefits By Sector (£'000s Present Value)

	Origin	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
1	City Centre	-1682	-1858	-157	-63	-190	66	-306	-215	-189	-269	-328	-316	11	**-5496**
2	Haymarket	-2721	-1190	-564	-142	-223	18	-353	-879	-723	-736	-4	-454	-178	**-8149**
3	Leith Walk/ Leith	200	-332	681	-42	178	525	285	1261	1792	774	217	266	249	**6054**
4	Granton	-266	-118	111	60	52	221	33	-3	450	-131	105	49	180	**743**
5	North Edinburgh	-382	-299	100	20	5	121	3	-57	460	-99	158	201	58	**289**
6	Leith Docks	-101	-111	91	-82	-64	30	-9	629	1107	151	226	558	843	**3268**
7	Railway corridor	-904	-468	7	-24	-40	13	-62	-135	244	-367	174	171	22	**-1369**
8	South Edinburgh	-280	-1456	1003	-118	-92	1477	-463	-4	-399	1790	427	730	312	**2927**
9	East Edinburgh	1838	549	4714	2724	2129	4783	1352	1901	854	1892	588	841	1124	**25289**
10	West Edinburgh inc. Newbridge	-2273	-1414	-27	-203	-19	1097	-47	836	347	4859	3893	5468	2618	**15135**
11	Ext. North	-381	-25	251	131	222	264	146	643	372	4976				**6599**
12	Ext. West	-453	49	508	413	611	479	1019	1329	985	9327				**14267**
13	Ext. South/ East	694	28	1904	1491	1313	3749	625	1046	731	3779				**15360**
	TOTAL	**-6711**	**-6645**	**8622**	**4165**	**3882**	**12843**	**2223**	**6352**	**6031**	**25946**	**5456**	**7514**	**5239**	**74917**

Note: External to external benefits have been excluded – see text for explanation

The overall impact on highway is positive, with the benefits spread across the modelled area due to a general reduction in traffic. Disbenefits arise on trips to and from the City Centre and Haymarket, particularly trips from West Edinburgh to the city centre, due to the reallocation of road space to the tram.

As noted above, the modelling of the External areas is not as detailed as the rest of the network. The model forecasts highway benefits in the external areas due to reduced congestion as a result of a switch to PT for trips to Edinburgh. It was considered advisable to exclude these benefits from the economic assessment as their reliability could be questioned.

Overall the tables demonstrate that accessibility is improved for both highway and public transport users.

8.4.1.6 Mode Split Impacts

Table 8.16 shows the impact of Edinburgh Tram Line 2 on mode split for movements to and from West Edinburgh in the AM peak and offpeak in 2011 conditions.

Table 8.16 Impact of Edinburgh Tram Line 2 on Public Transport Mode Share to and from West Edinburgh (2011)

	Reference Case			With Edinburgh Tram Line 2			Proportional Change
AM Peak			(%)			(%)	(%)
City Centre	1927	2281	54.2	1927	2342	54.9	1.2
Haymarket	1655	1158	41.2	1645	1142	41.0	-0.5
Leith Walk/Leith	719	983	57.7	700	1020	59.3	2.7
Granton	721	114	13.7	718	109	13.2	-3.5
North Edinburgh	904	434	32.4	894	449	33.4	3.1
Leith Docks	568	131	18.7	560	147	20.8	11.0
Railway Corridor	1614	372	18.7	1607	366	18.6	-1.0
South Edinburgh	3209	1213	27.4	3200	1205	27.4	-0.3
East Edinburgh	1681	631	27.3	1668	631	27.4	0.5
West Edinburgh	9518	3192	25.1	9474	3306	25.9	3.0
External North	4130	609	12.9	4126	619	13.0	1.5
External West	8666	1181	12.0	8653	1176	12.1	-0.2
External South East	2381	323	11.9	2372	325	12.1	0.9
TOTAL	**37695**	**12622**	**25.1**	**37542**	**12837**	**25.5**	**1.6**
Off Peak							
City Centre	1065	1652	60.8	1068	1738	61.9	1.9
Haymarket	1052	490	31.8	1030	508	33.0	4.0
Leith Walk/Leith	288	235	44.9	298	279	48.4	7.7
Granton	409	45	9.9	407	41	9.1	-7.6
North Edinburgh	363	153	29.7	378	177	31.9	7.6
Leith Docks	224	50	18.3	224	64	22.2	21.7
Railway corridor	1148	189	14.1	1159	198	14.6	3.3
South Edinburgh	1981	686	25.7	1973	712	26.5	3.1
East Edinburgh	841	231	21.5	836	277	24.9	15.5
West Edinburgh	6615	1774	21.1	6608	1830	21.7	2.6
External North	2042	217	9.6	2060	214	9.4	-2.1
External West	4582	300	6.1	4589	298	6.1	-0.8
External South East	1251	106	7.8	1243	118	8.7	11.0
TOTAL	**21861**	**6128**	**21.9**	**21873**	**6454**	**22.8**	**4.1**

At first sight the gain in public transport market share appears to be modest for most movements, with a 2% increase in public transport share in the AM peak and 4% in the offpeak for all movements to, from and within West Edinburgh. However it should be remembered that the analysis was conducted at a sector to sector level. Accordingly it includes substantial areas which are outside the catchment area of Edinburgh Tram and would not gain as a result of its construction.

8.4.2. Costs to the Public Sector

A range of potential procurement options are being developed by tie and are reported elsewhere, however it remains that Edinburgh Tram Line Two will be a public sector scheme. The tram would be operated by a private company, but CEC may continue to own the assets, would pay for the operation and receive the revenues. The Scottish Executive would finance the capital costs either through a direct grant or PFI payments.

The capital costs include land cost, some of which is public sector land. The public sector land is assumed to be gifted to the project.. However, it is still a cost to the public sector, so an estimate of the full market value of this land has been included in the capital cost and also shown as a funding contribution. Within table 8.17 this funding contribution is identified as PV11 noting that costs and disbenefits are shown with negative values whilst a positive value indicates additional revenue for government.

VAT is assumed on parking, though in the case of public sector parking, this is a redistribution of public sector revenues to public sector indirect tax revenues.

Table 8.17 shows the Costs to the Public Sector, while Table 8.18 summarises the Net Present Value and the Benefit Cost Ratio to the Public Sector, in 1998 prices (averaged throughout the year) .

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Table 8.17 Costs to the Public Sector (£'000s Present Value)

	STAG	TOTAL	Highway		PT
Cost to government					
Public sector investment costs	PV9	**-204954**			-204954
Public sector operating & maintenance costs	PV10	**-97219**			-97219
Gifted public land		-3273			-3273
Net grant/subsidy	PV11	**-3273**			-3273
Revenues	PV12	**109459**	19920		89539
Taxation impacts	PV13	**-10164**	11921		-22085
Total PVC to Government	**PVC**	**-206151**			

Table 8.18 NPV and Benefit Cost Ratio to the Public Sector (£'000s Present Value

	STAG	Derivation	Value
Present Value of Transport Benefits	PVB	sum(PV1:PV8)	287798
PV of Cost to Government	PVC	sum(PV9:PV13)	-206151
Net Present Value	NPV	PVB+PVC	81647
Benefit Cost Ratio to the Public Sector	BCR	PVB/(-PVC)	1.40

8.4.3. Economic Activity and Location Impacts

8.4.3.1 Overview of Approach

The STAG AST2 Appraisal requires an assessment of the economic activity and location impacts (EALI) of the proposed tram line scheme. This assessment is undertaken at the local or regional level and at the wider Scottish level. The appraisal seeks to quantify the impacts in terms of employment gains and losses as well as income/GDP.

The analysis is also intended to identify how impacts will be distributed across geographical locations and at differing spatial levels. It is worth remembering, however, that the impact outlined in this section of the report should not be treated as additional to those identified in the earlier transport economic efficiency (TEE) section. The EALI section merely highlights the estimated impacts in an alternative format to that expressed by the TEE approach.

Our approach reflects the STAG guidance in devising a means of understanding: "the potential behavioural responses of different 'sectors' of economic activity…The approach suggested involves dividing or segmenting the economy into 'sectors' and considering each of these in turn. Once a usable segmentation has been selected, this approach involves investigating how the economic actors relevant to each sector might be affected by, and respond to, the changes in costs or accessibility brought about by the transport proposals under analysis." To this end we have made use of the DELTA modelling capability available to **tie** through the David Simmonds Consultancy (DSC) and MVA to generate an understanding of the economic and spatial impacts of the proposed tram line.

Following the DELTA model run we have analysed the results in terms of outputs and provided the necessary conclusions in terms of impacts by zones within the wider modelled area and within proximity of the tram line corridor. These impacts have been set within the relevant development context and policy framework the impacts to the relevant economic sectors have been ascribed; and the likely related regeneration effects have been identified. The model provides a range of outputs indicating the likely effects of the tram line on population and households, employment, floor space development, rental values and changes in value added.

Although this approach does not specifically involve any survey-based work, comments have been made outlining the anticipated land use effects of this significant investment in the tram line.

A full economic development report has been prepared, offering further detailed and supplementary information to this part of the STAG report.

8.4.3.2 Tram Corridor Impacts

The STAG AST2 EALI analysis requires detailed consideration of impacts, including an expression of the levels of economic activity by type and location of business or land use activity. The findings of the analysis of the tram line model are provided in detail within the aforementioned economic development report, but are also shown in summary below.

The greatest impact will be experienced in relation to employment, with up to 410 additional jobs being created within the City of Edinburgh during the period 2009-2025. Since these impacts would result from the introduction of the tram, they would occur mainly in the areas directly served – the West Edinburgh corridor and the city centre. In relation to employment sectors there will be limited notional gains in construction, public administration and other services. The greatest employment increases will occur amongst the financial and business sectors. This will provide opportunities for employment in providing support services as well as the more highly skilled occupations.

In respect of property related impacts the tram line is projected by 2025 to directly contribute towards the creation of minimal additional residential, retail and industrial development, but slightly higher levels of office accommodation.. Similarly, it is estimated that there is unlikely to be any resultant impact upon property rental values in the retail, office and industrial sectors, from the introduction of the tram line in West Edinburgh. It does, however, envisage a small rental value fall in the residential market across Lothian.

As many of the businesses and other land uses within the tram line corridor do not as a whole depend upon high levels of passing trade, by virtue of the nature of employment, there is likely to be limited direct impact from the tram line, especially in respect of access to customers and suppliers. Indeed Edinburgh Tram Line Two alignment has fewer areas of traditional retail and commercial orientated areas, than, say, along the route of Edinburgh Tram Line One (ie Leith Walk).

It is expected that the tram line will provide some benefit to businesses and residents alike through improved accessibility to employment and also through the widening of the available labour market.

8.4.3.3 Developments Likely to Benefit from Edinburgh Tram Line Two

Although many of the proposed and committed developments within the tram line study area are already planned to proceed irrespective of whether or not the tram itself is introduced, there may be some development areas where the full development potential or realisation, as well as the timing and scale of development, could be influenced by the operation of the tram line.

These developments and areas may comprise:

- Newbridge – further potential for industrial and distribution development – the accessibility analysis set out below shows significant improvements in ease of access to Newbridge;
- Edinburgh Airport – Airport related development and expansion linked to increased growth at the Airport. This may include airline-related and support services, and terminal facilities;
- Gogarburn – long term re-development of site for Royal Bank of Scotland HQ;
- Edinburgh Park – continuing development of Park's southern extension site, which could create up to 20,000 further jobs (for example, financial and business services) in a 10- to 15-year period.
- South Gyle and Sighthill – site development and redevelopment for range of potential uses including commercial, industrial and office accommodation.
- Gyle Shopping Centre and Hermiston Gait – additional potential scope in the longer term for further leisure and retailing development.
- Murrayfield Stadium – redevelopment proposals for surrounding land to west and north of the stadium including the existing Murrayfield Ice Rink.
- Tynecastle Park – possible relocation of Heart of Midlothian FC to Murrayfield (matches) and Riccarton football academy (training) release Tynecastle Park and surrounding land for redevelopment, whilst encouraging greater use of Murrayfield Stadium.
- Westfield Road – existing bonded warehousing and range of other under-utilised and lower value uses could provide future development potential for higher value land uses.
- Haymarket – the proposed redevelopment of Donaldson's College for Deaf Children providing a prime residential development opportunity.

8.4.3.4 Property Related Impacts at Scotland Level

The STAG appraisal guidance indicates that potential impacts of transportation projects should also be examined at the Scotland level. The analysis of the model outputs indicates that the tram line will contribute towards the creation of additional floorspace across all four land use categories – residential (200 sq m), retail (240 sq m), office (1,100 sq m) and industrial (100 sq m).

Furthermore, the EALI assessment estimates that the implementation of Edinburgh Tram Line Two will result in no net change to property rental values in the retail, office, residential and industrial sectors.

However we consider in qualitative terms that the development of Edinburgh Tram Line Two will act as a fundamental 'building block' in the continuing competitiveness of Edinburgh as an investment location, particularly within the West of Edinburgh, which acts as the premier business location in the East of Scotland for the attraction of high value mobile investment, with proximity to Edinburgh Airport and the benefits of the multi-modal transport network connections and accessibility in the area. In addition if this continued competitiveness is to be maintained the area's 'gateway' role to the City from both the motorway network and from airline/airport connections by highly accessible rapid public transport, must be improved, by this form of investment.

8.4.3.5 Property Related Impacts at Regeneration Area Level

The tram line will clearly provide a key strategic transportation link connecting West Edinburgh to both the City Centre and Edinburgh Airport. It will also provide greater accessibility and choice of transport for many of the more deprived and social excluded regeneration areas, particularly those in the South West of the City. This would include some of the more established residential neighbourhoods such as Broomhouse, Sighthill and Stenhouse.

It is very difficult to provide an estimate of the precise level of any such impact upon these local regeneration areas, but it will clearly depend upon the extent to which the residents of these communities

are able to access the provided tram line services to subsequently gain access to new employment opportunities throughout West Edinburgh and indeed elsewhere in the City.

The anticipated growth and increasing levels of demand and pressure for new forms of development across the City will result in a potential growth in the construction industry which may also subsequently provide greater employment opportunities for local residents.

8.4.3.6 Regeneration Areas

The Scottish Indices of Multiple Deprivation (SIMD) measure levels of deprivation through means of five key indicators of deprivation: access, education, employment, health and income. In the areas immediately alongside and adjoining Edinburgh Tram Line Two, five wards fall within the 21 worst wards in the City of Edinburgh (out of 58 wards):

- Stenhouse - ranked as 14th most deprived in Edinburgh;
- Dalry - ranked as 15th most deprived;
- Sighthill - ranked as 17th most deprived;
- Moat - ranked as 18th most deprived; and
- Tollcross - ranked as 21st most deprived.

In assessing the extent of the level of deprivation within the tram line corridor we have also taken into consideration the ward's overall deprivation ranking across Scotland. The SIMD indicates that the Stenhouse ward is the 399th most deprived ward in the country out of 1222 wards, the lowest of all the respective wards falling within the Edinburgh Tram Line Two corridor.

- Stenhouse - ranked as 399th most deprived in Scotland;
- Dalry - ranked the 432nd most deprived;
- Sighthill - ranked as 502nd most deprived;
- Moat - ranked as 517th most deprived; and
- Tollcross - ranked as 660th most deprived.

Again it is anticipated that the regeneration area wards will seek to benefit from the transport improvements resulting from the tram line, primarily by virtue of increased accessibility and greater job and labour market opportunities being created in West Edinburgh, as well as other opportunities situated within the City Centre and elsewhere in the City. Table 8.19, below, shows both the current working age population levels at the time of the 2001 Census and the number of unemployed residents within each ward.

Table 8.19 Regeneration Areas: Population and Unemployment

Ward	Working Age Population (16-74 yrs)	Unemployed Residents	Unemployment Rate (%)
Stenhouse	5,724	168	2.9 %
Dalry	7,100	244	3.4 %
Sighthill	6,702	221	3.3 %
Moat	5,893	166	2.8 %
Tollcross	6,228	237	3.8%

Source: 2001 Census

As can be seen from Table 8.19, unemployment is higher than the 2.9% City of Edinburgh average in Dalry, Sighthill and Tollcross; equal to the City average in Stenhouse and just below in Moat. In each instance, employment was less than that across Scotland where average unemployment stood at 4%. Although more recent unemployment figures are available at the City level in April 2003, similar corresponding data is not available at the ward level.

It is more than likely that overall economic activity rates within these neighbourhoods are below the average corresponding levels for the City of Edinburgh. This would therefore suggest that there may be additional available labour workforce in the area which could benefit from, and be accessed to satisfy, a number of employment opportunities which may arise in the West of Edinburgh.

8.4.3.7 Employment Opportunities in West Edinburgh

The Edinburgh and Lothian region continues to benefit from the buoyant effects of the City region's growing economy and property market, and employment levels are also likely to benefit as a result.

The future development sites identified in the above Sections could provide a significant range of job opportunities for the local population in West Edinburgh. However, historically in the wider Edinburgh conurbation there have been few opportunities for high quality, highly accessible sites appropriate for high value business investment and development. The former focus of such development in the City Centre has more recently been constrained by lack of development land and conservation factors, and the result has been the pressure for development to the west of the city, and particular pressure for development towards Edinburgh Airport. The focus for much high value internationally mobile business investment has to date been Edinburgh Park, which is regarded as the premier business park location in Scotland, and the attractive facilities, prestigious occupier profile, proximity of and access to multi-modal transport links, and high quality environment have continued to attract such development interest. This has also been built

upon by the location and development of the Royal Bank of Scotland Group's World HQ at Gogarburn, which adds to the critical mass of such high quality, high skill, and high value activities.

The benchmark criteria that provide the basis for a successful business location can be illustrated with reference to equivalent locations throughout the UK. Those attributes, most highly valued by high quality and mobile business investors and occupiers comprise:

- Excellent Accessibility, Location and Visibility - The significance of accessibility, location and visibility cannot be emphasised enough. Close to strategic routes and/or major public transport infrastructure, including airport, main line railway station, and/or major bus station. It is also important for any business to be situated in a prime location with highly visibility particularly from the major transportation routes, including strategic routes and motorways.
- Proximity to an Airport – Many occupiers favour a business location in close proximity to a major airport, particularly for those firms trading on a global level. The level of international scheduled flights and 'interlining' routes therefore is also a key requirement.
- Proximity to Major Urban Conurbations – Business locations should preferably be close to one or more major urban conurbation. This relates not only to availability of supporting facilities but also to access to markets. The relative proximity of a location to a major conurbation also has implications for the availability of labour.
- Provision of Infrastructure - It is essential to have good on-site infrastructure in terms of telecommunications, and other utilities. There is also a continuing and growing importance attached to the level of on-site car parking provision, particularly for those businesses where 'mobility' during working hours is an integral part of employment.
- High Quality Environment - The wider environment should include sites with good quality profile and presence; complementary uses and attractive visual appearance; and should support good quality housing, good schools and attractive facilities.
- Sufficient Scale of Development Land - Small sites are unlikely to have the critical mass sufficient to create a prestigious environment. Smaller sites could, however, be suitable where they form an integral part of a larger high quality environment that lends prestige to the smaller scheme.
- Good Quality and Availability of Labour – it is important to have a substantial resident population and labour catchment within a 30 minute travel time. Sites would, typically, be located close to major cities and/or motorway junctions that are highly accessible to such major settlements.
- Prestigious Occupier Profile – Occupiers or users should in principle be high quality offices, research and development facilities, and light industry, which in effect are all businesses falling within Class 4 of the Use Classes Order (Scotland) 1997. Available sites should ideally be developed for multiple-occupation, rather than simply for single-users.
- Supporting Services and Amenities – It is becoming increasingly important for high quality business locations to have a range of supporting services and amenities in close proximity, such as shops, restaurants, and leisure facilities.
- Proximity to other Related Businesses – for some high value businesses it is a very important aspect of business location that they be located within close proximity to related industries, sectors, and other businesses.
- Proximity to Higher Education Institutions (HEIs) – those companies actively involved in knowledge intensive industries will likely seek a business location with ready accessibility to Higher Education facilities.

Thus it is clear from this analysis of the key attributes for a high quality business location, that these are answered particularly in the West of Edinburgh, with the top factors being associated with accessibility to transport networks and services, and an airport with international and 'interlining links'. It is therefore no surprise that this area has and is likely to continue to be the focus of attraction of such investment in the city in the future.

Such employment opportunities are likely to emerge in the continuing agreed expansion and pressure for further expansion of established employment locations including Edinburgh Park, South Gyle, Edinburgh Airport and the Gyle Shopping Centre. For example, there is currently projected to be up to 12,000 additional jobs at Edinburgh Park over a period of 10-15 years, associated with the Park's expansion.

Other pressures will be for employment growth directly and indirectly related to the continuing development of Edinburgh Airport, its burgeoning international and domestic route networks, and passenger numbers. Such airport related employment growth is generally found within close proximity of the subject airport and Edinburgh would seem unlikely to be an exception. Thus for the economic benefits of such high value investment and employment to be accommodated within wider west Edinburgh area, the pressures derived from this future growth must be addressed in terms of public transport networks and services and the management of the constraint of increasing congestion.

To maintain this economic buoyancy and address the pressures which will inevitably arise will require a high volume high quality public transport system, best served by a LRT network. Without this type of network the pressures deriving from the existing employment and residential allocations to the West of Edinburgh will be difficult to accommodate, and the increasing traffic congestion will act as a discouragement to the very high value mobile investment essential for future prosperity of both Edinburgh and the wider Scotland economy.

Although we cannot predict the precise type and nature of employment opportunities which may arise in the future, we can expect that at least a reasonable proportion of employment will be suited to existing West Edinburgh residents. In particular, the continuing growth in the services and construction sectors could provide appropriate opportunities for higher employment, especially amongst the female working population and those that may be seeking part-time employment.

It should be noted that despite such employment opportunities it is likely that only a proportion of these jobs will be truly additional, with others resulting from business and job relocations. There should thus be some caution or allowance made to account for any such displacement effects.

It is, therefore, anticipated that in tandem with wider changes in society, the introduction of Edinburgh Tram Line Two will provide positive impacts and employment opportunities across the social group spectrum.

8.5. Integration

8.5.1. Introduction

Published in July 1998, the Transport White Paper is the framework within which the Government aims to develop a transport system which recognises that:

"A sustainable environment requires, above all, an effective and integrated transport policy at UK, Scottish and local level that will provide genuine choice to meet people's transport needs."

The Government's transport policies seek to achieve improved integration:

- "Within and between different modes of transport, to promote genuine choice, so that each mode contributes its full potential and people can move easily between different modes;
- "With environmental aims and policies, so that transport choices do not conflict with the achievement of environmental objectives;
- "With land use planning at national, regional and local level, so that the two work together to reduce the need to travel and support more sustainable regional travel choices;
- "With Government policies on education, health, economic growth and the objective of a fairer, more inclusive society."

Environment integration is considered in Section 8.3 and integration with social inclusion is dealt with in Section 8.8. Issues relating to transport, land-use and policy integration will be reviewed in this Section.

8.5.2. Transport Integration

An integrated transport system must operate as a true network across all modes in order that passengers can move easily from one service to another in a comfortable environment. Integrated transport can, thus, reduce the need to travel, tackle congestion and pollution and support a strong economy, a sustainable environment and a healthy and inclusive society.

Important elements which should be considered when planning integrated transport facilities include through ticketing / joint ticketing arrangements; enhanced connections and co-ordination of services; clear, accessible and wider availability of information; improved waiting facilities; appropriate location and accessibility for the elderly and mobility impaired.

The attractiveness of the public transport system as a whole in Edinburgh can be enhanced with the implementation of Edinburgh Tram Line Two by:

- The existence and quality of infrastructure facilities at stations, such as seating and waiting areas with weather protection (shelter) – slight beneficial;
- Maximising bus and rail interchange with tram at key locations, with greater opportunities for interchange, greater convenience and shorter distance between boarding points, and level floor boarding for all trams. In addition, there may be opportunities for the provision of cycle racks at some stops – moderate beneficial;
- Maximising public transport interchange with car at Park and Ride location; and
- Real-time passenger information at all stations – moderate beneficial.

For an integrated public transport system to be fully exploited by the public, it must provide a truly "seamless" journey in which passengers can have sufficient confidence to use it as an alternative to the private car. Interchange facilities therefore form a key component of transport integration. The preferred route corridor offers interchange with bus, rail, air and Park and Ride. This will potentially have a significant impact on patronage and opportunities for feeder services to widen the catchment for the tram. The direct, segregated alignment will provide good access to interchange facilities in the City Centre in addition to connections at key locations in the corridor.

As described more fully in paragraph 9.2.6, **tie** has recognised the potential for a lack of transport service integration, or bus competition, to impact adversely on the benefits, which should result from the introduction of the trams. **tie** has therefore instigated the Development, Partnering and Operating Franchise (DPOF) process leading to the appointment of a tram operator early in 2004 to confirm assumptions made by **tie**'s technical, legal and financial advisors related to the operation of the network.

The operator's brief will require their active cooperation with bus operators in the region to reach operating agreements to facilitate service integration.

The preferred route corridor provides interchange opportunities at Edinburgh Airport and Haymarket Rail Station. This corridor would allow a principally dedicated tram route, and would likely provide the fastest journey time between the Airport and Haymarket. This corridor would also interchange with the new Edinburgh Park Rail Station and there is potential for interchange with buses at the Gyle Shopping Centre. In addition, there are good opportunities for interchange with the A8 bus halt between Gogar Roundabout and Gogar hamlet.

The tram route will provide direct access to Edinburgh Airport with a stop immediately adjacent to the terminal entrance. The tram will, therefore, act as a feeder mode from the Airport to Edinburgh Park and the City Centre. A high quality and fully accessible interchange will be provided at Edinburgh Airport. The role of this interchange would be further enhanced when the proposed Edinburgh Airport Rail Link opens.

The tram route will enable the integration of journeys via car and public transport through the use of Park and Ride at Eastfield Road, Ingliston. The stop which serves both the main line and the Newbridge branch has been located to maximise the use of the Park and Ride. This will therefore offer an attractive alternative to the congested route into the City Centre.

It is estimated that all users of Edinburgh Tram Line Two will benefit, to varying degrees, from the various aspects of transport integration improvements identified above, when compared to the existing level of service. The overall impact of Edinburgh Tram Line Two on transport integration is expected to be moderate beneficial, leading to an improvement in the accessibility of the public transport network.

8.5.3. Land-Use Transport Integration

Recent developments in UK and Scottish Government policy have provided a clear framework for the integration of land use and transport planning with a general requirement to promote sustainability and reduce the need to travel to relevant existing or future developments.

The land-use transport integration sub-objective should consider whether:

- Any land required for the proposal is preserved for uses which are incompatible with transport (for example, protected or conservation areas);
- The proposal fits with the general policies of all authorities at all levels concerning transport and land use; and
- The proposal conflicts with any other existing or planned development.

Thus, there is a requirement for the identification of the land use policies or proposals conflicting with statutory planning documents at local, regional and national levels. This has been carried out to some extent during the AST1 process and any serious conflicts would have been identified at an earlier stage.

At the national level, the National Planning Policy Guidelines set out the policies on land use and sustainable transport. Edinburgh Tram Line Two supports a range of land use policy objectives at all levels. National policies supported include:

- National Planning Policy Guidance (NPPG) 17, Transport and Planning, sets out Government policy on the integration of land use and transport planning, under the following relevant principles (which are also referred to by the accompanying Planning Advice Note PAN 57):
- Locate and support development in places well served by public transport and restrict associated car parking, so that access to significant travel-generating developments by non-car modes improves significantly;
- Need to prioritise accessibility within the integrated transport system by sustainable modes of travel;
- Use Green Transport Plans and planning agreements to promote sustainable transport solutions; and
- Manage traffic demand effectively and support the provision of high quality public transport services on the road network.

The Scottish Planning Policy (SPP) 17, Transport and Planning - Maximum Parking Standards, is an addendum to NPPG17 which provides further guidance relating to maximum parking standards, stating specifically the need to:

- Manage motorised traffic to contribute to sustainable development objectives;
- Constrain car parking for new developments;
- Locate development where it is most accessible to more sustainable modes of travel; and
- Provide for travel by public transport, on foot and by cycle.

The regional policies supported include:

- The Regional Planning Guidance (RPG) in relation to economic prosperity, regeneration, ensuring quality of life and choices of opportunities for all;
- The overall development principles of the RPG, together with the specific objectives which it defines in relation to transport and regeneration; and
- The aims of the Regional Transport Strategy (RTS).

Further planning objectives have been described in Chapter Two, including those in the Local transport Strategy (2001 – 2004).

Overall, it can be said that the preferred route corridor integrates well with land-use, as outlined below.

The Finalised Edinburgh and Lothians Structure Plan 2015 makes clear that the delivery of a tram system is crucial for the successful delivery of the plan's development strategy. That strategy includes identification of core areas where major new development will take place. One of these is the Ratho/Newbridge/Kirkliston area where major new business developments and greenfield land release for housing is to take place. These land releases are dependent on the provision of new associated infrastructure, including provision of the West Edinburgh Tram. The Structure Plan has not yet been approved by the Scottish Ministers. However, draft modifications published by the Scottish Ministers in January 2004 suggest that there is unlikely to be any significant changes made to this strategy before approval.

The Finalised Rural West Edinburgh Local Plan is designed to implement the emerging Structure Plan. Major new greenfield housing land sites for a total of 765 houses are identified in the plan at Kirkliston North and Ratho Station to meet the requirements of the Structure Plan. However, the Local Plan makes clear that housing on these sites shall not be occupied before the West Edinburgh Tram to Newbridge is operational or its funding committed (Policy H2). In justification of this the plans states that the West Edinburgh Tram to Newbridge, and eventually beyond, is crucial to delivering a sustainable development solution in the Newbridge/Kirkliston/Ratho area.

The preferred route corridor will integrate well with major employment, leisure and transport hubs, such as Edinburgh Airport, Haymarket Rail Station, the Gyle Shopping Centre, Edinburgh Park and the RBoS, thus contributing to sustainability and reducing the need to travel. In addition, there is also greater scope for development opportunities resulting from the eventual routing of Edinburgh Tram Line Two.

The preferred route option will provide a generally positive impact for the business community, principally through improving accessibility and also potential for increased trade custom. This is particularly relevant for businesses located in Edinburgh Park, South Gyle and Sighthill, as well as those businesses located nearer to the City Centre.

There will be some minor impacts where existing business and residential holdings may require to be compulsory purchased to accommodate the tram line.

The Roseburn – Carrick Knowe section of the preferred route corridor will significantly impact upon residential properties on Roseburn Drive and residents along Baird Drive raised concerns regarding noise and visual impacts from the tram.

It can be summarised that the improvements in public transport brought about by Edinburgh Tram Line Two are expected to meet or support most local, regional and national policy objectives, in particular those related to sustainable travel (with increased use of public transport and reduced dependence on the car), regeneration and improving access, particularly for those dependent on public transport.

The overall assessment of the land-use transport integration impacts can be considered moderate beneficial.

8.5.4. Policy Integration

The White Paper, Travel Choices for Scotland, quotes education, health and wealth creation as key areas of concern when planning transport, recognising that transport decisions have wide impacts upon communities.

The Policy Integration criterion examines whether the proposed scheme contributes to, and is consistent with, other Government policies and legislation beyond transport.

Edinburgh Tram Line Two can contribute to the following wider Government policies:

- Disability – The design of trams and stations, fully DDA (1995) compliant and with level boarding, will provide easy access to wheel chairs and push chairs, thus facilitating access not only for the mobility impaired but also the elderly and those with young children;
- Health – The expected modal shift from car to public transport for journeys by local residents and others travelling to local employment and recreational facilities will provide greater opportunities for increased walking and cycling trips to reach the new tram stops. In addition, the use of trams (as opposed to cars) will reduce the adverse environmental impacts of traffic, particularly harmful local emissions, with an overall positive effect on health;
- Rural affairs – The scheme does not reach rural areas and therefore it can do very little to contribute to improve rural affairs or retaining rural communities;
- Social exclusion – the scheme fits in with policies to promote social inclusion, by enabling the socially deprived (particularly those with no access to a car) access to the public transport network. These benefits are accounted for in the following section.

It can therefore be said that the scheme is consistent with national policies beyond transport.

The local and regional planning policy context is set within national guidance and particularly reflects priorities for sustainability and integration. The West Edinburgh Planning Framework has been prepared by the Scottish Executive and provides policy guidance on planning, development and growth in West Edinburgh. A key element is that adequate transport provision is essential to enable any additional development in the area.

Similarly, the emerging Edinburgh and the Lothians Structure Plan presents the challenge to ensure that a sustainable future can be built in West Edinburgh and the wider area using the proposed tram corridor as a key artery of business and community activity. Key principles of this policy are as follows:

- Combating social exclusion by ensuring access between disadvantaged local communities and subsequent new employment opportunities situated in or adjacent to the proposed tram corridor.
- The need to ensure access to affordable transportation networks for all parts of the local community and particularly those in disadvantaged areas, such as West Edinburgh and West Lothian.
- Support for controlled development and re-use of existing buildings and vacant, derelict and Brownfield sites where regeneration potential will be maximised through integration with the proposed tram line.

The preferred route corridor will provide additional public transport in a previously un-served corridor. It is thus likely to have a positive impact on congestion, converting car users to public transport passengers utilising a highly efficient transport mode. The tram route will also improve accessibility and social inclusion, particularly in relation to the less advantaged communities to the south of the route.

The preferred route corridor integrates well with planning and transport policies by serving the Gyle Shopping Centre and avoiding further impacts on traffic congestion at Gogar Roundabout.
The requirement for a signal controlled junction at the A8 – RBoS access junction may not suit planning policy, and is likely to draw an objection from RBoS and possibly CEC Transport. In addition, the development of Green Belt land will be required at this location.

8.6. Accessibility

8.6.1. Introduction

STAG highlights four aspects of accessibility that need to be considered in relation to transport schemes, grouped under the headings of Community Accessibility and Comparative Accessibility. These are:

Community Accessibility

- Public transport network coverage;
- Access to local services.

Comparative Accessibility

- Distribution of impacts by people group;
- Distribution of impacts by location.

In order to illustrate the impact of Edinburgh Tram Line 2 in relation to these issues, changes in accessibility to a number of key destinations for employment, shopping and education have been assessed. Key transport interchanges have also been considered as these provide access to a wider network for longer distance trips for all purposes.

In relation to each of the destinations we have mapped two measures of accessibility. The first measure is change in absolute public transport accessibility, in terms of difference in public transport generalised time between the Reference Case and the with tram scenario. The second measure examines changes in relative generalised time of accessing the destinations by public transport and car. These were assessed using the transport models and are therefore consistent with the economic evaluation of the scheme.

The destinations considered, and the Figure numbers where the applicable maps can be found, are shown below:

- Newbridge (employment): Figures 8.13 and 8.14;
- Edinburgh Airport (employment, transport interchange) Figures 8.15 and 8.16;
- Gyle Centre (Shopping): Figures 8.17 and 8.18;
- Edinburgh Park (employment): Figures 8.19 and 8.20;
- Edinburgh Park Station (transport interchange): Figure 8.21 and 8.22;
- Sighthill Industrial Estate (employment): Figures 8.23 and 8.24;
- Napier University (education): Figures 8.25 and 8.26; and
- City centre (employment, transport interchange): Figures 8.27 and 8.28.

In the Figures, negative numbers (shaded green) represent an improvement in public transport accessibility either in absolute terms, or relative to car. Positive numbers (shaded yellow, orange or red) represent a worsening of accessibility, while grey shading indicates no significant impact. Figures relating to employment, education and transport interchange relate to the AM peak, while shopping is represented using off peak data.

The results shown in the Figures are discussed below in relation to each of the aspects of accessibility in turn.

8.6.2. Public Transport Network Coverage

Public transport network coverage is concerned with the impact of the scheme on people's ease of access to major destinations in the Edinburgh Tram Line 2 corridor.

Figure 8.13 shows that there is a substantial improvement in accessibility to Newbridge and Figure 8.15 indicates there is a significant improvement from most areas to the airport.

Figures 8.17, 8.19 and 8.21 show that the tram leads to improved access to the Gyle Centre, Edinburgh Park and Edinburgh Park station from most areas within the corridor and from much of North and East Edinburgh. However, in the absence of Line 1, there is worse access to these locations from the Leith area. This is due to the impact of the traffic management arrangements in the city centre, which make certain cross-city public transport links more difficult.

Figures 8.23 and 8.25 show significant gains in accessibility to both Sighthill Industrial Estate and Napier University from most zones within the Edinburgh Tram Line 2 corridor, and from North and East Edinburgh, providing better access to both employment and education.

Figure 8.27 indicates that there is a significant accessibility benefit in accessing the city centre from the outer end of the corridor, although there is some loss in accessibility at the inner end, due to the removal of the WEBS services. There are also some changes in accessibility from zones outside the immediate catchment of Edinburgh Tram Line 2 due to the impact of the scheme on traffic volumes and city centre traffic management. It should be noted that a number of the zones, which are shown as suffering a disbenefit would gain improved accessibility as a result of Edinburgh Tram Line 1. However the analysis focuses on Line 2 in isolation so this is not taken into account. Overall, however, the impact on access to the City Centre from the West Edinburgh corridor is positive, especially given that many of the zones that benefit, experience an improvement greater than 10 minutes.

Overall the Figures indicate improved public transport accessibility to the main attractors of trips within the corridor, with only limited localised disbenefits. The results show a mixture of gains and losses for trips outside the corridor, in the absence of Edinburgh Tram Line 1. If, this is also implemented, as planned, it would improve accessibility from North Edinburgh to the City Centre and to locations on the Line 2 corridor.

8.6.3. Local Accessibility

The local accessibility criterion considers walking and cycling access to local activity centres and to public transport. Edinburgh Tram Line 2 will run mainly off-street paralleling the Glasgow-Edinburgh railway line or on other reserved routes. On these route sections there would be few additional barriers to movement and appropriate crossing facilities will be designed into the scheme.

There will be some improvement in walk and cycle access where the tram runs on-street as crossing facilities and pedestrian refuges will be included in the scheme. The lower frequency and predictable swept paths of trams mean that pedestrians are more confident in crossing tram-only sections of streets than those available to buses or general traffic. This would lead to some improvement in local accessibility, particularly within the city centre.

The system will be designed to encourage non-motorised access including high quality walking and cycling routes to stops.

Overall the impact on local accessibility will be limited but the net effect is likely to be minor beneficial.

8.6.4. Distribution by People Group

The analysis in Chapter 3 examined a number of measures of social exclusion and concluded that the wards in the southern part of the corridor, particularly Sighthill, Stenhouse and Moat, suffered particular problems. The change in accessibility experienced by residents in these wards provides a good proxy for the social inclusion benefits of the scheme.

As a result of Edinburgh Tram Line 2, Sighthill ward would benefit from improved public transport accessibility, both in absolute terms and relative to car, to the city centre, Edinburgh Park station, Edinburgh Park, Gyle Centre, the airport and Newbridge. Parts of the ward would also gain improved access to Napier University and Sighthill industrial estate.

Stenhouse and Moat wards would gain improved public transport accessibility in both absolute and relative terms, to the airport and Newbridge. Parts of these wards would also gain improved access to the Gyle Centre, Edinburgh Park and Edinburgh Park station. Moat ward would gain improved access to Napier University and Sighthill Industrial Estate. Parts of Stenhouse ward would also gain better access to these locations and to the city centre. Conversely, Moat ward and parts of Stenhouse ward would have somewhat worse accessibility to the city centre.

The overall effect of Edinburgh Tram Line 2 is to improve the accessibility of the more socially excluded areas of the corridor, relative to the Reference Case. As this case includes the West Edinburgh Busway, the improvement in accessibility relative to the current position would be greater.

The analysis in Chapter 3 showed that four other wards – Shandon, Fountainbridge, Dalry and Tollcross – have low levels of car ownership and therefore a high degree of dependence on public transport. Figures 8.13 to 8.28 show that Fountainbridge, Dalry and Tollcross wards enjoy improved public transport accessibility, in both absolute terms and relative to car, to all the identified destinations except the city centre, where the effect is neutral. The latter is not surprising as these wards are close to the city centre and bus, cycling and walking are likely to be the main modes used to access it. Shandon ward would obtain improved public transport access to Napier University, Sighthill Industrial Estate, the airport and Newbridge. However zones within the ward experience a mix of positive, negative and neutral impacts to the other destinations analysed.

Overall, the analysis indicates a beneficial impact on residents in the more socially excluded wards within the corridor and on areas where dependence on public transport if high.

8.6.5. Distribution by Location

The discussion above, based on a qualitative interpretation of Figures 8.13 to 8.28, has demonstrated that there is an overall gain in accessibility and that the areas where issues of social exclusion are most important and those which are particularly public transport dependent share in this improvement. However, it is also important to consider whether any areas fail to share in the overall accessibility improvement. Examination of the maps shows that the remaining wards in the corridor – New Town, Dean, Murrayfield, South East Corstorphine, North East Corstorphine, Gyle and Dalmeny & Kirkliston - experience an overall improvement in accessibility.

8.7. Cost to Government

8.7.1. Introduction

Edinburgh Tram Line Two shares a section of common track with Edinburgh Tram Line One, extending from St Andrew Square to Roseburn Junction. The technical work to design the infrastructure and provide cost estimates for this section of the route has been undertaken by the Edinburgh Tram Line One technical team led by Mott MacDonald. The costs associated with this element of the infrastructure have been added to those developed by the Edinburgh Tram Line Two team for the route between Roseburn Junction and Newbridge/Edinburgh Airport.

Full details of the estimate build-up for the section between the western termini and Roseburn Junction can be found in Appendix F to this report.

Where practicable, the assumptions used to derive the costs have been agreed between Edinburgh Tram Line One and Edinburgh Tram Line Two, as driven by **tie** and Grant Thornton (GT). For example, rates used for vehicle costs, contractors' preliminaries and design costs are consistent for both lines. For the majority of other factors, the rates and/or quantities used are expected to vary from line to line, as the individual characteristics of the particular route are taken into consideration

8.7.2. Capital Costs

Cost estimates have been prepared using a combination of benchmarking, previous experience and engineering judgement, with the rates used reflecting experience in a wide variety of LRT and highway projects throughout the UK and Europe. Rates are based upon 2Q 2003 prices.

The assumptions underlying the estimates are provided in the Scheme Cost Report in Appendix F.

The detailed cost estimate has been split into three main constituents:

- St Andrew Square to Roseburn Common Section;
- Roseburn to Airport; and
- Newbridge Shuttle.

Table 8.20 provides a summary of Edinburgh Tram Line Two costs, a more detailed breakdown can be found within Appendix F.

Table 8.20 Summary of Edinburgh Tram Line Two Costs

Scenario	Route Description	Capital Cost (£M)
Line One already completed	Roseburn to Airport only	215.6
Line One already completed	Roseburn to Airport; Ingliston to Newbridge	266.6
No Line One	St Andrew Square to Airport	269.8
No Line One	St Andrew Square to Airport; Ingliston to Newbridge	320.9

Note: All costs include 25% Optimum Bias

8.7.3. Operating Costs

Operating cost is a major component of the business case. However, this element is often difficult to assess as it varies a lot from network to network. Moreover, engineering consultants have very little

access to the accounts of public transport operators. Recognising this, **tie** has instigated the DPOF process through which the appointed Operator will provide information to verify or adjust the assumptions made in this report.

Estimations of the operating costs have been realised based on an iterative process to take into account the different updates and the level of definition of the project. The methodology and the unit rates for the calculation have also been discussed with Edinburgh Tram Line One consultants to ensure consistency in the calculations.

The assumptions used to provide the basis can be found in Appendix F. The Newbridge shuttle service is presented separately, but most of the administrative costs have been allocated to the principle between St Andrew Square and the Airport.

Table 8.21 Operating Cost Breakdown

Item	Airport Service (£M)	Newbridge Shuttle (£M)	Total (£M)
Staff Cost	3.07	0.64	3.71
a. Drivers	*0.70*	*0.17*	*0.87*
b. Conductors	*0.54*	*0.14*	*0.68*
c. Other Operating Staff	*0.52*	*0.06*	*0.58*
d. Management and Admin Staff	*0.36*	*0*	*0.36*
e. Maintenance and Engineering Staff	*0.95*	*0.27*	*1.22*
Power	0.22	0.04	0.26
Maintenance Materials	0.61	0.14	0.75
Insurance	0.23	0.05	0.28
Policing	0.17	0.03	0.20
Other Overheads	0.21	0.05	0.26
Business Rate 5%	0.16	0.05	0.21
Automatic Ticket Gates	0.03	0	0.03
TOTAL	**4.70**	**1.01**	**5.71**

Subsequent to this assessment, the appointed operator, TRANSDEV, has provided their own assessment of operating costs, of £6.10M (2003 prices). This includes operator management fee, which is a cost the public sector will also have to meet. The TRANSDEV value has been used for assessment of tram as it is more comprehensive and has the advantage of operations experience.

8.7.4. Lifecycle Costs

Lifecycle costs have been estimated using a similar approach to the capital costs, namely using a combination of benchmarking, previous experience and engineering judgement. In addition, detailed discussions with Edinburgh Tram Line One Consultants have taken place to ensure consistency of approach.

The lifecycle costs for Edinburgh Tram Line Two encompass all costs associated with operating and maintaining the tramway that are outwith the standard operating costs. These include the replacement of civil, electrical and stop installations, tram vehicle refurbishment and other non-routine maintenance activities.

The build-up of lifecycle costs has been based around a standard list of lifecycle items agreed between **tie** and the Consultants for Edinburgh Tram Line One and Edinburgh Tram Line Two. Lifecycle costs have been determined by specifying maintenance intervals for "minor" or "major" refurbishment of each item, and by applying a cost as a percentage of the original value.

Lifecycle costs have been "smoothed" through the 30-year design life of the system, by using a profile agreed between **tie** and the Consultants for Edinburgh Tram Line One and Edinburgh Tram Line Two.

The lifecycle costs for Edinburgh Tram Line Two are summarised in Table 8.25, below:

Table 8.22 Lifecycle Costs

Section	Cost (£M)
St Andrew Square to Roseburn	6,760
Roseburn to Airport	34,264
Newbridge Shuttle	10,648
St Andrew Square to Airport	41,024
St Andrew Square to Airport plus Newbridge	51,672

8.7.5. Revenue

A thirty-year profile has been calculated assuming that Edinburgh Tram Line Two commences operation at the start of 2009. A period of ramp up is assumed, in which full revenue is only achieved in the fourth year of operation. Table 8.26 shows the ramp up assumed.

Table 8.23 Assumed Ramp Up

	Year 1	Year 2	Year 3 (2011)
Percentage of base revenue	75%	85%	95%

Base revenue between 2011 to 2026, the two model years was interpolated as a straight line, which was also extrapolated back to 2009. Past 2026, revenue is assumed to be constant as per TUBA recommendations. The impact of ramp-up ceases to apply after 2012.

The model uses full adult single fare to compare the relative attractiveness of the different modes, however, not everyone pays full single fare. Therefore, revenue loss due to ticket type and fare evasion should be taken into account in estimating actual revenue.

Adjusted patronage and revenue forecasts are shown in Table 8.27, below.

Table 8.24 Edinburgh Tram Line Two Patronage and Revenue (2003 prices)

	2011 (excluding ramp-up)	2011 (including ramp-up)	2026
Patronage	**5.38M**	**5.11M**	**6.94M**
Revenue (full adult fare)	**£7.98M**	**£7.58M**	**£9.90M**
Loss due to ticket type	£0.94M	£0.89M	£1.15M
Loss due to fare evasion	£0.35M	£0.33M	£0.44M
Revenue, less revenue loss	**£6.69M**	**£6.36M**	**£8.31M**

The impact of various sensitivity tests, including that of not implementing the Newbridge shuttle service, is discussed in Section 9.6.

8.7.6. Economic Returns

The relevant report forms contain details of the calculated benefit/cost ratios for the tram scheme. Table 8.17 shows that the benefit / cost ratio for the preferred scheme is 1.38. This illustrates that the provision of the Edinburgh Tram Line Two represents excellent value for money.

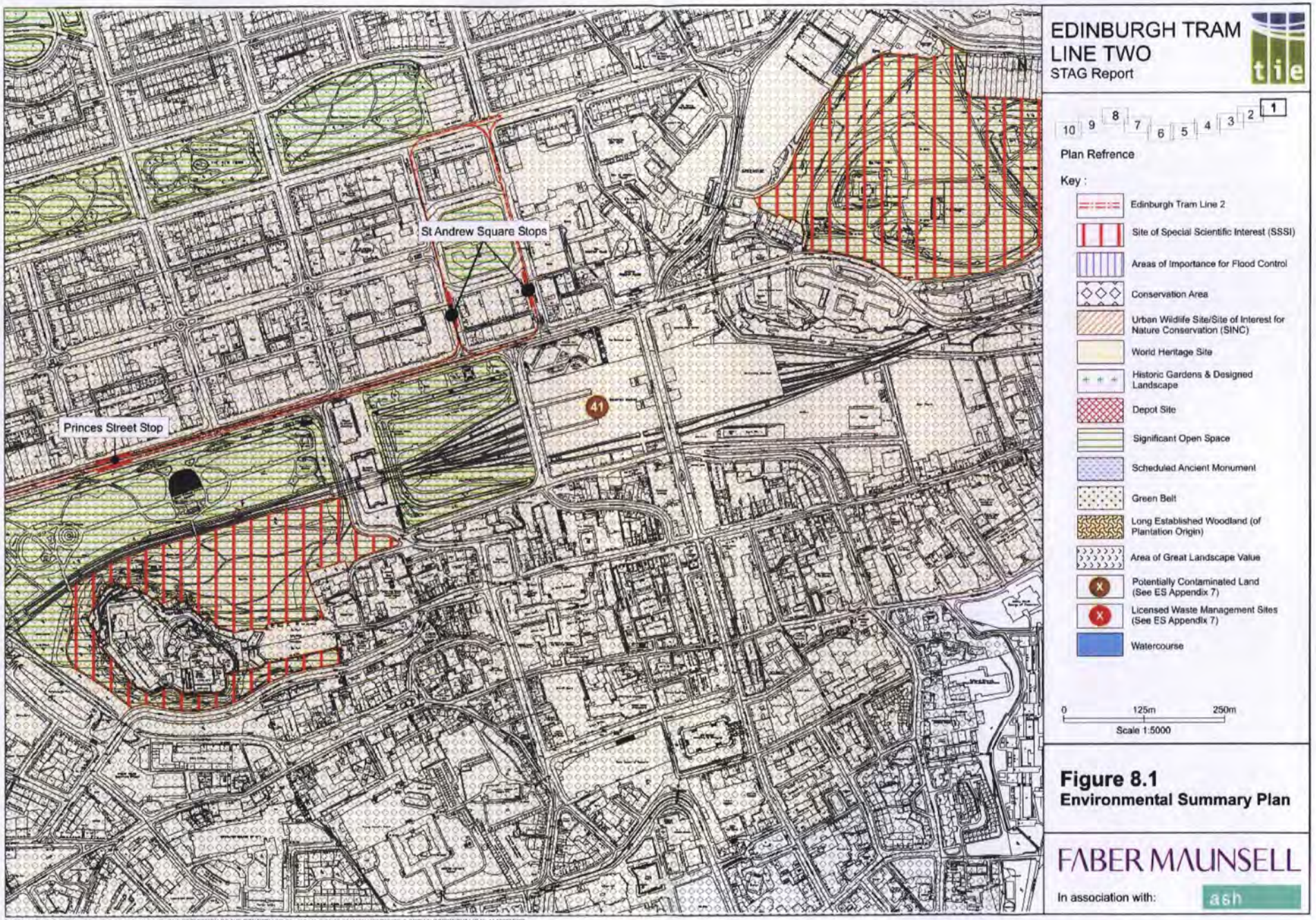
8.8. Contribution To Meeting Planning Objectives

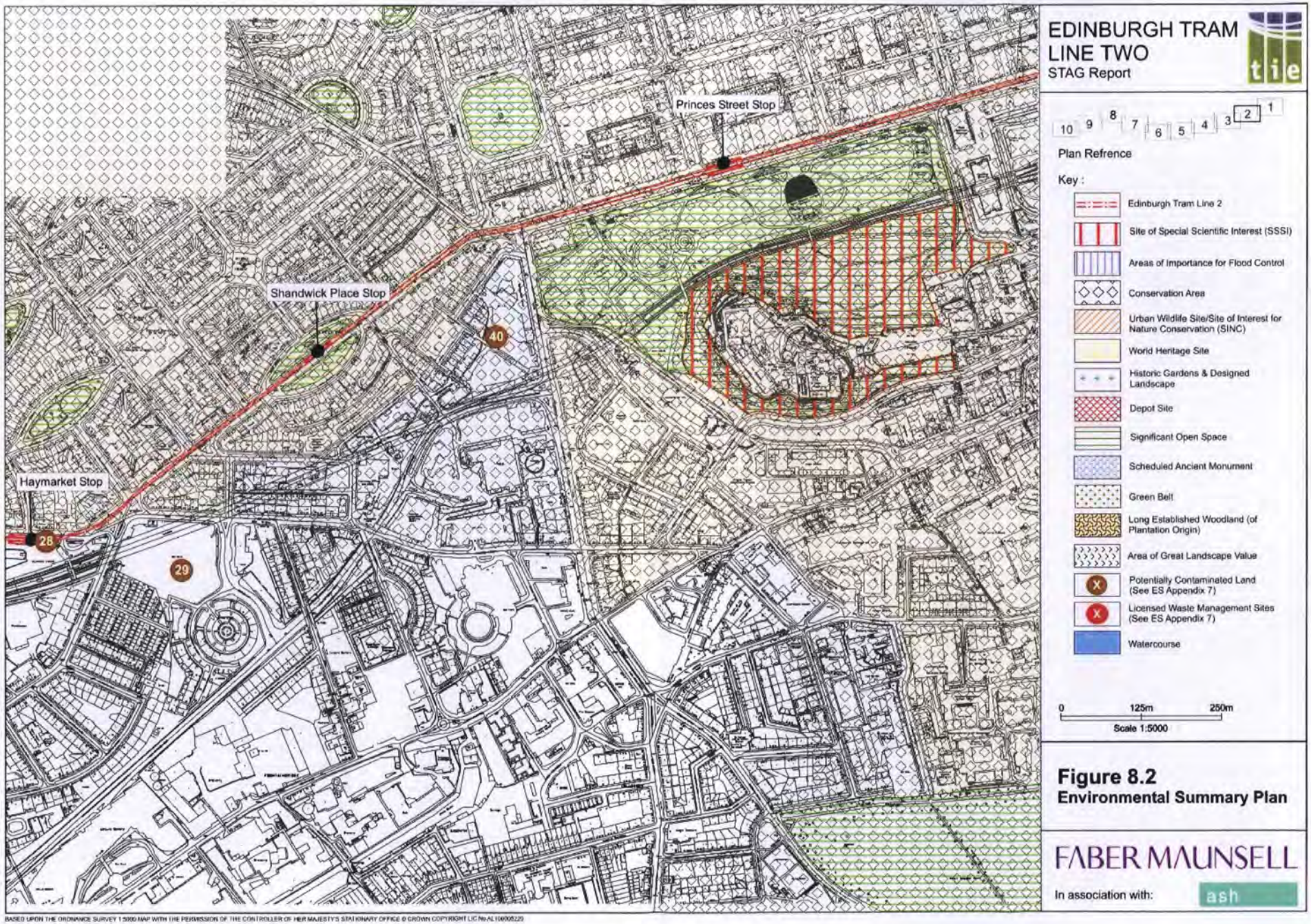
Table 8.25 below summarises the Planning Objectives for the scheme and the extent to which the appraisal has shown that it meets them.

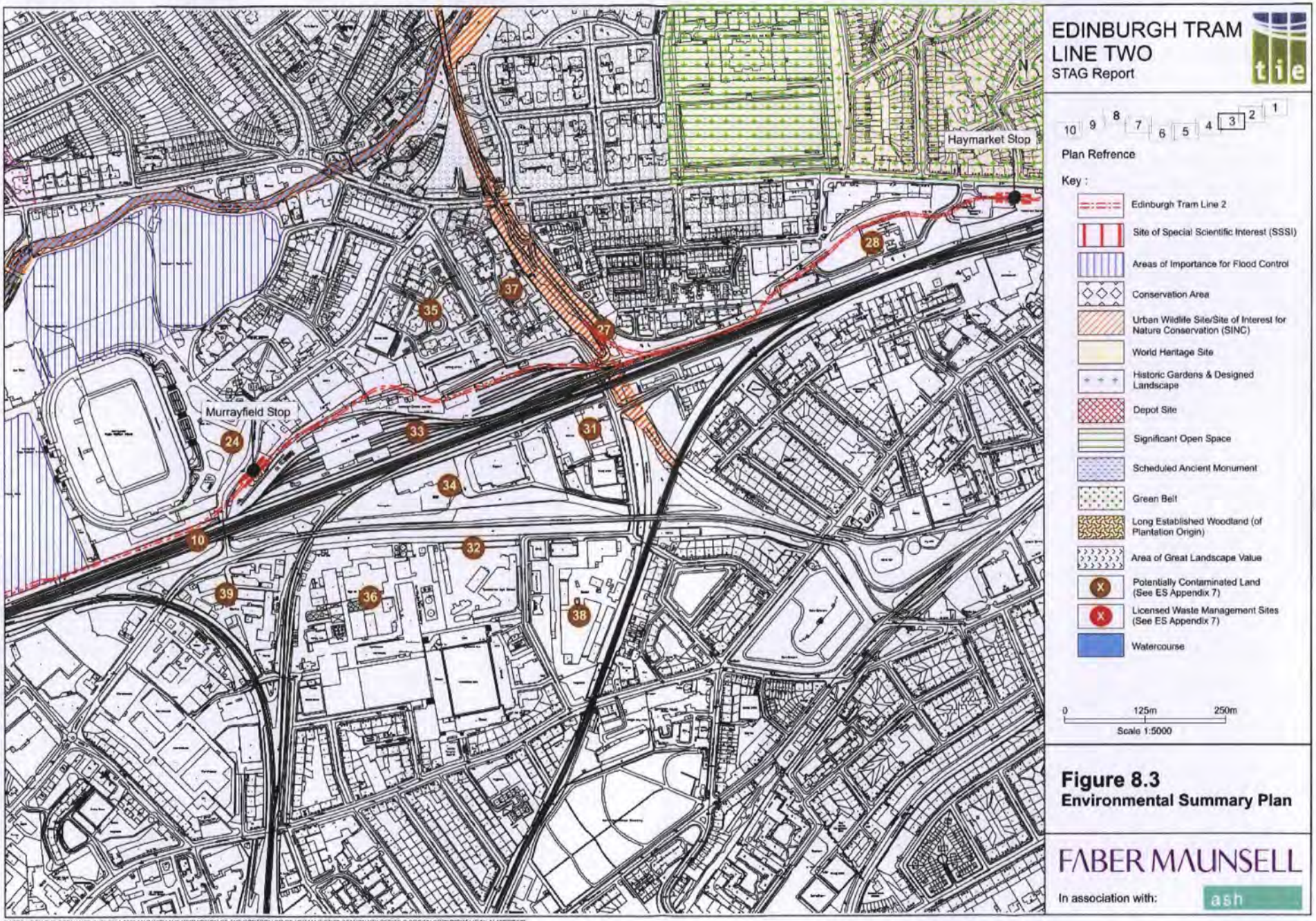
Table 8.25 Contribution to Meeting Planning Objectives

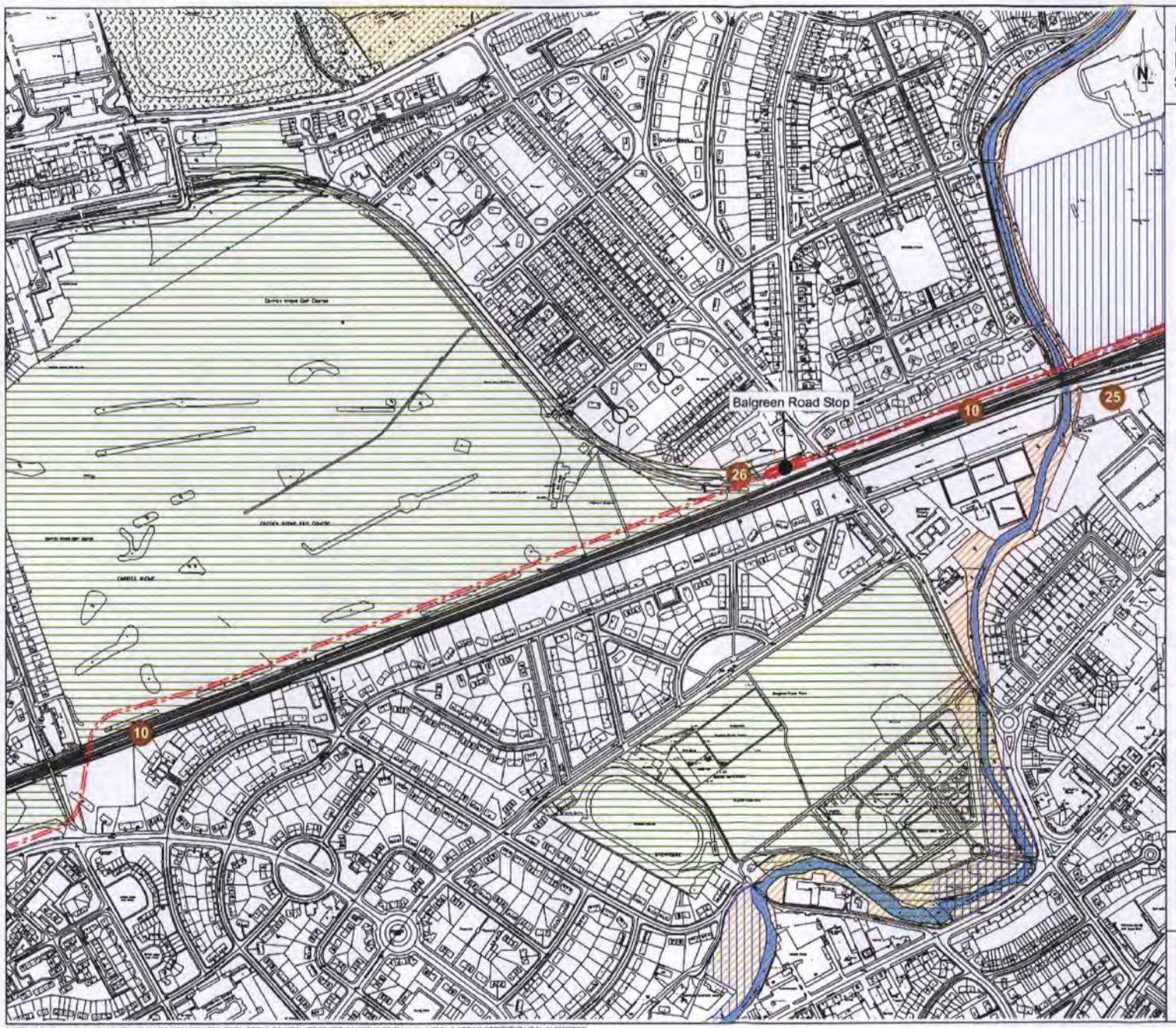
Planning Objective	Contribution of Scheme
Improve access to public transport	Accessibility improves, with a saving in generalised journey time worth £168 million over the scheme life
Improve access to employment opportunities	Journey times from residential areas and transport interchanges generally show a reduction, with limited exceptions
Support economic development	The scheme would unlock additional development potential in the corridor and could assist in attracting major new developments
Increase proportion of journeys made by public transport, walking and cycling	There is a significant transfer from car to tram
Improve local air quality	Local air quality would be improved for 176,000 residents in 2011 and 165,000 in 2026 as compared with 101,000 and 106,000 respectively who would suffer worse air quality
Reduce greenhouse gas emissions	Greenhouse gas emissions in the study area would reduce by 3% in 2011 and 9% in 2026 relative to the do-minimum
Reduce number of private vehicle kilometres	General background economic development over the assessment period of 30 years leads to a net increase in car use and accidents. The tram scheme results in a change in the modal split between public transport and cars, attracting patronage from both cars and existing public transport users. On the basis of the forecast background growth in demand, the tram gives rise to a net decrease in car use and accidents and the scheme meets the overall objective of improving road safety. Second order effects of the tram lead to further economic development and an associated increase in demand for travel, generating further highway trips and modal transfer to tram. The latter is greater in the peak due to higher congestion levels. This leads to an overall reduction in peak vehicle kilometres and an increase in off peak. This gives rise to a small net increase in car use and minor accidents in the later years of the scheme life. This issue would need to be addressed by other appropriate policy measure
Reduce traffic volumes on key routes	
Reduce number of road traffic accidents	
Improve personal security	Tram will provide improved personal security relative to other public transport options.

The table shows that the scheme would make a significant contribution to meeting the majority of the Planning Objectives.









EDINBURGH TRAM LINE TWO
STAG Report

tie

10 9 8 7 6 5 4 3 2 1

Plan Refrence

Key :

- Edinburgh Tram Line 2
- Site of Special Scientific Interest (SSSI)
- Areas of Importance for Flood Control
- Conservation Area
- Urban Wildlife Site/Site of Interest for Nature Conservation (SINC)
- World Heritage Site
- Historic Gardens & Designed Landscape
- Depot Site
- Significant Open Space
- Scheduled Ancient Monument
- Green Belt
- Long Established Woodland (of Plantation Origin)
- Area of Great Landscape Value
- Potentially Contaminated Land (See ES Appendix 7)
- Licensed Waste Management Sites (See ES Appendix 7)
- Watercourse

0 125m 250m

Scale 1:5000

Figure 8.4
Environmental Summary Plan

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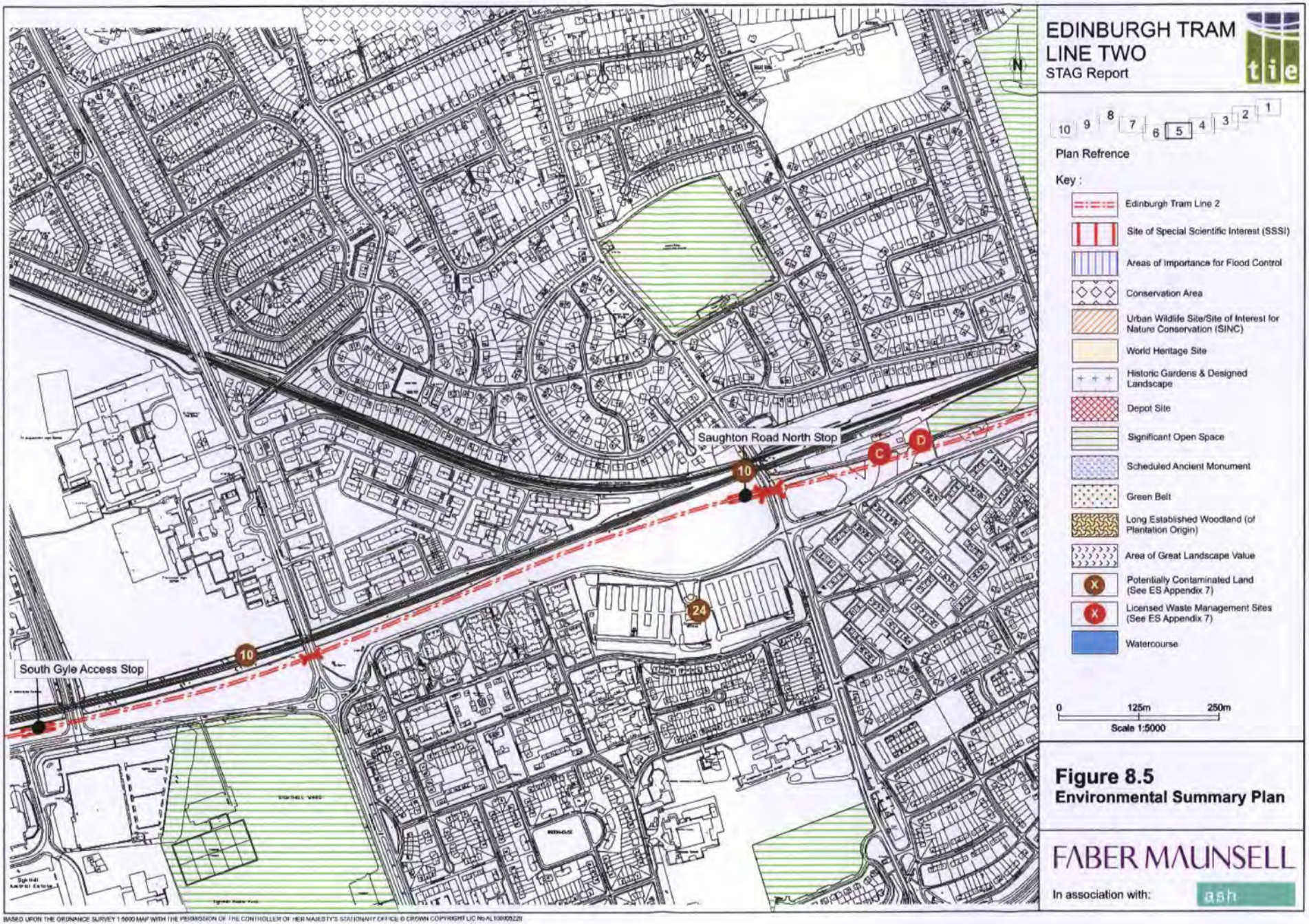

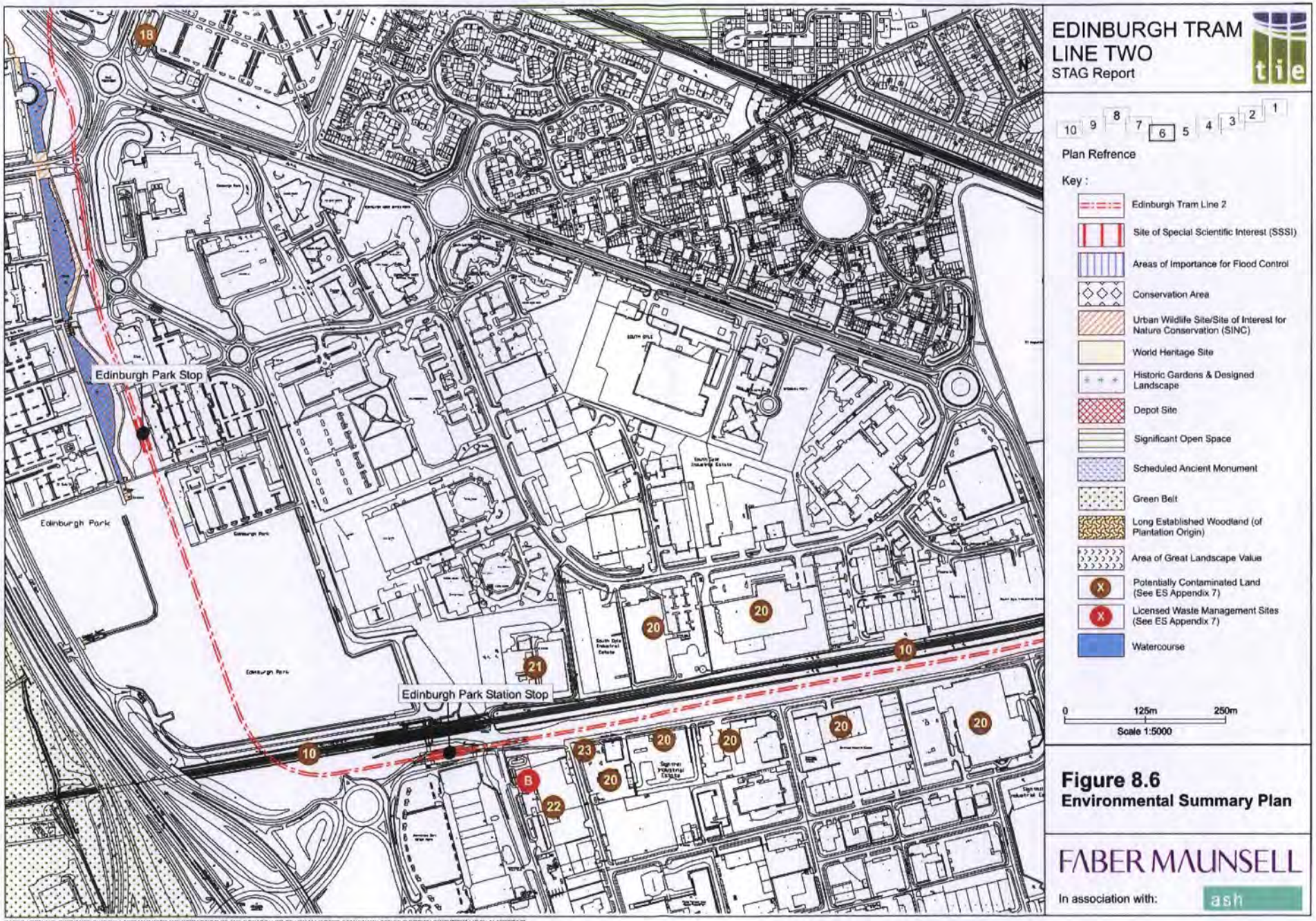

EDINBURGH TRAM LINE TWO
STAG Report

tie

10 9 8 7 6 5 4 3 2 1

Plan Refrence

Key :

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- Licensed Waste Management Sites (See ES Appendix 7)
- Watercourse

0 125m 250m

Scale 1:5000

Figure 8.6
Environmental Summary Plan

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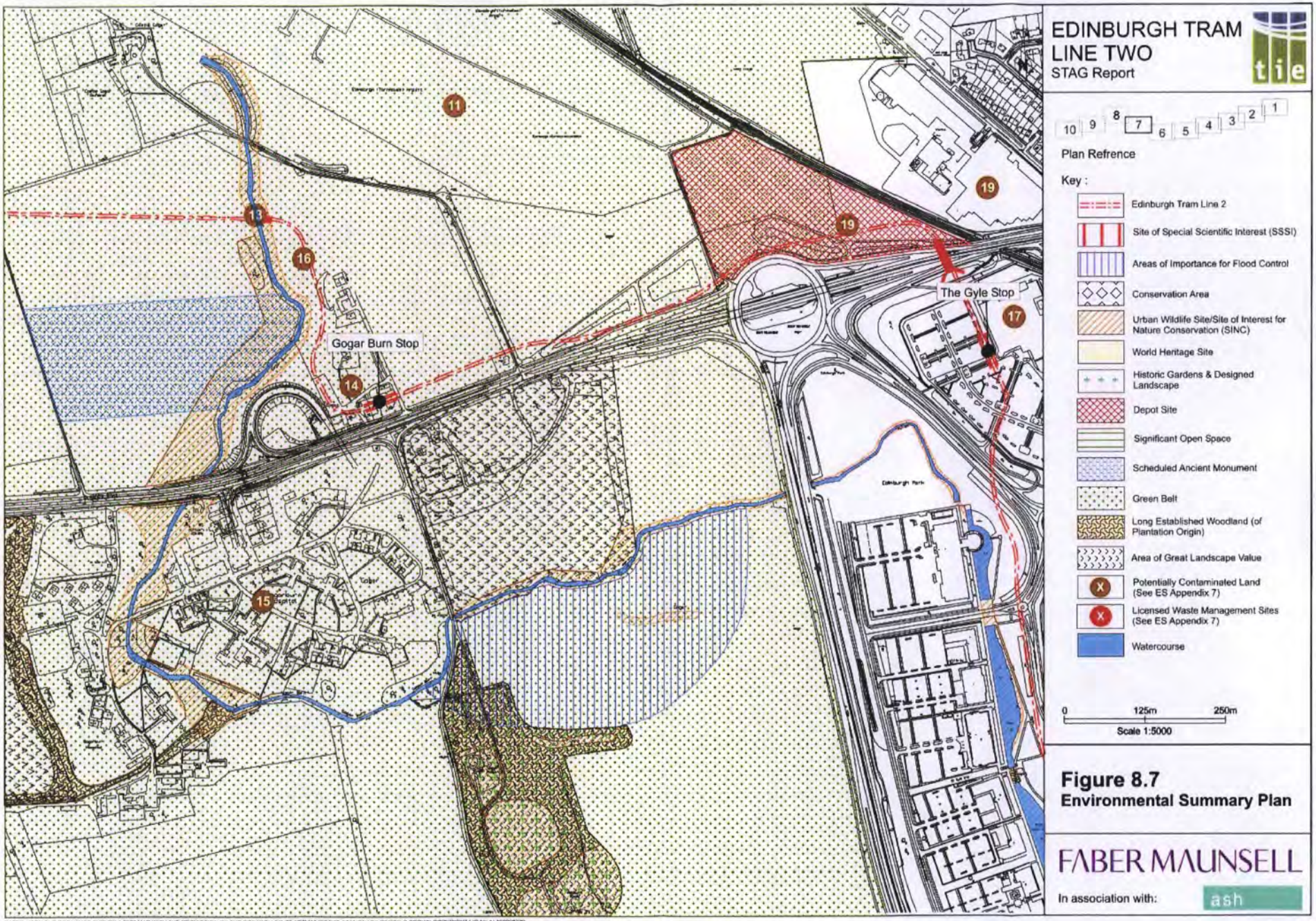

EDINBURGH TRAM LINE TWO
STAG Report

10 9 8 7 6 5 4 3 2 1

Plan Refrence

Key :

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- Licensed Waste Management Sites (See ES Appendix 7)
- Watercourse

0 125m 250m

Scale 1:5000

Figure 8.7
Environmental Summary Plan

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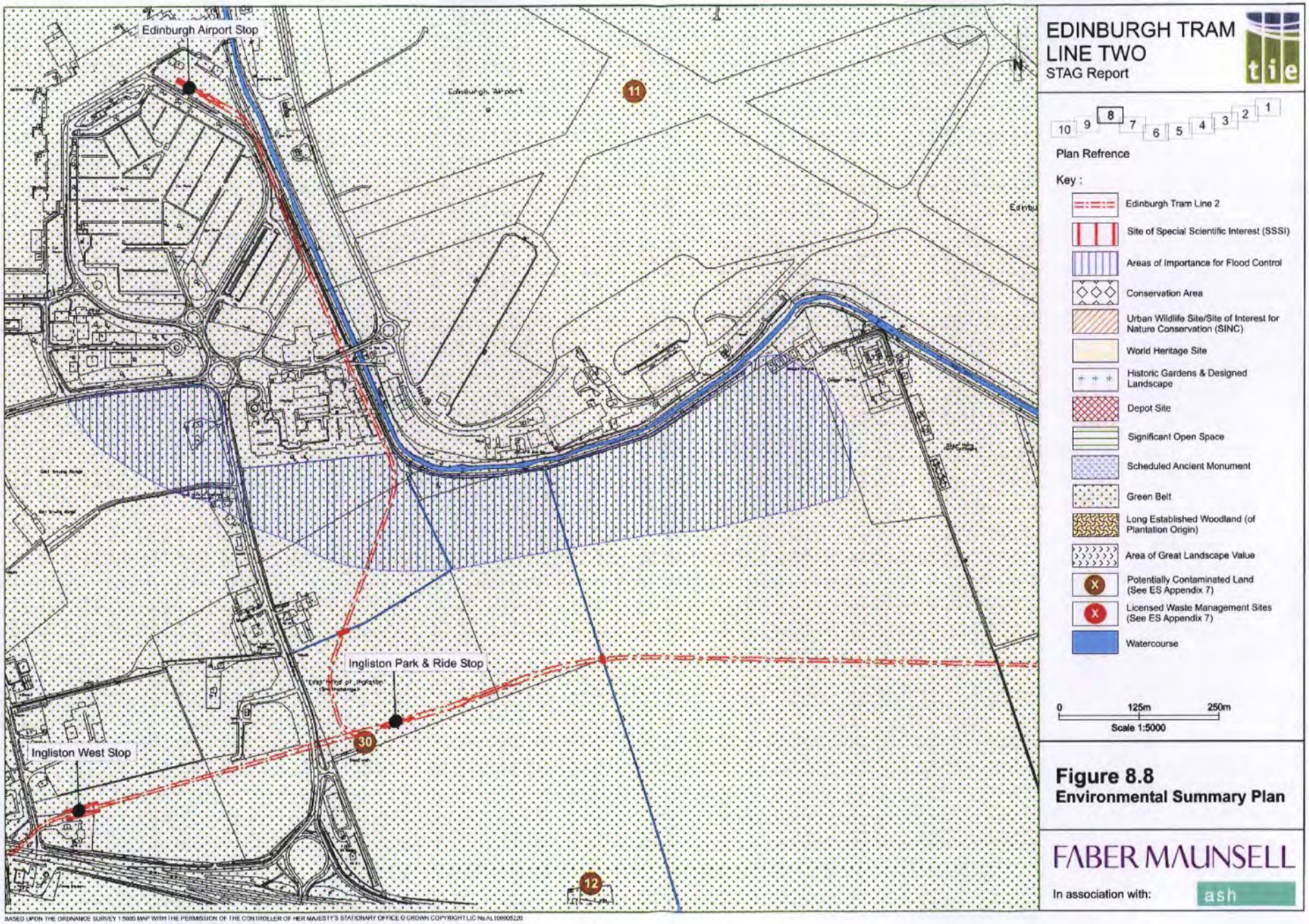

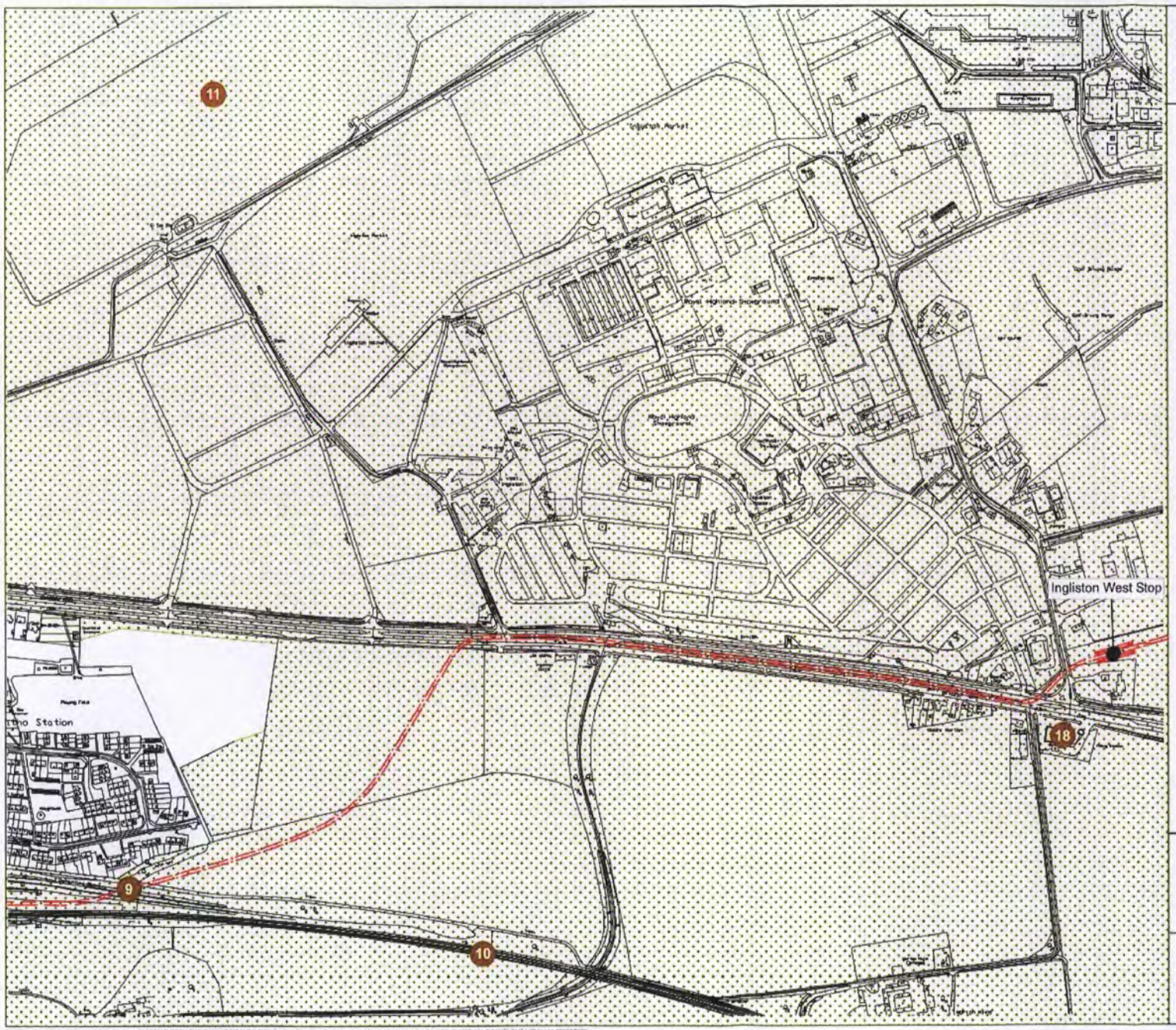

BASED UPON THE ORDNANCE SURVEY 1:5000 MAP WITH THE PERMISSION OF THE CONTROLLER OF HER MAJESTY'S STATIONARY OFFICE © CROWN COPYRIGHT LIC No:AL 100005229

EDINBURGH TRAM
LINE TWO
STAG Report

tie

10 9 8 7 6 5 4 3 2 1

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- Edinburgh Tram Line 2
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- Licensed Waste Management Sites (See ES Appendix 7)
- Watercourse

0 125m 250m

Scale 1:5000

Figure 8.9
Environmental Summary Plan

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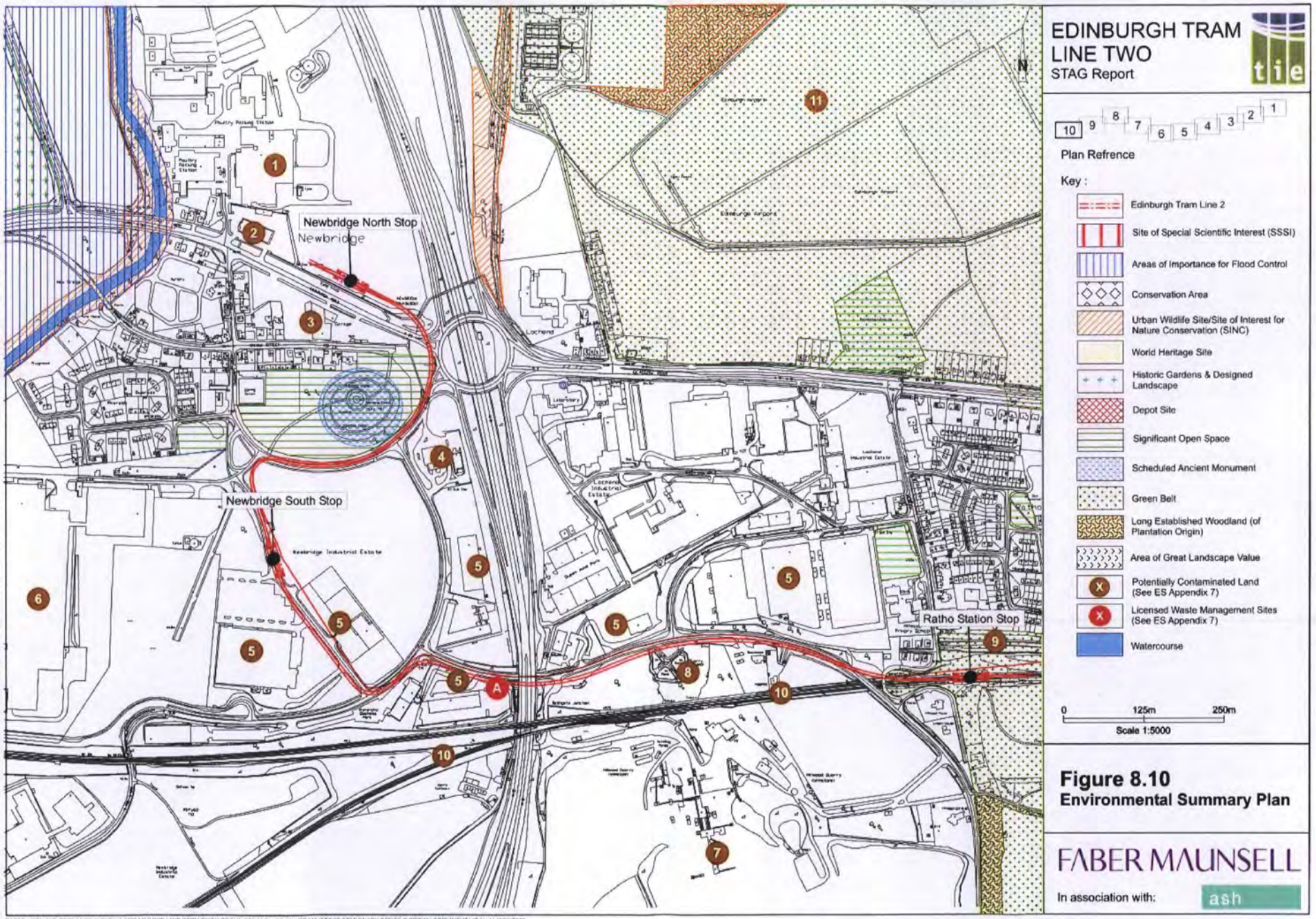
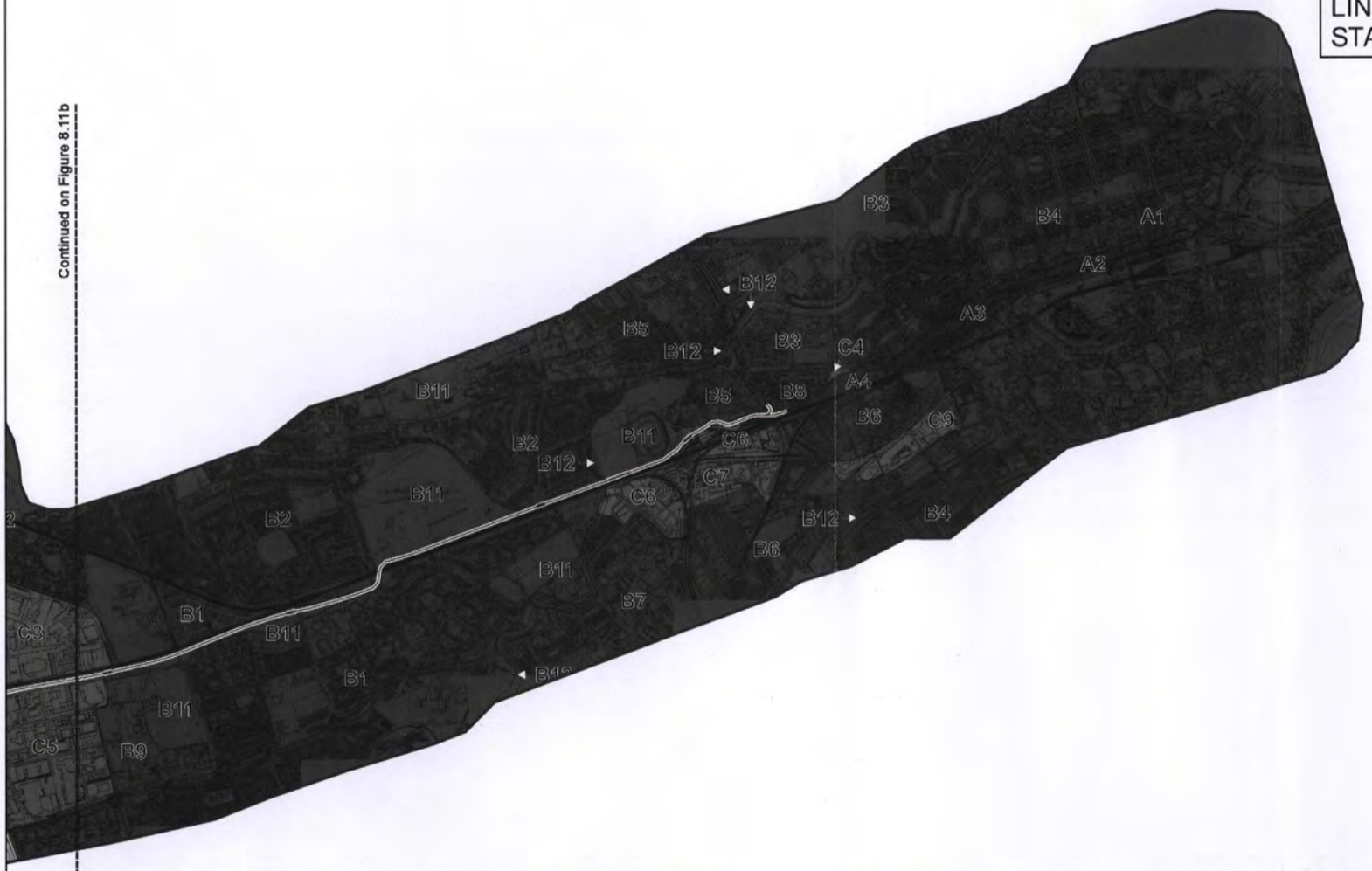


EDINBURGH TRAM
LINE TWO
STAG 2



Key :

- Tram Alignment
- Tram Alignment & Stops
- Study Corridor

Character Area A: Historic City Core

- A1 New Town: St. Andrews Sq.
- A2 New Town: Princes St.
- A3 New Town: West End
- A4 Haymarket

Character Area B: Urban and Suburban Residential with Urban Green Space

- B1 High Density Housing
- B2 Low Density Villa Suburbs
- B3 Low Density Town Housing
- B4 Terraced Town Housing
- B5 Terraced Town Suburban Housing
- B6 Tenement Housing
- B7 Mixed Housing/ Industry
- B8 Low Density Cottage Style Housing
- B9 High Rise Buildings
- B10 Village
- B11 Amenity and Open Space
- B12 Linear Green Space

Character Area C: Landscape Dominated by Large Scale Business and Office Development

- C1 High Technology Business Centre
- C2 Derelict Area, Expansion Zone
- C3 Business Centre
- C4 Office Development
- C5 Industrial Retail Park
- C6 Light Industrial Area
- C7 Heavy Industrial Area
- C8 Retail Development
- C9 Leisure Development

Character Area D: Urban Fringe Character Greenbelt Dominated by Infrastructure

- D1 Rolling Lowland Agriculture
- D2 Wooded Estate
- D3 Flat Farmland
- D4 Airport
- D5 Showground
- D6 Link to Airport
- D7 Motorway

Plan Reference

b | a

0 500m 1000m

Scale 1:25000

N

Figure 8.11a Landscape Character Areas Rev A: 20/11/03

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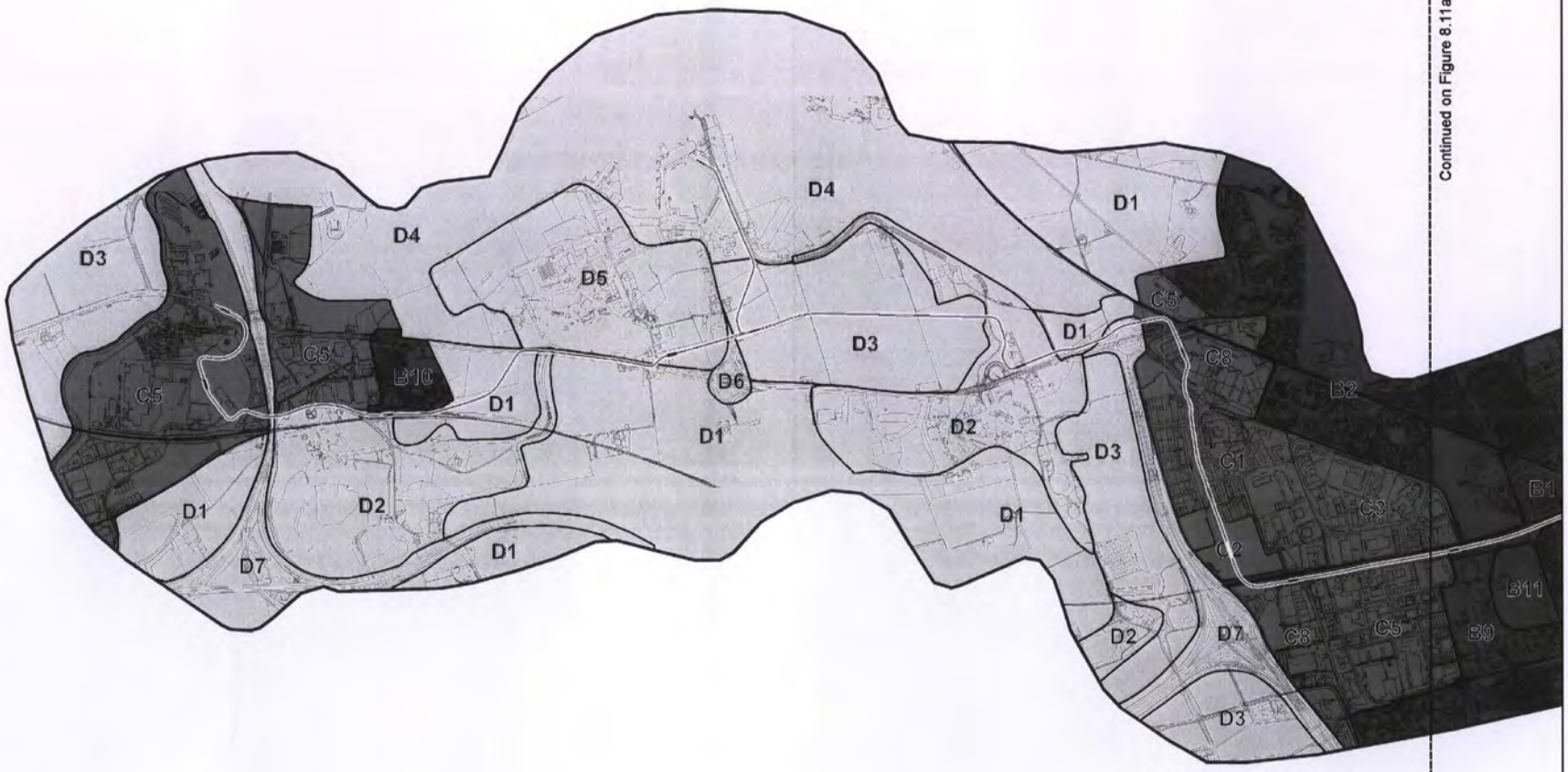
EDINBURGH TRAM
LINE TWO
STAG 2

tie



Key :

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- Tram Alignment & Stops
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- D2 Wooded Estate
- D3 Flat Farmland
- D4 Airport
- D5 Showground
- D6 Link to Airport
- D7 Motorway

Plan Reference: b | a

0 500m 1000m
Scale 1:25000

N

Figure 8.11b Landscape Character Areas Rev A: 20/11/03

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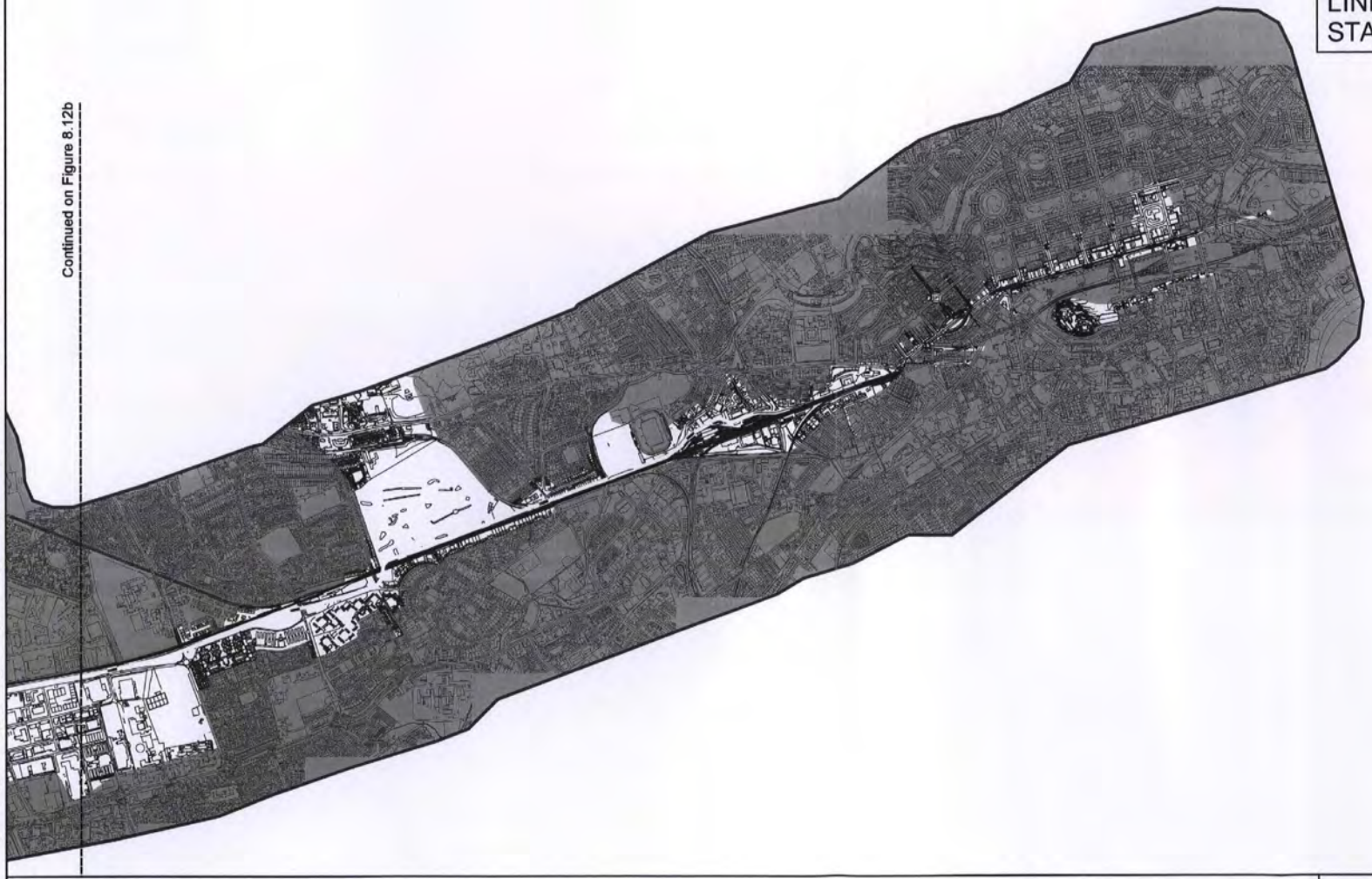
EDINBURGH TRAM
LINE TWO
STAG 2

tie



Key :

- Tram Alignment
- Tram Alignment & Stops
- Study Corridor
- Zone of Visual Influence

Plan Reference

b | a

0 500m 1000m

Scale 1:25000

Figure 8.12a
Zone of Visual Influence
(During Operation) Rev A: 20/11/03

FABER MAUNSELL

In association with: ash

EDINBURGH TRAM
LINE TWO
STAG 2

tie

Key :
- Tram Alignment
- Tram Alignment & Stops
- Study Corridor
- Zone of Visual Influence

Plan Reference

b | a

0 500m 1000m

Scale 1:25000

N

Figure 8.12b
Zone of Visual Influence
(During Operation) Rev A: 20/11/03

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EDINBURGH TRAM
LINE TWO

Figure 8.13

Change in AM Peak Public Transport Generalised Time to Newbridge

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EDINBURGH TRAM
LINE TWO

Figure 8.14

Change in AM Peak Public Transport Generalised Time Relative to Car Time to Newbridge

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EDINBURGH TRAM
LINE TWO

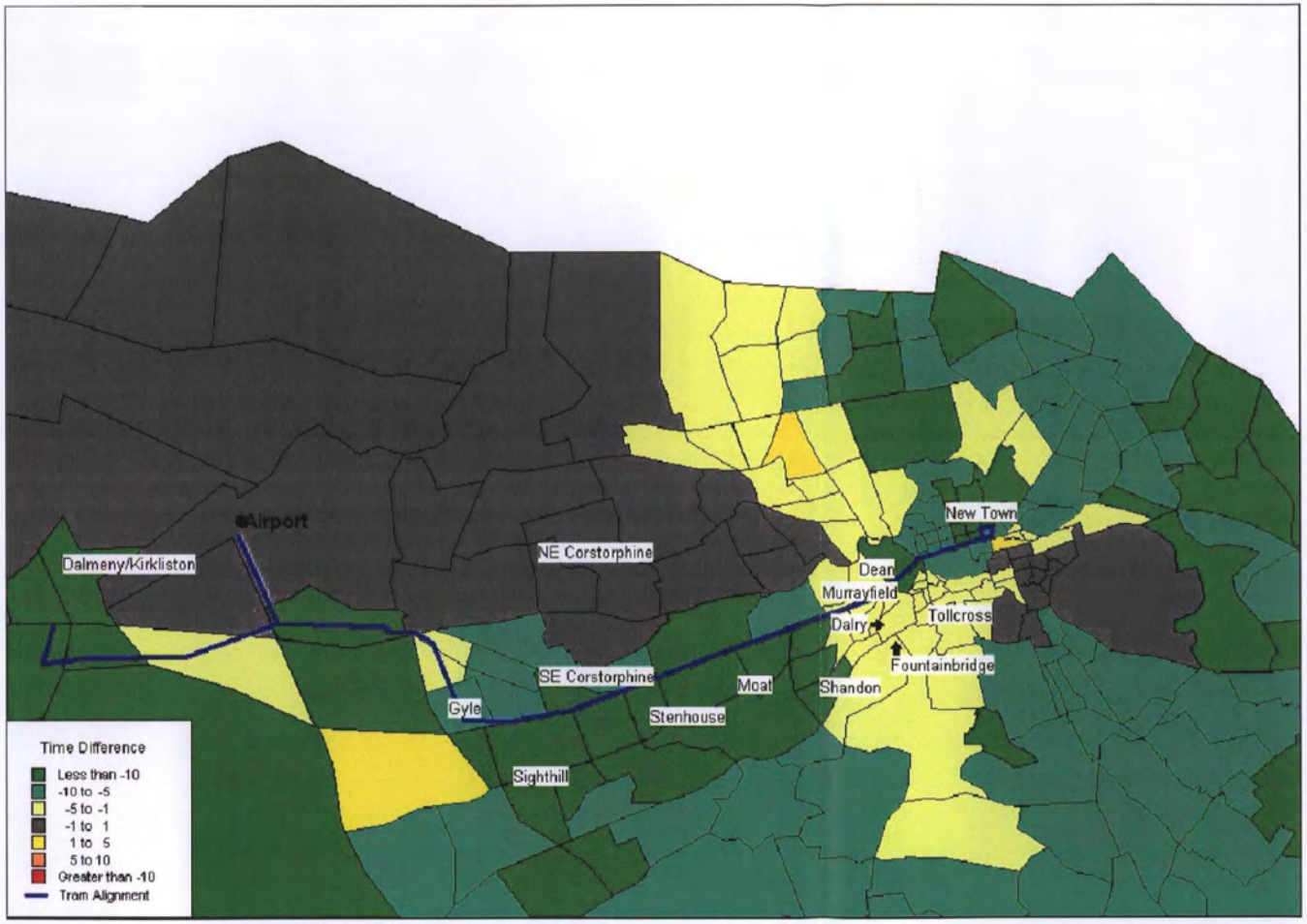

Figure 8.15

Change in AM Peak Public Transport Generalised Time to Edinburgh Airport

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EDINBURGH TRAM
LINE TWO

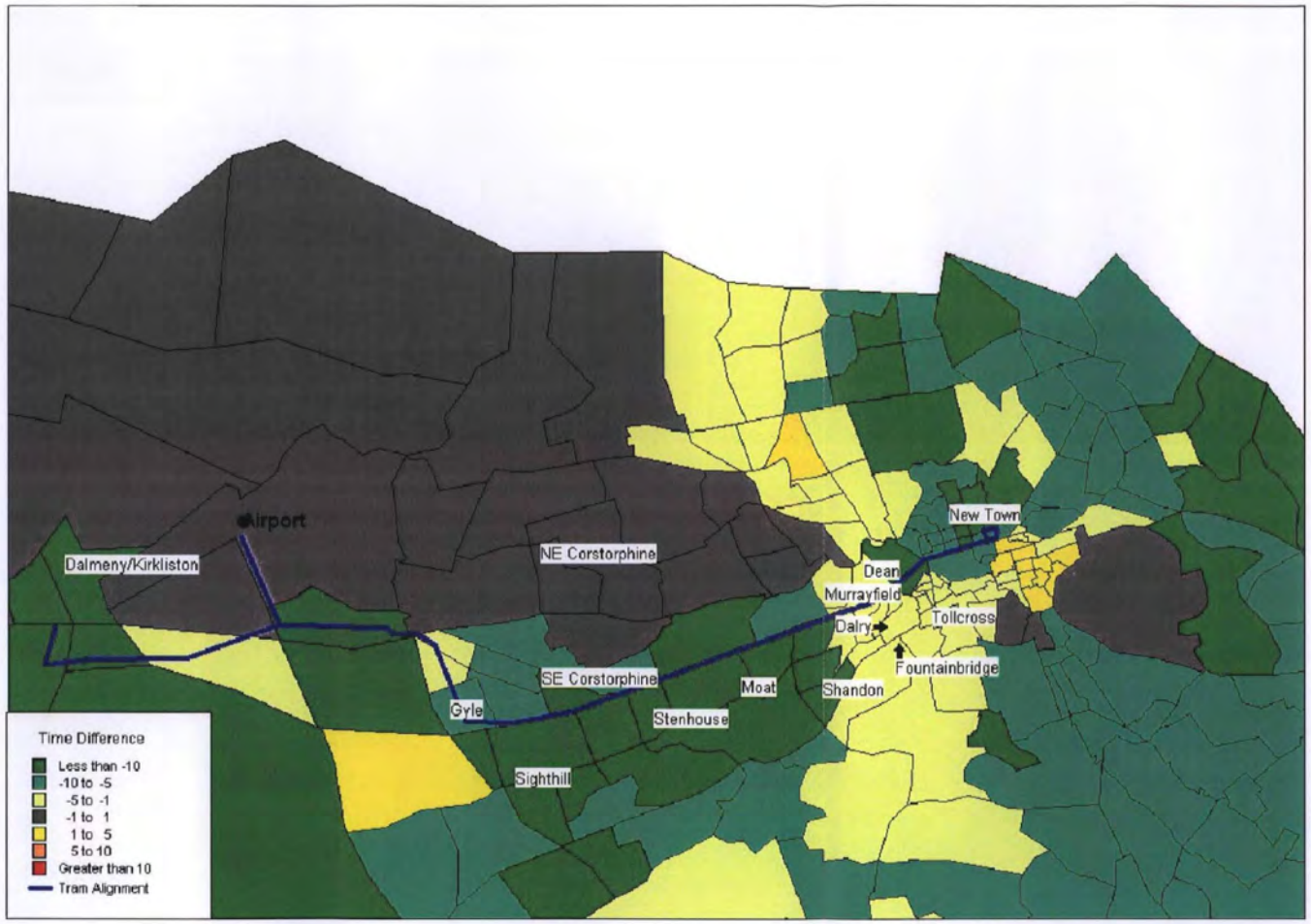

Figure 8.16

Change in AM Peak Public Transport Generalised Time Relative to Car Time to Edinburgh Airport

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EDINBURGH TRAM
LINE TWO

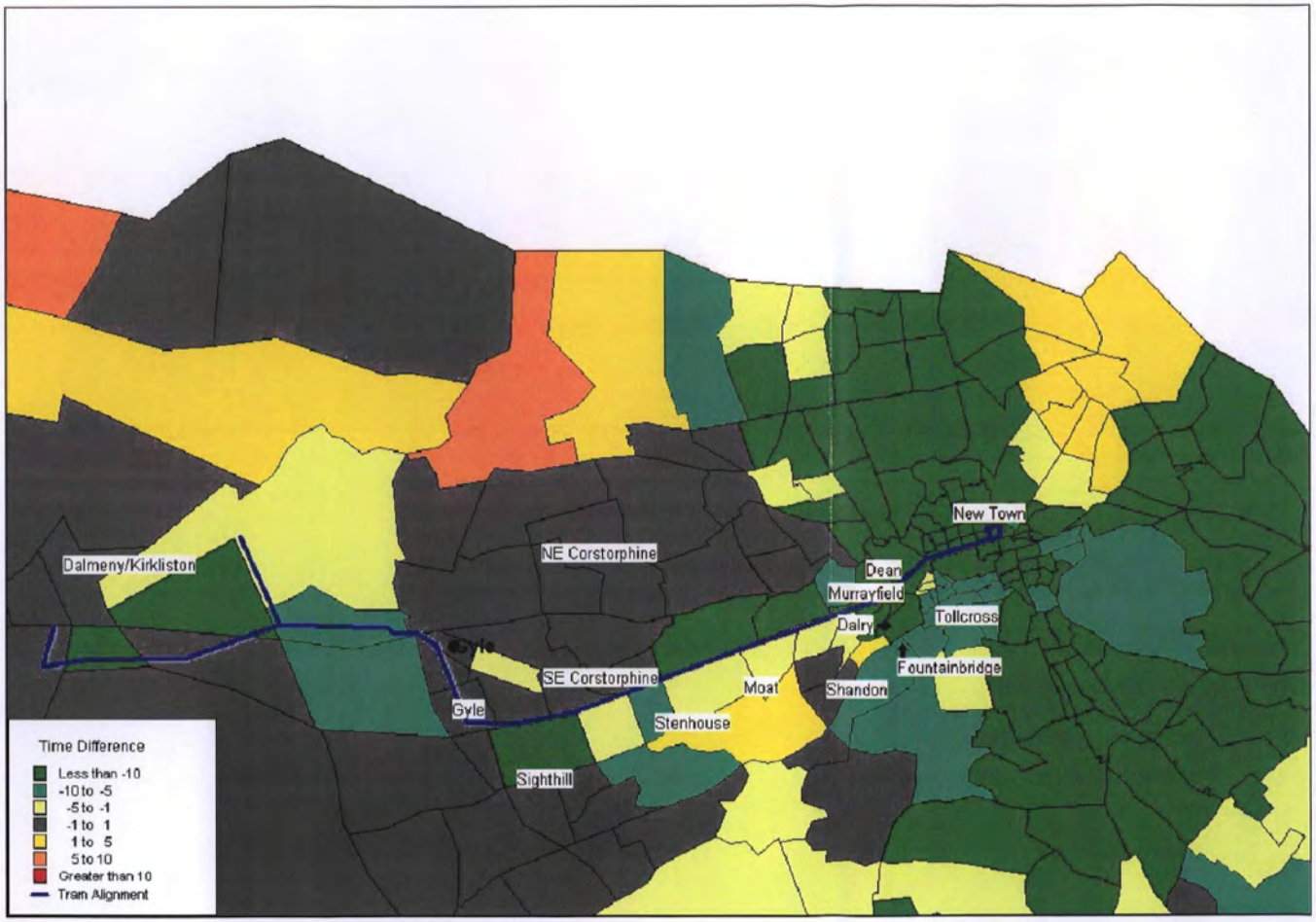

Figure 8.17

Change in Offpeak Public Transport Generalised Time to Gyle Centre

FABER MAUNSELL

EDINBURGH TRAM
LINE TWO

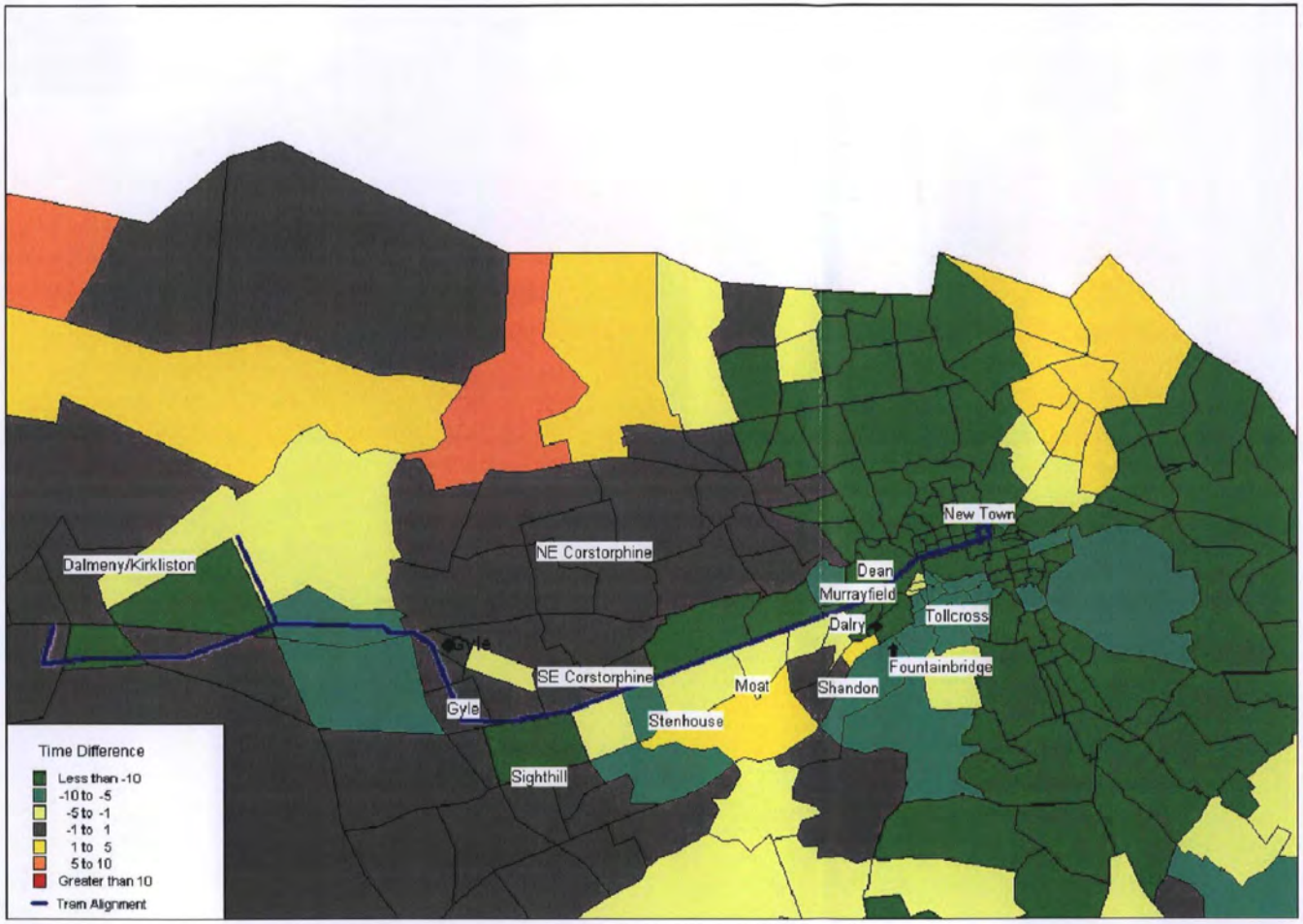

Figure 8.18

Change in Offpeak Public Transport Generalised Time Relative to Car Time to Gyle Centre

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EDINBURGH TRAM
LINE TWO

Figure 8.19

Change in AM Peak Public Transport Generalised Time to Edinburgh Park

FABER MAUNSELL

EDINBURGH TRAM
LINE TWO

Figure 8.20

Change in AM Peak Public Transport Generalised Time Relative to Car Time to Edinburgh Park

FABER MAUNSELL

EDINBURGH TRAM
LINE TWO

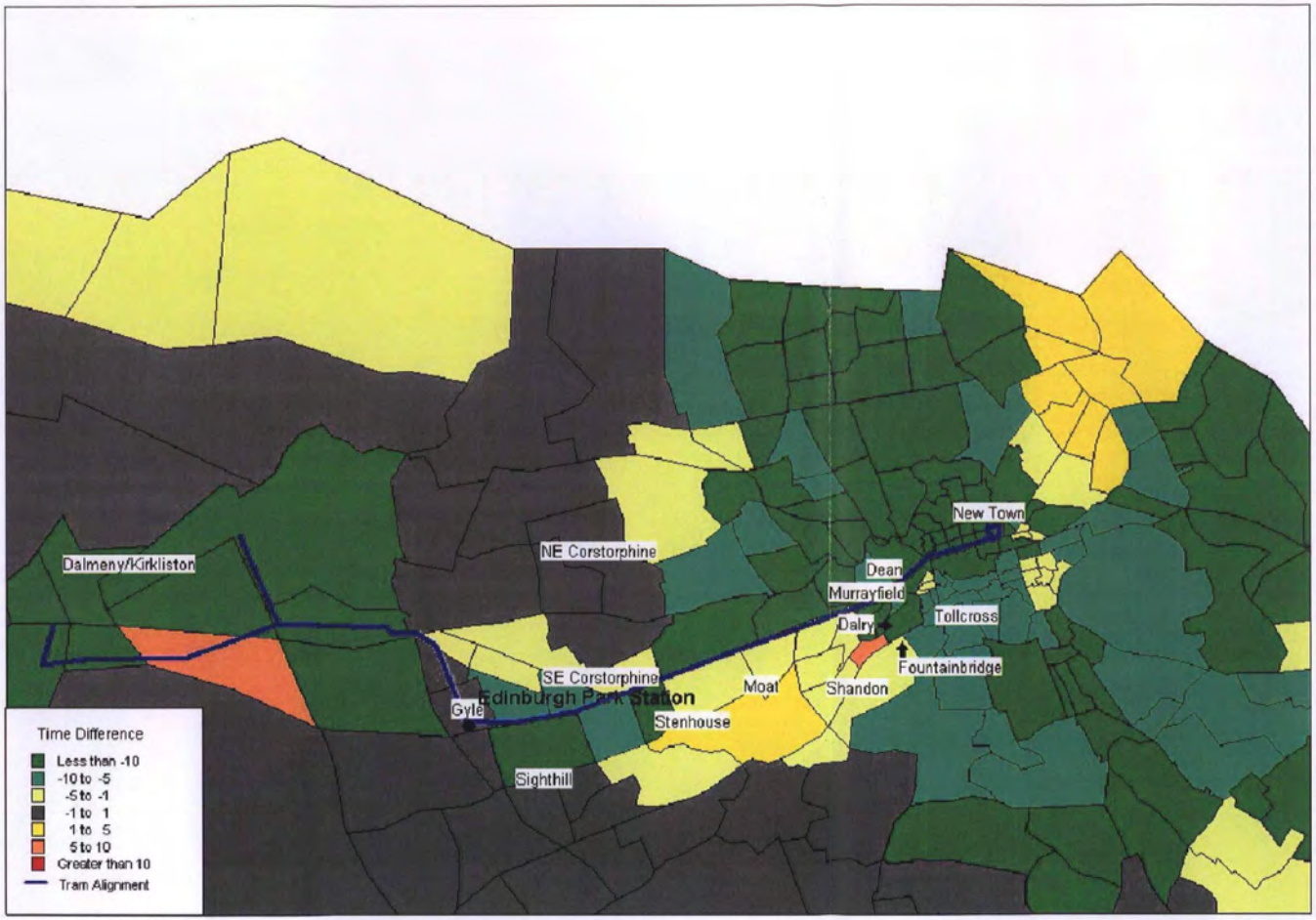


Figure 8.21

Change in AM Peak Public Transport Generalised Time to Edinburgh Park Station

FABER MAUNSELL

EDINBURGH TRAM
LINE TWO

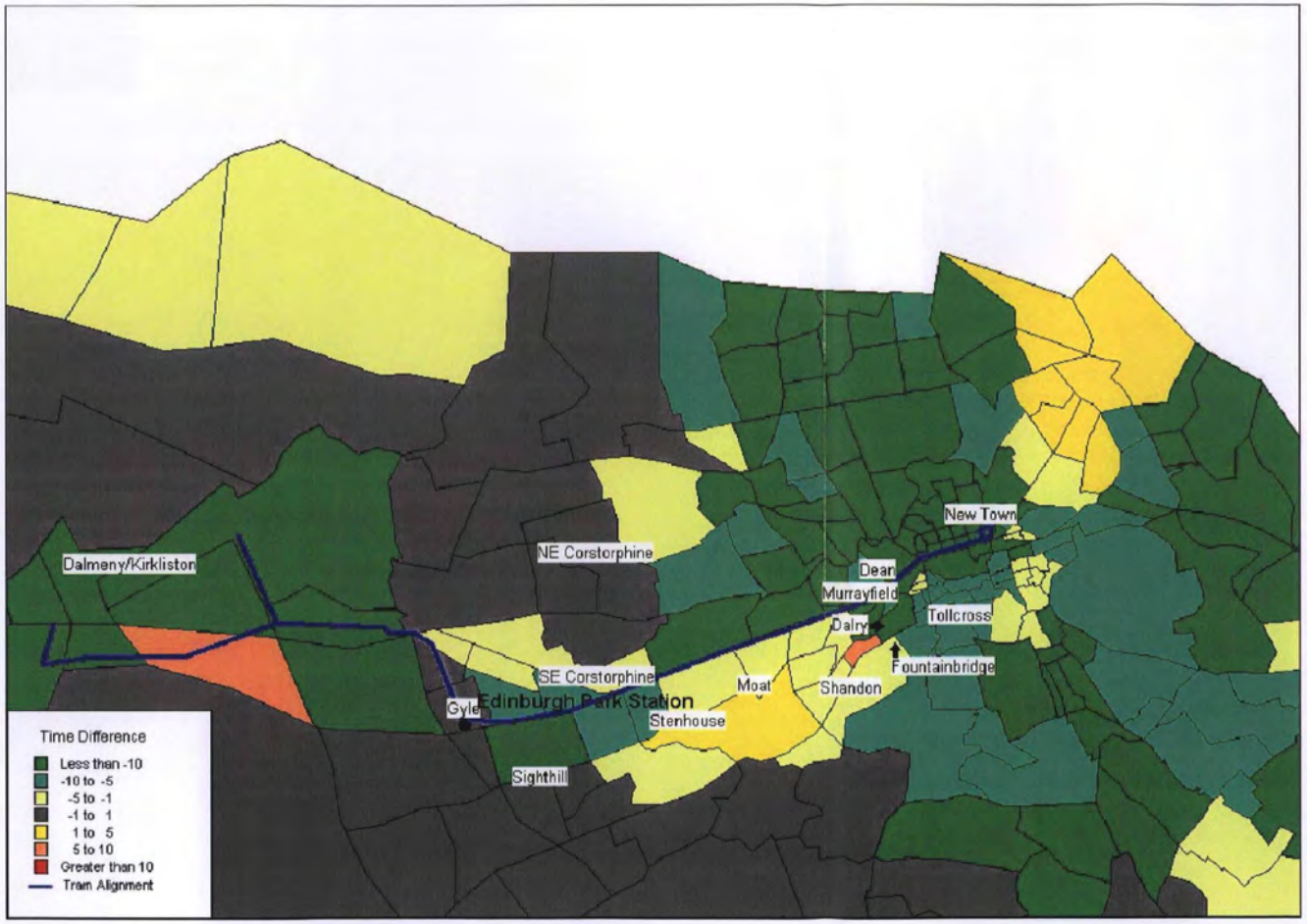


Figure 8.22

Change in AM Peak Public Transport Generalised Time Relative to Car Time to Edinburgh Park Station

FABER MAUNSELL

EDINBURGH TRAM
LINE TWO

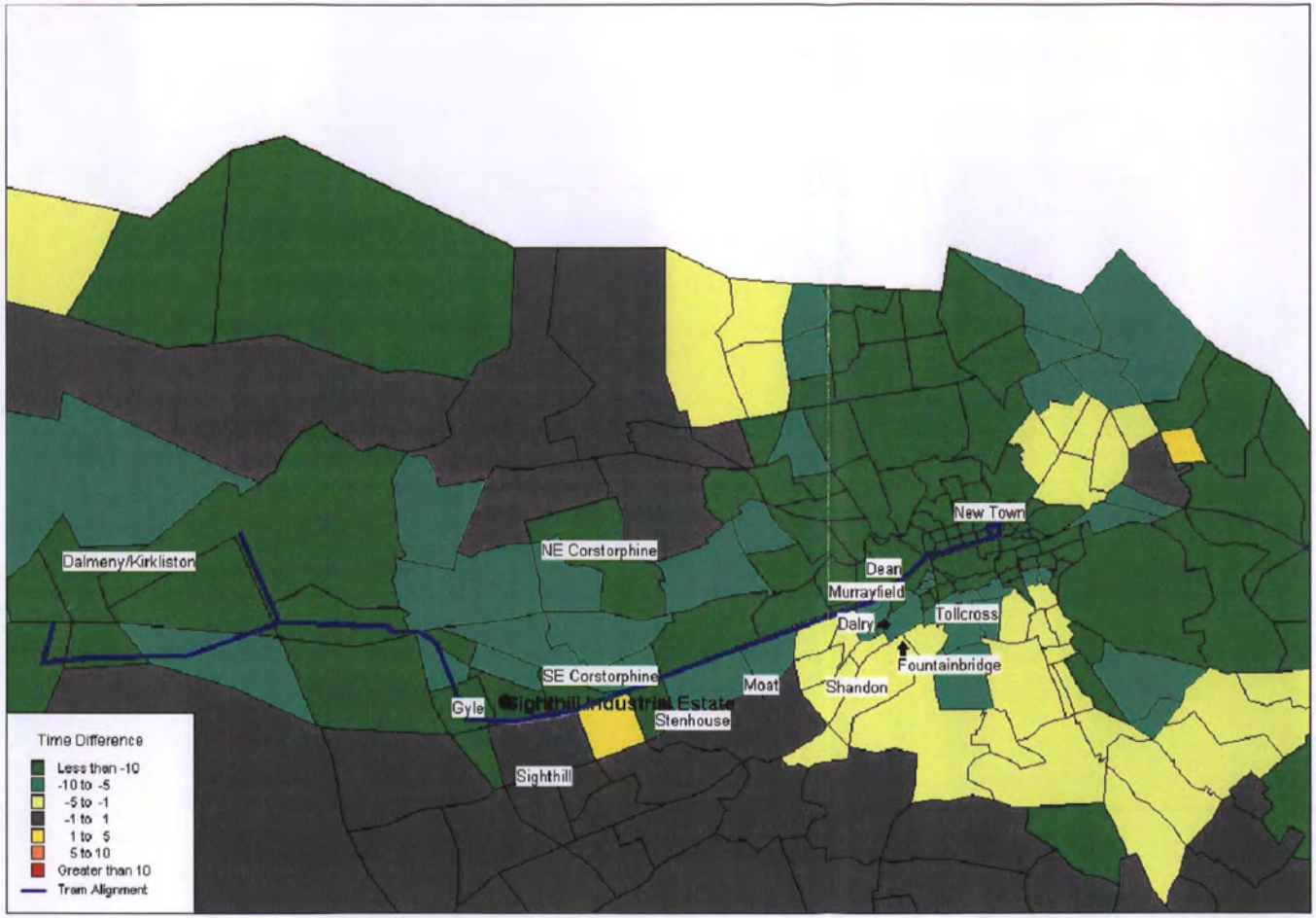


Figure 8.23

Change in AM Peak Public Transport Generalised Time to Sighthill Industrial Estate

FABER MAUNSELL

EDINBURGH TRAM
LINE TWO

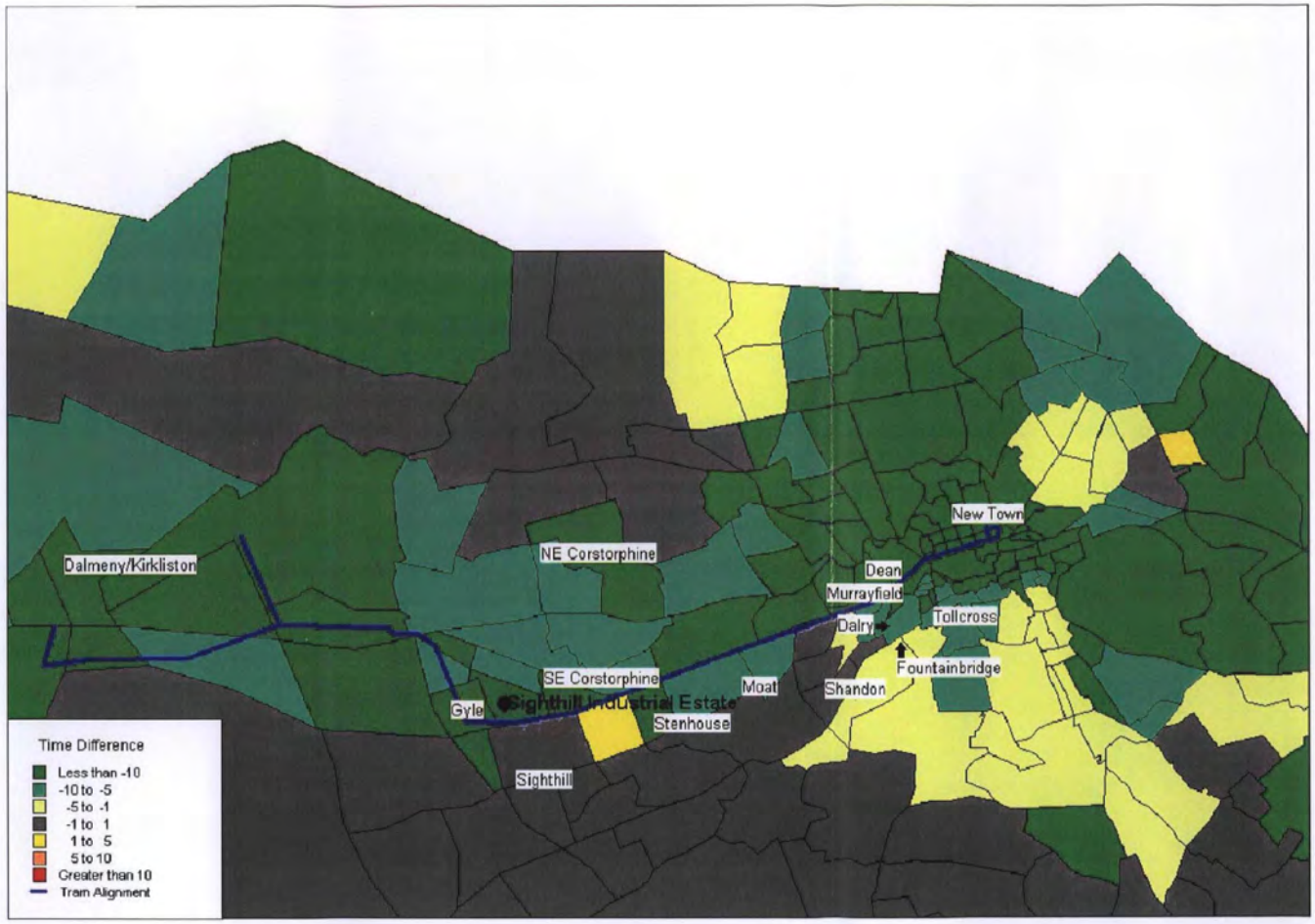


Figure 8.24

Change in AM Peak Public Transport Generalised Time Relative to Car Time to Sighthill Industrial Estate

FABER MAUNSELL

EDINBURGH TRAM
LINE TWO

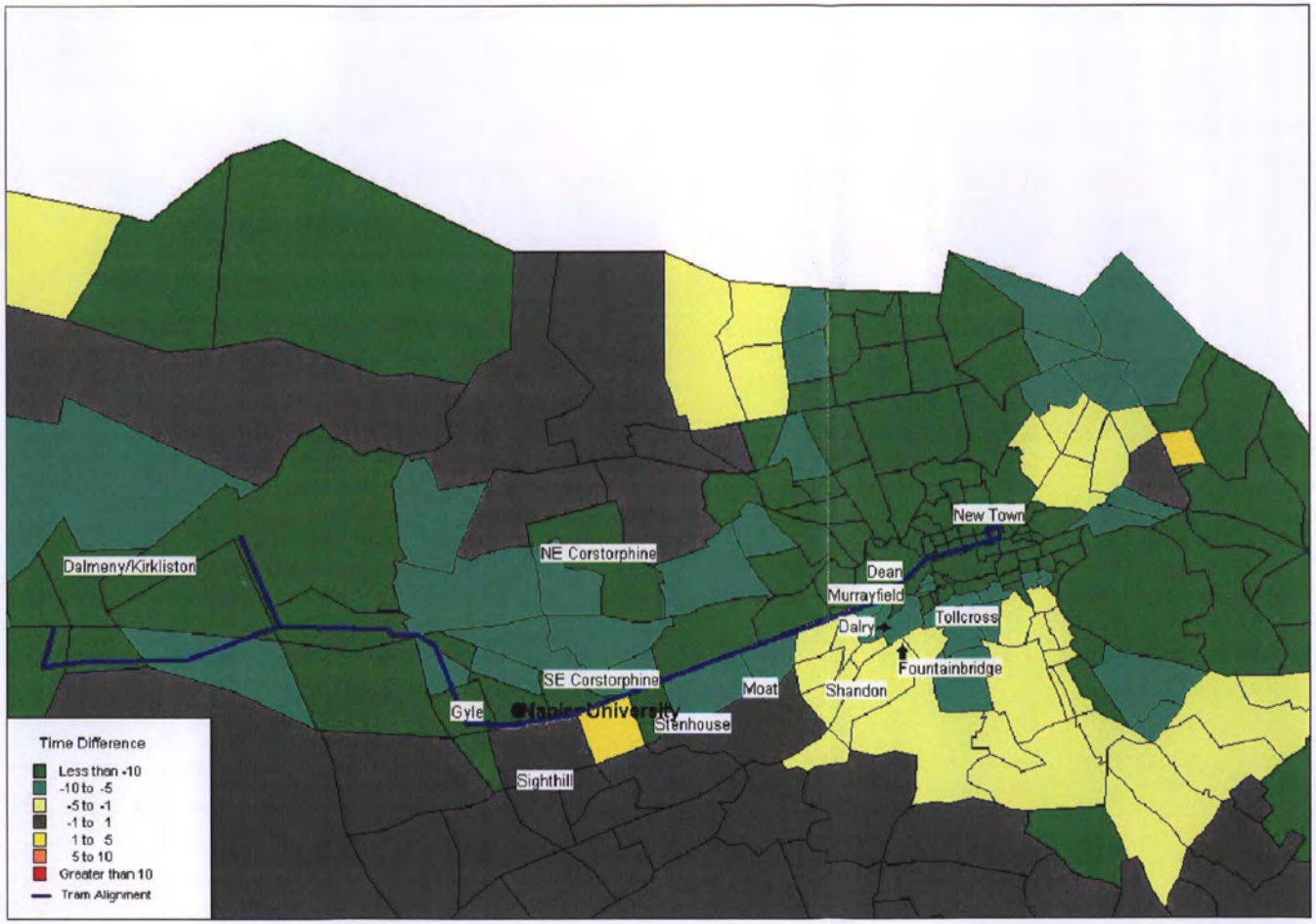


Figure 8.25

Change in AM Peak Public Transport Generalised Time to Napier University

FABER MAUNSELL

EDINBURGH TRAM
LINE TWO

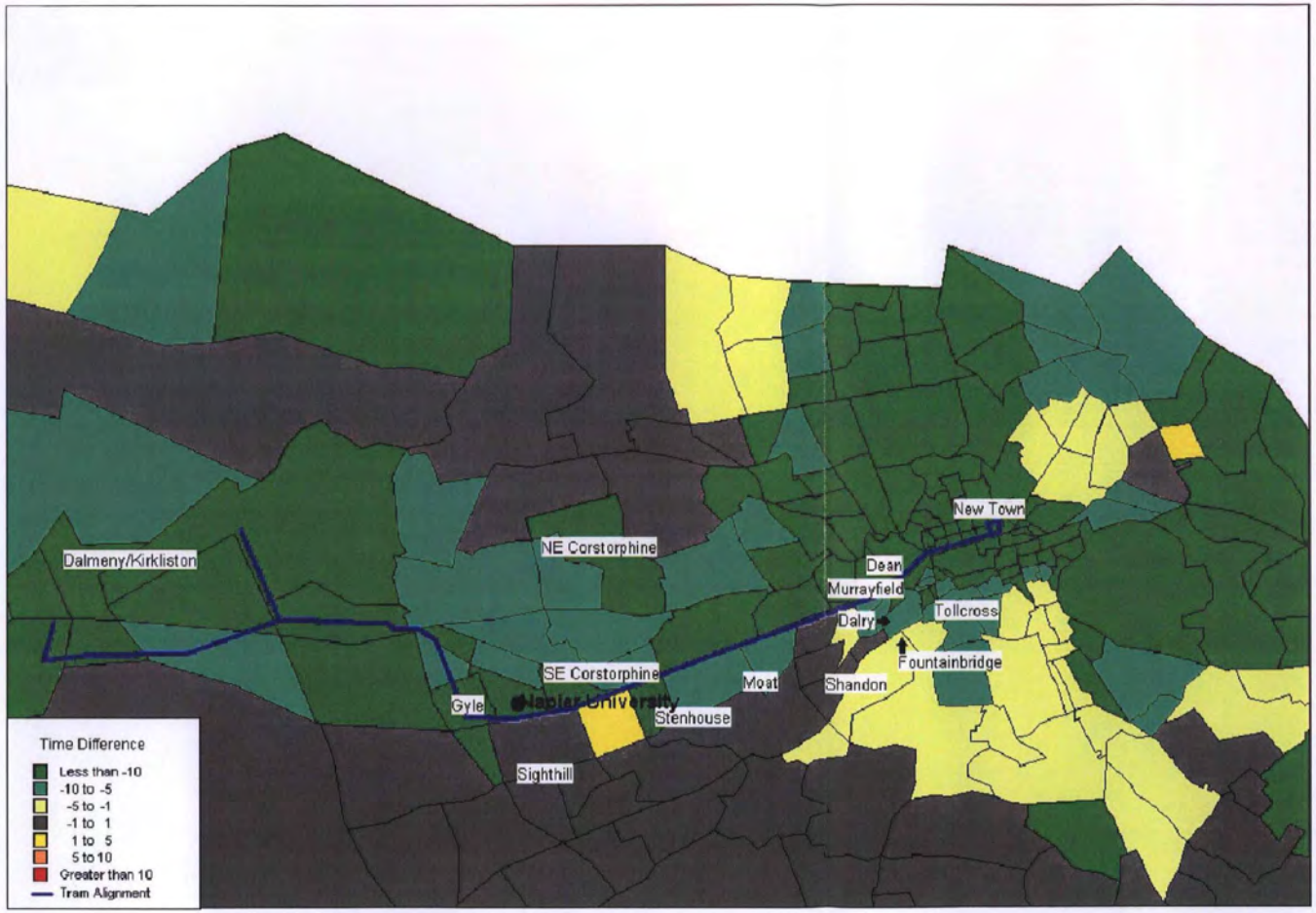


Figure 8.26

Change in AM Peak Public Transport Generalised Time Relative to Car Time to Napier University

FABER MAUNSELL

EDINBURGH TRAM
LINE TWO

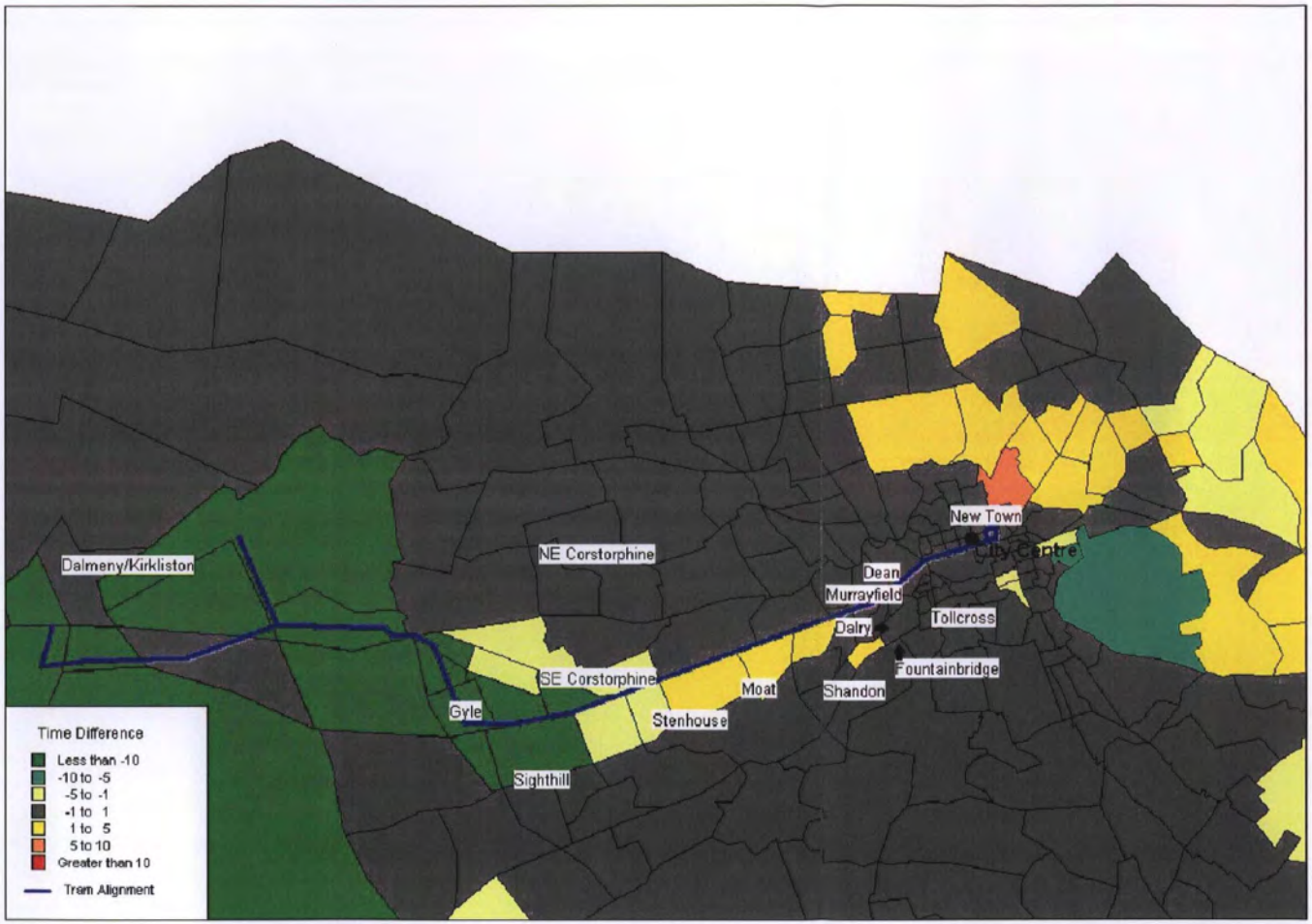


Figure 8.27

Change in AM Peak Public Transport Generalised Time to Edinburgh City Centre

FABER MAUNSELL

EDINBURGH TRAM
LINE TWO

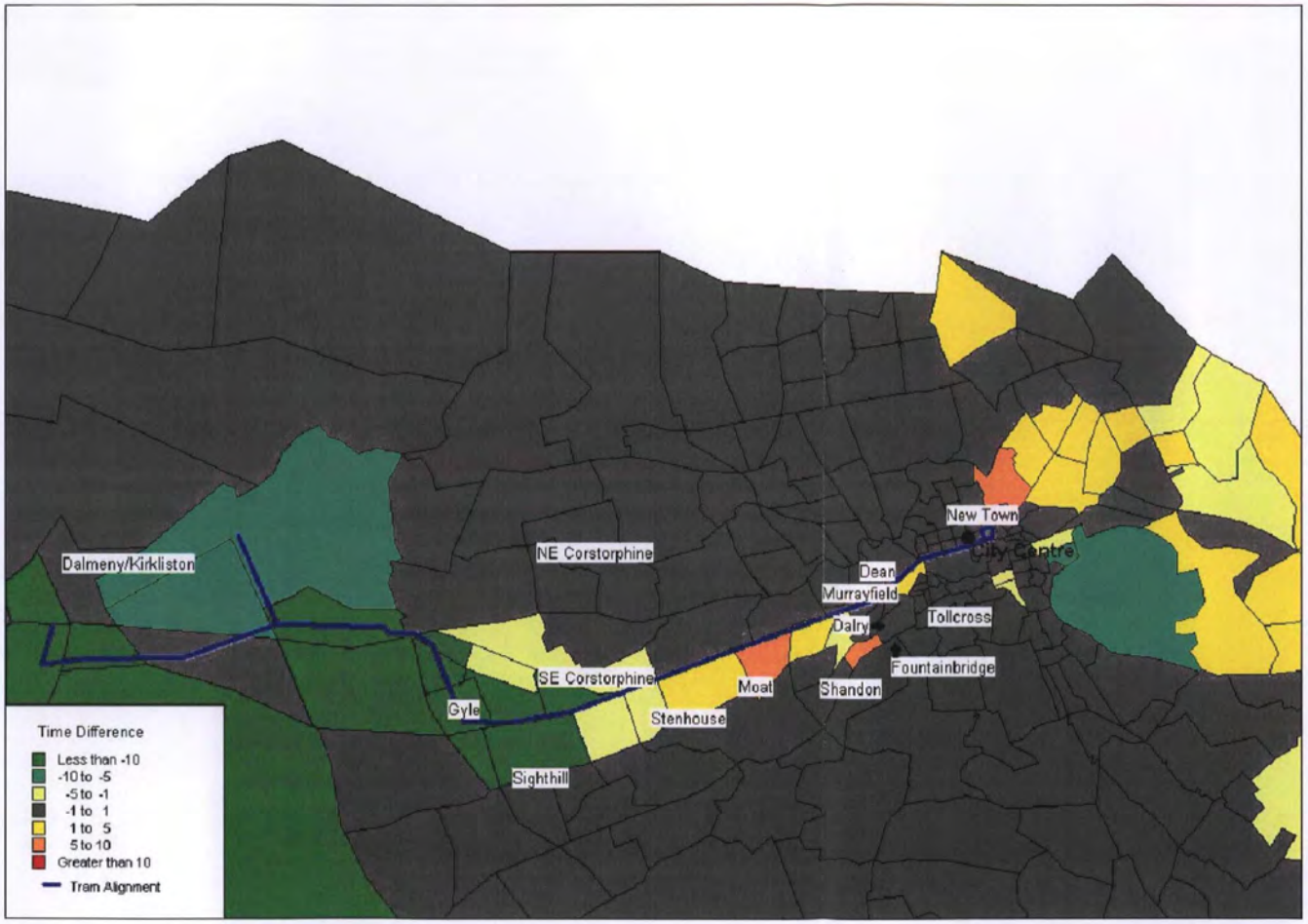


Figure 8.28

Change in AM Peak Public Transport Generalised Time Relative to Car Time to Edinburgh City Centre

FABER MAUNSELL

9 RISK AND UNCERTAINTY



9. Risk and Uncertainty

9.1. Introduction

One of the critical success factors for Edinburgh Tram Line Two is the identification and mitigation of the risks inherent in a project of this nature. HM Treasury's Green Book has identified optimism bias as the systematic tendency for appraisers to be over-optimistic about key project parameters. Evidence from other tram projects in the UK has confirmed this to be a major issue. In order to manage risk in a structured manner, **tie** has appointed a full-time Risk Manager to develop and apply a framework of risk analysis and evaluation to assist in decision-making, and identified the following prime objectives:

- Mitigate all identified risks to a 'medium' significance or less;
- Pass all identified risks to the best parties capable of managing the risk;
- A culture of risk awareness (not risk averse) and management be created;
- Delivery within budget and on time;
- Provide a fully functioning operational service; and
- Obtain support from all key stakeholders.

9.2. Risk Management Process

9.2.1. Early Strategic Risk Appraisal

During 2002, **tie** and CEC gave early consideration to the overall strategic risks associated with the introduction of a tram network in Edinburgh. Previous experience with the proposed City of Edinburgh Rapid Transit (CERT) suggested that a major risk was that associated with the integration of public transport services following introduction of the trams. CEC commissioned a report by Turner & Townsend to review the development of the Edinburgh Tram Line One and the appropriateness of potential procurement routes, funding sources, best practice in scheme delivery and issues and pitfalls on other schemes. Papers were written as a means of briefing both CEC members and officers on the nature of strategic risks related to the proposed tram system and other ITI proposals. Identified risks were recorded as a preliminary risk matrix used as a basis for discussion at a workshop involving CEC officers, the **tie** Board and several key advisors during January 2003. This matrix and discussion upon it assisted **tie** in the formulation of an overall Risk Management Plan.

9.2.2. Line Specific Activities

In parallel with overall risk management, all advisors appointed by **tie** to provide services associated with the tram network and other ITI schemes were required within their appointment briefs to advise **tie** on risks associated with their particular element of work. The advisors for technical, operational and environmental issues have such responsibilities and this report covers both the overall and line-specific issues related to risk management.

Soon after appointment, a line-specific risk register was compiled for each line, with the intention of populating the register with detailed information on the likelihood and potential impact of each identified risk.

9.2.3. Tie Risk Management Plan

Throughout the development of the tram and other ITI proposals, **tie** has initiated and continued to develop a plan for management of risk. The principle components are:

- Appointment of experienced advisors covering legal, financial, technical, operational, environmental, PR and communications, project management and implementation issues;
- Engagement of Partnerships UK for specialist procurement advice;
- Consultation with relevant authorities such as the Office for Fair Trading, Scottish Executive, etc to obtain advice on competition issues and on the funding and development of similar schemes;
- Involvement of an Operator at an early stage in scheme development;
- Periodic briefing and updating of CEC to advise progress and development of risk management process;
- Benchmarking with other schemes;
- Constitution of a multi-disciplinary Risk Management Working Group to facilitate preparation of a consolidated risk register and to monitor the management of risk; and
- Appointment of a full-time Risk Manager to oversee the complete process.

9.2.4. Consultation

In order to reduce strategic risk, **tie** has taken steps to consult with key organisations such as Scottish Executive, City of Edinburgh Council (CEC) and bus operators in the Edinburgh area.

In the case of Scottish Executive:

- In terms of overall knowledge of the progress of scheme development, Scottish Executive has an observer on the board of **tie**. In addition there have been a series of specific consultations:
- The **tie** Risk Manager has held meetings concerned with scheme economics and risk;
- Grant Thornton (**tie**'s financial advisor) has consulted the Financial Partnerships Unit;

- There have been meetings between **tie**, **tie**'s technical advisors and Scottish Executive on the structure and coverage of the STAG report; and
- The Private Bills Unit has been consulted by **tie**'s legal advisor, Bircham Dyson Bell and the land referencing teams.

CEC provides a number of **tie** Board members and is thus directly involved in the decision-making process related to tram scheme development. At the technical level, there has also been regular and close involvement, with Council officers engaged in some of the Topic Working Groups established by **tie**, notably the Planning and Environment Working Groups. These have been involved in detail with development of the Design Manual and with the evolution of streetscape designs in critical areas of the city, with the aim of ensuring that the scheme meets CEC's aspirations for the tram. In addition, a senior officer from CEC Transport is a member of **tie**'s Steering Group, which convenes monthly to discuss all tram projects.

Recognising the importance to the viability of the tram scheme of a properly integrated public transport network, **tie** has been in discussion with major bus operators in the Edinburgh region. In addition to regular liaison at Chief Executive Officer level through the Operator Liaison Group, there have been specific discussions related to the appointment of a tram operator using the DPOF process. See 8.2.6 below.

9.2.5. Risk Transfer and Procurement

Optimal risk transfer dictates that risk is allocated to the party best able to manage that risk. This in turn requires the terms of any contract to be negotiated in order to achieve the optimal risk spread amongst the participants in the project. A key element in determining how best to manage and mitigate the risk has been the evaluation of the appropriate procurement route and the conclusion of this analysis is to separate the Operator and Infrastructure contracts. The consequence of adopting this approach has been to allocate the appropriate risks to the Operator contract and similarly the appropriate risks to the Infrastructure contract. This separation is believed to offer a more attractive commercial package to bidders for the respective contracts and should, as a consequence, deliver a better value for money solution to **tie** and CEC. **tie** and CEC will retain certain risks and will require to ensure that during the operation of the tram system that risk is appropriately attributed to either the Operator or the Infrastructure provider(s).

9.2.6. Early Operator Involvement / Development Partnering and Operating Franchise

The potential for a lack of integration of public transport services to adversely impact the introduction of a viable tram network was recognised at an early stage of scheme development. The review by Turner and Townsend of comparable transit schemes in the United Kingdom (September 2002) also identified a number of issues and problems associated with their delivery. The report did not fully address the issue of mode integration, nor the legal and financial issues of the proposed Edinburgh network.

tie established a Procurement Working Group, comprising representatives from legal, financial and technical advisors, at the end of 2002 in order to address these issues with respect to Edinburgh. The major strategic risks anticipated by the group were:

- Integration of the tram network with other transport modes;
- Delivery of the tram network within an affordable and certain capital cost;
- Delivery within an acceptable timescale; and
- Minimisation of the impact of tram costs on the finances of CEC.

The group considered a range of potential procurement methods to evaluate the performance of these methods in mitigation of the identified risks, concluding that the early appointment of an Operator as an additional specialist advisor to **tie** would be advantageous.

A briefing paper was presented to the **tie** Board during March 2003 and the Board endorsed a decision to proceed with the early appointment of an Operator, the objectives being:

- To begin development at the earliest practical stage as the basis for a successful operating franchise through efficient procurement;
- To foster intellectual and commercial ownership of the tram system infrastructure and its operational characteristics through **tie**'s partnership with an experienced and incentivised public sector tram operator;
- To achieve tram/bus/heavy rail integration in Edinburgh;
- To make operational expertise available to **tie** in order to refine requirements with regard to system design capacity, expansions and performance and to align procurement expectations with likely market response;
- To help verify and strengthen the economic and technical case to be presented to parliamentary inquiry; and
- To provide continuity in operator support for **tie** in management of the infrastructure procurement process.

A sub-group was appointed by **tie** comprising legal, technical and financial advisors augmented by Partnerships UK to prepare 'Invitation to Negotiate' documentation. This has evolved into an agreement for the Development Partnering and Operating Franchise (DPOF). Market testing suggested considerable

support and interest from Operators to this approach, which has continued throughout the contract preparation process.

A presentation of the strategic risks associated with the DPOF process was made to CEC officers during May 2003 in order to assure them that issues related to public transport integration were being adequately addressed.

The Operator will be engaged to help development of the scheme throughout the parliamentary approval process and to assist in procurement and commissioning of infrastructure and equipment, thereby mitigating some of the risks associated with these elements of procurement. At the same time, the Operator will develop, in partnership with **tie**, agreed targets for revenue and operating cost, with the payment mechanism dependent upon performance against these figures and other key performance indicators. It is anticipated that this will aid management of risks during the operational phase.

An appointment of the Operator is anticipated during March 2004, prior to the parliamentary inquiry stage.

9.2.7. Infrastructure Procurement

The Procurement Working Group is undertaking a review of issues of risk, timing and funding associated with potential methods of procurement of infrastructure and equipment. Following appointment, the Operator will also become part of this advisory Group.

9.3. Derivation of Costs and Revenues

The technical teams engaged to advise upon the estimation of costs have extensive experience in the development of tram schemes in the United Kingdom and Europe and are thus cognisant of the likely factors and risks that will impact upon outturn costs. Full details of the derivation of costs and revenues can be found in the Project Cost Report, attached as Appendix F.

9.3.1. Capital Costs Base Data

Where practicable and appropriate, the assumptions used to derive costs have been agreed between the Edinburgh Tram Line One and Edinburgh Tram Line Two technical teams, and agreed with **tie** and Grant Thornton, as **tie**'s financial advisors. For example, rates used for vehicle costs, contractors' preliminaries, design costs and contingencies are consistent for both lines One and Two, as agreed between the advisors. For the majority of other factors, the rates and quantities used vary between Edinburgh Tram Line One and Edinburgh Tram Line Two, as the individual characteristics of each Tram Line are taken into consideration. However, the teams have worked closely together to ensure an overall consistency between estimates for Edinburgh Tram Line One and Edinburgh Tram Line Two.

Estimates have been prepared using a combination of benchmarking, previous experience and engineering judgement to define the works elements and to obtain and refine implementation costs.

9.3.2. Operating Costs Base Data

Operating costs have been built up from a detailed appraisal of likely staffing levels, power requirements, maintenance costs and other related costs such as insurance and policing. These in turn are based upon an assumed operational service pattern and frequency.

The ongoing DPOF process will inform the process to confirm or amend these operating assumptions taking into account advice from the system Operator.

9.3.3. Costing Assumptions

Assumptions used in the derivation of capital and operating costs are as attached in Appendix F.

9.3.4. Revenue and Patronage

The projected revenues for the scheme are summarised elsewhere in this report. Assumptions associated with the estimates are provided in the Cost Report provided as Appendix F.

9.3.5. Benchmarking

tie has undertaken a comparison with other operational tram schemes within the United Kingdom to assess the values adopted for the Edinburgh tram projections. These are reported fully in the Business Case. The principle points of note are summarised as follows:

- Project-wide construction cost overruns have been up to 25% of award construction cost. **tie** will manage this risk by structuring and integrated construction and (potentially) maintenance contract. Current optimism bias value is at 25%. See 8.4.2.
- Completed projects have typically overrun by three to six months with minimal Promoter downside risk due to contractual structures used. Current optimism bias suggests a value of 14%, which represents an additional 5 months on a 36-month construction programme.
- **tie** has the benefit of learning from the experience of other Promoters in respect of time delays and costs escalation. This is influencing choice of procurement method and funding options.
- Based upon current practice and expectations, most Promoters would seek a two-contract structure separating infrastructure and operations, as proposed by **tie**.
- Cost escalations in utilities diversion budgets have been recognised by **tie**.
- The potential advantage to be gained from full cooperation of bus and tram operators has not always been forthcoming on other projects. **tie** has progressed the DPOF process to facilitate this.

- **tie** continues to liase with other Promoters to obtain maximum benefit from their experiences.

Tables 9.1 and 9.2 compare the model results with existing LRT systems and with the original Edinburgh LRT Masterplan Feasibility Study Report forecasts.

Table 9.1 Comparative Annualised Statistics For Existing LRT Systems and Edinburgh Tram Forecasts

System	Route length (km)	No. of stops	Pax boardings (M)	Pax kms (M kms)	Pax boardings per stop (M)	Pax boardings per route km (M)	Pax kms per route km
Manchester Metrolink							
Bury/Altrincham	30.9	24	13.7	136.1	0.57	0.44	4.40
Eccles	9.2	15	2.3	16.2	0.15	0.25	1.76
Croydon Tramlink	28.0	38	16.2	97.0	0.43	0.58	3.46
Sheffield Supertram	29.0	47	11.1	38.0	0.24	0.38	1.31
Midland Metro	20.4	23	5.4	55.8	0.23	0.26	2.74
Edinburgh LRT Masterplan							
Line 1	15.6		11.6	59.5		0.74	3.81
Line 2	16.4		4.2	41.1		0.26	2.51
Line 3	10.1		3.8	19.6		0.38	1.94
Line 2 Study							
Line 2	17.3	18	5.4	43.7	0.30	0.31	2.52

Sources: Edinburgh LRT Masterplan Feasibility Study Final Report and Line 2 Study model results

This comparison shows that Edinburgh Tram Line Two, on its own, is shorter than existing UK systems. When combined with Edinburgh Tram Line One proposals, Edinburgh tram is comparable in length with existing UK systems.

Edinburgh Tram Line Two boardings are low compared to other systems, though in terms of passengers per route kilometre, Edinburgh Tram Line Two is comparable with Midland Metro and is significantly better than Manchester Metrolink Eccles and Sheffield Supertram.

Edinburgh Tram Line Two passenger kilometres are greater than Sheffield Supertram and over twice that of Manchester Metrolink Eccles. Edinburgh Tram Line Two performs slightly better in terms of passenger kilometres per route kilometre

The implication of comparison with existing services, is that Edinburgh Tram Line Two is rather short for a standalone system. It is likely to be more economic if operated as part of an extended tram system, incorporating Edinburgh Tram Line One at least.

This recent Edinburgh Tram Line Two work is in line with previous work by the Edinburgh LRT Masterplan Study, however where as the initial study assumed tram fares were the same as bus, Edinburgh Tram Line Two assumes a 33% premium, which might have been expected to deter some of the passengers.

Table 9.2 Benchmark Fare Statistics For Existing LRT Systems and Edinburgh Tram Forecasts (2000)

System	Annual Revenue (£M)	Revenue per passenger (£)	Revenue per tram kilometre (£M)
Manchester Metrolink			
Bury/Altrincham	15.8	1.15	4.65
Eccles	1.9	0.83	1.90
Croydon Tramlink	12.2	0.75	4.36
Sheffield Supertram	7.1	0.64	2.96
Midland Metro	3.1	0.57	1.63
Edinburgh LRT Masterplan			
Line 1	9.6	0.83	6.4
Line 2	6.0	1.42	4.0
Line 3	3.9	1.03	4.3
Line 2 Study			
Line 2	6.7	1.24	5.7

Sources: Edinburgh LRT Masterplan Feasibility Study Final Report and Line 2 Study model results

Note that Edinburgh LRT Masterplan assumed everyone paid full adult fare and, though patronage forecasts assumed tram fares were the same as bus, the fare values used for part of the revenue calculation were about 50% higher than actual bus fares.

9.4. Optimism Bias

9.4.1. Process

tie and its advisers have considered the implications of the new Green Book Guidance as issued by the Treasury and have discussed the application of this guidance to Edinburgh Tram Line One with PUK and the Scottish Executive.

The Optimism Bias process as required by Scottish Executive for all major public transport schemes is being followed. **tie** 's Risk Manager has taken management control of this process and has consulted both the Executive and the originators of the report developed on Optimism Bias to discuss various aspects of its application to the Edinburgh Tram network.

Optimism Bias provides a methodology to determine what level of additional cost and programme delay should be applied to a project given its particular stage of development. A project at the stage of developing a business case is inherently less certain, in terms of its cost envelope, than one, which is close to contract signature. The Optimism Bias adjustment allows a factor to be applied to the capital costs of a project to reflect this and the costs involved in mitigating the impact of this. Standard factors are given dependent upon the nature of the project based on analysis of previous schemes. This Optimism Bias adjustment sits as a percentage factor above any specific contingencies identified for the particular scheme. It is not therefore a predictor of where the costs might finally end up. No Optimism Bias adjustments exist at present to cover operating costs, lifecycle costs or revenue.

Steps involved are:

- Determine capital expenditure;
- Determine works duration;
- Identify project risks;
- Confirm the impact of risks on capital expenditure and programme
- Determine risk mitigation strategies
- Determine the cost of managing risks
- Review the implementation of risk management
- Allocate risks to Optimism Bias
- Review the scope of the Risk Register
- Assess the Project Type
- Determine starting values for Optimism Bias
- Determine the mitigation Factor for each risk
- Independent review of evidence to support mitigation factor
- Determine Optimism Bias
- Check lower bound is not below recommended values
- Final estimate of Optimism Bias incorporating risk management
- Consider need for further mitigation
- Incorporate capital expenditure including Optimism Bias and risk management costs in financial model.

9.4.2. Benchmarking / Factors Adopted

As there are a number of light rail or tram schemes either in operation or under development in the United Kingdom, it is considered that the starting Optimism Bias factors to be adopted for Edinburgh Tram Line Two are those appropriate to a 'Standard Civil Engineering' project, i.e.

Works duration	20%
Capital expenditure	44%

Various actions to mitigate these factors have been undertaken.

Optimism Bias does not appear to account for the rigorous capital costing methodology employed by **tie**'s technical advisors, that is, determining the cost from the out-turn costs of a number of recent tram schemes. It is therefore considered that the capital costs (net of contingency) include for a portion of Optimism Bias. It has not been possible to quantify this portion and therefore it may be considered that the Capital Cost Optimism Bias is conservative.

9.4.3. Independent Review

The factors adopted as the staring point for the Optimism Bias process have been discussed and agreed with the originators of the report prepared for the Treasury.

9.5. Current Risk Status

9.5.1. Risk Identification

tie and its advisors have identified project risks through workshops, strategic reviews, experience of other UK tram schemes and recording of risks throughout the development process. These risks have been recorded on a register which has been further developed from checklists contained in the following published industry guidance.

- RAMP Risk Analysis and Management for Projects;
- CIRIA Funders Report: Developing a risk communication tool (RiskCom); and
- HM Treasury Review of Large Public Procurement in the UK.

9.5.2. Risk Matrix

A consolidated risk register has been prepared for the tram network and is attached as Appendix G.

For each risk identified, the register identifies:

- The stage of scheme development at which the risk might materialise;
- The underlying nature of the risk (procedural, specification, external influence, etc)
- Elements impacted by the risk (capital expenditure, operating expenditure, revenue, programme, quality, etc)
- Likelihood of realisation prior to mitigation and following mitigation
- Mitigation strategy
- Responsibility for mitigation management
- Mitigation factor achieved
- Status of risk; and
- Dates for action.

In order to review timing, the risks have been categorised in order to identify the risk level of each of the following five stages of the project and to ensure risks are reviewed and mitigated for each stage of the project.

- Planning – STAG AST2 and business case preparation;
- Application for Powers – Private Bill preparation;
- Procurement – Operator and Infrastructure Contracts;
- Construction; and
- Operation.

tie and advisers identified all potential risks. These risks were categorised into the following groups in accordance with HM Treasury guidance:

- Procurement;
- Project Specific;
- Client Specific;
- Environment; and
- External Influences.

Each of the project risks have been assessed against the following principle impacts.

- Capital Costs;
- Operating Costs;
- Revenue;
- Programme;
- Quality;
- Functionality; and
- Approvability.

Of these areas, capital costs, operating costs and works duration (programme) have been shown to lie within Optimism Bias considerations. Two strategies have been adopted to quantify the impact of risk, in accordance with Green Book guidance. The first has been to calculate the Optimism Bias to be applied to Capital Costs and Works Duration. The second has been to appraise the risks associated with operating costs (and revenue) through sensitivity analysis.

The significance of each risk is classified by means of a 5-point AS/NZS system for combining 'impact' and 'likelihood' aspects of each risk in order to prioritise actions.

Table 9.3 Financial and Programme Tolerances

Level	Impact	CAPEX (£)	OPEX/ Life-cycle/ Revenue (£ per annum)	Programme
1	Insignificant	Up to £25k	Up to £25k	Up to 1 week
2	Minor	>£25k to £100k	>£25k to £100k	>1 week to 2 weeks
3	Moderate	>£100k to £500k	>£100k to £500k	>2 weeks to 1 month

The following range of likelihood's are proposed:

Table 9.4 Proposed Likelihood's

Level	Likelihood
1	Remote
2	Unusual
3	Possible
4	Probable

The likelihood of risks and impacts can be combined in a 2-dimensional table as follows:

Table 9.5 Likelihood of Risks and Impacts

Likelihood/ Impact	Insignificant	Minor	Moderate	Significant	Major
Remote	1	2	3	4	5
Unusual	2	4	6	8	10
Possible	3	6	9	12	15
Probable	4	8	12	16	20

The following significance of risk has been adopted:

Table 9.6 Significance of Risk

Significance	Range		Colour
Negligible Risk	>=0	<4	WHITE
Low Risk	>=4	<8	WHITE
Medium Risk	>=8	<12	ORANGE
High Risk	>=12	<16	ORANGE

9.5.3. Key Risks

tie has developed clear and active processes to prevent and mitigate project risks in accordance with industry best practice. Through this management, a total of 101 risks have been identified.

A number of lessons have also been learnt from the previous UK tram schemes. The following key risks occurred on other UK tram schemes have been recognised and duly mitigated through **tie**'s procurement strategy, consultations and design and cost assumptions.

- Revenue – reduction in tram capacity, negative PR, bus competition (fares and coverage) and overestimated revenues;
- Capital Costs – underestimated costs due to utility diversions, compliance with planning, traffic management and bid costs;
- Approvability – planning issues and negative PR; and
- Operating Costs – lack of tram priority and reduced operational performance.

Utilising the ranking process identified above the principle very high risks arising from this exercise can be summarised as follows:

- SE funding availability is less than **tie** requires to proceed - A key element of this Business Case is to demonstrate the requirement for a minimum amount of SE funding to enable the project to proceed.
- Delay in securing other funding sources beyond SE funding – **tie** have mitigated this risk through review of alternative funding options by **tie**'s financial advisors and discussions with potential lenders.
- Passenger numbers are lower than forecast – **tie** and their technical advisors have established a conservative and credible base model and reviewed the factors affecting revenue, assumptions and sensitivities. Further comfort will be gained through early involvement of an experienced Operator.
- Delay and cost increases due to CEC Planning requirements – **tie** have significantly mitigated this risk through convening a Planning and Environment Working Group who have held regular meetings with Planning Department and sought approvals of Design Manual and proposals to account for the World Heritage Site.
- Inclusion of CETM influence on the Project – **tie** and their advisors have considered the influence of CETM and discussed this with CEC;
- Delays due to lack of Parliamentary time with other Bills under consideration, Bus Operator Objections or change of Transport Minister, **tie** and their Parliamentary Legal Advisors have discussed protocol with Parliamentary Bills Unit and commenced procurement of a tram Operator to bring about integration with Bus Operators.

- Capital costs associated with land purchase, contractor's area and compensation, Network Rail, unforeseen ground conditions, vehicle costs, CEC/**tie** instructed changes and utility diversion costs exceed current forecasts following completion of the DPOF process and breach the contingency level included within the model. This risk should be mitigated through the level of work undertaken to date by the technical advisers and inclusion of Optimism Bias to account for further design development.
- Operating costs exceed current projections due to lack of priority to tram at junctions. The DPOF process will identify cost issues but not until after completion of considerable further work by the selected partner. This could be influenced by specification issues, such as staffing levels.

The risks listed above represent, in some instances, those considered as most serious to the success of the project in the short term and also certain ongoing risks which will require management as the project progresses. **tie** will use the risk mitigation summary as a means to undertake this process through regular reviews and updates of the risk documentation and proactive management of the risks.

9.5.4. Treatment of Contingency

The technical advisors have included where appropriate a contingency allowance against possible increases in capital costs. It should be noted that such allowances are deemed to be included within the allowance for Optimism Bias.

9.5.5. Residual Optimism Bias Factors

The extent to which risks have been mitigated is measured by a mitigation factor, that is, 0.0 means that risks in a project risk area are not mitigated and 1.0 means all the risks in a project risk area are fully mitigated. **tie** has ensured that clear and tangible evidence has been observed prior to reducing the Optimism Bias.

Responsibilities were allocated amongst **tie**, various **tie** Working Groups and advisers for each risk and, in particular, to develop a risk mitigation strategy. The risk mitigation strategy sets out an understanding of the risk identified, the actions to be taken to minimise the impact of the risk, by whom and to an agreed timescale. Furthermore, the list of risks was reviewed to identify the "critical path" risks, being either fundamental in principle, or time critical to the success of the project. These risks have been managed by **tie** to ensure risks are addressed in an ongoing positive manner. It is intended that the risk register will be updated regularly as the project progresses, and will be a utilised by **tie** as a live risk management tool.

Given the level of development the project has reached, together with the amount of mitigation that has been carried out across the range of risk areas identified by Optimism Bias, it is considered appropriate to use lower factors of 25% for Capital Cost Optimism Bias and 14% Works Duration Optimism Bias.

9.6. Sensitivity Analysis

A number of sensitivities have been tested within the financial modelling exercise, designed to simulate a number of the key project risks. These sensitivities are designed to test the overall financial robustness of the project, and to give an indication of the impact of key project risks on the financial structure proposed.

Base data used for revenue and operating costs in 2011 and 2026 is as follows:

Table 9.7 Base Data

Year	Revenue	Operating Cost	Operating Surplus/Deficit
2011	£6.36M	£6.35M	£0.01M
2026	£8.31M	£6.84M	£2.19M

All costs and revenues are adjusted to 2003 prices. The increase in operating costs between 2011 and 2026 arises as a result of an assumed increase in salaries above inflation.

Revenues for 2011 are adjusted for an anticipated ramp-up to forecast levels within the early years of system operation. Revenues for both 2011 and 2026 take account of assumed losses due to concessionary fares and fare evasion.

The principle sensitivity tests are summarised below.

9.6.1. Newbridge Shuttle

An obvious option for phased construction of Edinburgh Tram Line Two is to curtail the initial phase at the Airport, omitting the section between Ingliston and Newbridge. A number of possible scenarios were considered varying the eastern termination of the shuttle and the availability or size of a possible park-and-ride site at Newbridge.

Under these circumstances:

- Operating costs in 2011 and 2026 would reduce by £1.12M and £1.21M respectively.

Revenues in 2011 and 2026 would reduce by £0.38M and £0.35M respectively.

9.6.2. Congestion Charging

The main purpose of congestion charging is to reduce traffic delays in the city. Tests for this study show charging to be successful in this respect, increasing both highway speeds and bus speeds, though where greenways already exist, the impact on buses is negligible as they are already largely protected from traffic delays. The consequence of congestion charging on tram is that buses become faster and are better able to compete with tram. As a result this test causes tram patronage and revenue to reduce in 2011.

Tram does extend beyond the congestion charging area. The stops at Gogar Burn, Ingliston, Airport, Ratho Station and Newbridge become more attractive to car users as an alternative to paying the congestion charge.

By 2026 there is more development along the A8 corridor outside the congestion charging border, so movements across this border become more important. As a result, the impact of cross-boundary trips becomes more important than the impact of improved bus competition.

The tests indicate a reduction in revenue of 8.1% in 2011 and an increase of 1.8% in 2026.

9.6.3. Bus Competition

It is acknowledged by **tie** that the integration of bus and tram services is critical to successful operation and CEC/**tie** are seeking to ensure maximum cooperation of the bus operators through the DPOF process. However, it is realistic to assume that bus operators might act competitively or in cooperation.

From a base scenario which is perceived to be neutral, a competitive case was tested assuming increased frequency of bus services on the A8 and A71 corridors

The impact on revenue arising from this test indicated a potential fall in revenue of 18.3% in 2011 and 11.5% in 2026.

9.6.4. Bus Co-operation

Similarly, it was assumed that if bus operators are cooperative, there would be a reduction in bus services which on their present routing would compete directly with the tram.

Under the assumed scenario, tram revenues would increase by 13.4% in 2011 and 12.5% in 2026.

9.6.5. Airport Heavy Rail Link

Proposals to divert the Edinburgh – Glasgow main railway line to pass beneath and interchange with Edinburgh Airport are being taken forward for further development.

There are a number of variables such as the frequency of the heavy rail service and the level of fare to be applied which would affect the tram patronage and several tests were done to examine this. For the purposes of this report a probable scenario assuming 5 trains per hour and standard rail fares has been used.

9.6.6. Tram Fare Adjustment

Tram Fare is assumed to be 33% greater than bus fares. The tram fares for existing systems in other UK cities range between 0% to around 35%, so the assumption for Edinburgh is at the upper range of existing practice.

Model tests were done varying the tram fare by plus and minus 10%. The Airport premium fare was kept constant.

Table 9.8 Tram Fare Adjustment

	-10% tram fare (+20% over bus fare)		**+10% tram fare (+46% over bus fare)**	
	2011	**2026**	**2011**	**2026**
Patronage	0.9%	5.9%	-11.0%	-2.5%
Revenue	-5.1%	-3.1%	-5.3%	2.7%

This shows that the current fare assumption of +33% over bus fares provides about the best return in terms of revenue optimisation in 2011. However, by 2026 passengers are less sensitive and a higher fare may generate more revenue, despite the loss in patronage.

The adjustment of tram fares is within the purview of **tie** and the Operator and it may be assumed that any change is unlikely if it were to result in reduced revenue.

9.6.7. Tram Frequency

The tram has been evaluated on the assumption of 6 trams per hour, which is adequate for providing enough supply to meet the forecast demand, as long as the vehicles are large enough and it is the minimum frequency generally considered reasonable for a mass transit system such as tram.

The impact of higher frequency services has been tested. For 8 trams per hour, similar to the frequency proposed for Edinburgh Tram Line One, revenues would increase by 8.2% in 2011 and 16.0% in 2026.

This is an additional operating cost (and capital cost). The estimated increase in cost is about £0.47M in 2011 and £0.50M in 2026.

9.6.8. Park and Ride

The tram forecasts include patronage from proposed P&R. Modelling has indicated a high demand for these facilities, constrained by the car park capacity provided. Early consideration was for separate sites at both Newbridge and Ingliston however latest CEC plans are to not provide a Newbridge P&R in favour of further commercial development, which itself may generate some tram trips. However, the intention is to provide adequate capacity for demand at Ingliston.

A further constraint on P&R PT passenger demand is the occupancy of the cars which park at these sites. Average occupancy varies at individual sites, a value of 1.8 has been assumed based on P&R surveys carried out for sites in Aberdeen.

An assessment of the potential impact of low and high P&R usage has been done by considering two scenarios.

- Low P&R estimate assume:
  - an average car occupancy of 1.4;
  - 1000 P&R car park places.
- High P&R estimate assume:
  - an average car occupancy of 1.8;
  - 1500 P&R car park places; and
  - Saturday P&R demand is a quarter of the constrained weekday P&R usage.

The findings are summarised in Table 9.9.

Table 9.9 – P&R Sensitivities

	Low P&R estimate		High P&R estimate	
	2011	2026	2011	2026
Patronage	-4%	-3%	3%	3%
Revenue	-4%	-3%	3%	3%

9.6.9. Worst Credible Scenario

As the initial omission of the Newbridge shuttle is a major factor in determination of likely outturn costs and revenues, results for the worst and best credible combination of circumstances are presented for the situation both with and without Newbridge shuttle.

This section suggests a worst possible combination of circumstances for tram operation, namely that which assumes congestion charging, a competitive bus response and the implementation of a heavy rail link. Changes in tram fare are not considered as it is unlikely they would be implemented if it would reduce revenues.

The impacts are summarised as follows:

Table 9.10 Worst Credible Scenario Including Newbridge Shuttle

Year	Base Revenue	Congestion Charging Impact	Bus Competition Impact	Airport Rail Link Impact	Combined Impact	Adjusted Revenue	Operating Surplus / Deficit
2011	£6.36M	-8.3%	-18.3%	-25.1%	-43.9%	£3.57M	-£2.78M
2026	£8.31M	+1.8%	-11.5%	-14.4%	-22.9%	£6.41M	-£0.43M

Table 9.11 Worst Credible Scenario Excluding Newbridge Shuttle

Year	Base Revenue	Congestion Charging Impact	Bus Competition Impact	Airport Rail Link Impact	Combined Impact	Adjusted Revenue	Operating Surplus / Deficit
2011	£5.98M	-8.3%	-18.3%	-25.1%	-43.9%	£3.36M	-£1.86M
2026	£7.96M	+1.8%	-11.5%	-14.4%	-22.9%	£6.14M	+£0.51M

Clearly the major impacts are from Bus Competition and the Airport Rail Link. An operating surplus will require that these two adverse impacts do not occur together, particularly in the early years of tram operation.

CEC and **tie** are working to minimise the possibility of excessive competition from the bus operators through the DPOF process. Other action may be possible through the introduction of quality bus contracts should the DPOF process not produce the desired effect, but such action may not be practical or desirable.

The implementation of the heavy rail link is not committed. If implemented it will be appropriate to investigate the extent of any resultant benefits which would offset the potential disbenefit to the tram.

9.6.10. Best Credible Scenario

The probable best option for the tram would be operation of an increased frequency in a cooperative bus environment. Again, the potential long-tern benefit from fare increases is ignored in this combination, which also assumes that neither congestion charging nor the Airport rail link would be implemented.

The impacts are summarised as follows:

Table 9.12 Best Credible Scenario Including Newbridge Shuttle

Year	Base Revenue	Bus Competition Impact	Tram Frequency Impact	Combined Impact	Adjusted Revenue	Adjusted Operating cost	Operating Surplus / Deficit
2011	£6.36M	+13.4%	+8.2%	+22.7%	£7.80M	£6.82M	+£0.98M
2026	£8.31M	+12.5%	+16.0%	+30.5%	£10.85M	£7.34M	+£3.51M

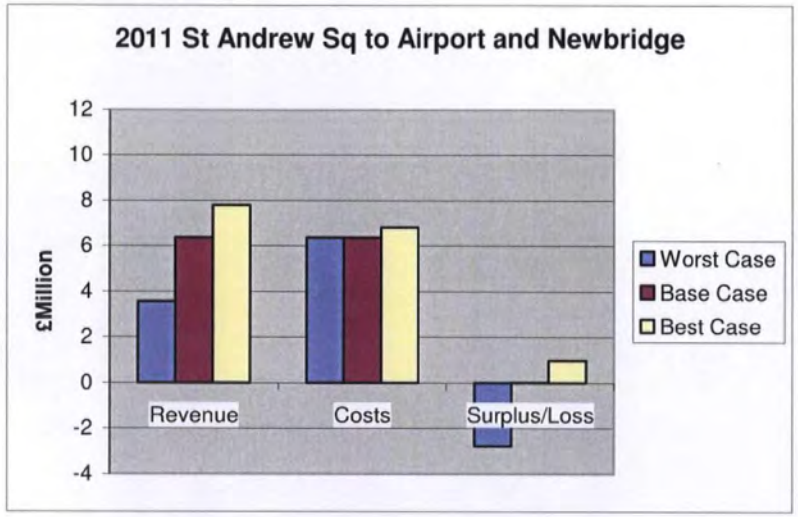
Table 9.13 Best Credible Scenario Excluding Newbridge Shuttle

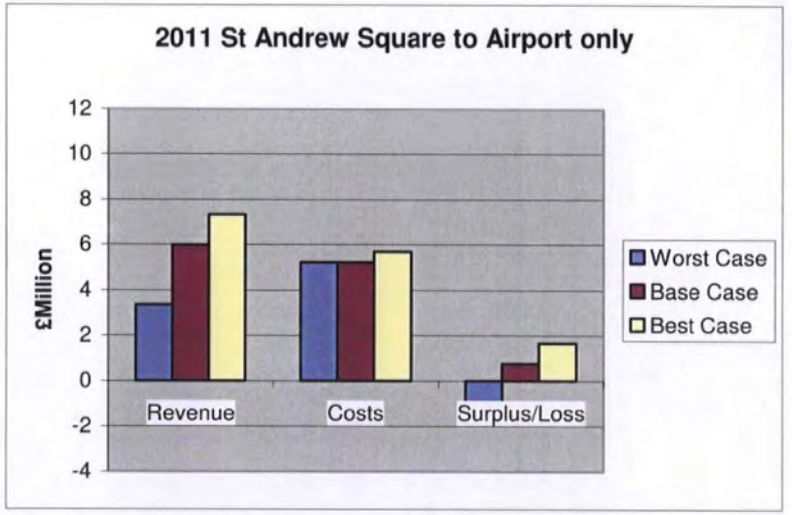
Year	Base Revenue	Bus Competition Impact	Tram Frequency Impact	Combined Impact	Adjusted Revenue	Adjusted Operating cost	Operating Surplus / Deficit
2011	£5.98M	+13.4%	+8.2%	+22.7%	£7.34M	£5.69M	+£1.65M
2026	£7.96M	+12.5%	+16.0%	+30.5%	£10.39M	£6.13M	+£4.26M

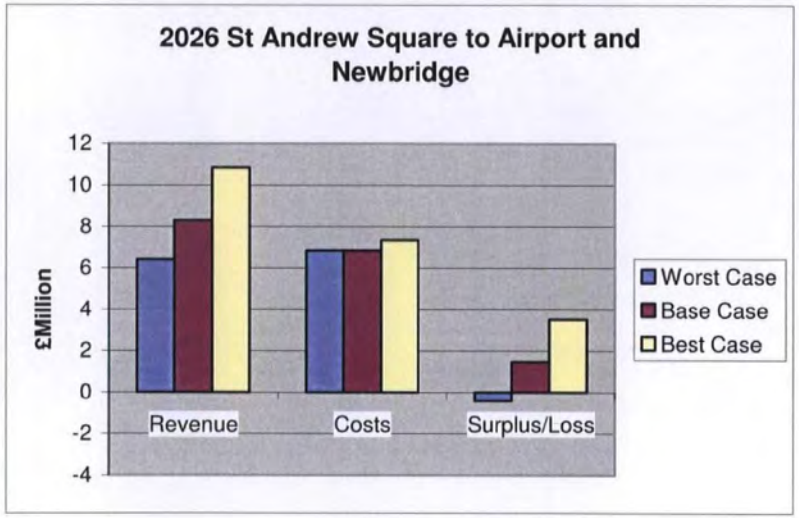
Should congestion charging be introduced to the above combination, it is noted that there would continue to be an operating surplus in 2011 and 2026 with or without the Newbridge shuttle.

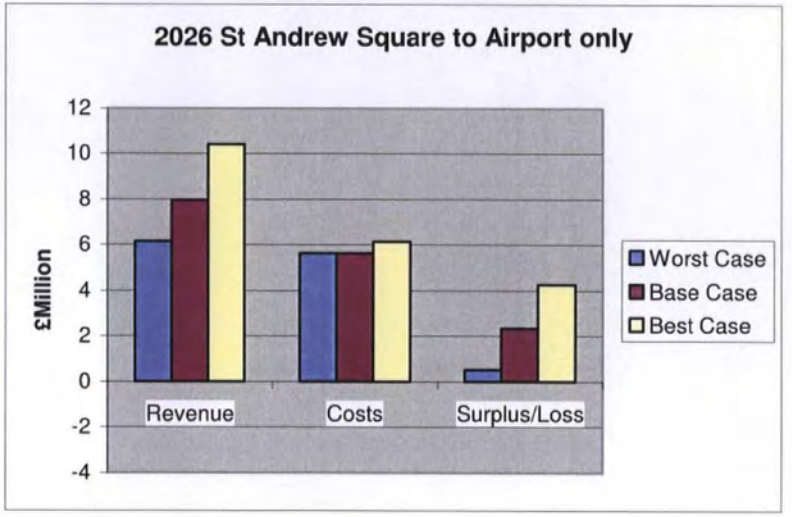
Introduction of the Airport Rail Link would lead to an operating loss with the Newbridge shuttle of about £1.6M in 2011 which would convert to a surplus of about £0.27M in 2026. Without the shuttle the tram would have an operating loss of £0.7M converting to a surplus of about £1.2M in 2026.

The revenues, operating costs and surplus/loss figures for 2011 and 2026, with and without the Newbridge shuttle are presented graphically in the following diagram:









9.7. Ongoing Risk Management Process

9.7.1. TIE Risk Management Structure

Ultimate responsibility for risk is taken by the **tie** Board, with responsibility delegated to the Projects Director. He has appointed a Risk Working Group comprising advisors covering technical, legal and financial issues, together with **tie**'s appointed Risk Manager. He is responsible for executing or overseeing actions necessary to mitigate risk on the tram scheme.

9.7.2. Development Partnering and Operating Franchise Agreement

It is expected that the DPOF Agreement will be signed with the selected Operator about March or April 2004. During Phases A and B of this agreement, the Operator will work in conjunction with **tie** and **tie**'s other advisors to agree contractual target costs and revenues, based upon accepted operating assumptions. Target costs will be based upon information submitted in a competitive tendering situation, adjusted as appropriate to accommodate any agreed changes in operating assumptions.

During Phases A and B, the Operator will also be advising upon the extent and quality of the infrastructure and equipment to be procured under the Infrastructure Delivery Agreements.

9.7.3. Further Work

It is clear from the above results that many of the potential risks will have negative impacts on the patronage and revenues for the Tram. Further work is being undertaken to provide further detail on the level of these impacts and to take steps to ensure that the possibility of these risks occurring are minimised. For example, as indicated above, work is ongoing to ensure that the existing bus operators respond in a cooperative way to the introduction of the Tram rather than in a competitive manner. Further work is also being undertaken to understand more fully the impacts of congestion charging particularly in the light of the evolution of the form of that system.

10 MONITORING AND EVALUATION



10. Monitoring and Evaluation

10.1. Introduction

10.1.1. Requirements of Stag

STAG guidance requires that a new project be subject to planned evaluation and monitoring, in addition to regular revalidation of the project throughout its development.

STAG defines Monitoring as *"an on-going process of watching over the performance of a project identifying problems as these arise and taking appropriate action"*, while Evaluation is used for *"specific, post-implementation events, designed to assess the project performance against established objectives and to provide in-depth diagnosis of successes as well as deficiencies"*. Therefore, by gathering and interpreting information, monitoring and evaluation will demonstrate how the project performs against its objectives, identify any deficiencies and allow adjustments to be made.

Soon after implementation, the performance of the project should be assessed against the specified objectives – the process evaluation. Recognising that certain projects, including public transport projects, require time before the full benefits can be realised, a further evaluation – the outcome evaluation – is required some time after implementation.

In addition, regular monitoring of the project is essential against specified Key Performance Indicators (KPIs) to assess the ongoing effectiveness of the scheme.

This Chapter describes the measures put in place by **tie** to meet the requirements of the STAG guidance with respect to evaluation and monitoring.

10.1.2. Stages of the Project

There are five phases of the project which require consideration during the monitoring and evaluation process, namely:

- Scheme development;
- Infrastructure procurement;
- Construction;
- Testing and Commissioning; and
- Operations.

The STAG requirements for monitoring and evaluation are principally associated with the operational phase, following scheme implementation. However, it is also necessary to assess and re-appraise the project during phases prior to implementation. Actions to be undertaken by **tie** during scheme development, procurement and construction to assess impacts on programme, costs and potential revenues are also described below.

10.2. Objectives

10.2.1. Introduction

The objectives for this scheme are described in Chapter 2 of this report. The specific project objectives are derived from a range of national, regional and local objectives reflecting transport and more diverse government and local authority strategies.

10.2.2. Project Objectives

The specific scheme objectives developed for the tram project as listed in Chapter 2 are as follows:

- Accessibility
  - To improve access to the public transport network;
  - To improve access to employment opportunities; and
  - To support economic development.
- Environment
  - To increase the proportion of journeys made by public transport, walking and cycling;
  - To improve local air quality;
  - To reduce emissions of greenhouse gases
- Traffic congestion
  - Reduce the number of private vehicle kilometres; and
  - Reduce traffic volumes on key routes.

- Safety
  - Reduce the number of road traffic accidents; and
  - Improve personal security when using the transport system.

10.2.3. Project Stage Influences

All development work undertaken to date has been done with the above objectives in mind. The choice of alignment and development of the design and specification has been directed towards meeting or aiding these objectives. The following are amongst the factors taken into account during scheme development to date:

- The introduction of the tram will improve travel mode choice for Edinburgh, providing a fast, clean and efficient service as an attractive alternative to the private car which should help reduction of congestion both on public transport and in general traffic;
- Design proposals have considered the interface between trams, buses and other transport modes, with the objective of favouring public transport, thereby encouraging an increase in the use of public transport and reducing the need for car travel;
- In turn, it is anticipated that the reduction will lead to improvements in road traffic accidents and in some environmental criteria such as air quality;
- The proposals to accommodate the tram on Princes Street have also been developed with the intention of improving the pedestrian environment in this well-used area of the city;
- A Design Manual has been developed for the tram and its immediate environment which will undergo periodic revision to reflect and enhance the city streetscape;
- Route options considered have been chosen to penetrate population centres in socially disadvantaged areas, thereby increasing access for low income groups;
- Specifications for infrastructure and equipment are being developed to cater for the mobility impaired.

During future scheme development, the scheme objectives will continue to be under review and re-appraisal where appropriate. As examples, the following are cited:

- Operating patterns will be reviewed in conjunction with the Operator (appointed through the Development, Partnering and Operating Franchise – DPOF – Agreement) to establish the optimum service pattern and frequencies;
- The Service Integration Plan will be finalised between the tram Operator and bus companies to encourage optimum use of public transport;
- Junction operation will be reviewed with the Operator and CEC to optimise priorities for public transport modes and minimise congestion;
- Operating plans will be developed with the Operator covering all aspects of operational safety;
- The Design Manual will continue to be developed to reflect the wishes of CEC and the community with respect to streetscape; and
- Specifications for infrastructure and equipment will be developed in conjunction with the Operator to obtain benefits with respect to safety, passenger security, system accessibility, etc all leading to improved public perception and system attractiveness.

Proposals will be agreed with CEC and the Operator for future fares policies, possibly including discounted fares which will encourage tram use by low-income groups.

10.3. Base Case

STAG guidance recognises the problems associated with establishing a valid Base Case against which the performance of the scheme may be judged. In the case of the tram scheme, there is an additional difficulty introduced by the length of the lead time prior to implementation of tram operations, which is unlikely to be before 2009. It is also possible that tram introduction may be phased.

Under these circumstances it is premature to be prescriptive in terms of the establishment of the collection and organisation of the data that will provide the Base Case. It is anticipated that this will be developed and agreed by **tie** with CEC and the Scottish Executive for execution during the period immediately prior to initial operation on any part of the tram network. In the case of environmental base data, it will also be necessary to consult with other heritage and conservation bodies to ensure that any changes in the environment since production of the Environmental Statement can be accommodated.

It is likely that the baseline data will include but will not necessarily be limited to:

- Data on noise, water quality, air quality, ecology, tree surveys and the like;
- Passenger usage on public transport, particularly buses and heavy rail services upon which patronage may be affected by the introduction of the tram;
- Junction performance, queue lengths, etc at critical locations;
- Mode choice survey;
- Safety records.

It will be important to establish through discussions with other organisations (e.g. CEC, train and bus operators) what information is available as part of their regular data gathering functions at that time, to avoid incurring additional cost and to limit the collection of new information to that which is strictly necessary to establish performance against scheme objectives.

It is also noted that it may be necessary to obtain some base line data prior to start of construction to be certain that construction activities do not adversely impact the validity of any changes measured.

10.4. Project Development, Procurement and Construction

10.4.1. Project Validation

There is a five to six year period required for scheme development, approval and construction. It is possible that circumstances may change within that time, which could affect the assumptions made regarding the scheme. For example, CEC will be implementing various Integrated Transport Initiative projects during that period and it will be necessary to keep under review the tram objectives, taking into account any changes in the underlying transport situation resulting from these and other measures.

Future changes in planning and transportation strategies as proposed or implemented by CEC would also result in a re-assessment of the tram proposals. Such changes might influence phasing of the network, detailed design or planned service pattern and frequency which would be assessed by **tie** and its advisors.

10.4.2. Cost and Revenue Review

The DPOF contract through which the Operator will be appointed, will be initiated during the spring of 2004. The initial phases of this contract, in place during 2004 and 2005, cover continuing development of the scheme leading to procurement of the infrastructure and equipment. It is a requirement of the contract during these phases that the Operator reviews the operating assumptions leading to existing estimates of patronage, revenue and operating costs. Any changes to the factors which affect these estimates must be agreed between **tie**, its advisors and the Operator. The DPOF Target Costs will be adjusted using the cost build-up submitted by the Operator as part of his Bid as a basis. Similarly any change in revenue estimates will be agreed.

DPOF also recognises that there may be subsequent changes to infrastructure and/or operating plans which could lead to changes in agreed costs and revenues, both before and after the start of operations. The DPOF Agreement includes a mechanism for adjustment of target costs and revenues and incentivises the Operator to achieve these targets through a pain/gain sharing formula during operations.

Thus the operating costs and revenues will be under continual review throughout the project development and operating phases.

In addition, **tie** will instigate a regular review of the costs associated with infrastructure and equipment during the development, procurement, construction and commissioning phases to confirm the ongoing validity of estimates and underlying assumptions.

10.4.3. Programme Monitoring

tie will lead a project management team comprising various advisors throughout scheme development and construction. In addition to monitoring changes in capital and operating costs and revenues, the same team will also regularly review progress against the assumed project programme, thereby evaluating any potential for changes in project costs and associated risks.

10.5. Operations

10.5.1. Process Evaluation

Evaluations are specific post-implementation events designed to identify whether:

- A project has performed as intended (or under or beyond expectations);
- Established objectives have been achieved (fully or partially, and the reasons for any failures); and
- The project continues to represent value for money (also considering actual cost budget).

The Process Evaluation is conducted straight after the implementation. It will draw lessons for on-going implementation and for the design, management and implementation of future projects.

For the reasons given above with respect to Base Case data, it is not possible at this stage to be specific about the nature of the process evaluation. It seems likely at this stage that there will be a need to provide data which will measure changes in the baseline parameters mentioned above such as various environmental parameters, public transport passenger counts, mode choice surveys and junction performance. Particularly in the case of the last of these, it would be prudent to ensure that junction performance is optimised to benefit the public transport modes without excessive inconvenience to general traffic. The introduction of additional minor traffic control measures to assist this process might be desirable and a process evaluation soon after implementation would provide information to justify any such action.

Table 10.1, below, summarises a possible example which might be employed as the basis for the process evaluation:

Table 10.1 Evaluation Performance Indicators

Objective	Performance indicator/measure	Performance target	Source of indicator	Monitoring method and frequency
Costs	Proportion of actual costs over budget	• X% of budget exceedance	Project costs	Budget and cost comparison – after implementation
	Proportion of budget allocated to the CEC which was actually spent within timescale	• X% budget spent by completion	Project costs by time	Project costs by time – after implementation
Views	The extent to which (stakeholder, public) consultation influenced outcomes	Significant number of views taken into account	Consultation process	Qualitative examination of consultation, by group
	Stakeholder's views on how well the project was designed and implemented	Overall positive views	Stakeholder interviews	Qualitative survey results by group – after implementation
Transport	The extent to which public transport model results reflected reality	• Travel time • Patronage • No bus services withdrawn or modified	PT model, TIMS, bus operator timetable and after surveys	Comparison between modelled and actual – after implementation and again one year later
	The extent to which highway model results reflect reality	• Traffic diversion • Congestion • Delays	Highway model and traffic surveys	Comparison between modelled and actual – after implementation and again one year later
Local economy	Actual impact on economic activity	• Employment • Commerce • Tourism	Before and after surveys	Comparison between before and one year after implementation, by location and activity

10.5.2. Outcome Evaluation

It is recognised that the full potential of a new transport mode will only be realised some time (perhaps 2 to 3 years) after its introduction. It is for this reason that the DPOF contract proposes a review and possible revision of Target Costs and Revenues after such a period. The outcome evaluation would probably be undertaken as part of the process to be followed prior to agreeing any change of the targets and would be based on similar data to that collected for the baseline survey and process evaluation mentioned above.

10.5.3. Monitoring

The payment mechanism within the DPOF contract for the tram project includes four discrete elements related to payment during the Operations phase:

- Operating costs and profit element;
- Performance regime;
- Pain/gain share mechanism;
- Vision achievement bonus.

The evaluation of payments due will require a degree of monitoring to be undertaken as a regular function of operations. The pain/gain share payment will be dependent upon the financial performance of the tram and will offer the Operator and **tie** the opportunity to share in savings on operating costs below the agreed Target Operating Cost and in any revenues generated in excess of the Target Revenues. The performance of the system with respect to operating costs and revenues will be undertaken on a daily basis and evaluated at no greater an interval than 28 days.

In addition, a significant proportion of payment is linked to the Performance Regime and the Vision Achievement Bonus. The Performance Regime is the day-to-day mechanism through which **tie** will monitor and incentivise the Operator to deliver a high quality and attractive tram scheme which will satisfy the primary scheme objectives, by increasing public transport use and reducing car use. Deductions will be applied to payments in the event of unsatisfactory performance against 7 Key Performance Indicators (KPIs).

The KPIs against which the service will be measured are:

- Headway – measuring performance against scheduled service intervals;
- First and last tram – punctuality of first and last services;
- Cleanliness of tram interiors and stops fulfilment of maintenance obligations;
- Security – to gauge personal security, equipment and incident responses;
- Information and signage – currency and coverage of service information;
- Revenue generation and protection – availability of ticket sales points and minimisation of fare evasion;
- Customer satisfaction – to indicate a measure of good performance in public perception.

These KPIs have been selected as being the aspects of service most likely to influence the attractiveness of the system to users, which in turn will assist achievement of the objectives set down for the tram.

The Vision Achievement Bonus is also payable dependent upon a consistent performance against these KPIs over time, promoting continued high quality service.

It is recognised that monitoring of these KPIs will not address all the expectations of the STAG guidance in assessing the performance against the scheme objectives and additional monitoring will be required for this purpose. It is proposed that the details of such performance indicators be developed in conjunction with interested parties closer to the date of service introduction. Nonetheless, based upon the planning objectives discussed in Chapter 2 of this report, the following performance indicators could be appropriate:

- Accessibility:
  - Improve access to public transport network;
  - Improve access to employment opportunities.
- Environment:
  - Increased use of sustainable modes;
  - Reduce local and global emissions, improving air quality.
- Traffic congestion:
  - Reduce traffic volume on key routes;
  - Reduce traffic delays.
- Safety:
  - Reduce traffic accidents.

A monitoring survey framework could be generated, which will encompass the collection, analysis and interpretation of data generated by:

- Traffic count surveys (e.g. cordon and screen line, but first checking the availability of any on-going traffic surveys by CEC or any national data sources);
- Data collection from Ticketing Information Management System (TIMS);
- Air quality monitoring equipment (first verify whether any air quality monitoring is already in place);
- Safety records from the Police; and
- Household and employee monitoring survey (first verify whether employee and school travel plans already exist).

Table 10.2, on the following page, summarises these performance indicators and a possible monitoring programme:

Table 10.2 Performance Indicators and Possible Monitoring Programme

Objective	Performance indicator	Definition of indicator	Performance target	Source of indicator/target	Monitoring method and frequency
Accessibility	Access to transport network	• Percentage of population within 400 metres walk distance from a public transport stop/service • Public transport use	• X% by 2014 (5 years after opening) • X million per year by 2014	• Population (from Scottish General Registry Office) • TIMS	• Yearly population and distribution updates by ward • Continuous monitoring of bus and tram ticketing
	Access to employment opportunities	• Transport connections to employment and regeneration areas	• X% employees at key locations accessing jobs by public transport by 2014	• Employee survey •	• Annual survey with employees from key employment locations.
Environment	Use of sustainable transport modes	• Increased modal share on sustainable modes (i.e. walking, cycling, public transport)	• X% increase on PT by 2014 • Y% reduction on cars by 2014 •	• Household survey •	• Citywide household survey every 5 years
	Air quality - pollutant concentrations	• Various pollutant concentration targets	• Meet all NAQS targets •	• UK National Air Quality Strategy (NAQS)	• Changes in air quality with monitoring equipment – weekly/monthly to allow for seasonal variations
Traffic Congestion	Traffic volumes - key routes	• Average AM/PM, daily, weekly, monthly and annual traffic volumes on key routes • Growth in car traffic	• Road Traffic Reduction Act (RTRA) local targets • Car traffic growth not to exceed X% in 2014	• Road Traffic Reduction Act UK Government's 1st Report	• Permanent/ temporary site automatic/ manual traffic count programme
	Traffic delays	• Changes in journey times by car	• No change in delays by 2014	• Household survey	• Citywide household survey every 5 years
Safety	Road traffic accidents and casualties	• Total number of people killed or injured in road accidents	• X% reduction by 2014	• Tomorrow's roads: safer for everyone (UK Road Safety Strategy)	• Road traffic accident database. Annual records from local Police and local authorities

Before the monitoring programme is agreed upon, consideration must be given to the actual availability of the data, practicalities from collecting new data, its format, whether it will properly reflect the indicators proposed and cost from obtaining it. Indicators and targets should be subject to regular reviews to ensure that they continue to properly reflect the performance of the project against its objectives, throughout the monitoring period.

Emphasis has been placed in the DPOF contract on the need for electronic data gathering to be employed as the preferred method wherever possible. This will also apply to data gathered outside the DPOF contract for monitoring purposes.

10.6. Conclusion

The paragraphs above demonstrate that **tie** has been, is and will continue to take steps to validate and evaluate the scheme (both before and after implementation) and to monitor its performance in the operational phase.

The project objectives are set out together with actions to be taken during the various phases from scheme development through to operations. A key factor in this process is the appointment of an Operator using the DPOF procedure. This action alone will contribute significantly to minimisation of risk and regular review of the project in that:

- Forecasts for operating costs and revenues will be validated during the scheme development phase;
- Operator advice on equipment and infrastructure will inform the procurement process and assist project validation;
- The operator will manage the commissioning and testing process, thereby exercising some degree of coordination between operator and infrastructure supplier; and
- An extensive, regular (and where possible automated) monitoring procedure will be followed during operations, with contracted parties incentivised to achieve KPIs targeted towards meeting scheme objectives

11 CONCLUSIONS



11. Conclusions

11.1. Introduction

This STAG Report summarises the work that has been undertaken in developing the case for a Tram Line in West Edinburgh. Initially the case for a network of Tram Lines was established within the Integrated Transport Initiative for Edinburgh and South East Scotland, which was examined as part of a package aimed at addressing the congestion problems in Edinburgh. This together with the North Edinburgh Rapid Transit Solution Feasibility Study and the Edinburgh LRT Masterplan study confirmed the priority of developing a new high quality Tram in West Edinburgh. Subsequently FaberMaunsell and their sub-consultants have developed a Preferred Route and Operating System for the Edinburgh Tram Line Two. During this time the engineering feasibility, environmental impact and revenue/patronage forecasting has been undertaken for a variety of options seeking to provide a first class public transport system from the city centre to the western edge of the city.

11.2. Pre-Appraisal Process

The Planning Objectives for this work have been established from a review of the City of Edinburgh Council's own aims and objectives for transport contained within their Local Transport Strategy. The planning objectives have been used consistently throughout the STAG process and are as follows:

- **To improve accessibility** – improvements, particularly for people without access to a car, on low incomes or whose mobility is impaired are fundamental to the achievement of both the social inclusion and economic development elements of the transport vision. Specific objectives are:
  - To improve access to the public transport network;
  - To improve access to employment opportunities; and
  - To support economic development.

- **To reduce pollution and environmental damage caused by traffic** – this is fundamental to the achievement of the environmental / sustainability aspiration and will contribute to the achievement of the safety element of the transport vision. Specific objectives are:
  - To increase the proportion of journeys made by public transport, walking and cycling;
  - To improve local air quality;
  - To reduce emissions of greenhouse gases

- **To reduce traffic congestion** – this is fundamental to the achievement of economic development and environmental aims. Specifically the scheme should:
  - Reduce the number of private vehicle kilometres; and
  - Reduce traffic volumes on key routes.

- **To make the transport system safer and more secure for both users and non-users** – this is fundamental to the achievement of the safety and community elements of the vision and will contribute towards achieving the environmental and social inclusion elements. Specific objectives are to:
  - Reduce the number of road traffic accidents; and
  - Improve personal security when using the transport system.

Edinburgh's economic success as a growing region for employment and increasing population has led to many pressures arising in it's transport networks. This together with increasing demands for new developments, particularly in the West Edinburgh area, will mean that this congestion is likely to increase further with a knock on impact on the local economy and the environment.

11.3. Project History (Option Generating, Sifting, Development and AST1 Work)

The ITI Vision for Edinburgh was submitted to the Scottish Executive in September 2002. This was approved in principle and therefore provided the initial justification for a package of schemes, including a network of Tram Lines serving the North, West and South East of the City. This network was explored further in the LRT Masterplan study undertaken by Arup, which confirmed that the Northern Loop should receive the highest priority followed by the Western and South-Eastern lines. In addition, the Feasibility Study for a North Edinburgh Rapid Transit Solution undertaken by Andersen examined the wide range of different technologies available in the Public Transport market before concluding that LRT or Tram based technology was the best solution for a network in Edinburgh.

These studies form the basis of the STAG Part 1 Appraisal and support the case for a LRT or Tram based system serving western Edinburgh.

The West Edinburgh Corridor

FaberMaunsell have undertaken more detailed work to choose a Preferred Route Corridor for Edinburgh Tram Line Two. From a wide selection of options a "Central" corridor based largely on the previous CERT corridor was chosen using the following criteria:

- Engineering;
- Traffic and Transportation;
- Safety;
- Environment;
- Economy/Development;
- Accessibility; and
- Integration.

11.4. Consultation

The Preferred Corridor together with local options were the subject of an extensive public consultation process that included:

- Client consultations;
- Public consultations; and
- Stakeholder consultations.

This informed major stakeholders and the residents of Edinburgh about the proposals and it provided the opportunity to comment in a variety of ways.

The results of the consultation show that there is broad support in Edinburgh for the tram proposals and preferences for each of the options presented was expressed. Further technical work and focussed consultation was undertaken to address specific issues arising from the consultation before the Preferred Route was determined.

11.5. STAG Part 2 Appraisal

Following the pre-appraisal process, Part 1 AST, extensive consultations and focused option analysis a total of twelve proposal options were subject to Part 2 AST. Completed AST2 tables are contained within Appendix B for all twelve options. The AST2 process appraised all twelve proposals based on the September 2003 guidance document and in particular against the planning objectives for the proposal and the Government's five objectives:

- Environment;
- Safety;
- Economy;
- Integration; and
- Accessibility.

Following the completion of the Part 2 AST process, a preferred route alignment has been selected for Edinburgh Tram Line Two. The preferred route alignment was considered to best satisfy the planning objectives set out that the beginning and adopted throughout the STAG process.

11.6. Preferred Scheme Description

The Preferred Route begins at St Andrew Square before travelling along Princes Street and Shandwick Place to Haymarket. It then runs parallel to the main Edinburgh to Glasgow railway line, initially on the north side but crossing over the railway to run on the south side as far as the new Edinburgh Park Rail Station.

From this point it crosses the rail line once more and runs northwards through the Edinburgh Park and Gyle Shopping Centre. After crossing under the A8 to the east of Gogar roundabout, the Tram passes close to the new Royal Bank of Scotland Headquarters (albeit on the other side of the A8) before reaching the new Park and Ride site at Ingliston. At this point the line swings northwards to Edinburgh Airport where it will terminate.

A second Line (the Newbridge branch) will run between the Ingliston Park and Ride stop westwards towards Ratho Station and the new developments at Newbridge where it will terminate. The point of termination has been chosen to allow for future extension of the line. This line to Newbridge was introduced as a branch line, instead of a direct extension of the main route, as a result of the patronage estimates and planning difficulties arising from uncertainties regarding the future expansion of the Airport and its impact on Royal Highland Showground land. Should the operator wish however he could operate it as the main service directly between Newbridge and the city.

The frequency of both the main line and the Newbridge branch will see 6 trams running in each direction in each hour during the peak. Each tram will have a capacity of up to 300 passengers giving an overall capacity for the system of 1,800 passengers per hour in each direction. It is proposed that the Tram depot will be located at Gogar and there will be stops located at the following locations:

Main Line
St. Andrew Square
Princes Street
Shandwick Place
Haymarket
Murrayfield
Balgreen Road
Saughton Road North
South Gyle Access
Edinburgh Park Station
Edinburgh Park
The Gyle
Gogarburn
Ingliston Park & Ride
Airport

Newbridge Branch
Ingliston Park & Ride (interchange with the main line)
Ingliston West
Ratho Station
Newbridge South
Newbridge North

11.7. Scheme Costs

The costs developed for this study include capital costs, operating costs and life cycle costs. The operating cost estimates have been refined and improved by TRANSDEV the appointed preferred operator.

Capital cost estimates for Edinburgh Tram Line Two have been prepared using a combination of benchmarking, previous experience and engineering judgement.

The capital costs are estimated at £320.9M (including 25% optimism bias), based on 2Q 2003 prices. Costs have been derived from a comprehensive database compiled from analyses of costs for the infrastructure works of completed and proposed LRT schemes throughout the UK, currently advised prices from vehicle manufacturers and preliminary diversionary works estimates obtained from utilities companies. The resulting estimates take account of the prevailing factors influencing this particular scheme including location, relative complexity, environment and anticipated programme.

Operating costs, which include the cost of operating the system, maintenance and lifecycle costs, and management fees are expected to be around £6.1 million pounds per annum.

The Tram is expected to carry around 5 million passengers in the opening years, which will grow to around 7 million passengers some 15 years later. The revenue expected from this level of demand will be £6 million in the early years, growing to over £8 million. These figures assume an allowance for fare evasion and a variety of ticket types.

Summary of Cost-Benefit Appraisal

Present Value of Benefits (PVB)	£288 million
Present Value of Costs (PVC)	£206 million
Net Present Value (NPV)	£82 million
Benefit Cost Ratio (BCR)	1.40

tie has developed clear and active processes to identify and mitigate project risks in accordance with industry best practice. The **tie** Board takes ultimate responsibility for risk, with responsibility delegated to the Project Director.

There are five phases of the project which require consideration during the monitoring and evaluation process, namely:

- Scheme development;
- Infrastructure procurement;
- Construction;
- Testing and Commissioning; and
- Operations.

The STAG requirements for monitoring and evaluation are principally associated with the operational phase, following scheme implementation. However, it is also necessary to assess and re-appraise the project during phases prior to implementation. **tie** has been, is, and will continue to take steps to validate and evaluate the scheme (both before and after implementation) and to monitor its performance in the operational phase.

This work has concluded that the introduction of a tram into West Edinburgh is consistent with the objectives of the City Council and will contribute to the realisation of the Vision for Edinburgh.

11.8. Contribution to Meeting Planning Objectives

Table 11.1 below summarises the Planning Objectives for the scheme and the extent to which the appraisal has shown that it meets them.

Table 11.1 Contribution to Meeting Planning Objectives

Planning Objective	Contribution of Scheme
Improve access to public transport	Accessibility improves, with a saving in generalised journey time worth £168 million over the scheme life
Improve access to employment opportunities	Journey times from residential areas and transport interchanges generally show a reduction, with limited exceptions
Support economic development	The scheme would unlock additional development potential in the corridor and could assist in attracting major new developments
Increase proportion of journeys made by public transport, walking and cycling	There is a significant transfer from car to tram
Improve local air quality	Local air quality would be improved for 176,000 residents in 2011 and 165,000 in 2026 as compared with 101,000 and 106,000 respectively who would suffer worse air quality
Reduce greenhouse gas emissions	Greenhouse gas emissions in the study area would reduce by 3% in 2011 and 9% in 2026 relative to the do-minimum
Reduce number of private vehicle kilometres	General background economic development over the assessment period of 30 years leads to a net increase in car use and accidents. The tram scheme results in a change in the modal split between public transport and cars, attracting patronage from both cars and existing public transport users. On the basis of the forecast background growth in demand, the tram gives rise to a net decrease in car use and accidents and the scheme meets the overall objective of improving road safety. Second order effects of the tram lead to further economic development and an associated increase in demand for travel, generating further highway trips and modal transfer to tram. The latter is greater in the peak due to higher congestion levels. This leads to an overall reduction in peak vehicle kilometres and an increase in off peak. This gives rise to a small net increase in car use and minor accidents in the later years of the scheme life. This issue would need to be addressed by other appropriate policy measure.
Reduce traffic volumes on key routes	
Reduce number of road traffic accidents	
Improve personal security	Tram will provide improved personal security relative to other public transport options.

The table shows that the scheme would make a significant contribution to meeting the majority of the Planning Objectives.