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EDINBURGH TRAM NETWORK

STAG Appraisal: Line One

30 July 2004



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Edinburgh Tram Network Line 1 (Northern Loop)

STAG Appraisal July 2004

Report No. 203011/100/G

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(The Appendices are provided in a separate document)

- A Demand and Revenue Modelling
- B Environmental Appraisal
- C Operations
- D List of Consultees
- E Public Utilities

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 1 project for **tie**.

The projections of demand and revenue contained within this document represent the authors' 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 which are influenced by external circumstances that can change quickly and could in certain circumstances affect the results.

It has also 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.

Summary

Introduction

The City of Edinburgh Council is examining ways of providing the city with the transport infrastructure necessary to promote and support a growing local economy and create a healthy, safe and sustainable environment. This is a key component of the strategy of public transport investment in Edinburgh, part of a £1.5 billion New Transport Initiative that the CEC is working in co-operation with other local authorities in South East Scotland to deliver.

In 2001, Waterfront Edinburgh Limited (WEL) commissioned a preliminary technical and economic Feasibility Study of a rapid transit system in north Edinburgh, led by a Steering Group involving the City Council. One of the objectives of this system was to provide a link between the city centre and the proposals for the Waterfront redevelopment planned at Granton.

This Feasibility Study concluded that a northern loop tram system would maximize a number of positive benefits for the area including economic regeneration and improved accessibility. The Feasibility Study and, critically, an associated preliminary appraisal, was submitted to and accepted by the Scottish Executive, and funding of £6.5m was subsequently made available for the development of the Line 1 project to full appraisal and Bill submission.

The alignment of the Line 1 route is proposed to connect the city centre with Leith, Newhaven and Granton, passing through the Waterfront development area and then along the line of the former Roseburn Railway to Haymarket.

This report sets out the justification and appraisal of Line 1 of Edinburgh tram network, the Northern Loop, linking the City Centre with Granton, Newhaven and Leith, passing through the Waterfront development area and then along the line of the former Roseburn Railway to Haymarket. This line is expected to provide a number of positive benefits for the area, including economic regeneration and improved accessibility.

Planning Objectives

The Council has a well developed transport vision with clear strategic objectives enabling projects to be categorised as part of particular strategies. This is beneficial in taking forward the projects through the STAG appraisal process. However, a further explicit process is needed for developing an option appraisal which addresses the requirements of a STAG appraisal. This process underlies the rationale for the project, by testing outcomes against objectives, assessing likely costs and value for money, and considering deliverability and fundability.

The Council has stated its vision for transport within the Local Transport Strategy (LTS) as follows:

Edinburgh aspires to be a city with a transport system that is accessible to all and serves all. Edinburgh's transport system should contribute to better health, safety and quality of life, with particular consideration for vulnerable people such as children, and elderly and disabled people: it should be a true Citizen's Network. The transport system should support a strong, sustainable local economy.

The Council will seek to maximise people's ability to meet their day-to-day needs within short distances that can easily be undertaken without the need to use a car. The city should

develop and grow in a form that reduces the need to travel longer distances, especially by car. Choice should be available for all journeys within the city.

A number of aims are stated in the City of Edinburgh Council's Local Transport Strategy:

- To improve safety for all road 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; and
- To maximise the role of streets as the focal point of local communities.

In the context of the OBC, the LTS aims were utilised as objectives. However, STAG2 comprises a more refined appraisal process and enables the appraisal of more detailed impacts, requiring higher-level planning objectives to be developed. For the purposes of STAG2 appraisal, more focused specific planning objectives were developed for the scheme, under broad categories:

- To support the local economy by improving accessibility:
 - Improve access to public transport network; and
 - Improve access to employment opportunities.
- To promote sustainability and reduce environmental damage caused by traffic:
 - Increase proportion of journeys made by public transport, cycling and walking; and
 - Reduce local and global emissions (improving air quality and reducing contribution to greenhouse gases).
- To reduce traffic congestion:
 - Reduce number of trips by car; and
 - Reduce traffic volume on key routes.
- To make the transport system safer and more secure:
 - Reduce traffic accidents and casualties.
- To promote social benefits:
 - Improve liveability of streets, maximising their role as the focal point of local communities; and
 - Reduce social exclusion, by improving the ability of people with low incomes, no access to car, the elderly or mobility impairments to use the transport system.

Problems and Opportunities in North Edinburgh

North Edinburgh has demonstrable social deprivation and in economic terms, performs below average when compared with the rest of the City. Unemployment is higher than the City average while skills and qualifications are below average. There is a high dependency on public transport, yet poor accessibility is highlighted as one of the key obstacles to residents gaining employment opportunities.

Studies examining the North Edinburgh public transport network have highlighted its apparent incoherence and the degree to which congestion affects journey times, punctuality and regularity.



Previous studies have already highlighted the potential of new and improved bus links. Connections to potential employment opportunities in Leith and the West of Edinburgh are inadequate, creating social exclusion problems. This has been identified in the North Edinburgh Public Transport Strategy and such a theme has recurred in several other studies on transport in the north Edinburgh area. Line 1 will not only improve existing connections with the north of the city but also create much needed links with the west.

The Waterfront Masterplan is predicated on the provision of high quality public transport. Studies that have preceded this one have already highlighted that additional capacity will be required to that available at present and, moreover, as well as additional capacity the development related public transport element will only occur if there is a step-change in the quality of public transport.

North Edinburgh's road network already experiences peak hour congestion and has a significant rat-running problem. Without a step-change shift to public transport, general economic and local regeneration is forecast to place increasing pressure on the road network.

Option Generation, Sifting and Development

The Outline Business Case investigated whether a feasible scheme existed which met the objectives of the study Steering Group and the Local Transport Strategy. The study considered a range of issues, including:

- Technology options – bus based systems, guided bus and rail based rapid transit;
- Alignment and route options – Granton – Haymarket, Granton – St. Andrews Square, the full Northern Loop; and
- Potential demand and revenue – demand and revenue forecasts were made for each of the three route options and for guided bus and light rail transit technologies.

The appraisal and sifting of the options was made in the context of technical, operational, patronage, cost and integration issues and in the ability of the options to satisfy the planning objectives. In general, the full loop option was considered to have the highest potential to solving the local problems, take advantage of the opportunities and address the planning objectives.

This process resulted in the Preferred Option being the full Northern Loop using LRT technology. A preliminary appraisal was produced for this scheme within the Outline Business Case (OBC) and was accepted by CEC and the Scottish Executive, from whom funding was made available to further develop the scheme. The PT network was explored further in the "Edinburgh LRT Masterplan Study" commissioned by the Council and undertaken by Arup. The study confirmed that the Northern Loop should receive the highest priority followed by the Western and South-Eastern Lines.

This option development process was revisited in the current study, which broadly confirmed the Preferred Option, subject to potential alignment variants at George Street and Telford Road. Whilst there were strong technical preferences, these options were taken forward to public consultation in order to ensure robust and inclusive decision-making.

Consultation

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 the tram. The considerable level of support is, however, punctuated by a range of concerns. 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 (particularly to local wildlife) and the impact of the tram on local traffic and parking.

The consultation process resulted in Princes Street being chosen over George Street and the former railway solum being chosen over Telford Road, completing the selection of the preferred route.

Scheme Description

Route

The preferred route will proceed on-street from Princes Street, along Shandwick Place to Haymarket. Going off-street at Haymarket, the alignment will parallel the heavy rail line, before turning north onto the disused railway solum (Roseburn corridor). Line 1 will remain on this corridor to Crewe Toll, whereupon it will run alongside the Western Access Road and enter the Granton redevelopment site. Passing through this site, the alignment will turn east and travel along Lower Granton Road and Starbank Road and enter the Forth Ports development area. Passing Ocean Terminal and the Scottish Executive, the alignment will return to the city centre via Constitution Street, Leith Walk and St. Andrews Square. The route comprises:

- 15.5 km of Double Track infrastructure (single track at St Andrews Square);
- 58% off street; and
- 22 proposed stop locations. (See also sections 7.2.1 & 7.2.2)

Wherever possible a segregated alignment has been proposed (where the tram operates on dedicated tramway or tramroad) such that the system can maintain speed and frequency and reliability of service without interference to and from other traffic. The alignment is effectively double track, clockwise and anti-clockwise running, throughout its length, with the exception of the one way loop at St. Andrews Square (approximately 520m long).

Tram Specification

It is assumed that the trams will be semi-low floor or total low floor vehicles. This implies a floor height of between 300 and 400mm. This type of vehicle has been adopted in order to ensure that the alignment characteristics will cater for most currently available rolling stock.

Construction

The construction of Line 1 is programmed to commence in mid 2006 with an estimated construction period of 36 months.

One of the early activities required for construction is the diversion of Public Utilities from beneath the tramway. This is generally undertaken either as an advanced works contract or as part of the main works contract. Generally the inclusion of this phase within the main contract can provide a reduction in overall programme due to the ability to coordinate efficiently within the main contract. The construction period is based upon the utilities diversions being undertaken entirely as part of the main contract. However, to meet the programme the PU diversion policy, including agreed diversionary works, would require to be established prior to construction activities commence.

Capital Costs

Capital costs are estimated at £274.15m, including optimism bias, set at a base point of Quarter 2, 2003. 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.

Operations

The single overarching objective from the operational viewpoint is to minimise journey times, so as to maximise the attractiveness of the service and minimise operating costs and rolling stock resources. The key is to achieve free flow wherever possible so that the running speed is the maximum safe speed for any particular type of environment.

The model forecasts a total time of 40.5 minutes around the loop, excluding any layover time allowance, equivalent to an average journey speed of 23.3 km/h. The frequency will be 8 trams per hour (i.e. a headway of 7½ minutes).

STAG2 Appraisal

Option Sifting

A restricted STAG2 appraisal was undertaken, focusing on the key objectives in order to determine the best performing route option (to be carried forward as an integral part of a full loop) between:

- George Street / Princes Street; and
- Telford Road / former railway solum.

George Street and Princes Street options have comparable capital costs. Run times are slower on George Street, there are fewer opportunities for transport integration and accessibility and greater environmental and heritage impacts. Telford Road option is more costly and slower than the railway solum, and would impact significantly on highway operations, while the former railway solum is completely segregated. Biodiversity impacts on Telford Road are recorded as neutral whilst there is a small adverse affect on the former railway solum. Given the merits of the respective options, Princes Street and the former railway solum are the preferred alternative options and have been carried forward for inclusion in the appraisal of the full loop.

Assessment Against the Planning Objectives

A key principle of STAG is that a scheme is assessed against both the planning objectives established by the planning authority and the Government's five overarching objectives. An appraisal of the scheme against the planning objectives and problems in North Edinburgh has been undertaken. Across all the objectives, Line 1 is considered to have a positive impact, notably on the level of public transport and car demand and the associated mode share and the consequent impacts on the environment. Notwithstanding some adverse impacts arising from the bus network changes, Line 1 has a positive impact on accessibility which will support the local economy and reduce social exclusion. The key findings were that Line 1 has considerable potential to:

- Contribute to improve the local economy (greater potential for regeneration);
- Facilitate access to employment opportunities (more attractive, integrated, comfortable, efficient and reliable public transport alternative);

- Reduce the adverse impacts of transport on the environment (zero exhaust emissions produced by the trams in urban areas, reduced noise levels, townscape benefits);
- Reduce traffic and congestion (greatest potential as an alternative to the private car, with decongestion benefits); and
- Reduce social exclusion (providing widely accessible, particularly to the new areas of employment and social deprivation in north and west areas of Edinburgh, and affordable transport connections for all).

Scheme Appraisal

The appraisal has followed STAG, which appraises the scheme against both the planning objectives set and the Governments five national objectives for transport:

- Environment
- Safety;
- Economy;
- Integration;
- Accessibility & Social Inclusion.

Environment

Noise and Vibration

The majority of the tram route follows existing roads and the additional noise generated by tram movements is not expected to give rise to significant noise impacts in these areas. Where the tram alignment runs along the disused Roseburn to Crewe Toll rail corridor, noise barriers will be required and, provided an appropriate design can be developed, for most locations they will mitigate significant impacts that would otherwise occur. Some slight residual impacts may be unavoidable.

On the road network traffic changes resulting from the tram's operation will give rise to noise increases in some areas and noise decreases in others, but most changes will be small. Overall the effect of the scheme is predicted to be neutral on the road network with slight negative impacts along the Roseburn to Crewe Toll rail corridor after mitigation in the form of noise barriers has been taken into account.

Air Quality

The proposed Edinburgh Tram Line 1 is predicted to have a moderate positive impact on air quality in the City of Edinburgh in 2011. In 2011, there will be an increase in properties near roads with improved air quality compared to the do minimum and more properties will benefit from roadside improvements than from degradations in roadside air quality, for both pollutants. In 2026, a greater number of households will be near roads with worse PM₁₀ concentrations than better (due to predicted increased congestion in 2026), but with improved or unchanged NO₂ compared with the do minimum.

There is no net change in CO₂ emissions in 2011 as a result of the tram. In 2026, there is a net predicted decrease in CO₂ emissions of 10 kilo-tonnes.

Water Quality, Drainage and Flood Defence

Overall the scheme is expected to have a minor negative impact on surface water quality and drainage in the short term during construction. Best construction practices will be adopted to minimise any

sediment laden or contaminated runoff during construction. Utilisation of existing drainage and installation of sustainable mitigation measures where appropriate will ensure that the operation of the scheme will not result in adverse impacts to drainage.

Construction and operation of the scheme will not increase the flood risks along the alignment. The contractor will consult with SEPA and CEC during detailed design to ensure that all requirements and guidelines will be adhered to. There are limited existing groundwater resources along the route and the construction and operation of the scheme is not predicted to impact on these.

Geology

Impacts to soils along the route are likely to be generic to construction activity including erosion, disaggregation, compaction and pollution. Soil erosion as a result of development is most likely to occur in the form of water erosion where the mean annual rainfall, storm intensity and frequency are comparatively high. The removal of vegetation, for example along the Roseburn Railway Corridor, will also contribute to erosion. Throughout the development, good practice will be adopted in order to prevent the occurrence of these potential impacts, particularly in sections of the route that are not on-street. Assuming that good practice measures are adopted during construction of the tram, no significant impacts on geological resources are predicted. Land take associated with the development of Edinburgh Tram Line 1 will not involve loss of any agricultural land.

Any contaminated material encountered during construction will be dealt with in compliance with best practice, current legislation and statutory guidance.

Biodiversity

Mitigation measures will be implemented to reduce impacts to the minimum necessary for the safe completion of the works. Opportunities will be sought in the design of the new structures to provide additional roosting opportunities for the species using this area and to mimic the existing habitat along the sea wall.

Construction of the tracks and walkway/cycleway will result in a significant impact to the Roseburn Railway Corridor UWS. The majority of vegetation will be removed along the embankments, affecting its function as a wildlife corridor. The impacts to this corridor will be limited to the minimum necessary through the implementation of mitigation measures, including the adoption of best practice measures during construction.

Construction of the tram will result in significant temporary and permanent impacts to badger. Mitigation measures will be implemented to ensure that works undertaken in close proximity to badger setts and foraging habitat will comply with the requirements of relevant legislation. Bats are known to forage along the Roseburn corridor and the loss of a significant amount of vegetation will reduce their foraging habitat availability. Prior to construction, all bridges and other built structures and mature and dead trees to be affected will be checked again for roosting bats and appropriate mitigation measures agreed with SNH and implemented if bats are found.

Landscape

Although the scheme provides opportunities for enhancing the local landscape in certain areas, other adverse impacts can be expected at varying degrees in different locations of the route. The key landscape impacts for each area affected by the scheme are:

- Haymarket – Potentially complex OLE support. Road alterations and demolitions weaken enclosure of junction area. Tram stop will improve Haymarket Terrace;
- West End – OLE in designed vista. Road widened into gardens;

- Princes Street – OLE in designed vista and iconic tourist views. Footway widening;
- St Andrew Sq – OLE in designed vista and iconic tourist views;
- Queen St to Picardy Pl – OLE in designed vista. Road widened and awkward level changes;
- Leith Walk – Road widening and loss of enclosure, but also improvement opportunity at top of Walk. OLE particularly visible in long views. Loss of street trees at north end;
- Leith – Distinctive small-scale local character, highly sensitive to change;
- Port of Leith – Tram a minor additional element in industrial parts, part of a much wider change elsewhere;
- Newhaven to Granton – OLE will partially enclose open sea-front sections. New footpath at Starbank beneficial;
- Waterfront Granton – Part of a much wider change;
- Pilton – Tram will be a minor addition; and
- Railway Corridor – Significant vegetation removal required.

Visual Amenity

The sensitivity of the receptors of visual impact varies according to their activity and expectations. There will be visual impacts on virtually all the properties and roads along the tram route, on public open spaces and recreational sites such as Princes Street Gardens, St Andrew Square and the Roseburn cycle route, and from important tourist viewpoints such as Princes Street and Edinburgh Castle.

Major visual impacts are caused where proposed development is clearly noticeable and affects the character or quality of view for sensitive receptors. For this reason there will be major visual impacts along much of the route because of the unavoidable visibility of much of the tram infrastructure, particularly the overhead line equipment, from houses and flats along the route and from many of the main city centre tourist locations.

Agriculture and Soils

There are no agricultural issues associated with the proposal.

Cultural Heritage

The vast majority of sites impacted upon by the implementation of Line 1 in terms of cultural heritage have a suggested Level 1 mitigation response (detailed photographic record). A high proportion of such sites comprise historic street furniture in the buffer zone, most of which are unlikely to suffer physical impact during the works, but preventive measures are required to avoid damage, particularly where the features form part of Listed Buildings.

Thirteen sites are recommended for Level 2 mitigation (detailed standing building survey). This higher level of survey has been suggested due to the physical impact on such sites expected as a result of engineering works. This includes the “B” listed bridge over Glasgow Road at Roseburn.

Level 3 mitigation (watching brief) is suggested for five sites. This includes the part of the route believed to pass through the Caroline Park designed landscape. However, it seems likely that some of this area has been rendered archaeologically sterile by modern development. The other four sites are areas of archaeological potential.

The two sites recommended for Level 4 mitigation (Detailed standing building survey and salvage) are both at Haymarket. The C(S) Listed Caledonian Ale House is likely to require demolition. The C(S) Listed Heart of Midlothian War Memorial may require relocation, unless through design this can be avoided.

Safety

Accidents

A reduction in private vehicle traffic has promoted an annual saving in the number of accidents in the road network at -7.6 (an increase) in 2011 and 51 (a decrease) in 2026, considering all severity levels. The majority of accidents are accounted for in terms of damage to property. The number of fatalities saved from the implementation of the scheme would be negligible.

The total savings as a result of reduced traffic on the road network has been calculated at approximately -£80,000 per year for 2011, and £0.7 million per year for 2026. Feeding these valuations through cash flow calculations into the accident framework, which discounts the annual valuations to a present value, the NPV of these savings represent £4.8 million (NPV), considering the project life-time.

Security

While all stops will be designed to high standards, some quieter locations may require mitigation facilities designed to ensure that they offer as great a level of security as possible (including any street lighting or furniture to ensure safe approach to the stop locations). The stops have tended to be located in more accessible locations, where the level of activity is greater and hence security higher. Although the stops will be unstaffed, they will be monitored by CCTV while all vehicles will provide high levels of security with the presence of conductors.

Economy

Transport Economic Efficiency (TEE)

The TEE analysis has been undertaken in compliance with the requirements of both Guidance on the Methodology for Multi-Modal Studies (GOMMMS) and STAG. The DfT Transport Users Benefit Appraisal (TUBA) software has been employed, using model output from the LUTI modelling framework employed in the study.

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

- Construction cost of £274.15 million (including optimism bias at 25%). This includes construction and vehicle capital costs, land and project supervision and design costs. This cost was spread over the years 2006 – 2009 inclusive based on the cost profile provided within the cost estimate;
- Private developer contribution of £11.6 million (PV);
- Annual Line 1 operating cost of £6.3 million; and
- Lifecycle costs of £44.6 million, allocated over years when particular costs were predicted.

The table below presents the TEE analysis for the Line 1 Central Case scheme. Issues to note include:

- Total PT benefits of £116.5m;

- Total highway benefits of £111.6m;
- A negative impact on bus operations, with a revenue reduction of £40.3m exceeding the operating cost reduction of £31.1m by some £9.2m;
- A small reduction in off-street parking revenues; and
- An overall present value of benefits of £231.1m.

	STAG Code	Total	Public Transport	Road Users	
				Cars	Freight
User benefits - Consumers					
Travel time	(PV2)	£184,329	£116,749	£67,580	
User Charges	(PV3)	£-9,166	£-9,166	£0	
Vehicle Operating Costs	(PV4)	£3,105	£0	£3,105	
Sub Total		£178,268	£107,582	£70,685	
User benefits - Business					
Travel time	(PV2)	£47,717	£9,244	£21,294	£17,179
User Charges	(PV3)	£-296	£-296	£0	£0
Vehicle Operating Costs	(PV4)	£2,474	£0	£756	£1,717
Sub Total		£49,894	£8,948	£22,050	£18,896
User benefits - Total					
Travel time	PV2	£232,045	£125,993	£88,874	£17,179
User Charges	PV3	£-9,462	£-9,462	£0	£0
Vehicle Operating Costs	PV4	£5,579	£0	£3,861	£1,717
Sub Total		£228,162	£116,531	£92,735	£18,896
Private Sector Provider Impacts					
Investment (Capital) Costs	PV5	£-213,542	£-213,542		
Operating Costs: Line 1	PV6	£-108,285	£-108,285		
Bus	PV6	£31,141	£31,141		
Rail	PV6	£0			
Revenues: Line 1	PV6	£0			
Bus	PV7	£-40,278	£-40,278		
Rail	PV7	£25,514	£25,514		
Off-street Parking	PV7	£-3,895		£-3,895	
Grant/ Subsidy	PV8	£321,827	£321,827		
Developer Contribution	PV8	£-9,563	£-9,563		
Sub Total		£2,918	£6,814	£-3,895	£0
Total PVB		£231,080			

Notes:

1. Disbenefits appear as negative
2. All values are £000s Present Value, 1998 Values and Prices

Economic Activity and Location Impacts

The aim of Economic Activity and Location Impact (EALI) analysis is to quantify the impacts of a proposed scheme on the economy at a local or regional level and at the level of Scotland as a whole. The appraisal is undertaken in terms of employment and where possible income. The analysis is intended to identify how different locations may be impacted upon and to capture net additional economic impacts at different spatial levels. These impacts are not however additional to those captured in the standard cost benefit analysis approach; rather, they express these impacts using an alternative unit of account.

Property related impacts

The tram will comprise a strategic transport link to and from the Waterfront regeneration area. This is essential for the successful implementation of:

- A sustainable community comprising high density units, as well as housing for key workers and social housing;
- New educational institution: students will be dependent on public transport for access to their education;
- New employment uses in the regeneration area: residents from outside the regeneration area will have better access to these sites; and
- Access to potential tourism and leisure event venues.

Developments have been planned on the assumption that the tram will be implemented in 2009. While some developments are either constructed or under construction now, it is likely that any changes in the plan to implement the tram will impact on the fulfilment of all proposed developments in the longer term. It will also impact on the development of major event developments that might otherwise not be located in Edinburgh, such as the proposed casino development currently under consideration.

Planned developments where employment impacts could be claimed at the Scotland level are still very much tentative proposals and any impacts cannot be claimed at this stage. At the regeneration level, the tram will provide a strategic transport link – the benefits at the level of the regeneration areas depend upon how residents of these areas are enabled to access the jobs in the North Edinburgh sites. Based on the proximity and travel to work characteristics of people living in the regeneration areas, it is reasonable to expect that a proportion of total new jobs will be taken up by these residents as a result of better accessibility and that this will amount to between 70 and 200 jobs. Some allowance needs to be made for displacement, which is assumed to be around 50%. Accordingly the net impact ranges from 35 to 100 jobs at the regeneration area level.

Business impacts

The surveys results indicated that the tram is expected to be of very limited benefit to businesses, except in terms of providing better access to labour, primarily in the retail, financial services and health sectors. However, it is difficult to argue that location is the reason for being unable to fill vacancies. Within the health sector, vacancies currently hard to fill could be filled by having better access to the regeneration areas in North Edinburgh. This could result in filling around 20 vacancies per annum, of which half might be additional at the regeneration area level and half at the Scotland level, which represents those jobs which would not be filled without the tram.

Social inclusion impacts

The new developments will attract a significant number of service sector based businesses, which will result in a large number of low skilled jobs being created. It is likely that these jobs may be filled by residents living in deprived areas in North Edinburgh. The tram will be pivotal in providing public transport access to these jobs for these individuals.

Integration

Transport Integration

Co-ordinated and integrated transport services with convenient, simplified (and possibly through) ticketing can contribute to more “seamless” journeys across the public transport network. Travel cards, season tickets, concession passes and probably the integrated “The One” ticket system will be available for purchase at other locations. Real time passenger information at bus stops will contribute to an integrated public transport system.

The attractiveness of the public transport system as a whole in Edinburgh can be enhanced with the implementation of Line 1 by the existence and quality of infrastructure facilities at tram stops, maximising bus and rail interchange with the tram and real-time passenger information at all tram and bus stops.

Land-Use Transport Integration

Improvements in public transport brought about by Line 1 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 (especially for those dependent on public transport).

Policy Integration

Edinburgh Line 1 can contribute to the following wider Government policies:

- Disability – The design of trams and stops, fully DDA (1995) compliant and with level boarding, will provide easy access to wheel (and push) chairs, facilitating thus the access not only for the mobility impaired but also the elderly and mothers with babies;
- 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; and
- 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.

Accessibility and Social Inclusion

Community Accessibility

Community accessibility has been measured to key local services and destinations:

- George Street / Frederick Street junction – representing the city centre (employment, shopping, leisure and access to Waverley rail station with integration with bus and rail);
- Haymarket rail station (integration, interchange with bus and rail);
- Foot of Leith Walk (employment, shopping, jobcentre);
- Leith Ocean Terminal (employment);
- Granton development area (employment, residential and education, with Telford College – amalgamation of 4 campuses – and new school on waterfront site. There is also the potential for hotels and leisure activities); and
- Crewe Toll / Western General Hospital (employment, visiting relatives).

The changes in public transport perceived travel time have been estimated by the transport model (accounting for walk time, wait time and interchange time, according to service frequencies) from all origins to each of the destinations identified above, considering the “without” (bus only) and “with”

the scheme scenarios (bus and tram). Seven time bands have been determined and the changes in the number of people with access to the selected locations within these time bands have been estimated.

Accessibility is significantly increased for travel from most zones to all the selected destinations. The most notable exception is for travel from the south-west of Edinburgh to destinations in the north-east, since these trips can currently be made by a single bus journey. With the introduction of the tram, these direct services are assumed to be withdrawn and an interchange will be required at or near Haymarket Station, making the journey longer in terms of total travel time (wait and interchange time), but probably more pleasant and comfortable on the tram section. A similar effect takes place also in parts of the south-east for travel to most of the selected destinations.

The tram provides increased opportunities for walking and cycling as access modes, but it has limitations to promote further non-motorised trips to access local services.

Comparative Accessibility

Some key benefits of the scheme will be realised by the socially disadvantaged. The distribution of accessibility impacts is relevant in that it identifies the extent to which the scheme benefits social groups or geographic locations most in need of access by public transport to essential activities. The analysis has been carried out for the locations where the local population depends most on public transport provision, that is, where there is no car availability.

The results vary considerably according to the destination under consideration. Overall, significant accessibility benefits can be realised by the introduction of Line 1 in Edinburgh, also for households without a car. Some 4 times as many households with no car benefit than disbenefit as a result of the scheme. It is important to bear in mind that any disbenefit in the accessibility analysis is a result of the changes in bus routes, when the tram is in place. Many journeys are likely to require one (or one additional) interchange, and this tends to increase the total travel time. However, the tram section of the journey will gain in quality, reliability, speed and comfort, which could become acceptable trade-offs for travellers. The accessibility impacts per selected location are:

- George Street: vast majority unaffected. Twice as many disbenefit than benefit;
- Haymarket: vast majority unaffected. No accessibility disbenefits;
- Leith Ocean Terminal and Foot of Leith Walk: many times more people/households benefit than disbenefit; and
- Granton and Crewe Toll: majority benefit significantly (i.e. reduction of more than 10 minutes in journey times).

Cost to Government

The cost to government sets out the net cost of a proposal from the public sector's point of view, which can then be compared with the overall benefits of the scheme covering all five of the main objectives (environment, safety, economy, integration and accessibility). The economic impact of Line 1 is presented in the table below, which summarises the monetised benefits of the scheme in terms of safety and economy and then compares this with the cost to government. The overall Present Value of Cost to Government is £195.5m, of which the principal component is the grant payment for the construction of Line 1. The overall PVB, including accidents, is some £235.9m. These combine to produce a BCR of 1.21 and an NPV of £40.4m. On this basis, the scheme represents good value for money. Sensitivities around this Central Case demonstrate the robustness of the case for Line 1; coupled with the benefits to the non-monetary objectives, a strong case for Line 1 has been made.

	STAG Code	Total	Public Transport	Cars	Road Users Freight
Local Government					
Public Sector Investment Costs	PV9	£0			
Public Sector Operating & Maintenance Costs	PV10	£0			
Grant/ subsidy payments (Developer Contribution)	PV11	-£108,285	-£108,285		
Revenues	PV12	£142,076	£116,241	£25,835	
Taxation impacts	PV13	£0			
Central Government					
Public Sector Investment Costs	PV9	£0			
Public Sector Operating & Maintenance Costs	PV10	£0			
Grant/ subsidy payments (Developer Contribution)	PV11	-£213,542	-£213,542		
Revenues	PV12	£9,563	£9,563		
Taxation impacts	PV13	-£25,326	-£17,087	-£7,862	-£377
Total PVC to Government		-£195,513	costs appear as negative		
Monetised Summary					
Present Value of Transport Benefits (PV1-8)					
Accidents, PV1		£4,799			
Transport Economic Efficiency		£231,080			
Total PVB (PV1-PV8)		£235,879			
Present Value of Cost to Government (PV9-13)		-£195,513			
Net Present Value		£40,366			
Benefit-Cost to Government Ratio		1.21			

Appraisal Summary Table

The table presented below summarises the appraisal of the various impacts under STAG2 for the preferred route.

Proposal Details			
<i>Name and address of authority promoting the proposal</i>		City of Edinburgh Council	
<i>Proposal name</i>	Edinburgh Tram Line 1	<i>Name of planner</i>	
<i>Proposal description</i>	Introduction of a tram line circular route serving Edinburgh city centre, the two main rail stations and the regeneration areas of Granton and Leith.	<i>Capital Costs/Grant Revenue Support PV Costs</i>	£274.15m (capital cost) £6.29m/year (operating cost)
<i>Funding sought from</i>	Scottish Executive	<i>Amount of application</i>	N/A
Proposal Background			
<i>Geographic context</i>	Edinburgh is the capital of Scotland, a World Heritage city, spread over 100 square miles in area, built upon a jumble of hills and valleys.		
<i>Social context</i>	High population density in areas covered by the route. 39.5% of households in Edinburgh do not have a car (2001 Census), and the route will serve much of the areas of low car ownership. The north east part of Edinburgh (served by the route) is the most deprived and of lowest income levels. Unemployment is at a 25-year low. The tram services will enable non-car owners and the socially excluded increased access to the public transport network.		
<i>Economic context</i>	Edinburgh's regional economy is expected to be the fastest growing economy of any major UK city over the next five years, with correspondent growth in population and jobs.		
Planning Objectives			
<i>Planning objectives</i>	<i>Performance against planning objectives</i>		

<ul style="list-style-type: none"> ▪ Improve accessibility ▪ Promote sustainability ▪ Reduce congestion ▪ Improve safety and security ▪ Social benefits 	<ul style="list-style-type: none"> ▪ Line 1 will improve accessibility to employment opportunities, education, shopping and leisure destinations, contributing to improve the local economy. ▪ The scheme will contribute to sustainable travel (zero emissions produced by trams in urban areas, reduced noise, townscape benefits) and less congestion (more public transport trips and less car trips). ▪ The tram system will provide a safe and secure means for travel as well as a safe local environment. ▪ The tram will provide social benefits in terms of enhanced liveability on streets and accessibility to mobility impaired and deprived segment of the population. 		
<i>Rationale for selection of proposal</i>	George Street and Princes Street options have comparable capital costs. Run times are slower on George Street, there are fewer opportunities for transport integration and accessibility and greater environmental and heritage impacts. Therefore, Princes Street is the preferred option. Telford Road option is more costly, slower and environmentally adverse than the railway solum, and would impact significantly highway operations, while the former railway solum is completely segregated; hence chosen.		
Implementability Appraisal			
<i>Technical</i>	The proposed alignment is technically feasible, as no untried technology is used, run times are maintained, urban design issues are acceptable and it is integrated with buses.		
<i>Operational</i>	Journey times can be minimised to maximise the attractiveness of the service and minimise operating costs and rolling stock resources. The line capacity is 640 seated and 1,840 total passengers per hour (pph) in each direction.		
<i>Financial</i>	The costs will be met from a number of sources, including developer contributions and grant-funding from Public Transport Fund. Revenue will broadly cover operating costs.		
<i>Public acceptability</i>	The results of the consultation show that there is broad support for trams, despite concerns with the impact on properties in proximity to the route, the requirement for CPOs in certain areas, disruption caused by construction, environmental impact, destruction of local wildlife and the impact of the tram on local traffic and parking.		
Environment			
<i>Mitigation options included (cost/benefit)</i>	Noise barriers have been assumed to be installed along some sections of the Roseburn Railway Corridor to reduce noise impacts at adjacent properties.		
Sub-objective	Qualitative information	Quantitative information	Significance of impact
Noise and vibration	Impact of noise from tram operations on receptors adjacent to the proposed tram route	<ul style="list-style-type: none"> • Roseburn rail corridor: Residential properties adversely affected by tram operations. • Remaining sections of tram route: no significant impact. 	<ul style="list-style-type: none"> • Significant (major) negative impact of tram noise on receptors along Roseburn corridor. These reduce to slight after mitigation.
	Residential receptors either side of the roads where traffic flow changes have been predicted	<ul style="list-style-type: none"> • 2011: Do minimum to with scheme: No change in population annoyed • 2026: Do minimum to with scheme: No change in population annoyed 	<ul style="list-style-type: none"> • Neutral-slight negative impact on remaining route sections. • Neutral
Local air quality — PM ₁₀ and NO ₂	In 2011 there will be an increase in properties near roads with improved air quality compared to the do minimum and more properties will benefit from roadside improvements than from degradations in roadside air quality, for both pollutants. In 2026 a greater number of households will be near roads with worse PM ₁₀ concentrations than better (due to predicted increased	<ul style="list-style-type: none"> • 70,200 households with increase in PM₁₀ in 2011 (134,500 in 2026) • 174,000 households with decrease in PM₁₀ in 2001 (112,050 in 2026) • 3,400 households with no change in PM₁₀ in 2011 (1,000 in 2026) 	Moderate positive (2011) Neutral (2026)

	congestion in 2026), but with improved or unchanged NO ₂ compared with the do minimum.	<ul style="list-style-type: none"> • 77,950 households with increase in NO₂ in 2011 (139,550 in 2026) • 177,250 households with decrease in NO₂ in 2011 (119,100 in 2026) • 26,200 households with no change in NO₂ in 2011 (22,750 in 2026) 	Moderate positive (2011) Minor positive (2026)
Global emissions — CO ₂	There will be a small reduction in CO ₂ emissions in the long term	<ul style="list-style-type: none"> • No net change in CO₂ emissions in 2011. Net reduction of 10,000 tonnes in 2026 	Minor positive
Water quality, drainage and flood defence	<ul style="list-style-type: none"> • Potential short-term increase in sediment-laden runoff during construction due to earthworks (slight adverse but mitigation measures will reduce potential). • Existing drainage will be utilised, but where new one is required the principles of SUDS will apply (slight adverse but mitigation will prevent impact). • The scheme is not located in high-risk flood areas and is not expected to increase flood risk (neutral). • Existing groundwater and hydrogeological resources will not be impacted (neutral). 	<ul style="list-style-type: none"> • The scheme crosses the Water of Leith twice. • Works to the seawall at Starbank Road run adjacent to the Firth of Forth for 250m. Potential for impacts on water quality during construction. 	Neutral
Geology	<ul style="list-style-type: none"> • The route will pass south of the designated Firth of Forth Geological SSSI. No significant impacts are predicted. • The route will pass 30m west of the RIGS site at Craigleith Quarry, now a retail park. The rock outcrops will not be impacted upon. 	<ul style="list-style-type: none"> • 1 SSSI • 1RIGS 	Neutral
Biodiversity	<ul style="list-style-type: none"> • The Firth of Forth is designated as SPA/Ramsar Site and SSSI, for supporting populations of European importance: Moderate adverse. • The Roseburn Corridor is designated as an Urban Wildlife Site for its function as a wildlife corridor: Large adverse. • Badger and bats have been recorded from the Roseburn Railway Corridor: Moderate adverse. 	<p>250m of the Firth of Forth will be affected in construction of the walk/cycleway over the sea wall, extending out by 3m (≅ 0.1ha in total).</p> <p>Significant amount of vegetation lost from ≅ 3km of Roseburn Corridor between Roseburn Terrace and Telford Rd.</p> <p>Badgers and habitats directly affected by works within Roseburn Railway Corridor.</p> <p>Bats affected by reduction in foraging habitat along Roseburn Railway Corridor.</p>	<ul style="list-style-type: none"> • Moderate adverse • Major adverse • Major adverse • Slight adverse

Landscape / Townscape	Townscape improvements at specific locations but major adverse impacts, primarily from OLE, in many sensitive areas. Significant vegetation removal and tree loss along the Roseburn corridor	World Heritage Site and Conservation Areas	Major adverse
Visual amenity	Varying range of visual impacts (mainly OLE) all along the route. Most significant in the New Town where iconic views are affected, open areas and Roseburn Railway corridor where views are opened up. Screening can mitigate in Railway corridor, but elsewhere design of tram system will need to fit to scene.	World Heritage Site and Conservation Areas	Major adverse
Agriculture and soils	No agricultural land affected. Soils addressed above under ' <i>Geology, Soils and Contaminated Land</i> '.		Neutral
Cultural heritage	<ul style="list-style-type: none"> • One listed building, the Caledonian Ale House (Category C(S)) at Haymarket is likely to require demolition. Mod adverse. • The war memorial/clock at Haymarket (Category C(S)) may require relocation. Slight adverse • The settings of groups of listed buildings will be affected (see Townscape). 	<p>86 sites of potential significance in the swept path or buffer zone will be directly affected:</p> <ul style="list-style-type: none"> • 16 sites of national importance; • 20 sites of regional importance; • 27 sites of local importance; • 23 sites of little or no importance. <p>In addition, the setting of a further 230 listed buildings will be affected</p>	Moderate adverse

Safety

Sub-objective	Item	Qualitative information statement	Quantitative information
Accidents	Change in annual personal injury accidents	Standard rates and methodology from NESA	Change in annual accidents: -7.6 in 2011 and +51 in 2026, for all severity levels
	Change in balance of severity	Rates by severity level: fatal, severe, slight and damage.	Annual changes (2026): Damage = 45.4; Slight = 4.8; Serious = 0.6; Fatal = 0.1
	Total discounted savings	PV 30 years	PV £4.8m
Security		CCTV system at all stops and vehicles. Good proximity of tram stops to retailers and other urban activities. Positive design. Conductors present in all vehicles. Lighting and help points at all stops.	Moderate beneficial

Economy

Sub-objective	Item	Qualitative information	Quantitative information
User Benefits	Travel Time	Public transport journey time savings: Roseburn Corridor / Pilton to Ocean Terminal / Leith 10+ min; access times to Granton development area improved by 10+ minutes from most of Edinburgh; access time to Haymarket from Granton and Leith improved by 5+ min.	£232,045m (PV)

	User Charges	Public transport fares	£-9,462m (PV)
	Vehicle Operating Costs		£5,579m (PV)
	Quality / Reliability Benefits	The higher quality afforded by Line 1 compared to the alternative public transport modes has been encapsulated in the demand modelling and appraisal through the use of differential in-vehicle time factors.	
Private Sector Operator Impacts	Investment Costs	Scheme's capital cost	£-213,542m (PV)
	Operating and Maintenance Costs	Operating cost = £6.29m pa. Bus operating costs savings = £2.2m pa.	£-77,144m (PV)
	Revenues	Reduction of bus revenue = £40,278m (PV). Rail revenue increase = £25,514m (PV).	£-14,764m (PV)
	Grant/Subsidy payments	Total grant for capital and operating costs = £321,827m (PV). Potential developer contribution of £9,563m (PV)	£312,264m (PV)
Economic activity and location impacts	Local Economic Impacts	<ul style="list-style-type: none"> • 5% of opportunities for low / no skill activities, some of which could be filled by residents of north Edinburgh regeneration areas. • Additional jobs at the regeneration area level. 	<ul style="list-style-type: none"> • 35 – 100 jobs. • 0 – 10 jobs.
	National Economic Impacts	<ul style="list-style-type: none"> • No net additional employment is claimed at the Scotland level. • Half of extra jobs in the health sector are additional, which would not be filled without tram. 	<ul style="list-style-type: none"> • No impacts. • 0 – 10 jobs.
	Distributional Impacts	<ul style="list-style-type: none"> • Not all jobs coming to North Edinburgh will be additional, as some will be relocations from other areas. Displacement assumed at 50% 	<ul style="list-style-type: none"> • 35 – 100 jobs.
Integration			
Sub-objective	Item	Qualitative information	Quantitative information
Transport interchanges	Services & ticketing	Integrated transport services and ticketing contribute to more "seamless" journeys across the public transport network.	All users benefited – moderate beneficial
	Infrastructure & information	Infrastructure facilities at tram stops, greater opportunities for bus and rail interchange with the tram at key locations, real-time information at all tram and bus stops.	All users benefited – moderate beneficial
Land-use transport integration	Transport assessment	The scheme is expected to meet or support most local, regional and national policy objectives, in particular related to regeneration, improving access and sustainable travel.	Moderate beneficial
Policy integration	Fit with key policies	The scheme is consistent with national policies beyond transport (disability, health and social exclusion).	Slight beneficial
Accessibility & Social Inclusion			
Sub-objective	Item	Qualitative information	Quantitative information

Community accessibility	Public transport network coverage	Accessibility is significantly increased for travel from most zones to all the selected destinations (apart from travel from the south-west of Edinburgh to the north-east).	
	Access to other local services	The tram provides increased opportunities for walking and cycling as access modes, but it has limitations to promote further non-motorised trips to access local services.	
Comparative accessibility	Distribution / Spatial impacts by social group	Significant accessibility benefits can be realised, also for households without a car.	Some 4 times as many households with no car benefit than disbenefit as a result of the scheme.
	Distribution / Spatial impacts by area	<ul style="list-style-type: none"> • George Street: vast majority unaffected. Twice as many disbenefit than benefit; • Haymarket: vast majority unaffected. No accessibility disbenefits; • Leith Ocean Terminal and Foot of Leith Walk: many times more people/households benefit than disbenefit; • Granton and Crewe Toll: majority benefit significantly (i.e. reduction of 10+ minutes in journey times). 	N° of households without a car benefit (disbenefit): <ul style="list-style-type: none"> • George St: 6,366 (12,604); • Haymarket: 17,337 (0); • Leith Ocean Terminal: 93,728 (53,176); • Foot of Leith Walk: 68,547 (39,127); • Granton: 161,998 (9,856); • Crewe Toll: 124,023 (9,286).

Cost to Public Sector

Item	Qualitative information	Quantitative information
Public Sector Investment Costs		
Public Sector Operating & Maintenance Costs		
Grant/Subsidy Payments	Grant to the private sector to cover the capital (£213,542 PV) and operating costs (£108,285 PV) of Line 1 = £321,827m (PV). Potential developer contribution of £9,563m (PV).	£312,264m (PV)
Revenues	Revenue from operation of Line 1 Revenue from car parking	£116,241m (PV) £25,835m (PV)
Taxation Impacts	Reduction in tax receipts arising from reduced travel and congestion on the highway network reducing fuel and other vehicle related taxes. Increased use of public transport (non-taxed) will reduce tax take from former consumption.	£25,326m (PV)

Monetised Summary

Present Value of Transport Benefits	£235,879
Present Value of Cost to Government	-£195,513
Net Present Value	£40,366
Benefit-Cost to Government Ratio	1.21

Sensitivity and Risk Analysis

One of the critical success factors for the Tram Line project 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 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.

Risk Management Process

Throughout the development of the tram and other ITI proposals, **tie** has initiated and continued to develop a plan for management of risk.

The proposed alignment and options have been found to be feasible, based upon a number of key assumptions (and consequent risks, associated with these assumptions):

- The design is based upon vehicle parameters. No new or innovative, untried technology is proposed, but new traction technologies will be reassessed prior to implementation;
- The run times can be maintained – this depends on achieving adequate tram priority;
- Acceptability of urban design issues – this is being addressed through the development of a detailed design manual, prior to implementation of the scheme;
- Integration with bus – the design provides opportunity for bus integration and mitigates potential adverse impacts on bus. The risk of changes in bus routes, competition and predatory bus pricing is significant and has proved to be problematic on other schemes.

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.

tie established a Procurement Working Group, comprising representatives from legal, financial and technical advisors, 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 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).

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 abroad and are thus cognisant of the likely factors and risks that will impact upon outturn costs.

Cost 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. Operating costs have been built up from detailed estimates of likely staffing levels, power requirements, maintenance costs and other related costs such as insurance and policing.

Line 1 boardings are comparable to existing systems, though in terms of passengers per route kilometre, Line 1 by 2026 will exceed all existing systems. Data on passenger kilometres shows a similar story. The revenue per passenger is in the centre of the range for existing systems, whilst the revenue per tram km is near the upper end of the range.

tie has undertaken a comparison with other operational tram schemes within the United Kingdom to assess the values adopted for the Edinburgh tram projections. The principal points of note are:

- 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%;
- 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; and
- **tie** continues to liaise with other Promoters to obtain maximum benefit from their experiences.

Optimism Bias

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 the Line One project with PUK and the Scottish Executive. The Optimism Bias process as required by Scottish Executive for all major public transport schemes is being followed.

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. Standard factors are given dependent upon the nature of the project based on analysis of previous schemes. No Optimism Bias adjustments exist at present to cover operating costs, lifecycle costs or revenue.

Optimism Bias does not appear to account for the rigorous capital costing methodology employed by **tie**'s technical advisers, 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.

Current Risk Status

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 published industry guidance.

A consolidated risk register has been prepared for the tram network. In order to review timing, the risks have been categorised in order to identify the risk level of each stage of the project and to ensure risks are reviewed and mitigated for each stage.

Of all areas, capital costs, operating costs and works duration (programme) have been shown to lie within Optimism Bias considerations. Strategies have been adopted to quantify the impact of risk. **tie** has developed clear and active processes to prevent and mitigate project risks in accordance with industry best practice. **tie** has also ensured that clear and tangible evidence has been observed prior to reducing the Optimism Bias.

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.

Sensitivity Analysis

A number of sensitivities have been tested to simulate a number of the key project risks. These sensitivities are designed to test the overall economic and financial robustness of the project, and to give an indication of the impact of key project risks on the financial structure proposed:

- Demand and Costs – The overall economic case for Line 1 will be impacted upon by capital and operating cost increases and by demand falling lower than forecast. To illustrate this, the ‘switching value’ of the capital cost, operating cost and scale of demand have been established where the NPV would fall to zero.
- Unchanged Bus Network – The integration of bus and tram services is critical to successful operation. Line 1 Central Case assumes that there is limited bus network restructuring, but a scenario was tested assuming an unchanged network. The analysis shows that Line 1 would add significant public transport supply, but this dilutes the available revenue to the various public transport operators. Therefore, from a financial viewpoint, i.e. the business case, this option performs noticeably worse, but from an economic viewpoint, it performs better with a BCR of 1.57.
- Mode Constant – The Central Case assumes a modal preference of 0.8 in-vehicle weighting. A test has been undertaken assuming a value of 0.9. This reduces the level of demand and benefits accruing to Line 1, reducing the BCR to 1.07.
- Tram Frequency – The current central case assumes a frequency of 8tph; however, by 2026 demand is forecast to be near or at the capacity of this frequency. On this basis, a test has been undertaken assuming 10tph, increasing the operating cost. The impact is positive on Line 1 demand and benefits, but the operating ratio of the tram is marginally worse, where the increase in revenue is insufficient to offset the increased capital and operating costs. The BCR is unchanged at 1.21, where the benefits of the frequency increase is offset by the additional operating cost.
- Tram run time – The Central case run time is some 40.5 minutes, assuming a reasonable level of priority at junctions. But, as it is possible that this is not achieved, run times of 43.0 minutes have been developed. There would be an increase in operating cost, with a larger fleet requirement, and the BCR would lower to 1.09.

- Work Split – The Central Case appraisal assumed a local work split based on Edinburgh household survey data. Using default TUBA work splits increases the PVB by some 6.3%, and the BCR to 1.28.
- Worst Credible Scenario – The results for the worst credible scenario with respect to the financial case for Line 1 indicates that the operating ratio would be substantially eroded. Bus operations would be similarly affected. This scenario produces a BCR of 1.26.

Monitoring and Evaluation

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.

Soon after implementation, the performance of the project should be assessed against the specified objectives – the process evaluation. Recognising that certain 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.

Project objectives have been set out as a more measurable and specific account of the planning objectives, and can be seen as scheme performance indicators. During future scheme development, the scheme objectives will continue to be under review and re-appraisal where appropriate.

There is a 5-6 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. Future changes in planning and transportation strategies as proposed or implemented by CEC will also result in a re-assessment of the tram proposals.

It 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.

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.

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 will probably be undertaken as part of the process to be followed prior to agreeing any change of the targets and will be based on similar data to that collected for the baseline survey and process evaluation mentioned above.

A monitoring programme will need to be developed within the development and implementation stages of the project, in order to ensure the gathering of relevant information on performance indicators. The monitoring programme will measure the progress towards meeting the objectives through an assessment against target indicators, in particular whether the project is providing Best Value.

It 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.

1 Introduction

1.1 Background

1.1.1 Edinburgh Tram

The City of Edinburgh Council (CEC) is examining ways of providing the city with the transport infrastructure necessary to promote and support a growing local economy and create a healthy, safe and sustainable environment. This is part of a £1.5 billion New Transport Initiative that the CEC is working in co-operation with other local authorities in South East Scotland to deliver.

As a key component of the strategy of public transport investment in Edinburgh, the council is proposing to develop a network of modern light rapid transit rail systems, or trams. The tram system is being developed in stages and will focus on the major city transport corridors including links to Park and Ride sites.

CEC has established a company, called Transport Initiatives Edinburgh (**tie**), which is responsible for the delivery of a number of major public transport schemes in the next 10 to 15 years, including the proposed tram network. At this time, **tie** is developing and promoting three tramlines, with further lines and extensions envisaged in the longer-term. This three-line network comprises the following:

- Line 1, the Northern Loop, linking the City Centre with Granton and Leith;
- Line 2, west from the City Centre to serve Edinburgh Park and the Airport, with Park and Ride at its western extremities; and
- Line 3, connecting the City Centre with the south-east area of Edinburgh.

Each line is being developed and approvals sought independently, with a separate, but parallel, network study providing the overarching framework for the development of trams in Edinburgh. On this basis, separate STAG (Scottish Transport Appraisal Guidance) appraisals and Parliamentary Bills will be submitted for each line.

Whilst a network of trams is being developed, each line is being promoted independently and as such this report relates to the impacts of Line 1 alone. A sister appraisal report will be submitted contemporaneously for Line 2. A full STAG for Line 3 is envisaged during 2004.

1.1.2 Line 1: Northern Loop

In 2001, Waterfront Edinburgh Limited (WEL) commissioned a preliminary technical and economic Feasibility Study¹ of a rapid transit system in north Edinburgh, led by a Steering Group involving the City Council. One of the objectives of the system was to provide a link between the city centre and the proposals for the Waterfront redevelopment planned at Granton.

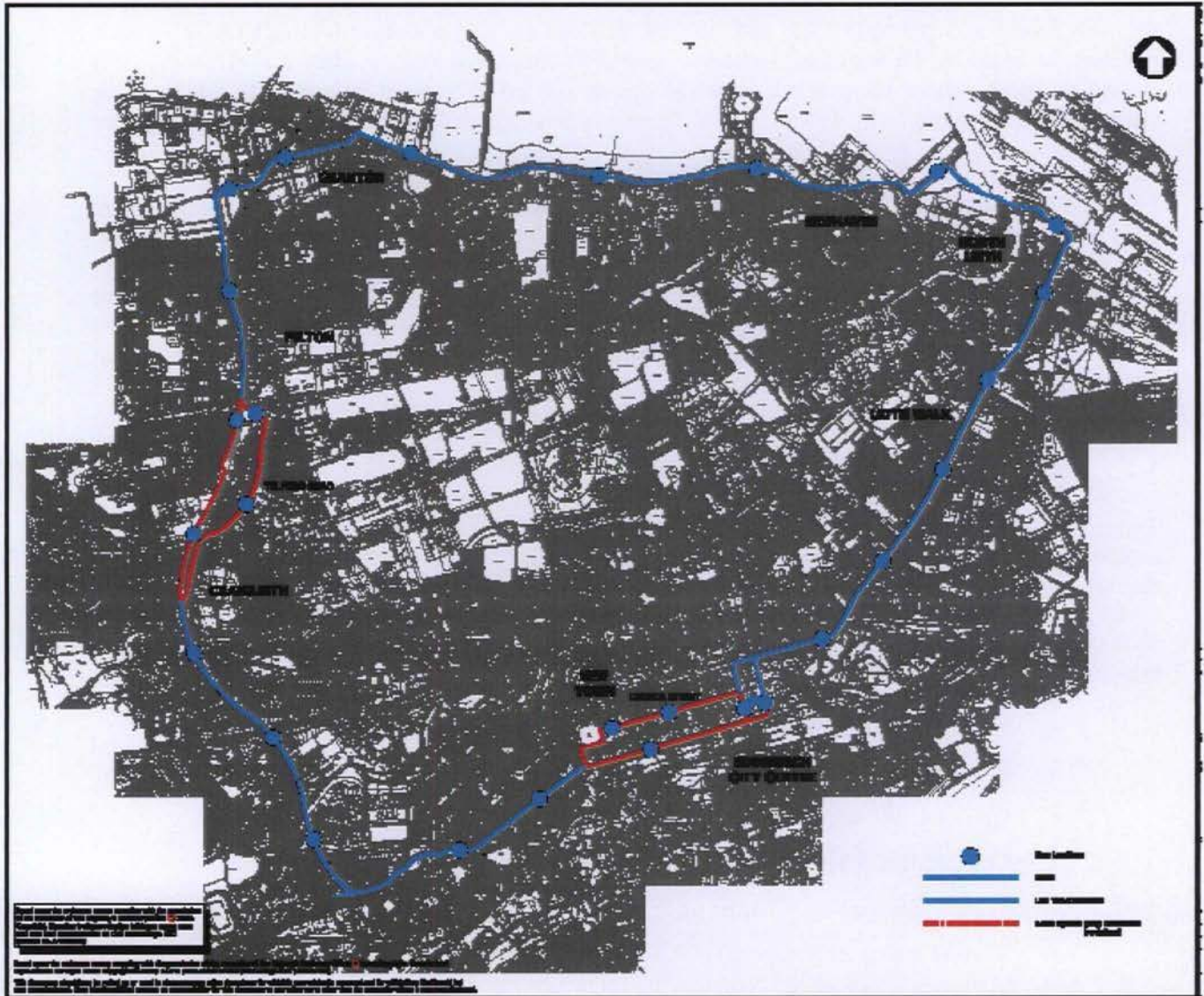
This Feasibility Study concluded that a northern loop tram system would maximize a number of positive benefits for the area including economic regeneration and improved accessibility. The Feasibility Study and, critically, an associated preliminary appraisal, was submitted to and accepted by

¹ Feasibility Study for a North Edinburgh Rapid Transit Solution, July 2001, Andersen, Steer Davies Gleave and Mott MacDonald.

the Scottish Executive, and funding of £6.5m was subsequently made available for the development of the Line 1 project to full appraisal and Bill submission.

The alignment of the Line 1 route, illustrated in Figure 1.1, is proposed to connect the city centre with Leith, Newhaven and Granton, passing through the Waterfront development area and then along the line of the former Roseburn Railway to Haymarket.

Figure 1.1 Route Alternatives



1.2 The STAG Appraisal Process

Scottish Transport Appraisal Guidance (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.

STAG has two parts:

- STAG1: 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
- STAG2: detailed appraisal against the scheme and Government's objectives.

For the purposes of the Edinburgh Tram projects, STAG1 appraisal was effectively undertaken in the scope of the feasibility study, and reported within the Outline Business Case (OBC). A formal STAG1 has not been undertaken since STAG had not been published at the time (the full guidance was only issued in September 2003) and the OBC fulfilled the role and objectives of STAG1 – which has been accepted by the Scottish Executive. The OBC concluded that the Light Rail Transit (LRT) system on the Northern Loop is the preferred option and offers greatest benefits. In addition, the scheme was considered to fit with the Local Transport Strategy and Steering Group objectives (more details in Chapter 4).

This report focuses on STAG2 appraisal (full details in Chapter 7), taking full cognisance of the recent release of the STAG guidance update (Scottish Executive², 2003).

A consistent basis for the technical development, modelling and appraisal of Edinburgh Tram has been developed and agreed between the respective Line 1 and 2 technical teams. Furthermore, on the section of common running between Haymarket and St. Andrews Square, the appraisal has been undertaken by the Line 1 team and adopted by Line 2.

1.3 Objective and Structure of this Report

This report sets out the STAG appraisal for Edinburgh Tram Line 1, building on the appraisal considerations in the OBC (as reported in the Feasibility Study report) and developing a full STAG2 appraisal.

This report describes the various processes, issues and results from the STAG appraisal for the Edinburgh Tram Line 1 scheme. This is set out in the following chapters:

- Planning objectives (Chapter 2);
- Problems and opportunities in North Edinburgh (Chapter 3);
- Option generation, sifting and development (Chapter 4);
- Consultation (Chapter 5);
- Scheme description (Chapter 6);
- STAG2 appraisal (Chapter 7);
- Sensitivity and risk analysis (Chapter 8);
- Monitoring and evaluation (Chapter 9); and
- Conclusions (Chapter 10).

For practical reasons, the report is accompanied by a separately bound volume containing a set of Appendices, which provide a more detailed treatise of some of the issues under consideration.

² <http://www.scotland.gov.uk/library5/transport/stag-00.asp>

2 Planning Objectives

The aim of this chapter is to develop the planning objectives to drive the appraisal stage, based on the requirements of STAG and on the planning policy framework.

2.1 STAG Requirements

STAG appraisal is not simply completion of the Appraisal Summary Tables but is a holistic process that begins from issues and objectives and traces the development of project proposals from objectives and is developed through a process of option appraisal. There is therefore a requirement to provide a rationale for the selection of particular project proposals, and that rationale must be traceable back to the issues to be addressed and the planning objectives determined by the promoter of the project.

In summary, the STAG appraisal process requires that proposals are tested against three sets of objectives:

- The planning objectives established by the planner (planning strategy);
- The Government's five objectives (environment, safety, economy, integration and accessibility); and
- Any other relevant external objectives relating to transport, land use or wider policies (local, regional and national policy framework).

STAG suggests that, when setting objectives in complex situations, there should be layers or levels of objectives, with strategic and operational level objectives and possibly intermediate objectives below but linked to the strategic level aims. While strategic level objectives are concerned with final (policy) outcomes, the lower levels of objectives can relate to outputs from particular strategies and / or to the inputs used.

The City of Edinburgh Council has clear strategic objectives enabling projects to be categorised as part of particular strategies. This is beneficial in taking forward the projects through the STAG appraisal process. However, a further explicit process is needed for developing an option appraisal which addresses the requirements of a STAG appraisal. This process underlies the rationale for the project, by testing outcomes against objectives, assessing likely costs and value for money, and considering deliverability and fundability.

In order to develop the required rationale and to provide a STAG driven basis for categorisation of projects, the following section sets out the transport vision and from it develops planning objectives suitable for a STAG appraisal.

2.2 Planning and Policy Framework

This section examines the planning and policy framework for Edinburgh in relation to transport, in the national, regional and city contexts.

2.2.1 National Context

The national policy framework for transport is set out in the White Paper, *Travel Choices for Scotland* (TSO, 1998), and more specifically in relation to planning and transport, in the Planning Advice Note

57 *Transport and Planning*, and in the National Planning Policy Guideline 17 (NPPG17) (Steer Davies Gleave, 2001).

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.

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 jobs 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.

In order to support the development of its integrated transport policy, the Government has established five appraisal objectives in STAG, which are used when authorities and agencies develop and appraise new transport proposals. Thus, planning objectives are required to satisfy the five overarching national objectives for transport:

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

2.2.2 Regional Context

The City of Edinburgh Council 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.

2.2.3 Local Context

The City of Edinburgh Council has a well developed vision for transport over the next 20 years. It recognises the importance of transport for the economy of the City while at the same time seeking a major change in the way transport needs are met in order to achieve central objectives relating to the sustainability of the City and its environment, safety in using transport and the need to promote greater social inclusion.

Local planning

The statutory development plan for Edinburgh is comprised of the Lothian Structure Plan (1994) and the local plans. The City of Edinburgh Council, West Lothian, Midlothian and East Lothian Councils are currently working together to prepare a new Structure Plan, and have published a major issues paper for consultation. The key issues that have been identified are housing pressures, jobs and the economy, transport and commuting. Within Edinburgh itself, the Granton Waterfront area is identified as having potential for brownfield residential development, as well as land for office and business space, provided transport and other infrastructure is adequate. In this context, the Waterfront Granton Masterplan³ aims to create a place which involves and benefits the existing communities of northern Edinburgh and which attracts employment, housing and other opportunities.

Local Transport Strategy 2001- 2004

The Local Transport Strategy⁴ (LTS) produced by the City of Edinburgh Council (CEC) sets the key framework for the City's transport strategy over the next years. CEC has stated its vision for transport within the LTS as follows:

Edinburgh aspires to be a city with a transport system that is accessible to all and serves all. Edinburgh's transport system should contribute to better health, safety and quality of life, with particular consideration for vulnerable people such as children, and elderly and disabled people: it should be a true Citizen's Network. The transport system should support a strong, sustainable local economy.

The Council will seek to maximise people's ability to meet their day-to-day needs within short distances that can easily be undertaken without the need to use a car. The city should develop and grow in a form that reduces the need to travel longer distances, especially by car. Choice should be available for all journeys within the city.

³ City of Edinburgh Council, Scottish Enterprise Edinburgh and Lothian, Scottish Homes, December 2000, Llewelyn-Davies et al.

A number of policy aims and objectives derive from this vision, which address specific issues and trends, including modal and spatial dimensions of the overall transport plan. There are also further policy aspirations that need to be taken into account. The City of Edinburgh Council has also considered specific schemes, programmes and projects⁵ that can be implemented to achieve its transport vision, of which Edinburgh Tram is a principal component, and wider policy goals.

The Council 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. Controlling congestion is, thus, considered crucial to maintain the effectiveness of Edinburgh's transport system, so that the focus is on:

- Ensuring that attractive alternatives to the car are available for the widest possible range of journeys; and
- Putting in place measures to tackle congestion at times and in places where it is a problem.

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, disabled as well as those with low incomes, children, women and parents with young children. To reduce social exclusion, the Council has identified good public transport, less traffic and lower speeds, better land use planning and transport integration, and accessible services as required.

The Council views congestion as affecting the economy in the city centre, but it 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.

A number of aims are stated in the City of Edinburgh Council's Local Transport Strategy, as follows:

- To improve safety for all road 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; and
- To maximise the role of streets as the focal point of local communities.

To help meet their aims, the Council has adopted a number of objectives and targets for their transport strategy:

- To reduce the need to travel, especially by car;
- To reduce the amount of car use and congestion on all modes of transport;

⁴ Local Transport Strategy 2004 – 2007; The City of Edinburgh Council. Subject to consultation in October/November 2003.

⁵ For convenience, these will all be referred to as projects, but it is recognised that this includes activities which involve more than and / or last longer than individual projects.

- To encourage and facilitate walking, cycling and public transport use;
- To reduce the adverse impacts of travel, including road accidents, air pollution, noise and economic enhancement through environmental improvement;
- To enhance streets as 'civic spaces', where priority is given to people rather than cars;
- To improve the ability of people with low incomes or mobility impairments to use the transport system, especially by public transport, as pedestrians or by bicycle; and
- To maintain the road network, and any other facilities for the movement of pedestrian, cyclists and bus users, to a standards 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 these objectives. The aims of the LTS clearly echo the transport vision and to a degree represent a re-statement of the key themes of the vision, and as such represent the high level strategic aims which City of Edinburgh Council wishes to achieve in the future. However, these combine some impacts relating to how transport performs (e.g. safety and environmental impacts) which are qualitatively different from those relating to how the transport scheme being appraised can contribute towards these and other wider aims (especially economic development, fitness and social inclusion). Accordingly, these are not directly usable as planning objectives for the scheme.

2.3 Developing Planning Objectives

In the context of the OBC, where a preliminary appraisal was undertaken, the LTS aims were utilised, leading to the overall appraisal under the five key Government objectives (environment, economy, safety, integration and accessibility). Since STAG2 comprises a more refined appraisal process and enable the appraisal of more detailed impacts, higher-level planning objectives were developed. These also needed to meet the STAG requirements and be consistent with the planning objectives set out in the OBC, as well as with the transport vision for Edinburgh, the LTS and with wider (regional and national) policy objectives for transport and beyond.

Thus, for the purposes of STAG2 appraisal, more comprehensive and specific planning objectives were developed for the scheme, under broad categories, as outlined below:

- **To support the local economy by improving accessibility** – To achieve an integrated, efficient, accessible and quality public transport system that promotes economic growth to the local community, improving its performance and competitiveness. This is fundamental to achieving both the social inclusion and economic development elements of the transport vision, through:
 - Improve access to public transport network; and
 - Improve access to employment opportunities.
- **To promote sustainability and reduce environmental damage caused by traffic** – To encourage more sustainable travel and comply with the targets set by the Air Quality Amendment Regulations. This is fundamental to achieving the environmental, sustainability, health & fitness and traffic aspirations:
 - Increase proportion of journeys made by public transport, cycling and walking; and
 - Reduce local and global emissions (improving air quality and reducing contribution to Greenhouse gases).

- **To reduce traffic congestion** – To enable cars to be used efficiently, reducing congestion and delays on key routes. This is fundamental to the achievement of economic development and environmental aims of the vision:
 - Reduce number of trips by car; and
 - Reduce traffic volume on key routes.
- **To make the transport system safer and more secure** – To aim at less deaths by road traffic accident, by reducing vehicle volumes, speeds and making roads safer for both users and non-users. This is fundamental to the achievement of the safety elements of the vision:
 - Reduce traffic accidents.
- **To promote social benefits** – To take the new system as an opportunity to promote social and community benefits, which are fundamental to the respective elements of the vision:
 - Improve liveability of streets, maximising their role as the focal point of local communities; and
 - Reduce social exclusion, by improving the ability of people with low incomes, no access to car, the elderly or mobility impairments to use the transport system.

These planning objectives can help to identify both where projects and programmes re-enforce each other in achieving a range of objectives, as well as where there may be trade-offs. For example, there will be projects which contribute positively towards accessibility objectives but which could be potentially negative against some environmental objectives.

3 Problems and Opportunities in North Edinburgh

The purpose of this chapter is to set out the key problems and opportunities in North Edinburgh. The main areas considered relate to:

- Socio-economic characteristics;
- Environment; and
- Transport.

The following sections deal with each in turn. The last section sets out the potential opportunities that exist for a transport scheme.

3.1 Socio-Economic Characteristics

Despite the current worldwide economic slowdown, the strength of Edinburgh's regional economy, with correspondent growth in population and jobs, is expected to continue (Transport Initiatives Edinburgh, 2002). Recent research suggested that Edinburgh will have the fastest growing economy of any major UK city over the next five years (European Regional Prospects, 2001). Economic growth is closely related to future labour supply and population growth, with a buoyant economy likely to result in both a high level of inward migration and a growth in commuting.

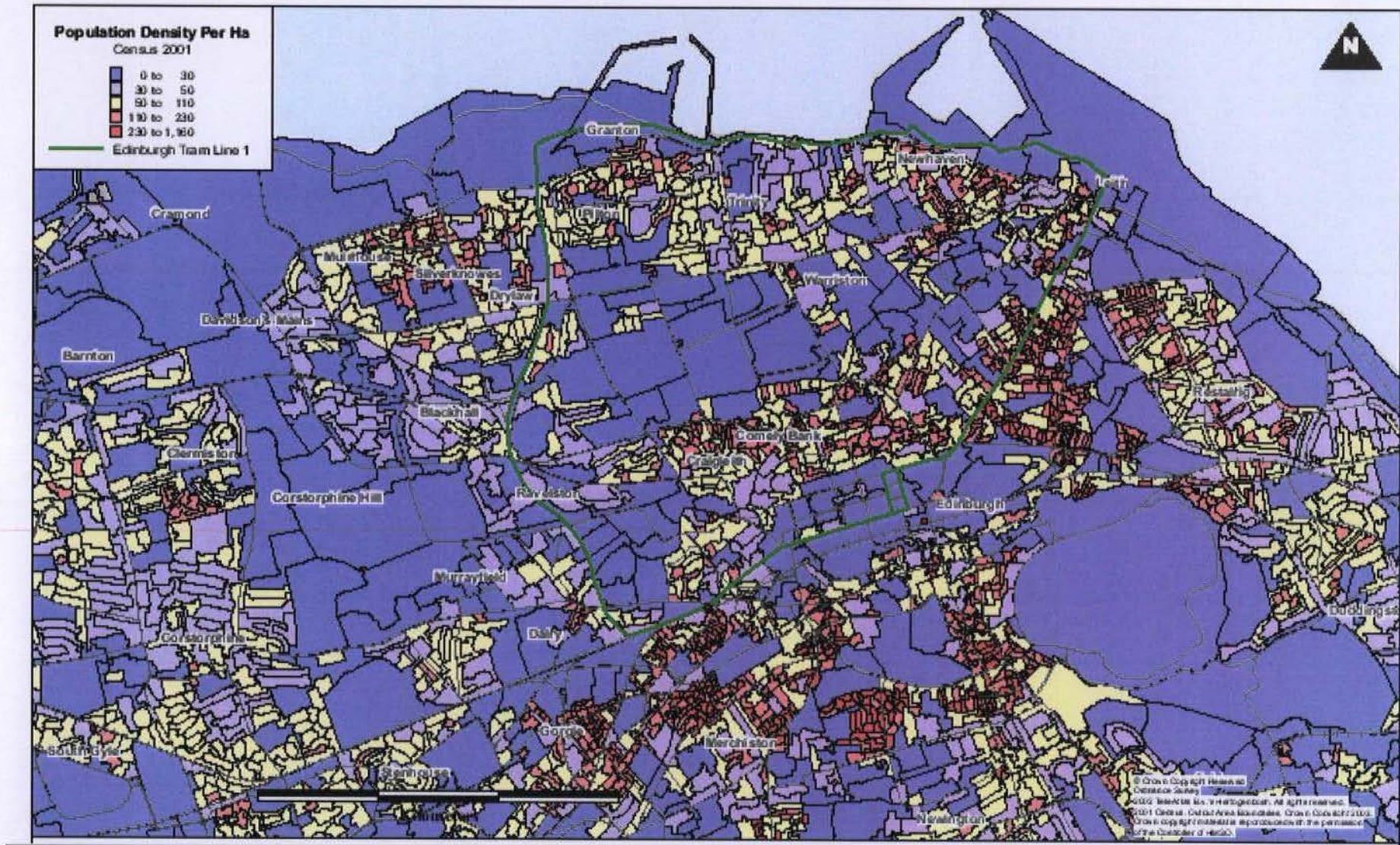
The following sections revise the socio-economic context for:

- Population;
- Car ownership;
- Employment;
- Income;
- Deprivation; and
- Education.

3.1.1 Population

The General Register Office (Scotland) estimates that Edinburgh's population will grow from 453,000 to 465,000 between 2001 and 2011 (The City of Edinburgh Council City Development Department). Figure 3.1 illustrates the variation in population density levels within the study area at Output Area level from the 2001 Census. High densities are found in the north of the New Town, along Leith Walk and into Leith, through to Newhaven and across the north west of Edinburgh, covering the areas of Granton, Pilton and Muirhouse. The City Centre, by its very nature has a low density. The areas of Granton and Leith Docks, whilst currently having low population levels and density, are the subject of major development plans. These anticipate up to 15,000 household units, some 30,000 residents, split approximately 60% at Granton and 40% at Leith.

Figure 3.1 Population Density



3.1.2 Car Ownership

At the end of the 1990s, Edinburgh experienced one of the fastest rates of growth in car ownership in Europe – the number of cars per 1000 population rose by 162% between 1971 and 1997. Comparing the results from the 1991 and 2001 census, the number of cars per 1000 population rose by nearly 20% in that period. However, 39.5% of households in Edinburgh do not own a car (according to the 2001 Census).

Figure 3.2 shows the distribution of non-car owning households for the study area (based on 2001 Census). The areas of low car ownership are broadly correlated to population density, which correspond to much of the study area. In part this reflects the compact nature of much of the City, which allied with the comprehensive bus system, makes car ownership less attractive than is the case elsewhere. However, it is also related to income and deprivation and this is covered below.

3.1.3 Employment

Unemployment is at a 25-year low and is expected to decline only slightly from its present level. A growing workforce, combined with increasing productivity, could lead to a 36% increase in economic output over the next decade. In turn, growing output would support substantial growth in real income and spending, with all the consequent effects on demand for services, such as shops, leisure, health, education and, particularly, travel (The City of Edinburgh Council City Development Department).

Figure 3.3 illustrates unemployment levels (from the 2001 Census) and their distribution. The key concentrations of unemployment are in pockets of Leith and, more widespread, in areas of Granton, Pilton and Muirhouse.

3.1.4 Income

Figure 3.4 shows the distribution of income in the study area at the ward level (2001 Census). As could be expected, the areas of lower income are correlated with areas of low car ownership and high unemployment, namely the areas of Leith and the Granton, Pilton and Muirhouse areas of north east Edinburgh.

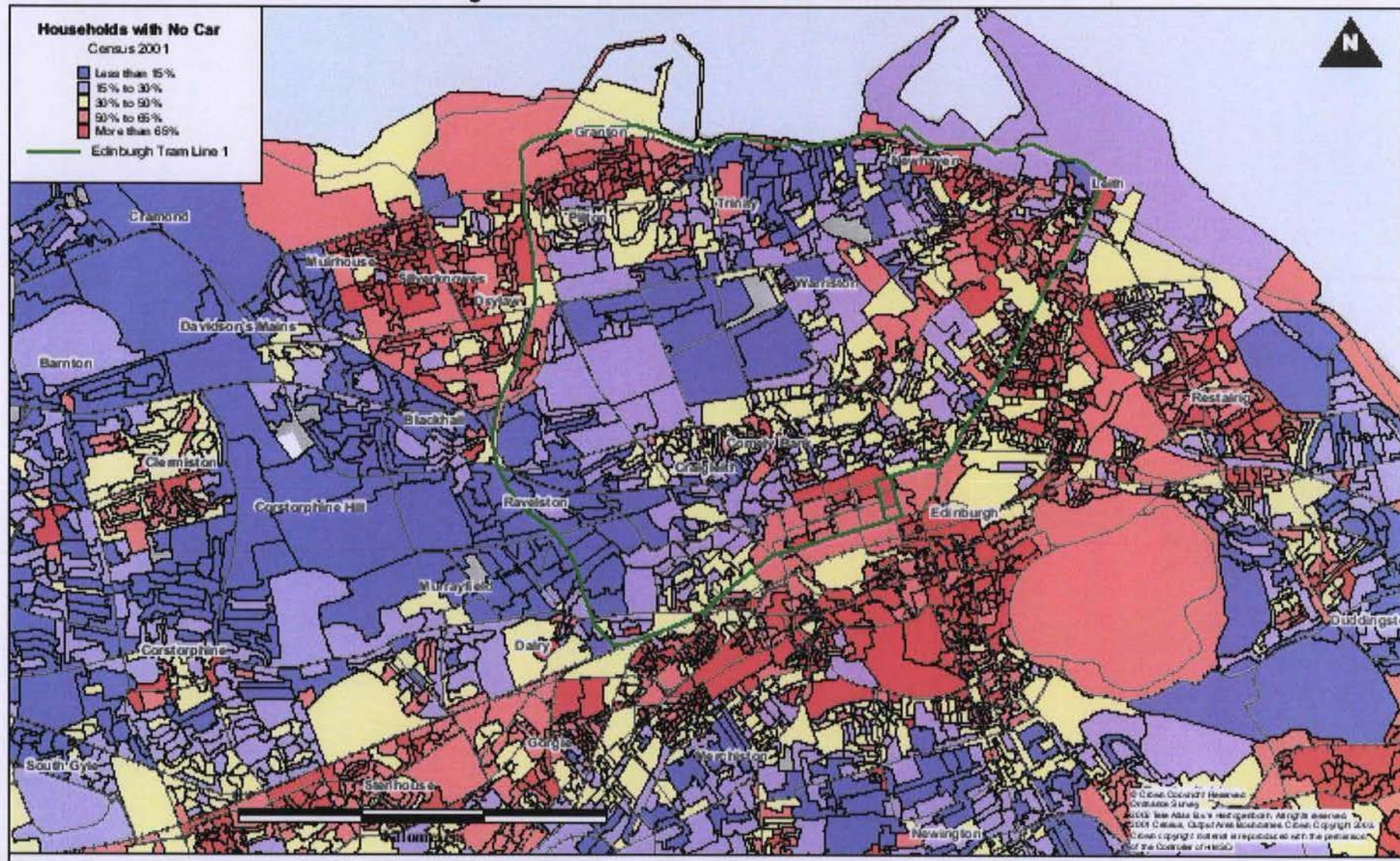
3.1.5 Deprivation

The area covered by the Waterfront regeneration initiative and surrounding neighbourhoods, notably the Granton, Pilton and Muirhouse areas, has a history of social deprivation and exclusion and this is shown in Figure 3.5, which illustrates the deprivation level for wards in Edinburgh, based on the Index of Multiple Deprivation (IMD) per ward. In north Edinburgh, this north-eastern section is one of the most deprived areas.

3.1.6 Education

Figure 3.6 illustrates the level of education in the study area. As with the other indicators shown above, the areas of Granton, Pilton and Muirhouse show poor levels of educational achievement amongst its populace, with Leith also performing poorly compared to the average.

Figure 3.2 Households with No Car Available



TRS0000041_0046

Figure 3.3 Percentage of Unemployment

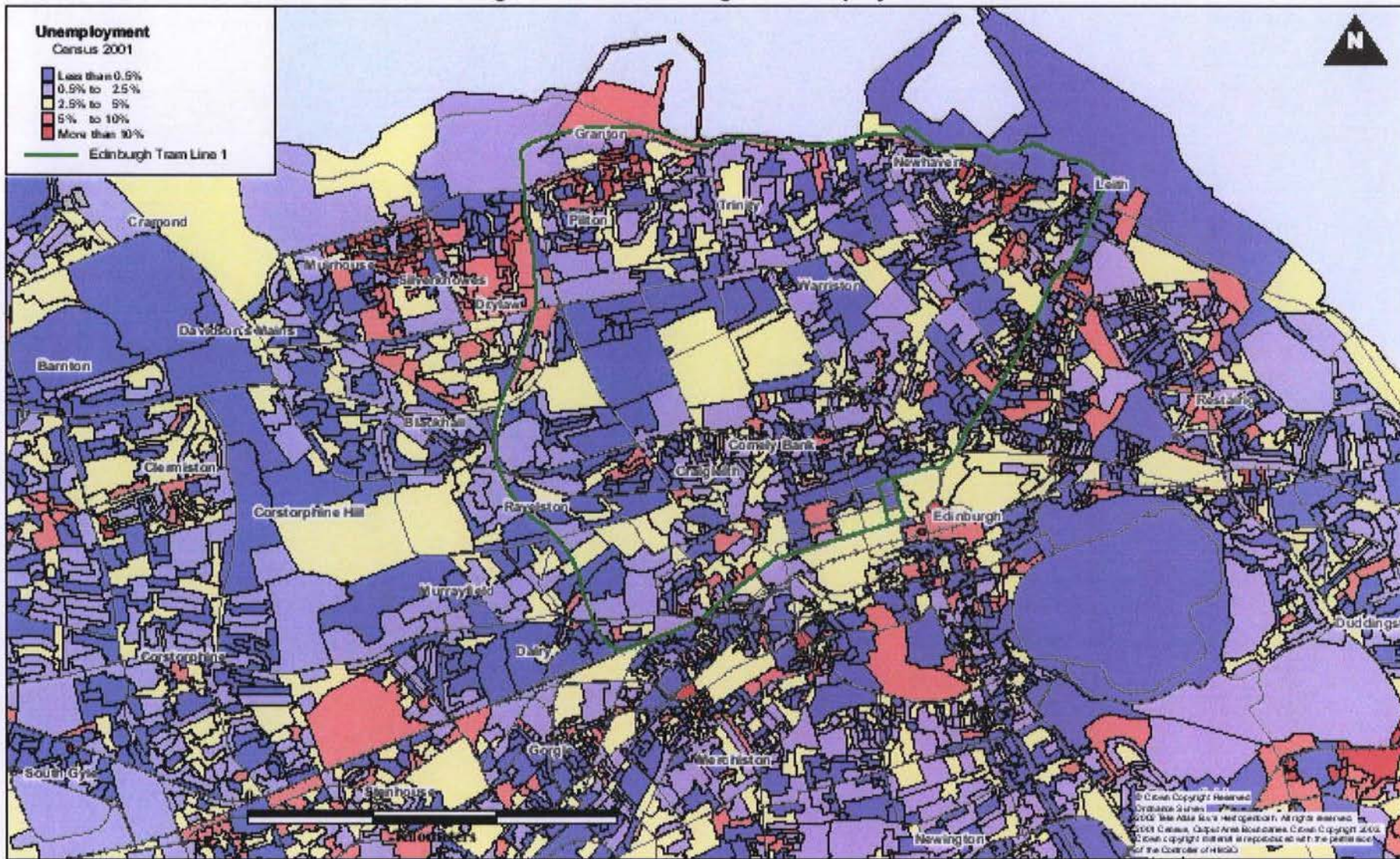


Figure 3.5 Index of Multiple Deprivation

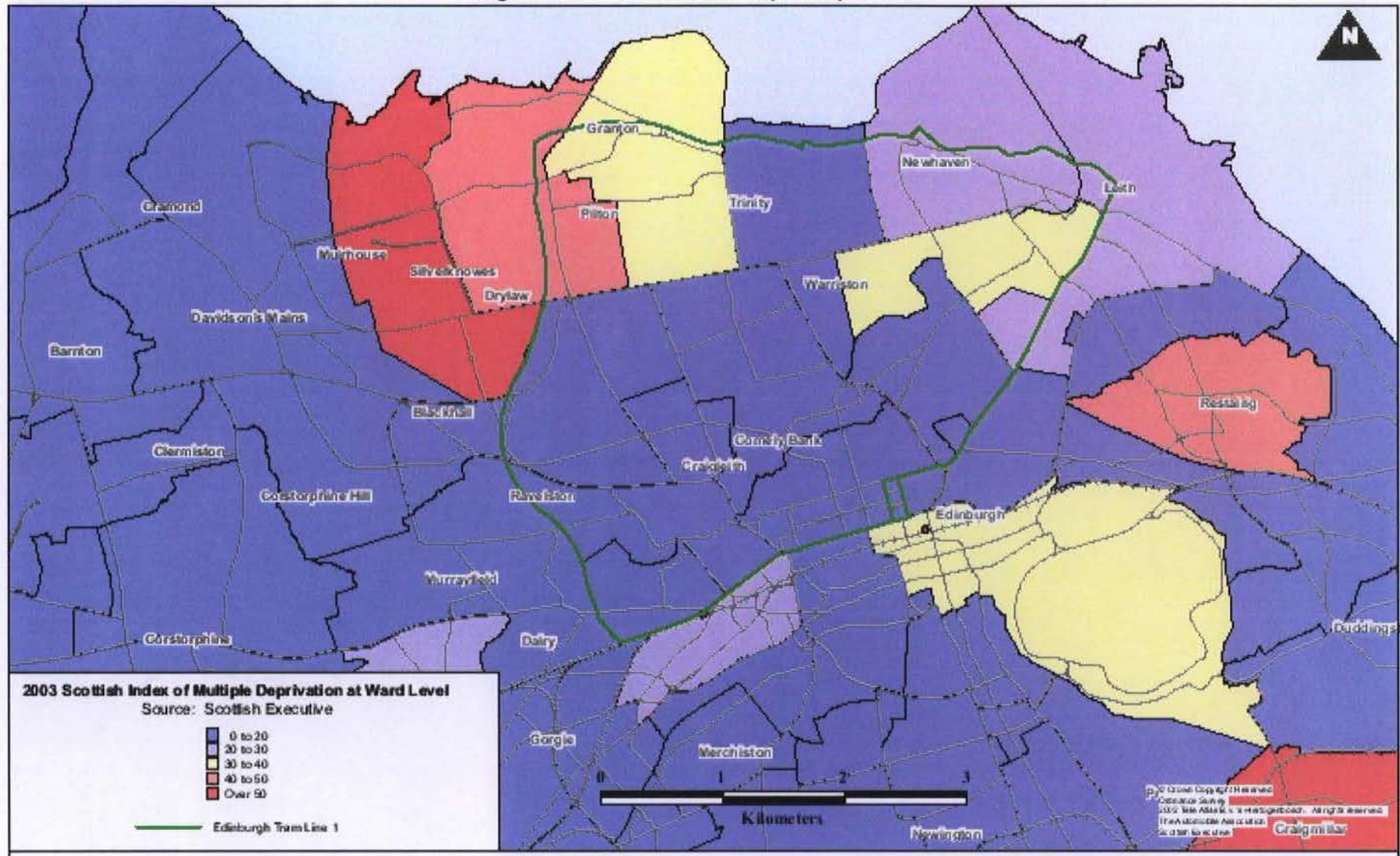
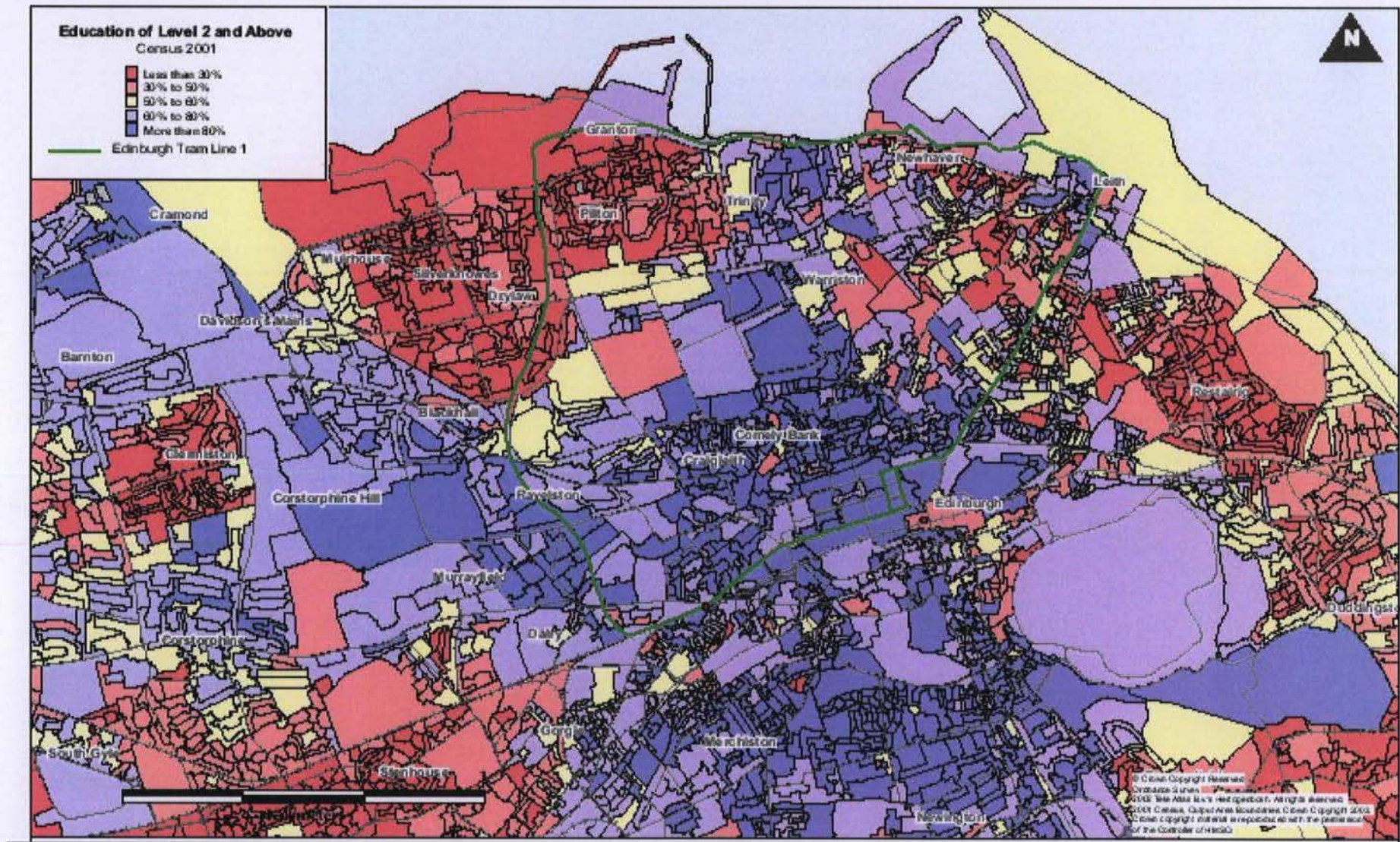


Figure 3.6 Education Levels



3.1.7 Socio-Economic Characteristics in North Edinburgh

The areas covered by the Waterfront regeneration, the surrounding neighbourhoods and North Edinburgh as a whole have a history of social deprivation and exclusion. The North Edinburgh area has been the subject of a policy initiative, which seeks to address social deprivation issues. As such, there is a rich stream of data that illustrates the area's social deprivation compared with the rest of the City and Edinburgh. However, whilst the available research is quoted extensively below, it is important to note that social needs are not limited to the neighbourhoods covered by the data. Social deprivation spreads across much of the north of the City, including Leith, where notwithstanding recent regeneration social issues remain. The situation in the North Edinburgh Area Renewal (NEAR) area is typical of many parts of the north of the city.

The redevelopment of the Waterfront area is intended to contribute to the regeneration of Granton and the surrounding areas. Granton, and its neighbouring areas of West Pilton, Muirhouse, Drylaw and Royston/Wardieburn suffer from significant levels of social deprivation. A 1999 study by Halcrow (Halcrow, 1999) produced an updated Economic and Social Profile of the NEAR area, covering these five areas.

The study highlighted some general social and economic characteristics of the NEAR area:

- North Edinburgh has larger household sizes than the city and national averages. There are also high proportions large households with children, and elderly households in the area;
- The area had a younger population than Edinburgh as whole;
- 53% of respondents in the NEAR area rented housing from the local authority. Owner-occupied levels were low, at 28% of households in the area. The Halcrow report noted the difficulties in developing a private housing market in the area, with market values of properties low. The proportion of respondents with housing from the Housing Association and Co-operative Sector is double the proportion in Edinburgh as a whole (at 11%, compared to 5% in Edinburgh). This reflects the growing significance of this sector in housing in the area;
- Access to a car varied amongst the areas surveyed. Overall, 66% did not have access to a car. This compares to 46% of Edinburgh residents with no access to a car, and 35% in Scotland overall. Therefore, the North Edinburgh area has significant proportions of people with no access to private vehicular transport;
- Across Scotland, 12% of households do not have a bank or Building Society account. In the NEAR area, this proportion was 23%, suggesting a high level of exclusion with regard to financial services;
- Overall 22% had a net income of less than £300 per month, with females faring worse than males – 29% of women in lowest income bracket, compared to 13% of men;
- The levels of qualifications in North Edinburgh were poor compared to the national average. Those with no qualifications were double the national average. In the NEAR area, 46% left school with no qualifications. Overall, only 22% had undertaken post school education.

In relation to employment, the following figures show the nature of employment patterns and modes of travel in the area:

- In the NEAR area 42% of adults in surveyed households were employed full-time, 12% part-time, with 22% unemployed and 13% retired. Unemployment figures for Edinburgh for 1997 suggested 4.5% unemployed in the city overall;
- The proportion of respondents employed part-time is lower than the Edinburgh average. Overall, differences between genders reflect wider trends, with 51% of males in full-time employment, compared to only 26% of females. More females are unemployed than males. However, females working part-time is much more significant at 16% compared to 2% of male respondents;
- Compared to Edinburgh as a whole, the NEAR area has a low proportion of adults working in managerial, administrator and professional sectors. The majority of respondents were employed in the service and skilled trade sectors, with some variations across neighbourhoods;
- There are significant levels of long-term unemployment: 80% of the unemployed respondents had been so for longer than a year, higher than the official statistics of 24% (explained by unregistered unemployed in this survey) and 48% had been unemployed for longer than 5 years. Long-term unemployment was particularly prevalent in older age groups, especially between 45-54 years old;
- Overall in the NEAR area, most respondents worked in the City Centre (29%), followed closely by the NEAR area (28%);
- When asked about mode of travel to work, overall the largest single proportion (36%) travelled by bus, followed by 31% travelling by their own car and 14% walking. Although this is considered a high modal share in favour of the bus in relation to the Scottish average, this proportion reduces significantly when looking at areas with lower levels of accessibility. For instance, the largest proportion of West Granton respondents travel to work by car (38%) with bus at 26%, walking at 15% and cycling at 11% (compared to an overall average of 4%);
- When asked about barriers to their ideal job, 21% stated access, the second highest obstacle after lack of experience. Access is likely to be a greater barrier to the new development and employment areas in the north of Edinburgh, where deficiencies to the current bus network are most evident;
- As a consequence of the research into modes of travel to work, the study concluded that employment patterns were shown to reflect public transport links. It also suggested that work patterns will continue to be affected by accessibility by bus and foot. The main growth areas were viewed to be service sector employment, in the City Centre and at The Gyle and Edinburgh Park. The report stressed that better public transport links to the latter two locations in particular were required to enable access to opportunities, with relatively good public transport access currently to the City Centre.

A study carried out by Oscar Faber (Oscar Faber, 2000) examining public transport option in North Edinburgh, reinforced Halcrow's findings. It stressed these communities' reliance on public transport and the inadequacy of current connections to areas of employment in Leith and the west of the city.

The recent studies that have examined the socio-economic characteristics have identified that the North Edinburgh area – defined as Muirhouse, West Pilton, West Granton, Royston/Wardieburn and Drylaw – is characterised by social deprivation and economic need. While there is an acceptance that improved transport provision will not address all of the needs of the area, there is also a recognition that in concert with other initiatives promoting housing, employment and urban regeneration, it can make a contribution to improving the well being of the North City. It is also important to note that while the available studies have concentrated on a sub-area of North Edinburgh, the socio-economic

deprivation is not limited to the area covered by the NEAR study. Needs spread further afield, including into Leith where, notwithstanding the regeneration that has occurred there, areas of social deprivation remain.

3.2 Environment

3.2.1 Aims and Objectives

The overarching planning objectives for the study have been set out and discussed in Chapter 2 of this report. Environmental objectives are expressed within these aims and objectives, and are clearly established by the Government's environmental objective as one of the five key objectives for transport.

These objectives are supported by policies and aspirations at the regional and local level in statutory documents such as structure and local plans and the Local Transport Strategy, which have an environmental theme. The statutory development plan for the area through which the scheme passes comprises the Edinburgh and Lothian Structure Plan and several local plans. The core strategy of these documents is to facilitate more sustainable patterns of land use and development, which include protection and enhancement of the natural and built environment.

The Local Transport Strategy (LTS) includes a key aim which is to reduce the environmental impacts of travel, and a number of the LTS's objectives support this aim:

- To make it easier to live without the car, or use the car less;
- To reduce the amount of car use;
- To encourage and facilitate walking, cycling and public transport use;
- To reduce the adverse impacts of travel including road accidents and environmental damage, particularly for those worst affected by these impacts; and
- To enhance streets as 'civic spaces', where priority is given to people rather than cars.

The LTS contains targets for air pollution and noise pollution from traffic which will be used to help monitor progress in achieving objectives.

The City Plan for Edinburgh⁶ sets out broad aims for the city's environmental policy:

- The promotion of sustainable practices in every sphere;
- The creation of practical alternatives to the private car together with improved accessibility and road safety, enhanced air and water quality, reduced energy use and waste, and an increase in the proportion of 'brownfield' to 'greenfield' land being developed; and
- The maintenance and improvement of the urban environment.

The City Plan for Edinburgh identifies a number of environmental issues which were raised as part of the process followed by the Lord Provost's Commission on Sustainable Development. A number of the findings of this process have relevance to the environmental context of the city centre and study area for the Edinburgh Tram, including:

⁶ The City of Edinburgh Council (1999) City Plan for Edinburgh.

- A recognised need to reduce energy consumption and meet internationally agreed targets for carbon dioxide emissions;
- Increasing concern about air quality – particularly nitrogen dioxide levels and particulate emissions;
- Water quality along the Forth Estuary and other waterways is poor and waste water treatment and surface water management needs to be significantly improved; and
- Increased low density, greenfield development around the periphery of Edinburgh, which leads to increasing travel distances and hence unsustainable patterns of activity.

The Commission also identified transportation problems as one of the highest profile issues in Edinburgh at present. Accessibility is a key factor governing future investment decisions by the business sector. The reconciliation between increasing car use with the need to improve accessibility, reduce energy use and improve air quality represents a major challenge.

3.2.2 Existing and Potential Environmental Problems

The relevant baseline environmental conditions for each of the environmental sub objectives is summarised in Chapter 7.3 of this report (with additional and supporting information presented in Appendix B). This section on existing and potential problems therefore focuses on particular issues of significance for the environment in the vicinity of the proposed Edinburgh Tram's study area.

In relation to the environmental sub-objectives set out in STAG, the key environmental sub-objective which can be identified as a 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) can 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 air quality report⁷ 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 International Airport⁸.

Road traffic clearly makes the principal contribution to air pollutant emissions in Edinburgh, and the measures included in the proposed Edinburgh City Council 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.

⁷ City of Edinburgh (2001) Stage 3 Review and Assessment of Air Quality. <http://www.edinburgh.gov.uk/airquality>

⁸ Summary Air Quality Action Plan from the Edinburgh City Council Website. <http://www.edinburgh.gov.uk/airquality>

These objectives are clearly relevant to the overall planning objectives for the proposed scheme, which are addressed in detail in Chapter 2 of this report.

Problems relating to other environmental sub-objectives are less straightforward to identify through comparison of existing conditions with objectives and standards. For example, whilst periodic flooding in parts of the Water of Leith is known to be a problem in Edinburgh, the locations where the proposed tram route crosses the watercourse are not flood prone, and the tram has been designed to use existing bridges in these locations (see Section 7.3.3).

The significance of the World Heritage designation of the city centre and its importance as a valued townscape is also a key factor in the environmental appraisal. This is therefore reflected in the appraisal against the appraisal sub-objectives relating to landscape/townscape, visual amenity and cultural heritage. Similarly, the significance of the Roseburn Railway Corridor for urban wildlife and open space/recreation, and of the foreshore at Granton for coastal ecology, is factored into the sub-objectives for biodiversity and landscape/townscape.

3.2.3 Environmental Issues and Constraints

No specific environmental uncertainties or constraints have been identified in the STAG appraisal of Edinburgh Tram proposals. However, the extent to which the tram scheme can contribute to reduce environmental adversities (i.e. air pollution) is constrained by other factors such as complementary measures to encourage use of public transport and reduce the demand for road traffic. These measures are part of the City of Edinburgh Council's New Transport Initiative, however in the context of this STAG appraisal of the proposed scheme, they have not been incorporated into the transport assumptions which underpin the predicted traffic flows (and therefore air quality effects) for the operation of the tram.

3.3 Transport

3.3.1 Public Transport

Current bus provision

Within Edinburgh (City of Edinburgh Council), 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 7 railway stations within the City area, and the rail network is important for medium and long distance travel to the city centre. According to the 2001 Census, nearly 28% of all trips to work made in Edinburgh were by bus. Since Edinburgh has 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.

Current bus services in North Edinburgh are operated mostly by Lothian Buses, with some run by First Edinburgh in the Silverknowes area. Existing services run predominantly radial through the city centre on a strong grid pattern. As many services cross the city centre, there are problems of congestion affecting journey times and reliability. In order to try and mitigate the effect this has on bus journey times, bus priority measures have been implemented throughout the city, adding to the existing Greenways strategy. Leith Walk is the principal bus corridor to the north, with seven frequent routes serving the City Centre to Leith section. There are a further four routes on Inverleith Row and three routes on Crewe Road South. All routes operate at high frequencies, with most routes running at 4bph or 6bph. Low floor buses are being introduced on many routes as the fleet is renewed.

Greenways are improving bus travel, especially to and from the city centre, the Gyle area and the airport. An innovative bus priority scheme has been installed on the A90, following a Scottish Office Challenge funding award.

Shortfalls with existing provision

Between 1991 and 2001, the percentage of trips to work by bus in Edinburgh fell from 33.2% to 27.9% (2001 Census). Over the previous two decades, commuting by bus in Edinburgh fell by 39% (City Plan for Edinburgh, 1999). A separate report (Feasibility Study, 2001) claims that bus usage in Edinburgh had the greatest decline registered by the European Local Transport Information Services (ELTIS), with a partial explanation given to the high fares. The growth areas at the Gyle, North Edinburgh and Kinnaird Park are inadequately served from many directions, with journeys by bus to these areas often requiring interchange.

Another study carried out by Oscar Faber (2000) into a public transport strategy for North Edinburgh reviewed existing services and recommended a strategy, with particular reference to the two main developments in the area, Leith and Granton Waterfronts. Amongst the findings of the report was the apparent incoherence of current public transport services in the area. As many services cross the City Centre, there are problems of congestion affecting routes and regularity, as well as the network constraints in the City Centre, which affect services.

It was reported that concerns over the capacity of the current road network were expressed by Lothian Buses, who indicated that there were particular pinch points in the central area through which services ran to and from the North of Edinburgh. It was argued that these points impair their ability to deliver effective service provision to the area in question. These areas are:

- Lothian Road/Prince's Street/Charlotte Square;
- Picardy Place and London Road/Leith Walk roundabouts; and
- George IV Bridge/The Mound/Lawnmarket.

Other areas along the routes were identified as causing problems for the running of service, mainly by lack of capacity and on-street parking.

In the same study, representatives of the Public Transport section of the City of Edinburgh Council commented on the lack of clarity of bus services in the area, with ad-hoc provision being made by operators for new developers, and expressed the general view that the North of Edinburgh is the only part of the city to suffer from a lack of high quality service. The comment was also made that the current road network in North Edinburgh hindered the development of a high quality bus service.

The study mapped accessibility to a set of defined strategic destinations (categorised under travel, education, employment, retail, leisure and health) from four local centres in North Edinburgh, namely Granton, Muirhouse, Newhaven and Leith. The mapping exercise clearly showed the lack of direct services to destinations in the West of the city, notably Haymarket, Gyle, Edinburgh Park, Sighthill and Hermiston Gait, as well as the Airport. This limited accessibility to the west is a recurring theme in several studies carried out on transport in the North Edinburgh area, and has implications for access to employment and social inclusion.

The report on the North Edinburgh public transport strategy recommended new and improved public transport services to and from North Edinburgh, as well as within, in the short to medium term. The strategic links (which should be aligned with the development areas) forming the core of the strategy were identified as the "Roseburn Link", utilising the Southern Access Road and the former railway solum via Haymarket, and from Newhaven and Leith to the City Centre.

In a review of the North Edinburgh Public Transport Strategy, Colin Buchanan and Partners suggested that new direct public transport services from Granton to the Gyle, Edinburgh Park and the airport should be considered, as the strategy produced by Oscar Faber appeared to focus mainly on improved links to and from the City Centre, and on east-west corridors. The same review emphasised certain issues in connection with the North Edinburgh Public Transport Strategy, such as the need to meet an incremental build-up of demand for public transport as a result of the development in North Edinburgh, by phasing additional capacity. The review agreed that a segregated public transport corridor would be required in the long-term.

3.3.2 Private Transport

Highway network

The principal routes into the city centre comprise the A8 Corstorphine Road and A90 Queensferry Road from the west and the A900 Leith Walk from the east. The principal east – west route is the A902 Ferry Road. The A903 and A901 provide access to the Forth shoreline area; the latter also provides an alternative east – west route serving Leith Docks. A new Southern Approach Road, constructed on the alignment of the former railway solum to Granton Harbour, was recently completed to serve the Granton development area. In general, the roads in the area are predominantly single carriageways with frontage development.

Car demand and congestion

Combined with frequent junctions and access points, travel speeds are typical of such dense urban areas, with low speeds and congestion during the peaks. During the 1980's and 1990's, commuting into Edinburgh by car rose by 53%, with traffic volumes increasing, for instance by 52% on the A8 at Gogar and by 31% at Barnton in the ten years to 1995 (City Plan for Edinburgh, 1999). However, peak hour traffic into the City Centre has remained static in recent years. In essence, traffic growth has occurred both spatially and temporally where there has been the available capacity to do so and reflects the impacts of capacity limitations and restrictions on growth in car use to the city centre and increasing car ownership and economic dispersal outwith the centre.

Between Leith Walk and Queensferry Road, the crossings of the Water of Leigh act as pinch points to north-south traffic. North-south traffic has to cross or use in part a number of heavily trafficked east-west routes. The area experiences significant rat running, with many alternative routes along roads often unsuitable for heavy volumes of traffic.

Forecast trends in traffic and congestion point to an overall growth in traffic levels by 20% over the 20 years 2001 – 2021, while time lost in traffic due to congestion almost doubles. All areas of the city are expected to suffer from worsened traffic congestion (Transport Initiatives Edinburgh, 2002). Of this growth, the largest impacts will be concentrated on those areas of highest growth, and consequently the highest congestion increases are expected to be on the strategic routes serving the areas of major economic activity around the city: West Edinburgh, the Waterfront, the South East Wedge and the city centre. Such increases in congestion will have commensurate effects on bus journey time and reliability.

3.4 Opportunities

In addition to addressing the socio-economic, environmental and transport problems of Edinburgh (in particular in the Northern area), as described in the previous sections, a rapid transit scheme through North Edinburgh can also contribute to the fulfilment of the opportunities that exist.

The biggest opportunity is the redevelopment of the Granton and Leith dock areas. Whilst substantial development has already taken place, notably at Leith, the overall aspirations for these areas are very considerable, as set out in Table 3.1.

Table 3.1 Waterfront Planning Aspirations

Floorspace type	Granton	Leith
Residential	8,900 units	5,700 units
Office	217,000 m ²	222,000 m ²
Retail	18,000 m ²	92,000 m ² (including Ocean Terminal)

Comprehensive urban and economic regeneration is expected to arise together with this level of development. Although this development will take some time to complete (possibly a decade or more), there is a unique opportunity to integrate it with the development and implementation of new transport links to the City Centre and beyond. This will support the redevelopment and, more importantly from a transport viewpoint, help influence the transport and wider 'lifestyle' choices of the residents, employers and employees from the outset.

4 Option Generation, Sifting and Development

4.1 Development Process

The current framework for the development and implementation of transport schemes is founded on two complementary elements: the definition of objectives for the transport system (at local, regional and national levels, as described in Chapter 2), and an associated analysis of transport problems and opportunities (as described in Chapter 3). A key aim of this approach is to develop the scheme most suited to addressing the problems and opportunities and satisfying the objectives set for the transport system, rather than develop a scheme looking for a problem. On this basis, it is important to set out the process through which the proposed scheme was developed to demonstrate that this approach has been adhered to.

The purpose of this chapter therefore is to trace the development of the preferred scheme presented in this STAG appraisal – in effect an audit trail of the scheme development. In broad terms, the key stages in the development of the scheme can be defined as:

- Initial feasibility study, leading to the Outline Business Case, with recommendations on the development of a preferred alignment using tram technology;
- Review of the initial feasibility study and confirmation of the preferred route and sub-options;
- Further option development and sifting; and
- Confirmation of the options to be carried forward to consultation and STAG2.

4.2 Feasibility Study

As previously stated, the 'Northern Loop' (or Line 1), was originally conceived through the feasibility study undertaken for Waterfront Edinburgh Limited, which was led by a Steering Group that involved the City Council. This study was charged with the task of considering the feasibility of a rapid transit scheme linking the Waterfront development sites in North Edinburgh (at Granton and Leith) with the City Centre. The objectives of the study were:

- To establish the economics of a comprehensive public transport solution connecting the Waterfront project site with the City Centre, considering all practicable modes of transport and combinations of modes;
- To recommend an appropriate procurement route; and
- To develop and outline business case supporting the recommendations

The study and report were developed in accordance with The Scottish Executive Guidance for Public Transport Fund bids and the draft STAG. In that context, the study:

- Reviewed the transport and land use policies, aims and objectives for Edinburgh and the wider environs;
- Set out existing problems in North Edinburgh;
- Developed a set of options to address the objectives and problems and undertook outline appraisal of each;

- Consulted with stakeholders (including CEC, local community groups and businesses);
- Define a Preferred option, with more detailed appraisal; and
- Considered the financial, procurement and risk transfer options.

4.2.1 Option Development and Sifting

The feasibility study and the Outline Business Case (OBC) considered a range of issues, including:

- Technology options;
- Alignment and route options;
- Demand and revenue forecasting; and
- Option appraisal and sifting to derive a Preferred Option.

Technology options

A range of technologies were considered, from bus based systems (including 'quality bus' and guided bus), rail based systems, and through to more specialist guideway systems (such as monorail or cable based systems). A two-stage process was adopted to determine the best option. Firstly, a broadly qualitative assessment on the strengths, weaknesses, opportunities and threats (SWOT analysis) of each technology was undertaken, followed by a more detailed analysis taking cognisance of the local topography, scheme development and general 'implementability' of the options.

The first stage assessment narrowed the options set down to a core of guided bus (with several guidance system options) and light rail. It demonstrated that a light rail solution is both proven, with many applications worldwide, and is feasible for the options put forward. The review showed that the only feasible alternative technology in this context was kerb guided bus. However, while covering operating costs from revenue, the guided bus system was unlikely to be attractive to private sector operators as the potential return was low. Moreover, an implementability issue was identified, associated with the institutional problems of establishing a concession. Engineering investigation showed other than along the Roseburn link and around Leith port, the guided bus would actually be operating on-street in the Greenways with other buses: it would not offer a step change improvement for much of its route. Light rail was identified as bringing much greater benefits and was therefore the preferred technology.

Alignment and route options

Adopting the option set of technologies defined previously, the next stage was to consider the alignment options available to serve the north Edinburgh area from the City Centre. The development of the study led to the identification of three route scenarios (which can be viewed in Figure 1.1), namely:

- Scenario 1 – Granton to Haymarket;
- Scenario 2 – Granton to St. Andrews Square via Haymarket; and
- Scenario 3 – The Northern Loop (Line 1).

Within this framework, the process of route development considered the technical, operational, patronage, financial and other issues associated with the implementation of a rapid transit system in an urban area in order to define possible alignments. This process derived a total of 24 route sections, which in various combinations satisfied the scheme objectives of serving north Edinburgh. These sections were appraised at a qualitative level, notably at a technical level, leading to a sub-set of

options for further consideration. In essence they combined to form a single loop, running south from Granton on the former railway solum to Haymarket, on street along Shandwick Place, Princes Street, St. Andrews Square, Leith Walk and into Leith Docks and then returning to Granton via Newhaven and Lower Granton Road. This alignment was then considered further in terms of the three route scenarios noted above.

Demand and revenue forecasting

To inform the option development process, a demand and revenue model was developed. This was based on a cordoned version of the CSTM3 PT assignment model with the addition of bespoke mode split and demand forecasting tools. Demand was split into background and Waterfront development related demand. Background demand was based on the 2006 CSTM3 Do-Minimum forecast, whilst development related demand was based on the application of trip rates and a mode split model to the development aspirations of the Waterfront companies for the years 2006, 2011 and 2016. Table 4.1 summarises the annual patronage for the three route options, considering guided bus and light rail technologies, considering the development related demand in 2011.

Table 4.1 Results of Demand Forecast

Route	Technology	Annual Demand (2011)
1 – Granton to Haymarket	Guided bus	1.47m
	Light rail	2.28m
2 – Granton to St. Andrews Sq.	Guided bus	3.31m
	Light rail	5.45m
3 – Northern Loop	Guided bus	9.33m
	Light rail	20.04m

Source: Waterfront Transit: Modelling Report (2001); Appendix 6 of the Feasibility Study Appendices Report.

It can be seen that the Northern Loop (Line 1) has by far the largest patronage, in comparison to the other route options, and that the light rail option consistently attracts more travellers in comparison with the guided bus. The other two light rail options examined are not considered to be financially viable. Guided bus alternatives also have a poor financial case and bring benefits which are at a much smaller scale to those that light rail can achieve.

4.2.2 Appraisal

The appraisal of the three route scenarios was then made within the context of technical, operational, patronage, cost and integration issues. This process resulted in the Preferred Option being the full Northern loop using LRT technology, generating revenue streams attractive to potential operators. In addition, the Preferred Option was considered to address the key planning objectives and to have the highest potential to contribute to resolve some of the local transport and economic problems.

A preliminary STAG appraisal of the Preferred Route was presented as part of the OBC. (Note that the draft STAG guidance was issued in July 2001, contemporaneously with the OBC. The appraisal contained within the OBC was therefore undertaken in accordance with STAG; however, strictly speaking it is not a STAG1 appraisal). This is summarised in Table 4.2 (note that the structure and layout follows the draft STAG guidance and may differ from the full guidance issued in September 2003). The key outcomes were:

- The Light Rail Transit (LRT) system on the Northern Loop offers greatest benefits;

- The preliminary economic indicators were:
 - Net present value at £275 million;
 - Benefit:Cost ratio at 2.6:1; and
 - Internal rate of return at 10.1%.
- The scheme was considered to fit with the Local Transport Strategy and Steering Group objectives:
 - Transport objectives: travel time and ride quality benefits for travellers transferring from car and bus, as well as decongestion benefits for remaining road users;
 - Local economy: developments at Granton are partially dependent on the implementation of the scheme and some 6,700 new jobs are estimated to arise as a result of the scheme in the regeneration area; and
 - Environment: key issues include potential negative impacts on built heritage of Princes Street, visual intrusion from overhead power supply, reduction in emissions and disruption to pedestrians and cyclists along the Roseburn corridor.

Following completion of the OBC, the City of Edinburgh Council concluded that the Northern Loop (Line 1) should progress in line with their local transport strategy. The OBC, containing a preliminary STAG appraisal, was submitted to and accepted by the Scottish Executive and funding subsequently made available for the project development to STAG2.

Table 4.2 Summary of OBC Appraisal Results

Proposal details			
Proposal name	Waterfront Light Rail Loop	Promoter name	Waterfront Edinburgh Limited in association with 14 other organisations in both public and private sectors along the preferred route.
Proposal description	A light rail service creating high-speed reliable public transport links between the Granton regeneration area, central Edinburgh and central Leith and multiple intermediate points.	Estimated costs	Estimated costs <ul style="list-style-type: none"> • £191 million • £5.4 million
Funding sought from	Not applicable	Amount of application (if applicable)	Not applicable
Proposal background			
Planning objectives	<p>This appraisal is based on the fact that the City of Edinburgh has approved the masterplan for the Waterfront regeneration area. Hence, the planning context is the question of identifying the best transport structure to support the achievement of the masterplan in keeping with the transport priorities for the City as a whole. The planning objectives which have informed the process leading to this appraisal are the six aims set out in the Local Transport Strategy for Edinburgh⁹:</p> <ul style="list-style-type: none"> • to improve safety for all road and transport users; • to reduce the environmental impacts of travel; • to support the local economy; • to promote better health and fitness; • to enhance social inclusion; • to maximise the role of streets as the focal point of local communities, where people can meet, shop and, in appropriate circumstances, children can play. <p>Supported by the principal aim of the Waterfront Granton Master Plan¹⁰:</p> <ul style="list-style-type: none"> • To create a place which involves and benefits the existing communities of Granton and which attracts investment in a full range of employment uses, housing opportunities, leisure, cultural and community development. (<i>The Vision, Waterfront Masterplan, page 1</i>) 		
Performance against planning	<p>A scheme very similar to this one ("North Edinburgh Light Rail") was appraised as part of a study carried out for SESTRAN to develop a strategy for travel to and within Edinburgh¹¹. The appraisal was carried out against a set of criteria extremely close in spirit and content to the LTS aims cited above. Of 80 schemes (across the Edinburgh area) considered, it performed fourth best. It was the strongest contender amongst those schemes facilitating accessibility for</p>		

⁹ City of Edinburgh Council Local Transport Strategy 2001-2004, p15

¹⁰ Three volumes, published by City of Edinburgh Council, Scottish Enterprise Edinburgh and Lothian, Scottish Homes, December 2000 (Llewelyn-Davies et al)

¹¹ Appraisal of Strategies for Travel to and within Edinburgh, WS Atkins, September 2000



objectives	<p>the Granton site as well as Leith and Newhaven. In effect, the technology favoured (light rapid transit) has a further strength given that the best performing measure from the 80 is also a light rapid transit scheme (Edinburgh Light Rapid Transit). Given the above and the fact that the pool against which the option was compared was so large, it is fair to say that the favoured scheme is a strong contender when considered against the planning objectives set out above.</p>				
Alternatives to proposal considered	<p>This study has considered alternative technologies and routes for a rapid transit in North Edinburgh. A review of available technologies indicated that either light rail or kerb guided bus were possible candidates: other technologies were discounted. A large number of route options were considered before three routes were identified as suitable for detailed consideration. These were:</p> <ul style="list-style-type: none"> • Scenario 1 – Granton to Haymarket via the Roseburn link. • Scenario 2 – Granton to St Andrew’s Square, via Haymarket, Prince’s Street and Waverley. • The Northern Loop – a loop link Granton to St Andrew’s Square as per option 2 before continuing to Leith via Leith Walk and then along the waterfront to Granton Square. <p>In the earlier SESTRAN study, alternative means of facilitating good links to the Waterfront/Granton development considered were¹²:</p> <ul style="list-style-type: none"> • North Suburban Rail Link • North Edinburgh CERT • Upgrades to bus services (frequencies and start/finish times) and priorities (lanes, selective vehicle detection) • Improvements to cycle access and parking <p>These options are not mutually exclusive (cycle accessibility improvements are probably compatible with a light rapid transit scheme); for the purposes of this exercise, however, each of these are considered as the principal element of a strategy to provide Granton, Leith and Newhaven with good links.</p>				
Comment on performance of alternatives	<p>Demand forecasting and financial appraisal undertaken as part of this study showed that for light rail:</p> <ul style="list-style-type: none"> • Scenario 1 – operating costs are not covered by revenue streams; • Scenario 2 – operating costs are covered by revenue streams, but the case was marginal. The financial case for the scheme is highly dependent upon the outturn development at Granton and elsewhere in North Edinburgh <p>The Loop had a strong financial case, which is strengthened by additional demand from developments planned for Granton, Leith and elsewhere. Despite other benefits from light rail options 1 and 2, the financial analysis indicated that only the Loop should be taken forward. Guided bus options were also considered for the three routes. The analysis showed that the financial case was not strong. While covering operating costs from revenue, the system was unlikely to be attractive to private sector operators as the potential return was low. Moreover, an implementability issue was identified, associated with the institutional problems of establishing a concession. Engineering investigation showed other than along the Roseburn link and around Leith port, the guided bus would actually be operating on-street in the Greenways with other buses: it would not offer a step change improvement for much of its route. Light rail was identified as bringing much greater benefits and was therefore the preferred technology. Similar findings were found from earlier work. The appraisal exercise undertaken for SESTRAN produced the following rankings for the schemes mentioned above:</p> <table border="0" style="margin-left: 40px;"> <thead> <tr> <th style="text-align: left;">Scheme</th> <th style="text-align: left;">Rank</th> </tr> </thead> <tbody> <tr> <td>• North Suburban Rail Link</td> <td>49</td> </tr> </tbody> </table>	Scheme	Rank	• North Suburban Rail Link	49
Scheme	Rank				
• North Suburban Rail Link	49				

¹² The density of development proposed for the site is such that predominantly car-based access would be unworkable (regardless of its relative acceptability in wider policy terms). The set of alternatives from which the favoured option has been drawn therefore reflects the assumption that “good links” implies good public transport access.

	<ul style="list-style-type: none"> • North Edinburgh CERT 11 • Upgrades to bus services 18, 40 46, etc¹³ • Improvements to cycle access and parking 13 <p>North Edinburgh CERT, the favoured option's nearest equivalent amongst the alternative schemes, visibly does not perform as well. This reflects a poorer showing under the headings of accessibility and integration.</p> <p>The various bus improvements could be seen as the obvious "low cost" option for access to Waterfront/Granton. The relatively poorer ranking of its components indicates that it would do less well in meeting the key aims set by Edinburgh.</p> <p>The North Suburban Rail Link would not serve Waterfront/Granton directly as it would terminate in Leith so its value must be judged in the context of the requirement for bus feeders to make it a viable transport connection for the site. Given that it performs poorly in relative terms even without this consideration, it can be seen to be a very weak competitor.</p> <p>The performance of cycle options suggests that, whilst it is not credible as a stand-alone strategy, it might significantly enhance the overall transport picture in combination with a major scheme.</p>
Rationale for selection of proposal	<p>The light rail loop option:</p> <ul style="list-style-type: none"> • Has a strong financial case; • Brings economic benefits to a wide area; • Goes towards meeting the planning objectives of the Edinburgh LTS; and • Will help contribute to the regeneration of Leith and Granton waterfronts. <p>The other two light rail options examined are not considered financially viable. Guided bus alternatives have a poor financial case, have difficulties associated with their implementation and bring benefits which are at a much smaller scale to those that light rail will achieve. This study's findings are supported by the earlier SESTRANS work, which concluded that light rail is the best technology for meeting the planning objectives set out for Edinburgh.</p>
Spatial and social information	
Area context: general	The Loop serves a large area within Edinburgh, salient within which is the Waterfront/Granton regeneration area (described below). Central Edinburgh is an increasingly vibrant business and leisure/tourism centre for which congestion charging is being taken forward by the City Council. Leith, until recently itself an area of significant deprivation, has seen considerable improvement of late but still has some regeneration needs of its own.
Economic performance	Parts of Edinburgh are enjoying considerable prosperity and can be expected to continue to do so. Meanwhile, areas within the City suffer significant deprivation: Granton, Pilton and Muirhouse make up the North Edinburgh Social Inclusion Partnership Area and have demonstrable economic deprivation. Recent regeneration in Leith has improved the situation there, but there are still significant areas of economic need there too. Granton Waterfront has been independently identified as a regeneration area.
Deprivation/ social exclusion	North Edinburgh has larger household sizes than Edinburgh on average though 24% of households in Granton are single-parent households. Owner occupied homes represent only 12% of the dwellings. Access to a car is relatively low: 66% across NEAR (North Edinburgh Renewal Area). 62% of a sample surveyed in West Granton had left school without qualifications. The fulfilment of the Waterfront/Granton Masterplan is expected to have considerable positive effects on the economic and social situations of local people.
Planning and	Edinburgh is for the most part highly urbanised with large sections of prized built heritage. There are significant conservation areas across Edinburgh (the

¹³ The bus improvements were separated into a number of service and infrastructure initiatives



environment	centre being a World Heritage Site) which the further design of this scheme will clearly have to respect. The planned alignment on the Roseburn railway bed is protected and is currently used as a cycle path and de facto linear park. Granton Waterfront is an area designated for redevelopment and is subject to a Masterplan which has been adopted by the City Council.
Spatial level of appraisal	Impacts on the whole of Edinburgh are considered as the primary level of appraisal. In addition, the particular issue of access to and from Waterfront / Granton is considered separately – here the regeneration area is the sector of concern. The <i>net</i> wider economic impacts are analysed at a Scotland level.
Implementability appraisal	
Transport land-use integration	<p>This statement is based on the examination of:</p> <ul style="list-style-type: none"> • Major Issues Paper (preparation for replacement of the Lothian Structure Plan 1994) • West Edinburgh Local Plan (consultation draft as at 27/3/01) <p>The favoured scheme is in keeping with the principles voiced in the Major Issues Report. It describes a “development direction” within Edinburgh along the lines of a “compact city” and speaks of the scope for further development intensification in two locations in particular, one of these being Waterfront. The possible benefits of reusing brown-field land and providing job opportunities for local people are contrasted with the danger of town cramming. The draft Local Plan actively embraces the Masterplan for Granton Waterfront and states that “the regeneration of this area is a priority objective of the Council”¹⁴. The draft local plan also contains no obvious conflict with the scheme. Its underlying objectives are those set out in <i>Changing Edinburgh for the Better</i>¹⁵: There are four themes to the objectives in the Local Plan. They are:</p> <ul style="list-style-type: none"> • Sustainable Development • Regeneration and Equality • Quality • Diversity and Identity <p>The first two are of most relevance to the Waterfront project. They include the objective to reduce car dependency and the need to travel, and to promote more sustainable travel choices: the greater use of public transport, walking and cycling. In addition, with regard to regeneration and equality, the objectives include opening up opportunity and developing stable and balanced communities in identified priority areas.</p> <p>In the Transport chapter, the following is said: “the Council also considers that a ... high quality, public transport link should be provided to access the Granton Waterfront area, to enable this to achieve its full economic and employment potential” (8.25). These objectives are also presented in the chapter:</p> <ul style="list-style-type: none"> • To facilitate development and activity in locations which promote accessibility, minimise car use and the need to travel and favour more sustainable means of transport – walking, cycling and public transport. • To minimise the incentive to use the car, particularly in areas where the direct adverse impacts of this are most severe. • To minimise the transport and parking impacts of new developments on neighbouring areas/people and the environment. • To ensure that development takes account of user and community safety, having regard in particular to vulnerable groups such as children and cyclists. <p>The scheme will clearly contribute directly to the achievement of the first two of these and it, in combination with the realisation of the Masterplan, will contribute to the achievement of the third and fourth.</p>

¹⁴ Executive Summary

¹⁵ City of Edinburgh Council, March 2000

Policy integration	<p>The development of a light rail loop in North Edinburgh fits well with the policy direction outlined in the Government's 1998 White Paper. It also fits well with regional transport policy as established by SESTRANS. The scheme is fully in accord with the Edinburgh Local Transport Strategy.</p> <p>At a local level, the scheme will contribute to the achievement of the strategy of the Social Inclusion Partnership (SIP) of NEAR in the following key ways:</p> <ul style="list-style-type: none"> • By providing excellent transport links to new job opportunities in the Waterfront area and in central Edinburgh, the scheme will open up significant potential for the residents of the area; • The scheme will link residents to the substantial amenities planned for the Waterfront as well as those already existing in Edinburgh at large. <p>When looked at in combination with the Waterfront Masterplan for land-use, the principles of community involvement and strategic planning inherent in the latter are clearly in keeping with the SIP's strategy. The preferred scheme will support and complement the Waterfront Masterplan.</p>
Distribution impacts	<p>The accessibility impacts of this scheme will be felt particularly strongly amongst the poorer communities served by the stops Drylaw, South Pilton, West Pilton and Caroline Park amongst whom car availability is generally low. Relatively large numbers of these people are unemployed. The expectation is that a substantial number of the jobs created at the Waterfront site will be in-scope for this community given its skills levels but a clearer picture of the likely numbers will become apparent on further analysis.</p>
Technical feasibility	<p>A technology review has demonstrated that the preferred light rail solution is both proven, with many applications worldwide and is feasible for the options put forward. The review showed that the only feasible alternative technology in this context was kerb guided bus, an option that has been ruled out for reasons other than technological feasibility.</p>
Operational feasibility	<p>The issues are:</p> <ul style="list-style-type: none"> • Maintaining patronage – lack of flexibility with light rail; need to develop alignment, at considerable cost, if patronage changes. • Choice of vehicle – if vehicle becomes outdated, obsolete, or servicing arrangements are not maintained by manufacturer then the system's fleet could be at risk. Risk typically occurs where technology choice is bespoke and from one manufacturer only. Generally, light rail is flexible enough to mitigate this risk due to the extensive vehicle market.
Technical risks	<ul style="list-style-type: none"> • Operation of a light rail system through the city centre, specifically Prince's Street, St Andrew Square and Leith Walk, which will need reconfiguration to produce an efficient LRT operation without unduly affecting other transport proposals such as CEC's 'Managing Traffic in Central Edinburgh'. • Finding agreement with interested parties for these areas, particularly Princes Street, which is a World Heritage Site. • Depending on chosen alignment there is potential for additional costs associated with immunisation of Network rail signalling cables at Haymarket, depending on the proximity of the nearest LRT & heavy rail running rails. These costs cannot easily be quantified for the Outline Business Case (OBC) as this requires detailed alignment design before definitive consultations can be had with Network rail; these consultations will be incorporated in the next phase of design development. • Fitting the alignment within Starbank Road knowing that current parking provision would be removed and parking outlawed, especially in light of the distance from residences to alternative parking sites. • Influence upon 'Greenways' and conflict with existing bus operations. • Impact of service diversions – accurate cost estimates not possible for OBC. • Impact upon ESW Stormwater Outfall facility at Trinity Crescent and its associated operations – precise details unknown for OBC.
Other risks	<ul style="list-style-type: none"> • Danger that the necessary political will to drive implementation of requisite priorities will not come about. • Possibility that the Waterfront/Granton Masterplan fails to deliver all that is promised of it and expected patronage and social benefits do not materialise. • Demand fails to transfer elsewhere on the route for other reasons (e.g. change of travel patterns, changes in wider transport policy).

Affordability	It is expected that the capital costs of this project will be met from a number of sources, including some form of developer contributions and grant-funding from the Public Transport Fund. A condition of the scheme's more detailed design is a robust case for the capital costs to be covered from established sources supported by a properly argued explanation of the capital cost estimates.	
Financial sustainability	One key reason for the selection of the Loop alignment for rapid transit is the strong indication that revenue will cover operating costs. Forecasting and appraisal work to date indicates that the preferred option will not require ongoing revenue funding.	
Public acceptability	Preliminary consultation has been carried out with a range of representative bodies (such as the NEAR Group, the Pilton Partnership, the Greater Pilton Community Alliance) in North Edinburgh to gauge the attitude of stakeholders to the proposed scheme. The response to date has been almost wholly positive.	
Objective	Assessment	Supporting information
Transport: what are the transport impacts of the proposal	<p>Those transferring to the system from bus and car are forecast to enjoy significant benefits in terms of travel time savings, quality improvements and gains in travel time reliability.</p> <p>There will in addition be decongestion benefits for continuing users of the road network.</p>	
The local economy: what will be the impacts in terms of employment	<p>Preliminary analysis suggests that were the scheme not built, developments at Waterfront Granton might be delayed and may come about at a smaller scale.</p> <p>A "mid-case" projection of impact indicates that 6,700 additional new jobs will arise as a result of the scheme in the regeneration area. Between 500 and 1,000 of these new jobs would result from displacement and would therefore be additional at the Scotland level.</p>	

<p>Environment : what will be the impacts on the environment</p>	<p>The principal environmental impact of this scheme will lie in its effect on the built heritage of Edinburgh and, in particular, the section of Princes Street that is a World Heritage Site. Overhead power supply is likely to bring visual intrusion which may excite resistance but its careful management could mitigate the degree of perceived damage.</p> <p>The aggregate noise and vibration impacts will depend on associated bus operations but the scheme can be expected to have at worst a neutral impact and at best a positive effect.</p> <p>The effect on air quality is expected to be positive because of decongestion effects on general traffic and the likely reduction in bus numbers and their associated pollution. Efficiencies in power production will lead to an overall reduction in greenhouse gas emission.</p> <p>Impacts on water quality, drainage and flood defence is likely to be negligible.</p> <p>There will be an impact along the Roseburn corridor, which is used as a cycleway and footpath.</p>	<p>An environmental scoping study was undertaken to support the Part 1 environmental assessment.</p>
<p>Safety: what will be the effects of the proposal on road and pedestrian safety</p>	<p>Accident savings are expected from the general reduction of traffic, but there is a danger that these are partially offset by accidents involving pedestrians and light rail vehicles given their novelty in Edinburgh. The groups benefiting most from the gains will be pedestrians and cyclists.</p> <p>There may also be gains in sense of personal security if, as envisaged, the scheme results in a more bustling, continental street atmosphere. In general, greater reliability will support the feeling of security and bring larger passenger flows, increasing the comfort of passengers, particularly women and the elderly.</p>	
<p>Accessibility : what will be the impacts on accessibility</p>	<p>Given low car ownership in certain key areas served by the scheme, change in base accessibility can be expected to be for the better particularly as the Loop alignment will provide good links between points in Edinburgh which are poorly connected by public transport at present.</p> <p>Severance benefits can be expected as the scheme creates a strong connection between the Waterfront area and points surrounding it. It should be possible to cross the alignment at any point along its length provided sufficient care is taken.</p>	<p>The change of severance impact relates to walk trips, the majority of which would not normally take place at present given the state of the regeneration site, but which can be expected in light of the jobs, housing and amenities which are to be located there.</p>
<p>Transport integration: what will be the impacts in integrating transport modes and services</p>	<p>The scheme will bring good links with mainline rail at Haymarket and Waverley. If buses continue to hub at St Andrew Sq. and with the forthcoming new coach station at that location, there will clearly be considerable interchange opportunities at this site for trips within and outside Edinburgh. In all these cases, the "turn up and go" frequencies of the scheme will mean that travellers will not need to worry about scheduling of interchanging services.</p> <p>The expectation is that bicycles will not be accommodated on the vehicles but the provision of good parking facilities at stops will ensure strong perceived links between the two modes on the part of users.</p> <p>The nature of ticketing remains to be established but this too could aid the integration of transport options within the SESTRAN region.</p>	



4.3 Review of OBC and Confirmation of Preferred Options

The initial exercise of the project development was to review the OBC, to confirm the selection of the Preferred Route and to define the options available within this route. This was undertaken in a staged process:

- Review and sifting of all the possible route links;
- Aggregate the sifted links into coherent and sensible complete routes for further development and appraisal; and
- Identify a preferred route with any possible options.

4.3.1 Sifting of Route Links

For the sifting of route links, a process akin to that employed in the OBC was initiated. All possible links were identified, including all those identified at OBC. New links added to that from those considered at OBC included Easter Road, Leith Street and Telford Road. For the purposes of sifting, a more formal approach was employed to that in the OBC. This process drew from the preliminary appraisal in the OBC and considered the links under four criteria:

- Technical implementability;
- Economy;
- Transport; and
- Environment.

These criteria differ from (but are consistent with) the planning objectives in that they are broader, include the issue of implementability and do not take account of safety and social aspects (which are less tangible and offer less opportunity for comparisons between options to be made).

Under each of these four criteria, a qualitative assessment was made of each link and a score attached (between -3 for large adverse impact to +3 for large beneficial impact). Using weightings, these scores were then aggregated for each link to give a total score used to rank the links.

4.3.2 Route Options

The next stage was to aggregate the best performing links into sensible sequences to establish route options for testing. This process was undertaken to identify those options sufficiently different to be distinguishable in the demand model and in wider appraisal terms and which differed on one particular section of the route so that the effect of each route variation could be isolated. The options therefore developed for further appraisal were as follows:

- Option 1: OBC route;
- Option 2: Crewe Road;
- Option 3: Easter Road; and
- Option 4: Junction Street.

These four options were appraised using a simplified version of the STAG2 appraisal table which retained the key elements of the appraisal, namely appraisal against the planning objectives and the

government five objectives (using a sub-set of sub-objectives commensurate with the level of appraisal and available information). This appraisal process was supported by running the demand model developed at OBC for the options.

Following the completion of the ASTs, analysis was undertaken to determine the Preferred Option, based on a comparison of scores by sub-objective. This demonstrated the best performing option was Option 1, with Option 3: Easter Road performing slightly worse. Options 2 and 4 performed demonstrably worse.

4.3.3 Preferred Route and Options

The process described above reconfirmed the OBC route as the best performing option for a Northern Loop LRT system. However, this was based on a broad analysis of the route options available, rather than a detailed assessment of all possible variants within the routes; in effect, the potential corridor had been identified and appraised rather than the detailed alignment at every section. On that basis, a number of variants were identified within the Preferred Route where the development of the Loop was not sufficiently advanced to demonstrate a clear preference. These were as follows:

- **Haymarket** – where the exact route from the street running section to the former railway solum was not determined, in part because of issues surrounding frontage servicing, traffic and heavy rail interfaces;
- **George Street / Princes Street** – where public realm and consultative issues were felt to be paramount;
- **Former railway solum / Telford Road** – where the proximity of the alignments counted against a robust case for either in patronage terms and where a key issue is the possible accessibility benefit in running close to the Western General Hospital; and
- **Easter Road** – as an alternative to Leith Walk and where the work to date did not yield any clear argument.

4.4 Further Option Development and Sifting

The next stage of scheme development focused on further development of the Preferred Route and variants therein. Whilst technical development and consultation with stakeholders was progressed on the George Street/Princes Street and former railway solum/Telford Road variants, the final choice was left open until the end of the public consultation period to accommodate and take cognisance of the feedback from the public.

Following further technical development of the Easter Road and Leith Walk variants, the former was discounted at an early stage on engineering grounds. The technical development at Haymarket has continued, but is focused on determining a feasible alignment through this area, rather than the route choices per se.

4.5 Option for Consultation and STAG2 Appraisal

Given the above, the option taken forward for public consultation and STAG2 appraisal was the light rail technology option along the Preferred Route (the Northern Loop), with variants at George Street/Princes Street and former railway solum/Telford Road.

5 Consultation

5.1 Objectives and Process

Extensive consultation has been undertaken in respect of the Edinburgh Tram network. **tie** has 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 Lines 1 and 2. In addition, there has been 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 principal 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 should have the following attributes:

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

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.

An early demarcation was drawn between public consultation and other consultation. The 'other' consultation became generally known as 'stakeholder' consultation and a simple definition of a 'stakeholder' is 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 Line 1 by the consultant team involved a variety of methods and actions. In the first instance the team collectively 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 though this is strictly not a stakeholder category.

Several of the consultants within the team were allocated categories of stakeholder with whom they consulted. This was generally arranged taking account of the consultant's discipline and role in the team. A full list of these consultees is provided in Appendix D1. The consultations commenced in September 2002.

The consultations were undertaken by letter, telephone or meetings and often by a combination of these. They were followed up by notes of meetings and issues brought to the consultant team. The basis for discussion at a consultation meeting was a Technical Briefing Note. The Technical Briefing Note, revision D, is provided at Appendix D2. From May 2003 onwards the tramtime leaflet prepared for public consultation superseded the Technical Briefing Note.

As noted above, the consultation strategy is to provide feedback to consultees where possible. This was achieved in a number of ways. When questions were asked at the public exhibitions these were answered directly by the professional advisers 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. Consultation 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 like fashion.

Many consultees expressed views but did not raise issues requiring a response.

5.2 Public Consultation

5.2.1 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;
- Freephone 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 parties were invited to one of two events to discuss the proposals, and ~~the~~ made representations or presentations at community council meetings, which were also open to the general public;

- 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 Faber Maunsell. 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 Faber Maunsell. 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; and
- 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 Free-phone number; and
 - Attending an exhibition or public meeting.

5.2.2 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 tram;
- 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; and

- The remaining 539 were received by letter, email, phone, comment book, comment cards, and at exhibitions.

5.2.3 Main Findings

Overall, 84% support the concept of the tram in Edinburgh.

The public consultation has disseminated information on the tram proposals in a comprehensive manner. Responses to this process have provided useful and important feedback. They have:

- Identified route option preferences on Lines 1 and 2;
- Gained public majority support for proposed stop locations;
- Enabled views, opinions and concerns to be expressed and recorded on a wide range of issues such as:
 - Property concerns, proximity and noise;
 - Disruption;
 - Wildlife;
 - Visual intrusion; and
 - Impacts on traffic and parking.

These are addressed in more detail in the PR consultant's reports and in this report where appropriate.

5.3 Stakeholder Consultation

A database of stakeholder organisations was compiled by Weber Shandwick. 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.

For Line 1, this part of the consultation was subdivided into groups of consultees to be dealt with by different members of the Line1 team according to their discipline. The broad groupings are described below with explanation as to the nature of the consultation.

5.3.1 Client Group

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

CEC established **tie** as a separate entity from the council charged with responsibility for delivery of Integrated Transport Initiative (ITI). **tie** is responsible for the implementation of council's policies and delivery of projects, however CEC still maintains responsibility for development of policy.

Regular meetings and communications with the client group have 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 an 'as required' basis have been held.

5.3.2 Business

The business consultees included several large individual employers, such as BAE Systems and State Street at Crewe Toll and business organisations, such as the Edinburgh and Leith Chambers of Commerce, the Federation of Small Businesses and Princes Street and George Street Associations.

The Western General Hospital and Telford College were also included under the broad umbrella of businesses in as much as they have large numbers of employees as well as students and visitors.

5.3.3 Council and Communities

Some initial contact was made by telephone and letter to Councillors and Community Councils prior to the public consultation. However, it was agreed that these should properly fall within the public consultation and they were not pursued as stakeholders.

5.3.4 Environment

The environmental consultation has been a major exercise and a significant part of the overall consultation programme. This is necessary to inform the environmental appraisal for STAG2 and the Environmental Impact Assessment (EIA) in conformity with STAG and EIA guidance.

Consultation with statutory and non-statutory organisations is an important part of the environmental appraisal process. Environmental consultation followed a number of stages as follows:

- Initial letters to key environmental consultees briefly setting out the proposals for Line 1, and seeking both information on environmental conditions and an early response from each consultee on the key impacts and issues for the assessment;
- The response to the initial consultation was used to feed into an Environmental Scoping Report which set out in more detail an initial environmental appraisal of the tram scheme; and
- The Environmental Scoping Report was then issued to all environmental consultees with a letter requesting more detailed comment on the environment impacts of the scheme.

The organisations consulted during the environmental appraisal process are listed in Appendix D1.

The project team then held further discussions and meetings with several of the above consultees in order to understand their views, discuss assessment methods, identify all the key environmental and development issues, obtain baseline information on the area and help evolve mitigation measures.

In addition, due to the importance of Edinburgh city centre for townscape and heritage (as recognised through its World Heritage status), a working group was convened with a number of consultees to specifically discuss aspects of design of the tram. This group includes representatives from **tie** and its advisors, the City of Edinburgh Council, Historic Scotland, and the Edinburgh World Heritage Trust. Consultation with these organisations identified a number of key issues for the appraisal which are summarised in Section 5.4 below.

Environmental issues were also raised during the programme of public consultation, through both the feedback forms provided by the public and through questions raised at public meetings and presentations. These issues generally were similar to those within the scope of the environmental

appraisal, but reinforced the need for consideration of effects of the tram on communities and natural habitats in particular.

5.3.5 Statutory

The statutory bodies consulted are recorded in Appendix D1. They include the City of Edinburgh Council, the Scottish Executive and several National Bodies.

5.3.6 Transport

This heading is used to gather a range of interested parties related to transport. These include overarching groups such as The Freight Transport Association and The Road Haulage Association but also include local interests such as bus and taxi operators.

Regular meetings have been held with Network Rail throughout development of the project.

5.3.7 Public Utilities and Technical Consultees

As well as consulting the Public Utilities about plant which could be affected by the tram line construction and operation, there are other technical consultees who have provided input to the design process. An important group in this context is the 'Traffic Interface Group' which incorporates CEC representatives from Transport Planning, Network Services and Strategic Services. This group has regular meetings with the Line 1 team to consider proposed on-street designs for implementing the tram, particularly at road junctions.

The Line 1 team has also had regular contact with the Line 2 team to discuss methodology and exchange information.

5.3.8 Other Groups

There are a small number of other consultees that do not fall within the categories already described. These include: Heritage, Disability and Emergency Services.

5.4 Key Issues Raised

5.4.1 Public Consultation

Two main types of issues were raised: those related to the route and other concerns. Public opinion on route options was sought for two parts of the Line 1 route. These were:

- Princes Street/George Street – Princes Street was supported by 66% of respondents. Responses highlighted that Princes Street offered the best balance between accessibility for the public, visual impact and commercial gain for city centre businesses and tourist attractions. Concerns were expressed about the environmental and heritage impact if George Street and Charlotte Square were to be used.
- Telford Road/Former railway solum – Responses from the public within the zone of influence of the route options favoured the former railway solum along the Roseburn

corridor. When taking into account all parties, the picture switched in favour of Telford Road, particularly because of the cycle groups, who are concerned that there may be an adverse effect on the cycleway if the former railway solum was used for the tram route. Notwithstanding, there was strong support for the former railway solum as a means of segregating trams from traffic and lessening congestion in the Telford Road area.

With regard to proposed stops on Line 1, 83% of the respondents considered them to be well placed and convenient, whereas, 17% considered them to be too few in number and not well placed.

Lower Granton Road attracted comment, in particular, concern about existing traffic problems and the plan for road realignment. A desire was expressed to relocate the tram from this section.

Trinity Crescent and Starbank Road also emerged as sections causing concern about width of carriageway, conflict with traffic and loss of parking.

On Leith Walk and Constitution Street concerns were expressed about impact of the tram on bus services and about traffic management generally.

The use of the Roseburn to Crewe Toll railway corridor was noted as impacting on wildlife, conflicting with cycling, having safety risks (of cyclists beside trams), impacting on adjoining housing.

Expressions of support came forward for Granton Road/Ferry Road/Great Junction Street/Trinity Railway corridor to Lindsay Road as an alternative to the proposed route. Some of these arose in conjunction with the opposition to the use of West Granton Road and Starbank Road.

Other matters raised and recorded by respondents to the public consultation were proximity to properties, disruption, design and visual impact, the use of alternative formats, congestion, environment, cycling, noise and safety. Numerically these other topics gave rise to far fewer comments than the specific route option issues.

5.4.2 Stakeholder Consultation

Environmental consultation

Table 5.1 summarises the key issues raised during the environmental consultation.

Table 5.1 Summary of Issues from Environmental Consultation

Environment Sub-Objective	Issues Raised through Consultation
Noise and Vibration	Variation in noise levels during the day depending on road traffic flows; noise from depot sites to be considered.
Air Quality	Air Quality Management Area (AQMA) designated in city centre due to predicted future exceedences of nitrogen dioxide levels.
Water Quality, Drainage & Flood Defence	Water of Leith designated as salmonid water of high amenity; measures needed to contain contaminated run-off during construction and operation; Sustainable Urban Drainage Systems (SUDS) measures should be considered.
Geology	Presence of geological SSSI at Wardie Shaw
Biodiversity	Appropriate assessment of potential works to seawall at Trinity Crescent required by SNH due to impacts on Firth of Forth SSSI/SPA; Roseburn corridor an important habitat for animals including protected species and scheme impacts are significant (and

Landscape and Visual Amenity	habitat compensation is important). Sensitivity of World Heritage Site, Conservation Areas and other monuments to townscape and visual changes; impacts on key views throughout the city to be considered.
Agriculture and Soils	Potentially contaminated areas of land identified along the route corridor; no agricultural issues raised.
Cultural Heritage	Greater archaeological sensitivity in the coastal and Forth port areas; important archaeological areas east of Constitution Street.

Transport consultation

With regard to transport-related consultees, the following issues arose:

- There is a need to ensure that tram operation will not adversely affect servicing and deliveries to businesses;
- Bus operators have been consulted about alignment issues and subsequently about participation in tram operation. The latter will be dealt with in the appointment of an operator;
- Taxi operator representatives did not see the tram as a threat to their business. However, they did express concern about traffic disruption during construction and the prospect of poor road surfaces at that time;
- The west side of the loop, Roseburn to Granton will provide a welcome new public transport link which is not available at present; and
- Network Rail generally approve of the principle of the Tram Lines. However, the interchange facility created by development opportunities at Haymarket Station was a specific concern that will need to be addressed. Discussions with NR are ongoing.

Other consultation

The preceding comments all arose from discussions in which general support was expressed for the tram proposals. Other notable comments follow that are not related to any specific group of consultees:

- Several consultees asked that integrated tickets should be available for bus and tram travel;
- Tickets should be made available through shops;
- The tram is beneficial for the operation of the new Telford College campus;
- Stop locations require fine tuning;
- There is a risk of dividing old and new Leith;
- Land take at Haymarket should be reduced;
- Timespan to implement. It should be as soon as possible;
- Design compatibility required with proposed developments;
- Urban design particularly in the city centre;
- City archaeology will maintain a watching brief;
- Alignment, safety and vehicle access all under scrutiny by the emergency services;



- Whether the proposals will integrate with the CETM proposals; and
- Information will be required on construction and operation to inform further response.

5.4.3 Overall

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 the tram. The considerable level of support is, however, punctuated by a range of concerns. 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.

The consultation is in conformity with the strategy outlined in STAG and noted here in Section 5.1.

The consultation process resulted in Princes Street being chosen over George Street and the former railway solum being chosen over Telford Road, completing the selection of the preferred route.

6 Scheme Description

6.1 Route

6.1.1 Background

The proposed route (shown blue) and options (shown red) are detailed in Figure 1.1. In summary, the preferred route comprises:

- 15.5 km of Double Track infrastructure (single track at St Andrews Square);
- 58% off street; and
- 22 proposed stop locations. (See also sections 7.2.1 & 7.2.2)

6.1.2 Extent of Segregation and Shared Running

Wherever possible a segregated alignment has been proposed (where the tram operates on dedicated tramway or tramroad) such that the system can maintain speed and frequency and reliability of service without interference to and from other traffic.

The proposed Edinburgh Tram Line 1 is approximately 15.5 km long in both directions of which 58% is off street segregated (9.0 km) and 42% (6.5 km) is on street running. Of the on street running section 23% (1.5 km) is segregated, 35% (2.3 km) is joint running and 42% (2.7 km) is public transport corridor (tram/bus lanes). Therefore, of the 15.5 km route a total of 68% (10.5 km) is entirely segregated from traffic, 15% (2.3 km) is joint running and 17% (2.7 km) is public transport corridor

The alignment is effectively double track, clockwise and anti-clockwise running, throughout its length, with the exception of the one way loop at St. Andrews Square (approximately 520m long).

6.1.3 Junction Re-prioritisation

To maintain the level of service throughout on-street sections, it is proposed that associated junctions are remodelled with revised signal priority applied where appropriate (with the agreement of the City of Edinburgh Council), including (but not limited to) the following key junctions:

Granton – Haymarket Section

- West Granton / Southern Approach Road
- Southern Approach Road / Ferry Road
- Haymarket Yards / Haymarket Terrace
- Haymarket Terrace / Dalry Road/ Morrison Street / West Maitland Street / Grosvenor Street

Haymarket – York Place

- West Maitland Street / Palmerston Place / Torphichen Street
- Shandwick Place / Rutland Street / Lothian Road

- Princes Street / South Charlotte Street
- Princes Street / The Mound / Hanover Street
- North St. David's Street / Queen Street / York Place / North St. Andrew's Street
- St. Andrew's Square North
- St. Andrew's Square South
- South St. David's Street / Princes Street / South St. Andrew's Street
- Picardy Place / Broughton Street / York Place / Leith Street / Leith Walk

Leith Walk – Granton Section

- Leith Walk / London Road / Elm Row
- Leith Walk / Duke Street / Great Junction Street / Constitution Street
- Constitution Street / Bernard Street / Baltic Street
- Newhaven Place / Pier Road / Lindsay Road
- Pier Place / Starbank Road / Craighall Road
- Trinity Crescent / Lower Granton Road
- West Harbour Road / West Granton Road

Further re-signalling and new signalling is proposed at other locations around the route, to promote road safety and the requirements of Her Majesty's Railway Inspectorate.

6.1.4 Route Alignment Parameters

The proposed route takes account of the following design parameters and constraints:

- Topography – based upon the updated OS 1:1250 mapping provided as at October 2003 and topographical survey work undertaken specifically for the scheme during Autumn 2003;
- Vehicle parameters – the ability of the proposed light rail vehicle to negotiate the alignment, based upon parameters given in Section 6.2; and
- Proposed new developments – the alignment takes account of proposed planned development and wherever possible is aligned to integrate with detailed planning proposals.

6.1.5 Route Description

The scheme is described, as follows, commencing in the City Centre and following an anti-clockwise direction around the loop:

City centre

The city centre is an essential component of the loop, since this section is by far the largest trip generator for the scheme. The service on this section provides convenient, on street access to shops and businesses and integration with bus and rail (at Waverley station).

Within the city centre, two option alignments are considered: one via Princes Street and the other via Charlotte Square and George Street.

For the Princes Street option the route passes from Shandwick Place through the World Heritage Site on Princes Street. Overall the introduction of the tram to Princes Street, including the committed mitigation, will have a negative townscape effect, primarily arising from the OLE (overhead line equipment) and the tram stop. The site, Edinburgh's principal street and a formally laid out part of the World Heritage site, has a very high public profile. Its designation and location makes it highly sensitive to change, although it can be argued that the degree of change wrought on the street in post-war developments is such that it is now only moderately sensitive. However, this section of the route will be afforded specific attention with respect to its townscape design.

The tram will run on-street from Rutland Place centrally onto and in a straight line along Princes Street, as far as South St David Street for eastbound trams and South St Andrew for westbound trams. A stop is proposed just east of the junction with Castle Street.

Between Lothian Road and South Charlotte Street there are three lanes in either direction, occupying the entire current road width to accommodate vehicle flows in this busy junction.

The main part of Princes Street will have a layout broadly similar to the existing but with reduced road space. It will consist of a dual carriageway as at present but the centre strip will be increased to approximately 1.6m width. There will be one continuous lane of mixed tram and bus traffic and a discontinuous second lane in each direction. The discontinuous second lane accommodates bus stopping and limited amounts of bus running, allows for the tram stop, reduced length pedestrian crossings and increased pedestrian circulation space at key points, all as outlined below.

At the junction with South Charlotte Street the north footway is widened for a length of approximately 20 metres. At Castle Street both the north and south footways are widened over a length of approximately 100m including the Princes Street tram stop. At the mound the north side footway is widened over approximately 50m west and 20 m east of the junction and the south footway over approximately 100m east of the junction, including the current pedestrian pinch-point at the steps to the Royal Scottish Academy. At South St David Street the north side footway is widened over approximately 60m in front of Jenners and the Mount Royal Hotel.

Between Princes Street and Queen Street the tram will run on-street with single-track alignments. The northbound trams will run up South St David Street in a straight line along the edge of the square and down North St David Street, turning east on to Queen Street. Southbound trams will turn off York Place and follow the equivalent route on North and South St Andrew Street.

Stops are proposed on South St David and South St Andrew Streets, between St Andrew Square and Meuse Lane.

For the Charlotte Square and George Street option, the key features of the route, lie in three main areas: St Andrew Square, George Street and Charlotte Square.

In St. Andrew square, a city bound tram (west bound) follows the line of the preferred alignment along York Place before turning onto North St Andrew Street. This section of the alignment would require the removal of parking/servicing, the cutting back of the steps on the south kerb line, the modification of the junctions at North St Andrew Street and Broughton Street along with the junction to accommodate the right turning traffic into the St James Centre car park and the Bus station. Once in the square the alignment runs on the east face before deviating from the preferred alignment to run along the south face of the square, where a stop will be located, and then runs onto George Street via the west face of the square. Within St Andrew Square there is a requirement to modify all the

junctions to accommodate the tram along with a loss of parking on both the east and west faces. A tram leaving the city (east bound) would exit George Street and join the preferred alignment which runs north onto North St David Street then head east on Queen Street (kerb running on the north). This leg requires the modification of two signalised junctions and the removal of parking along Queen Street. With this option along both Queen Street and York Place there will be four dedicated traffic lanes.

On George Street, the alignment was developed to maintain a straight segregated alignment centrally on George Street adjacent to a single traffic lane kerbside in both directions. This option requires the removal of the on street parking and servicing from Hanover Street to Castle Street both kerbside and centrally, although limited parking would remain kerbside from Hanover Street east and Castle Street west. The three main junctions along George Street all operate as roundabouts at present with incorporated zebra crossings, however, there would be a requirement to signalise these junctions and incorporate pedestrian crossings. It is anticipated that the level of priority at these junctions will be tram, pedestrian then road traffic. At present there is no designated cycleway along George Street although it is part of the National Cycle Network and under this option there would be no allocated cycleway along George Street.

The stop location is staggered either side of the Fredrick Street junction with central island platforms.

In Charlotte Square the alignment is the result of early consultations and is principally designed to minimise visual impact on the Square. The route runs from the end of George Street south round Charlotte Square onto the southern face where it is expected that the tram will run with the traffic. The alignment then turns south into Hope Street where it runs with traffic through to Rutland Place. The alignment then runs across Rutland Place to Shandwick Place then heads west to the West End Stop location. This option will have serious impacts on the traffic operations in the Square. There could also be a requirement to run general traffic around the northern face of Charlotte Square and reopen the northern end of Glenfinlas Street to general traffic, however, further work is required to develop the traffic operations and model the flows. There would not be a requirement to remove any of the on-street parking currently provided within Charlotte Square for this option, although the taxi rank currently at the southern end of Hope Street would require to be relocated further north.

North of St Andrew square, the northbound tram will run on-street single-track on Queen Street and both north and southbound trams will run twin-track along the centre of York Place.

In order to accommodate the heavy vehicular flows along York Place and Queen Street, two general traffic lanes are maintained in each direction. The result is a requirement to widen York Place slightly. It is recognised that this arrangement changes with the likely introduction of CETM which will alleviate this impact.

Leith Walk to Constitution Street

Whilst the extent of tram boarding along this section is relatively low for the loop, it forms an essential link for ridership between the City Centre and key locations and areas of new development in Leith and Newhaven.

The junctions at the top of Leith Walk will be entirely reorganised. The roundabouts at Picardy Place and London Road will both be replaced by T-junctions and a stop introduced in the reorganised junction at Picardy Place. The tram will then run the full length of Leith Walk along the centre of the road, with stops at MacDonald Road, Balfour Street and the Foot of the Walk. The tramline will be shared with bus throughout this length, offering a high degree of priority of movement through junctions to both tram and bus. Buses will leave the shared centre-running alignment to stop at a number of locations along Leith Walk approximately in line with existing bus stop provision (subject to limited rationalisation).

The tram lines will run on-street out of the centre of York Place into Picardy Place, swinging slightly south to allow two lanes of general traffic along Picardy Place on the line of the current access lane. Through the new junction and tram stop at Picardy Place there will be a short section of fully segregated running. Down Leith Walk the tracks will generally follow the alignment of the street, along the centre of the road, deviating occasionally to allow for right turn lanes.

Tram stops are proposed at Picardy Place, MacDonald Road, Balfour Street and the Foot of Leith Walk. All these stops are currently envisaged as island stops, located centrally between tram lanes, with Picardy Place linked to a large pedestrian traffic island. Stops located at Picardy Place and, more significantly, at the Foot of the Walk are also located to provide potential for integration with possible bus services.

Constitution Street to Ocean Terminal & Chancelot Mill

Moving north from Leith Walk, Line 1 will run on-street, sharing road space with all other traffic through Leith from the Foot of Leith Walk along Constitution Street to the dock gates at Constitution Place, with a staggered stop in the old town centre between Queen Charlotte and Bernard Streets. This would take the form of a north bound stop (Kerbside) immediately to the south of Maritime Lane and a south bound stop close to the south side of the junction with Bernard Street. Both stops would be designed to appear as well-detailed slightly raised areas of footpath. Apart from the area of the stop and minor junction alterations at Bernard Street, the alterations to the streetscape will be minimal.

Tram Line 1 will run through the Port of Leith from Constitution Street through an area of new development (by Cala Homes) off-street on the north side line of a realigned section Ocean Drive to a realigned newly signalised junction with Tower Place. A stop is proposed to the west of the junction between Constitution Street and Ocean Drive to serve this area including the new development. The tram road will continue west following the alignment of the existing, privately owned, section of Ocean Drive to Ocean Terminal. A stop at Ocean Terminal is proposed providing access for passengers within this area of extensive redevelopment (including the new Skyliner and Ocean Point Developments). From there the route will proceed along the dock road past the entrance to Chancelot Mill and then ramp up to join Lindsay Road at Anchorfield.

The tram depot will be located just inside the port area, on the east side of the route, immediately north of the dock gates on Constitution Street. There will be two stops, one at Ocean Terminal and one on Ocean Drive, between Constitution Street and Tower Place.

From Ocean Terminal to Lindsay Road the tram will run on-street for a short section (to avoid the sewage pumping station) then segregated parallel to the street. A new ramp structure, approximately on the line of the existing pedestrian ramp, will provide access from the dock road to Lindsay Road. This will cut the end off a lightly used piece of public open space but allows the opportunity to reinstate the area to a higher quality and provide better public access.

Newhaven to Wardie Bay

The tram will run from Newhaven to Granton along the waterfront – Lindsay Road, Pier Place, Starbank Road, Trinity Crescent and Lower Granton Road. Stops are proposed at Newhaven, adjacent Great Michael Square, and at the east end of Lower Granton Road.

From the top of the ramp at Anchorfield to the junction at Newhaven Place, the tram will run on-street in segregated on the north (dock) side of the road. Detailed alterations to the road alignment will be required along much of the length and new traffic islands will be introduced

From Newhaven Place to Trinity Road it will run on-street, entirely integrated with other traffic.