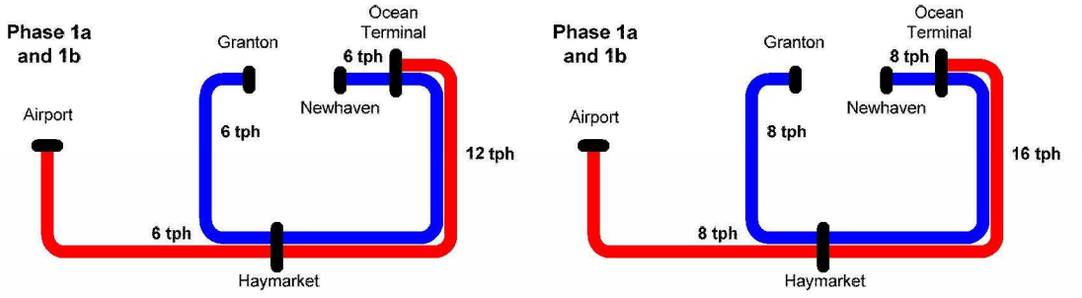
Integrated service patterns

1.99 TEL's strategic operational plan fully incorporates Phase 1b as an option. The planned service patterns for opening of Phase 1b, representing the completion of the combined Phase 1 (Phase 1a and Phase1b), are shown in Figure 1.3.

Figure 1.3. Planned service patterns for Phase 1a and 1b combined (tph = trams per hour).



1.100 The operational assumptions and strategies that apply to an integrated bus and tram network including Phase 1b are the same as for Phase 1a alone (in terms of service integration, ticketing and operating costs). The financial highlights above show that TEL is potentially a very viable and profitable business. However, there is a higher level of uncertainty attached to the forecasts for patronage and revenue on Phase 1b. Although forecast patronage on Phase 1b in 2011 amounts to approximately 30% of total tram passengers, nearly 70% of that demand will be directly dependent on the new development at Granton waterfront. In context, this represents a relatively small proportion of TEL's total revenue.

1.101 Compared to Phase 1a, the opportunities to mitigate the impact on operating profits of short-term lower demand are less on Phase 1b, since a greater proportion of the patronage will be carried by the tram on 1a. However, opportunities will exist to reduce the planned level of tram services to mitigate any negative impact.

Affordability

1.102 There is no doubt that pursuing Phase 1b in tandem with Phase 1a, with either concurrent or staggered construction, further enhances the Business Case. However, it is recognised that, within current funding constraints alternative sources of funding will be required. Nevertheless, there is a reasonable period, during which the opportunities for funding can be investigated. This will also give time for risks currently pertinent on Phase 1a to crystallise / disappear during this period and this may give impetus to the possibility of undertaking and completing Phase 1b in an overlapped timeframe with 1a.

Funding requirements

1.103 To date, TS and CEC have approved funding which should be sufficient to meet forecast expenditure commitments up to Financial Close, scheduled for January 2008. This includes funding for compensation under a General Vesting Declaration (GVD) process to secure land required for the construction of Phase 1a and for the design, development and commencement of utility diversions.

1.104 Upon approval of this FBC, **tie** will require approval and immediate release of the remaining funding committed to the project, as per the milestone drawdown schedule under discussion between CEC and TS.

Summary of specific approvals arising from this Business Case

1.105 To approve the recommendation that the Edinburgh Tram Project Phase 1a proceeds at an estimated cost of £498m.

1.106 To approve the selection of the chosen preferred bidder for the Infraco and Tramco contracts.

1.107 To approve the request to **tie** Limited, with CEC officials, to examine the means of funding Phase 1b, with a view to potential commitment in 2008.

Conclusion

1.108 The Edinburgh Tram Project has now been under assessment for more than seven years. During that period, the underlying rationale for the project, support to the growth of the Edinburgh economy by providing high quality transport connectivity, has been reinforced by events. The city's economy and population continue to grow and the prospects are that this will continue. The Scottish economy as a whole is strongly influenced by the success of Edinburgh.

1.109 The Business Case seeks to set out in an objective and clear manner the advantages and disadvantages of the proposed scheme as a means of providing the enhancement to transport provision which the city will require if its growth ambitions are to be realised. The documentation reflects the scale and complexity of the scheme and the need for rigorous, professional analysis of the proposal. In its entirety, the document should represent a "balanced scorecard" assessing all the key aspects of the proposal. The document also sets out the means by which the project may be implemented in a risk-controlled manner, should the Business Case be approved.

1.110 The responsibility for delivering this document was given to the Tram Project Board by CEC through TEL. It is these organisations who now have the responsibility of concluding on the way forward for the project, based on the evidence presented in this Business Case.

2. Introduction

FBCv2 structure

The following summarises the content of the remaining sections of the Final Business Case:

3 – Project Development and Phasing: Details the historical development of the project up to the end of the Parliamentary process and describes the adoption of Phase 1a as the first phase of tram implementation.

4 – Project Justification: Summarises the findings of the STAG2 on Phase 1 and Phase 1a of the tram which is included in full at Appendix II.

5 – Project Scope: The functional specification for Phase 1a of the tram.

6 – Governance: The Governance structure which summarises the roles of CEC, TEL, **tie** and the Tram Project Board as well as the interests of the Scottish Government and Transport Scotland.

7 – Procurement: Details the contractual structures for the implementation of the project and the way risks are allocated between the public and private sector in a way which delivers value for money for the Public Sector.

8 – Implementation: Details the plans to manage the construction, testing and commissioning phases and outlines the strategies to reduce construction impacts as balanced against cost and programme impacts.

9 – Operational plan: Summarises the TEL Business Plan as included in full at Appendix I incorporating an assessment of the prospective profitability of TEL operating as an integrated bus and tram business.

10 – Financial Analysis: Gives details of the process by which capital costs for Phase 1 and Phase 1a of the project were estimated, assesses the affordability of the project in light of available funding and examines the benefits of maintaining flexibility and managing risk through a staged construction of Phase 1a and Phase 1b.

11 – Risk Management: Explains the type of risk the project faces and the management processes by which they are identified, quantified where possible and managed / mitigated.

12 – Programme Summary: Summarises the key milestones in the programme for delivery of the project which is in turn based upon Phase 1a opening in Quarter 1 of 2011. Detailed Gantt charts are provided at Appendix V.

13 – The case for Phase 1b: Summarises the economic case for Phase 1b, the options for construction included in the Infraco / Tramco contracts and potential funding opportunities.

14 – Future expansion: Considers developments in relation to tram schemes elsewhere in the UK and Dublin and what conclusions can be drawn for future expansion of the ETN.

3. Project development and phasing

History of project development

3.1 Substantial road traffic growth across the Edinburgh area, combined with forecast population and employment increases, will lead to significant growth in road congestion and demand for transport solutions. To support the local economy, the City of Edinburgh Council (CEC) identified trams as the preferred way to provide the backbone for a comprehensive, high quality public transport network to support the local economy and to help to create sustainable development. The key milestones in the development of the project to date are summarised in Table 3.1 and detailed in the text that follows. Progress to date on the procurement and implementation of the project is detailed in sections 7 and 8.

Table 3.1. Key development milestones to date.

1998	• **White paper – "Scotland's Transport Future".**
1999	• **City of Edinburgh Council (CEC) Integrated Transport Initiative (ITI) – Inception.** • **CEC Local Transport Strategy (LTS) – Interim.**
2000	• **CEC LTS 2000 – Published.** • **Waterfront Edinburgh Limited (a Joint venture between City of Edinburgh Council and Scottish Enterprise Edinburgh and Lothian) commissions the 'Feasibility Study for a North Edinburgh Transit Solution'.**
2001	• **Feasibility Study for a North Edinburgh Transit Solution – Published.** • **CEC commissions the 'Edinburgh LRT Masterplan Feasibility Study'.**
2002	• **Transport Initiatives Edinburgh Limited (now tie) incorporated** • **Scottish Executive 'Approval in Principle' of the City of Edinburgh Council's ITI.** • **Scottish Executive funding grant awarded to support the introduction two Bills into Parliament - Tram Line 1 and Tram Line 2.**
2003	• **Edinburgh LRT Masterplan Feasibility Study – Published.** • **Transport Minister announces £375million 'available in principle' for the Edinburgh Tram'.**
2004	• **Tram Line 1 and Tram Line 2 Bills submitted to parliament.** • **CEC LTS 2004 – Published.**
2005	• **Tram Line 1 and Tram Line 2 Bills preliminary reports heard by parliament and proceed to consideration stage.**
2006	• **Both bills passed by parliament following final stage debate and receive Royal Assent** • **Draft Final Business Case – Published.** • **Scottish Executive National Transport Strategy – Published.**
2007	• **CEC LTS 2007 – Published.** • **SESTRAN Regional Transport Strategy 2007 – Published.**

3.2 The tram scheme was first considered in the white paper entitled "Scotland's Transport Future" which was published in 1998. In line with the aspirations of the white paper, CEC included the development of a rapid transit network in its Local Transport Strategy (LTS) Interim Report published in 1999. This was followed in 1999 by CEC's New Transport Initiative (now known as the Integrated Transport Initiative or ITI). The ITI was aimed at making a significant contribution to meeting national, regional and local transport objectives and supporting long term economic prospects and quality of life offered by the south east of Scotland through the introduction of a congestion charging scheme with a supporting package of major transport investment.

3.3 In 2000 CEC's LTS was published which confirmed that the development of a tram network was central to its transport policy. In addition, Waterfront Edinburgh Limited commissioned a

feasibility study for a North Edinburgh Rapid Transit Solution (RTS). This study, which was published in 2001, examined the technical and economic case for a rapid transit system serving North Edinburgh and concluded that a loop which connected North Edinburgh with Haymarket and the city centre using light rapid transit (LRT) or tram based technology offered the best potential. Further details of the findings of this study are provided below (3.30).

3.4 In October 2001, CEC approached the Scottish Ministers with an "Application in Principal for an Integrated Transport Initiative for Edinburgh and South East Scotland" (the Application) setting out the underlying rationale for their ITI. Before reaching a final ministerial decision on the Application, the Minister for Enterprise, Transport and Lifelong Learning proposed that an arm's length company should be established to further review and develop the Application and the scope of the ITI and to deliver the ITI.

3.5 On 30 April 2002, Transport Initiatives Edinburgh Limited (now **tie** limited) was incorporated. Thereafter, on 18 December 2002, the Application was approved by the Scottish Ministers. As a result, the Scottish Executive (SE) awarded a funding grant to support the introduction of the Edinburgh Tram (Line 1) Bill and the Edinburgh Tram (Line 2) Bill to the Scottish Parliament.

3.6 The case for the tram was further considered in the Edinburgh LRT Masterplan Feasibility Study commissioned by CEC in 2001 / 2002 and produced and published by Arup in 2003 (the Arup report). It confirmed that the northern loop should receive the highest priority followed by the western and south-eastern lines. The Arup report also concluded that LRT or tram was the appropriate choice for a city of Edinburgh's size. Further details of the findings of the Arup Report are provided below (3.36).

3.7 The recommendations in the 'Feasibility Study for a North Edinburgh Rapid Transit Solution', the 'Edinburgh LRT Masterplan Feasibility Study', CEC's LTS and the CEC ITI culminated in funding support in June 2002 from the Scottish Executive to develop the North Edinburgh Loop (Line 1) and the Western Route (Line 2) for Parliamentary submission.

3.8 In March 2003 the Transport Minister announced that there was £375 million 'available in principle' for the Edinburgh Tram.

3.9 In respect of Line 1, the option development process was revisited in 2002 and 2003 through the work carried out by Mott Macdonald in the Work Package One Report. The preferred option was broadly confirmed, subject to potential alignment variants at George Street / Princes Street and Telford Road / Roseburn Railway Corridor. These options were taken forward to public consultation.

3.10 As for Line 2, the starting point was to examine and select the preferred route corridor through west Edinburgh. Over thirty route options were defined and three basis corridors identified. The preferred route corridor was carried forward to public consultation as were various sub-options – George Street / Princes Street; Roseburn to Carrick Knowe section; Gogar Roundabout and the alignment at the airport.

3.11 Public consultation took place on the preferred route alignments for both lines during May – July 2003 and as a result of the consultation responses and comments, a single preferred route alignment for each line was identified and the necessary Private Bill and accompanying documents developed.

Parliamentary approval

3.12 On 23 December 2003 the Edinburgh Tram (Line One) Bill and the Edinburgh Tram (Line Two) Bill were submitted to the Scottish Parliament. CEC approved its LTS 2004 – 2007 on 22 January 2004 which reconfirmed that the development of a tram network was central to their transport strategy. Thereafter, both Bills were formally introduced to the Scottish Parliament on 29 January 2004.

3.13 The Bills, as drafted, proposed two lines which could be operated as part of a network.

- Line 1: a loop from St Andrew Square along Leith Walk to Leith, west to Granton, south to Haymarket via the Roseburn Railway Corridor and back to St Andrew Square via Princes Street. The overall route length is 15.6km with tramstops at 22 locations.
- Line 2 follows a western direction from St Andrew Square via Princes Street, Haymarket, Murrayfield and South Gyle to Edinburgh Airport and with a shuttle extension from the Airport to Newbridge. In total, the line covers 17.8km and has tramstops situated at 18 locations.

3.14 The section of tramway between St Andrew Square and Roseburn is common to both Line 1 and Line 2.

3.15 Both bills were considered by separate committees. The Edinburgh Tram (Line 1) Bill Committee published its preliminary stage report on 16 February 2005, which was debated by the Scottish Parliament on 2 March 2005. The Edinburgh Tram (Line 1) Bill Committee published its preliminary stage report on 9 February 2005 and it was debated on 23 February 2005. Both Bills received unanimous, but qualified, support to proceed to the consideration stage.

3.16 During the consideration stage, the promoter (CEC) sought to amend the route alignment of both bills. In relation to Line 1, there was a small amendment at Leith. In relation to Line 2, there was an amendment at the Gyle to pull in the limits of deviation so that the alignment runs along the edge of, rather than through, the Gyle car park. In relation to the common section, there was an amendment at Haymarket which moved the alignment from between Citypoint and Elgin House to a line in front of Elgin House along the reserved public transport corridor. These changes were assessed using the STAG appraisal guidance and supplementary accompanying documents were submitted with the proposed amendments to the bills.

3.17 The Edinburgh Tram (Line 1) Bill Committee published its consideration stage report on 1 March 2006 and this included a recommendation that the route be amended as sought by the promoter. The Edinburgh Tram (Line 2) Bill Committee published its consideration stage report on 21 December 2005. Again this included a recommendation that the route be amended as sought.

3.18 The final stage debate for the Edinburgh Tram (Line 1) Bill took place on 29 March at which time the bill was passed. It subsequently received Royal Assent on 8 May 2006. The Final Stage debate for the Edinburgh Tram (Line 2) Bill took place on 22 March at which time the bill was passed. It subsequently received Royal Assent on 27 April 2006.

National transport policy

3.19 National planning policy is shaped by the National Planning Framework. This document supports the integrated planning of land-use and transport as exemplified by the Edinburgh and the Lothians Structure Plan.

3.20 National transport policy is set out in the White Paper "Scotland's Transport Future." This sets out the overall aim of promoting economic growth, social inclusion, health and protection of the environment through a safe, integrated, effective and efficient transport system. It sees the principal challenges in achieving this are changing attitudes to transport choices, stabilising road traffic volumes at 2001 levels by 2021, facilitating the development of new transport links and delivering value for money. Linked to this is maximising the opportunities presented by the rapid pace of technological change and ensuring the right governance arrangements are in place to deliver.

3.21 In terms of delivering the vision, the white paper specifically states

> *"We [the Scottish Executive] are supporting City of Edinburgh Council's proposals to introduce a modern tram network to Edinburgh, to tackle congestion and link communities with areas of economic growth. Trams will provide fast, efficient, mass transport and provide a real alternative to travel by private car."*

National, Regional and Local Transport Strategies

3.22 In December 2006, the Scottish Executive published the National Transport Strategy (NTS) which sets out, for the first time, the long term vision for transport, together with objectives, priorities and plans. The NTS states three 'strategic outcomes':

- Improve journey times and connections – making it quicker, easier and more reliable for passengers to travel between our towns and cities and across our global markets;
- Reduce emissions – making sure that Scotland takes a lead in the future of sustainable transport; and
- Improve quality, accessibility and affordability – ensuring everyone across Scotland has high quality public transport choices.

3.23 SESTRAN (south east of Scotland transport partnership) is one of seven regional transport partnerships in Scotland. Within the SESTRAN area there is a huge diversity of transportation issues from urban congestion to rural public transport and from ferry ports to airports. SESTRAN aims to address these issues and work towards a more sustainable and efficient transport network. Under the Transport (Scotland) Act 2005, SESTRAN has a statutory obligation to prepare a Regional Transport Strategy (RTS). A Draft RTS was published for consultation in November 2006, and the final document was published in March 2007 The SESTRANS RTS has been developed with close links to the NTS. The following vision statement describes the overarching direction of the RTS:

> *"South east Scotland is a dynamic and growing area which aspires to become on of northern Europe's leading economic regions. Essential to this is the development of a transport system which enables businesses to function effectively, allows all groups in society to share in the region's success through high quality access to services and opportunities, respects the environment, and contributes to better health."*

3.24 The purpose of this RTS is to set out a clear framework for the future direction of investment in, and management of, transport in the SESTRAN area for the next 10-15 years. Two main aspects form the basis of the RTS – the sustainable development of the area in a less car-dependent manner and the widening of access for all areas and groups. The RTS strongly supports the tram and states that SESTRAN will strive to see expansions of the tram network in the future.

3.25 CEC resolved in October 1998 to prepare its Local Transport Strategy (LTS), and this was published in 2000. Updates of the LTS were approved by CEC in January 2004 and March 2007. It sets out a vision for transport in Edinburgh as follows:

> *"Edinburgh aspires to be a city with a transport system which is accessible to all and serves all. The transport system should support a sustainable and prosperous economy. It should contribute to better health, safety and quality of life of all Edinburgh's citizens and visitors, particularly children, the elderly and disabled people."*
>
> *"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 having to rely on a car. The city should develop and grow in a form that reduces the need to travel long distances." Choice should be available for all journeys within the city.*

3.26 The aims of the LTS are to support a sustainable and growing local and regional economy; improve safety for all road and transport users; reduce the environmental impacts of travel; support the local economy; promote better health and fitness; and reduce social exclusion. The LTS also sets out a number of more specific objectives, including "implementing the tram project by 2011 as the core of a modern transport system for the city".

3.27 The LTS included identifying and implementing a series of measures including the ITI, which was presented to CEC's Transportation Committee in May 1999. The committee authorised implementation of Phase 1 of the strategy, which was to identify major improvements needed to the city's transport system. The measures that were identified were a congestion charging scheme, together with a package of improvements to public and private transport.

3.28 In May 2000, CEC considered the results of Phase 1 of the ITI and agreed to embark on Phase 2, an examination of the ways of achieving the measures that had been identified. The CEC Executive considered Phase 2 in September 2001. The package of suggested improvements to public and private transport was divided into five areas: rail, tram and guided bus; integrated transport including park and ride; bus improvements; road maintenance; and quality of life and environmental improvements.

3.29 The report concluded that the best way to deliver the improvements was to set up a wholly-owned subsidiary to implement such elements of the ITI. CEC established **tie** as a wholly-owned subsidiary company in 2002 with the role of project management, procurement and implementation. **tie** was established with its own staff, a majority of private sector board members, and the remit to develop the ITI and to take forward the development of three tram line projects. CEC retained the transport strategy function and once agreed projects move to the detailed development and procurement stage, **tie** takes responsibility for them.

Feasibility Study for a North Edinburgh Rapid Transit Solution

3.30 In support of the development of CEC's LTS, a potential RTS for linking the Waterfront development in the north of Edinburgh to the city centre was commissioned. This work was performed by a partnership of Andersen, Steer Davies Gleave and Mott MacDonald and published in July 2001.

3.31 The 'Waterfront Report' as it came to be known, examined potential technical solutions for a RTS. The options considered were initially:

- Bus based - Quality bus, alternative fuel;
- Guided bus based - Kerb guided and electronic guided;
- Light rapid transit - Light rail; and
- Automated guideway - Monorail, people mover and maglev.

3.32 After initial assessment of the relative merits and demerits of each transport mode they were judged against four key questions:

- Will the technology work in the available corridor?
- Does it achieve the overall quality desired of the system?
- Does the technology match the scale and form of network proposed, including future developments? and
- Will the technology attract the anticipated patronage or have adequate capacity?

3.33 Leading on from the above assessment the following options, as discussed in the 'Waterfront Report', were discounted:

- Transitional bus;
- Monorail;
- Guideways;
- Magnetic levitation; and
- People movers.

3.34 Two remaining options - guided bus and light rail, were taken forward for detailed assessment against the criteria in Table 3.2 below:

Table 3.2. "Waterfront Report" – Assessment of guided bus and light rail transit options.

Criterion	Guided bus	Light rail transit
Alignment.	If segregated, similar issues to LRT, otherwise easier to design.	Dedicated alignment design required whether segregated or not.
Public utilities impacts.	If segregated similar issues to LRT, otherwise no relocation required.	All longitudinal services beneath swept path must be relocated.
Traffic impact.	Will need to contend with existing bus service on street.	Greater priority afforded, thus reduced impact if properly policed.
Modal interchange.	No major benefit over existing bus services.	Benefit of incorporating new mode of transport at interchange.
Journey time.	Guided bus will not receive any greater priority than normal buses if un-segregated.	Greater priority afforded to LRT on un-segregated sections thus reducing journey times.
Patronage.	Not perceived as significantly different from conventional bus thus reduced patronage.	Reduced journey times, improved reliability and comfort will result in increased patronage.
Carrying capacity.	Would require additional vehicles for the same peak capacity.	Increased carrying capacity with peak capacity of 2,500 people per hour.
Depot site.	No dedicated infrastructure required.	Dedicated infrastructure required.
Capital cost.	Reduced capital costs.	Increased capital costs.
Operating costs.	Comparable to LRT but increased lifecycle replacement costs.	Comparable to guided bus but fewer lifecycle replacement costs.
Revenue.	Less revenue.	More revenue.
Construction programme.	Programme contracted due to works extent being significantly reduced.	Programme lengthened due to works extent being significantly increased.
Accessibility.	More difficult access for disabled persons, push chairs etc.	Greater accessibility for all including disabled persons with level access.
Comfort / ride quality.	Inferior comfort levels due to irregularity of road surface.	Superior comfort levels with light rail vehicles (LRV's) fitted with resilient wheels and high specification suspension on rails.
Frequency / reliability.	More frequent but not as reliable due to reduced priority traffic impacts.	Improved frequency / reliability mainly due to given priority.
Image.	Perceived by public as normal bus.	Improved public image over buses.
Safety.	Reactionary operation therefore path not as easily perceived.	Improved safety due to fixed path easily perceived (pedestrian / driver).
Air quality / noise impacts.	Increased air quality and noise impacts due to the bus vehicles generally being diesel powered. These impacts can be reduced by adopting dual powered buses.	Reduced impact as LRV's being electronically powered do not discharge noxious emissions and equipped with resilient wheels and skirting, as well as, using continuously welded rail, means noise is minimised.

* Highlighted cells denote which option is better against each criteria.

3.35 Following this detailed analysis, tram was selected as the preferred transport solution. Three route options were derived from a long list of 26 configurations. Following the detailed assessment and consultation the preferred solution of a light rail system was identified and the route configuration now known as the North Edinburgh Loop was proposed. This proposal

was submitted to full City of Edinburgh Council and has been incorporated in the LTS 2000, 2004 and 2007.

Edinburgh LRT Masterplan Feasibility Study

3.36 This report was commissioned by CEC (December 2001) to build on the initial work proposed under the 'Waterfront Report'. The specific remit for Ove Arup and Partners was to develop:

- A "viable network" of LRT routes which, in conjunction with other modes, will best meet the LTS and other project specific objectives;
- An outline of capital costs, revenue and operating costs for the LRT lines;
- Sufficient data on LRT routes for use in overall assessment and prioritisation of scheme with the ITI; and
- Inputs to the development of the road user charging scheme business case and to support applications to the government for approval and funding of the ITI.

3.37 The approach taken was in two phases. Phase 1 comprised a comparison of the nine identified transport corridors and their appraisal against preliminary criteria based on Scottish Transport Appraisal Guidance (STAG) 1. This comparison led to the recommendation of seven schemes (see table below) for a more detailed assessment at Phase 2, which formed the basis of the recommendation on priorities for LRT implementation.

Table 3.3. Edinburgh LRT Masterplan Feasibility Study – Ranking of possible LRT corridor options.

Corridor	Scores	Ranking
Queensferry	+9	4
North Edinburgh Loop	+22	2
West Edinburgh	+24	1
South Edinburgh	+6	5
South East Edinburgh	+17	3
South Suburban	+4	7
South Orbital	+5	6

3.38 Following the detailed appraisal, it was recommended the top three were taken forward for further detailed consideration. This further analysis resulted in the conclusion that the North Edinburgh Loop (Line 1) be accorded the highest priority among the corridors tested and that the Masterplan should include both the West (Line 2) and South East (Line 3) lines as high priority schemes. This proposal was submitted to CEC and was incorporated in the LTS 2000, 2004 and 2007.

Establishment of Transport Edinburgh Limited (TEL)

3.39 CEC has established TEL as the single economic entity under which both the Tram and Lothian Buses will operate in an actively planned and managed integrated transport network. TEL is taking full advantage of the continuing engagement of Transdev as the intended operator of the Tram network who bring to bear their experience and expertise in the design and operation of tram and other public transport system systems.

3.40 TEL has developed its presence with the appointment of its Board of Directors, including two independent non-executives. The Chief Executive of Lothian Buses has been appointed as Chief Executive of TEL. The governance structure of the Tram project has been amended, such that TEL has clear accountability for planning and implementing the integrated transport business, with **tie** (advised by Transdev), charged with delivery of the tram project. This structure has been implemented such that clear and full accountability to the Council as promoter of the Tram project, and majority owner of Lothian Buses, is sustained. The governance structure is further considered in section 6.

3.41 TEL played a leading role in the preparation of the DFBC, approved in December 2006, and this FBCv2, with particular contributions in the following areas:

- Development of the adopted phasing strategy as described below (3.42);
- Development of future integrated service patterns for tram and buses working together;
- Validation of the prospective economic benefits delivered by the introduction of tram as summarised in section 4; and
- Validation of modelled patronage and revenue forecasts for tram and for TEL as a combined tram and bus business and incorporation of same into a 'TEL Business Plan' which encapsulates the operational plans for the tram as detailed in section 9.

Project phasing

3.42 During 2005 the key funding and affordability issues were addressed with respect to the funding of the Project, in the context of a SE grant of £375m, and the financial risks which will have to be borne by either CEC or SE. Four possible configurations of the Tram network were addressed as follows:

a) Line 1 only
b) Line 2 only
c) Line 1 and 2
d) Line 1 and 2 less the Newbridge Shuttle

3.43 A great deal of work was carried out to ensure that the capital cost estimates available at the time were as accurate as possible and they were benchmarked against outturn costs on completed tram projects and other third party comparators. It was recognised that on a project of this scale and complexity, there will remain a degree of uncertainty (including that relating to construction market prices generally) up to the point where tender prices are negotiated. Therefore, it is important to achieve as much certainty as possible on the likely costs before procuring the major contracts for the tram infrastructure and vehicles.

3.44 The conclusion reached was that although Line 1 only or Line 2 only had a high degree of deliverability, within the constraint of a fixed SE grant of £375m, a complete network of Lines 1 and 2, with or without the Newbridge Shuttle, was unlikely to be affordable in one phase of construction and that a phased approach to procurement and delivery would be implemented.

3.45 CEC's identification of a phased approach was welcomed and discussions with officials of CEC and senior civil servants in TS focused on the capital funding available and which sections of the tram network could realistically be afforded as a first phase of the network. As a result the Transport Minister indicated a willingness to consider indexation of the original £375m grant (i.e. to increasing the amount of the grant to take account of inflation), provided that a substantial capital contribution was made by CEC, and subject to the submission of a FBC demonstrating the benefits and viability of the phased scheme.

3.46 Concurrent with development of the in-principle revised funding contribution from SE and CEC above, the analysis of the phasing options progressed. Taking a prudent view on capital cost estimates and funding sources, an examination was undertaken by a number of parties — **tie**, CEC, TEL, LB and Transdev to assess the optimum construction phasing of a complete network of Lines 1 and 2. This work was validated by SE. The parties determined through reasoned argument and professional judgement which phases within the totality of Lines 1 and 2 would be the best to proceed with.

3.47 Consideration was given to a range of options for first phase network construction and to the pattern of construction of subsequent phases. This work indicated that the core of the network would be the line from Leith Waterfront to Edinburgh Airport via Haymarket and Princes Street (Phase 1a), would give a good balance of costs and benefits and would present a high probability of being financially viable when integrated with LB services. In addition, the first phase of the tram development was extended to include the section from Roseburn to Granton Square (Phase 1b) serving the development area in Granton. The assumed Phase 1 of Leith waterfront to Edinburgh Airport (Phase 1a) and Roseburn to Granton (Phase 1b) has been adopted by all parties.

3.48 Phase 1 would provide the core support for the city economy and would directly link the major growth centres at the airport, Gogarburn, The Gyle, Granton and Leith Waterfront with the city centre. It would provide access to the major housing and commercial developments under construction and planned for the medium to long-term and would underpin the role of these developments in sustaining the Edinburgh's role as a growing successful capital city.

3.49 The link to Leith will serve two thirds of the waterfront development contained in the area that runs across the Leith waterfront between Newhaven and the eastern end of the Victoria dock in Leith. Two thirds of the totality, approaching 20,000 residential units plus retail and commercial development, is within that arc. The tram will serve that area extremely well. Under the latest proposals from Forth Ports, a community the size of Bathgate will be built in Leith docks.

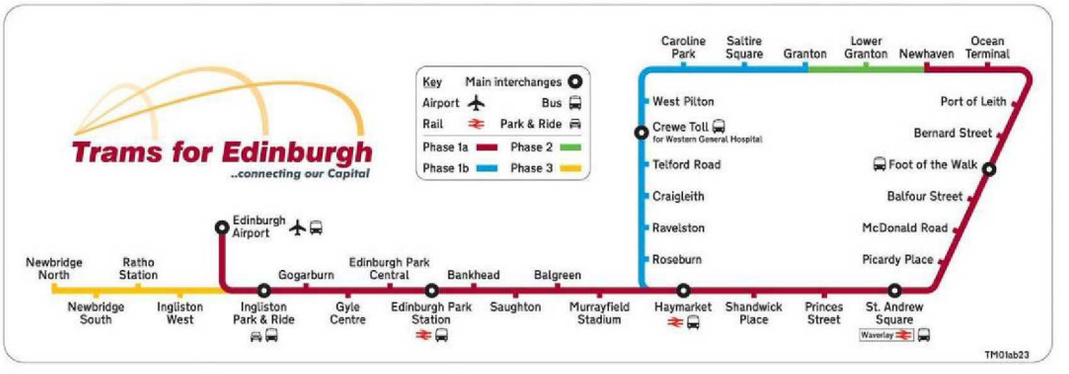
3.50 The advantages to CEC in achieving its vision for the city and in securing transport infrastructure stemming from this first phase of the tram include:

- A world class gateway to the city for visitors arriving at the airport, providing access to all modes of transport;
- Direct access to the major shopping destinations of the Gyle, Ocean Terminal and the city centre and to the Royal Bank of Scotland's (RBS) new international headquarters at Gogarburn;
- Access for existing communities to employment, leisure, shopping and other opportunities;
- A link with existing transport hubs at Edinburgh Park, Haymarket and Waverley Railway Stations and at the bus station in St Andrew Square to give first class interchange for local and long distance trips;
- Serving an expanded Park and Ride at Ingliston increasing the catchment area of the tram and further reducing the demand for car travel in the city;
- Serving Murrayfield, Tynecastle and Easter Road stadia, giving access to international and national sporting and other events; and
- Providing the core infrastructure on which expansion of the network would be built and could include in the future the proposed Line 3 linking the city centre with the new Royal Infirmary and the key development areas in south Edinburgh.

3.51 CEC remains committed to seeking future funding for the subsequent phases which would complete the full network of Lines 1 and 2 as depicted in Figure 3.1. These have been defined as:

- Phase 2 – Granton to Leith section along the waterfront, enabling through running of trams past Ocean Terminal and onto central Leith; and
- Phase 3 – Ingliston to Newbridge section which opens development opportunities in west Edinburgh under the West Edinburgh Planning Framework. Future funding will be closely linked with the continued expansion of the city and the associated opportunities for private sector contributions.

Figure 3.1. Line 1 and Line 2 phasing plan



3.52 In January 2006, following consideration of the phasing proposals, CEC made a commitment to contribute £45m towards the capital cost of Phase 1a of the project, to be structured in a manner which minimises financial risk.

3.53 In February 2006, the Transport Minister made an in principle commitment to increase the grant originally offered in March 2003 in line with inflation, estimated at the time as up to £500m. On 27 June 2007, the Cabinet Secretary for Finance and Sustainable Growth announced that funding would be conditionally provided to continue the delivery of the Edinburgh Tram system, up to a maximum of £500m, with no further indexation for inflation. Additional funding required for the project would need to be provided by CEC or by other parties under the direction of CEC. The detail of these arrangements is explained in Section 10.

Implementation of Phases 1a and 1b

3.54 **tie**'s procurement strategy as described in section 7 is entirely compatible with a phased approach. Since the network scope guidance provided in early 2006, **tie** prioritised its design and other implementation activities toward Phase 1a and, in particular, the most complicated section from Leith to Haymarket.

3.55 The invitations to tender for the infrastructure works and provision of the tram vehicle were based on a core bid, focussing on Phase 1a with an a fixed price option, based on the same principles for Phase 1b, to be exercised by Spring 2009. All bidders have returned compliant bids which reflect this phased approach and final negotiations for the 1b option will be completed prior to Infraco award. Confirmation of the continued economic validity of Phase 1b and details of the option for construction as they will be included in the Infraco contracts are set out in section 13. This includes the relative costs and benefits, as well as the impact of deferring a decision on this phase of the tram project.

3.56 This approach meets the aspirations for development of a core section of the original Lines 1 and 2 as a first phase, which is fully supported by TEL and Transdev. The resulting system is a good fit with the structure and local plans and reflects long term objectives

4. Project justification

STAG appraisal process

4.1 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 the Government's objectives.

4.2 As part of the supporting documentation submitted to parliament, full STAG1 and STAG2 appraisals were developed for each of Line 1 and Line 2 by Mott MacDonald and Faber Maunsell, respectively. This detailed work assessed the projects against the key STAG criteria and confirmed that both lines met, or exceeded, the Scottish Executive criteria. The documents were submitted to the CEC Executive for approval and final versions were submitted to parliament in September 2004. A separate, but parallel, network study providing the overarching framework for the development of trams in Edinburgh was developed by Faber Maunsell and reported to the Line 2 committee.

4.3 Following the decision to proceed with Phase 1 of the project, as described in section 3, **tie** commissioned the preparation of an updated report from Steer Davis Gleave setting out the STAG2 appraisal of Phase 1 of the tram, taking into account its constituent parts of Phase 1a and 1b (Appendix II). Given that Phase 1 is essentially a hybrid of Lines 1 and 2, the appraisal built upon the work undertaken on the previous appraisals for these individual lines, with much of the existing material updated and reconfigured for the appraisal of Phase 1. The work also identified Phase 1a as an individual phase for all aspects of the appraisal and this forms the baseline for this FBCv2.

4.4 Where the appraisal was based on the use of transport modelling outputs, such appraisal was reworked from first principles using the transport modelling undertaken under the Joint Revenue Committee (JRC) contract, again led by Steer Davis Gleave, and presents an assessment of the benefits and costs to Government of constructing Phase 1 and Phase 1a only.

4.5 This summary of the justification for Phase 1a of the tram encapsulates the STAG2 report in respect of the planning objectives established by the planner (planning strategy) and the Government's five objectives for transport:

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

Although this summary focuses on Phase 1a, it is recognised that there are significant benefits and links to planning objectives which could be derived from Phase 1b. Details of the case for Phase 1b are provided in section 13.

Planning objectives

4.6 Development of planning objectives is fundamental to development and appraisal of transport proposals. Planning objectives were developed with reference to the SE's national objectives and incorporate the relevant policies in local planning documents. They were based significantly on the opportunities, problems and constraints in the waterfront – city centre – airport corridors.

4.7 The planning and policy context at national, regional and local levels was used as the basis to develop the following Transport Planning Objectives:

- To support the local economy by improving accessibility;
- To promote sustainability and reduce environmental damage caused by traffic;
- To reduce traffic congestion and encourage mode shift;
- To make the transport system safer and more secure; and
- To promote social benefits.

Economic regeneration

4.8 In the parts of Edinburgh served by tram such as Leith Docks, Sighthill and, potentially, Granton, regeneration is a key priority. Phases 1a and 1b of the tram will connect these core development areas (CDA) across the city and minimises the need for dependence on private car to access employment, residential and retail areas.

4.9 Equivalent to a new town in scale, Edinburgh Waterfront is the largest brownfield development in Scotland. Phase 1 of the tram will support and catalyse this development by providing sustainable transport connections to areas where public transport service could be improved or which are or will experience congestion, particularly at peak times. This can significantly contribute to city regeneration. The major developments at Leith Docks will be more likely to succeed, and do so in a shorter timescale, with Phase 1a of the tram. These developments will bring high quality living, leisure and employment opportunities to the area.

4.10 As part of the demand forecasting and appraisal process of the tram, a thorough and robust review of planning opportunities was undertaken involving CEC planners. This considered the likely range of new development possible at the various sites identified and the potential impact that the tram might have on the overall scale of development. Table 4.1 sets out the most likely considered level of development up to 2020 with Phase 1a of the tram in place. Details of the impact of Phase 1b are provided in Section 13. Given the already dense nature of much of the central area of the city, the opportunities in that area are relatively modest in scale. The biggest development opportunity in Edinburgh is the redevelopment of the Granton and Leith Docks areas. Whilst substantial development has already taken place, notably at Leith, the overall aspirations for these areas are considerable. Nearly 350,000m^2 of other uses complete the development potential. The significant development planned in the West Edinburgh office / business sector would also have a considerable impact on tram patronage levels.

Table 4.1. Most likely new development to 2020 with Phase 1a of the tram in place.

Location	Residential (Units)	Office / Business (m^2)	Retail (m^2)	Hotel (rms)	Commercial (m^2)	Leisure (m^2)	Other (m^2)
City Centre	2,719	141,390	91,705	450	4,800	5,750	5,100
Leith Docks	18,000	30,000	26,000	0	41,500	0	0
West Edinburgh	0	253,350	0	168	50,000	14,300	174,000
Total	**20,719**	**424,740**	**117,705**	**618**	**96,300**	**20,050**	**179,100**

4.11 Without Phase 1a of the tram it is unlikely the large scale redevelopment of Leith Docks could go ahead in the same timescales or to the same extent. The new developments will bring high quality living, leisure and employment opportunities. In addition to opening up brownfield land for redevelopment, it is highly probable that the tram will have a positive impact on the image of the area and hence help to stimulate further inward investment. For certain employers whose workforces may be more than usually reliant on public transport access, the tram should act as a catalyst to encourage them to locate in areas that they would have previously discounted. In addition, by contributing to reducing growth in congestion, the tram will be assisting with maintaining the economic viability of North and West Edinburgh.

4.12 In order to compete in an increasing competitive marketplace, and to further stimulate economic regeneration, it is important to maintain and improve upon the city's wider streetscape. In spite of its historical and cultural importance, parts of Edinburgh's urban environment are of much poorer quality than is desirable. Experience in France has shown that investment in trams has been a catalyst for improvements to the streetscape and environmental amenity in general, bringing both economic and social benefits. In recognition of this important role of tram, the planning authority (CEC) has developed and approved a Tram Design Manual which is supplementary planning guidance that must be taken into account when the necessary prior approvals for the tram are being considered.

Environment

4.13 The tram will need to address the effect on the World Heritage Status of Edinburgh and **tie** is seeking to minimise or eliminate any adverse impact the tram may have, by working closely with the CEC Planning Committee to develop complementary solutions. Design work is targeted on the most sensitive sections of the route, with the aim of facilitating planning solutions in these areas. The topography, layout, numerous ancient monuments and Sites of Special Scientific Interest, have all been evaluated and have shaped the routing of the tram system. **tie** is committed to minimising any adverse impact on these areas. Mitigation is set out in the Tram Design Manual. This provides specimen designs for key areas, including the whole of the World Heritage Site. Specific contract requirements ensure that the final design complies with the Tram Design Manual.

4.14 There are also some areas of contaminated ground along the route, including disused railway land and a former landfill site. Temporary impacts from the construction works will cause minor negative impacts on the land here, but, with effective mitigation, the permanent impacts during the operation of the tram will be minor. There are several protected species present in the corridor including bats, otters and badgers. However, mitigation measures have been implemented to ensure that works undertaken in close proximity to badger setts and foraging habitat comply with the requirements of relevant legislation, in consultation with Scottish Natural Heritage (SNH) and the Scottish Executive's Countryside and Natural Heritage Unit (CANHU). Details of mitigation measures for this and the retention, protection and enhancement of existing plantings and habitats and replacement of those lost as a consequence of the development can be found in the Landscape and Habitat Management Plan (LHMP).

4.15 Assessment of the environmental aspects of Phase 1a show that it can make a positive contribution towards objectives of reducing emissions and improving air quality in the Air Quality Management Area (AQMA) set up by CEC. Phase 1a passes through the heart of the city centre and will specifically contribute to these issues which CEC is addressing through an Air Quality Action Plan (AQAP). Vehicles within the city have been shown to account for up to 88% of emissions of nitrogen oxides. Trams will contribute to the objectives of the AQAP by providing a large number of journeys through the city centre; improving mobility and accessibility without adding to current levels of nitrogen dioxide (trams have zero emissions at point of use). Trams are also relatively quiet, compared to other modes of road transport, providing a higher quality environment for those living, working and travelling in the area.

4.16 The tram's contribution to mode shift will enable further progress towards objectives set in the Air Quality (Scotland) Amendment Regulations 2002 and to national objectives to reduce emissions of greenhouse gases. CEC have identified air quality issues in the western corridor of the city leading to the airport area, with a particular focus on Corstophine Road, St Johns Road and the Drumbrae roundabout. Monitoring of this is being carried out with a view to determining it a second AQMA. Phase 1a will pass directly through this corridor and, as a result, will contribute to air quality improvements in the area.

Safety and reliability

4.17 Personal security will improve, reflecting tram design elements (CCTV and help points at all stops and vehicles) and designed access arrangements aimed at enhancing security. The planned high use of inspectors on vehicles will also assist this objective.

4.18 Trams will improve the overall reliability of public transport, as they generally benefit from greater segregation from general traffic and priority at junctions, and present an opportunity to significantly reduce the variability of dwell time at stops compared to a bus-only public transport service. In the absence of trams, a significantly increased number of bus vehicles would be required on the main Phase 1a corridor on Princes Street and Leith Walk to cope with forecast increased passenger demand. Despite continuing implementation of a wide range of bus priority measures, buses remain vulnerable to the effects of increasing congestion across the city.

4.19 The current method employed to maintain bus services despite the negative influences of increasing congestion is that LB review and update the operating timetables on a regular basis, flexing them as necessary and inserting additional buses to achieve bus frequency. An important issue in reflecting prevailing traffic operating conditions is to consider the implications of the natural variability in the levels of queues and delay that are experienced across the city on a day to day basis. In practice, journey times vary, so the timetables reflect an average journey time, in order to achieve a high level of reliability.

4.20 Research has shown that unreliability of journey time is particularly off-putting to public transport passengers. One piece of research, for example, suggests that the standard distribution of journey time (a measure of variability) was as off-putting to passengers, per minute, as 1.3 minutes of additional average journey time (Table 8.14, The Demand for Public Transport: a practical guide, TRL Report TRL593, TRL, 2004).

4.21 Over the past decade, CEC and LB have worked in tandem through a process of operational management interventions and improved bus priority measures at key locations, in order to maintain timetable and, thus, service delivery. It is commendable that it has been possible to steadily keep up with the changing demands for travel against the context that available road capacity has not markedly changed, and that road traffic volumes across the city have been on the rise over time. It is unlikely that the types of intervention that have worked in the past can indefinitely be sustained into the future.

4.22 It is envisaged that in a 'no tram' world, in order to meet passenger demand, it would be necessary to increase the number of buses along the tram operating corridor by more than 30% by 2031. This, in turn, would be likely to be commensurate with adjacent growth in highway traffic.

4.23 Despite increased priority, segregation and effective operational management, the introduction of higher frequency services to tackle the level of patronage growth alongside growth in other road traffic, allied with increased levels of bus queuing and passenger boarding and alighting times at critical stops would inevitably lead to deteriorating journey times and reliability.

4.24 The mechanisms at play leading to the possibility of a reduction in bus service reliability include:

- Greater demand => higher bus loads;
- Greater demand => increased other road traffic;
- Higher bus loads => longer journey times (due to dwell times);
- Higher bus loads => larger vehicles => even higher bus loads;
- High bus loads => Increased service frequency;

- Increased service frequency => Increased queing of buses at stops => Longer journey times;
- Increased service frequency => lower bus loads;
- Lower bus loads => shorter journey times (due to dwell times);
- Increased service frequency => increase bus / bus interaction;
- Increase bus / bus interaction => increased journey times and decreased reliability;
- Increased other road traffic (including additional buses) => increased bus / traffic interaction;
- Increased bus / traffic interaction => increased journey times and decreased reliability;
- Increased priority and segregation => reduced bus / traffic interaction; and
- Reduced bus / traffic interaction => reduced journey times and increased reliability.

4.25 Clearly this is a complex system, which can be influenced heavily by external measures (segregation / priority and management intervention). Therefore, it is not straightforward to predict the deterioration of bus journey times without detailed operational understanding and a clear view of what is feasible in terms of bus priority and segregation. With existing peak period traffic congestion and relatively high bus service frequencies already in place, significant future increases in bus provision would be likely to need supportive segregation and priority measures, which would impact adversely on road capacity for other traffic.

Accessibility and social inclusion

4.26 An integrated, efficient, accessible and high quality public transport system is vital to promoting economic growth in the local community and to improving its performance and competitiveness. Phase 1a of the tram will achieve this by increasing the number of people with access to the public transport network and with access to employment opportunities at the new development areas in Leith Docks and in the west of the city at Edinburgh Park, the Gyle and the airport. Phase 1b will similarly support the redevelopment at Granton (see section 13).

4.27 Phase 1a of the tram scheme improves accessibility to identified key trip attractions and destinations from a substantial portion of Edinburgh e.g.:

- 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);
- Leith Ocean Terminal (leisure / shopping / employment);
- Edinburgh Airport (employment, transport interchange); and
- Gyle Centre / Edinburgh Park (shopping / employment).

4.28 Mapping of the levels of economic deprivation, employment levels and levels of educational attainment show a considerable variance across the city. A number of trends are evident, which make it possible to identify a range of pockets and corridors which are less affluent than others. Zones around Leith Walk, as well as around Saughton and Balgreen in the west, have been identified as areas where socio-economic status is considerably lower than surrounding areas. Employment, income levels and car ownership tend to be comparatively low in these areas.

4.29 Direct connection to the city centre and other employment areas, which will be facilitated by Phase 1a of the tram, will undoubtedly improve the situation for these areas. Despite the high levels of car ownership at the city wide level, pockets of low car ownership exist, broadly correlated to areas of high population density. The tram will offer an attractive service to those areas, with Phase 1a servicing Newhaven, Leith and Leith Walk, as well as Haymarket and Gorgie near the city centre and Saughton and Balgreen in the west.

4.30 The design of tram vehicles and tram stops will ensure that the trams and tram stops are fully accessible by people with mobility impairments, those travelling with small children and the

elderly. For these groups, and notwithstanding continuing improvements in access for people with mobility impairments on LB, there is a relative advantage for trams in terms of design specifications, ride-quality and reliable accessibility for a significant section of Edinburgh's population. Where the distance between tram stops presents a challenge to accessibility, the service integration patterns with buses have been designed to maximise the continuing accessibility of Lothian Buses for these groups.

Transport and land use integration

4.31 Phase 1a of the tram will connect the residential developments at Leith Docks with the city centre, West Edinburgh and the airport. The city centre and West Edinburgh represent the second and fourth largest concentrations, respectively, of employment in Scotland and West Edinburgh and, in particular, are forecast to grow considerably. At the core of this growth is the West Edinburgh Planning Framework area, south of the airport and identified by the Scottish Government as a national growth point. Phase 1a of the tram will be core infrastructure for this development area; without investment in new transport, it is unlikely that this major national opportunity can be realised. The tram will be particularly vital in responding to the expected growth in travel demand arising from the development. Without this development, major greenfield and greenbelt releases would be required. This not only has planning implications, but would result in a settlement pattern that would be more difficult to serve by public transport.

4.32 In the absence of the tram, the new development underway in North Edinburgh may contribute significantly more to city wide congestion as a direct result of the failure to integrate land use and transport policies. It is also possible that the new development will be diverted to less sustainable locations with less potential for effective transport integration.

4.33 The introduction of tram will provide an opportunity to significantly improve integration between transport modes. The major advantage here is that integration can be planned before the start of services. This is much more effective than trying to achieve integration between already established services. The interchange at Haymarket, and close proximity to Waverley Station and Edinburgh Park Station, mean integration with heavy rail will be effective. These interlinking services, along with the proposed frequency of the service, means tram will afford easier access to employment and service areas. The tram will also facilitate enhanced integration between public transport and travel by air by serving Edinburgh Airport. The integration of the bus, rail, air and the tram services to and from the airport will mean considerable improvement for the travelling public. This could lead to demand for additional feeder services to the main network, thus further benefits in terms of integrated public transport usage and inclusion.

4.34 A detailed description of the planned integration of service patterns between tram and buses is provided in section 9.

4.35 The tram will enhance the opportunity to make journeys on the public transport network through bus-tram service integration plans and ticketing arrangements, reflecting specifically designed stops and interchange facilities for effective integration with the bus and rail networks. This is most notable at:

- Edinburgh Airport;
- Waverley, Haymarket and Edinburgh Park rail stations;
- The foot of Leith Walk, St Andrews bus station, and the bus hubs at Ocean Terminal and the Gyle Shopping Centre; and
- Expanded Park and Ride at Ingliston and, potentially, other locations.

4.36 A fuller analysis of the existing and potential opportunities for transport interchange is provided in section 5.

4.37 In relation to land-use policy and proposal integration, Phase 1a of the tram integrates positively with land-use policies and proposals as detailed in:

- National Policy – National Planning Framework (NPF) and Scottish Planning Policy (SPP17);
- Regional Policy – Developing SESTRANS RTS and Edinburgh and Lothians Structure Plan 2015; and
- Local Policy – Edinburgh local plans and associated development proposals, most notably Leith Docks Western Harbour development and Haymarket-airport including Edinburgh Park / Gyle.

Patronage and mode shift

4.38 Phase 1a of the tram will permit further development while limiting additional congestion on key urban routes. The tram has the potential to reduce traffic congestion by encouraging drivers to use the tram instead of their car. As other tram schemes in the UK have shown, there is greater potential for modal shift from car to tram than to buses, or guided buses. This is especially so if the tram is in operation before new development is constructed and travel patterns have been established. Modal shift from car is a key objective of the LTS and RTS as it will help to relieve the problems of traffic congestion that are experienced in the city and the wider region. Modal shift is fundamental to achieving the environmental, sustainability, health and traffic aspirations of the tram.

4.39 Extensive work was undertaken at DFBC stage to build new demand forecasting models to predict use of the tram and the impact upon use of other transport: bus, rail and car. Annual demand for Phase 1a is predicted to be **10.9m** tram passengers in 2011 assuming that 75% of modelled demand occurs in the first year. This rises to **25.5m** in 2031 in the absence of EARL. This growth is predicated on a forecast of substantial growth in the total travel market, as well as the additional predicted commercial and housing development as a result of the scheme. Between 2005 and 2031, demand for journeys by car in the city is forecast to increase by **37%** (1.2% p.a.) and demand for journeys by public transport is forecast to increase by **61%** (1.8% p.a.).

4.40 The introduction of the tram is forecast to generate a sizeable shift from car to public transport, with the biggest impacts in areas directly served by the tram. However, the proportion of people moving to public transport in the wider Edinburgh area is limited by the fact that Phase 1a of the tram has a limited influence in other areas of the city.

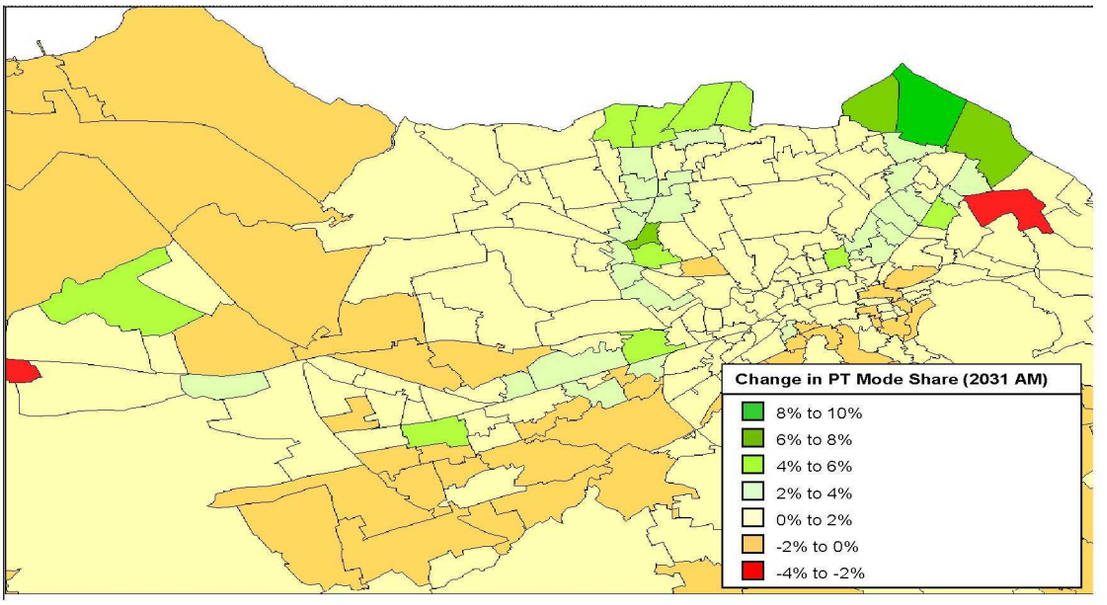
4.41 Table 4.2 presents the forecast mode shift from the introduction of Phase 1a of the tram. The data is for all trips into, out of and within Edinburgh in the daily morning (AM) peak from 0700-0900, the inter-peak (IP) from 1000-1200, and an annualised total. Figures are provided for forecast years 2011 and 2031. The shift to public transport, in terms of mode share percentage points, is in keeping with what would normally be anticipated for such a scheme in the context of an entire car travel market for the city, including those areas outside the market for Phase 1a of the tram.

Table 4.2. Mode shift to public transport with Phase 1a of tram.

2011	**Without tram**	**With tram**	**Difference**
AM peak	47.1%	47.9%	0.9%
Inter-peak	24.8%	25.4%	0.6%
All	32.5%	33.2%	0.7%
2031	**Without tram**	**With tram**	**Difference**
AM peak	50.5%	51.9%	1.4%
Inter-peak	27.9%	29.0%	1.1%
All	36.0%	37.3%	1.2%

4.42 The impact of the tram on mode shift is proportionately higher in areas that it will directly serve and where it is appropriate to anticipate achieving mode shift. Figure 4.1 presents the forecast percentage point change in mode share by area of trip origin for the AM peak period in 2031 with the full Phase 1 scheme implemented.

Figure 4.1. Geographical change in public transport usage with Phase 1 of tram (2031).



4.43 From Figure 4.1 it is apparent that changes in mode share of up to 10% from car to public transport will be generated for trips from certain areas directly served by the tram. Areas exhibiting mode shift of greater than 5% (encompassing significant areas of development and growth which otherwise would be associated with higher levels of car travel) include:

- Leith / Newhaven;
- Craigleith;
- Roseburn;
- Sighthill; and
- Edinburgh Airport.

4.44 Tram patronage and revenue, in the context of overall TEL patronage revenue, and the analysis of risks thereto is summarised in section 9.

4.45 Abstraction from buses to the Phase 1a tram is predicted to be **8.3m** passengers in 2011, rising to **17.8m** by 2031. About **21%** of tram patronage (2.3m) is attracted as new public transport patronage in 2011, rising to **26%** (6.7m) in 2031. This proportion of tram patronage new to the public transport market is significant and in keeping with that achieved on successful tram schemes such as Croydon Tramlink, Nottingham and Dublin.

4.46 The sources of demand for Phase 1a of the tram are set out in Table 4.3. The increasing share from car is consistent with the higher congestion levels and hence attractiveness of tram expected and forecast in the later year.

Table 4.3. Sources of Phase 1a tram patronage.

Millions of passengers	**2011**	**2031**
From bus	8.3	17.8
From rail	0.3	1.0
From cars or new generated trips	2.3	6.7
Total Phase 1a tram patronage	**10.9**	**25.5**

Economic activity and locational impacts (EALI)

4.47 The key EALI impacts of introducing Phase 1 of the tram are projected to be:

- **Employment development**: In 2011, more than 22,500 m^2 of employment development is anticipated to be advanced as a result of Phase 1a of the tram. This rises to more than an additional 48,900 m^2 by 2015 and 52,800 m^2 by 2020, as the development pipeline catches up in the "without tram" scenario.
- **Residential development**: The construction and occupation of more than 900 additional residential units are anticipated to be advanced as a result of Phase 1 by 2011, rising to 5,250 by 2015 and 5,600 by 2020. The majority of these (4,500 by 2015 and 3,800 by 2020) would be in Granton and therefore, dependent to a great extent on Phase 1b. Post 2020, the development pipeline recovers in the "without tram" scenario, resulting in a net gain of 2,800 units with tram.
- **Employment generation**: More than 590 jobs, in present value terms, are expected to be generated or brought forward by the development impact of Phase 1a of the tram, after allowing for displacement of jobs elsewhere in Scotland.

4.48 It should be recognised that the full benefit arising from the EALI analysis is incumbent primarily upon the promulgation of the planned developments in North Edinburgh. The timing of these developments may be dependent on the implementation of Phases 1a and 1b of the tram up to the assumed development horizon of 2020.

4.49 It should also be noted that a substantial proportion of the capital investment will be spent in Scotland, encompassing utility works, land purchase, civil engineering works and professional services.

Benefits and costs to Government (TEE analysis)

4.50 As required by STAG, the economic welfare impacts of delivering Phase 1 and Phase 1a only of the tram were assessed as part of a Transport Economic Efficiency (TEE) assessment. The appraisal provides a review of what users are willing to pay in order to use the tram line; the financial impact on private sector transport providers; and impacts arising from land use or other impacts of the tram line.

4.51 Both Phase 1 and Phase 1a of the tram project were appraised against a 'reference case' as well as a conventional 'do minimum'. The 'reference case' sensibly reflects the traffic management and bus policies that would be necessary to cater for travel demand growth, should the tram scheme not be implemented. This includes, for example, the closing of Shandwick Place to through traffic (private cars), both with and without the tram, as well as priority signalling for buses at major junctions. The appraisal against the 'reference case' contained in the DFBC assumed that the Edinburgh Airport Rail Link (EARL) was developed as planned both with and without the tram, reflecting wider transport planning in Scotland. As part of that work, the scenario excluding EARL was also prepared as one of the sensitivity tests contained in the Risk and Revenue report which was submitted as Appendix III of the DFBC. The rationale for the reference case rather than a conventional do minimum is further explained at 4.56 below.

4.52 The benefits and costs of Phase 1a of tram, appraised against the 'reference case' and calculated over a 60-year period in accordance with STAG requirements, are summarised in Table 4.4.