SEStran

Edinburgh Orbital Bus Project

Final Report

September 2008

Halcrow Group Limited

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Contents Amendment Record

This report has been issued and amended as follows:

Issue	Revision	Description	Date	Signed
1	-	Draft STAG Part 1	23/05/08	PF
2	-	Draft STAG Part 1	05/08/08	PF
3	-	Final Report of Study	05/09/08	PF
3	1	Final Report of Study incorporating client comments	08/10/08	PF

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EXECUTIVE SUMMARY

Background

The employment area to the west of Edinburgh has been identified in the West Edinburgh Planning Framework as one of the most important opportunities in Scotland to attract internationally mobile headquarters development. A number of factors combine to give the area a competitive advantage over other UK and European investment locations including a strategic location within the Central Belt with major road links and firm proposals for the introduction of heavy and light rail networks; and proximity to major centres of population and within commuting distance of a large and talented workforce.

However a significant part of the population growth has occurred and is planned to occur to the south and east of the city in Midlothian and East Lothian. There are also key employment developments taking place in those areas, notably at the New Edinburgh Infirmary, Shawfair and The Bush, which create their own demands for commuting trips. It is unfortunate, but inevitable, that efforts to balance the numbers of jobs and homes in any one area may mitigate but will not eliminate the pattern of commuting across the city which is occurring and will increase.

The A720 Edinburgh bypass is the main artery linking these areas, and it is a road which is already under stress at peak periods. Additional demands for orbital travel can only add to the present problems, whilst additional cars accessing the employment areas will also add to local problems of road and parking capacity. The development strategies for the region all stress that it is essential that the growth in car trips is minimised and public transport alternatives are maximised.

At present the alternative public transport options are limited. There is a cross city rail service linking the few areas to the east which have railway stations to Edinburgh Park and South Gyle (and, in the future, a new station at Gogar). There are cross city bus services, though these are themselves caught up in city centre congestion and provide only a slow and lengthy link. The evidence is that, for those who do have a car available, the public transport options do not persuade them to leave the car at home, whilst many of those who do not have access to a car are not in a position to benefit from the new opportunities being created.

The South East Scotland Regional Transport Strategy (RTS) prepared by SEStran – the South East Scotland Regional Transport Partnership - identified these orbital links around Edinburgh as a key issue, and further identified a Bus Rapid Transit or Quality Bus Service as the most likely solution to the problem.

The Edinburgh Orbital Bus Project

SEStran commissioned Halcrow to undertake a STAG appraisal of the orbital corridor, to validate the assumptions of the RTS and to progress the development of orbital public transport around Edinburgh.

SEStran defined a broad study corridor that encompassed the development zone stretching from the Fife shore of the Forth Estuary at Inverkeithing through the West Edinburgh development zone, around the south side of the city to the New Edinburgh Infirmary and new Queen Margaret University Site at Musselburgh to the East Lothian Park & Ride Site at Wallyford. This corridor contained a substantial number of established and developing employment sites, as well as Edinburgh International Airport, University and major Hospital locations. It also intersects all of the main radial routes into the city by rail and road, generally at or near existing or planned Park and Ride facilities.

From the RTS, the study identified a range of economic, social and environmental issues relating to transport in the corridor. The study also reviewed the strategic objectives at national, regional and local level and identified common aims and policies. From these issues and from these strategies, specific objectives for the study corridor were defined and agreed with the client.

The Transport Model for Scotland was used as a basis for projecting future travel demand in the corridor. The model covered the study corridor and zones lying outside the corridor. All developments expected to come to completion by 2012 were included and the level of trips generated from both existing and proposed development was projected. This analysis showed a very considerable increase in the volume of movement in the corridor, but also demonstrated that, in the absence of new public transport services, this would be predominantly supplied by private car travel. The forecast increase in demand on the A720 Edinburgh by-pass would surpass free-flow capacity, and could be expected to result in extended periods of peak congestion through the day. Some traffic would spill onto neighbouring but less suitable roads.

High level demand analysis indicated that a high frequency direct public transport link, substantially free from the adverse effects of congestion, could potentially attract additional demand (above existing level of public transport patronage) of up to 6 million bus passenger journeys per annum around the corridor. Demand would be distributed around the greater part of the route, although appearing unevenly in the two directions of travel and over different sections of route. This level of demand would be consistent with high frequency bus operations, and such operations could, potentially, be financially viable at typical operating costs. This analysis therefore confirmed the expectations of the RTS that a bus-based orbital service was likely to meet the scheme objectives, and informed the development of options.

The nature of the Edinburgh Orbital Bus Project was therefore evolved through the parallel analysis of:

- the potential market and the travel patterns of future users;
- the alternative methods of operation and procurement;
- the alternative route and alignment options within the study corridor;
- the rolling stock and guidance technology options; and
- fares and ticketing issues.

These were developed jointly with the client, SEStran, through workshop sessions, and the outcome of those discussions fed back into the process of evaluating the options most appropriate to the Edinburgh Orbital Bus scheme against the scheme specific objectives.

Detailed appraisal of the corridor identified:

- The key traffic generators, and interchange opportunities along the corridor;
- The most significant locations of congestion and delay in the corridor;
- Opportunities to develop sections of route that could be segregated from congestion; and
- Physical and environmental constraints upon new infrastructure arising from existing development, and from sites of environmental quality.

A number of detailed routing options were developed, and grouped into high cost/high segregation and low cost/low segregation. A nil investment option using available roads was also included.

Coupled with the options for infrastructure, options for service patterns were developed, which were not necessarily confined to sections of new infrastructure but could extend to traffic generators outside the orbital corridor. Following the outcome of the high level demand assessment, all service options were based upon high frequency service. Recognising that service patterns, unlike infrastructure, can readily be altered and adapted, for the purpose of evaluation service options were limited to three route patterns against the three levels of infrastructure.

A STAG level 1 appraisal of the infrastructure options and operating patterns was carried out, evaluating the options against scheme objectives. The outcome provides strong support for the concept of a high-quality orbital bus route with a considerable degree of segregated operations and supporting bus priorities, serving the orbital corridor and areas beyond. Only by providing for substantial segregation can a service be operated that attracts a significant number of drivers from private cars and makes a substantial new market for public transport. The higher segregation options therefore deliver the greatest benefits of mode shift, but also entail the greatest environmental costs in terms of local impact on residential areas, protected environments and historic/cultural sites. Most of the adverse impacts can however be mitigated by careful design.

The capital costs of delivering the necessary degree of segregation ranged between nil for the option based only on using existing roads, £15 - £20 million for low degrees of segregation, and £54 - £60 million for high segregation. An appraisal of the financial effects of the options demonstrated that only a high frequency service operating with a high degree of segregation from traffic congestion could achieve operational viability. This is achieved by a combination of lower operating costs on congestion-free routes, and higher fares income from greater ridership. Extending routes beyond the orbital corridor to provide direct routes between residential areas and employment sites within the corridor added additional ridership and value.

Appraisal

The appraisal has identified that a Quality Orbital Bus service around the A720 corridor can deliver the strategic objectives of the Regional Transport Strategy. Furthermore, given sufficient segregation from road traffic congestion, high frequency services could be operationally self-funding.

The appraisal has shown that without investment in improved infrastructure, a viable service cannot be operated along the study corridor. It has also shown that, in order to have a significant impact on orbital travel opportunities and to effect significant mode switch, there needs to be a step-change in the quality of service offered. Over the core section between Gogar and Musselburgh the orbital service and its associated infrastructure does have the potential ability to make a considerable improvement to travel times for orbital trips, and thus to effect a real impact on mode choice.

However the road sections north of Newbridge (A8000) and also east of Musselburgh (A1) do not cause substantial delays to buses, whilst the current delays on the Forth Road Bridge cannot reasonably be avoided until the new Forth crossing is provided. The present services are both fast and frequent. In these circumstances new segregated infrastructure for orbital services adds little value to the present network and investment in additional infrastructure cannot be justified on the basis of benefits to orbital movement.

Whilst high user benefits seem likely from infrastructure improvements between Newbridge and Gogar, and also between Sheriffhall and The Infirmary, these benefits accrue principally to radial traffic and are not critical to establishing an effective orbital service.

The low segregation options have a limited contribution to make towards the strategic aims of the project, and especially in terms of altering mode share. However it is recognised that, in comparison to the high segregation options, they have a lower cost and a lower environmental impact and therefore cannot be discounted from further appraisal on these grounds alone.

However the nil investment and low segregation options do not generate enough revenue to cover their annual operating costs, and a high degree of segregation is therefore necessary to secure a viable and deliverable scheme.

Demand modelling suggests that a high proportion of trips will originate beyond the orbital corridor in East, West and Midlothian. These can be captured at key interchange points where the major radial routes intersect the orbital corridor, principally at the Newbridge/Ingliston (Park & Ride), the Airport (air), Gogar (Radial bus, rail and tram), Edinburgh Park (rail and tram), Hermiston (Park & Ride), Lothianburn (Park & Ride and bus), Straiton (Park & Ride and bus), Newcraighall ((Park & Ride and rail) and Musselburgh (rail and bus). The volume of demand from off the line of route strongly suggests that orbital services should not be confined to the orbital corridor, but should extend into the hinterland in East Lothian, to Dalkeith and Penicuik in Midlothian, into West Lothian and Fife. Where the level of demand will support such through routes, the delays, inconvenience and penalties of interchange can be avoided and the market size can be maximised.

Sensitivity tests exploring the impact of alternative land use development distribution suggests that the traffic forecasts are robust. These alternative land-use plans are considered by the planning authorities to be realistic and probable outcomes. Whilst they are currently insufficiently detailed to allow a firm forecast of revenue and demand, the implications are that this redistribution of residential development would increase the demand for high quality orbital services, enhance the strategic value of the project and improve its financial viability.

It is therefore the recommendation of this STAG Part 1 Study that the following options are taken forward for further detailed analysis and appraisal following the STAG Part 2 guidance:

- All high segregation infrastructure from Newbridge to Musselburgh with 12 buses per hour throughout. Estimated capital cost £54 million (2008 prices excluding optimism bias); estimated demand c.5.9 million passenger trips per annum.

- All high segregation from Newbridge to Musselburgh (but omitting Sheriffhall) with composite timetable of overlapping services from off-route origins/destinations. Estimated capital cost £44 million; estimated demand c.6.1 million passenger trips per annum.

The segregated infrastructure required will include sections of busway, bus-lanes alongside existing roads and some enhanced bus priorities on existing roads. There is, in part, an unavoidable intrusion into the greenbelt and agricultural land. The construction of new sections of road will therefore have some adverse environmental effects, but these can largely be mitigated by keeping the new busways close to existing road alignments and by careful design.

Conclusions

In developing detailed proposals for a STAG 2 appraisal the following criteria are key issues for consideration:

- Only a high degree of segregation of the bus service from congested road traffic conditions can deliver the quality of service that will persuade travellers to commit to the orbital service and effect real mode shift;

- Only a high degree of segregation of the bus service from congested road traffic conditions can reduce operating costs to the point where revenue can potentially cover all costs;

- The synergy of the whole route is of great significance and provision of individual links in isolation will not deliver strategic benefits or enable a viable orbital service to be operated. The provision of infrastructure that enables orbital services to travel swiftly from Gogar, Edinburgh Park, Lothianburn, Straiton, the New Edinburgh Infirmary and Queen Margaret University should be seen as the core 'Orbital Package';

- Even so, these links are not all of equal merit, and in particular a link eastwards from Hermiston towards Lothianburn has low contributory value and high environmental impacts between Hermiston and Torphin Bridge; an alternative way of linking the proposed bus facilities between Lothianburn and Torphin Bridge directly to Edinburgh Park without passing through Baberton merits further investigation;

- Radial improvements between Newbridge and Gogar, and also between Sheriffhall and the Infirmary, appear to offer considerable benefit, but these sections are not critical to delivering orbital services around the city and are of greater value to radial than to orbital services;

- The interchange points at the Newbridge/Ingliston, the Airport, Gogar, Edinburgh Park, Lothianburn, Straiton, Newcraighall and Musselburgh provide essential opportunities for interchange with radial routes and other modes, extending the benefits of the orbital service into surrounding areas;

- The volumes of through traffic suggest there is a strong case for through services from many areas outside the city and beyond the orbital corridor, including East Lothian, Dalkeith and Penicuik, West Lothian and Fife;

- This provision of through services needs to be facilitated by the provision of effective congestion-free links between the orbital bus infrastructure and existing road and bus networks; and

- The optimal spacing of stops along the orbital corridor requires more detailed assessment, but these must be limited in number and concentrated on the major points of boarding and alighting so that the overall quality and speed of the service is not compromised.

1 Introduction

1.1 Background

1.1.1 The South East Scotland Transport Partnership's Regional Transport Strategy (SEStran RTS) 2008-2023 identified a series of transport measures to be introduced across the South East of Scotland which will assist in achieving the Strategy's main objectives for the region. Two of the key issues identified were the need to provide enhanced transport links between the expanding employment areas west and south of Edinburgh to the areas with expanding population and, in doing so, to make these more accessible to those reliant on public transport and without adding to existing road traffic congestion. Consequently one of the measures identified as a priority was the Edinburgh Orbital Bus Project (EOBP): a high quality orbital bus route linking a number of key transport interchanges and areas of employment in the SEStran region.

1.1.2 Halcrow was appointed in September 2007 to undertake a feasibility study for the EOBP, identify and assess potential demand for travel along the corridor, undertake a STAG Part 1 appraisal and produce an outline business case for options to serve demand along the route.

1.1.3 Since the orbital bus concept proposed in the RTS was itself subject to a STAG analysis, primary consideration in this study has been given to Bus Rapid Transit options. For the sake of completeness the Pre-Appraisal process has been followed in outline, and details of other potential options considered during the preparation of the RTS are included here, along with reasons as to why they may have been sifted out of the process.

1.1.4 This report covers the identification of the strategic objectives of the project, the development of options for evaluation and STAG Part 1 appraisal. Chapter two sets out problems, issues, constraints and opportunities of the transport network in the study area. Chapter three details the setting of objectives, while chapter four sets out the option generation, sifting and development processes. Chapter five is the application of the Part 1 appraisal, summarised in Chapter six and leading to a series of recommended options to be taken forward to the Part 2 appraisal along with the initial financial assessments and outline business case. In Chapter 7 Halcrow provides a vision of how the scheme could develop further, based upon the preceeding analysis and appraisal, taking into account the initial feedback from SEStran.

1.2 Scottish Transport Appraisal Guidance

1.2.1 The Scottish Government's Purpose is 'to focus the Government and public services on creating a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth.

1.2.2 The Scottish Transport Appraisal Guidance (STAG) supports the Government's Purpose by allowing the contribution that can be made by potential transport interventions to be presented in a clear and consistent manner.

1.2.3 The STAG process ensures that planned transport schemes are objectively appraised, that they will contribute to the Government's Purpose and meet the transport planning needs of Scotland.

1.2.4 A number of key concepts underpin STAG, a number of these are detailed below:

- The process must be objective led rather than solution led;
- The transport planning objectives developed as part of the process must capture the essence of the evidence-based problem or opportunity to be addressed;
- It can be used in all transport planning contexts;
- It should be applied proportionately but comprehensively;
- It does not prioritise between options; rather it is an aid to decision makers to allow them to make informed judgements.

1.3 Geographic Context

1.3.1 Arising from the issues identified in the RTS, the brief requires this study to focus on a corridor to the south of Edinburgh, approximately following the route of the A720 City of Edinburgh Bypass, which contains substantial areas of planned employment growth. The corridor route runs from Wallyford Park and Ride (P&R) site in the east to Inverkeithing Station to the north of the Forth Road Bridge in Fife. A plan of the study corridor is shown below in Figure 1.1.

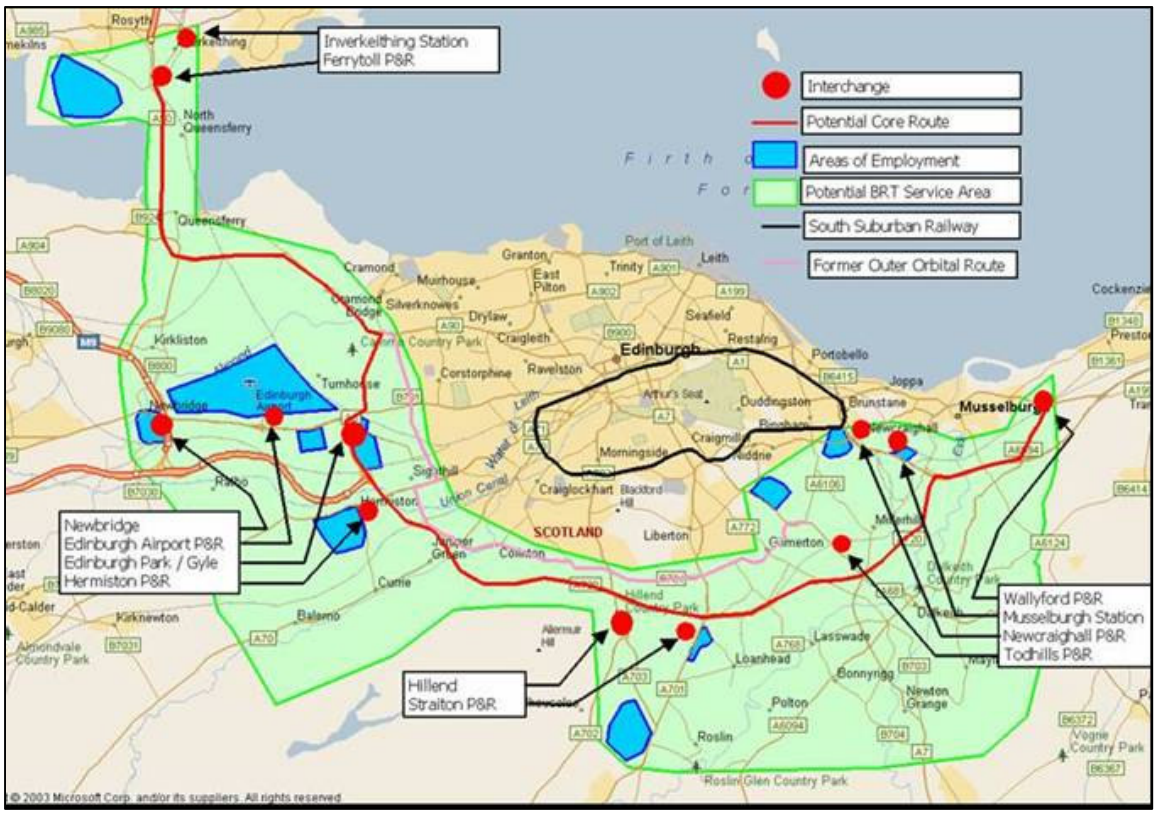


Figure 1-1 EOBP Study Corridor

1.4 Participation and Consultation

1.4.1 Participation and consultation are key elements of the STAG process in ensuring the interests of stakeholders are considered in an inclusive, open, transparent and appropriate manner.

1.4.2 The EOBP was first proposed through the SEStran Regional Transport Strategy. Effective stakeholder and public consultation was a core element in the development of the RTS. Tailored consultation mechanisms were used at each of the key RTS stages to ensure that the diverse views of consultees were considered and that there was widespread buy-in to the emerging strategy

1.4.3 The following key elements were involved in the RTS consultation:

- Awareness raising;
- Structured telephone interviews;
- Face to face interviews;
- Expert panel workshop;
- Strategic stakeholder workshop;
- Interest group meetings – objectives;
- Opportunities emerging from Consultation;

- Expert panel consultation workshop;
- Public consultation questionnaire; and
- Consultation on draft strategy.

1.4.4 All these different consultation stages fed into the development of the final strategy. At key stages, such as the strategic stakeholder workshop, these consultation streams were combined to maximise integration between the processes. All chapters of the RTS, issues and trends, objectives, policies, targets and measures, aim to reflect the outputs of this considerable volume of consultation.

1.4.5 Throughout the EOBP study there has been extensive involvement of key internal stakeholders from SEStran, City of Edinburgh Council, West Lothian Council, Midlothian Council, East Lothian Council and Fife Council. Representatives from each have contributed to all stages of the project so far, including identification of problems, issues and constraints, objective setting, option generation and sifting. Further external stakeholders will be involved in future stages of this project.

1.5 Planning Context

1.5.1 The study corridor passes through several local authority areas, namely The City of Edinburgh, East Lothian, Midlothian, West Lothian and Fife. The following section therefore provides a background to current planning policy nationally, regionally and for these particular local authority areas.

National Transport Strategy

1.5.2 Scotland's National Transport Strategy (NTS) was published in 2006 and maps out the long-term future for transport in Scotland for the first time.

1.5.3 Three key issues are identified within the NTS that aim to make a fundamental difference towards delivering a world class transport system:

- **Improve journey times and connections** between our cities and towns and our global markets to tackle congestion and provide access to key markets
- **Reduce emissions** to tackle climate change
- **Improve quality, accessibility and affordability** of transport, to give people the choice of public transport and real alternatives to the car.

1.5.4 Addressing these three key issues will contribute to the delivery of a number of other key priorities including health improvement, social inclusion and regeneration.

1.5.5 Scotland's NTS identifies that buses are the principal, most frequently used and most widely available mode of public transport currently providing for around 480 million passenger journeys a year. A priority of the NTS is to encourage the bus market to continue to improve services to attract passengers and, where required, improve journey times. Infrastructure improvements on local and trunk roads are highlighted as being key to making bus services more attractive and effective by improving bus journey times. Because of their modest capacity, flexibility and low infrastructure costs, buses are identified as being the most appropriate mode of public transport in many circumstances, and complementary to rail and light rail which are more suitable to high travel demand arising in a single corridor.

1.5.6 Scotland's NTS encourages Regional Transport Partnerships and Local Authorities to have explicit bus policies and targets which include key economic and social aims. The necessity of a step change is identified as being required in bus service provision and infrastructure if bus services are to meet the needs of current bus users as well as to encourage modal shift from the car.

1.5.7 As part of the development of the National Transport Strategy an overview of bus policy in Scotland was carried out. The Bus Action Plan highlights the fact that buses provide the sustainable mass public transport necessary to support economic growth and accessibility. The Bus Action Plan sets out 17 actions to achieve a step change in bus service provision and infrastructure with the outcome of a comprehensive bus network where sustainable bus services are delivered to a high quality and which the movement of people promotes economic growth and social inclusion, whilst reducing congestion.

SEStran Regional Transport Strategy

1.5.8 The Edinburgh Orbital Bus Project route is proposed to facilitate the distribution of trips around the periphery of the city by public transport, enhancing employment opportunities and expanding the labour market for those without private cars, avoiding cross-city trips across the central area and to the relief of road traffic congestion. The project aims to address a number of issues identified in the Regional Transport Strategy:

- Economy - to ensure transport facilitates economic growth, regional prosperity and vitality in a sustainable manner;

    1. To maintain and improve labour market accessibility to key business / employment locations, from all localities and communities.

    2. To support other strategies, particularly land-use planning, and economic development.

    3. To reduce the negative impacts of congestion, in particular to improve journey time reliability for passengers and freight.

- Accessibility - to improve accessibility for those with limited transport choice (including those with mobility difficulties) or no access to a car, particularly those who live in rural areas:

    1. To improve access to employment.
    2. To improve access to health facilities.
    3. To improve access to other services, such as retailing, leisure / social and education.
    4. To make public transport more affordable and socially inclusive.

- Environment - To ensure that development is achieved in an environmentally sustainable manner:

    1. To contribute to the achievement of the UK's national targets and obligations on greenhouse gas emissions.
    2. To minimise the negative impacts of transport on natural and cultural resources.
    3. To promote more sustainable travel.
    4. To reduce the need to travel.
    5. To increase transport choices, reducing dependency on the private car.

1.5.9 It is SEStran's policy to improve public transport services, particularly where public transport has a low share of travel demand, which signifies high environmental impacts from private car travel and poor accessibility for those dependent upon public transport options. Such a corridor has been identified around the edge of Edinburgh, accessed by the A720 Edinburgh bypass and a number of radial rail, bus and tram routes but lacking any orbital public transport services.

The City of Edinburgh Council

1.5.10 The City of Edinburgh Council Local Transport Strategy 2007 sets out the council's aims and objectives for transport and provides an overview of the council's strategy, setting the scene for managing and improving the city's transport up until the year 2012. An effective, integrated transport system is viewed as being essential to the continuing development of the economy of the whole Edinburgh region, the quality of life of its citizens and the experience of all who travel into and within the city.

1.5.11 The main elements of the strategy are identified as follows:

- To facilitate reliable and convenient access to the city and movement within it, with particular reference to the reduction of congestion
- To increase the proportion of journeys made on foot, by cycle, and by public transport

- To implement the tram project
- To reduce the need to travel, especially by car
- To reduce the adverse impacts of travel and transport infrastructure
- To recognise the many roles that streets have for the community
- To improve the ability of people with low incomes and of people with mobility impairments to use the transport system
- To ensure that the road, footway, and cycle networks are of a standard suitable for safe and comfortable movement.

1.5.12 The LTS highlights the fact that public transport plays an essential role in the lives of a large proportion of Edinburgh's residents, workers, and visitors. Buses are identified as the mainstay of the public transport system within the urban area, and Lothian Buses is recorded to have experienced 3.7% passenger growth each year since 1998. The LTS seeks to ensure that the bus network in Edinburgh is reliable, convenient, and economical.

1.5.13 Edinburgh City Council Local Transport Strategy also places an emphasis upon the interrelationships between transport and development. Development should be designed to fit the aims of the transport strategy and should give priority to sustainable transport and minimising dependence in the use of the private car.

East Lothian Council

1.5.14 Published in 2001, East Lothian Council's Local Transport Strategy sets out East Lothian's transport and travel vision covering the period to the year 2020. The prime objective of the strategy is to reduce dependence on the private car and to encourage the use of more sustainable modes of transport.

1.5.15 High levels of commuting presents a challenge to the region and it is viewed as imperative that current patterns of predominantly car-based commuting are encouraged to shift towards more sustainable modes, including public transport, cycling, and car sharing. In order to achieve this objective by the target year of 2020, East Lothian Council aims to implement a range of measures including the improvement of bus services.

1.5.16 Within the list of appraised schemes acknowledged within the East Lothian Council LTS is the Orbital express bus/mini bus corridor linking the major edge of towns. It is recognised that this scheme, alongside others, will provide benefits to East Lothian residents.

Midlothian Council

1.5.17 Published in 2007, Midlothian Council Local Transport Strategy sets out the framework by which Midlothian Council will direct future investment in order to meet its objectives, and maintain and improve transport provision in the area. One of the key issues emerging from the consultation process was congestion on routes between Midlothian and the City of Edinburgh. Parts of Edinburgh, such as the west of the city, are less accessible by public transport from Midlothian, and links across Midlothian are poor. These issues are reflected in the high proportion of people commuting by car in Midlothian.

1.5.18 Midlothian's transport objectives correspond with a set of broader planning objectives and national priorities for transport as laid out in the National Transport Strategy. Midlothian's transport objectives are:

- To widen travel choices and make travel by more sustainable modes of transport more attractive than the private car, particularly at peak times
- To protect the health of the population
- To reduce, and where possible mitigate the effects of the transport system on the built and natural environment
- To reduce the number of casualties involving death and serious injury and ensure that the design of the transport system improves personal safety and minimises crime
- To stabilise traffic growth in line with national targets and secure more reliable journey times by all modes
- To ensure that transport networks are managed, maintained and improved so as to provide the quality of infrastructure that will meet the needs of all users
- To improve integration between all modes of transport
- To ensure connections between areas within Midlothian and provide improved links to the rest of Scotland and beyond
- To reduce social exclusion by improving accessibility to jobs, education and services for all and by all modes of transport.

1.5.19 Midlothian Council LTS recognises that a number of frequent and high quality bus services run between the main towns in Midlothian and Edinburgh. A number of services also run from the Borders to Edinburgh, through Midlothian. Cross authority, Community Transport, and Demand Responsive services are also in operation within Midlothian.

1.5.20 The LTS highlights the fact that buses offer the biggest opportunity to make alternatives to the private car more attractive. Potential opportunities for improvements exist through providing increased coverage of the bus network, improvements to hours of operation and service frequencies, and increased integration of the bus network with other public transport services.

1.5.21 Since the 2001-2004 LTS, the council and its partners claim to have made significant progress. The council promises to pursue the following interventions relating to public transport:

- Expand the coverage of the public transport network
- Introduce bus priority measures at key junctions to improve public transport journey times and reliability
- Continue to phase in DDA compliant bus stops, constructed with raised kerbs
- Continue to work closely with public transport operators to represent the interests of Midlothian residents
- Promote the development of Park and Ride sites
- Review the council's existing programme of public transport subsidy
- Ensure that all new rail stations are planned and designed so that they provide easy interchange between bus services, cycling and walking
- Tackle crime and the fear of crime over the whole public transport journey, for both passengers and staff
- Continue to support the national concessionary fares scheme
- Continue to promote the use of public transport services as a viable alternative to the private car.

West Lothian Council

1.5.22 The Local Transport Strategy for West Lothian was published by West Lothian Council in October 2000 to cover the following 10 years. The strategy outlines the council's policies, objectives and strategies and highlights links between the LTS and national policies. The West Lothian LTS also provides a basis for future strategy and policy development.

1.5.23 The vision of the council, as spelled out in the Local Transport Strategy, is to provide all citizens of West Lothian with a genuine choice of transport which fulfils their needs and provides opportunities for work and leisure on a sustainable basis. The objectives of the LTS reflect those identified within the West Lothian Local Plan. Associated with these objectives are more specific policies, objectives and strategies developed by the council:

- Maximise accessibility for all and minimise the need for travel, especially by car
- Ensure adequate means of access, including by public transport, to existing and proposed strategic employment locations, major public attractions and key development sites
- Enhance the convenience and attractiveness of non-private car travel, whether by public transport, cycling, or on foot.
- Improve road and pedestrian safety
- Reduce the adverse effects of traffic in residential areas, in town and village main streets and in the countryside
- Sustain the viability of commercial centres

- Contribute to meeting national and local road traffic reduction and environmental targets.

1.5.24 West Lothian has experienced a significant population increase from 1995 to the date of publication of the LTS. In a five year period between 1990 and 1995, traffic levels on major routes in West Lothian are said to have increased by between 8% and 28%.

1.5.25 High commuter levels, increasing road safety concerns, and high traffic flows are amongst the key problems identified within the Local Transport Strategy for West Lothian, alongside a high proportion of trips being made by car. Indeed even with increasing car ownership in West Lothian, there are still a considerable number of people who are reliant on other modes of transport. Low car ownership is recognised as being one of the factors that can lead to social exclusion, and bus services are identified as a vital link.

1.5.26 West Lothian Council recognises the importance of promoting sustainable transport by reducing the need to travel by car, with walking and cycling used for short journeys, and bus and rail used for longer journeys. The role of public transport is also considered important in that it gives residents the opportunity to travel. Good bus services are viewed as vital in tackling social exclusion, particularly in the west of the district.

Fife Council

1.5.27 Fife Local Transport Strategy 2006 sets the 5 year short term programme, 10 year medium plan and longer term 20 year vision and objectives for transport delivery. The core issues and structure of the strategy are identified within the LTS as being:

- The transport issues for Fife, both now and in the future
- The vision for transport in Fife
- The practical objectives to improve transport provision
- The relevant priorities, policies and projects for future transport provision

1.5.28 A range of targets and indicators are also outlined to monitor the delivery of the strategy. The LTS is developed within the context of other policy documents such as Fife Council's Community Plan, Development Plan and Environmental Strategy.

1.5.29 Issues identified within Fife Council boundaries include the correlation between the elderly population and reduced mobility and inability to access much of the transport networks, and access to health care services.

1.5.30 A pertinent transport issue in Fife is Cross Forth Travel. The growth in passengers and traffic on the Forth Bridge and Forth Road Bridge are said to confirm the demand for travel across the Forth, which has been increasing at twice the national average rate. Beyond Fife it is hoped that a number of schemes will help to improve capacity across the Forth, including the Edinburgh Airport Rail Link, improvements to Waverley Station and major road improvements between the Forth Road Bridge and the M9/M8 motorways.

1.5.31 Fife Council's LTS indicates that in Scotland over the past 40 years, use of the private car has grown extensively, while travel by foot and bus appears to have reduced. In Fife, 30% of households do not have access to a car and are reliant on a quality public transport service to access everyday needs and services. A range of schemes are planned to improve infrastructure and services and to help promote access to the bus network. These include significant upgrades to major bus stations and provision of quality bus corridors. Improvements are also planned for overall quality, safety and security, comfort and appropriate travel information.

West Edinburgh Planning Framework

1.5.32 'A Partnership for a Better Scotland' (Scottish Executive May 2003) confirms that growing the economy is the Executive's top priority. The National Planning Framework for Scotland (April 2004) refers to the West Edinburgh Planning Framework as a mechanism to ensure a co-ordinated approach to land use and transport issues in one of the fastest growing parts of the country. This is an area incorporating the international airport, the Royal Highland Showground, the Heriot Watt University campus and the Gogarburn and Edinburgh Park business centres, together with existing development areas east and west of the airport. The West Edinburgh Planning Framework highlights the unique opportunity which West Edinburgh offers as an international business location. The global connectivity afforded by West Edinburgh, together with the economic benefits conferred by corporate headquarters, provide one of the most important opportunities in Scotland to attract internationally mobile headquarters development. A number of factors combine to give the area a competitive advantage over other UK and European investment locations including a strategic location within the Central Belt with major road links and firm proposals for the introduction of heavy and light rail networks; and proximity to major centres of population and within commuting distance of a large and talented workforce.

1.5.33 The framework addresses issues of congestion, the integration of land use and transport and the provision of modern transport infrastructure at this strategic location. The proposals arising from this vision include:

- The implementation of committed development, the rounding off and more intensive development of "Core Development Areas" previously identified in the Edinburgh and Lothians Structure Plan 2015 and the integration of development with a greatly improved public transport network;

- The introduction of tram links into and through the area for rapid transit within and between Leith, the City Centre and West Edinburgh, and for local distribution;
- The introduction of rail links to Edinburgh Airport to improve accessibility and reduce journey times from other parts of Scotland and the UK;
- The integration of transport modes within West Edinburgh by means of the construction of a high quality transport interchange at Edinburgh Airport as well as commuter park and ride facilities served by bus, tram and rail, building on wider efforts to promote sustainable transport, manage traffic congestion and help meet wider environmental and social inclusion objectives;
- The taking forward of public transport investment, the management of road traffic and parking, and planned new road links in an integrated and managed process, the primary aim being no net detrimental impact to the free flow of traffic on the motorway and trunk road network.

2 Analysis of Problems and Opportunities

2.1 Introduction

2.1.1 The identification of problems and opportunities within the transport and land-use system forms the starting point of a STAG based study.

2.1.2 A workshop was held with key stakeholders from SEStran and the relevant local authorities in December 2007 to reach a consensus on the key problems and opportunities within the study area.

2.2 Problems and Opportunities Identified

2.2.1 The starting point for consideration of the problems and opportunites was the Regional Transport Strategy and other current planning reports. At the workshop a number of problems and opportunities specifically relevant to the outer Edinburgh orbital corridor were identified and discussed, and the following list of problems and opportunities were identified:

- Development planned/potential in corridor will:
  - Increase demand for travel;
  - Exacerbate existing congestion on the A720;
  - Generate further delay in journey times and their predictability.
- Transport/Land-use integration – opportunity for providing more effective relationship between public transport and land-use development.
- Transport integration – opportunity for increased interchange in corridor – enhancing existing and providing new interchanges (including improved security).
- Low level of existing orbital public transport service.
- Poor public transport alternatives – for some journeys that can be made by car these are either non-existent or so unattractive as to make it seem so.
- Opportunity of New Forth Crossing.
- Capturing suburban market within City of Edinburgh north of A720.
- Public transport congestion in City Centre, and the indirect routes of many cross-city services, making cross-city trips unattractive.

2.2.2 The above noted problems and opportunities reflect a summary of the main discussion held at the workshop and were used as the basis for the Objective Setting session.

2.3 Validation of Problems and Opportunities

2.3.1 For each of the problems and opportunities identified above, further work has been carried out since the workshop to determine the impact of each. Much of this work has been based around a model built using the Transport Model for Scotland (TMfS).

2.3.2 During the course of discussions between Halcrow, SEStran, Transport Scotland and MVA, it was agreed to use TMfS as the basis of the modelling approach for the Edinburgh Orbital Bus Project, subject to relevant sensitivity tests. TMfS is a strategic modelling tool developed by MVA for Transport Scotland and has been used to assess a range of major transport projects. The model has three main components: the land-use model; the demand model; and the assignment model. For this project, the model simulation was based on the standard run of the land use and assignment components. Demand flows were provided by the Highways and Public Transport Assignments and a Park & Ride module, which facilitates modelling the transfer of travellers between car, public transport modes and Park & Ride and allows for the testing of new orbital bus links.

2.3.3 The assessment is based upon forecasts for a single year - year of opening – which has been assumed to be 2012.

2.3.4 The TMfS is designed to reflect the impacts of the planning assumptions provided by the local authorities by taking them into the land use model and generating future year trip matrices. The forecast impact and the transport infrastructure changes, including Edinburgh Tram, are utilised by the land use model to assist in the determination of the distribution of trips.

2.3.5 This model zoning system in the study corridor is not sufficiently disaggregated to directly simulate all the issues raised as part of the scheme proposals. However the model has been adjusted to provide forecasts which will address the majority of the issues pivotal to the forecasting of patronage on the project and allow an appraisal of the project at a strategic level.

2.3.6 The following sections detail the results of our analysis for each of the identified problems and opportunities.

Planned/Potential Developments

2.3.7 At the workshop it was agreed that both planned and potential development in the study corridor will increase demand for travel; exacerbate existing congestion on the A720; and generate further delay in journey times and their predictability, all of which affect mode and route choice.

2.3.8 Following the workshop, the TMfS model has been built taking into consideration all planned development and associated future congestion expected along the study corridor. Therefore all assumptions made regarding demand and patronage are inclusive of these developments.

2.3.9 A presentation was provided detailing the results of the assessment of the current and proposed land-uses within and adjacent to the study area. This data has been gathered from reviews of the relevant Local Plans and the West Edinburgh Planning Framework. The full current and future land-use assessment report can be found in the separate technical note 'Current and Future Land-Use' prepared by Halcrow (January 2008).

2.3.10 To summarise the findings of the note, the current and future land use assessment has identified key development locations within the study corridor that would benefit from inclusion in routing options while highlighting areas that are sensitive to development and which should be avoided. With regards to the latter, the inclusion of areas of high environmental status such as SSSIs, Natura 2000, AGLV/AOLQ and other conservation classifications may attract opposition from planning authorities and possibly public support groups. To ensure efficient implementation of the EOPB these areas should be excluded from potential options where possible, or mitigation measures should be considered.

2.3.11 The study corridor includes a number of key existing and future development locations for housing and employment which could provide a passenger base to support new services. Figure 2.1 shows the location of development sites in the study corridor.

2.3.12 Table 2.1 lists the TMfS zones actually spanning the orbital bus corridor, and shows the change in the number of trips they are expected to generate over the period 2005 to 2012 as projected by the TMfS trip generation model.

2.3.13 The model also includes trips generated outside the study corridor arising from existing development and from projected changes in employment and housing. These development assumptions have been subject to a separate sensitivity analysis reported in section 2.3.40.

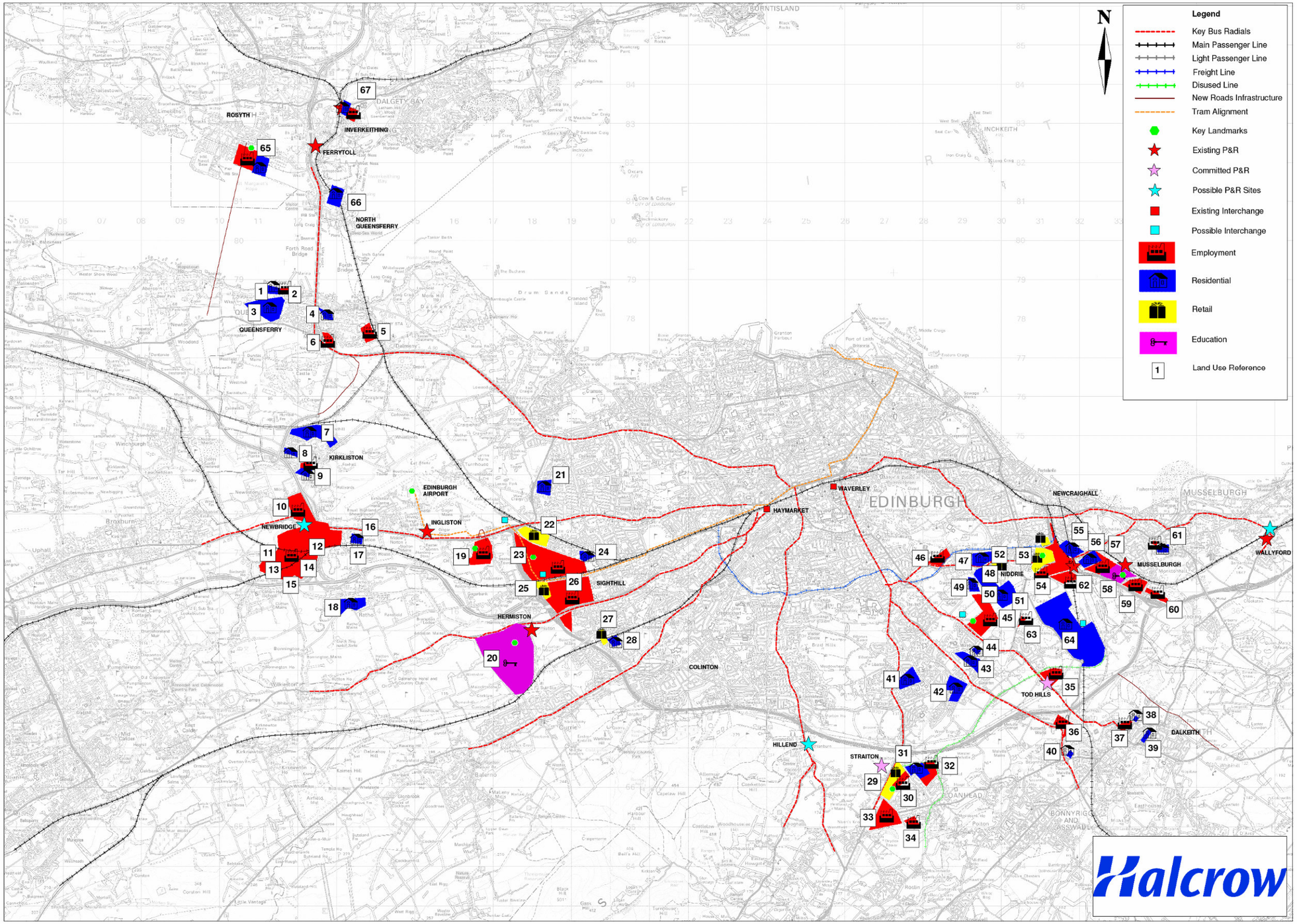


Figure 2-1 Land Use along Study Corridor

Change in Trips per Day from 2005 to 2012 (selected zones)					
Zone	**Housing**	**Car Trips from Zone**	**Car Trips to Zone**	**PT Trips from Zone**	**PT Trips to Zone**
194 *	Shawfair / Danderhall (Millerhill)	5176	5417	1123	1231
200	Shawfair / Danderhall (Danderhall)	815	730	634	573
180	North Kirkliston (Kirkliston)	495	386	-34	-38
59	Newcraighall (Brunstane)	254	231	41	40
62	Niddrie	1417	1719	170	323
63	Hyvots (Gilmerton)	775	1012	6	43
64	Hyvots (Gilmerton Dykes)	107	102	-36	-40
73	Greendykes (Greendykes)	2309	2710	273	375
350	Inverkeithing	616	623	326	278
Zone	**Employment**	**Car Trips from Zone**	**Car Trips to Zone**	**PT Trips from Zone**	**PT Trips to Zone**
194 *	Shawfair (Millerhill)	5176	5417	1123	1231
171	South Queensferry (Queensferry)	115	61	36	-42
173	South Queensferry (Dalmeny)	482	417	157	151
164	Newbridge	1561	2155	305	314
179	Newbridge	26	28	1	0
188	Craighall (Whitecraig)	351	379	-1	-11
72	Little France (Edmondstone)	3178	3017	325	440
102	Edinburgh Park	5685	5571	2190	1924
305	South Rosyth (Rosyth)	375	394	57	76
Additional Trips on Network		23737	24953	5572	5637

[Note: For Zone 194 separate data was unavailable for housing and employment; therefore combined figures have been used, but only counted once in the additional trips total.]

Source: TMfS

Table 2.1 – Key Development Locations within Study Corridor and Expected Trips

Transport / Land-Use Integration

2.3.14 The opportunity for providing better integration between public transport and land-use developments was identified at the workshop.

2.3.15 Major development sites have been identified along the study corridor and options have been developed in order to serve the larger potential trip generators.

2.3.16 In terms of creating access to development by public transport, the options have been developed to maximise the penetration of the main trip generation areas. The TMfS model, with the use of the Park & Ride sub-model and simulated 'walk-in' catchment areas for each route, is designed to represent the interchange between land-use and public transport, and to reflect the travel options available to travellers at each location.

Transport Integration

2.3.17 In the nature of an orbital corridor, it is intersected at many points by the main radial routes into the city. It was agreed at the workshop that there is an opportunity for increasing the number of interchanges in the study corridor through both enhancing existing interchange (including improved security) and providing new interchanges.

2.3.18 Interchange points have been identified and options which maximise interchange opportunities have been developed. The scope for through services in place of interchange has also been considered. With regard to improved security, this study is at a strategic level and therefore it is not appropriate to consider specific details of layout or security measures that might be deployed at this stage.

2.3.19 As was detailed above, interchanges have been modelled in TMfS to allow for the highest level of integration between modes of transport.

Low Level of Existing Orbital Public Transport Service / Poor Public Transport Alternatives

2.3.20 The workshop group noted the absence of any current orbital public transport service and that, for some car trips, public transport alternatives are either non-existent or so unattractive as to make it seem so. A review of existing public transport services was conducted and it was confirmed that there are currently no orbital services covering the whole study corridor. There are a small number of services available with segments of the corridor, some very effectively meeting specific traffic flows, but in regard to the objectives of facilitating public transport connectivity for orbital trips, these are attractive options only for small sectors of the overall orbital travel demand. These services are shown in Table 2.2.

Lothian Buses	From	To	Via
18	Gyle Centre	New Royal Infirmary	Wester Hailes, Colinton, Fairmilehead, Kaimes
21	New Royal Infirmary	Gyle Centre	Cameron Toll, Portobello, City Centre, Corstorphine
11	Ocean Terminal	Hyvot's Bank	City Centre, Fairmilehead
33	Wester Hailes	Hyvot's Bank	City Centre, Cameron Toll, New Royal Infirmary
7	Newhaven	Ferniehill	City Centre, Kaimes
Prentice	**From**	**To**	**Via**
Healthlink 400	St John's Hospital, Livingston	New Royal Infirmary	Livingston, Hermiston Park and Ride, City Bypass
Stagecoach	**From**	**To**	**Via**
747	Inverkeithing Station	Heriot-Watt University, Riccarton Campus	Ferrytoll, RBS HQ, The Gyle, Edinburgh Park and Edinburgh Airport

Table 2.2 – Existing Orbital Bus Services

2.3.21 It is clear from the table above that these bus routes are not true orbital services in that they only travel short segments of the orbital corridor and the majority still travel via the city centre. These services, in parts, run between the east and the west of Edinburgh through the study corridor, thereby providing a segmented service. A small number of these services are through routes, notably the direct rail link between Newcraighall and Edinburgh Park which is a continuous service across the city centre, but the majority require interchange between routes.

2.3.22 The low level of existing orbital public transport links can clearly be seen in the reference case Public Transport Assignment model shown in Fig. 2.2.

2.3.23 Figures 2.2 and 2.3 illustrate the expected transport situation along the study corridor in terms of public transport flows and highway flows in the absence of any new orbital public transport option. Both of these assignment plots represent the reference land-use case, including committed development and infrastructure to 2012. They show all forecast trips with one or both ends within the study corridor.

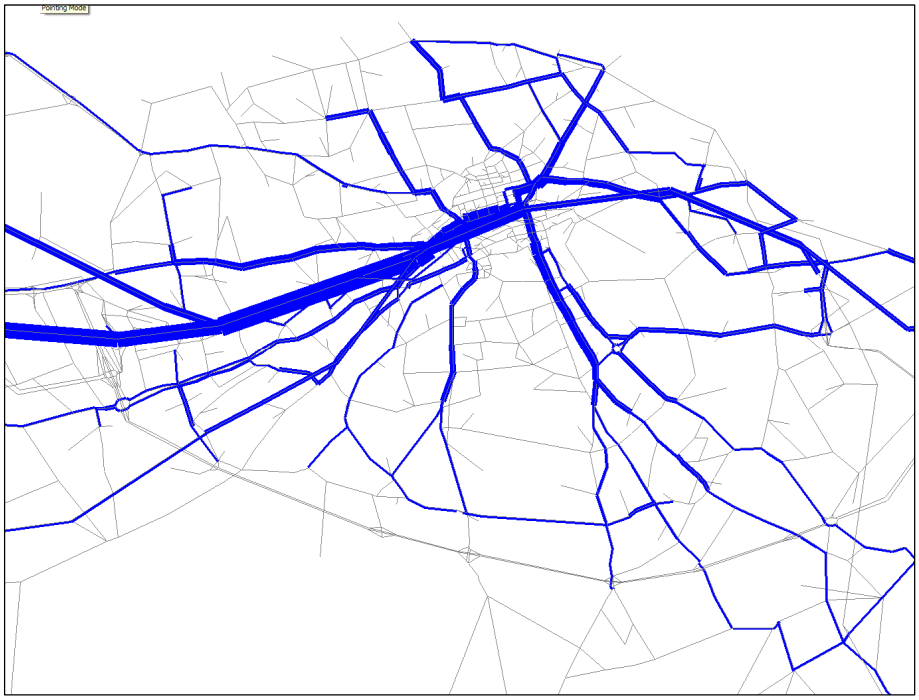


Figure 2-2 Public Transport Assignment flows from 2012 AM

In Fig. 2.2, the public transport flows are shown as bandwidths at a scale 10 times higher than those for the Highway flows bandwidths in Figure 2.3.

Figure 2-3 Highway Assignment flows from 2012 AM peak Reference Case

2.3.24 It can be clearly seen in these figures that there would be substantial volumes of road traffic moving between the east and the west of the city and yet that there are comparatively few public transport trips taking place for these journeys. These are concentrated largely on a single bus/rail/tram radial corridor across the city centre.

Public transport congestion in City Centre making cross-city trips unattractive

2.3.25 The modelling includes all existing alternative routes across the city by all modes, whether by orbital or cross-city routes. Therefore the TMfS expectations and outputs reflect these public transport congestion issues.

Opportunity of New Forth Crossing

2.3.26 Consideration was given as to whether the new Forth Crossing might present alternative or additional options to this study. The proposed new crossing is located some distance west of the existing bridge and will add additional mileage to any route. The effect of the new crossing is expected to be the relief of congestion affecting the existing bridge, whether or not the capacity of the bridge is prioritised for public transport or HOV use.

2.3.27 The demand analysis modelling has shown that time savings would be critical to attracting a market. Consequently, the additional distance, running time and operating costs involved in utilising the new crossing were considered to make any such options unattractive compared with using the existing bridge. The relief of congestion on the existing bridge can be expected to benefit all public transport using the bridge, whether making radial or orbital journeys, and this does not constitute a specific option for enhanced orbital provision. Options involving the Forth crossing have not therefore been further developed.

Demand Analysis

2.3.28 An analysis has been conducted using the TMfS model to determine the potential demand for travel along the study corridor in 2012.

2.3.29 Table 2 shows the modelled flows (12 hour weekday car passenger unit flows) for the current (2005) and expected (2012) road traffic along the study corridor. It is clear to see that a substantial increase in traffic flows is to be expected from 2005 to the 2012 levels and that the current network, in the absence of transport improvements or investment, will be under further stress over and above current levels of daily congestion.

Between		2005 Flows	2012 Flows	% Increase
A1 (Old Craighall)	A68 (New Bypass)	33400	43100	29%
A68 (New Bypass)	Sheriffhall		37500	12%
Sheriffhall	A772	36700	41900	14%
A772	Lasswade Road	46000	53400	16%
Lasswade Road	A701 (Straiton)	53300	62400	17%
A701 (Straiton)	A702	60800	74400	22%
A702	Dreghorn	68900	84500	23%
Dreghorn	A70	72000	88000	22%
A70	A71 (Hermiston)	66300	81700	23%
A71 (Hermiston)	M8	55300	71700	30%
M8	A8 (Gogar)	42600	54200	27%

Table 2.3 - 2005 and 2012 Traffic Flows (12 hour weekday Car Passenger Unit Flows)

2.3.30 At the present volumes of demand the A720 exceeds the free-flow capacity during peak periods, with the result that excess demand causes congestion and lower traffic speeds. The capacity of the links on the A720 under freely flowing traffic conditions is theoretically 2,100 vehicles per hour in each direction[1] (approximately equivalent to 34,000 passenger car units per 24 hours, depending on the duration of the peak). It may be noted that, on this assessment, all-day free flow conditions are not currently achieved on any part of the bypass.

[1] The NESA Manual; July 2005 Figure 7/9/2

2.3.31 Beyond this level of demand, capacity continues to increase notwithstanding falling speeds. The maximum throughput of vehicles is estimated to occur when traffic speed falls to approximately 45kph (25mph) when the theoretical capacity reaches 5,200 vehicles per hour in each direction (approximately equivalent to 83,000 passenger car units per 24 hours). This level of demand is not yet evident, but by 2012 is expected to be exceeded over the busiest links. At yet higher levels of demand, the speeds will progressively fall, the throughput of vehicles drops and the demand will not be met.

2.3.32 TMfS incorporates a projection of speed and capacity as an outcome of demand, and where alternative routes become quicker as a consequence of falling link performance, a portion of the traffic will be reassigned to such alternatives. The model therefore seeks to represent the real-life choices that regular motorists will make when faced with recurring delays on congested links in the network.

2.3.33 The initial modelling was used to establish a range of public transport demand forecasts based on an idealised level of direct connectivity from each of 14 nodes around Edinburgh to every other node. For this purpose a notional network comprising direct bus links at a frequency of 12 buses per hour and travelling at an average operating speed of 60kph was assumed, without reference to actual operating speeds on the road network This established a high level estimate of unconstrained demand for a potential highly segregated orbital transport system.

2.3.34 These 14 nodes, nominally at the key interchange points along the orbital corridor, represented simultaneously the potential access points for local origins and destinations, for those interchanging from radial bus services and other modes, and Park and Ride opportunities for those transferring from car. Further information on the modelling methodology is provided in a separate report 'Outcome of Modelling Options' (Halcrow, April 2008).

2.3.35 Figures 2-4 and 2-5 graphically illustrate the projected pattern of trips in the two directions. Flows are shown schematically as a single continuous service (passengers per peak hour). These figures represent the additional public transport trips over and above the existing demand that would be attracted to use the idealised BRT service if the notional service levels could be delivered. The total maximum travel volume on the 2012 idealised service trip matrix (taking account of all planned/potential developments) is 2,075 in the AM peak hour, 1,016 westbound and 1,059 eastbound. Although these volumes are very close, the figures show a very different pattern of usage. The evening peak flows, not illustrated, broadly mirror the morning in reverse.

2.3.36 Since these projections show net additional demand for public transport, the actual usage of the service could be greater than indicated, with some travel also being abstracted from other existing services. This is however a very small proportion of the projected totals since very little cross city bus travel is currently taking place.

Figure 2-4 2012 East-to-West Morning Peak 60Kph Service Flows (Passengers)

Figure 2-5 2012 West-to-East Morning Peak 60Kph Service Flows (Passengers)

2.3.37 The westbound flow was analysed and it was found that there is intensive use between Musselburgh and Ingliston, but only very modest increase in demand at the extremities of the study corridor (across the Forth and Wallyford). The most heavily used section is the short distance from Hermiston to Edinburgh Park. There is a cumulative build up of demand on the westward flow with significant numbers of trips joining at Sheriffhall, Straiton and Lothianburn. This implies trips joining at the interchange points (which have very limited local catchments) which originate from Penicuik and from Dalkeith, either by Park and Ride or by radial-orbital bus interchange. Through services from Penicuik and Dalkeith going westward on EOB should therefore be considered. There is a subsidiary local bulge in demand to Edinburgh Royal Infirmary from Wallyford, Musselburgh and Newcraighall. This could be readily served by supplementary services from Wallyford (and possibly East Lothian) using EOB route to Edinburgh Royal Infirmary (and then possibly continuing to the City centre). This may indeed be a future feature of bus network development without EOB if the proposed bus-link between Craigmillar and Edinburgh Royal Infirmary is put in place.

2.3.38 The eastbound flow assessment has shown a very different projected travel pattern, with very high volumes locally at the two ends which are as intensive as the westbound flows, but very low flows across the central segment of the EOB route linking the west and east ends of the city. This is to be expected from the predominance of residential development to the east and employment to the west. There are marginally more projected trips in total but a much shorter average trip length. The heaviest flow between Sheriffhall and Edinburgh Royal Infirmary is actually radial and would be as well served by buses from Midlothian and the Sheriffhall Park and Ride site to the city centre as by EOB services. These could be complemented by through routes from Penicuik and Dalkeith to Edinburgh Royal Infirmary and Musselburgh. Similarly, the high projected flow from Newbridge to Ingliston and Gogar can be served by radial services from West Lothian to the city centre. These could be complemented by through services from West Lothian to Edinburgh Park and Hermiston. This leaves only a relatively low level of demand for a through service along the whole EOB route.

2.3.39 It can be seen from the discussion and analysis above that the planned and potential developments produce significant levels of additional demand along the study corridor. At present, the corridor is poorly served by public transport with no services covering the whole route in either direction. From this it can therefore be concluded that these additional developments *will* increase the demand for travel, exacerbate existing levels of congestion and generate further delay in journey times and their predictability if measures are not taken to minimise the number of these additional trips which are accommodated by the road network.

Sensitivity to Land-Use Assumptions

2.3.40 During the development of the baseline land-use planning assumptions concerns were raised outwith this study that the distribution of development represented in TMfS did not correspond with the most up-to-date assumptions of the separate local plans for the area. Work was in progress, but incomplete, to develop a revised land-use base for TMfS as part of the review of the Structure Plan.

2.3.41 The general effect of the changes being made was to reduce the scale of residential development and the number of trips expected to be generated within the City of Edinburgh, and to increase the scale of residential development in the surrounding local council areas, within a constant regional total. Although the major effect might thus be expected to be reflected in higher radial demand for commuting into the city from peripheral areas, it was recognised that this revision could also have implications for the level of demand projected along the orbital corridor to the many workplaces it includes.

2.3.42 At a late stage in the study, alternative trip end forecasts became available from the on-going work on the Structure Plan, although these lacked the spatial detail of the full TMfS. (A full report of the outcome of these tests is contained in the Technical Note "Patronage Sensitivity Testing"). From this data it was possible to calculate the proportional change to the number of trips originating in each Council area, and to apply these scale factors to the demand forecasts used in this study. The proportional changes in trips are shown in Table 2.4.

2.3.43 These changes in overall trips were then factored into two representative options for the EOB, to determine the overall scale of the change in demand for the orbital service arising from the alternative distribution of development, namely Option 2 with high segregation and Option 3 with low segregation (see section 5 for further details of the Options tested). These sensitivity tests suggested that, with a low degree of segregation, demand might be 24% higher than the basic demand modelling has predicted, and with a high degree of segregation demand could be 33% higher.

Percent change – alternative development scenario compared with base model.				
	Person-trips by car		All person trips	
Area	Origins	Destinations	Origins	Destinations
AM Peak				
Edinburgh	81%	89%	85%	95%
East Lothian	127%	117%	123%	118%
Midlothian	192%	150%	179%	153%
east part of West Lothian	163%	142%	156%	138%
west part of West Lothian	172%	251%	175%	258%
Inter-Peak				
Edinburgh	82%	83%	88%	88%
East Lothian	111%	117%	113%	118%
Midlothian	144%	140%	155%	146%
east part of West Lothian	163%	130%	161%	131%
west part of West Lothian	184%	195%	187%	194%
PM Peak				
Edinburgh	88%	84%	93%	88%
East Lothian	111%	112%	113%	113%
Midlothian	149%	132%	150%	130%
east part of West Lothian	119%	113%	117%	115%
west part of West Lothian	164%	120%	170%	121%

Table 2.4: Proportional change in numbers of trips arising from alternative development distribution assumptions.

2.3.44 Because of the lack of spatial detail in the revised TMfS model used for these sensitivity tests, these forecasts must be treated with extreme caution. There is potentially a huge difference between the impact of the redistribution if the development sites are located in proximity to the EOB or integrated connecting services, or located remotely in other parts of each Council area. For the purposes of the tests it was assumed that the future distribution within each council area reflects the current distribution in terms of accessibility to the EOB.

2.3.45 Nevertheless the outcome is clearly to show that the alternative distribution of development – which is considered a probable scenario in relation to developable land and planning strategies – would result in higher levels of commuting, and significantly higher levels of demand for orbital public transport services. It also suggests that providing a high degree of segregation could be even more effective in this situation.

Capturing the suburban market within City of Edinburgh north of A720

2.3.46 The modelling approach adopted based on TMfS zone structure uses relatively large origin and destination zones, and does not enable additional local zones to be modelled. In a strategic study the many alternative local market possibilities cannot all be evaluated.

2.3.47 Walking and cycling catchments have been extended to cover these areas and the 'walk-in' Park and Ride modelling addresses this at a strategic level as there are fairly large zones adjacent to the bypass. Trips will transfer to the new public transport at the interchanges and may be taken from both existing public transport and from car trips if the existing travel cost is close to the new public transport cost.

2.3.48 In practice intermediate stops would potentially improve local access to the service, but also would have the effect of slowing the service, reducing its attractiveness to through passengers and increasing costs. It is a truism that each passenger wants a service to stop close their home and outside their place of work, but not to stop anywhere else. The optimal service is inevitably a compromise.

2.3.49 A common working guideline for accessibility for bus services suggest that stops should be placed at 400m intervals to limit the distance passengers require to walk in order to gain access to the service. However an orbital service designed to such a standard would be relatively slow, unattractive and resource intensive. It would be little better than the radial services into the city centre on the Greenway routes, and would clearly fail to meet the strategic objectives.

2.3.50 Tram design generally works to a greater stop spacing of 800m, compromising walk accessibility in order to improve running speeds. Evidence from numerous places shows that many fit and able passengers will choose to walk that far to a fast and frequent service even where it means walking past a stop with a slower or less frequent level of service. The tram network is complemented by parallel bus services which continue to provide for local access for those unable / unwilling to walk further.

2.3.51 Although the model does not enable an estimate to be made of the number of additional passengers that might be attracted to the service by having additional stops closer to people's homes/workplaces, it does in a general way enable the effect of putting in additional stops and thus slowing the service down. Just as an illustration of this effect, an intermediate stop between Lothianburn and Hermiston (assumed to be at the Dreghorn interchange) was modelled. The model suggests that this would deter 8,500 long distance trips per annum and this additional stop would therefore only be worthwhile if the additional stop generates more than 8,500 extra passengers from the local area. (No additional operating costs were assumed in this case, although cumulatively a number of extra stops would require increased resources.)

2.3.52 It follows that additional stops are of greatest value where the numbers boarding and alighting at each stop are potentially high.

2.3.53 Since additional stops in residential areas trade off a disbenefit to long distance orbital travellers in order to benefit shorter local trips, such a stop may generally be viewed as contrary to the strategic aims of the orbital service. However additional stops to facilitate access to the major destinations points used by the orbital travellers themselves may be strategically advantageous. One area where additional local stops would almost certainly be well justified is within the Edinburgh Park employment area where high intensity activities within the area could generate the numbers of passengers boarding and alighting at each major site could justify the loss of time and higher operating costs associated with the stop.

2.3.54 More detailed modelling analysis will require to be carried out in the STAG2 appraisal to determine the overall effect of providing additional stops to local origins and destinations along the line of route.

3 Objective Setting

3.1 Introduction

3.1.1 Objective setting is an integral part of the STAG process. Objectives are required to reflect the issues and opportunities as well as to reflect established policy directives, including the Government's Purpose.

3.1.2 Transport Planning Objectives are essential to ensure that the final options address the identified problem fully. The Transport Planning Objectives express the outcomes of the study and describe how problems will be alleviated. Additionally, the Transport Planning Objectives provide the basis for the appraisal of alternative options and, during Post-Appraisal, will be central to monitoring and evaluation.

3.1.3 For the purposes of this Pre-Appraisal and Part 1 Appraisal, the Transport Planning Objectives will be articulated in general terms indicating the desired direction of change. However as the study progresses it will be necessary to sharpen and refine the objectives as more information becomes available. For the Part 2 Appraisal, the Transport Planning Objectives must be refined further and made SMART:

- **Specific** – it will say in precise terms what is sought;
- **Measurable** – there will exist means to establish to stakeholders satisfaction whether or not the objective has been achieved;
- **Attainable** – there is general agreement that the objective set can be reached;
- **Relevant** – the objective is a sensible indicator or proxy for the change which is sought; and
- **Timed** – the objective will be associated with an agreed future point by which it will have been met.

3.1.4 In addition to the Transport Planning Objectives, all potential options must also be appraised against the five STAG Criteria:

- **Environment**
- **Safety**
- **Economy**
- **Integration**
- **Accessibility and Social Inclusion**

3.2 Transport Planning Objectives

3.2.1 Transport Planning Objectives were developed at the Option Generation workshop in November 2007. As detailed above, these objectives are currently articulated in general terms. In advance of the Part 2 Appraisal it will be necessary to refine these further in order to ensure that they are SMART (specific, measurable, attainable, relevant and timed).

3.2.2 The Transport Planning Objectives for this study are as follows:

- To aim towards achieving RTS mode share targets within the study corridor;
- To aim towards achieving RTS environmental targets within the study corridor;
- To ensure the integration of public transport with existing and proposed land-use within the study corridor;
- To improve community and comparative (local and wider) accessibility by public transport, especially to employment and health; and
- To make public transport journey times, reliability and quality attractive versus single occupancy private car served study corridor.

3.2.3 These initial Transport Planning Objectives reflect the themes identified during pre-appraisal and express the transport outcomes sought.

3.2.4 It was also agreed at the workshop that while the focus was on public transport, opportunities for achieving the objectives should be sought for other sustainable modes, including High Occupancy Vehicles.

3.2.5 It is clear that the Edinburgh Orbital Bus Project can make a positive contribution to a number of these objectives. The following section sets out the results of the analysis considering the impact on the planning objectives and the STAG criteria.

3.3 Appraisal

3.3.1 Each option will be appraised against the Transport Planning Objectives using the STAG seven point scale below:

- Major Beneficial
- Moderate Beneficial
- Minor Beneficial
- Neutral
- Minor Negative
- Moderate Negative
- Major Negative

3.4 Problem / Objective Matrix

3.4.1 Table 3.1 sets out a matrix summarising which of the pre-defined problems are expected to be addressed by which objectives:

Objectives \ Problems	Planned / potential development will Increase demand for travel	Planned / potential development will exacerbate existing congestion	Planned / Potential development will further delay in journey times and predictability.	Transport / Land-Use integration	Opportunity for increased interchange in corridor.	Low level of existing orbital public transport.	Poor public transport alternatives.	Opportunity of New Forth Crossing.	Capturing suburban market north of A720.	City centre PT congestion makes cross-city trips unattractive.
To aim towards achieving RTS mode share targets within the study corridor.		✓			✓		✓			
To aim towards achieving RTS environmental targets within the study corridor.		✓								
To ensure the integration of public transport with existing and proposed land-use within the study corridor.	✓		✓	✓				✓		
To improve community and comparative (local and wider) accessibility by public transport, especially to employment and health.	✓								✓	
To make public transport journey times, reliability and quality attractive versus single occupancy private car served study corridor.	✓	✓	✓			✓	✓		✓	✓

***Table 3.1* - Matrix of Problems against Transport Planning Objectives**

3.5 SEStran Objectives

3.5.1 As stated in chapter 1, there are a number of SEStran objectives supportive of a project such as the EOBP. A number of these identified in the Regional Transport Strategy are detailed below:

- Economy - to ensure transport facilitates economic growth, regional prosperity and vitality in a sustainable manner;

    1. *To maintain and improve labour market accessibility to key business / employment locations, from all localities and communities.*
    2. *To support other strategies, particularly land-use planning, and economic development.*
    3. *To reduce the negative impacts of congestion, in particular to improve journey time reliability for passengers and freight.*

- Accessibility - to improve accessibility for those with limited transport choice (including those with mobility difficulties) or no access to a car, particularly those who live in rural areas:

    1. *To improve access to employment.*
    2. *To improve access to health facilities.*
    3. *To improve access to other services, such as retailing, leisure / social and education.*
    4. *To make public transport more affordable and socially inclusive.*

- Environment - To ensure that development is achieved in an environmentally sustainable manner:

    1. *To contribute to the achievement of the UK's national targets and obligations on greenhouse gas emissions.*
    2. *To minimise the negative impacts of transport on natural and cultural resources.*
    3. *To promote more sustainable travel.*
    4. *To reduce the need to travel.*
    5. *To increase transport choices, reducing dependency on the private car.*

3.5.2 It is SEStran's policy to improve public transport services, and particularly in areas where public transport has a low share of travel demand which signifies high environmental impacts from private car travel and poor accessibility for those dependent upon public transport options. Such a corridor has been identified around the edge of Edinburgh, accessed by the A720 Edinburgh bypass and a number of radial rail, bus and tram routes but lacking any orbital public transport services. This policy has therefore been adopted to address the issues and problems identified in the RTS.

3.6 Government Objectives – National Transport Strategy

3.6.1 The Transport White Paper of June 2004, "Scotland's Transport Future", sets out the Scottish Government objectives for transport. This was continued in the National Transport Strategy published in 2006:

> *"Our overall aim is to promote economic growth, social inclusion, health and protection of our environment through a safe, integrated, effective and efficient transport system".*

3.6.2 The Scottish Government objectives are to:

- Promote economic growth by building, enhancing, managing and maintaining transport services, infrastructure and networks to maximise their efficiency;
- Promote social inclusion by connecting remote and disadvantaged communities and increasing the accessibility of the transport network;
- Protect our environment and improve health by building and investing in public transport and other types of efficient and sustainable transport which minimise emissions and consumption of resources and energy;
- Improve safety of journeys by reducing accidents and enhancing the personal safety of pedestrians, drivers, passengers and staff;
- Improve integration by making journey planning and ticketing easier and working to ensure smooth connection between different forms of transport.

3.6.3 The above objectives are accompanied by three strategic outcomes:

- To improve journey times and connections;
- To reduce emissions; and
- To improve quality, accessibility and affordability.

3.6.4 In regard to improving journey times and connections the NTS acknowledges that infrastructure measures are key to improving bus journey times. These include on-road demand management measures (bus priority, bus lanes on key arterial corridors, park and ride, traffic managements systems and Bus Rapid Transit on segregated sections of roadway).

3.6.5 The NTS states that managing demand has a vital role to play in order to ensure more reliable journey times and reducing congestion. The NTS supports such measures by encouraging Regional Transport Partnerships (RTPs) and local authorities to create a network of innovative parking, to provide park and choose facilities at suitable sites near towns and cities and at key interchange hubs and to ensure that bus priority measures are introduced on key corridors.

3.6.6 In respect of reducing transport related emissions the NTS has set out to promote better synergies between transport and land-use planning to minimise the environmental effects of the transport network and contribute to health improvement. It actively promotes the use of smart measures (travel plans, travel information etc.) to both reduce the need to travel and to make journeys more sustainable.

3.6.7 Another key objective of the NTS is to improve the quality, accessibility and affordability of travel. To achieve this objective RTPs and local authorities are to consider flexible solutions when planning bus services.

3.7 Conclusions

3.7.1 The above summary of relevant objectives at both the regional and national level clearly illustrates that the Transport Planning Objectives set at the workshop are generally in accord with the pre-existing higher level objectives.

4 Option Generation, Sifting and Development

4.1 Introduction

4.1.1 Having identified the problems, issues, constraints and opportunities, as well as the objectives detailed in Chapter 3, workshop attendees were asked to suggest options for potential solutions to the transport problems identified. At this stage of the STAG process, the intention is to draw out *all* possible solutions in order to ensure wide consideration is given to all types of solutions.

4.1.2 The concept of a segregated Edinburgh Orbital Bus service was developed through the Regional Transport Strategy for the SEStran area. The RTS document was subject to a STAG analysis which identified the orbital serive as a positive option which would address the identified problems. Therefore primary consideration has been given to Bus Rapid Transit options in this study. For the sake of completeness, the following sections of this report details the reasons why the other options generated at the workshop have been sifted out of the process, largely by consideration of work done in other studies or in the RTS itself.

4.2 Option Generation

4.2.1 The following list of potential options was generated through the workshop:

- Congestion Charging;
- Tram;
- Bus Rapid Transit;
- Heavy Rail Enhancement;
- Cycling and Walking;
- Enhance Capacity on A720;
- High Occupancy Vehicle Lanes;
- Waterborne; and
- Air transport solutions.

4.3 Option Sifting

4.3.1 The STAG process allows option sifting to take place when either an unmanageably large number of options have been generated or where there is general consensus that options generated will clearly not achieve the intended objectives or meet the identified transport problems and/or opportunities. The following section details each of the above options and provides evidence and a recommendation as to whether or not they should be taken forward for further consideration within this study.

Congestion Charging

4.3.2 A referendum was held by the City of Edinburgh Council in 2005 in relation to the introduction of road user charging in the city, the result of which went against the proposal. At a national level road user charging is given consideration in the National Transport Strategy however there has been no indication from the Government on progressing with it as an option on the strategic road network. In the context of the study area, currently, the introduction of road user charging should be considered as failing to meet the public acceptability criteria.

4.3.3 Furthermore, of itself congestion charging does not create the public transport options required to meet the objectives.

4.3.4 It is therefore recommended that this option is not taken forward for appraisal.

Tram

4.3.5 The City of Edinburgh Council (CEC) commissioned Arup to undertake a feasibility study for a light rail network in Edinburgh in 2001. The resulting report, The Edinburgh LRT Masterplan Feasibility Study, was published in 2003 and involved an analysis of the potential implementation of light rail at various locations and across a variety of routes in Edinburgh.

4.3.6 One route considered for LRT was the South Edinburgh Orbital which is 21km corridor through predominantly residential areas immediately north of the City Bypass (A720) from Ferniehill to Sighthill / South Gyle. The corridor also extends east of Ferniehill towards Musselburgh. The South Edinburgh Orbital corridor follows a very similar route to the EOBP study corridor.

4.3.7 In Phase 1 of the LRT study it was found that the South Orbital corridor was unlikely to have sufficient demand for light rail and alignment difficulties were expected. However, given the substantial interest in the corridor the decision was made to continue with the phase 1 analysis to ensure the comparative performance with other corridors was clearly demonstrated. The Phase 1 analysis methodology was primarily based around the principles of the STAG Appraisal Summary Tables.

4.3.8 The more detailed assessment carried out in the Edinburgh LRT Masterplan Feasibility Study concluded that LRT was not feasible on the South Edinburgh Orbital route as there would be alignment problems, there would be an impact to radial corridors due to the tram crossing the main flows and it is unlikely to be financially viable as it would be such a high cost scheme because of its length. It is therefore recommended that this option is *not* taken forward for appraisal.

Heavy Rail Enhancements

4.3.9 Given the above argument to rule out tram as a viable option on the grounds of cost and demand levels, it is clear to see that heavy rail should also be removed as an option. The costs associated with heavy rail are significantly higher than tram and also require higher levels of patronage to be commercially viable. Heavy rail options would also be subject to similar (but more severe) alignment constraints as tram and LRT options.

4.3.10 It is therefore recommended that heavy rail is not taken forward for appraisal.

Bus Rapid Transit

4.3.11 Following the workshop an analysis of the total additional demand that might be won by a fast and frequent orbital service along the study corridor was carried out (as reported at paragraph 2.3.33). The busiest sections of the route in each direction carry between 350 and 450 travellers per hour in the peak hours. These trip rates are consistent with single-deck bus operation with between 6 and 12 buses per hour. This option could also provide low-high cost infrastructure options, depending upon the degree of segregation from other road users, but would not be subject to the alignment constraints of tram or LRT options.

4.3.12 The Arup LRT Masterplan Feasibility Report, which ruled out LRT as a viable option for the Orbital corridor, recommended that improvements to public transport are made around Edinburgh, including major improvements to orbital bus services to provide a high quality link between edge-of-city employment locations, park and ride sites and interchanges with radial bus and rail services. An Orbital Bus Project was also recommended in the SEStran RTS, which was subjected to the STAG process prior to its approval by the Scottish Ministers.

4.3.13 From the RTS, Bus Rapid Transit showed the highest contribution towards the objectives of the Strategy. It is therefore recommended that Bus Rapid Transit options are taken forward for appraisal.

Traditional on-street Bus Services

4.3.14 A traditional on-street bus service could be operated around the orbital corridor, either on the A720 Edinburgh by-pass or other parallel streets. The indications of the Arup LRT study are that conventional on-street bus service would not be sufficiently attractive to make a substantial impact on travel patterns. It is also notable that, in the free market for bus services which currently exists, no operator has chosen to provide an orbital service. The only such service to be attempted was withdrawn in the 1990's having failed to achieve financial viability.

4.3.15 Underlying growth arising from new development since then may have changed the prospects for such a service, which could contribute to the objectives set for the orbital corridor, and on-street bus is therefore taken forward for appraisal.

Cycling and Walking

4.3.16 It was agreed at the workshop that although cycling and walking proposals on their own were unlikely to have a significant impact on the problems identified within the study area due to the distances involved, they should however be investigated as complementary measures where appropriate, for example, provision of cycle facilities at transport interchanges and links to both existing and planned routes.

4.3.17 It is therefore recommended that cycling and walking options are considered as complementary measures and that these measures should continue to be pursued by the local authorities in the SEStran area.

Enhance Capacity on A720

4.3.18 The capacity of the A720 Edinburgh by-pass, and the current congestion occurring in peak periods, have been identified as problems in the Local and Regional Transport Strategies. The increasing employment opportunities in the West Edinburgh development area centred around the Airport, including Edinburgh Park, Heriot Watt University, the RBS headquarters site and Newbridge, all require to be supported by expanding residential opportunities at accessible locations. A proportion of these opportunities will be provided to the east in Midlothian and in East Lothian, increasing the pressure for cross-city transport improvements. Increasing the capacity of the A720 might be an option to reduce the congestion which is currently occurring and to make capacity available for future road traffic growth.

4.3.19 However the planning and transport strategies all recognise that for this purpose:

- The private car has unacceptable global and local environmental impacts;
- The road space and parking space requirements arising from increased car use would have adverse implications for land-use within the development areas; and

- The absence of effective and attractive public transport options will result in the exclusion of those who are dependent upon public transport from the growth and wealth opportunities presented by the development.

4.3.20 Therefore the established RTS, NTS Government objectives and Transport Planning Objectives of this study all identify the environmental impacts of increasing use of the private car as a key problem to be addressed. They also identify the social need to provide effective public transport travel opportunities for those who do not have access to a car. Enhancing the capacity of the A720 City of Edinburgh Bypass would be contrary to the objectives and positively harmful to the agreed aims and objectives.

4.3.21 It is therefore recommended that this option is not taken forward for appraisal.

High Occupancy Vehicle Lanes

4.3.22 Although a general increase in capacity of the A720 would be contrary to the objectives of the approved Regional Transport Strategy, a selective increase to provide additional road space for buses, taxis and high occupancy cars through the provision of HOV lanes may enable the objectives to be delivered by facilitating not only the effective provision of bus services, but also encouraging higher vehicle occupancy and more efficient use of the road capacity that is available. HOV lanes thus may, or may not, be compatible with the option of a Bus Rapid Transit system, and could potentially also address the recognised issue of increasing congestion on the strategic road network.

4.3.23 However HOV lanes of themselves would not address the objective of providing a public transport alternative to the private car. They do not therefore, taken in isolation, contribute sufficiently to the aims and objectives of this study.

4.3.24 At the detail design stage it is possible to envisage that some or all of the infrastructure provided for the purpose of ensuring that a quality public transport service can be provided could be shared with other road users, and in doing so the benefits might be greater than for infrastructure reserved to buses only. However the implications would extend far beyond the geographic area of this study, and beyond the defined issues which have been identified in the Regional Transport Strategy. HOV lanes might thus contribute to an overall strategy, but are not sufficient in themselves to deliver a solution.

4.3.25 It is therefore recommended that this option is not taken forward for appraisal, although lane sharing may be an option worth further consideration at the detail design stage.

Waterborne and Air Transport Solutions

4.3.26 Waterborne and air transport solutions were discussed and discounted at this stage as it was agreed by the group that neither would be able to provide a significant impact with the study area.

4.3.27 It is therefore recommended that neither of these options are taken forward for further appraisal.

4.4 Option Development

4.4.1 Following on from the sifting process, the next step is to develop a number of broadly defined alternative options that can be subjected to Part 1 Appraisal.

4.4.2 The consideration of Options was informed by the high level demand analysis previously described, which informed the debate about the potential scale of demand and its distribution around the study corridor.

4.4.3 After further discussion at the workshop, it was agreed that the options most likely to solve the transport problems identified and achieve the Transport Planning Objectives were bus based, either on existing streets or with a degree of segregation from other road traffic.

4.4.4 The workshop group then identified, discussed and developed potential bus based options, based on the assessed travel demand and major trip generators/attractors, that could then be investigated / developed further after the workshop. Base plans were marked up to show potential alignments, major trip generators/attractors and other suggestions. Since the workshop these plans have been rationalised further and the final composite plans prepared.

4.4.5 There are many different options available to implement an appropriate bus system. The options that are to be taken forward to the Part 1 Appraisal will be:

- Route alignment options;
- Service levels (operations and frequency) options;
- Rolling Stock Options;
- Fares and Ticketing Options; and
- Operational Arrangements (Procurement).

4.4.6 Further features were also identified from background work and initial modelling:

- That the effective speed of travel between origin and destination (taking account of in-vehicle speeds, access and interchange time) would critically determine the level of demand that could be captured by a new public transport service;
- That there would be a diverse but substantial volume of trips originating off the line of route and outside the corridor, but for the most part destined to sites within the corridor;
- That therefore the service requires to be fully integrated with services in a wider area, and not confined to services contained wholly within the corridor;

- That this implies integration with the commercial networks of several different established operators in the region;
- That this implies accepting and accommodating the different commercial, technical and operating practices of these operators and may limit the ability of the orbital service to set distinct practices of its own;
- That integration of ticketing systems, marketing and publicity across several networks would be necessary to maximise the public awareness and use of the new facility.

4.4.7 It was further agreed that although walking and cycling proposals on their own were unlikely to have a significant impact on the problems identified within the study area, they should be investigated during detailed development in a STAG Part 2 Appraisal as complementary measures where appropriate, for example, cycle facilities at transport interchanges and links to both existing and planned routes.

4.4.8 It was emphasised that there is unlikely to be any significant source of revenue funding to support an operating deficit, and that therefore to ensure deliverability, the commercial viability of the service operations would be a critical evaluation criterion.

5 STAG Part 1 Appraisal

5.1 Introduction

5.1.1 This chapter of the report sets out the details of the STAG Part 1 analysis and provides a recommendation of the options to be taken forward to more detailed analysis in the STAG Part 2 Appraisal.

5.1.2 The Part 1 Appraisal is an initial appraisal of the option generated during Pre-Appraisal and involves a qualitative assessment of the likelihood of such options being able to meet the Transport Planning Objectives, and subsequently proceed to the detailed Part 2 Appraisal.

5.1.3 The Part 1 Appraisal concentrates on the following areas:

- An initial appraisal of the likely impact of options against the Transport Planning Objectives;
- An initial appraisal of the likely impact of options against the STAG criteria;
- An initial appraisal of the fit of options with established policy directives; and
- An initial appraisal of the feasibility, affordability and likely public acceptance of options.

5.1.4 In the first instance each option is appraised against the five Transport Planning Objectives identified previously in this report. These are reiterated below for information:

- To aim towards achieving RTS mode share targets within the study corridor;
- To aim towards achieving RTS environmental targets within the study corridor;
- To ensure the integration of public transport with existing and proposed land-use within the study corridor;
- To improve community and comparative (local and wider) accessibility by public transport, especially to employment and health; and
- To make public transport journey times, reliability and quality attractive versus single occupancy private car served study corridor.

5.1.5 The options are then appraised at a high level for their performance against the five STAG criteria. This part of the appraisal reflects the anticipated impact each option could have on alleviating the problems, issues and constraints identified during the Pre-Appraisal process, in the context of the STAG criteria, namely:

- Environment
- Safety
- Economy

- Integration
- Accessibility and Social Inclusion.

5.1.6 The performance of each option against the STAG criteria is assessed using the STAG seven-point scale noted below.

- Major Benefit
- Moderate Benefit
- Minor Benefit
- Neutral
- Minor Negative
- Moderate Negative
- Major Negative

5.1.7 In order to appraise each option fully it is first of all necessary to provide the relevant context and background information. A summary of the geographic, social and economic context of the study corridor is provided below.

5.1.8 The results from the Part 1 Appraisal are summarised using Appraisal Summary Tables (ASTs). These can be found in Appendix A.

5.2 Geographic Context

5.2.1 The SEStran region covers a diverse range of areas across 8 local authority areas. The region covers 3,180 square miles and is home to 28% of the Scottish population. The area has a wide range of urban and rural environments with a major capital city in Edinburgh, to very rural areas in East Lothian and the Scottish Borders.

5.2.2 The level of transport provision generally reflects the geography of the area, with the densely populated areas supporting well developed public transport systems, which diminish as areas become less densely populated. Reflecting this, the levels of traffic congestion vary enormously across the area. Geographic constraints such as the Firth of Forth and the Pentland Hills create natural bottlenecks which are particularly prone to congestion.

5.2.3 Consequently a significant problem identified by the Regional Transport Strategy is the key role played by the A720 Edinburgh by-pass in distributing traffic across the region and linking key centres of activity, the level of congestion occurring on this artery, the absence of public transport in this corridor and the comparativel indirect cross-city radial public transport options which are available providing only lengthy, expensive and time-consuming opportunities for people without cars to make these same journeys. The study corridor therefore broadly parallels this route and runs from the Wallyford Park and Ride in the east to Inverkeithing Station north of the Forth Road Bridge. Between these locations there are a wide range of possible route alignments available along the corridor. Destinations that have been considered as key areas along the corridor are:

- Queen Margaret University / Musselburgh Station;
- Edinburgh Royal Infirmary (ERI);
- Sheriffhall
- Straiton
- Lothianburn
- Hermiston Park and Ride;
- Edinburgh Park;
- RBS HQ Gogarburn; and
- Edinburgh Airport.

5.2.4 The corridor includes several existing or planned Park & Ride sites, and also opportunities for interchange with radial public transport routes into the city centre from outlying communities.

5.2.5 As was detailed in Chapter 2 there are a number of residential and employment related developments planned within the study corridor which will increase the demand to travel on the existing network if no further services are put in place.

5.3 Social Context

5.3.1 The Scottish Index of Multiple Deprivation (SIMD) 2006 data suggests that the level of deprivation along the study corridor is relatively low. An analysis of Scottish Parliament constituencies along the study corridor shows that the percentage of the total population that are income deprived are all well below the Scottish average (14.2%) with the exception of Edinburgh East and Musselburgh (15.5%). Similarly, the percentage of employment deprived people along the study corridor compares favourably with the national average of 13.1%. Again the only Scottish Parliament Constituency along the route with a higher level of employment deprivation is Edinburgh East and Musselburgh with 13.5%.

5.3.2 According to the 2001 Census data car ownership along the study corridor is broadly in line with the national average. 34.2% of all Scottish households do not have access to a car. Four out of five Scottish Parliament constituencies along the study corridor have between 28 and 36% of households without access to a car. The notable exception again being Edinburgh East and Musselburgh where the average is considerably higher at 41.9% of households without access to a car. Whilst car ownership (especially in Edinburgh) should not be taken as a proxy for social exclusion, the low car ownership rates do suggest high dependency on public transport travel options.

5.4 Economic Context

5.4.1 The City of Edinburgh is a major centre of economic activity and employment in Scotland. It is therefore the main source of economic growth and the focus of future development in the SEStran area. There are several centres of economic activity within the study corridor including, The Gyle, Edinburgh Park, Shawfair, Edinburgh Royal Infirmary, Edinburgh Airport and the Royal Bank of Scotland HQ at Gogarburn.

5.4.2 Census data shows a clear demand for travel along the route to reach these economic centres. The planned spatial development of the region suggests that increased volumes of commuting will be necessary to support the economic growth of the city and region, and the initial modelling projects considerable growth in both car and public transport trips.

5.5 General Information

5.5.1 Following on from the option sifting and generation process, it is envisaged that the EOBP will be a bus-based public transport system which provides a reliable express service. Whilst operation by traditional buses on existing streets is an option, there are also a range of options involving degrees of segregation from other road traffic and congestion. Various engineering measures would be required in order to provide priority over general traffic and bypass congestion and provide features of a Bus Rapid Transport System (BRT). These measures could include, but not necessarily be limited to:

- New Off-road busways;
- On-road bus lanes;
- Bus gates;
- Local road widening; and
- Traffic signal priority.

5.5.2 When considering the route options preference was given to measures that are required to achieve the desired priority balanced against the likely cost and feasibility. Where possible, existing bus priority measures have been used along the route.

5.5.3 The route options were initially considered during a route selection process which examined the various land uses, interchanges, park and ride sites and road infrastructure within the study corridor area. These options were further discussed during the EOBP workshop (23 November 2007), at which, stakeholders raised new ideas that have subsequently been considered.

5.5.4 The initial route selection process identified that the EOBP was likely to operate between Wallyford Park and Ride and Inverkeithing Railway Station in Fife. In order to help limit the route alignment variations and stopping points between these two destinations decisions were made through reference to environmental issues, key land uses, modelling analysis and workshop discussions. Destinations within the route corridor that were considered as key areas were:

- Queen Margaret University/Musselburgh Station;
- Edinburgh Royal Infirmary (ERI);
- Sheriffhall;
- Straiton;
- Lothian Burn;
- Hermiston Park & Ride;
- Edinburgh Park;
- RBS HQ, Gogarburn; and
- Edinburgh Airport.

5.5.5 Based on the geographic area of the study and the destinations identified above, the study corridor has been split into five links:

- Wallyford Park & Ride to Edinburgh Royal Infirmary;
- Edinburgh Royal Infirmary to Straiton Park & Ride;
- Straiton Park & Ride to Hermiston Park & Ride;
- Hermiston Park & Ride to The Gyle; and
- The Gyle to the North-West (Inverkeithing)

5.5.6 Each of the above links has been examined in detail to determine suitable route alignments along their length. For each link between the interchanges three options that have significantly different levels of improvements (associated with running speed and infrastructure costs) have been examined as follows:

- Nil investment – utilising existing streets;
- Lower segregated option – easier to implement, lower cost measures; and
- Higher segregated option – showcase route, no capped costs.

5.5.7 The different route alignments are shown on the Figures contained within Appendix B. Further detailed information on each route option can be found in the Route Options Working Paper (Halcrow, March 2008).

5.5.8 Technical reports on fares and ticketing, rolling stock and operational arrangements have been prepared on the different options available for each of these aspects. However it is considered that these aspects are too detailed to be considered at this stage of the STAG process and therefore they will considered in more detail during the STAG Part 2 Appraisal.

5.6 Environmental Impact

5.6.1 An appraisal of the geographic area of the study corridor against the environmental factors of the Transport Planning Objectives has been carried out in parallel to the main STAG study. The environmental Transport Planning Objective set out for the EOBP was:

> *To aim towards achieving RTS environmental targets within the study corridor.*

5.6.2 Therefore for the purposes of this study the performance of each option has been appraised against the environmental objectives set in the SEStran RTS. These are detailed below:

- To contribute to the achievement of the UK's national targets and obligations on greenhouse gas emissions;
- To minimise the negative impacts of transport on natural and cultural resources;
- To meet or better all statutory air quality requirements; and
- To reduce the impacts of transport noise.

5.6.3 A brief summary of the environmental impact of each option is detailed below. The full environmental report is available as a separate report (Halcrow July 2008).

5.7 Option 1

Nil investment; 12 buses per hour throughout between Inverkeithing and Wallyford on existing roads.

5.7.1 This option assumed a new orbital service following the study corridor using existing roads would be provided as a self-contained high frequency operation, providing interchange opportunities at each of the 14 nodes identified in earlier work. Model testing has been carried out on option 1 and it has been shown that with no new infrastructure, the demand along this corridor is likely to be 3,268,000 additional passenger trips attracted to public transport per year and the operating cost is estimated at £6,556,000 per annum. Assuming a flat fare at £1.00 per single journey in line with current Lothian Buses policy, there would be a net annual deficit of c.£3.2m per annum. It was noted that no such orbital services are currently operated and that limited orbital services which have been operated in previous years have proved not to be viable and were withdrawn, adding practical evidence to this conclusion.

5.7.2 It is not anticipated that Option 1 will result in any impacts to the environment during the construction phase as no construction practices are needed for its implementation. During operation, as this service is utilising the existing road network, it is anticipated that there will be no adverse impacts to the natural or cultural resources of the study corridor. However, this option is unlikely to result in a significant modal shift from private vehicles to public transport and as a result the addition of more traffic to the network is likely to result in long-term adverse impacts to air quality and to noise & vibration.

5.7.3 Although this option does achieve the objective of minimising negative impacts to the natural and cultural heritage, it is unlikely to achieve any of the other environmental objectives that have been set for the EOBP.

Option 1: Performance against Transport Planning Objectives

Transport Planning Objective	Option 1: Performance
To aim towards achieving RTS mode share targets within the study corridor.	Minor Beneficial
To aim towards achieving RTS environmental targets within the study corridor.	Neutral
To ensure the integration of public transport with existing and proposed land-use within the study corridor	Minor Beneficial
To improve community and comparative (local and wider) accessibility by public transport, especially to employment and health	Minor Beneficial
To make public transport journey times, reliability and quality attractive versus single occupancy private car served study corridor.	Neutral

Option 1: Performance against STAG Criteria

STAG Criteria	Predicted Impact
Environment	Neutral
Safety	Neutral
Economy	Neutral
Integration	Minor Beneficial
Accessibility and Social Inclusion	Minor Beneficial

5.8 Option 2

All high segregation from Inverkeithing to Wallyford with 12 buses per hour throughout

5.8.1 This option proposed the same level of self-contained service as Option 1, providing the same access and interchange opportunities, but with a high degree of segregation of the bus service from other road traffic through a combination of segregated busways, dedicated bus lanes and priority turning facilities. Model testing has been carried out on option 2 and it has been shown that by providing a high segregated option along the length of the corridor, the projected demand is 6,467,000 new passenger trips per year and the operating cost is estimated at £5,133,000 per annum. Assuming a flat fare at £1.00 per single journey in line with current Lothian Buses policy, there would potentially be an operating surplus of c.£1.3m per annum.

5.8.2 Between Wallyford and ERI this option performs well against the environmental planning objectives, although it is anticipated that there will be adverse impacts upon the natural and cultural heritage of the area if this route is implemented.

5.8.3 From ERI to Straiton, option 2 is likely to result in several long-term adverse impacts given the sensitive nature of the environment located along this section including The Drum Designed Landscape and Straiton Ponds Local Nature Reserve. The construction of a new route also lies within the greenbelt, though will be mitigated to a degree if it is closely aligned alongside the A720 to prevent severance of land holdings and minimise visual intrusion.

5.8.4 From Straiton to Hermiston, option 2 will likely result in more long-term adverse impacts with the agriculture and soils, noise and air quality all being directly affected along with further impacts to the cultural heritage of the area. This section of option 2 will not meet three of the environmental planning objectives as a result of its impacts upon local sensitive receptors along its length. The most severe impact occur between Baberton and Hermiston where the new alignment crosses open agricultural land and would cause severance to agricultural land holdings.

5.8.5 Between Hermiston and The Gyle, option 2 is likely to result in long-term adverse impacts to the air quality, noise and vibration along the route as well as adversely affecting the setting of The Union Canal SAM. These impacts also follow a temporary construction period where the various environmental areas will all be adversely affected. This section of option 2 will not meet three of the environmental planning objectives as a result of its impacts upon local sensitive receptors such as The Union Canal which is an important cultural and recreational resource.

5.8.6 From The Gyle to Inverkeithing, option 2 is likely to result in adverse impacts upon the agriculture and soils of the area with some field areas severed for the purpose of the route alignment. However there are also likely to be benefits associated with reductions in noise and vibration and improvements to air quality through the predicted modal shift in transportation use. This section of option 2 will only meet two of the environmental planning objectives.

5.8.7 Over all sections this option is likely to result in benefits to greenhouse gas emissions through the anticipated modal shift to public transport, but is unlikely to achieve the other environmental planning objectives with adverse impacts anticipated along several sections of the route.

Option 2: Performance against Transport Planning Objectives

Transport Planning Objective	Option 2: Performance
To aim towards achieving RTS mode share targets within the study corridor.	Major Beneficial
To aim towards achieving RTS environmental targets within the study corridor.	Minor Negative
To ensure the integration of public transport with existing and proposed land-use within the study corridor	Moderate Beneficial
To improve community and comparative (local and wider) accessibility by public transport, especially to employment and health	Major Beneficial
To make public transport journey times, reliability and quality attractive versus single occupancy private car served study corridor.	Major Beneficial

Option 2: Performance against STAG Criteria

STAG Criteria	Predicted Impact
Environment	Minor Negative
Safety	Moderate Beneficial
Economy	Moderate Beneficial
Integration	Moderate Beneficial
Accessibility and Social Inclusion	Major Beneficial

5.9 Option 3

All low segregation from Inverkeithing to Wallyford with 12 buses per hour throughout

5.9.1 Option 3 assumed the same operating frequency and pattern as options 1 and 2, but a modest degree of segregation where bus lanes could be provided as a low cost alternative to busways. The result is lower capital costs, lower operating speeds (but consequently high running costs). Model testing has been carried out on option 3 and it has been shown that by providing a low level of segregation along the study corridor, the demand is likely to be 4,429,000 new passenger trips per year and the operating cost is estimated at £6,059,000 per annum. Assuming a flat fare at £1.00 per single journey in line with current Lothian Buses policy, there would be an annual deficit of c.£1.6m per annum.

5.9.2 Between Wallyford and ERI it is anticipated that most of the impacts will be restricted to the temporary construction phrase, however there are some long term impacts and these are likely to be focused upon agriculture and soils. This section also has the potential to bring about long-term benefits to the environment with the scheme leading to an anticipated modal shift from private vehicles to public transport. This shift will likely see a reduction in noise and vibration as well as benefits to air quality within the section. This section of the route will meet all of the environmental planning objectives set.

5.9.3 From ERI to Straiton, option 3 will likely result in some adverse impacts locally as a result of reduced air quality and increased noise and vibration during construction, however, it is likely that these areas will improve in the long-term and result in some benefits. In this section, option 3 achieves the environmental planning objectives with benefits likely to be seen to local noise and air quality whilst there are unlikely to be any significant impacts upon the natural and cultural heritage of the area as a result of this option.

5.9.4 Along the remainder of the route, from Straiton to Inverkeithing, option 3 will result in long-term benefits for air quality, noise and vibration, however, there is also the potential for impacts to the quality of water resources. This option meets all of the environmental planning objectives that have been set for the scheme along these three sections of the study corridor, although the benefits of mode shift are modest in the low segregation option.

5.9.5 Modest mode switch from cars to public transport is projected to occur, with correspondingly modest benefits to air quality and levels of greenhouse gas emissions.

Option 3: Performance against Transport Planning Objectives

Transport Planning Objective	Option 3: Performance
To aim towards achieving RTS mode share targets within the study corridor.	Moderate Beneficial
To aim towards achieving RTS environmental targets within the study corridor.	Moderate Beneficial
To ensure the integration of public transport with existing and proposed land-use within the study corridor	Minor Beneficial
To improve community and comparative (local and wider) accessibility by public transport, especially to employment and health	Moderate Beneficial
To make public transport journey times, reliability and quality attractive versus single occupancy private car served study corridor.	Moderate Beneficial

Option 3: Performance against STAG Criteria

STAG Criteria	Predicted Impact
Environment	Moderate Beneficial
Safety	Minor Beneficial
Economy	Minor Beneficial
Integration	Minor Beneficial
Accessibility and Social Inclusion	Moderate Beneficial

5.10 Option 4

All high segregation from Newbridge to Musselburgh with 12 buses per hour throughout

5.10.1 From earlier modelling results, very little additional traffic is expected to be attracted to public transport as a consequence of operating the service from Fife or Wallyford, this being a result of the high level of service already available and the very limited scope to make substantial improvements to travel times. The model was run excluding these origins/destinations from the service and assuming they were replaced by interchange with alternative services from Fife at Gogar and from East Lothian at Musselburgh or Newcraighall. In Option 4 the high level of segregation proposed in Option 2 was assumed to be provided, serving 11 interchange points. This removal of Fife produced a reduction of 231,000 (3.6%) trips and the removal of Wallyford reduced trips by 243,000 (3.8%) – 7.4% of the total demand.

5.10.2 This shorter route would result in a reduction in operating costs which is greater than the potential reduction in demand and revenue, confirming the low added value of these sections of route. Consequently the projected operating surplus rises to £2.5m for the high segregated option, compared to the £1.3m surplus created with option 2.

5.10.3 Option 4 performs to a similar level as option 2 in terms of the environmental impact. However the environmental impacts will be slightly reduced for this option given that it comprises a shorter route, running between Newbridge and Musselburgh, instead of extending out to Wallyford and Inverkeithing.

Option 4: Performance against Transport Planning Objectives

Transport Planning Objective	Option 4: Performance
To aim towards achieving RTS mode share targets within the study corridor.	Major Beneficial
To aim towards achieving RTS environmental targets within the study corridor.	Minor Negative
To ensure the integration of public transport with existing and proposed land-use within the study corridor	Moderate Beneficial
To improve community and comparative (local and wider) accessibility by public transport, especially to employment and health	Major Beneficial
To make public transport journey times, reliability and quality attractive versus single occupancy private car served study corridor.	Major Beneficial

Option 4: Performance against STAG Criteria

STAG Criteria	Predicted Impact
Environment	Minor Negative
Safety	Moderate Beneficial
Economy	Moderate Beneficial
Integration	Moderate Beneficial
Accessibility and Social Inclusion	Major Beneficial

5.11 Option 5

All low segregation from Newbridge to Musselburgh with 12 buses per hour throughout

5.11.1 The same operating assumptions were made as for Option 4, excluding Fife (Inverkeithing and Ferrytoll) and Wallyford. The low segregation proposed in Option 3 was assumed, serving 11 interchange points. The model projected that the removal of Fife, for the low segregation option, produced a reduction of 248,000 (5.6%) trips and the removal of Wallyford produced a reduction of 110,000 (2.5%) of trips – overall 8.1% of the total demand.

5.11.2 The shorter route would result in a reduction in operating costs which is greater than the potential reduction in demand and revenue. Consequently the projected operating deficit falls to £0.4m for the low segregated option, compared to the £1.6m deficit created with option 3.

5.11.3 Option 5 performs to a similar level as option 3 in terms of the environmental impact. However the environmental impacts will be slightly reduced for this option given that it comprises a shorter route, running between Newbridge and Musselburgh, instead of extending out to Wallyford and Inverkeithing.

Option 5: Performance against Transport Planning Objectives

Transport Planning Objective	Option 5: Performance
To aim towards achieving RTS mode share targets within the study corridor.	Moderate Beneficial
To aim towards achieving RTS environmental targets within the study corridor.	Moderate Beneficial
To ensure the integration of public transport with existing and proposed land-use within the study corridor	Minor Beneficial
To improve community and comparative (local and wider) accessibility by public transport, especially to employment and health	Moderate Beneficial
To make public transport journey times, reliability and quality attractive versus single occupancy private car served study corridor.	Moderate Beneficial

Option 5: Performance against STAG Criteria

STAG Criteria	Predicted Impact
Environment	Moderate Beneficial
Safety	Minor Beneficial
Economy	Minor Beneficial
Integration	Minor Beneficial
Accessibility and Social Inclusion	Moderate Beneficial

5.12 Option 6

All high segregation from Newbridge to Musselburgh with composite timetable of overlapping services from off-route origins/destinations

5.12.1 This option has been developed to attempt to match supply to demand. The option comprised:

- A through service at 6 buses per hour from Newbridge to Musselburgh (using a direct link between Straiton and ERI, omitting Sheriffhall);
- Through services at 6 buses per hour from West Lothian to Hermiston;
- Through services from Gogar Interchange to Dalkeith and to Penicuik, each at 3 buses per hour and combined to provide a bus every 10 minutes between Gogar and Straiton;
- Through services from Dalkeith and from Penicuik to Musselburgh, each at 3 buses per hour and combined to provide a bus every 10 minutes between Edinburgh Royal Infirmary and Musselburgh; and
- Through services from Edinburgh Royal Infirmary to East Lothian at 3 buses per hour.

5.12.2 It must be stressed that this is only one of a number of potential permutations of service route and frequency that might be operated, and it is tested for illustrative purposes only.

5.12.3 The high degree of segregation serving 11 interchanges proposed in Option 4 was assumed.

5.12.4 This high segregation option with composite route operating pattern generates a demand of 6,100,000 passenger trips per annum and has an operating cost of £4,070,000 per annum. This produces an annual operating surplus of £2.03m based on a £1.00 flat fare for a single journey.

5.12.5 Option 6 performs similarly to options 2 and 4 in terms of the environmental factors.

Option 6: Performance against Transport Planning Objectives

Transport Planning Objective	Option 6: Performance
To aim towards achieving RTS mode share targets within the study corridor.	Major Beneficial
To aim towards achieving RTS environmental targets within the study corridor.	Minor Negative
To ensure the integration of public transport with existing and proposed land-use within the study corridor	Moderate Beneficial
To improve community and comparative (local and wider) accessibility by public transport, especially to employment and health	Major Beneficial
To make public transport journey times, reliability and quality attractive versus single occupancy private car served study corridor.	Major Beneficial

Option 6: Performance against STAG Criteria

STAG Criteria	Predicted Impact
Environment	Minor Negative
Safety	Moderate Beneficial
Economy	Moderate Beneficial
Integration	Moderate Beneficial
Accessibility and Social Inclusion	Major Beneficial

5.13 Option 7

All low segregation from Newbridge to Musselburgh with composite timetable of overlapping services from off-route origins/destinations

5.13.1 This option proposed the same operating pattern as Option 6, but with the lower degree of segregation from road traffic proposed in Option 5.

5.13.2 Again it should be stressed that this is only one of a number of potential permutations of service route and frequency that might be operated, and it is tested for illustrative purposes only.

5.13.3 This low segregated option with composite route operating pattern has a projected demand of 4,386,000 passenger trips per annum and an operating cost of £5,234,000 per annum. Again, assuming a £1.00 flat fare for a single journey, an operating deficit of £0.84m per annum would be produced with this option.

5.13.4 Option 7 performs similarly to options 3 and 5 in terms of the environmental factors.

Option 7: Performance against Transport Planning Objectives

Transport Planning Objective	Option 7: Performance
To aim towards achieving RTS mode share targets within the study corridor.	Moderate Beneficial
To aim towards achieving RTS environmental targets within the study corridor.	Moderate Beneficial
To ensure the integration of public transport with existing and proposed land-use within the study corridor	Minor Beneficial
To improve community and comparative (local and wider) accessibility by public transport, especially to employment and health	Moderate Beneficial
To make public transport journey times, reliability and quality attractive versus single occupancy private car served study corridor.	Moderate Beneficial

Option 7: Performance against STAG Criteria

STAG Criteria	Predicted Impact
Environment	Moderate Beneficial
Safety	Minor Beneficial
Economy	Minor Beneficial
Integration	Minor Beneficial
Accessibility and Social Inclusion	Moderate Beneficial

5.14 Environmental Conclusion

5.14.1 The nil investment option achieves the objective of minimising negative impacts to the natural and cultural heritage. However it is unlikely to achieve any of the other objectives that have been set for the project.

5.14.2 Overall the lower segregated options perform well against the planning objectives, achieving each of the four objectives of the SEStran RTS in each of the five sections of the route. In summary it is therefore shown that the adoption of the lower segregated alignment would result in long-term benefits to air quality and traffic noise through a modal shift to public transport whilst also minimising the impacts the scheme would have upon the natural and cultural heritage of the area. However the degree of mode shift anticipated is modest and the benefits, though positive are minor.

5.14.3 Any of the higher segregated options will result in significantly greater benefits to greenhouse gas emissions through the modal shift that is anticipated, and therefore this objective is met in each of these options. The benefits are lower at the ends of the route where lower mode shift is predicted. Although the higher segregated option will result in some short-term temporary adverse environmental impacts, and some impacts to locally sensitive receptors along the proposed route corridor, the long-term benefits that the use of this option would bring through reductions in vehicular emissions brought about through an anticipated modal shift. There are particular concerns however about the local environmental impacts of new route construction in the high segregation options between Hermiston and Baberton, which crosses open agricultural land, and may result in both visual intrusion and severance of the agricultural land holding.

5.14.4 In overall terms, the implementation of either the lower or higher segregated options has the potential to result in long-term environmental benefits along the proposed route corridor alignments, especially when related to air quality and

greenhouse gas emissions. These benefits are generally higher for the higher segregation options due to greater mode switch.

5.14.5 In general the higher levels of segregation have both higher benefits and more severe adverse impacts. Many of these adverse impacts are local in their effect and are capable of mitigation through detailed design. It is recommended that in determining which route alignment/s should be taken forward for more detailed analysis that the performance of the route options against the environmental objectives set for the scheme is taken into account.

5.15 Financial Appraisal – Outline Business Case

5.15.1 The Part 1 Appraisal must also assess the feasibility, affordability and public acceptability of each option. The following section provides an overview of the financial appraisal and outline business case for the Edinburgh Orbital Bus Project.

Option 1

5.15.2 There are no capital costs associated with Option 1. Operating costs are predicted to be **£6,556,000** per annum and revenue is estimated at **£3,268,000** per annum. This creates a deficit of c.£3.2m per annum based on 2008 prices. This option therefore fails the proposed criterion that there should be no revenue deficit, and also explains why no commercial service is currently provided to meet orbital travel demands.

Option 2

5.15.3 Capital costs for Option 2 are estimated to be **£54,311,628** (£78,208,744 with optimism bias) based on 2008 prices. Operating costs are predicted to be **£5,133,000** per annum and revenue is estimated at **£6,467,000** per annum. This creates a surplus of c.£1.3m per annum based on 2008 prices.

Option 3

5.15.4 Capital costs for Option 3 are estimated to be **£15,116,617** (£21,767,928 with optimism bias) based on 2008 prices. Operating costs are predicted to be **£6,059,000** per annum and revenue is estimated at **£4,429,000** per annum. This creates a deficit of c.£1.6m per annum based on 2008 prices. This option therefore fails the proposed criterion that there should be no revenue deficit.

Option 4

5.15.5 Capital costs for Option 4 are estimated to be **£54,019,024** (£77,787,394 with optimism bias) based on 2008 prices. Operating costs are predicted to be **£3,510,000** per annum and revenue is estimated at **£5,990,000** per annum. This creates a surplus of c.£2.5m per annum based on 2008 prices.

Option 5

5.15.6 Capital costs for Option 5 are estimated to be **£14,824,013** (£21,346,578 with optimism bias) based on 2008 prices. Operating costs are predicted to be **£4,430,000** per annum and revenue is estimated at **£4,070,000** per annum. This creates a deficit of c.£0.36m per annum based on 2008 prices. This option therefore fails the proposed criterion that there should be no revenue deficit,

Option 6

5.15.7 Capital costs for Option 6 are estimated to be **£43,845,892** (£63,138,084 with optimism bias) based on 2008 prices. Operating costs are predicted to be **£4,070,000** per annum and revenue is estimated at **£6,100,000** per annum. This creates a surplus of c.£2.03m per annum based on 2008 prices.

Option 7

5.15.8 Capital costs for Option 7 are estimated to be **£14,824,013** (£21,346,578 with optimism bias) based on 2008 prices. Operating costs are predicted to be **£5,234,000** per annum and revenue is estimated at **£4,386,000** per annum. This creates a deficit of c.£0.84m per annum based on 2008 prices. This option therefore fails the proposed criterion that there should be no revenue deficit,

5.16 Evaluation of individual links

5.16.1 The various links proposed carry different combinations of trips and show a variable sensitivity to the speed of the service. These differences are the product of the speed of alternative options open to travellers for each Origin – Destination pair on the whole network.

5.16.2 The impact of different levels of infrastructure provision on each link was tested in four ways and results shown in Table 5.1:

- Assuming all links are to the High Segregation Option (HSO), except one which is tested with the Low Segregation Option (LSO) to assess the significance of lower investment in that specific link;
- Assuming all links are LSO, except one which is assumed to receive nil investment;
- Assuming nil investment throughout except for one single link, which is tested at both LSO and HSO levels of provision.

5.16.3 The results need interpretation with care. Examining the effects of investment in single links on an otherwise nil investment base case shows that, in general, single links make little overall impact on the numbers of passengers attracted to the service - without the rest of the orbital service there are few orbital travellers to benefit from this infrastructure. The major exceptions are where the link carries large numbers of radial passengers, namely:

- The link from Gogar to Newbridge;
- The links between Newcraighall and The Infirmary;
- The link between Sheriffhall and The Infirmary where the model includes 675k trips pa which are wholly radial between Sheriffhall and the hospital, all of which could use alternative radial services.

5.16.4 The other exception is the link between Lothianburn and Hermiston. The significance of this link is that it facilitates a large number of potential orbital movements. Even in isolation this link has the potential to attract significant passenger demand to a service. The importance of this link is further emphasised by the significant effect of removing it from the LSO, and the HSO option naturally has a bigger impact.

	HSO Base	LSO Base	Nil Base	Nil Base
Link	Traffic loss if link is LSO ('000 trips pa)	Traffic loss if link is nil investment ('000 trips pa)	Traffic gain if link is LSO ('000 trips pa)	Traffic gain if link is HSO ('000 trips pa)
Newcraighall to Infirmary	933 (15.6%)	158 (3.9%)	374 (11.4%)	610 (18.7%)
Infirmary to Sheriffhall	667 (11.1%)	99 (2.4%)	95 (2.9%)	231 (7.0%)
Sheriffhall to Straiton	935 (15.6%)	45 (1.1%)	26 (0.8%)	170 (5.2%)
Straiton to Lothianburn	747 (12.5%)	78 (1.9%)	20 (0.6%)	100 (3.0%)
Lothianburn to Hermiston	920 (15.3%)	436 (10.7%)	369 (11.3%)	626 (18.9%)
Hermiston to Edinburgh Park	642 (10.7%)	122 (3.0%)	52 (1.6%)	145 (4.4%)
Edinburgh Park to Gogar	605 (10.1%)	55 (1.3%)	289 (8.8%)	450 (14.0%)
Gogar to Newbridge	559 (9.3%)	185 (4.6%)	421 (12.9%)	546 (16.7%)

Table 5.1: Summary of Link Results

5.16.5 On its own however even the link between Lothianburn and Hermiston does not appear to increase usage sufficiently to make orbital services viable. It is the package of links that make up the whole that make a significant difference to the volume of traffic attracted to the service. Examining the effect of taking out single links from the HSO shows that most of them would result in a significant loss of patronage. It is thus the synergy of the whole route upgrade that has benefits for a wide range of individual trips that makes the impact on overall demand. (Similarly it is only the whole package of links that would significantly reduce total resource requirements and cut operating cost.)

5.16.6 The projected demand growth derived from most of the more limited LSO investment in individual links is however very modest, both individually and cumulatively.

Torphin Bridge to Hermiston

5.16.7 The demand at Hermiston is very unequal, with much more traffic between Hermiston and Edinburgh Park than between Hermiston and the eastern end of the route. The effect of routing all services via Hermiston is however to extend the travel times between the eastern end of the route and Edinburgh Park / Gogar which represents a delay to much larger flows of passengers making such trips. The effect of omitting any direct link from Hermiston eastwards would therefore be to lose that traffic, but to attract additional demand to the faster direct service between Edinburgh Park and the east.

5.16.8 Therefore two service options were tested against the HSO:

- operating all services via Hermiston; versus
- omitting Hermiston on services from Lothianburn (and beyond) and deleting the HSO link from Torphin Road Bridge to Hermiston, but serving Hermiston with a frequent shuttle service from Gogar.

5.16.9 The results showed a potential small net loss of traffic of 33k trips per annum (1.5%) from removing the infrastructure link between Torphin Bridge and Hermiston and removing direct services between Hermiston and the east. This suggests that the gain from providing direct services from Lothianburn to Edinburgh Park might balance any loss from serving Hermiston eastwards on orbital journeys and the cost of the direct link between Hermiston and Torphin Bridge might be saved. This section also gives rise to noted environmental concerns which might be avoided.

5.16.10 This conclusion does need to be treated with caution. The degree of bus priority proposed between Torphin Bridge and the A71 Calder Road is limited to a bus lane on the approach to the junction with the A71 and pre-signals could be provided on the approach to the signal controlled roundabout. Here the A720 Edinburgh Bypass suffers from significant congestion and therefore the average running speeds would still be low in the peak periods and journey times unpredictable. In practice the time savings for running direct between Lothianburn and Edinburgh Park may therefore be less than we have assumed in the model.

5.16.11 Alternative ways of linking Torphin Bridge directly to Edinburgh Park, avoiding congestion on the A720, that were not identified or considered in this study should be explored further in a taking the project forward.

Straiton to The Royal Infirmary

5.16.12 The route between Straiton and the Royal Infirmary via Sheriffhall is indirect and adds significantly to travel mileage and time for all demand from Straiton and points west of there to the Infirmary and points east. Providing a direct link between Straiton and the Infirmary would provide a faster service and potentially increase orbital demand. However Sheriffhall itself is projected to generate significant demand:

- 675k trips pa to/from the Infirmary, although these trips may be expected to transfer to other radial services if the Orbital Bus did not operate via Sheriffhall (though with a loss of revenue to the orbital services themselves);
- Park & Ride or interchange traffic from Midlothian to Musselburgh / Queen Margaret University – these could be catered for by direct services from Midlothian;
- Park & Ride or interchange traffic from Midlothian and Shawfair towards the west – these too could be catered for by direct services from Midlothian.

5.16.13 The affect of providing a direct link from Straiton to The Infirmary in the HSO was modelled and projected to gain 245k additional orbital trips, but to lose 675k radial trips pa between the Infirmary and Sheriffhall, a net loss to the orbital service of 430k trips pa. Nevertheless, in terms of meeting the strategic objectives this option might be considered to represent a net benefit (despite the net overall loss of traffic on orbital services) since the radial trips between Sheriffhall and the hospital are not part of the purpose of the project and can be provided for by other means.

5.17 Park & Ride / Interchange

5.17.1 A number of interchange points represent (in the model) a combination of Park & Ride opportunities and interchange points between Orbital services and radial bus services. Such interchange represents inconvenience and a potential time penalty for through passengers. Due to the relatively high number of projected trips drawn from extensive catchment areas, potentially significant numbers of passengers are affected by the delays arising from interchanges, and would be better served by through services.

5.17.2 The model was based on TMfS which is not constructed to enable detailed origins to be identified within zones. However the effect of adding or removing an interchange penalty could be replicated in the spreadsheet model, giving a broad indication of the scale of the potential increase in demand that might be achieved by replacing interchange with through services.

5.17.3 The combined impact of the interchange penalties at Newbridge, Hermiston, Lothianburn, Straiton and Sheriffhall was modelled and showed a potential 613k additional trips (10.5% increase) from providing frequent through services from West Lothian and Midlothian onto the orbital route. The actual volume of additional trips attracted would depend upon the frequency of such through services in comparison with the level of interchange opportunities.

6 Summary of Appraisal Conclusions

6.1.1 The appraisal has identified that a Quality Orbital Bus service around the A720 corridor can deliver the strategic objectives of the Regional Transport Strategy. Furthermore, given sufficient segregation from road traffic congestion, high frequency services could be operationally self-funding.

6.1.2 The appraisal has shown that without investment in improved infrastructure, a viable service cannot be operated along the study corridor. It has also shown that, in order to have a significant impact on orbital travel opportunities and to effect significant mode switch, there needs to be a step-change in the quality of service offered. Along the orbital corridor between Gogar and Musselburgh a high frequency orbital service and its associated infrastructure does have the potential ability to make such a considerable improvement to travel times for orbital demand, and thus to effect a real impact on mode choice.

6.1.3 By contrast the road sections north of Newbridge (A8000) and also east of Musselburgh (A1) do not cause substantial delays to buses, whilst the current delays on the Forth Road Bridge cannot reasonably be avoided until the new Forth crossing is provided. The present services are both fast and frequent. In these circumstances the orbital infrastructure adds little value to the present network and investment in additional infrastructure cannot be justified on the basis of benefits to orbital movement.

6.1.4 The low segregation options have a limited contribution to make towards the strategic aims of the project, and especially in terms of altering mode share. However it is recognised that, in comparison to the high segregation options, they have a lower cost and a lower environmental impact and therefore cannot be discounted from further development on these grounds alone.

6.1.5 However the nil investment and low segregation options do not generate enough revenue to cover their annual operating costs and can be discounted from further development on these grounds.

6.1.6 The sensitivity tests exploring the impact of alternative land use development distribution suggests that the traffic forecasts are robust. These alternative land-use plans are considered by the planning authorities to be realistic and probable outcomes. Whilst they are currently insufficiently detailed to allow a firm forecast of revenue and demand, the implications are that the redistribution of residential development would increase the demand for high quality orbital services, enhance the strategic value of the project and its improve its financial viability.

6.1.7 It is therefore the recommendation of this STAG Part 1 Study that the following options are taken forward for further detailed analysis and appraisal following the STAG Part 2 guidance:

- Option 4 – All high segregation from Newbridge to Musselburgh with 12 buses per hour throughout. Estimated capital cost £54M (2008 prices excluding optimism bias); estimated demand c.5.9 million passenger trips per annum.
- Option 6 – All high segregation from Newbridge to Musselburgh with composite timetable of overlapping services from off-route origins/destinations. Estimated capital cost £44M; estimated demand c.6.1 million passenger trips per annum.

6.1.8 The segregated infrastructure required will include sections of busway, bus-lanes alongside existing roads and some enhanced bus priorities on existing roads. There is, in part, an unavoidable intrusion into the greenbelt and agricultural land. The construction of new sections of road will therefore have some adverse environmental effects, but these can largely be mitigated by keeping the new busways close to existing road alignments and by careful design.

6.1.9 In developing detailed proposals for a STAG 2 appraisal the following criteria are also key issues for consideration:

- Only a high degree of segregation of the bus service from congested road traffic conditions can deliver the quality of service that will persuade travellers to commit to the orbital service and effect real mode shift;

- Only a high degree of segregation of the bus service from congested road traffic conditions can reduce operating costs to the point where revenue can potentially cover all costs;

- The synergy of the whole route is of great significance and provision of individual links in isolation will not deliver strategic benefits or enable a viable orbital service to be operated. The provision of infrastructure that enables orbital services to travel swiftly from Gogar, Edinburgh Park, Lothianburn, Straiton, the New Edinburgh Infirmary and Queen Margaret University should be seen as the 'Orbital Package';

- Even so, these links are not all of equal merit, and in particular a link eastwards from Hermiston towards Lothianburn has low contributory value and high environmental impacts between Hermiston and Torphin Bridge; an alternative way of linking Lothianburn directly to Edinburgh Park without passing through Baberton merits further investigation;

- Radial improvements between Newbridge and Gogar, and also between Sheriffhall and the Infirmary, appear to offer considerable benefit, but these sections are of greater value to radial than to orbital services, and are not critical to delivering orbital services around the city;

- The interchange points at Gogar, Lothianburn, Straiton, Newcraighall and Musselburgh provide essential opportunities for interchange with radial routes and other modes, extending the benefits of the orbital service into surrounding areas;

- The volumes of through traffic suggest there is a strong case for through services from many areas outside the city and beyond the orbital corridor, including East Lothian, Dalkeith and Penicuik, West Lothian and possibly Fife; and

- The optimal spacing of stops along the orbital corridor requires more detailed assessment, but these must be limited in number and concentrated on major points of boarding and alighting so that the overall quality and speed of the service is not compromised.

7 The Vision

7.1 Introduction

7.1.1 The employment area to the west of Edinburgh has been identified in the West Edinburgh Planning Framework as one of the most important opportunities in Scotland to attract internationally mobile headquarters development. A number of factors combine to give the area a competitive advantage over other UK and European investment locations including a strategic location within the Central Belt with major road links and firm proposals for the introduction of heavy and light rail networks; and proximity to major centres of population and within commuting distance of a large and talented workforce.

7.1.2 However a significant part of the population growth has occurred and is planned to occur, to the south and east of the city in Midlothian and East Lothian. There are also key employment developments taking place in those areas as well, notably at the New Edinburgh Infirmary, Shawfair and The Bush, which create their own demands for commuting trips. It is unfortunate, but inevitable, that efforts to balance the numbers of jobs and homes in any one area may mitigate but will not eliminate the pattern of commuting across the city which will take place.

7.1.3 The A720 Edinburgh bypass is the main artery linking these areas, and it is a road which is already under stress at peak periods. Additional demands for orbital travel can only add to the present problems, whilst additional cars accessing the employment areas will also add to local problems of road and parking capacity. The development strategies for the region all stress that it is essential that the growth in car trips is minimised and public transport alternatives are maximised.

7.1.4 At present the alternative public transport options are limited. There is a cross city rail service linking the few areas to the east which have railway stations to Edinburgh Park and South Gyle (and in the future a new station at Gogar). There are cross city bus services, though these are themselves caught up in city centre congestion and provide only a slow and lengthy link. The evidence is that, for those who do have a car available, the public transport options do not persuade them to leave the car at home, whilst many of those who do not have access to a car are not in a position to benefit from the new opportunities being created.

7.1.5 The South East Scotland Regional Transport Strategy has identified these orbital links around Edinburgh as a key issue, and identified a Bus Rapid Transit or Quality Bus Service as the most likely solution to the identified problem. This study confirms that such a service, given sufficient segregation from congestion, has the potential to attract up to 6.5 million passenger journeys a year, sufficient to support a core frequency of 12 buses per hour on a self-financing basis. The necessary infrastructure would comprise a mixture of separate busways, bus lanes alongside existing roads and local bus priorities at key junctions. The level of demand is expected to be sufficient to support viable through services from the major origins outside the corridor in East, West and Midlothian, and possibly Fife. Park and Ride facilities, linked also to the surrounding areas by quality walking and cycling facilities, and served also by radial bus and rail routes, would integrate the orbital service with the wider regional public transport network, opening up a wide range of new travel opportunities. Key interchange points are identified at Gogar, Hermiston, Lothianburn, Straiton, Newcraighall and Musselburgh.

7.1.6 The nature of the Edinburgh Orbital Bus Project has been evolved through the parallel analysis of:

- the potential market and the travel patterns of future users;
- the alternative methods of operation and procurement;
- the alternative route and alignment options within the study corridor;
- the rolling stock and guidance technology options; and
- fares and ticketing issues.

7.1.7 These were developed jointly with the client, SEStran, through workshop sessions, and the outcome of those discussions feeds back into the process of evaluating the options most appropriate to the Edinburgh Orbital Bus scheme.

7.1.8 A STAG 1 appraisal of the infrastructure options and operating patterns has been carried out which provides strong support for the concept of a high-quality orbital bus route with a considerable degree of segregated operations and supporting bus priorities, serving the orbital corridor and areas beyond.

7.2 Edinburgh Orbital Infrastructure

7.2.1 The core section of the recommended orbital service comprises a semi-circle stretching from Queen Margaret University in Musselburgh to the east to Gogar in the west. It is critical to the orbital concept that a high degree of segregation is achieved along the whole of this core route, and limited piecemeal enhancements to individual links will not deliver the orbital service that is strategically required.

7.2.2 From the east the enhanced infrastructure will comprise:

- A segregated link between Queen Margaret University site and Newcraighall village, probably using the disused railway alignment but alternatively across agricultural land;
- Bus priorities on the existing road between Newcraighall village and the Newcraighall railway station and P&R site;
- On-street bus priorities between Newcraighall and Fort Kinnaird, with new bus interchange facilities at Fort Kinnaird;
- New segregated busway between Fort Kinnaird and the New Edinburgh Infirmary;
- Bus lanes alongside the A7 between the Infirmary and Ferniehill Road and then a segregated busway to Straiton retail park and P&R site;
- A segregated busway along the south side of the A720 between Straiton and the proposed Lothianburn P&R site;
- Bus lanes created by use of the hard-shoulder alongside the A720 between Lothianburn and Torphin Bridge, where (westbound) prioritised traffic signals would enable buses to join the main A720 carriageway to the Wester Hailes interchange;
- A congestion free link (which requires to be further considered) between Wester Hailes interchange and Edinburgh Park, either directly or via Baberton and Hermiston;
- A segregated busway through the heart of the Edinburgh Park business development to a new bus, rail and tram interchange at Gogar.

7.2.3 The further extension of the infrastructure westward to Edinburgh Airport and Newbridge would appear to have very high value, though more to the existing radial services than to any new orbital services, and would not be critical to the delivery of the orbital concept.

7.3 Edinburgh Orbital Services

7.3.1 Two route patterns have been examined as part of this assessment, and of course many others are possible. A key finding of the demand modelling is that a substantial proportion of the potential market is for travel from residential areas outside the orbital corridor, and especially in the development areas of East, West and Midlothian (and possibly Fife) to destinations located within the orbital corridor.

7.3.2 The details of the service patterns, the routes and specific linkages that are created, do not require to be defined in detail or fixed over time. To maximise its value, the infrastructure should be made available to operators who see opportunities to make use of it in whole or in part to improve their operations and to provide improved links to the many intensive activity sites located along the corridor.

7.3.3 Interchange is always a disincentive to the use of any particular journey by public transport. It enforces a disruption to the journey, which may entail going into the outdoor environment in inclement weather. It causes a delay which, even if minimised by high frequency and reliable operation of both services concerned, is nevertheless always greater than a through journey. It gives rise to a degree of uncertainty and even risk that a journey will not be completed as planned. The volumes of through travel from outside the orbital corridor suggest strongly that through services should be possible, viable and attractive for a range of origin-destination pairs, thus maximising through travel opportunities and minimising the need to change. It is important to maximise these through travel opportunities. However some interchange is unavoidable as the market for some links across the network is too small and too fragmented to sustain separate though services at acceptable frequencies. It is a strength of the Edinburgh City network, and potentially a considerable strength of the new orbital service, that connections will open up many new travel opportunities through making one convenient change.

7.3.4 The extension of routes into the Edinburgh hinterland has a number of consequences both for operations and for procurement;

- Orbital services and radial services can potentially be synchronised to maximise service levels along common parts of routes;
- The orbital services could serve a number of interchange points outwith the orbital corridor as well as key interchanges along it;
- A number of operators in the regional bus market may be involved because the services will cross the current 'boundaries' of operating territories;
- The orbital services may require to be integrated into ticket and marketing initiatives by different companies in different areas.

7.3.5 However this approach has a weakness in that it makes it more difficult to establish the orbital service as a distinctive and identifiable product, to raise its profile and to capture the public imagination for a new transport facility substantially unlike the current services, and which provides a new range of travel opportunities.

7.4 The vehicles

7.4.1 A bespoke system using unique vehicles, such as the First Bus 'ftr' scheme in York, can have a major impact on public perceptions, separating the BRT system from the image of the 'ordinary' bus and hence increasing the level of use. However there is evidence, for example from the Fastrack service in Dartford, Kent, that a high quality of operation with a smart and distinctive image and actively promoted, can achieve high levels of user acceptability and usage without distinctive high tech vehicles, and the considerable cost savings from not having to purchase a dedicated fleet is obviously an advantage. The savings in infrastructure and fleet costs must to some extent be offset by putting in place quality management systems and extensive marketing efforts.

7.4.2 The combination of high quality vehicles with dedicated routes and high degrees of segregation, can combine to create new markets for bus travel and attract car drivers onto bus services without the infrastructure and fleet costs of advanced vehicle technology systems. The key appears to be to deliver the right service network at a consistent standard, and to make it stand out for the rest of the network as a distinctive product.

7.4.3 A review of alternative fuels has identified that there are a number of options for reducing local emissions at point if use, through electric or hybrid diesel-electric propulsion. These currently have a modest price premium, although they are increasing becoming mainstream products. Reducing local impacts may of particular significance where a service operates in a sensitive urban environment, whether the requirement is to minimise vehicle emissions or noise. However in relation to the EOB no such critical environments have been identified.

7.4.4 Wider concern for the global impact of emissions, notably CO2, is less evidently resolved by currently available alternative fuel technologies. The major benefits to these global concerns are best achieved through mode switch from the use of private cars to mass transport modes. A well utilised bus service has potentially less than one quarter of the emissions per person of the average single user car.

7.4.5 The implications of a network of orbital services provided by a number of operators, each integrating the orbital services with their normal fleet procurement and technical policy references, is that the vehicles supplied are likely to be based on conventional modern low-emission diesel technology, and no compelling reason has been identified to specify any alternative policy for orbital services.

7.5 The Edinburgh Orbital Brand

7.5.1 There would be strong advantages in proceeding on the basis that the service is a single specification, promoted under a single identity to consistent standards, with unified publicity, information and ticketing. This would enhance public comprehension and the impact of the new service, which will help to build confidence and patronage.

7.5.2 The ability to specify and secure the desired quality of service, its frequency of operation, operating hours and fares will depend upon the nature of the contractual agreements that can be made between the sponsors and the operator(s).

7.5.3 The provision of extensive lengths of dedicated busway, legally classified as a private road, gives the infrastructure provider the means to restrict access to approved operators. This restriction can be used to set reasonable quality standards, provided it is not used to discriminate between operators who meet those standards or to limit their commercial freedom.

7.5.4 Alternatively quality standards might be set and enforced for the whole corridor, including on-street sections through a multi-operator Statutory Quality Partnership. However the overlap of orbital and radial services on many sections implies that this would be a very complex Partnership to devise.

7.5.5 In the UK there are a number of contracted services, typically park and ride services, that require very high standards and include the following features:

- elements of operation off the public road that enable the contracting authority to legitimately restrict access;
- precise vehicle specifications;
- training requirements of drivers and restricted rota of drivers;
- requirement to carry a promotional livery;
- requirements to meet marketing and passenger information standards and/or to provide vehicles equipped to drive automated real-time passenger information systems;
- associated services (sometimes let as a separate contract) such as site or interchange security, maintenance and management.

Each of these elements is potentially of relevance to the Edinburgh Orbital Bus concept.

7.5.6 If the Edinburgh Orbital service is to be integrated with the networks of more than one operator in the region, this implies establishing a joint marketing policy, which would necessarily include a degree of compromise on the normal fleet identities of the individual operators. This however is no longer an unusual marketing device, and the extensive branding used by Lothian Buses, with varied liveries and logo to distinguish their different routes, is now widespread practice. It is envisaged that an 'Orbital' brand could be established that would not be incompatible with the freedom of each operator to integrate operations with their own networks.

7.5.7 The experience of other high quality service products, even within a single operating company, is that a dedicated marketing manager is required, with sufficient authority to set and enforce brand service standards as well as to develop a unique product and image.

7.6 Ticketing

7.6.1 The emerging structure of the Orbital Bus Project as an infrastructure shared by several operators providing services which extend out of the orbital corridor means that fares structures and fares systems will need to be integrated with each operator's own established policies and practices.

7.6.2 The speed of operation has been found to be an essential attribute of the orbital service if passengers are to be attracted to use it. One element of ensuring fast

operation is minimising boarding times. These in turn are significantly affected by fare collection practices. Off-bus ticket sales are a very effective means of speeding up operations and, in formulating a Quality Bus Partnership or operating framework agreement, the method of ticket sales should be considered with a view to maximising the use of pre-purchased tickets. This should include:

- Consideration of the provision of bus-stop ticket machines capable of selling single operator or multi-operator tickets;
- Maximising the use of multi-operator and multi-trip tickets;
- Examination of off-bus sales opportunities though Pay-Point or other outlets;
- Considering whether vehicles should be equipped with on-board ticket issuing and verifying machines at all entrances. Alternatively provision should be made for the mounting of ITSO-compliant Smart Card readers in the vicinity of boarding and alighting doors of vehicles, without ticket purchasing facilities.
- Consideration of the possibility of using the Orbital Bus as a test bed for developing m-ticket applications that might, in time, become more widely applicable across the network.

7.6.3 Given the degree of integration between network within and outwith the city of Edinburgh, joint ticketing would very clearly be a potentially major asset to the network. One-ticket provides the established basis for a region-wide integrated ticketing product.

7.6.4 Transport Scotland has recently issued a consultation paper on how smartcard ticketing may evolve over the next few years, and an integrated Orbital Bus network might be the ideal test-bed for new products developed within the resultant national framework.

7.7 Procurement

7.7.1 Whatever approach is taken to procuring orbital services the need for a clear, unambiguous specification for the service is evident. This is both to ensure that the service provided matches expectations and delivers the scheme objectives, and also to ensure that both sponsors come to an agreed expectation about the details of service levels and standards. This will also provide a clear basis on which to monitor outcomes and to adapt the service to the evolving circumstance.

7.7.2 The nature of the market for orbital services, and of the current bus market in the region, suggests that the maximum benefit from the project will be derived by opening access to the infrastructure to a number of operators who would benefit from it. The services on the busway should be an integral part of each operator's

network, whether they use a single link or more substantial sections to develop new routes and travel opportunities.

7.7.3 Operators should however be encouraged or required (so far as is practical) to adopt high quality standards in terms of:

- Their choice of vehicles;
- Their reliability of operation;
- Participation in network ticketing; and
- Their presentation of services as part of an 'Orbital' family of services, where they make significant use of the infrastructure.

7.7.4 Given the prospective viability of orbital services it is anticipated that there will be no difficulty in attracting commercial operators to use the orbital infrastructure, although without the infrastructure commercial orbital services would appear not to be possible. Three options therefore present themselves for procurement:

- That, like 'greenways' and other on-street bus priorities, the infrastructure is simply made freely available to all operators who meet pre-defined quality standards;
- That access to dedicated busway sections might be limited to 'partner operators' who have signed up to deliver agreed standards of quality and contribute to the creation and maintenance of an Orbital brand; or
- That a Statutory Quality Bus Partnership is put in place to secure consistent standards of operation from partners along the whole corridor, including both on-street and busway sections.

7.7.5 Any of these options may require to be backed by contracts to procure complementary services in periods of low demand such as evenings or Sundays, but only as far as may be necessary where these are not offered commercially by any of the potential operators involved.

7.7.6 Raising funds from an access charge to those sections of the infrastructure which are exclusive and dedicated busways is a possibility, but needs to be approached with care. Such a policy would reduce consumer benefits and undermine strategic policies to integrate fares and ticketing policies across the city and between modes.

7.7.7 Early operator involvement is a requirement of a QBP, and in any case has considerable advantages to the infrastructure provider in that it would enable agreed operating standards and best practice to be built into the design and programme for the project from an early stage.

7.8 Operating Partners

7.8.1 The early creation of a potential operating partnership is recommended to contribute to the further development of the Orbital Bus concept. Early operator involvement would be a statutory requirement if a statutory Quality Bus Partnership is ultimately developed. The partnership should include the three operators already running commercial networks in the area covered by the orbital corridor, namely Lothian Buses, First Group and Stagecoach, but not be exclusive if other partners wish to join on equal terms.

7.8.2 The partnership should be involved in concept development to establish operating requirements and optimise the infrastructure. The value of operator involvement in the design process should not be underestimated, and the process can also be expected to increase operator commitment to operation of suitable services once the infrastructure is in place.

7.8.3 The details of route options will need to be developed to a STAG 2 stage including, consultation with all interested stakeholders and public consultation with land owners, businesses and residents.

7.8.4 The Outline Business Case suggests that operations should be substantially viable without revenue support. The operating surplus however is modest in relation to scheme costs, and it is therefore inevitable that a substantial element of external capital funding will be required. A full business case will require to be developed for this capital investment. A development phasing programme can also be designed, although it requires to be borne in mind that the demand appraisal carried out in this study shows strong synergies between segments of the route and piecemeal development of individual segments is unlikely to produce a viable or effective project.

7.8.5 Sources of private funding contributions should be explored, which might include input from businesses in the major development areas. In view of the level of the projected operating surplus, user charges to bus operators on the route are possible, though these should be considered carefully so as not to undermine the integration benefits or depress ridership and the consequent scheme benefits.

Appendix A

Appraisal Summary Tables

Proposal Details			
Name and address of authority or organisation promoting the proposal: (Also provide name of any subsidiary organisations also involved in promoting the proposal)	South East of Scotland Transport Partnership First Floor, Hopetoun Gate, 8b McDonald Road, Edinburgh, EH7 4LZ		
Proposal Name:	**Option 1**	Name of Planner:	*SEStran*
Proposal Description:	Nil investment; 12 buses per hour throughout between Inverkeithing and Wallyford on existing roads.	Estimated Total Public Sector Funding Requirement:	Capital Cost = nil Capital Cost inc. Optimism Bias = nil Revenue deficit = £3.2 million pa
Funding Sought From: (if applicable)	N/A	Amount of Application:	N/A
Background Information			
Geographic Context:	The SEStran region covers a diverse range of areas across 8 local authority areas. The region covers 3,180 square miles and is home to 28% of the Scottish population. The area has a wide range of urban and rural environments with a major capital city in Edinburgh, to very rural areas in East Lothian. The level of transport provision generally reflects the geography of the area, with the densely populated areas supporting well developed public transport systems, which diminish as areas become less densely populated. Reflecting this, the levels of traffic congestion vary enormously across the area, whilst a number of regional bottlenecks, such as the Edinburgh City Bypass and the Forth Crossings, are particularly prone to congestion. The study corridor follows the general route of the A720 City of Edinburgh Bypass. This is an important strategic route linking a number of key trunk roads including the M8, the A1, the A68 and the A702. It is also includes several critical interchanges for radial routes into the centre of Edinburgh. There are a number of residential and employment related developments planned within the study		

	corridor which will increase the demand to travel on the existing network if no further services are put in place.
Social Context:	The Scottish Index of Multiple Deprivation (SIMD) 2006 data suggests that the level of deprivation along the study corridor is relatively low. An analysis of Scottish Parliament constituencies along the study corridor shows that the percentage of the total population that are income deprived are all well below the Scottish average (14.2%) with the exception of Edinburgh East and Musselburgh (15.5%). Similarly, the percentage of employment deprived people along the study corridor compares favourably with the national average of 13.1%. Again the only Scottish Parliament Constituency along the route with a higher level of employment deprivation is Edinburgh East and Musselburgh with 13.5%. According to the 2001 Census data car ownership along the study corridor is broadly in line with the national average. 34.2% of all Scottish households do not have access to a car. For 4 out of 5 Scottish Parliament constituencies along the study corridor have between 28 and 36% of households without access to a car. The notable exception again being Edinburgh East and Musselburgh where the average is considerably higher at 41.9% of households without access to a car.
Economic Context:	The City of Edinburgh is a major centre of economic activity and employment in Scotland. It is therefore the main source of economic growth and the focus of future development in the SEStran area. There are several centres of economic activity within the study corridor including, The Gyle, Edinburgh Park, Shawfair and Edinburgh Royal Infirmary. Census data shows a clear demand for travel along the route to reach these economic centres. Current service provision requires users along the study corridor to either travel by car on the A720 or to travel into the city centre and back out again on radial public transport routes to access these services.

Planning Objectives

Objective:	Performance against planning objective:
• To aim towards achieving RTS mode share targets within the study corridor; • To aim towards achieving RTS environmental targets within the study corridor; • To ensure the integration of public transport with existing and proposed land-use within the study corridor; • To improve community and comparative (local and wider) accessibility by public transport, especially to employment and health; and	• Minor Beneficial • Neutral • Minor Beneficial • Minor Beneficial

• To make public transport journey times, reliability and quality attractive versus single occupancy private car served study corridor.	• Neutral

Rationale for Selection or Rejection of Proposal:	**Reject** – This nil investment option is being rejected from further consideration as modelling has shown it is unlikely to attract a significant level of patronage and it operates at a deficit of £6.5m per annum. Without investment in segregated links it has been shown that a viable service is not possible.
Implementability Appraisal	
Technical:	No technical issues impede this option.
Operational:	Bus operation will be constrained by the impacts of continuing congestion which will adversely affect service reliability. This is likely to become worse over time.
Financial:	No capital costs proposed. Operating costs are predicted to be £6,556,000 per annum and revenue is estimated at £3,268,000 per annum. This creates an annual deficit of c.£3.2m per annum based on 2008 prices. No revenue resources identified to sustain this deficit.
Public:	The general consultation over the Regional Transport Strategy secured general public approval for an effective orbital transport alternative to the private car. The individual options have not been subject to public consultation.

Government's Objectives for Transport		
Objective	Assessment Summary	Supporting Information
Environment:	Neutral	Likely to lead to an increase in noise and vibration through addition of extra vehicles to the existing road network and no modal shift to public transport occurring. Although the dominant noise source is from the road network the impact anticipated will be minor adverse. The implementation of additional public transport onto the existing road network will result in long-term adverse impacts to air quality with no anticipated modal shift taking place.

Safety:	Neutral	No safety implications.
Economy:	Neutral	No significant mode shift impacts. Some small time savings for existing public transport users will encourage change in route, but unreliability will remain a deterrent to public transport use. No significant impact on business, employment or the economy.
Integration:	Minor Beneficial	Integrated with planning policy to support key growth areas. Interchange opportunities' with other transport modes on main radials, but limited levels of use of these opportunities is forecast. Enhances public transport network, but negligible relief of strategic network traffic or congestion.
Accessibility & Social Inclusion:	Minor Beneficial	Modestly enhanced travel opportunities for people without cars to employment, education and health facilities.

Proposal Details			
Name and address of authority or organisation promoting the proposal: (Also provide name of any subsidiary organisations also involved in promoting the proposal)	South East of Scotland Transport Partnership First Floor, Hopetoun Gate, 8b McDonald Road, Edinburgh, EH7 4LZ		
Proposal Name:	**Option 2**	Name of Planner:	*SEStran*
Proposal Description:	All high segregation from Inverkeithing to Wallyford with 12 buses per hour throughout.	Estimated Total Public Sector Funding Requirement:	Capital Cost = £54,311,628 Capital Cost inc. Optimism Bias = £78,208,744
Funding Sought From: (if applicable)	N/A	Amount of Application:	N/A
Background Information			
Geographic Context:	The SEStran region covers a diverse range of areas across 8 local authority areas. The region covers 3,180 square miles and is home to 28% of the Scottish population. The area has a wide range of urban and rural environments with a major capital city in Edinburgh, to very rural areas in East Lothian. The level of transport provision generally reflects the geography of the area, with the densely populated areas supporting well developed public transport systems, which diminish as areas become less densely populated. Reflecting this, the levels of traffic congestion vary enormously across the area, whilst a number of regional bottlenecks, such as the Edinburgh City Bypass and the Forth Crossings, are particularly prone to congestion. The study corridor follows the general route of the A720 City of Edinburgh Bypass. This is an important strategic route linking a number of key trunk roads including the M8, the A1, the A68 and the A702. It is also includes several critical interchanges for radial routes into the centre of Edinburgh.		

	There are a number of residential and employment related developments planned within the study corridor which will increase the demand to travel on the existing network if no further services are put in place.
Social Context:	The Scottish Index of Multiple Deprivation (SIMD) 2006 data suggests that the level of deprivation along the study corridor is relatively low. An analysis of Scottish Parliament constituencies along the study corridor shows that the percentage of the total population that are income deprived are all well below the Scottish average (14.2%) with the exception of Edinburgh East and Musselburgh (15.5%). Similarly, the percentage of employment deprived people along the study corridor compares favourably with the national average of 13.1%. Again the only Scottish Parliament Constituency along the route with a higher level of employment deprivation is Edinburgh East and Musselburgh with 13.5%. According to the 2001 Census data car ownership along the study corridor is broadly in line with the national average. 34.2% of all Scottish households do not have access to a car. For 4 out of 5 Scottish Parliament constituencies along the study corridor have between 28 and 36% of households without access to a car. The notable exception again being Edinburgh East and Musselburgh where the average is considerably higher at 41.9% of households without access to a car.
Economic Context:	The City of Edinburgh is a major centre of economic activity and employment in Scotland. It is therefore the main source of economic growth and the focus of future development in the SEStran area. There are several centres of economic activity within the study corridor including, The Gyle, Edinburgh Park, Shawfair and Edinburgh Royal Infirmary. Census data shows a clear demand for travel along the route to reach these economic centres. Current service provision requires users along the study corridor to either travel by car on the A720 or to travel into the city centre and back out again on radial public transport routes to access these services.

Planning Objectives	
Objective:	Performance against planning objective:
• To aim towards achieving RTS mode share targets within the study corridor; • To aim towards achieving RTS environmental targets within the study corridor; • To ensure the integration of public transport with existing and proposed land-use within the study corridor;	• Major Beneficial • Minor Negative • Moderate Beneficial

• To improve community and comparative (local and wider) accessibility by public transport, especially to employment and health; and • To make public transport journey times, reliability and quality attractive versus single occupancy private car served study corridor.	• Major Beneficial • Major Beneficial

Rationale for Selection or Rejection of Proposal:	**Reject** – option 2 is being rejected from further consideration as very little demand is predicted from north of Newbridge or east of Musselburgh and these sections contribute little to the overall project.
Implementability Appraisal	
Technical:	No novel technology required. Policy innovation involved in the provision of hard-shoulder running for buses on a trunk road.
Operational:	No operational issues identified
Financial:	Capital costs are estimated at £54,311,628 based on 2008 prices. Operating costs are predicted to be £5,133,000 per annum and revenue is estimated at £6,467,000 per annum. This creates an annual surplus of c.£1.3m per annum based on 2008 prices.
Public:	The general consultation over the Regional Transport Strategy secured general public approval for an effective orbital transport alternative to the private car. The individual options have not been subject to public consultation.

Government's Objectives for Transport		
Objective	Assessment Summary	Supporting Information
Environment:	Minor Negative	A high level of modal shift is predicted from private car to public transport with this option and this therefore will have a positive effect on Greenhouse Gases along the length of the route. Adverse impacts during construction and also longer-term adverse impacts upon the natural and cultural heritage of the area, agriculture and soils, noise, vibration and air quality if this route is implemented. The setting of the Union Canal SAM will also be affected.

Safety:	Moderate Beneficial	Modest safety gains inherent in mode switch from private car to bus-based public transport.
Economy:	Moderate Beneficial	High mode shift from the private car. Significant accessibility gains to employment, education and health facilities in key growth areas.
Integration:	Moderate Beneficial	Integrated with planning policy to support key growth areas. Interchange opportunities with other transport modes on main radials.
Accessibility & Social Inclusion:	Major Beneficial	Significantly enhanced travel opportunities for people without cars to employment, education and health facilities.

Proposal Details			
Name and address of authority or organisation promoting the proposal: (Also provide name of any subsidiary organisations also involved in promoting the proposal)	South East of Scotland Transport Partnership First Floor, Hopetoun Gate, 8b McDonald Road, Edinburgh, EH7 4LZ		
Proposal Name:	**Option 3**	Name of Planner:	*SEStran*
Proposal Description:	All low segregation from Inverkeithing to Wallyford with 12 buses per hour throughout.	Estimated Total Public Sector Funding Requirement:	Capital Cost = £15,116,617 Capital Cost inc. Optimism Bias = £21,767,928 Revenue deficit = £1.6 million pa
Funding Sought From: (if applicable)	N/A	Amount of Application:	N/A
Background Information			
Geographic Context:	The SEStran region covers a diverse range of areas across 8 local authority areas. The region covers 3,180 square miles and is home to 28% of the Scottish population. The area has a wide range of urban and rural environments with a major capital city in Edinburgh, to very rural areas in East Lothian. The level of transport provision generally reflects the geography of the area, with the densely populated areas supporting well developed public transport systems, which diminish as areas become less densely populated. Reflecting this, the levels of traffic congestion vary enormously across the area, whilst a number of regional bottlenecks, such as the Edinburgh City Bypass and the Forth Crossings, are particularly prone to congestion. The study corridor follows the general route of the A720 City of Edinburgh Bypass. This is an important strategic route linking a number of key trunk roads including the M8, the A1, the A68 and the A702. It is also includes several critical interchanges for radial routes into the centre of Edinburgh.		

	There are a number of residential and employment related developments planned within the study corridor which will increase the demand to travel on the existing network if no further services are put in place.
Social Context:	The Scottish Index of Multiple Deprivation (SIMD) 2006 data suggests that the level of deprivation along the study corridor is relatively low. An analysis of Scottish Parliament constituencies along the study corridor shows that the percentage of the total population that are income deprived are all well below the Scottish average (14.2%) with the exception of Edinburgh East and Musselburgh (15.5%). Similarly, the percentage of employment deprived people along the study corridor compares favourably with the national average of 13.1%. Again the only Scottish Parliament Constituency along the route with a higher level of employment deprivation is Edinburgh East and Musselburgh with 13.5%. According to the 2001 Census data car ownership along the study corridor is broadly in line with the national average. 34.2% of all Scottish households do not have access to a car. For 4 out of 5 Scottish Parliament constituencies along the study corridor have between 28 and 36% of households without access to a car. The notable exception again being Edinburgh East and Musselburgh where the average is considerably higher at 41.9% of households without access to a car.
Economic Context:	The City of Edinburgh is a major centre of economic activity and employment in Scotland. It is therefore the main source of economic growth and the focus of future development in the SEStran area. There are several centres of economic activity within the study corridor including, The Gyle, Edinburgh Park, Shawfair and Edinburgh Royal Infirmary. Census data shows a clear demand for travel along the route to reach these economic centres. Current service provision requires users along the study corridor to either travel by car on the A720 or to travel into the city centre and back out again on radial public transport routes to access these services.

Planning Objectives	
Objective:	Performance against planning objective:
• To aim towards achieving RTS mode share targets within the study corridor; • To aim towards achieving RTS environmental targets within the study corridor; • To ensure the integration of public transport with existing and proposed land-use within the study corridor;	• Moderate Beneficial • Moderate Beneficial • Minor Beneficial

• To improve community and comparative (local and wider) accessibility by public transport, especially to employment and health; and • To make public transport journey times, reliability and quality attractive versus single occupancy private car served study corridor.	• Moderate Beneficial • Moderate Beneficial
Rationale for Selection or Rejection of Proposal:	**Reject** – option 3 is being rejected from further consideration as very little demand is predicted from north of Newbridge or east of Musselburgh and these sections contribute little to the overall project.
Implementability Appraisal	
Technical:	No novel technology required. Policy innovation involved in the provision of hard-shoulder running for buses on a trunk road.
Operational:	No operational issues identified.
Financial:	Capital costs are estimated at £15,116,617 based on 2008 prices. Operating costs are predicted to be £6,059,000 per annum and revenue is estimated at £4,429,000 per annum. This creates an annual deficit of c.£1.6m per annum based on 2008 prices. Operating costs unlikely to be fully self-financing and some revenue support likely to be required from public funds.
Public:	The general consultation over the Regional Transport Strategy secured general public approval for an effective orbital transport alternative to the private car. The individual options have not been subject to public consultation.

Government's Objectives for Transport		
Objective	Assessment Summary	Supporting Information
Environment:	Moderate Beneficial	Most adverse impacts with option 3 are restricted to the temporary phase of construction although there are some long term impacts focussed on agriculture and soils. This option however has the ability to bring about some longer term benefits given the expected modal shift from private car to public transport. This will see a

		reduction in noise and vibration along with improved air quality.
Safety:	Minor Beneficial	Modest safety gains inherent in mode switch from private car to bus-based public transport.
Economy:	Minor Beneficial	Modest mode shift from the private car. Some accessibility gains to employment, education and health facilities in key growth areas.
Integration:	Minor Beneficial	Integrated with planning policy to support key growth areas. Interchange opportunities with other transport modes on main radials.
Accessibility & Social Inclusion:	Moderate Beneficial	Modestly enhanced travel opportunities for people without cars to employment, education and health facilities.

Proposal Details			
Name and address of authority or organisation promoting the proposal: (Also provide name of any subsidiary organisations also involved in promoting the proposal)	South East of Scotland Transport Partnership First Floor, Hopetoun Gate, 8b McDonald Road, Edinburgh, EH7 4LZ		
Proposal Name:	**Option 4**	Name of Planner:	*SEStran*
Proposal Description:	All high segregation from Newbridge to Musselburgh with 12 buses per hour throughout.	Estimated Total Public Sector Funding Requirement:	Capital Cost = £54,019,024 Capital Cost inc. Optimism Bias = £77,787,394
Funding Sought From: (if applicable)	N/A	Amount of Application:	N/A
Background Information			
Geographic Context:	The SEStran region covers a diverse range of areas across 8 local authority areas. The region covers 3,180 square miles and is home to 28% of the Scottish population. The area has a wide range of urban and rural environments with a major capital city in Edinburgh, to very rural areas in East Lothian. The level of transport provision generally reflects the geography of the area, with the densely populated areas supporting well developed public transport systems, which diminish as areas become less densely populated. Reflecting this, the levels of traffic congestion vary enormously across the area, whilst a number of regional bottlenecks, such as the Edinburgh City Bypass and the Forth Crossings, are particularly prone to congestion. The study corridor follows the general route of the A720 City of Edinburgh Bypass. This is an important strategic route linking a number of key trunk roads including the M8, the A1, the A68 and the A702. It is also includes several critical interchanges for radial routes into the centre of Edinburgh.		

	There are a number of residential and employment related developments planned within the study corridor which will increase the demand to travel on the existing network if no further services are put in place.
Social Context:	The Scottish Index of Multiple Deprivation (SIMD) 2006 data suggests that the level of deprivation along the study corridor is relatively low. An analysis of Scottish Parliament constituencies along the study corridor shows that the percentage of the total population that are income deprived are all well below the Scottish average (14.2%) with the exception of Edinburgh East and Musselburgh (15.5%). Similarly, the percentage of employment deprived people along the study corridor compares favourably with the national average of 13.1%. Again the only Scottish Parliament Constituency along the route with a higher level of employment deprivation is Edinburgh East and Musselburgh with 13.5%. According to the 2001 Census data car ownership along the study corridor is broadly in line with the national average. 34.2% of all Scottish households do not have access to a car. For 4 out of 5 Scottish Parliament constituencies along the study corridor have between 28 and 36% of households without access to a car. The notable exception again being Edinburgh East and Musselburgh where the average is considerably higher at 41.9% of households without access to a car.
Economic Context:	The City of Edinburgh is a major centre of economic activity and employment in Scotland. It is therefore the main source of economic growth and the focus of future development in the SEStran area. There are several centres of economic activity within the study corridor including, The Gyle, Edinburgh Park, Shawfair and Edinburgh Royal Infirmary. Census data shows a clear demand for travel along the route to reach these economic centres. Current service provision requires users along the study corridor to either travel by car on the A720 or to travel into the city centre and back out again on radial public transport routes to access these services.

Planning Objectives

Objective:	Performance against planning objective:
• To aim towards achieving RTS mode share targets within the study corridor; • To aim towards achieving RTS environmental targets within the study corridor; • To ensure the integration of public transport with existing and proposed land-use within the study corridor;	• Major Beneficial • Minor Negative • Moderate Beneficial

• To improve community and comparative (local and wider) accessibility by public transport, especially to employment and health; and • To make public transport journey times, reliability and quality attractive versus single occupancy private car served study corridor.	• Major Beneficial • Major Beneficial
Rationale for Selection or Rejection of Proposal:	**Select –** this option is predicted to generate a significant level of demand and result in a substantial level of modal shift from private to public transport. The option is expected to operate with a surplus of £2.5m per annum. It is therefore recommended that this option is taken forward for further consideration.
Implementability Appraisal	
Technical:	No novel technology required. Policy innovation involved in the provision of hard-shoulder running for buses on a trunk road.
Operational:	No operational issues identified.
Financial:	Capital costs are estimated at £54,019,024 based on 2008 prices. Operating costs are predicted to be £3,510,000 per annum and revenue is estimated at £5,990,000 per annum. This creates an annual surplus of c.£2.5m per annum based on 2008 prices. Capital costs likely to depend upon public funding. Operating costs should be self-financing.
Public:	The general consultation over the Regional Transport Strategy secured general public approval for an effective orbital transport alternative to the private car. The individual options have not been subject to public consultation.

Government's Objectives for Transport

Objective	Assessment Summary	Supporting Information
Environment:	Minor Negative	A high level of modal shift is predicted from private car to public transport with this option and this therefore will have a positive effect on Greenhouse Gases along the length of the route. Adverse impacts during construction and also longer-term

		adverse impacts upon the natural and cultural heritage of the area, agriculture and soils, noise, vibration and air quality if this route is implemented. The setting of the Union Canal SAM will also be affected.
Safety:	Moderate Beneficial	Modest safety gains inherent in mode switch from private car to bus-based public transport.
Economy:	Moderate Beneficial	Highs mode shift from the private car. Significant accessibility gains to employment, education and health facilities in key growth areas.
Integration:	Moderate Beneficial	Integrated with planning policy to support key growth areas. Interchange opportunities with other transport modes on main radials.
Accessibility & Social Inclusion:	Major Beneficial	Significantly enhanced travel opportunities for people without cars to employment, education and health facilities.

Proposal Details			
Name and address of authority or organisation promoting the proposal: (Also provide name of any subsidiary organisations also involved in promoting the proposal)	South East of Scotland Transport Partnership First Floor, Hopetoun Gate, 8b McDonald Road, Edinburgh, EH7 4LZ		
Proposal Name:	**Option 5**	Name of Planner:	*SEStran*
Proposal Description:	All low segregation from Newbridge to Musselburgh with 12 buses per hour throughout.	Estimated Total Public Sector Funding Requirement:	Capital Cost = £14,824,013 Capital Cost inc. Optimism Bias = £21,346,578 Revenue Deficit = £0.4 million pa
Funding Sought From: (if applicable)	N/A	Amount of Application:	N/A
Background Information			
Geographic Context:	The SEStran region covers a diverse range of areas across 8 local authority areas. The region covers 3,180 square miles and is home to 28% of the Scottish population. The area has a wide range of urban and rural environments with a major capital city in Edinburgh, to very rural areas in East Lothian. The level of transport provision generally reflects the geography of the area, with the densely populated areas supporting well developed public transport systems, which diminish as areas become less densely populated. Reflecting this, the levels of traffic congestion vary enormously across the area, whilst a number of regional bottlenecks, such as the Edinburgh City Bypass and the Forth Crossings, are particularly prone to congestion. The study corridor follows the general route of the A720 City of Edinburgh Bypass. This is an important strategic route linking a number of key trunk roads including the M8, the A1, the A68 and the A702. It is also includes several critical interchanges for radial routes into the centre of Edinburgh.		

	There are a number of residential and employment related developments planned within the study corridor which will increase the demand to travel on the existing network if no further services are put in place.
Social Context:	The Scottish Index of Multiple Deprivation (SIMD) 2006 data suggests that the level of deprivation along the study corridor is relatively low. An analysis of Scottish Parliament constituencies along the study corridor shows that the percentage of the total population that are income deprived are all well below the Scottish average (14.2%) with the exception of Edinburgh East and Musselburgh (15.5%). Similarly, the percentage of employment deprived people along the study corridor compares favourably with the national average of 13.1%. Again the only Scottish Parliament Constituency along the route with a higher level of employment deprivation is Edinburgh East and Musselburgh with 13.5%. According to the 2001 Census data car ownership along the study corridor is broadly in line with the national average. 34.2% of all Scottish households do not have access to a car. For 4 out of 5 Scottish Parliament constituencies along the study corridor have between 28 and 36% of households without access to a car. The notable exception again being Edinburgh East and Musselburgh where the average is considerably higher at 41.9% of households without access to a car.
Economic Context:	The City of Edinburgh is a major centre of economic activity and employment in Scotland. It is therefore the main source of economic growth and the focus of future development in the SEStran area. There are several centres of economic activity within the study corridor including, The Gyle, Edinburgh Park, Shawfair and Edinburgh Royal Infirmary. Census data shows a clear demand for travel along the route to reach these economic centres. Current service provision requires users along the study corridor to either travel by car on the A720 or to travel into the city centre and back out again on radial public transport routes to access these services.

Planning Objectives	
Objective:	Performance against planning objective:
• To aim towards achieving RTS mode share targets within the study corridor; • To aim towards achieving RTS environmental targets within the study corridor; • To ensure the integration of public transport with existing and proposed land-use within the study corridor;	• Moderate Beneficial • Moderate Beneficial • Minor Beneficial

• To improve community and comparative (local and wider) accessibility by public transport, especially to employment and health; and • To make public transport journey times, reliability and quality attractive versus single occupancy private car served study corridor.	• Moderate Beneficial • Moderate Beneficial
Rationale for Selection or Rejection of Proposal:	**Select** – option 5 is predicted to generate a significant level of demand and result in a modal shift from private to public transport. It is therefore recommended that this option is taken forward for further consideration.
Implementability Appraisal	
Technical:	No novel technology required. Policy innovation involved in the provision of hard-shoulder running for buses on a trunk road.
Operational:	No operational issues identified.
Financial:	Capital costs are estimated at £14,824,013 based on 2008 prices. Operating costs are predicted to be £4,430,000 per annum and revenue is estimated at £4,070,000 per annum. This creates an annual deficit of c.£0.36m per annum based on 2008 prices. Capital costs are likely to depend upon public funding. Operating costs are unlikely to be fully self-financing and some revenue support likely to be required from public funds.
Public:	The general consultation over the Regional Transport Strategy secured general public approval for an effective orbital transport alternative to the private car. The individual options have not been subject to public consultation.
Government's Objectives for Transport	

Objective	Assessment Summary	Supporting Information
Environment:	Moderate Beneficial	Most adverse impacts with option 5 are restricted to the temporary phase of construction although there are some long term impacts focussed on agriculture and soils. This option however has the ability to bring about some longer term benefits

		given the expected modal shift from private car to public transport. This will see a reduction in noise and vibration along with improved air quality.
Safety:	Minor Beneficial	Modest safety gains inherent in mode switch from private car to bus-based public transport.
Economy:	Minor Beneficial	Modest mode shift from the private car. Some accessibility gains to employment, education and health facilities in key growth areas.
Integration:	Minor Beneficial	Integrated with planning policy to support key growth areas. Interchange opportunities with other transport modes on main radials.
Accessibility & Social Inclusion:	Moderate Beneficial	Modestly enhanced travel opportunities for people without cars to employment, education and health facilities.

Proposal Details			
Name and address of authority or organisation promoting the proposal: (Also provide name of any subsidiary organisations also involved in promoting the proposal)	South East of Scotland Transport Partnership First Floor, Hopetoun Gate, 8b McDonald Road, Edinburgh, EH7 4LZ		
Proposal Name:	**Option 6**	Name of Planner:	*SEStran*
Proposal Description:	All high segregation from Newbridge to Musselburgh with composite timetable of overlapping services from off-route origins/destinations.	Estimated Total Public Sector Funding Requirement:	Capital Cost = £43,845,892 Capital Cost inc. Optimism Bias = £63,138,084
Funding Sought From: (if applicable)	N/A	Amount of Application:	N/A
Background Information			
Geographic Context:	The SEStran region covers a diverse range of areas across 8 local authority areas. The region covers 3,180 square miles and is home to 28% of the Scottish population. The area has a wide range of urban and rural environments with a major capital city in Edinburgh, to very rural areas in East Lothian. The level of transport provision generally reflects the geography of the area, with the densely populated areas supporting well developed public transport systems, which diminish as areas become less densely populated. Reflecting this, the levels of traffic congestion vary enormously across the area, whilst a number of regional bottlenecks, such as the Edinburgh City Bypass and the Forth Crossings, are particularly prone to congestion. The study corridor follows the general route of the A720 City of Edinburgh Bypass. This is an important strategic route linking a number of key trunk roads including the M8, the A1, the A68 and the A702. It is also includes several critical interchanges for radial routes into the centre of Edinburgh.		

	There are a number of residential and employment related developments planned within the study corridor which will increase the demand to travel on the existing network if no further services are put in place.
Social Context:	The Scottish Index of Multiple Deprivation (SIMD) 2006 data suggests that the level of deprivation along the study corridor is relatively low. An analysis of Scottish Parliament constituencies along the study corridor shows that the percentage of the total population that are income deprived are all well below the Scottish average (14.2%) with the exception of Edinburgh East and Musselburgh (15.5%). Similarly, the percentage of employment deprived people along the study corridor compares favourably with the national average of 13.1%. Again the only Scottish Parliament Constituency along the route with a higher level of employment deprivation is Edinburgh East and Musselburgh with 13.5%. According to the 2001 Census data car ownership along the study corridor is broadly in line with the national average. 34.2% of all Scottish households do not have access to a car. For 4 out of 5 Scottish Parliament constituencies along the study corridor have between 28 and 36% of households without access to a car. The notable exception again being Edinburgh East and Musselburgh where the average is considerably higher at 41.9% of households without access to a car.
Economic Context:	The City of Edinburgh is a major centre of economic activity and employment in Scotland. It is therefore the main source of economic growth and the focus of future development in the SEStran area. There are several centres of economic activity within the study corridor including, The Gyle, Edinburgh Park, Shawfair and Edinburgh Royal Infirmary. Census data shows a clear demand for travel along the route to reach these economic centres. Current service provision requires users along the study corridor to either travel by car on the A720 or to travel into the city centre and back out again on radial public transport routes to access these services.

Planning Objectives

Objective:	Performance against planning objective:
• To aim towards achieving RTS mode share targets within the study corridor; • To aim towards achieving RTS environmental targets within the study corridor; • To ensure the integration of public transport with existing and proposed land-use within the study corridor;	• Major Beneficial • Minor Negative • Moderate Beneficial

• To improve community and comparative (local and wider) accessibility by public transport, especially to employment and health; and • To make public transport journey times, reliability and quality attractive versus single occupancy private car served study corridor.	• Major Beneficial • Major Beneficial
Rationale for Selection or Rejection of Proposal:	**Select –** this option is predicted to generate a significant level of demand and result in the largest level of modal shift from private to public transport. The option is expected to operate with a surplus of £2.03m per annum. It is therefore recommended that this option is taken forward for further consideration.
Implementability Appraisal	
Technical:	No novel technology required. Policy innovation involved in the provision of hard-shoulder running for buses on a trunk road.
Operational:	No operational issues identified.
Financial:	Capital costs are estimated at £43,845,892 based on 2008 prices. Operating costs are predicted to be £4,070,000 per annum and revenue is estimated at £6,100,000 per annum. This creates an annual surplus of c.£2.03m per annum based on 2008 prices. Capital costs are likely to depend upon public funding. Operating costs should be self-financing.
Public:	The general consultation over the Regional Transport Strategy secured general public approval for an effective orbital transport alternative to the private car. The individual options have not been subject to public consultation.
Government's Objectives for Transport	

Objective	Assessment Summary	Supporting Information
Environment:	Minor Negative	A high level of modal shift is predicted from private car to public transport with this option and this therefore will have a positive effect on Greenhouse Gases along the length of the route. Adverse impacts during construction and also longer-term

		adverse impacts upon the natural and cultural heritage of the area, agriculture and soils, noise, vibration and air quality if this route is implemented. The setting of the Union Canal SAM will also be affected.
Safety:	Moderate Beneficial	Modest safety gains inherent in mode switch from private car to bus-based public transport.
Economy:	Moderate Beneficial	Maximises mode shift from the private car. Significant accessibility gains to employment, education and health facilities in key growth areas.
Integration:	Moderate Beneficial	Integrated with planning policy to support key growth areas. Interchange opportunities with other transport modes on main radials. Through links created between residential and employment development areas.
Accessibility & Social Inclusion:	Major Beneficial	Significantly enhanced travel opportunities for people without cars to employment, education and health facilities.

Proposal Details			
Name and address of authority or organisation promoting the proposal: (Also provide name of any subsidiary organisations also involved in promoting the proposal)	South East of Scotland Transport Partnership First Floor, Hopetoun Gate, 8b McDonald Road, Edinburgh, EH7 4LZ		
Proposal Name:	**Option 7**	Name of Planner:	*SEStran*
Proposal Description:	All low segregation from Newbridge to Musselburgh with composite timetable of overlapping services from off-route origins/destinations.	Estimated Total Public Sector Funding Requirement:	Capital Cost = £14,824,013 Capital Cost inc. Optimism Bias = £21,346,578 Revenue deficit = £0.84 million pa
Funding Sought From: (if applicable)	N/A	Amount of Application:	N/A
Background Information			
Geographic Context:	The SEStran region covers a diverse range of areas across 8 local authority areas. The region covers 3,180 square miles and is home to 28% of the Scottish population. The area has a wide range of urban and rural environments with a major capital city in Edinburgh, to very rural areas in East Lothian. The level of transport provision generally reflects the geography of the area, with the densely populated areas supporting well developed public transport systems, which diminish as areas become less densely populated. Reflecting this, the levels of traffic congestion vary enormously across the area, whilst a number of regional bottlenecks, such as the Edinburgh City Bypass and the Forth Crossings, are particularly prone to congestion. The study corridor follows the general route of the A720 City of Edinburgh Bypass. This is an important strategic route linking a number of key trunk roads including the M8, the A1, the A68 and the A702. It is also includes several critical interchanges for radial routes into		

	the centre of Edinburgh. There are a number of residential and employment related developments planned within the study corridor which will increase the demand to travel on the existing network if no further services are put in place.
Social Context:	The Scottish Index of Multiple Deprivation (SIMD) 2006 data suggests that the level of deprivation along the study corridor is relatively low. An analysis of Scottish Parliament constituencies along the study corridor shows that the percentage of the total population that are income deprived are all well below the Scottish average (14.2%) with the exception of Edinburgh East and Musselburgh (15.5%). Similarly, the percentage of employment deprived people along the study corridor compares favourably with the national average of 13.1%. Again the only Scottish Parliament Constituency along the route with a higher level of employment deprivation is Edinburgh East and Musselburgh with 13.5%. According to the 2001 Census data car ownership along the study corridor is broadly in line with the national average. 34.2% of all Scottish households do not have access to a car. For 4 out of 5 Scottish Parliament constituencies along the study corridor have between 28 and 36% of households without access to a car. The notable exception again being Edinburgh East and Musselburgh where the average is considerably higher at 41.9% of households without access to a car.
Economic Context:	The City of Edinburgh is a major centre of economic activity and employment in Scotland. It is therefore the main source of economic growth and the focus of future development in the SEStran area. There are several centres of economic activity within the study corridor including, The Gyle, Edinburgh Park, Shawfair and Edinburgh Royal Infirmary. Census data shows a clear demand for travel along the route to reach these economic centres. Current service provision requires users along the study corridor to either travel by car on the A720 or to travel into the city centre and back out again on radial public transport routes to access these services.
Planning Objectives	
Objective:	Performance against planning objective:
• To aim towards achieving RTS mode share targets within the study corridor; • To aim towards achieving RTS environmental targets within the study corridor; • To ensure the integration of public transport with existing	• Moderate Beneficial • Moderate Beneficial • Minor Beneficial

and proposed land-use within the study corridor; • To improve community and comparative (local and wider) accessibility by public transport, especially to employment and health; and • To make public transport journey times, reliability and quality attractive versus single occupancy private car served study corridor.	• Moderate Beneficial • Moderate Beneficial

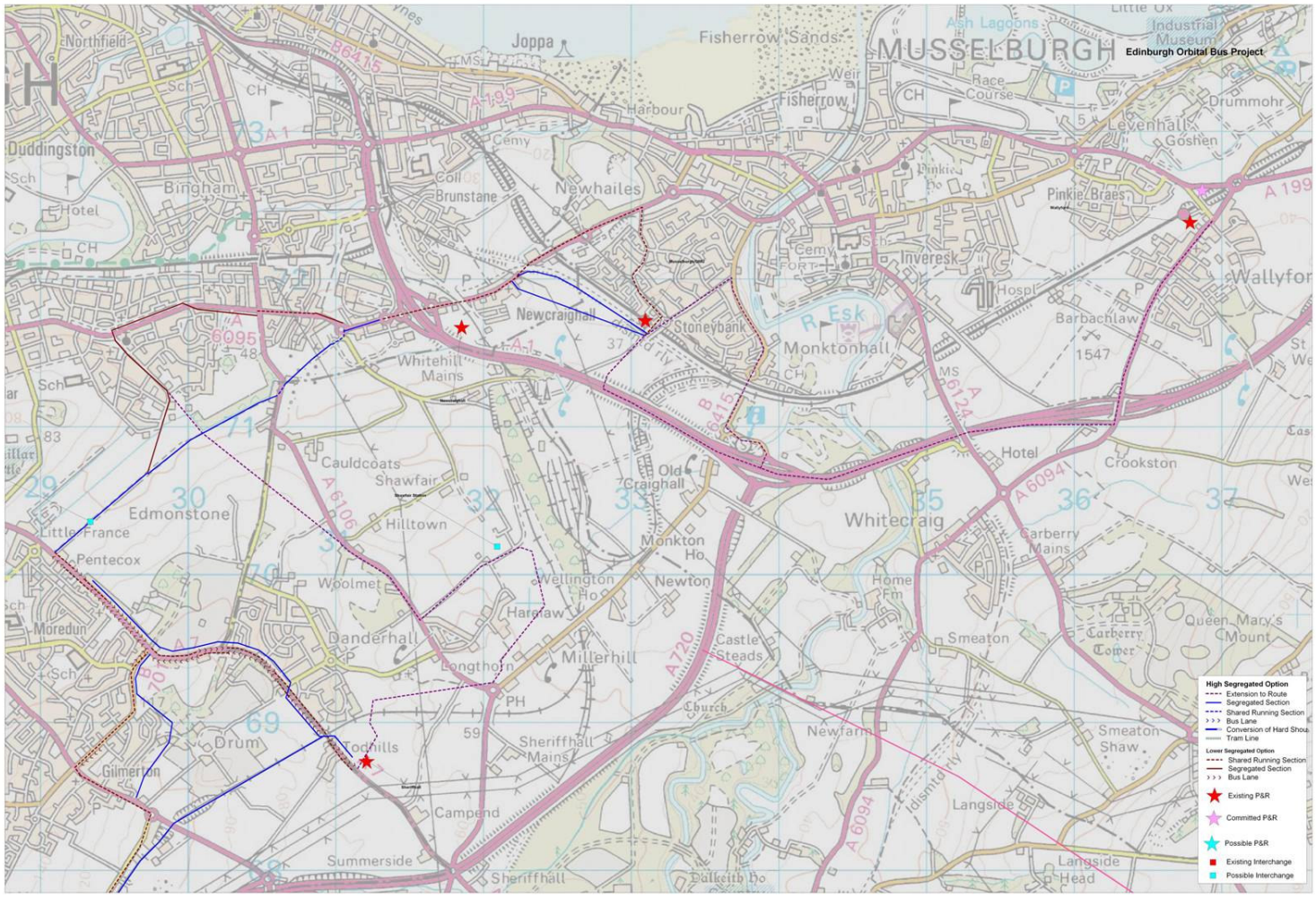
Rationale for Selection or Rejection of Proposal:	**Select** – option 7 is predicted to generate a significant level of demand and result in a modal shift from private to public transport. It is therefore recommended that this option is taken forward for further consideration.
Implementability Appraisal	
Technical:	No novel technology required. Policy innovation involved in the provision of hard-shoulder running for buses on a trunk road.
Operational:	No operational issues identified.
Financial:	Capital costs are estimated at £14,824,013 based on 2008 prices. Operating costs are predicted to be £5,234,000 per annum and revenue is estimated at £4,386,000 per annum. This creates an annual deficit of c.£0.84m per annum based on 2008 prices. Capital costs are likely to depend upon public funding. Operating costs are unlikely to be fully self-financing and some revenue support is likely to be required from public funds.
Public:	The general consultation over the Regional Transport Strategy secured general public approval for an effective orbital transport alternative to the private car. The individual options have not been subject to public consultation.
Government's Objectives for Transport	

Objective	Assessment Summary	Supporting Information
Environment:	Moderate	Most adverse impacts with option 7 are restricted to the temporary phase of construction although there are some long term impacts focussed on agriculture and

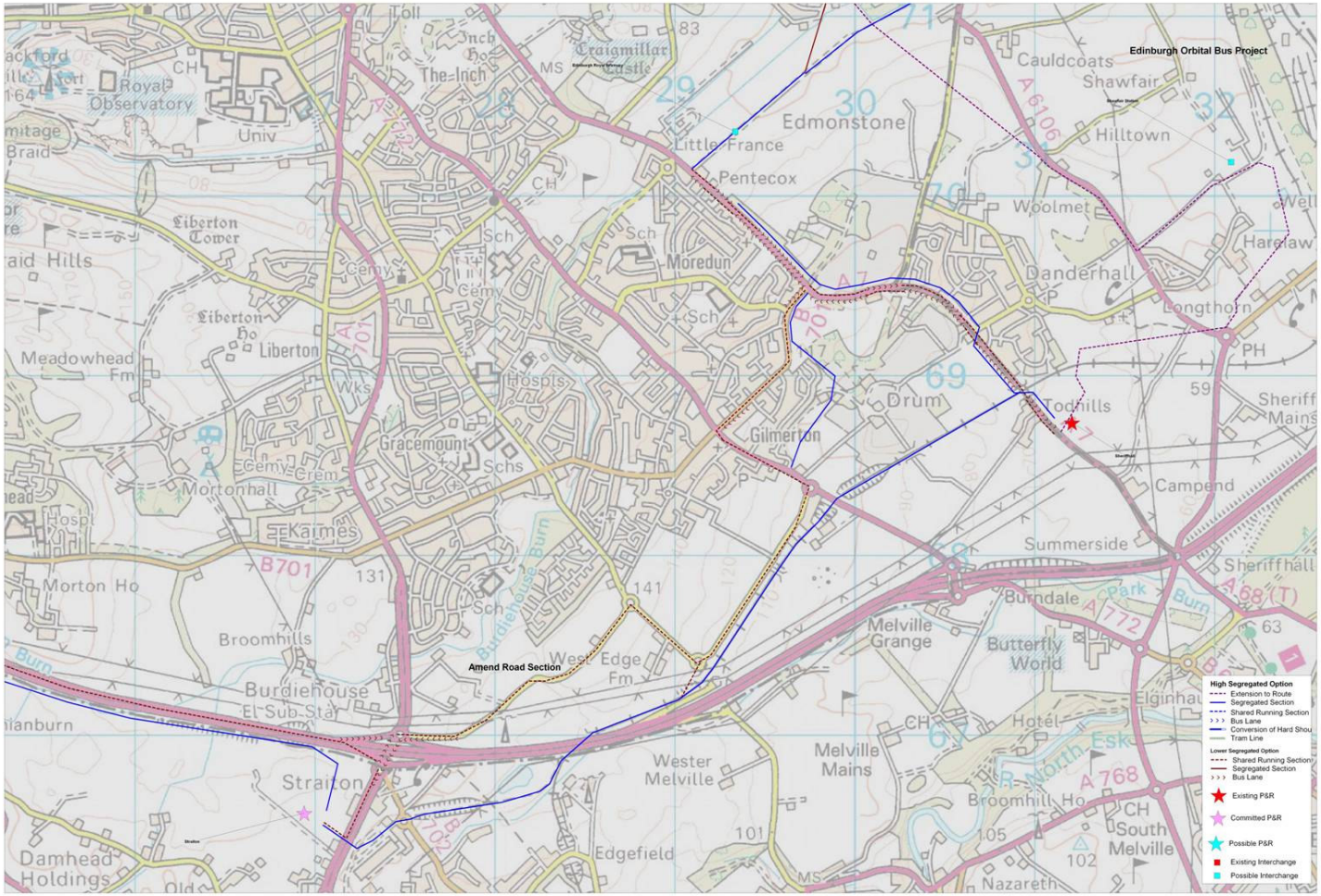
	Beneficial	soils. This option however has the ability to bring about some longer term benefits given the expected modal shift from private car to public transport. This will see a reduction in noise and vibration along with improved air quality.
Safety:	Minor Beneficial	Modest safety gains inherent in mode switch from private car to bus-based public transport.
Economy:	Minor Beneficial	Modest mode shift from the private car. Some accessibility gains to employment, education and health facilities in key growth areas.
Integration:	Minor Beneficial	Integrated with planning policy to support key growth areas. Interchange opportunities with other transport modes on main radials. Through links created between residential and employment development areas.
Accessibility & Social Inclusion:	Moderate Beneficial	Modestly enhanced travel opportunities for people without cars to employment, education and health facilities.

Appendix B

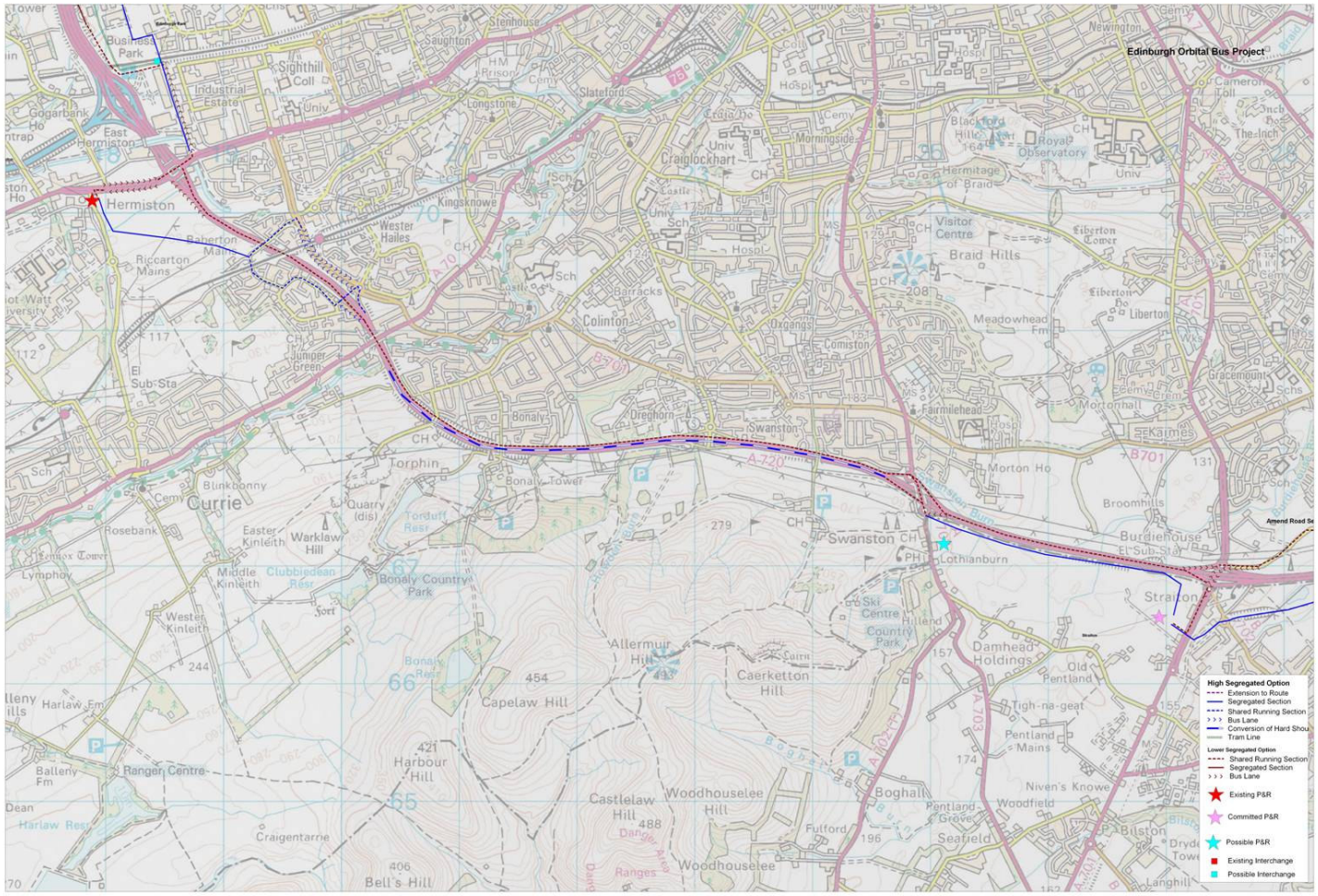
Route Alignment Maps



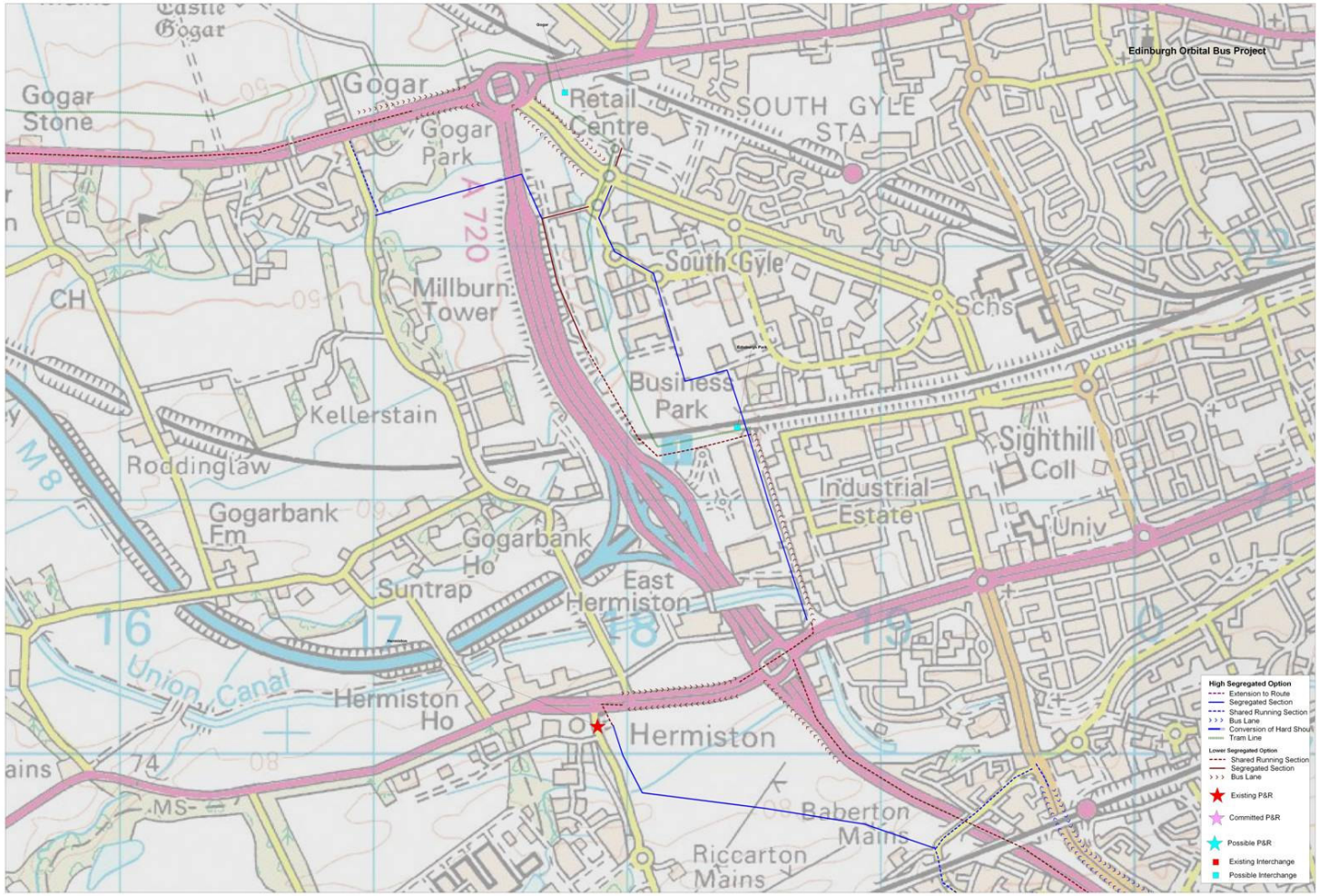
Appendix B1: Section 1 - Wallyford Park & Ride to Edinburgh Royal Infirmary



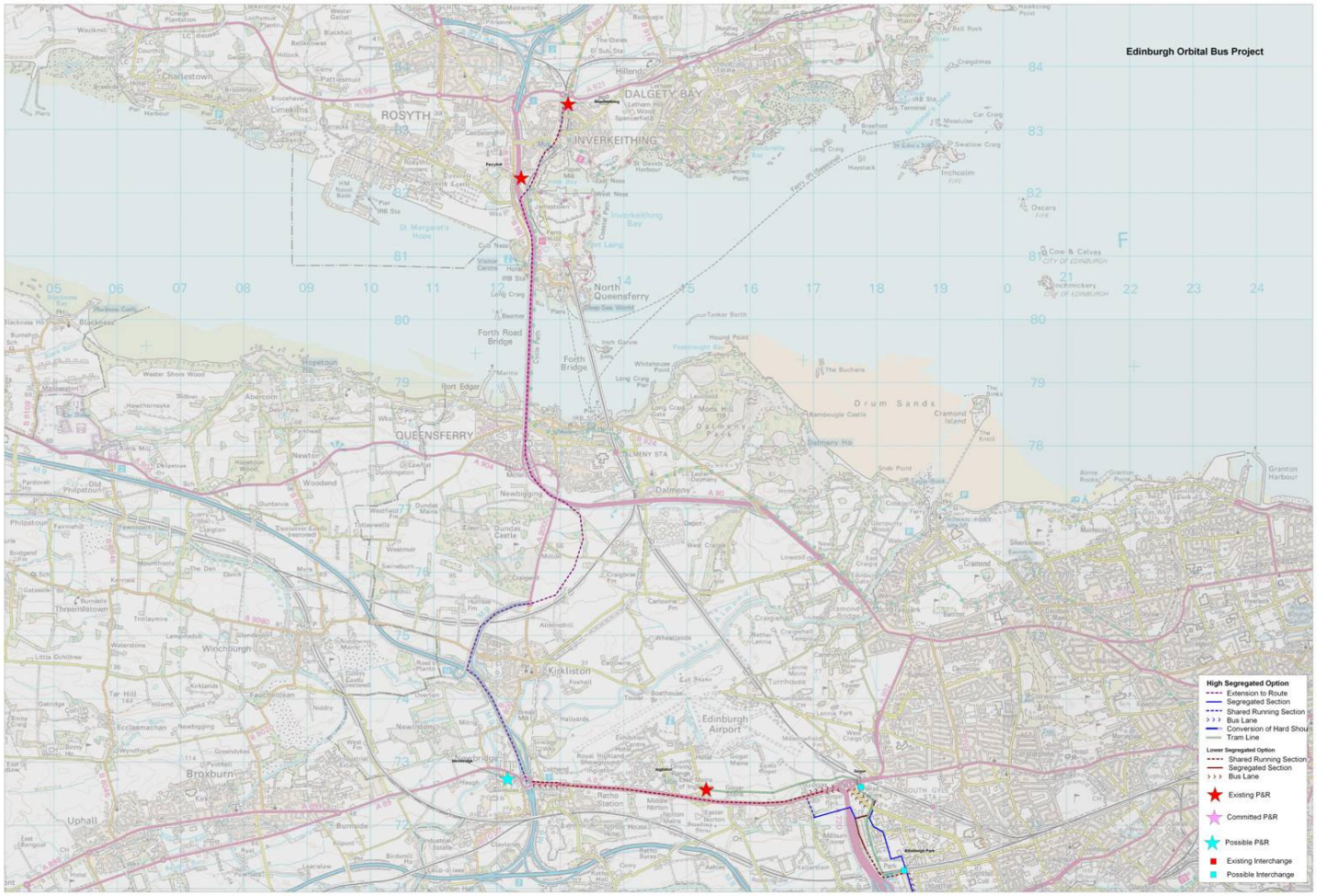
Appendix B2: Section 2—Edinburgh Royal Infirmary to Straiton Park & Ride



Appendix B3: Section 3 — Straiton Park & Ride to Hermiston Park & Ride



Appendix B4: Section 4—Hermiston Park & Ride to The Gyle



Appendix B5: Section 5 — The Gyle to Inverkeithing