South East Scotland Transport Partnership (SEStran)

Edinburgh Orbital Bus Project

STAG Part 2 Appraisal Report

Scott Wilson Scotland Ltd

June 2009

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1 Introduction

1.1 Background

1.1.1 South East Scotland Transport Partnership (SEStran) appointed Scott Wilson to carry out a STAG study to provide transport planning support for the Edinburgh Orbital Bus Project (EOBP).

1.1.2 Two key issues have been identified in the SEStran Regional Transport Strategy (RTS) 2008-2023 in the South East of Scotland region. Firstly, the requirement to provide enhanced transport links between the expanding employment areas west and south of Edinburgh and the areas with expanding population, especially to the east of the city; and secondly, to make these areas more accessible to those reliant on public transport.

1.1.3 EOBP was conceived as an important measure to link a number of key transport interchanges and employment areas. As a first step, Halcrow Consultants were appointed in September 2007 to undertake a feasibility study of the EOBP, identify and assess potential demand for the service, carry out a STAG Part 1 Appraisal and produce a business case for the scheme[1].

1.1.4 Subsequent to the release of this report, Scott Wilson Scotland Ltd was appointed by SEStran as their consultants on their Transport Advisor Framework. Part of our responsibility is to take forward the original work undertaken by Halcrow, and further enhance the analysis. This report sets out the results of the evaluation of the opportunities identified following a STAG Part 2 Appraisal.

1.1.5 The Part 1 Appraisal set out to analyse the options identified in the pre-appraisal process. This tested the options against the identified planning objectives and the initial (high level) evaluation against the Government's five main objectives[2]. This report will complete the STAG Part 2 evaluation against these objectives. This work takes the assessment undertaken in Part 1 to a more rigorous level, addressing the framework methodology central to the STAG process. Wherever possible, we have followed the reporting structure advised in Chapter 14 of STAG.

1.2 Study Rationale

1.2.1 The SEStran RTS divided a number of 'measures' to address the issues of connectivity and accessibility identified and categorised into three broad groups, 1) region-wide measures, 2) initiatives for specific areas and groups and 3) network-based measures. The latter was primarily concerned with commuter corridors where the choice is essentially between public transport and car travel, and where distances would it be in excess of what could be considered reasonable for walking and cycling (other than as secondary modes to access public transport).

1.2.2 In view of this, the RTS identified the corridors where public transport modal share was particularly low when compared with other reasonably similar corridors. The Edinburgh orbital corridor to the south of the city, largely following the City Bypass, emerged as particularly poor in this respect. Consequently this was earmarked in the RTS for further work.

1.2.3 The RTS went through a full 'strategic' STAG process and the Strategy was eventually approved by the Minister. Based on this 'strategic' STAG process, the starting point for this study was therefore already focused on public transport with a key objective to increase PT modal share.

[1] Edinburgh Orbital Bus Project STAG 1 Report, Halcrow, July 2008
[2] Scottish Transport Appraisal Guidance: Executive Summary, paragraph 27, Scottish Government, September 2003

1.2.4 The corridor had already been included in previous work for City of Edinburgh Council by Arup in 2001, where rail-based modes had been excluded as a realistic option due to insufficient demand to meet their costs. The SEStran study therefore focussed on bus-based options, although if the modelling results had indicated 'seriously' high flows, the study remit would have been widened to include higher capacity modes.

1.2.5 The STAG Part 1 Report (produced by Halcrow) did however discuss numerous options in Section 4.3 of the study (Option Sifting) but only the various bus options from 'normal' on-street running to fully segregated bus rapid transit options were appraised in detail, (including operational variations), and it was the best performing options out of these that are now subject to this more detailed STAG part 2 appraisal.

1.3 Structure of this Report

1.3.1 The overall structure of this report follows that set out for STAG Part 2 appraisal.

Chapter 2 – Outlines the pre-appraisal of the issues in the study area.

Chapter 3 – Summarises the findings of the STAG Part 1 Appraisal.

Chapter 4 – Provides a summary of the Transport Modelling results.

Chapter 5 – Sets out the Option Development.

Chapter 6 – Details the STAG Part 2 Appraisal of the options.

Chapter 7 – Sets out the Risk and Uncertainty assessment.

Chapter 8 – Outlines the Monitoring and Evaluation recommendations.

Chapter 9 – Provides the overall Conclusions.

2 Summary of the Pre-Appraisal

2.1 Introduction

2.1.1 The Halcrow STAG Part 1 Appraisal set out the problems, issues, constraints and opportunities of the transport network in the study area[3]. It continued to describe the objectives, the option generation, sifting and development processes. It then applied the STAG Part 1 appraisal to a series of recommended options and identified a preferred option to be taken forward to the Part 2 appraisal along with an initial financial assessment and outline business case.

2.1.2 The Halcrow assessment finally provided a vision of how the scheme could develop further, based on their previous analysis, taking into account the initial feedback from SEStran. This Chapter presents a both a summary of the Halcrow study their work and our interpretation of their findings.

2.1.3 The orbital bus concept proposed in the RTS was originally subject to a STAG analysis, the result of which was to give further consideration to a number of Bus Rapid Transit options. The Pre-Appraisal process had been followed in outline in the appraisal, and details of other potential options that had been considered during the preparation of the RTS were also included in Halcrow's assessment, along with reasons as to why they may have been sifted out from further consideration.

2.1.4 In terms of geographical location, the EOBP is to operate 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.

2.2 Travel Pattern Context

Geographical and Social Context

2.2.1 The level of transportation provision reflects the geography of the area, with the densely populated areas supporting well developed public transport systems, which diminish as areas become more lightly populated. As a result, the levels of traffic densities vary enormously across the region. Geographical constraints such as the Firth of Forth and the Pentland Hills create natural bottlenecks which are particularly prone to congestion.

2.2.2 A number of significant issues were identified by the Regional Transport Strategy. These included 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 poor provision of public transport in this corridor and the comparatively indirect cross-city radial public transport options which are available. As the Halcrow study notes, the latter provide only lengthy, expensive and time-consuming opportunities for people without cars to make these same journeys.

2.2.3 The study corridor broadly runs parallel to the A720 Edinburgh by-pass, linking 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 along this corridor. Destinations that have been considered by the Halcrow study as key areas along the corridor are:

- Queen Margaret University / Musselburgh Station;

[3] Edinburgh Orbital Bus Project STAG 1 Report, Halcrow, June 2008

- Edinburgh Royal Infirmary (ERI);
- Sheriffhall;
- Straiton;
- Lothianburn;
- Hermiston Park and Ride;
- Edinburgh Park;
- RBS HQ Gogarburn; and
- Edinburgh Airport.

2.2.4 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 nearby and outlying communities.

2.2.5 The Halcrow STAG report used the Scottish Index of Multiple Deprivation (SIMD) 2006 data which suggested that the level of deprivation of these communities, both those adjacent to the study route and slightly further afield, is relatively low. The percentage of employment amongst deprived people along the study corridor compares favourably with the national average. Only the population in Edinburgh East and Musselburgh amongst Scottish Parliamentary constituencies at the eastern end of the corridor have, on average, lower levels of income and employment than the national average.

2.2.6 In addition car ownership, according to the 2001 Census data, is broadly in line with the national average. The notable exception again is Edinburgh East and Musselburgh, where the average is considerably lower. Although car ownership should not be taken as a proxy for social exclusion in Edinburgh, low car ownership rates suggest high dependency on public transport travel options.

2.2.7 The Halcrow study found that travel demand on the existing network, including that for public transport, will increase owing to the number of residential and employment related developments planned within the study corridor, and this is discussed below in greater detail.

Identification of Problems and Opportunities

2.2.6 The identification of problems and opportunities formed the starting point of the STAG based study, which originated from the Regional Transport Strategy, and other relevant planning reports. A workshop undertaken by Halcrow for the STAG Part 1 appraisal had identified a number of problems and opportunities where the EOBP could have an impact, of which the principal ones were:

- Address the needs of planned and potential development, where the latter is expected to increase the demand for travel, with commensurate congestion and delays;
- Provide an opportunity for improving the integration between public transport and land-use development, such as new interchanges in the corridor;
- Address the low level of existing orbital public transport services and improve public transport alternatives to car use;
- Improve in cross-city public transport journey times by reducing dependence on congested public transport in the city centre; and
- Capture opportunities by articulating services with the North Forth Crossing.

2.2.7 For each of the opportunities and problems identified above, further work was undertaken to determine the impact of these. The analysis was based on the standard modelling run of the land use and assignment components, where demand flows had been provided by the Highways and Public Transport Assignments and a Park and Ride module, which assisted in modelling inter-modal transfer (i.e. between car and public transport) and allowed the testing of the orbital bus links. The results of the analysis for each of the opportunities and problems are discussed in turn below.

Planned and Potential Developments

2.2.8 All planned development and associated future congestion associated with this along the study corridor has been considered. This included key existing and future development locations that may provide a passenger base to support new services. Table 2.1 shows the change in the number of trips that are expected to be generated over the period 2005 to 2012 due to key development at various locations, as predicted by the TMfS trip generation model.

Table 2.1: Key Development Locations and Change in Trips per Day from 2005 to 2012 for Selected Areas

Housing Area	Car Trips from	Car Trips to	PT Trips from	PT Trips to
Shawfair / Danderhall (Millerhill)	5,176	5,417	1,123	1,231
Shawfair / Danderhall (Danderhall)	815	730	634	573
North Kirkliston (Kirkliston)	495	386	-34	-38
Newcraighall (Bruntstane)	254	231	41	40
Niddrie	1,417	1,719	170	323
Hyvots (Gilmerton)	775	1,012	6	43
Hyvots (Gilmerton Dykes)	107	102	-36	-40
Greendykes (Greendykes)	2,309	2,710	273	375
Inverkeithing	616	623	326	278
Employment	**Car Trips from**	**Car Trips to**	**PT Trips from**	**PT Trips to**
Shawfair (Millerhill)	5,176	5,417	1,123	1,231
South Queensferry (Queensferry)	115	61	36	-42
South Queensferry (Dalmeny)	482	417	157	151
Newbridge	1,561	2,155	305	314
Newbridge	26	28	1	0
Craighall (Whitecraig)	351	379	-1	-11
Little France (Edmondstone)	3,178	3,017	325	440
Edinburgh Park	5,685	5,571	2,190	1,924
South Rosyth (Rosyth)	375	394	57	76
Additional trips on network	23,737	24,953	5,572	5,637

2.2.9 The Table shows that the total numbers of car trips are approximately 24,000 in either direction, compared to 5,500 for public transport trips. The imbalance of public transport and car trips undertaken, and problems and opportunities presented by congestion associated with the projected number of car journeys, provides the basis for subsequent objectives setting, discussed later in this Chapter.

Transport Connectivity and Congestion Impacts

2.2.10 It was noted from the consultation undertaken that there are no complete current orbital public transport services, and for cross-city journeys covering the proposed orbital route there were no reasonable alternatives to car use at the present time. It was recognised that there were a number of public transport services that served parts of the orbital route, and this they did effectively, but these services were poorly articulated which reduced connectivity across the entire orbital corridor, and increase public transport dependence on radial services.

2.2.11 The demand analysis demonstrated that time savings are critical to attracting usage of an orbital bus route. However the position of the new Forth Crossing, as part of the route, would make options the linking of the proposed orbital bus route to the new crossing prohibitively expensive in terms of journey times and operating costs. These options were therefore discounted from further analysis.

2.2.12 The potential demand for travel on the study corridor in 2012 found that a substantial increase in traffic flows is to be expected by 2012 and this will, in the absence of remedial investment or improvements, cause further stress on current levels of congestion. Current traffic flows on the A720 exceeds free-flow capacity during peak periods, with resulting lower traffic speeds and congestion.

2.2.13 Table 2.2 shows the modelled increase in flows between 2005 and 2012.

Table 2.2: 2005 and 2012 Traffic Flows on Major Links

Origin	Destination	2005 Flows	2012 Flows	% Increase
A1 (Old Craighall)	A68 (New Bypass)	33,400	43,100	29%
A68 (New Bypass)	Sheriffhall		37,500	12%
Sheriffhall	A772	36,700	41,900	14%
A772	Lasswade Road	46,000	53,400	16%
Lasswade Road	A701 (Straiton)	53,300	62,400	17%
A701 (Straiton)	A702	60,800	74,400	22%
A702	Dreghorn	68,900	84,500	23%
Dreghorn	A70	72,000	88,000	22%
A70	A71 (Hermiston)	66,300	81,500	23%
A71 (Hermiston)	M8	55,300	71,700	30%
M8	A8 (Gogar)	42,600	54,200	27%

Note: Units are in 12 hour weekday car passenger units (PCU) flows.

2.2.14 The implications of this increase on the ratio of flow to capacity on the key routes above for the years 2012 and 2022 are shown in Tables 2.3 and 2.4 overleaf.

Table 2.3: Ratio of Flow to Capacity (RFC) for 2012 on Major Links

Origin	Destination	AM		OP		PM	
		Flow	RFC	Flow	RFC	Flow	RFC
A1 (Old Craighall)	A68 (New Bypass)	4,069	51%	3,454	43%	4,321	54%
A68 (New Bypass)	Sheriffhall	3,343	42%	3,174	40%	3,559	44%
A772	Lasswade Road	4,969	62%	4,382	55%	5,301	66%
A701 (Straiton)	A702	7,605	95%	5,450	68%	7,842	98%
A702	Dreghorn	8,394	105%	6,467	81%	8,467	106%
A70	A71 (Hermiston)	6,238	78%	6,173	77%	8,479	106%
A71 (Hermiston)	M8	6,615	83%	5,388	67%	7,392	92%
M8	A8 (Gogar)	4,503	56%	3,958	49%	5,771	72%

Table 2.4: Ratio of Flow to Capacity (RFC) for 2022 on Major Links

Origin	Destination	AM		OP		PM	
		Flow	RFC	Flow	RFC	Flow	RFC
A1 (Old Craighall)	A68 (New Bypass)	4,231	53%	3,802	48%	4,819	60%
A68 (New Bypass)	Sheriffhall	3,332	42%	3,123	39%	3,682	46%
A772	Lasswade Road	5,462	68%	5,006	63%	5,989	75%
A701 (Straiton)	A702	8,050	101%	6,537	82%	8,642	108%
A702	Dreghorn	8,856	111%	7,873	98%	9,314	116%
A70	A71 (Hermiston)	8,542	107%	7,466	93%	9,103	114%
A71 (Hermiston)	M8	7,150	89%	6,396	80%	8,269	103%
M8	A8 (Gogar)	4,961	62%	4,511	56%	6,584	82%

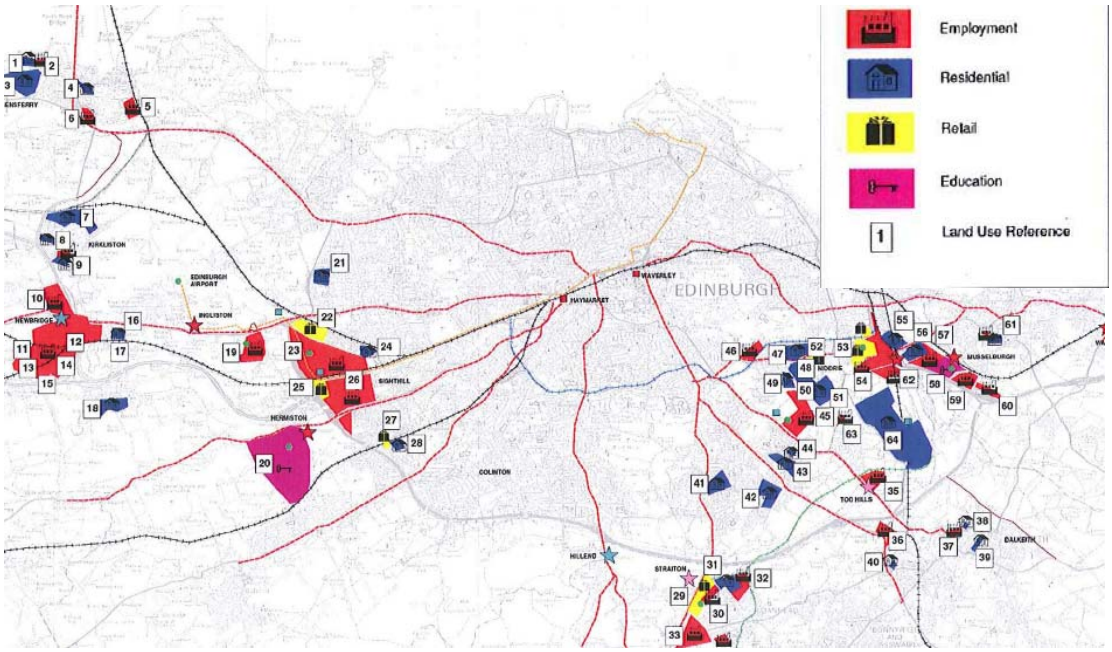
2.2.15 A range of public transport demand forecasts were established based on an estimated level of direct connectivity from each of 14 nodes around Edinburgh to every other node. The 14 nodes were nominally placed at interchange points on the orbital corridor representing potential access points for local origins and destinations, interchanges from radial bus services to other modes and Park and Ride (P&R) opportunities.

2.2.16 The projected total maximum public transport travel demand for 2012, taking into account all planned and potential developments, is estimated at 2,075 in the AM peak hour, split 1,016 westbound and 1,059 eastbound. The evening peak flows broadly mirror the morning flows in reverse. These values show the net additional demand for public transport. Actual usage could be higher with some trips being displaced from other existing services, although this impact is likely to be low, as very little cross city bus travel currently takes place.

Transport and Land-use Integration

2.2.17 Major development areas have been identified along the study corridor, as seen in Figure 2.1. Options have been developed for these that introduce opportunities for access to these areas by public transport, and maximise the potential for penetration of the main trip generation areas.

Figure 2.1: Major Development Areas Identified by Land-use



2.2.18 Because the proposed route is an orbital corridor, it will be intersected at a number of key points by the main radial routes into the city centre. Therefore a number of interchange points were identified and options developed which maximise the interchange opportunities available. Interchange opportunities between land-use and public transport were analysed, thereby allowing the highest level of integration between different modes of transport which reflect the travel options available to travellers at each location.

2.2.19 The am peak westbound and eastbound flows show very different projected travel patterns. Westbound flow is characterised by intensive use between Musselburgh and Ingliston, with modest increase in demand at the extremities of the study corridor. Significant trips join the corridor at Sheriffhall, Straiton and Lothianburn, implying that those who join at these interchange points would use the P&R or radial-orbital bus interchange facilities there. In contrast the eastbound flows show much lower flows across the central segment of the orbital corridor, linking east and west ends of the city. This is as expected with the predominance of residential development in the east, and employment in the west of the city, respectively. Eastbound flows have marginally more trips projected in total, but they are of a much shorter average trip length, signifying a relatively low level of demand for a through service along the whole EOBP route in this direction.

2.2.20 Therefore it can be concluded that additional planned and potential developments will increase the demand for travel, which will exacerbate existing problems of congestion and generate further delays in journey times and predictability. The EOBP is forecast to attract a substantial number of the increase in trips, although the characteristics and pattern of usage of the EOBP route will differ significantly in either direction as a result of prevailing land use patterns across the city as a whole.

2.3 Summary of Consultation

2.3.1 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.

2.3.2 The EOPB was first proposed on a formal basis in 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.

2.3.3 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.

2.3.4 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 processes.

2.3.5 Throughout the EOBP study there has been significant 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 consultation was also carried out by Scott Wilson, including a STAG workshop on the 19 November 2008 (minutes of the workshop are in Appendix A), and with statutory consultees for the environmental appraisal. The consultation also included discussions with public transport operators and other relevant stakeholders.

2.4 Identification of Planning Objectives

Government (National Transport Strategy) and SEStran Objectives

2.4.1 The National Transport Strategy (NTS) states that managing demand has a vital role to play to ensure quicker, more reliable journey times, and to reduce congestion. The NTS acknowledges that public transport infrastructure and other measures are key in meeting these outcomes including bus priority, bus lanes on key arterial corridors, park and ride facilities and Bus Rapid Transit on segregated sections of roadway.

2.4.2 In support of the NTS, the Scottish Government's transport objectives has identified three further strategic outcomes that are particularly important, which are:

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

2.4.3 The NTS and Scottish Government objectives have been incorporated into the SEStran objectives which are manifest in SEStran's policy, and which have been adopted in the RTS. These address the issues and problems associated with poor public transport services characterised by attracting a low share of travel demand, which in turn reduces accessibility for those dependent on public transport and exacerbates environmental impacts from private car usage. These are precisely the problems that the EOBP seeks to address.

Local Transport Planning Objectives

2.4.4 The Transport Planning Objectives were developed at an Option Generation workshop undertaken in November 2007. These Planning Objectives were 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 times, reliability and quality attractive verses single occupancy private car in the study corridor.

2.4.5 These initial Transport Planning Objectives reflect the themes identified during pre-appraisal and express the transport outcomes sought. It was agreed by the stakeholders at the workshop that although the primary focus should be on public transport, opportunities for achieving the objectives should be sought for other sustainable modes, including High Occupancy Vehicles.

2.4.6 It is clear that the EOBP project can make a positive contribution to a number of these objectives, and that the Transport Planning Objectives set at the workshop articulate well with the relevant higher level objectives at both the regional and national level.

2.4.7 For the STAG Part 2 Appraisal it will be necessary to refine the Transport Planning Objectives further in order to ensure that they are SMART (specific, measurable, attainable, relevant and timed). This is addressed in Chapter 4 of this report.

2.5 Identification of Options

2.5.1 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 associated congestion. Various engineering measures would be required to provide priority over general traffic to avoid bypass congestion, features that characterise a Bus Rapid Transport (BRT) system. 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.

2.5.2 The route options were initially considered during the 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 at which stakeholders raised new ideas that have subsequently been considered.

2.5.3 When examining the route options, preferences were given to measures that achieve the desired priority, balanced against their likely cost and feasibility. Where possible, existing bus priority measures were used along the route.

2.5.4 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. The initial route was modified to include the following:

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

2.5.5 An optioneering workshop was held which produced a long list of options, including non-PT and congestion charging. This was then sifted down into a smaller list of options, which included either expansion of existing bus services or a new bus-based rapid transit system with varying stopping patterns, frequencies and levels of segregation from other traffic.

2.5.6 Seven options were identified are as follows:

- Option 1: Nil investment – 12 buses per hour throughout between Inverkeithing and Wallyford on existing roads;
- Option 2: All high segregation from Inverkeithing to Wallyford with 12 buses per hour throughout;
- Option 3: As per Option 2 but with all low segregation;

- Option 4: All high segregation from Newbridge to Musselburgh with 12 buses per hour throughout;
- Option 5: As per Option 4 but with all low segregation;
- Option 6: All high segregation from Newbridge to Musselburgh with composite timetable of overlapping services. This involves a slight reduction in the number of interchanges (as per Option 4) and a slight reduction in services in the middle sections of the corridor, from 12 buses per hour to 9 buses per hour; and
- Option 7: As per Option 6 but with all low segregation.

2.5.7 The options have significantly different levels of improvements (associated with running speed and infrastructure costs). For example, option 1 will utilise existing streets, while option 2 would have higher capital costs, and option 3 would be easier to implement and have lower costs measures. The remaining options are variations of options 2 and 3.

3. Summary of the STAG Part 1 Appraisal

3.1 Introduction

3.1.1 This Chapter summarises the STAG Part 1 Appraisal of the proposals. The appraisal of impacts, where this is explicitly tabulated, is based on a standard seven-point scale as outlined below:

✓✓✓	major beneficial impact	✗✗✗	major adverse impact
✓✓	moderate beneficial impact	✗✗	moderate adverse impact
✓	minor beneficial impact	✗	minor adverse impact
		O	neutral impact

3.1.2 Each score is assigned to each STAG sub-criterion to indicate the likely impact.

3.2 Findings of the STAG 1 Appraisal

Environmental Appraisal

3.2.1 The environmental Transport Planning Objective set out for the EOBP was:

To aim towards achieving RTS environmental targets within the study corridor

3.2.2 Therefore for the purposes of this study the performance of each option has been appraised against the environmental objectives set out in the SEStran RTS. This is based on the results of the Halcrow Environmental Report[4].

3.2.3 It is not anticipated that Option 1, the nil investment option, will result in any impacts during construction, and because this option would use 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 significant modal shift from private vehicles to public transport, so the addition of more traffic is likely to result in long-term adverse impacts to air quality and to noise and vibration.

3.2.4 Option 2, the all high segregation option is, along several segments of the Edinburgh orbital route, likely to result in long-term adverse impacts with agriculture and soils, as it will require new land. There will be impacts in terms of noise, air quality and vibration and on the cultural heritage of the area, and this option will adversely affect the setting of the Union Canal SAM, an important cultural and recreational resource. However, with this option there are likely to be benefits to greenhouse gas emissions through the anticipated modal shift to public transport, which mitigates to some extent, but by no means all, the adverse impacts noted above.

3.2.5 Option 3, the all low segregation option is, along a number of segments, likely to result in some adverse impacts locally, especially reduced air quality and increased noise and vibration during construction. However in the long term most sections will see benefits from improvements to local air quality, noise and vibration, and there are unlikely to any significant impacts on the natural and cultural heritage of the area with this option. In addition, the anticipated modest mode switch from cars to public transport is expected to generate modest benefits to air quality and levels of greenhouse gas emissions.

3.2.6 Option 4, the investment in high segregation, would be expected to have a similar set of environmental impacts as Option 2. However, because this option represents a shorter section of

[4] Edinburgh Orbital Bus Project STAG 1 Environmental Report, Halcrow, July 2008

route, the environmental impacts are reduced overall, and limited to the route between Newbridge and Musselburgh.

3.2.7 Option 5, representing low segregation, is likely to have very similar environmental impact as Option 3, but clearly, as with Option 4, these are expected to be less as the route is shorter, being only between Newbridge and Musselburgh.

3.2.8 Options 6 and 7 are very similar to Options 4 and 5 but with slightly fewer services and stops, so the environmental impacts would be expected to be a slight improvement, with fewer PT emissions in addition to the environmental benefits expected from similar levels of modal shift from car use to PT.

3.2.9 The conclusions from the environment objective are as follows:

- Option 1: Neutral impact;
- Option 2: Minor negative impact;
- Option 3: Moderate beneficial impact;
- Option 4: Minor negative impact;
- Option 5: Moderate beneficial impact;
- Option 6: Minor negative impact; and
- Option 7: Moderate beneficial impact.

Safety and Security

3.2.8 The Safety objective identified within STAG is concerned with reducing the loss of life, injuries and damage to property resulting from transport accidents and crime. Two sub-objectives are considered, namely accidents and security.

3.2.9 It would be expected that those options that exhibit the greatest segregation from current traffic flows would secure the largest potential benefits in terms of accident savings. This is on two accounts. Firstly removing public transport completely removes the potential for vehicular traffic conflict between PT vehicles and other traffic. Secondly, and more importantly, by potentially generating greater modal shift onto public transport, the segregated options will see the greatest relative potential decrease in car usage (against the background annual trend in increasing traffic).

3.2.10 In terms of security, all the options would be expected to see a broadly similar impact where similar vehicles are used for the routes concerned. The halts themselves would be equipped with the same level of equipment required to meet mandatory passenger security standards.

3.2.11 Therefore, whilst all the options would be anticipated to have a positive impact on safety and security, because Options 2, 4, and 6 involve a high level of segregation, these options will be expected to see the greatest impact in total.

3.2.12 The conclusions from the safety and security objective are as follows:

- Option 1: Neutral impact;
- Option 2: Moderate beneficial impact;
- Option 3: Minor beneficial impact;
- Option 4: Moderate beneficial impact;
- Option 5: Minor beneficial impact;

- Option 6: Moderate beneficial impact; and
- Option 7: Minor beneficial impact.

Economy

3.2.13 The economic appraisal was based on a financial assessment, the results of which were obtained from the transport model that was selected for use for this study[5]. This model was a refinement of the Transport Model for Scotland (TMfS), the development of which was discussed with the developers of TMfS (MVA Consultancy), Transport Scotland and SEStran, and which was considered appropriate for identifying potential patronage for the options being reviewed.

3.2.14 To simulate the transfer of trips from car to PT, the Park and Ride sub-model of TMfS was used. This was adopted in its standard form to model existing and proposed Park and Ride sties, together with PT enhancement to reflect the opportunities offered by the EOBP.

3.2.15 The model was run initially with a common level of service at 12 buses per hour from Inverkeithing to Wallyford. The model incorporated runs that involved calling at all intermediate interchanges, with interchange to other services for all off-route origins / destinations, three sets of running time assumptions, and the model was subsequently run for all seven options.

3.2.16 The financial assessment considered the capital expenditure, operating expenditure and revenues generated by each option. The capital costs were quoted both with and without HM Treasury standard optimism bias (OB) multipliers. The appraisal scoring is therefore based on the differences between revenues and operating expenditure. As a flat rate of £1.2 per fare was used (this was the fare structure applied at the time of the appraisal), revenues and patronage have identical values. Table 3.1 shows the results of the assessment for the seven options considered based on estimates produced by Halcrow[6].

Table 3.1: Summary of Financial Results by Option

Option	Capital Expenditure	Operating Expenditure	Revenues	Net Revenues
1	£0.00m	£6.56m	£3.27m	-£3.29m
2	£54.31m	£5.13m	£6.47m	£1.34m
3	£15.12m	£6.06m	£4.43m	-£1.63m
4	£54.31m	£3.51m	£5.99m	£2.48m
5	£14.82m	£4.43m	£4.07m	-£0.36m
6	£43.85m	£4.07m	£6.10m	£2.03m
7	£14.82m	£5.23m	£4.39m	-£0.84m

3.2.17 Compared with the existing infrastructure, represented by Option 1, the Low Segregation Option (LSO) from Inverkeithing to Wallyford, Option 3, increases overall demand (by revenues) by £1.16m, although this is not enough to cover the estimated additional operating expenditure.

3.2.18 It is only the High Segregation Options (HSOs) that show positive net revenues as can be seen in the Table. For instance, Option 6 characterised by all high segregation on the section from Newbridge to Musselburgh with a composite timetable of overlapping services, showed an increase in overall demand by £2.83m (by revenues) compared with Option 1.

3.2.19 However, the HSO options also have the highest capital expenditure associated with them, and Options 2 and 4 the highest of all at £54.5 million each.

[5] Edinburgh Orbital Bus Project Model Development and Future Market Working Paper, Halcrow, January 2008
[6] Edinburgh Orbital Bus Project Outcomes of Modelling Options Technical Note, Halcrow, April 2008

3.2.20 Based on the Table above, the appraisal results are as follows:

- Option 1: Major adverse impact;
- Option 2: Moderate beneficial impact;
- Option 3: Moderate adverse impact;
- Option 4: Major beneficial impact;
- Option 5: Minor adverse impact;
- Option 6: Major beneficial impact; and
- Option 7: Minor adverse impact.

3.2.21 Clearly both Options 4 and 6, based on the financial analysis above, were estimated to have major beneficial impacts, and Option 2 was estimated to have a moderate beneficial impact. The remaining options associated either with no investment, as in Option 1, or those with low levels of segregation, as in Options 3, 5 and 7, had adverse impacts, with Option 1 recording the most adverse of all.

Integration

3.2.20 In appraising the Government Objective, Halcrow considered transport and land-use integration[7]. This is summarised below.

Transport Integration

3.2.21 The potential routes would have to integrate with existing networks, services and Park and Ride sites, and operators would seek to integrate vehicle fleets with operations elsewhere.

3.2.22 The paper concluded that in general the EOPB has a good level of transport integration with other public transport services and with P&R sites. However different options produce different levels of transport integration, with some of the options integrating particularly well with existing services and/or link well with P&R sites.

Land-use Integration

3.2.23 A review of land allocations had been carried out in the STAG Part 1 appraisal which identified the amount and location of development land committed from the local plans and from the local authorities in the study area. This also documented the amount and future type of land-uses, and key locations in the study corridor that would benefit from the introduction of the EOBP. The finding from the review showed that there are a number of housing and employment prospects, existing and committed, that would contribute a significant passenger base to support the EOBP scheme. The additional passengers generated by these new developments helps to ensure that the scheme is successful.

3.2.24 The conclusions from the two types of integration area are as following:

- Option 1: Minor beneficial impact;
- Option 2: Moderate beneficial impact;
- Option 3: Minor beneficial impact;
- Option 4: Moderate beneficial impact;
- Option 5: Minor beneficial impact;
- Option 6: Moderate beneficial impact; and
- Option 7: Minor beneficial impact.

[7] Edinburgh Orbital Bus Project Rolling Stock Options Working Paper, Halcrow, March 2008

3.2.25 All the options considered scored a minor to moderate beneficial impact. However, Options 2, 4 and 6 are all expected to have greater possibilities of integrating highly segregated services with both existing public transport services and with the P&R sites on the orbital route. In addition, the passenger base will be expected to be higher for these options, as noted in the economy appraisal. Therefore, these options are expected to experience a moderate impact as opposed to the minor impacts expected for the remaining options.

Accessibility and Social Inclusion

3.2.26 STAG requires the consideration of two aspects as part of the Accessibility and Social Integration Government Objective, namely:

- Comparative accessibility; and
- Community accessibility.

3.2.27 In terms of comparative accessibility, the demand modelling projected significant levels of trips coming from three major trip generators that were identified as:

- The Edinburgh Business Parks;
- Queen Margaret University; and
- Edinburgh Royal Infirmary.

3.2.28 The trips generated by these sites were distributed to 13 destinations, which suggest that the EOBP would have a positive impact with respect to comparative access, that is, in terms of linking these large trip generating sites with the wider area.

3.2.29 Furthermore, the type of the activities associated with the sites noted above, especially education and health, also suggests that the EOPB improves community accessibility to these important facilities, providing benefits for these different trip purposes, especially for those without access to private transport. As such the EOPB is more than capable of meeting the community accessibility and social inclusion objectives.

3.2.30 The options that would be expected to generate the greatest impacts are those that would be predicted to have the highest levels of expected patronage. In this case options 2, 4 and 6 are anticipated to have the greater impact, as they are projected to carry the most passengers (see Table 3.1, the difference between Option 1 and the rest, where every £1 increase in revenue equates to an extra passenger carried). The results for the two aspects of accessibility are therefore as follows:

- Option 1: Minor beneficial impact;
- Option 2: Major beneficial impact;
- Option 3: Moderate beneficial impact;
- Option 4: Major beneficial impact;
- Option 5: Moderate beneficial impact;
- Option 6: Major beneficial impact; and
- Option 7: Moderate beneficial impact.

Appraisal against Planning Objectives

3.2.31 As was noted in section 2.4.4 there are five planning objectives identified at the option generation workshop. Each of the seven options was appraised against these planning objectives.

3.2.32 Planning Objective 1: to aim towards achieving RTS mode share targets within the study corridor are met by Options 2, 4 and 6 to a very significant degree, and are estimated to have major

beneficial impacts. This planning objective is met only to a moderate amount with Options 3, 5, and 7, and only to a minor degree with option 1. This suggests that the higher the level of PT segregation, the more likely that modal share targets will be achieved in the study area.

3.2.33 Planning Objective 2: to aim towards achieving RTS environmental targets within the study corridor is not met by Option 1. However the high segregation options (Options 2, 4, and 6) all have a minor negative impact with regard to this option. This is attributable to the large amount of new land required to build the infrastructure for these options, and the disruption to local heritage and construction disbenefits this causes, which fails to outweigh the positive longer term impacts of reduced emissions. However, these positive influences outweigh the negative impacts in the case of options 3, 5, and 7, simply because they require much less land-take and the construction disbenefits associated with this, so the net result is a moderate beneficial impact for these options.

3.2.34 Planning Objective 3: to ensure the integration of public transport with existing and proposed land-use within the study corridor is met to some extent by all the options being considered. However, the segregated options, (Options 2,4, and 6) which require new infrastructure, give the opportunity to integrate public transport services more completely with proposed developments than those options having partial segregation (Options 3, 5, and 7) or none at all (Option 1). Therefore Options 2, 4, and 6 have a moderate beneficial impact in this regard.

3.2.35 Planning Objective 4: to improve community and comparative accessibility by public transport is also met to some degree by all the options being considered. However Options 2, 4, and 6 have a major beneficial impact on accessibility because of their ability to integrate more closely than the other options with existing and new developments, and the attractiveness provided by the superior performance offered by these options. These result in heavier PT patronage along the route corridor, with the implicit accessibility benefits spread over a wider geographical area, covering a wider cross section of the population.

3.2.36 All the options, with the exception of Option 1 (no investment), meet Planning Objective 5: to make public transport, with improved times, reliability and quality, more attractive verses single occupancy private car in the study corridor, well or very well, offering either moderate or major beneficial impacts. The high segregated options (Options 2, 4, and 6), because they offer superior performance in terms of speed and reliability over the other options, would be expected to score the highest beneficial impacts in terms of attracting modal shift from single occupancy private car trips.

Summary of STAG Part 1 Scores

3.2.37 Table 3.2 illustrates the results in summary form of the appraisal of the options, both in terms of the Government's transport objectives and the local planning objectives.

Table 3.2: Summary of Option Appraisal against Government Transport And Local Planning Objectives

Option / Test	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Planning Objective 1	✓	✓✓✓	✓✓	✓✓✓	✓✓	✓✓✓	✓✓
Planning Objective 2	O	✗	✓✓	✗	✓✓	✗	✓✓
Planning Objective 3	✓	✓✓	✓	✓✓	✓	✓✓	✓
Planning Objective 4	✓	✓✓✓	✓✓	✓✓✓	✓✓	✓✓✓	✓✓
Planning Objective 5	O	✓✓✓	✓✓	✓✓✓	✓✓	✓✓✓	✓✓
Environment – air quality & noise	✗	✓	✓	✓	✓	✓	✓
Environment – other	O	✗✗	✗	✗✗	O	✗✗	O
Safety	O	✓✓	✓	✓✓	✓	✓✓	✓
Economy	✗✗✗	✓✓	✗✗	✓✓✓	✗	✓✓✓	✗
Integration	✓	✓✓	✓	✓✓	✓	✓✓	✓
Accessibility / Social inclusion	✓	✓✓✓	✓✓	✓✓✓	✓✓	✓✓✓	✓✓

3.2.38 The preferred option would be the one that scores highest in terms of ticks, adjusted by the corresponding number of crosses. This signifies the net level of aggregate benefits the option would be expected to contribute.

3.2.39 The STAG Part 1 results of the assessment summarised in the Table above show that in terms of the local planning objectives, the high segregation options perform very well, particularly Options 4 and 6, and especially in terms of meeting Planning Objectives 1, 4 and 5. These planning objectives refer to achieving modal shift from car to public transport along the study corridor, improving community and comparative accessibility for existing communities and new developments adjacent to the corridor, and offer superior performance in terms of speed, journey times and reliability.

3.2.40 Furthermore the high segregation options also provide a significantly higher level of benefit for the Government transport objectives with the exception of some of the environmental factors associated with the amount of land-take required. For value for money, expressed in the appraisal as the anticipated net revenues of the services considered, the best performing were those again which were highly segregated, especially Options 4 and 6 as they were expected to generate the most additional patronage.

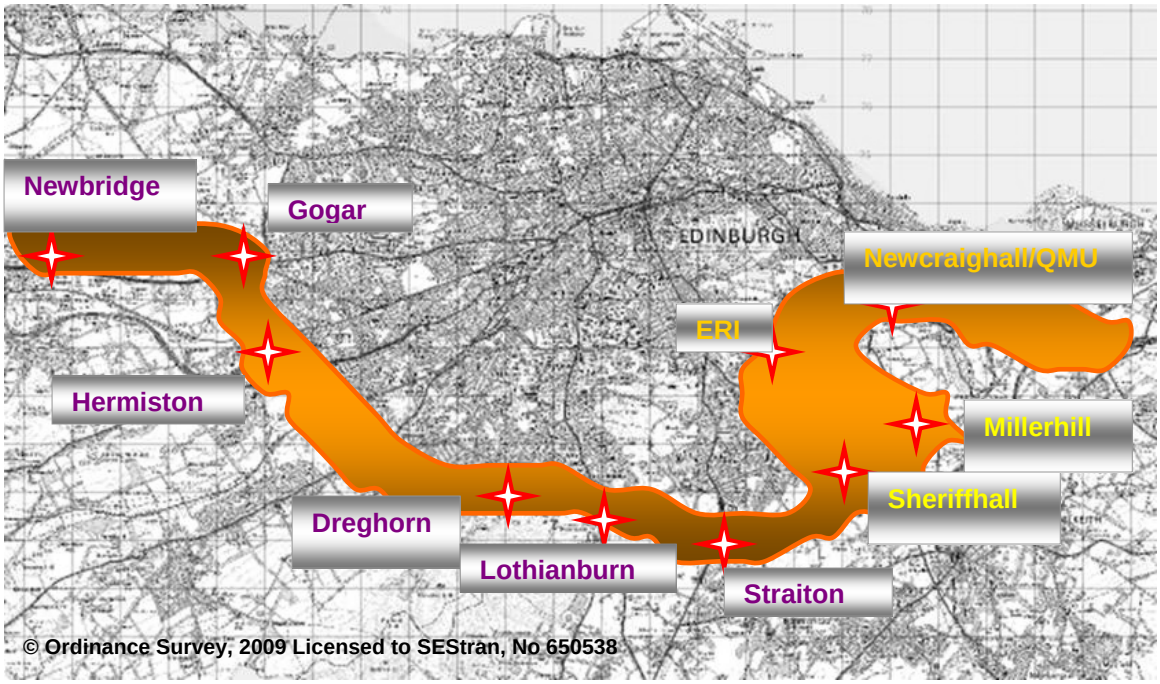
3.2.41 From the appraisal distilled above, the preferred options to take forward to the subsequent STAG Part 2 appraisal are Options 4 and 6. These options will now be taken forward for further option development.

4 Option Development

4.1 Background to Selection of Options

4.1.1 The Study Area for this appraisal, covers the Edinburgh area, and is shown in Figure 4.1. This includes the outskirts of East, South and West Edinburgh and the immediate area surrounding Newbridge and Straiton, located within Midlothian local authority boundary, and the Musselburgh area located within East Lothian local authority area.

Figure 4.1: Option Coverage



4.1.2 The Study Area falls within the "Edinburgh City Bypass" corridor, characterised by high volumes of commuter tidal flow between West Edinburgh and East Edinburgh and their respective hinterlands. The Edinburgh City Bypass Corridor represents a strategic corridor where a high degree of modal shift is desirable, and significant investment is required to achieve this. The Figure shows the key locations of Park and Ride locations and stops on the routes being considered.

4.1.3 Option development is based on the Pre-feasibility Report[8] where the STAG Part 1 appraisal identified two basic options, both with segregated links, to be taken forward for further consideration which had demonstrated the greatest potential benefits. The first, option A, followed a northern alignment, with a link from Sheriffhall to the ERI and onto the QMU, where the route terminates. The second, option B shares the same route with option A as far as Sheriffhall, but this option continues on a southern alignment onto the Park and Ride site at Millerhill. Both

[8] Edinburgh Orbital Pre-feasibility Report, Scott Wilson June 2009

options A and B are to be taken forward for further consideration as they clearly demonstrate the greatest potential benefits.

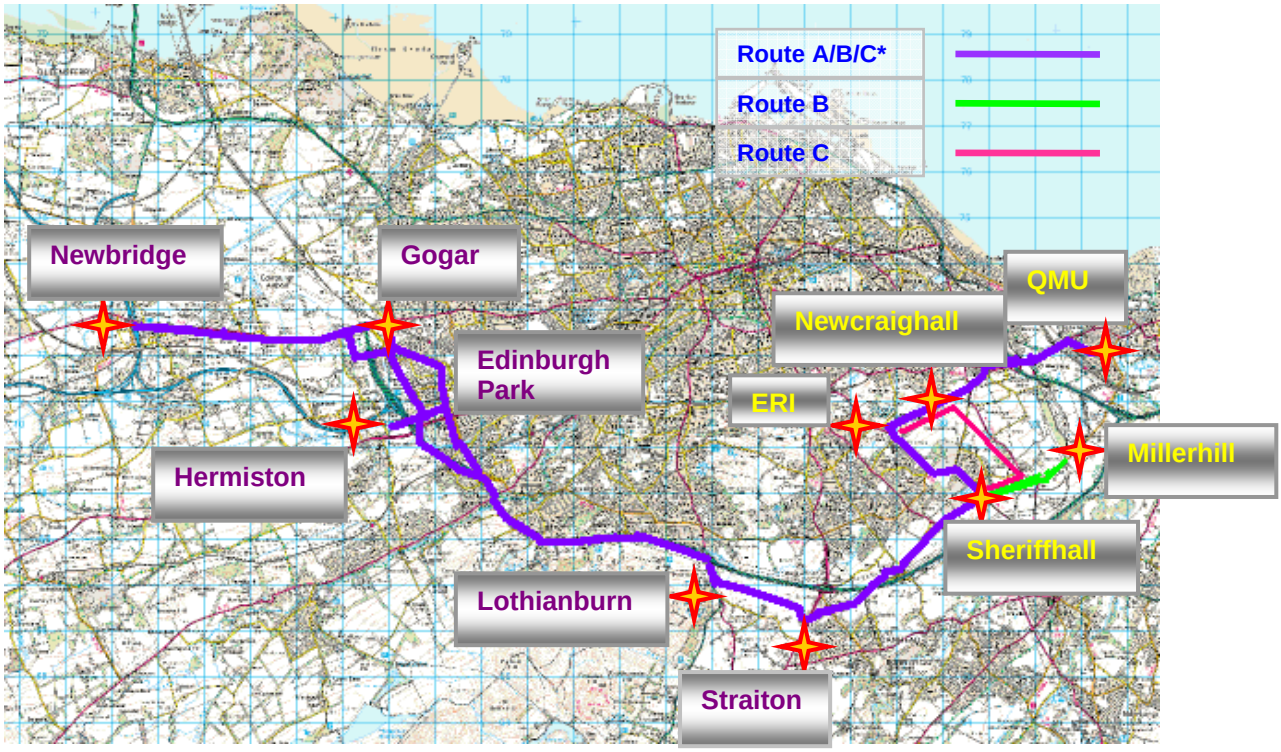
4.1.4 One of the results of this consultation has been the identification of a third option, option C, also with segregate links, the Shawfair option, which shares a common route with both options A and B as far as Sheriffhall, but then is routed to the north, via Whitehall Mains, before terminating at the ERI.

4.1.5 The following summarises the base options.

- Option A: from Newbridge to Newcraighall with 12 buses per hour throughout;
- Option B: from Newbridge to Millerhill with 12 buses an hour; and
- Option C: from Newbridge to ERI, with 12 buses an hour.

4.1.6 Figure 4.2 shows the anticipated route for route option A, the fully segregated northern route alignment, route option B, the hard shoulder running southern route alignment, and route option C, the Shawfair alignment between the two, with a section towards Millerhill, before turning back and terminating at the ERI. There are minor differences for those variations of these route options where the route follows the hard shoulder of the A720, but these are too small to demonstrate for the scale shown.

Figure 4.2: Route Options A/B/C Alignments



**The mauve alignment is common to route options A, B and C only as far as the Sheriffhall P&R*

4.2 STAG Part 2 Detailed Scheme Descriptions

4.2.1 The workshop undertaken by Scott Wilson on the 19 November 2008 with the relevant local authorities and SEStran, along with subsequent discussions with these parties, the Land-use Planning Review, and consultation with the major PT operators, have all contributed to the identification of EOBP options. The aim was to allow this scheme to operate with a significant level of segregation/separation from general traffic to maintain sufficiently high running speeds with the optimal infrastructure requirements and service frequency on the route corridor.

4.2.2 These modifications involve operating the services with different service level frequencies and fare options, including a flat fare and staggered 3-stage fares dependant on length of trip taken. In addition the modelling of the options tests route performance with different stopping patterns, including omitting Hermiston and Newbridge, so that in terms of the latter, the route would begin/end at Edinburgh Airport.

4.2.3 Furthermore, in addition to examining fully segregated (new, off road routes), the options also take into account the potential for using existing hard shoulders and planned new hard shoulders along the bypass. These are in the light of potential plans by Transport Scotland to implement hard shoulders along the bypass by 2015. The hard shoulder sections would still provide a reasonably fast running speed while being significantly cheaper to implement, since it is assumed the Government would have covered the costs of the hard shoulder infrastructure.

4.2.4 The 30 options and sub-options are summarised in Table 4.1, showing the permutations based on the discussion above, with different fare options, mixture of hard running, and with/without stops at Hermiston and Newbridge.

4.2.5

Table 4.1: Summary of Scheme Descriptions

Option	Alignment	Level of Segregation	Service Level Frequency per hour	Fares
A1	North alignment	Fully segregated	12 buses	£1.20
A2	North alignment	Fully segregated	10 buses	£1.20
A3	North alignment	Hard shoulder	12 buses	£1.20
A4	North alignment	Fully segregated	12 buses peak; 6 buses off-peak	£1.20
A5	North alignment	Hard shoulder	12 buses peak; 6 buses off-peak	£1.20
A6	North alignment	Hard shoulder, Section 4 Segregated	12 buses peak; 6 buses off-peak	£1.20
B1	South alignment	Fully segregated	12 buses	£1.20
B2	South alignment	Fully segregated	10 buses	£1.20
B3	South alignment	Hard shoulder	12 buses	£1.20
B4	South alignment	Fully segregated	12 buses peak; 6 buses off-peak	£1.20
B5	South alignment	Hard shoulder	12 buses peak; 6 buses off-peak	£1.20
B6	South alignment	Hard shoulder, Section 4 Segregated	12 buses peak; 6 buses off-peak	£1.20
B7	South alignment	Hard shoulder, Section 4 Segregated	12 buses peak; 6 buses off-peak	£1.2 - £2.5 - £3

Option	Alignment	Level of Segregation	Service Level Frequency per hour	Fares
B8	South alignment	Hard shoulder	12 buses peak; 6 buses off-peak	£1.2 - £2.5 - £3
B9	South alignment, without Hermiston (£150k pa OpEx saving)	Hard shoulder, Section 4 Segregated	12 buses peak; 6 buses off-peak	£1.20
B10	South alignment, without Hermiston (£200k pa OpEx saving)	Hard shoulder, Section 4 Segregated	12 buses peak; 6 buses off-peak	£1.20
B11	South alignment, without Hermiston & Newbridge (£150k pa OpEx saving)	Hard shoulder, Section 4 Segregated	12 buses peak; 6 buses off-peak	£1.20
B12	South alignment, without Hermiston & Newbridge (£200k pa OpEx saving)	Hard shoulder, Section 4 Segregated	12 buses peak; 6 buses off-peak	£1.20
B13	South alignment, without Hermiston & Newbridge (£150k pa OpEx saving)	Hard shoulder, Section 4 Segregated	12 buses peak; 6 buses off-peak	£1.2 - £2.5 - £3
B14	South alignment, without Hermiston & Newbridge (£200k pa OpEx saving)	Hard shoulder, Section 4 Segregated	12 buses peak; 6 buses off-peak	£1.2 - £2.5 - £3
B15	South alignment, without Newbridge	Hard shoulder, Section 4 Segregated	12 buses peak; 6 buses off-peak	£1.20
B16	South alignment, without Newbridge	Hard shoulder	12 buses peak; 6 buses off-peak	£1.20
B17	South alignment, without Newbridge	Hard shoulder, Section 4 Segregated	12 buses peak; 6 buses off-peak	£1.2 - £2.5 - £3
B18	South alignment, without Newbridge	Hard shoulder	12 buses peak; 6 buses off-peak	£1.2 - £2.5 - £3
C1	Shawfair alignment	Fully segregated	12 buses	£1.20
C2	Shawfair alignment	Fully segregated	10 buses	£1.20
C3	Shawfair alignment	Hard shoulder	12 buses	£1.20
C4	Shawfair alignment	Fully segregated	12 buses peak; 6 buses off-peak	£1.20
C5	Shawfair alignment	Hard shoulder	12 buses peak; 6 buses off-peak	£1.20
C6	Shawfair alignment	Hard shoulder, Section 4 Segregated	12 buses peak; 6 buses off-peak	£1.20

4.2.6 The result of the modelling (Chapter 5) identified the four best performing options, which are:

- Route Option A5;
- Route Option B17;
- Route Option B18; and
- Route Option C5.

4.2.7 These four options are all hard shoulder options with the exception of route option B17, which has section 4 segregated. Transport Scotland, is preparing to introduce hard shoulder running along almost the whole length of the A720 by-pass to be implemented by 2015. However, with option B17, it is assumed that Transport Scotland has been unable to introduce hard shoulder running on section 4 by this date, and consequently the costs for this option would be higher than option B18 which has full hard shoulder running along section 4.

4.2.8 Only the results of these four options are described through the remainder of this report. Apart from the economic and financial performance of these options, the results of the other STAG parameters tested do not, as a rule, vary much between the options.

4.3 Scheme Costs

4.3.1 The costs below are fully explained in the Pre-Feasibility Report, so a detailed description of how they have been derived is not produced here. Table 4.2 shows a summary of capital and operating costs in 2008 Q3 prices for the 4 best performing options (hard shoulder) and 3 segregated options for comparison.

Table 4.2: Summary of Capital and Operating Costs for the Hard Shoulder Options

Route Designation	Construction	Contingencies	Risk and uncertainty	OB	Grand Total	Operating
Route A5	£16.4m	£2.5m	£4.1m	£4.6m	£27.5m	£2.2m
Route B17	£22.4m	£3.4m	£4.1m	£3.0m	£32.9m	£1.7m
Route B18	£15.1m	£2.3m	£3.7m	£2.6m	£23.7m	£1.7m
Route C5	£22.7m	£3.4m	£5.1m	£4.7m	£35.9m	£2.1m

Notes: All costs are in 2008 prices
Grand Totals might not add up exactly due to rounding

4.3.2 While the above options are the most cost effective and use the existing and panned hard shoulders along the bypass, if the fully segregated alignments (i.e. off line routes) were implemented the capital costs would be higher, as shown in Table 4.3.

4.3.3 In all options, the maintenance costs are assumed to be 5% of the capital costs. It should be noted that, in contrast to capital costs, operating costs will differ for each sub-option where bus service levels vary. In addition, the options that omit Hermiston and/or Newbridge as a stop have a saving of £150,000 / £200,000 per annum in operating costs.

Table 4.3: Summary of Capital and Operating Costs for the Segregated Options

Route Designation	Construction	Contingencies	Risk and uncertainty	OB	Grand Total	Operating
Route A4	£36.4m	£5.5m	£5.5m	£6.3m	£53.7m	£2.2m
Route B4	£33.7m	£5.1m	£5.2m	£5.3m	£49.2m	£1.7m
Route C4	£40.5m	£6.1m	£6.5m	£5.9m	£59.0m	£2.1m

Notes: All costs are in 2008 prices
Grand Totals might not add up exactly due to rounding

5 TRANSPORT MODELLING ESTIMATES

5.1 Introduction

5.1.1 This Chapter summarises the results of the transport modelling carried out to estimate bus patronage and revenues of the options appraised, as explained in the EOBP Modelling Technical Note[9] reproduced in Appendix B of this report. The Chapter provides a brief overview of the transport model used for this exercise and then goes on to present the results of the forecasts for different years of the analysis.

5.1.2 For the purposes of this appraisal, the analysis has assumed the first full year of operation would be 2012 and a future design year of 2022. Estimates for intermediate years have been obtained by interpolation of the results for 2012 and 2022. Patronage and revenue figures for future years beyond 2022 have been set at the estimates for 2022 due to the level of uncertainty over the long term.

5.2 Reference Case

5.2.1 The reference case for this study is based on the Transport Model for Scotland (TMfS) version 05A. TMfS is a multi-modal transport demand and assignment model that incorporates an integrated Transport and Economic Land Use Model (TELMoS). The model has progressed through a number of versions over the past 7 years, incorporating improvements in geographical and data coverage, with TMfS:05A using 2005 as the base year.

5.2.2 The model contains an extensive dataset of both transport and land use data within Scotland and has a capability of forecasting the transport and land-use changes resulting from major infrastructure and/or policy initiatives. TMfS:05A includes a number of public transport modes, including national and local rail services, urban and inter-urban bus services. There were minor updates made to urban services, of which the most notable was the inclusion of the Edinburgh Park and Ride services. In addition, public transport crowding was included in TMfS, while 2004/2005 ticket data were also incorporated into the model as part of the public transport validation process.

5.2.3 In order to model future scenarios across the transport network, it is important to compare against the Reference Case. This takes into account planned and committed schemes which will occur and allow for comparison against the future state of the network. The TMfS has defined the following Reference Case of committed transport schemes for inclusion in future demand modelling:

By 2012

- M74 Completion;
- M9 Spur Extension;
- Finnieston Bridge;
- A68 Northern Bypass;
- Ferrytoll Link Road;
- New Forth Crossing;

[9] Edinburgh Orbital Bus Project Modelling Technical Note, Scott Wilson, June 2009

- Alloa – Stirling – Glasgow Rail Service;
- M8 Upgrade;
- Airdrie – Bathgate Rail Reopening;
- Edinburgh Tram Lines;
- Edinburgh Airport Rail Link;
- Glasgow Airport Rail Link;
- Borders Rail Service;
- M80 Upgrade;
- A801 Upgrade; and
- Aberdeen Western Peripheral Road.

By 2022

- Rosyth Bypass.

5.2.4 It was noted at the Local Authority Workshop, held on the 19 November 2008, that a new park and ride facility is planned at Lothianburn. This is on hold at the moment as funding sources are not clearly identified. However, this P&R facility may be taken forward as part of this project, hence it was considered appropriate to assume that this would be completed by 2022.

5.2.5 A number of other infrastructure projects will be completed at approximately the same time as the EOBP is due to commence, including Tramline 1a and the Airdrie to Bathgate rail line, both of which are estimated to be completed by 2012. There were also a number of transport projects identified that will be completed by 2022, of which the most important include the New Forth Crossing, the replacement of the EARL proposals, the Dalmeny Chord (variation of EARL) and the Waverley to the Borders rail link.

5.2.6 A number of potential future transport services had been identified as being of importance. These include improved (express) rail services on the Shotts rail line; improved timetable for rail services between Edinburgh and Fife; additional early morning services from Dunblane and Perth, each of which is expected to be in place by 2012. In addition to these there was also the potential of improved rail services between Edinburgh and Dunbar by 2022.

5.3 Overview of the Transport Modelling

5.3.1 The aim of the modelling is to determine the maximum possible patronage for the EOBP service and the sensitivity of the identified level of demand to changes in travel cost and time, including fares, journey times and frequency of service. The work would update and extend similar Orbital Bus Appraisal work previously carried out by Halcrow.

5.3.2 As noted above, the proposed approach used the stand-alone Park and Ride module from TMfS:05A to predict the patronage on different variants of the proposed service, including both genuine Park and Ride Users and those who access the service as walk-on trips from within the relevant TMfS zone.

5.3.3 Demand forecasting used the 2001 Census Travel to Work, which was updated using the latest planning data forecasts and was supplemented (by Scott Wilson) to include a plausible representation of other journey purposes and to reflect more closely the pattern of trips to/from Edinburgh Airport and/or the new Royal Infirmary. The demand for P&R was estimated using travel demands, highway and public transport costs and parking charges. The model

incorporated both existing and proposed P&R sites, which together with the PT enhancements, reflected the opportunities presented by the EOBP.

5.3.4 The Park and Ride model was also used to simulate the additional opportunities for trips which arrive at the Park and Ride sites on foot. The model output was in the form of adjusted peak hour demand matrices for assignment using the highway and public transport models and Park and Ride patronage statistics.

5.3.5 The design of the EOBP was subject to a number of iterative stages, subject to the level of forecast demand and the demand between each interchange on the route. The initial review of the model outputs included a check of the level of calibration/validation of journey times and link flows on the relevant stage between each of these interchanges on the A720 corridor.

5.3.6 It was observed at the workshop that car parking may become an important issue, which has some bearing on the modelling undertaken. Currently some major services (such as the Royal Hospital) presently charge for car parking. Political pressure to remove these charges and their subsequent abolishment would have a major impact on passenger forecasts for the EOBP, with consequences for bus service operations. Charging policy in both the public sector and major players in the private sector will need to be reviewed. Related to this is the issue of lack of capacity at some major attractors (e.g. the Gyle) for parking spaces. It may be that in future these attractors, at which it is currently free to park, begin charging as a means of demand management.

New Developments

5.3.7 The forecast demand for the EOBP will be heavily influenced by existing and planned new developments along the EOBP route. In terms of developments and employment areas, the modelling includes the impacts on the transport network of South Gyle, Edinburgh Business Park, the Royal Bank of Scotland and Edinburgh Airport, each of which are situated adjacent or close to the route.

5.3.8 The EOBP study corridor falls within four local councils – Midlothian, East Lothian, West Lothian and Edinburgh. The relevant councils' respective local plans are sufficient in providing reasonably up-to-date land-use development plans.

West Edinburgh Planning Framework 2003

5.3.9 The Framework has the status of a Scottish Panning Policy (SPP), and aims to promote development on selected established development sites and the intensification of existing land uses up to 2020. The Framework identifies six key sites for development for 2020:

- Sighthill/South Gyle – redevelopment of employment areas particularly relating to retail. The area is now identified as a "core development area" in the Edinburgh and Lothians Structure Plan;
- Edinburgh Park – permission has been granted for further development of the site;
- The Gyle Centre – extension or redevelopment of the Gyle Shopping Centre with supporting leisure and community facilities and public transport access improvements. The shopping centre was extended at one end and there are plans for further expansion;
- Gogarburn Hospital – since developed as the HQ for the Royal Bank of Scotland;
- Edinburgh Airport – development which supports airport growth target for 2020 including road and public transport access improvements. A Masterplan has since been prepared;

- Royal Highland Showground – redevelopment of the Showground site, adjacent land uses and car parking areas. The site is now earmarked to accommodate expansion of Edinburgh Airport; and
- Newbridge – promotes the regeneration of Newbridge / Kirkliston / Ratho / which has been identified as a "core development area" in the Edinburgh and Lothians Structure Plan 2015.

5.3.10 In addition to the potential development and development areas identified in the Framework, a number of other developments have been earmarked along the EOBP corridor, and the largest of these are shown in Table 5.1. Only commercial and education developments of over 10 hectares, and housing developments of more than 100 units, are included in the Table.

Table 5.1: Summary of Major Developments on the EOBP Corridor

Land-use Description	Area	Location	Size
Commercial	Newbridge	Newbridge North	22.2 ha
Commercial	Newbridge	Newbridge West	20.5 ha
Commercial	Newbridge	Newbridge South	31.1 ha
Commercial	Edinburgh Park	Edinburgh Park	16.0 ha
Commercial	Dalkeith	Sheriffhall South	11.5 ha
Commercial	Loanhead	Ashgrove	10.0 ha
Commercial	Newcraighall	Little France	65.0 ha
Commercial	Craighall	Musselburgh	34.0 ha
Commercial	Shawfair	Whitehills Mains	13.0 ha
Commercial	Shawfair	Shawfair	115.0 ha
Commercial	Shawfair	South Danderhall	13 units
Housing	Kirkliston	North Kirkliston	650 units
Housing	Ratho	Freelands Road	100 units
Housing	Ratho	Craigpark Quarry	117 units
Housing	Craigs Road	Craigs Road	280 units
Housing	Gyle	South Gyle Wynd	180 units
Housing	Harvesters Way	Harvesters Way	168 units
Housing	Loanhead	Burghlee, Loanhead	100 units
Housing	Gracemount	Gracemount	136 units
Housing	Hyvots	Hyvots	620 units
Housing	Niddrie	Niddrie Mains	1,221 units
Housing	Niddrie	Thistle Foundation	170 units
Housing	Greendykes	Greendykes	1,990 units
Housing	Greendykes	South of Greendykes	1,200 units
Housing	Craigmillar	Castlebrae HS	145 units
Housing	Greendykes	New Greendykes	810 units
Housing	Newcraighall	Newcraighall North	200 units
Housing	Newcraighall	Newcraighall East	220 units
Housing	Shawfair	Shawfair	3,500 units
Housing	Shawfair	North Danderhall	190 units
Housing	Shawfair	South Danderhall	300 units
Education	Craighall	QMU Campus	21.0 ha

5.3.11 The Table shows that much of the proposed housing development is located towards the eastern end of the EOBP study corridor, whereas a large proportion of proposed commercial development sites are in the western parts of the corridor. However, it should be noted that both Newcraighall and Shawfair to the east of Edinburgh will also see substantial new commercial development. The implication is that potential PT movements may be skewed westwards in the morning peak, and eastwards in the evening peak travel periods.

5.4 Results of Modelling

Summary of Results

5.4.1 A number of options were assessed during the modelling process, in order to identify the route and service offering the best ratio between patronage and costs. In total three different routes were modelled, a northern alignment, a southern alignment and the Shawfair alignment, as described in Chapter 4. The results of the modelling exercise are illustrated in the following Table 5.2, as well as the costs associated with each option.

Table 5.2: Estimated Annual EOBP Patronage and Costs

Route Option	Service Description	2012		Operating Costs
		Pax (X 1000)	Revenues	
Northern Alignment A5	6 buses per hour during Interpeak + Hard Shoulder	2,448	£2.9m	£2.2m
Southern Alignment B17	6 buses per hour during Interpeak + Hard Shoulder (segregated on section 4)	1,864	£3.1m	£1.7m
Southern Alignment B18	6 buses per hour during Interpeak + Hard Shoulder	1,864	£3.1m	£1.7m
Shawfair Alignment C5	6 buses per hour during Interpeak + Hard Shoulder	2,344	£2.8m	£2.1m

5.4.2 From these results, it appears that:

- option A5 earns the highest revenues, but also has the highest operating costs;
- option C5 has lower operating costs but also has lower revenues than option A5;
- option B17 has lower revenues and has fewer passengers compared with options A5 and C5, but also has significantly less operating costs compared to the other options, therefore has a higher operating margin than these options; and
- option B18 is similar to option B17 in terms of passenger loads, but is all hard shoulder running, therefore this option has the lowest operating costs of all these options and therefore the highest operating margins.

5.4.3 For this reason, the southern hard shoulder running route with only 6 buses during the Interpeak (option B18) seems to be the most viable, but options B17, A5 and C5 are also suitable alternatives.

5.4.4 Table 5.3 show the proportion of EOBP passengers being abstracted from car and from other PT services for the four preferred options. It can be seen that the different modelled routes followed do not impact significantly on the abstraction modal split, which remains the same for all four route options.

Table 5.3: Abstraction from Car & Public Transport to EOBP

	Car to EOBP	PT to EOBP
North Route A5	69%	31%
South Route B17	68%	32%
South Route B18	68%	32%
Shawfair Route C5	69%	31%

5.4.5 Figures 5.1 to 5.4 overleaf show the passenger movements for the principal EOBP stops for the four preferred options.

Figure 5.1: 2012 Passenger Movements – Option A5, North Route with Hard Shoulder and 6 buses per hour during Interpeak

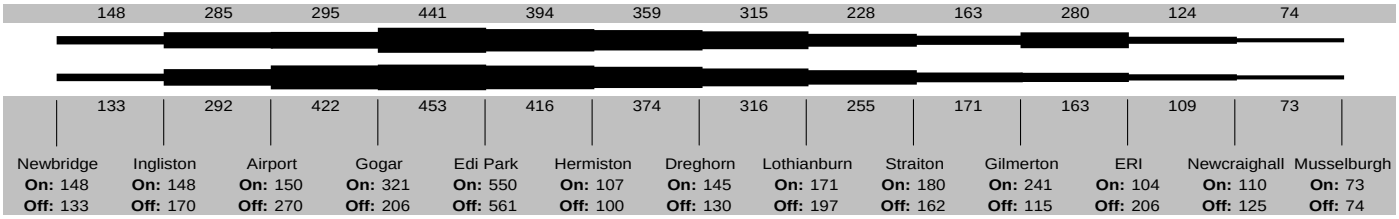


Figure 5.2: 2012 Passenger Movements – Option B17 and B18, South Route with Hard Shoulder and 6 buses per hour during Interpeak

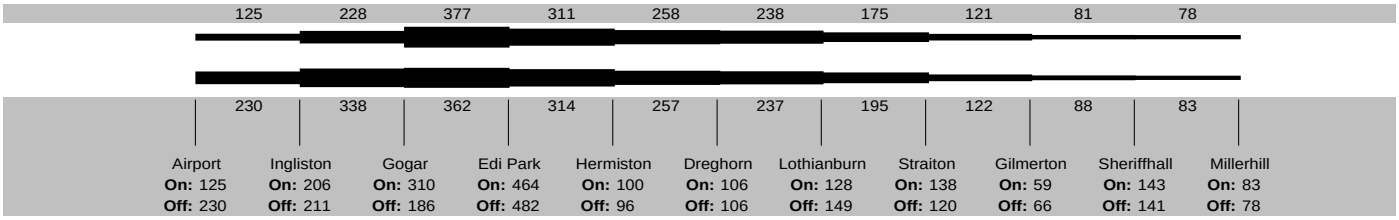
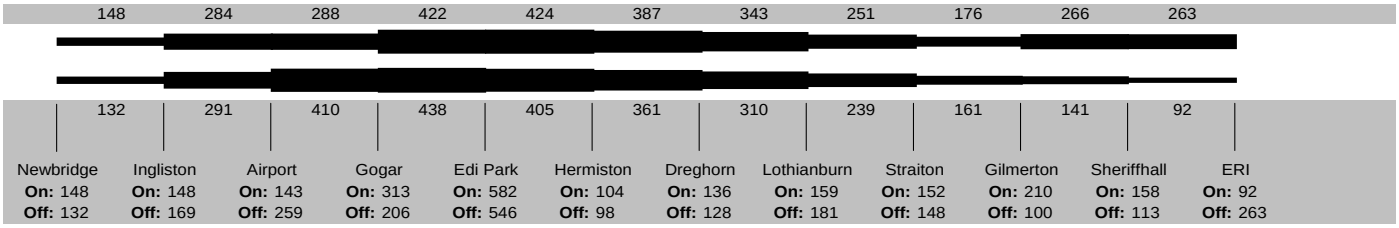


Figure 5.3: 2012 Passenger Movements – Option C5, Shawfair Route with Hard Shoulder and 6 buses per hour during Interpeak



5.4.6 These figures show the following key characteristics of the options considered:

- westbound and eastbound flows show quite similar projected travel patterns between each option, with heavier bus passenger loadings on the western half of the route corridor;
- the main trip generators / attractors are the Airport, Gogar, the ERI and especially Edinburgh Park;
- the Gilmerton P&R shows a significant “bulge” in passenger number projected to use the service eastbound for route option A5; and
- Sheriffhall and ERI show a significant “bulge” in passenger number projected to use the service for the Shawfair route option (C5) in an eastbound direction.

6. STAG PART 2 APPRAISAL

6.1 Overview and Planning Objectives

6.1.1 This Chapter sets out the detailed STAG Part 2 Appraisal in terms of the performance of these eighteen options and sub-options for the EOBP against the Government's five objectives for transport, which are environment, safety, economy, integration and accessibility and social inclusion. It is assumed that the service opening year of the EOBP will be 2012, and that the appraisal period will cover the period from 2012 up to 2022, a ten year appraisal period.

6.1.2 The STAG Part 1 Appraisal identified five outline local *Planning Objectives* which were discussed with key local stakeholders. From the transport modelling work it was possible to expand the outline planning objectives to make them SMART (specific, measurable, achievable, realistic and time-bound) and provide target values for each of them. In consultation with SEStran, and a review of their targets in the SEStran Regional Transport Strategy, the following SMART planning objectives have been identified as being suitable:

- 5% mode shift from cars to public transport at key locations within the study area by 2022;
- decrease of 20 m.veh-kms per annum to account for reduction in environmental emissions at key locations within the study area by 2022;
- improve the integration of public transport services by encouraging 0.75 million passengers per annum (mppa) by 2022 from existing radial public transport services onto the direct orbital service, thereby reducing interchange and unnecessary trips to the city centre;
- improve accessibility by attracting a minimum of 2 mppa using the service by 2022; and
- improve public transport travel times by 20m passengers-minutes (m.pax-mins) per annum for users by 2022.

6.2 Appraisal of Impacts

6.2.1 As with the STAG Part 1 process, the appraisal of impacts, is based on a standard seven-point scale as outlined below:

✓✓✓	major beneficial impact	✗✗✗	major adverse impact
✓✓	moderate beneficial impact	✗✗	moderate adverse impact
✓	minor beneficial impact	✗	minor adverse impact
	O neutral impact		

6.2.2 Each score is assigned to each STAG sub-criterion to indicate the likely impact.

6.3 The Environmental Appraisal

6.3.1 A full Environmental Appraisal has been carried out in accordance with STAG guidance, and is contained in Appendix C. It is important to note that the environmental evaluation considers the likely impacts that will occur during the construction and operation of the proposed transport options. Accordingly, this section of appraisal focuses initially on the guidance provided for environmental appraisal in STAG Part 2, before concluding with a summary of the anticipated impacts. This section is a summary of the full environmental appraisal report.

Planning Objectives

6.3.2 The following Planning Objectives have been identified as nesting within the overall environmental heading.

Government Objective[10]:	To protect our environment and improve health by building and investing in public transport and other types of efficient and sustainable transport which minimises emissions and consumption of resources and energy.
Planning Objective:	To aim towards achieving RTS environmental targets within the study corridor.

Appraisal Methodology

6.3.3 The study is based on a desktop review of technical reports, consultation responses and initial site survey information. Each sub-objective section follows the same format and assessment hierarchy in accordance with the STAG guidance, which consists of four stages as follows:

- Scoping – defining potential impacts and assessment methods. Within each sub-objective this includes specific methodologies and a definition of the study area;
- Baseline – information about the environment in the year of project commencement and foreseeable developments;
- Assessment – identifying the likely environmental impacts and magnitude of these impacts. All types of impacts are assessed which may be positive or negative, permanent or temporary, direct, indirect, short, medium or long term, secondary, cumulative and synergistic. For the purpose of this study the assessment has considered the effects of construction, as well as future operations, unless other timescales are used for specific sub-objectives; and
- Appraisal – determining the significance of the impacts.

Consultation

6.3.4 The statutory consultees were consulted as recommended by the STAG guidelines. In addition a number of non-statutory bodies were also consulted. A summary of the responses is given in the full environmental appraisal presented in Appendix C.

Appraisal of Options

6.3.5 The potential impacts of all the options are summarised in Table 6.1 overleaf.

[10] Government Objectives are quoted from Scotland's Transport Future, White Paper, 2004

Table 6.1: Summary of Environmental Assessment Results

Option	Noise & Vibration	Air Quality	Water Quality, Drainage & Flood Defence	Geology, Agriculture & Soils	Bio-diversity	Visual Amenity	Cultural Heritage	Landscape
Routes A1/A2/A4	✓✓	✓✓	✗	✗	✗✗	✗	✗	✗
Routes A3/A5	✓✓	✓✓	✗	✗	✗	✗	✗	✗
Routes A6	✓✓	✓✓	✗	✗	O	O	O	O
Routes B1/B2/B4	✓	✓	✗	✗	✗✗	✗	✗	✗
Routes B3/B5/B8/B16/B18	✓	✓	O	O	O	O	O	O
Routes B6/B7/B9/B10/B11/ B12/B13/B14/B15/ B17	✓	✓	✗	✗	✗	O	O	O
Routes C1/C2/C4	✓✓✓	✓✓✓	✗✗	✗✗	✗✗	✗✗	✗	✗✗
Routes C3/C5/C6	✓✓	✓✓	✗	✗	✗✗	✗	✗	✗

6.3.6 The Table indicates that options A1, A2, A4, C, C2 and C4 will have the largest negative impact in environmental terms as the largest proportion of this route, for these options, rely on fully segregated sections of new build.

6.3.7 A summary of the impacts of the thirty options and sub-options are as follows:

- Options A1, A2 and A4: assessment is moderate negative impact;
- Options A3 and A5: assessment is neutral impact;
- Options B1, B2 and B4: assessment is minor negative impact;
- Options B3, B5, B8, B16, and B18: assessment is neutral impact;
- Options B6, B7, B9 - B15, and B17: assessment is minor negative impact;
- Options C1, C2 and C4: assessment is moderate negative impact; and
- Options C3, C5 and C6: assessment is minor negative impact.

6.4 The Safety Appraisal

Planning Objectives

6.4.1 The following local planning objectives have been identified as nesting within the overall safety heading.

Government Objective[11]*:*	To improve safety of journeys by reducing accidents and enhancing the personal safety of pedestrians, drivers, passengers and staff.
Planning Objective:	*No specific Planning Objective identified – appraisal will be against Government Objective*

6.4.2 The Safety objective identified within STAG is concerned with reducing the loss of life, injuries and loss or damage to property resulting from transport accidents and crime. Two sub-objectives are considered, namely accidents and security. These are described below.

[11] Government Objectives are quoted from Scotland's Transport Future, White Paper, 2004

Accidents

6.4.3 STAG emphasises the need to *"consider the impact of the proposal under consideration on accidents"*[12]. For proposals which change road traffic accident numbers, or their severity, standard methodologies exist for calculating the projected number of accidents, the types of accidents and associated casualties in the before and after scenarios. The methods relate the traffic on a road (measured by vehicle-kilometres) to the number of accidents via the application of an accident rate. Accident rates and costs for different road types are set out in Government appraisal guidance[13] and which STAG suggests *"these should be adopted"*.

6.4.4 The options under consideration will remove traffic from the strategic network and will undoubtedly have an impact on both the number and severity of accidents.

6.4.5 Given that the transport modelling has suggested there will be modal shift from cars to PT, the options will change road traffic accident numbers and/or their severity, and to estimate the potential impacts, the following method has been used:

- in carrying out the accident data analysis, accident casualty rates were used, as described in Table 6/5/2 of the NESA Manual;
- personal injury accident (PIA) rates have been obtained directly from Table 6/5/2 of the NESA Manual;
- the appropriate NESA Road Category to derive appropriate PIA and casualty rates to use is the NESA Road Category 31 (Rural Dual-carriageway – 2 or more lanes); and
- accident rates and costs were re-based and factored as per the NESA manual rates, to allow for a drop in the PIA rate as future road safety measures take effect.

6.4.6 The results of the appraisal are shown in Table 6.4 at the end of this section with the results of the security appraisal (this is described in the following section) also included.

Security

6.4.7 STAG Section 7.3 states that *"when undertaking a Part 1 appraisal [for Security], planners should consider whether the proposal under consideration has any material impact on security for the users"*[14]. Detailed assessment, for example using GOMMMS[15], is required at the STAG Part 2 appraisal, and the GOMMMS security indicators provide a useful checklist for this, namely:

- site perimeters, entrances and exits;
- formal and informal surveillance;
- landscaping;
- lighting and visibility; and
- emergency call facilities.

6.4.8 Reference to the security indicators set out above show that the emphasis is on physical infrastructure and its impact on security. The essence of the assessment could be paraphrased:

"Will travellers be (or feel) any safer as a result of the measure proposed?"

[12] Section 7.2 in Chapter 7 of STAG
[13] NESA Manual, DMRB (Volume 15), April 2002
[14] STAG, September 2003, section 7.3.1
[15] Guidance on the Methodology for Multi-Modal Studies, DETR, March 2000

6.4.9 The preferred options A5, B17, B18 and C5 will involve substantial amounts of construction, including the construction of some new fully segregated sections for some of the options and additional street furniture. In terms of these new facilities, it is expected that minimum safety requirements would be met with regard to personal security concerning their design and construction with respect to site perimeters, site surveillance, both formal and informal, lighting, visibility and emergency call facilities. Therefore in terms of personal security, it is reasonable to assume that for the four preferred options, there will be a *minor* to *moderate beneficial impact*.

Summary of Safety Appraisal Results

6.4.10 Table 6.2 summarises the results of the safety appraisals for the thirty options. In conclusion, by removing some of the vehicle traffic, there are modest accidents benefits from the options, although these vary in significance to some degree between the options.

Table 6.2: Summary of Safety Appraisal Results

Option	Accidents	Security	Overall Average Appraisal for Safety
Routes A1 – A6	✓	✓	✓
Routes B1 – B18	✓	✓	✓
Routes C1 – C6	✓	✓	✓

6.5 Economy

Planning Objectives

6.5.1 The following local planning objectives have been identified as nesting within the overall economy heading.

Government Objective[16]*:*	Promote economic growth by building, enhancing managing and maintaining transport services, infrastructure and networks to maximise their efficiency.
Planning Objective:	To aim towards achieving RTS modal share targets within the study corridor. To make public transport more attractive, with improved times, reliability and quality.

6.5.2 The Economy objective identified within STAG is concerned with improving the economic efficiency of transport and the efficiency of economic activities, with the key aim of supporting sustainable economic activity and returning good value for money. Two sub-objectives are considered, namely:

- Transport Economic Efficiency (TEE); and
- Economic Activity and Location Impact (EALI).

Transport Economic Efficiency

6.5.3 The central principle of the TEE analysis is to estimate the welfare gain from the transport investment, as measured by the "willingness to pay" for these improvements and the financial impact on the private sector transport operators. The TEE does not include financial costs and benefits to the Government as these are quantified separately.

[16] Government Objectives are quoted from Scotland's Transport Future, White Paper, 2004

Development of TEE Appraisal Model

6.5.4 In order to appraise the benefits and costs of the different options, the Transport Users Benefits Appraisal (TUBA) program[17] was adopted because it offered the following benefits:

- the programme is based on the requirements of DfT's web-based Transport Appraisal Guidance (webTAG[18]) and STAG. It has a long track-record in appraising other projects;
- the model has been developed over a number of years and is constantly being updated to reflect recent project appraisal experiences, feedback from Government agencies and appraisal guidance; and
- its analysis is transparent to users thereby helping to avoid potential 'black box' calculations.

Application of TEE Appraisal Model

6.5.5 Specific economic assumptions and cost adjustments are consistent with the Scottish Government's STAG appraisal methodology. All monetary values are in 2002 market prices, unless explicitly stated otherwise, and values are discounted to the base year 2002, as adopted in the webTAG convention.

6.5.6 An appraisal period of 10 years has been adopted for the options. The appraisal discount rate is 3.5% for the appraisal years, as per STAG procedures, with an assumed first full year of appraisal of 2012 and with a final horizon year of 2022. The capital expenditure profiles for the options are assumed to be over two years, with a 40%:60% split.

6.5.7 The undiscounted costs for the twelve options to be considered are shown in Table 6.3 in 2008 prices. These costs include allowances for risk and uncertainty and Optimism Bias as estimated in Chapter 7.

Table 6.3: Costs Including Risk & Uncertainty and Optimism Bias

Costs Option	Capital Costs	Of which the following make up Optimism Bias	Operation and Maintenance Costs (per annum)
Northern Alignment A5	£27.5m	£4.6m	£3.6m
Southern Alignment B17	£22.4m	£3.0m	£3.4m
Southern Alignment B18	£15.1m	£2.6m	£2.9m
Shawfair Alignment C5	£35.9m	£4.7m	£3.9m

Note: all costs are in 2008 prices

6.5.8 With respect to the Optimism Bias calculations, the process used followed that applied in the Edinburgh Airport Rail Link (EARL) and Waverley Station Redevelopment appraisal. Details of the calculations are covered in Chapter 7.

[17] TUBA programme, Version 1.7a, Department for Transport, September 2006
[18] webTAG: web-based Transport Analysis Guidance, Department for Transport 2004

Summary of TEE Appraisal Results

6.5.9 The results of the TEE appraisal on monetised benefits and costs, derived from the TUBA model, are shown in the STAG Part 2 AST's and summarised in Table 6.4 below. This includes the tests of each of the preferred options under the different route modification and frequency scenarios. From these, it will be possible to gain an insight into the relative economic efficiency of the options. Appendix D contains TEE model output tables showing the various benefits and cost streams.

Table 6.4: Summary of TEE Appraisal

			A5	B17	B18	C5
Accidents	Reduced Accident Collisions Savings	PB1	£6.72m	£5.26m	£5.26m	£6.93m
Benefits	Times Savings	PB2	£124.89m	£109.14m	£109.14m	£128.80m
	Vehicle Operating Costs (VOC) Savings	PB3	£22.87m	£18.14m	£18.14m	£23.30m
	Revenues	PB4	£72.81m	£80.27m	£80.27m	£74.35m
	Carbon Savings	PB5	£3.12m	£2.44m	£2.44m	£3.15m
	Present Value of Benefits (PB1 … PB5)	**PVB**	£230.40m	£215.25m	£215.25m	£236.52m
Costs	Investment (Capital) Costs	PC1	£25.51m	£31.07m	£22.48m	£33.35m
	Operating Costs	PC2	£51.45m	£34.50m	£34.19m	£49.96m
	Maintenance Costs	PC3	£26.24m	£31.96m	£23.12m	£34.31m
	Indirect Tax Revenues	PC4	£21.65m	£16.76m	£16.76m	£21.82m
	Subsidy	PC5	£0.00m	£0.00m	£0.00m	£0.00m
	Present Value of Costs (PC1 … PC5)	**PVC**	£124.85m	£114.29m	£96.55m	£139.43m
Returns	*Net Present Value (NPV = PVB - PVC)*		£105.55m	£100.96m	£118.70m	£97.09m
	Benefit to Cost Ratio (BCR = PVB / -PVC)		1.85	1.88	2.23	1.70

Note: all values are re-based and discounted to 2002 prices

6.5.10 The TEE Appraisal results show the relative performance of the preferred options in terms of the Benefit-to-Cost Ratio (BCR) and Net Present Value (NPV). As can be seen in the Table, the southern alignment terminating at Millerhill (options B18) presents the highest BCR value for the lowest cost outlay, and offer the least in indirect tax revenues.

Economic Activity & Locational Impacts

6.5.12 The EALI analysis is intended to identify how and under what circumstances the options analysed above impacts on the economic performance of the Edinburgh area, and in different economic sectors, and to capture those economic impacts that Transport Economic Efficiency (TEE) appraisals do not capture.

6.5.13 EALIs are particularly important in this case as the transport investment is targeting employment opportunities, market accessibility and supply chains by generally improving accessibility and connectivity within, to and from the area.

6.5.14 In the study area, some of the stakeholders that are likely to directly benefit from investment in new transport infrastructure are, in the short term, the builders, materials suppliers and engineering firms contracted to construct or re-habilitate the infrastructure requirements of each of the options. In the longer term, however, they will also include:

- Local businesses and organisations that depend on customers or employees for access from outside the area including the ERI, QMU, Edinburgh Airport and Edinburgh Business Park;

- Local businesses and organisations such as those noted above that depend on the use of regional transport services for the deliveries of small parcel, postal items and other supplies, where these are quicker and more reliable;
- Transport operators that would operate the new transport services;
- Local and regional commuters; and
- Business based within and outside the region and who invest in the Edinburgh area.

6.5.15 There may be some displacement activity at the local level but this is unlikely to make a large impact on local business. Most of the displacement activity would be expected to occur on commuting patterns, and in the case of the public transport, the losers are likely to be rail companies losing customers to the new EOBP services. Values from the TEE appraisal suggest up to 2.6 million trips in 2012 rising to 3.6 million trips by 2022 will be abstracted, of which circa 70% will be from private car journeys.

6.5.16 Table 6.5 summarises the EALI issues arising from the EOBP. In EALI terms, these issues remain identical between all the options, so no particular distinction between these are made in the Table.

Table 6.5: Summary of EALI Issues Resulting from the EOBP

Factor	Issue
Perceptions, confidence and profile	Improvements in access would increase confidence of the area's potential in meeting the local needs and aspirations in bringing health (ERI), education (QMU) and other services and facilities within reach to a broader population
	Perceptions of improved PT accessibility raises profile of investment opportunities in area
	Shorter road journey times within and to and from Edinburgh will precipitate greater intra- and inter-business interaction within Edinburgh and between Edinburgh and other areas, possibly promoting opportunities for some business agglomeration
Retail and service sectors	Opportunities for retail and service sectors to engage a wider workforce catchment area, with improved access to people, skills and training
	Quicker road access means enhanced commercial opportunities for expediting the marketing of goods, produce and services, and tapping into an extended marketing environment
	Improvements to local public transport and quicker road access to the within and to Edinburgh area fosters retail competition & encourages retail customers based elsewhere to shop in the greater Edinburgh area
Land and Property	Improved PT infrastructure in the study corridor increases property and land prices on the peri-urban fringe, stimulating a greater level of economic activity backed by these rising local asset prices in the area
	Improved PT infrastructure increases transport accessibility - important for kick-starting and/or maintaining momentum for development on the fringes of Edinburgh facing recent, recession-related difficulties
Labour and employment	Improved accessibility, within, to and from the Edinburgh area means increased employment potential, both for local employment and for the employment of locals further afield
	Local businesses based within the study corridor no longer as confined to or dependent on the local population for employment or skills
	EOBP would help to assimilate the study corridor area closer with other adjacent urban areas ensuring greater potential for integration in education, training and broader employment policies
	Improved transport infrastructure in the study corridor would assist unemployed and underemployed local people in the Edinburgh area to reach jobs elsewhere

6.5.17 It is worth stressing the impact that the EOBP may have in two areas in particular. Firstly in meeting the needs and aspirations of the population based to the south and on the southern periphery of Edinburgh in bringing health, education and retail facilities within easier reach. Secondly, the importance of the EOBP in offering the opportunity to foster the movement of employment from areas of high residential density (east Edinburgh) to opportunities presented in the numerous retail and business parks located on the western fringe of the city.

6.5.18 However, there will be gainers and losers from improvements to the local transport network. It is important to identify whom these likely gainers and losers might be and specify where they are based and what their likely response would be in terms of economic behaviour.

6.5.19 Table 6.6 summarises the likely gainers and losers by sector, identifying them as to whether they are local or national.

Table 6.6: EALI Summary of Impacts

Sector	Summary of Impacts			
	Local		National	
	Gainers	Losers	Gainers	Losers
Manufacturing and Processing	No significant effects	No significant effects	No significant effects	No significant effects
Local Trade	Local businesses able to respond to greater market opportunities and catchment area	Local businesses unable to respond to increased competition especially those based outwith Edinburgh area	No significant effects	No significant effects
External Trade	No significant effects	No significant effects	No significant effects	No significant effects
Inward Investment	Improved transportation enables those companies able to reduce costs and facilitate access to markets and skilled employment will attract interest in investment locally and from further afield	No significant effects	No significant effects	No significant effects
Tourism	No significant effects	No significant effects	No significant effects	No significant effects
Shoppers	New opportunities result from greater local retail accessibility on city periphery	City centre shops face some loss of custom	No significant effects	No significant effects
Residents	EOBP construction assists local unemployed to get back to work, & greater accessibility across Edinburgh allows increased employment opportunities, especially for non car-users	No significant effects	No significant effects	No significant effects
Transport	Bus operators will gain passengers & therefore revenue	Impact on local train operating companies (TOCs) where passenger numbers hemorrhage from some local rail services	No significant effects	No significant effects
Agglomeration effects	Potential for some greater economic connectivity resulting from proximity between businesses located close to the EOBP	No significant effects	No significant effects	No significant effects

6.5.20 It is notable that there are no anticipated impacts on a national scale; these will be restricted to the local and regional levels.

6.5.21 There should be no major differences in terms of impact occurring between the different EOBP options. It is therefore concluded that an overall appraisal of ***moderate beneficial*** for each option most reasonably reflects the EALI issues identified.

6.6 Integration Appraisal

Planning Objectives

6.6.1 The following local *Planning Objectives* have been identified as nesting within the overall integration heading.

Government Objective:	To improve integration by making journey planning and ticketing easier and working to ensure smooth connection between different forms of transport.
Planning Objectives:	To ensure the integration of public transport with existing and proposed land-use within the study corridor.

Overview of the Integration Appraisal

6.6.2 In appraising this the Government Objective, STAG requires the consideration of:

- Transport integration;
- Transport land-use integration; and
- Policy integration.

Transport Integration

6.6.3 STAG makes clear that the TEE will capture most of this sub-objective. Transport Integration needs only to be appraised if both of the following justifications apply:

- There is an identifiable impact on transport interchange; and
- Aspects of this impact are not captured elsewhere in the appraisal (e.g. TEE)[19].

6.6.4 Transport Interchange as it affects people is subdivided by STAG into:

- Services and ticketing; and
- Infrastructure and information.

Services and ticketing

6.6.5 STAG recognises the role played by services and ticketing to the potential "seamlessness" of movement between trips and between transport modes. This must confer benefits additional to those of savings of time or money, such as greater convenience. STAG emphasises that the extent of this integration must be substantial and supported by shared-branding and whole-journey information.

6.6.6 All the options will have an impact in terms of integration of services with the existing bus service network. Opportunities will arise within the EOBP corridor for seamless ticketing and seamless journeys achievable by sharing brand names, ticketing arrangements and to 'dove-tail' the new BRT bus services with both existing bus services and timetables, and with new rail timetables at certain interchange points along the EOBP route, such as at Edinburgh Park and Newcraighall.

[19] STAG, section 9.2.1

6.6.7 Advantage can be taken of electronic ticketing such as the current Smart Card, branded "Ridacard", which is operated by Edinburgh's principal bus operator, Lothian Buses. There are also possibilities with integration of non-Smart Card based multi-operator ticketing along the lines of One-Ticket, organised on a partnership basis between the member councils of SEStran and the transport operators who operate in the SEStran area.

6.6.8 Moreover the Edinburgh area has the BusPlus scheme which adds on connecting bus services to a rail ticket that starts or finishes at a railway station served by participating bus operators on the EOBP route corridor. All the main bus operators in the Edinburgh area take part in the BusPlus ticketing regime.

Infrastructure and Information

6.6.9 This relates to the physical attributes of an interchange site, and must be additional to those reflected in other parts of the appraisal. Again STAG emphasises the need for considerable integration before an appraisal can be considered under this sub-heading.

6.6.10 All the options involve multiple Park and Ride interchange sites positioned adjacent to or close to the EOBP route corridor. The new P&R facilities represent an opportunity to provide car-bus interchange facilities, but in some cases, such as those located at Edinburgh Park and Newcraighall, bus-rail interchange infrastructure can facilitate modal switch at the P&R sites themselves.

6.6.11 There will be opportunities at the Park and Ride interchange sites to provide a good waiting environment and level of facilities offered, as well as electronic bus timetable displays that show the connecting rail services at those interchanges which have a rail connection.

6.6.12 The appraisal must be as objective as possible, with quantification of benefits if available. The methodology adopted here is that set out in GOMMMS[20], with the analysis based on an extension of GOMMMS Worksheet 8.1 to incorporate services and ticketing.

Table 6.7: Transport Integration Appraisal

Transport Interchange Indicator	Options A1 – A6	Options B1 – B18	Options C1 – C6
Seamless Public Transport Network	✓✓	✓✓	✓✓
Seamless Ticketing	✓✓✓	✓✓✓	✓✓✓
Waiting Environment	✓	✓	✓
Level of Facilities	✓	✓	✓
Level of Information	✓✓	✓✓	✓✓
Visible Staff Presence	O	O	O
Physical Linkage for Next Journey	✓✓	✓✓✓	✓✓
Overall Assessment of Impact	✓✓	✓✓	✓✓

✓✓✓	Major Beneficial Impact	O	Neutral Impact	✗	Minor Adverse Impact
✓✓	Moderate Beneficial Impact			✗✗	Moderate Adverse Impact
✓	Minor Beneficial Impact			✗✗✗	Major Adverse Impact

6.6.13 In terms of the transport integration appraisal, the services appraisal have almost identical results, and as such score the same in terms of overall assessment for transport integration – that is they each have a ***moderate beneficial impact***.

[20] GOMMMS Volume 2, section 8.2

Transport Land-use Integration

6.6.14 This has been approached in two parts, including a *"simple check to see if the proposal is in harmony with the aims of wider government policies and national transport targets."*[21] The opportunity is also taken to briefly assess options against transport policies, such as the appropriate Local Transport Strategy and central government policies.

6.6.15 The Disability and Social Exclusion issues will be dealt with in the Accessibility and Social Inclusion section of this Chapter. It is also worthwhile to consider at this stage the relationship between such documentation as Structure Plans, Local Plans and Scottish Planning Policy statements on the one hand, and the options under initial appraisal, to avoid wasted work with proposals that are incompatible with land-use.

6.6.16 For the purpose of appraising land use and related policy, reference was made to the following statutory documents:

- SPP2 Economic Development;
- SPP3 Planning for Housing;
- SPP15 Rural Development;
- SPP17 Planning for Transport;
- PAN75 Planning for Transport;
- West Edinburgh Planning Framework 2008;
- Rural West Edinburgh Local Plan (Adopted) 2006;
- The Edinburgh and Lothians Structure Plan 2015;
- The Finalised Edinburgh City Local Plan 2007;
- South East Edinburgh Local Plan (Adopted) 2005;
- South West Edinburgh Local Plan (Adopted) 1993;
- Finalised Midlothian Local Plan (due to be adopted early 2009);
- Midlothian Local Plan (Adopted) 2003; and
- East Lothian Local Plan (Adopted) 2008.

6.6.17 The proposed transport improvements in the study area offer a major opportunity to implement local and strategic planning and transport policies, as a mechanism for promoting sustainable development. The proposals examined in this STAG Part 2 Appraisal would generally encourage a modal shift away from private car use, improve the quality of the environment, increase access for all to a public transport system serving areas of employment, housing and education and would encourage social inclusion.

6.6.18 The corridor includes a number of key existing and future development locations for housing and commercial activity, which would provide a passenger base to support new services. The locations with prominent development sites identified are shown in Table 5.1 in Chapter 5. A summary of the impact of the EOBP on land-use integration is presented below on a section by section basis.

[21] STAG, section 9.4.2

Sections 1 & 2: Newbridge – Gogar – Hermiston – A70 Bypass

6.6.19 The Scheme provides an EOBP service from Gogar Roundabout (Gyle) towards Newbridge settlement and the Core Development Area located there. As a result, land uses along the route corridor, including the RBS headquarters at Gogarburn, the Royal Highland Showground and Edinburgh International Airport have the potential to be better linked together. The implementation of the Scheme will provide additional transport links to development land as part of the wider regeneration initiatives at Newbridge.

6.6.20 The proposed EOBP service then passes from Gogar Roundabout (Gyle) towards Hermiston and the City Bypass providing access to the south and east of the city. As a result, land uses along the route corridor, including the Core Development Area at Edinburgh Park/South Gyle, Hermiston Gate Retail Park, Westerhailes commercial centre and Heriot-Watt University have the potential to be better linked together, and the implementation of the EOBP will provide additional transport links to core development land at Edinburgh.

Sections 3, 4 & 4h: A70 Bypass – Lothianburn P&R – Straiton P&R

6.6.21 The EOBP service will operate between Lothianburn and the A70 by means of the City Bypass. As a result, land uses at either end of the route corridor, including the proposed Park & Ride at Lothianburn, the adjacent Hillend ski centre and residential and employment in the Rural West of Edinburgh have the potential to be better linked together. Because the route follows the existing City Bypass the opportunity to link communities and land uses along this corridor is not offered, but the implementation of the Scheme will provide additional transport links from the southern to the western edges of the city and will contribute towards achieving an integration of land uses with public transport further afield. Section 4h is the hard shoulder running alternative to Section 4, but essentially follows a similar alignment.

6.6.22 From Lothianburn the EOBP route carries onto Straiton by means of the City Bypass. As a result, land uses at either end of the route corridor, including the proposed Park & Ride at Lothianburn, the adjacent Hillend ski centre and commercial and housing developments at Straiton have the potential to be better linked together. The implementation of the Scheme will provide additional transport links between sites located along the southern edge of the city and will contribute towards achieving an integration of land uses with public transport.

Sections 5, 5h, 6, 6a & 6h: Straiton P&R – Bypass Underpass – Todhills P&R – ERI

6.6.23 From Straiton to the south and east of Edinburgh by way of the City Bypass. As a result, land uses at either end of the route corridor, including the Bioscience Quarter at Roslin and commercial and housing developments at Straiton have the potential to be better linked together. The implementation of the Scheme will provide additional transport links between sites located along the southern edge of the city and will contribute towards achieving an integration of land uses with public transport. Section 5h is the hard shoulder running alternative to Section 5, but essentially follows a similar alignment.

6.6.24 The EOBP passes from the City Bypass to key land uses in Edinburgh's South East Wedge. As a result, land uses at either end of the route corridor, including employment and housing at Straiton in the A701 CDA and the ERI and strategic housing developments in the South East Wedge CDA have the potential to be better linked together. The implementation of the Scheme will provide additional transport links between sites located along the southern and eastern edges of the city.

6.6.25 Section 6 is the alignment running from the A20 at Wester Melville to the ERI via Sheriffhall P&R, with the first part to the Sheriffhall P&R as new build. Section 6a follows the identical alignment to Section 6, but terminates at the Sheriffhall P&R, and Sections 6h and 6ha are the hard shoulder running versions of the equivalent alignments.

Sections 7 & 8: Straiton P&R – Bypass Underpass – Todhills P&R – ERI

6.6.26 The EOBP carries on from the City Bypass to key land uses in Edinburgh's South East Wedge. As a result, land uses at either end of the route corridor, including employment and housing at Straiton in the A701 CDA and the ERI and strategic housing developments in the South East Wedge CDA have the potential to be better linked together in terms of public transport provision.

6.6.27 The bus service continues to serve Edinburgh's South East Wedge. As a result, land uses at either end of the route corridor, including employment and housing at Shawfair and the QMU campus have the potential to be better linked together.

Sections 9: Sheriffhall P&R – ERI

6.6.28 The EOBP carries on for a short section towards the Millerhill P&R before almost doubling back on itself towards the Edmonstone area from route joins the ERI.

6.6.29 All the sections of the EOBP route combine together to assist in serving the disparate housing developments which for the most part are situated at the eastern end of the corridor, and the commercial developments promoting employment, which are largely centred on the western part of the route corridor. In this context, all the options will, in terms of transport land-use integration, have ***major beneficial impact***.

Policy Integration

6.6.30 The study corridor passes through several local authority areas: the City of Edinburgh, East Lothian, Midlothian, West Lothian and Fife. The following section provides a background to current policy; nationally, regionally and for the relevant local authority areas.

National Policy - National Transport Strategy

6.6.31 Three key issues are identified within the National Transport Strategy (NTS), published in 2006, that address delivering a world class transport system:

- Improve journey times and connections between cities and towns across the country, connecting this to the global markets;
- Reduce emissions to tackle climate change; and
- Improve quality, accessibility and affordability of transport, giving people choice of public transport and real alternatives to car use, encouraging modal shift.

6.6.32 A priority of the NTS, as detailed in the daughter document, the Bus Action Plan, is to encourage the bus market and to improve services to attract passengers and, where possible and required, to improve journey times. Infrastructure improvements on the local and trunk roads, by improving bus journey times, are seen as key to making bus services more attractive. As a result of their flexibility and low infrastructure costs, buses are often deemed the most appropriate mode of public transport especially suitable to high travel demand arising in a single corridor as characterised by the Edinburgh orbital route.

West Edinburgh Planning Framework

6.6.33 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. It addresses congestion, transport integration with land-use, and accessibility to key facilities such as Edinburgh Airport on the west side of Edinburgh, with particular emphasis on high quality transport interchange and commuter park and ride facilities served by bus, tram and rail.

SEStran Regional Transport Strategy (RTP)

6.6.34 At a regional level, SEStran's policy is to improve public transport, particularly where public transport has a low share of travel demand and used by those with limited alternatives, and where there is poor accessibility to key facilities and areas of employment. The EOBP represents a flagship policy of the SEStran RTP to address these problems and facilitate the distribution of public transport journeys around the periphery of the city.

6.6.35 The nature of the EOBP route is aimed at reducing the requirement for car trips through the city centre and also on the A720, so assisting in reducing congestion and delivering journey time savings and environmental benefits.

Participating Councils

6.6.36 At a local level, each council's Local Transport Strategy (LTS) set out the aims and objectives for transport, and provide an overview of each council's strategy. Many of the main elements of each strategy are common to all of the council's transport strategies, especially when addressing the National Transport Objectives, which they are required to do. Only those transport policies directly relevant to the EOBP are discussed.

6.6.37 In terms of Edinburgh Council, buses are identified as the mainstay of the public transport system within the urban areas, which has experienced significant passenger growth. The Council places emphasis on the interrelationships between transport and development, with the aim of minimising dependence on car use.

6.6.38 For the Lothian Councils, commuting presents a particular challenge, and their policies reflect this where their respective LTS address methods to encourage modal shift from car dominated commuting to public transport.

6.6.39 East Lothian Council is set to implement a range of measures to improve bus services, and the Council's LTS has acknowledged the importance of the EOBP scheme in assisting to deliver its transport objectives. Midlothian Council is dedicated to ensure that there is public transport access to existing and proposed strategic employment locations and key development sites.

6.6.40 In terms of policy integration from national down to local level, all the options are estimated to have a ***major beneficial impact***.

Overall Appraisal against Government Objective for Integration

6.6.41 Taking account of the discussions set out so far in this Chapter, Table 6.8 summarises the results of the integration appraisals and presents the conclusions for the Government Objective. As noted there is no difference between the options, and without exception, each would be expected to have ***a major beneficial impact*.**

Table 6.8: Transport Integration Appraisal

	Transport Integration	Land-Use Transport Integration	Policy Integration	Overall Average Appraisal for Integration
All Options	✓✓	✓✓✓	✓✓✓	✓✓✓

6.7 Accessibility and Social Inclusion Appraisal

Planning Objectives

6.7.1 The following local *Planning Objectives* have been identified as nesting within the overall accessibility/social inclusion heading.

Government Objective:	To promote social inclusion by connecting remote and disadvantaged communities and increasing the accessibility of the transport network.
Planning Objectives	To improve community and comparative (local and wider) accessibility by public transport, especially to employment and health.

Overview of the Accessibility/Social Inclusion Appraisal

6.7.2 STAG requires the consideration of two aspects as part of the Accessibility and Social Integration Government Objective, namely:

- Community accessibility; and
- Comparative accessibility.

6.7.3 STAG advises "*the scope and detail required in the accessibility analysis needs to be commensurate with the planning objectives*"[22]. STAG also states that *"quite simple measurement approaches should be adequate"* for appraising accessibility and identifying changes (improvements) as a result of new proposals. Hence, given the scale of the study and the STAG advice regarding scope, a qualitative approach has been undertaken.

Community Accessibility

6.7.4 This element of appraisal allows a focus on minority groups in society, and allows "*Social Inclusion policy [to] be informed by accessibility measures to ensure that all relevant people groups and trip purposes are considered*"[23]. For the purposes of this study, a qualitative approach is adopted, looking at the potential benefits (or disbenefits) for public transport network coverage resulting from the provision of the various options.

6.7.5 The public transport improvements in the study corridor will facilitate a large number of trip purposes, including commuter, retail, service (health and education) and social activities across the whole area, both for communities residing in urban areas and those living in more rural areas. All the options being considered will increase access to and from the surrounding region for these purposes. All the options will therefore generate substantial benefits for the non-car using population in the region, and therefore are considered to have a ***major beneficial impact***.

Comparative Accessibility

6.7.6 For STAG purposes this is divided into two further sub-headings:

- Impacts by People Group; and
- Impacts by Location.

[22] STAG, paragraph 10.1.4
[23] STAG, paragraph 10.5.1

6.7.7 The impacts by people group relates to *the impact of the transport options on various groupings of individuals in society* (e.g. age group, socio-economic status, gender, ethnicity, and mobility status, as well as impacts split between car-owners and non car-owners). Enhancing the modal choice available to all residents in the Edinburgh area provided by the EOBP will be beneficial to all groups, without exception. Even car users will benefit. The only possible caveat is the fare terms arranged for public transport and whether there is a cost recovery component included in these that penalise those unable to afford this level of fare, such as the unemployed, the elderly and the lower socio-economic groups.

6.7.8 Considering impacts by Location, STAG states "*it is important to understand the locus of impact of transport investment. This is particularly when assessing … major network changes … [and] as a minimum the analysis should compare the impacts on designated areas of deprivation such as social inclusion partnership (SIP) areas or priority partnership areas*"[24]. There is little doubt that the scale and type of public transport investment proposed for study corridor will assist a broad range of beneficiaries. All the options considered will assist commuters and those seeking work, those visiting further afield, those accessing the ERI and QMU, and for accessing retail sites for shopping purposes.

6.7.9 Given the above arguments, it is reasonable to assume the appraisal results shown in Table 6.9.

Table 6.9: Summary of Accessibility Appraisal

Option	Community Accessibility	Comparative Accessibility	Overall Appraisal
All Options	✓✓✓	✓✓✓	✓✓✓

6.8 Implementability Appraisal

6.8.1 In addition to the five main Government objectives, STAG also recommends that the capability of delivering an option should also be considered. This can highlight any potential "implementability" problems with any proposal.

6.8.2 In terms of the technical issues, the options considered in this study are relatively straight forward since they are all based on standard civil engineering practices and have been successfully implemented elsewhere. However, those options that terminate at the QMU and the ERI rather than the shorter route to Millerhill, and those that require extensive new build sections, which will contend with a higher degree of urban sites along the route, and/or may require greater service relocation or establishment, may be more complicated to implement. These options are options A1, A2, A4, B1, B2, B4, and C1, C2 and C4. Options A3, A5, B3, B5, B8, B16, B18, C3, C5 and C6 are hard shoulder running, and have reduced or minimal new build section lengths. The remaining options, A6, B6, B7, B9 – B15 and B17 are for the most part hard shoulder running but with a segregated section (section 4). These sections with the limited amount of segregation would be expected to demonstrate a similar Implementability performance to those which are completely hard shoulder running.

6.8.3 There are no foreseeable difficulties envisaged with operational aspects of the services for each option. However, attention will need to be paid to service articulation, such as timetabling and co-ordination, with other local services that extend out as onward bus services to the Lothians from the core orbital route.

[24] STAG, sections 10.8.1 to 10.8.3

6.8.4 There is significant public interest and direct local government support for an orbital bus route that allows the opportunity for substantial modal shift for across-city journeys, and allows connectivity between major areas of existing and new housing and existing and new centres of employment in the diverse areas both east and west of Edinburgh. The Implementability appraisal results are summarised in Table 6.10.

Table 6.10: Summary of Implementability Appraisal

Option	Technical Issues	Operational Aspects	Public Acceptability
Routes A1, A2, A4, B1, B2, B4, C1, C2 & C4	✓✓	✓✓✓	✓✓✓
Routes A3, A5, B3, B8, B16, B18, C3, C5 & C6	✓✓✓	✓✓✓	✓✓✓
Routes A6, B6, B7, B9 – B15, B17 & B18	✓✓✓	✓✓✓	✓✓✓

6.8.5 With the exception of Options A1, A2, A4, B1, B2, B4, C1, C2 and C4, which would be expected to have a ***moderate beneficial impact***, the majority of options would be expected to have a ***major beneficial impact*** in terms of Implementability appraisal.

6.9 Appraisal against Local Planning Objectives

6.9.1 The appraisal of the SMART planning objectives was based on estimates from the transport modelling. Before presenting the results, it is perhaps helpful to re-cap the established planning objectives:

- ***Objective 1:*** 5% mode shift from cars to public transport at key locations within the study area by 2022;
- ***Objective 2:*** decrease of 20 m.veh-kms per annum to account for reduction in environmental emissions at key locations within the study area by 2022;
- ***Objective 3:*** improve the integration of public transport services by encouraging 0.75 million passengers per annum (mppa) by 2022 from existing radial public transport services onto the direct orbital service, thereby reducing interchange and unnecessary trips to the city centre;
- ***Objective 4:*** improve accessibility by attracting a minimum of 2 mppa using the service by 2022; and
- ***Objective 5:*** improve public transport travel times by 20m passengers-minutes (m.pax-mins) per annum for users by 2022.

6.9.2 The modelling results have confirmed that all four options meet each of the five SMART local planning objectives and have identified the levels of achievement for all options. The results are summarised in Table 6.11 overleaf.

Table 6.11: Summary of Local Planning Objectives Appraisal

Criteria/ Option	Objective 1 – Modal shift	Objective 2 – Environmental impact	Objective 3 – Transport – Land-use integration	Objective 4 – Accessibility	Objective 5 – Improved journey times & reliability
Route A5	7.3%	32.7 m.veh-kms pa	1.1 mppa	3.4 mppa	35.6 m.pax-mins pa
Route B17	6.8%	25.6 m.veh-kms pa	0.9 mppa	2.8 mppa	23.1 m.pax-mins pa
Route B18	6.8%	25.6 m.veh-kms pa	0.9 mppa	2.8 mppa	23.1 m.pax-mins pa
Route C5	6.8%	33.8 m.veh-kms pa	1.1 mppa	3.5 mppa	41.0 m.pax-mins pa

6.9.3 The levels of achievement for all options is as follows:

- ***Objective 1:*** all four options are above the stated objective, with option A5 performing the best and the three other routes giving similar results;
- ***Objective 2:*** all options are above the stated objective, with routes A5 and C5 giving the best results, followed by routes B17 and B18 (which are approximately 24% lower);
- ***Objective 3:*** all options are above the stated objective with the best options being routes A5 and C5 which give similar results, and options B17 and B18 being roughly 20% lower;
- ***Objective 4:*** all options are above the stated objective, with routes C5 and A5 returning the best results and routes B17 and B18 being circa 20% lower; and
- ***Objective 5:*** all options are above the stated objective, with route C5 returning the best results, followed by route A5 being approximately 13% lower and then routes B17 and B18 both being 44% lower than route C5.

6.9.4 From these results, it is clear that the four preferred options all meet the five local planning objectives. The best performing options is generally route C5, followed by option A5. Routes B17 and B18 give somewhat lower results, although they are still largely above the minimum requirements. This is mostly due to the incremental fare system for these options, which has a noticeable impact on patronage.

6.9.5 It must be noted that results for B17 and B18 are identical since both routes are very similar in terms of infrastructure and services.

6.10 Cost to Government

6.10.1 Table 6.12 shows the Government impacts of the project. The TEE investment costs indicate the costs that have been adjusted and discounted back to 2002 prices.

Table 6.12: Summary of Investment and Public Sector Costs

Option	Investment Costs (from TEE Appraisal)	Grant/Subsidy (from TEE appraisal)	Indirect Tax Revenues (from TEE Appraisal
Route A5	£25.51m	None	£21.65m
Route B17	£31.07m	None	£16.76m
Route B18	£22.48m	None	£16.76m
Route C5	£33.35m	None	£21.82m

Note: all values are discounted to 2002 prices and appraised over a 60-year period

6.10.2 The Table above shows that in terms of grant or subsidy, none of the options require support. Both options B17 and B18 return the greatest operating surplus, and of these B18 returns the largest margin, as this option has the lowest operating, maintenance and renewals costs. The Table clearly illustrates that route option B18 also has the lowest investment costs.

7 RISK AND UNCERTAINTY

7.1 Introduction

7.1.1 Estimates of project costs of the EOBP proposals, as with all large infrastructure projects, are subject to a degree of uncertainty and change. This is due to changes in a number of factors including technical standards, the political environment, project interfaces, technological improvements and/or amendments required to obtain the necessary consents and approvals.

7.1.2 It should be stated at the outset that it is impossible to identify and manage all project risks. The objective of the EOBP project management team is to reduce all identified financial and programme risks to a minimum level as is reasonably practical for each stage of the project lifecycle.

7.1.3 To reduce the level of uncertainty of the EOBP proposals, the project team has employed a risk management process based on current best practice guidelines and on experience with similar projects elsewhere.

Best Practice Risk Management

7.1.4 The risk management approach adopted is aligned to the key UK Government guidelines required for large transport infrastructure projects. These are:

- The four stages central to the risk management process, that is to identify, assess, mitigate and monitor risk, should be implemented;
- Risks should be identified for all stages of the project lifecycle;
- Risks should be recorded in a Risk Register, which as a "live" document, should be continuously reviewed, revised and updated throughout the project lifecycle; and
- Identified risks should be managed to a level "as low as reasonably practicable" for each stage of the project lifecycle.

7.1.5 Not all tools and techniques for risk management can be applied to all projects, so we have selected and utilised the most appropriate tools to reflect the characteristics of the study area.

7.1.6 The selection of the correct tools and techniques has been facilitated by our experience drawn from work on other comparable projects in terms of geographical location, size, complexity and similarities in engineering requirements. This has aided our ability to identify the likely risks generated by the EOBP proposals, and the upfront risk mitigation techniques to reduce the probability that such risks will occur.

7.2 Risk Management Process

Key Stages

7.2.1 As has been identified above, there are four key stages to the risk management process as applied to this study:

- Risk Identification;
- Risk Assessment;
- Risk Mitigation; and
- Risk Monitoring.

7.2.2 The identified risks are analysed by combining their probability of occurrence and their scale of impact on the proposed EOBP investment. They are subsequently assessed in terms of overall risk of exposure and priority for action. Mitigation measures are developed, where suitable, for each risk recorded in the Risk Register. These measures are applied in proportion to the severity of the risk in question, which influences the time and cost required to address the relevant risk.

7.2.3 The risks and costs associated with these are monitored on a regular basis by the project team. The Risk Register includes data which provides a current risk profile of the project, and represents a snapshot of the progress towards mitigation of all identified project risks.

Project Risk Register

7.2.4 The Risk Register is the key tool of the Risk Management process in line with best practice. It records all identified risks as inputs and produces qualitative and quantitative information regarding these risks as outputs such as risk severity, mitigation process and capital expenditure contingencies. In summary, the Register provides:

- A fully auditable track record of all identified risks;
- A central focus to the management of risks across all project workstreams;
- A management reporting tool to assist in delivering better performance of key project activities;
- Motivation for all team members to assess and manage risks on a frequent and regular basis;
- Assistance in facilitating purposeful action and management of threats to the delivery of key project activities as early as possible; and
- An interface with other key project reporting tools to ensure total transparency in the reporting of all identified risks.

7.2.5 The Register provides the basis for risk prioritisation, mitigation action, risk control and risk reporting. It is maintained and updated by the EOBP's technical advisors, and is regularly monitored by the project team.

Stakeholder Management Process

7.2.6 It is clear that the perception and reputation of the EOBP proposals rests on the stakeholder management process employed by the project team. It is particularly important that the risk management process captures the anticipated concerns of all identified stakeholders, the composition of which may change depending on the stage of the project lifecycle.

7.2.7 An important product of the stakeholder management process is the generation of risk mitigation processes designed to address the concerns raised by the stakeholders and their potential impact on project costs, and to take the appropriate steps identified to mitigate these.

7.2.8 A risk workshop was conducted on the 9th March 2009 with SEStran and its partners to discuss and agree the risk register with SEStran. The results of these discussions were taken forward in the development of the risk mitigation plan and the resulting monetary estimates set out in this Chapter.

Other Key Activities

7.2.9 Risk identification, recording, monitoring and mitigation is not an isolated activity, but undertaken in conjunction with a number of other project activities, including:

- Construction methodology;

- Environmental Impact Assessment (EIA);
- Demand forecasting and STAG Assessment; and
- Finance and funding.

7.2.10 The construction methodology involves considerable potential for risk, and therefore account should be taken of the management processes applied to the mitigation of construction risks recorded in the Project Risk Register. The construction methodology will also have an environmental impact, the consideration of which will be in the EIA. Both these and the mitigation measures identified in the EIA will be entered into the Project Risk Register.

7.2.11 The Project Risk Register also shows the risks arising from the uncertainties surrounding forecasting of projected travel patterns and modal shift values used to develop the STAG Part 2 Appraisal for the scheme. Furthermore the Register highlights issues that may affect the level or likelihood of available funding to finance the project, where the assessment of risks is used to develop robust capital cost estimates informing the projects financial requirements.

Approach to Optimism Bias

7.2.12 Optimism Bias (OB) is the tendency for a project's costs and duration to be underestimated and/or benefits overestimated. It is defined as a measure of the extent to which actual project costs (capital and operating costs), and project duration (planning to operations) exceed the expected benefits delivered by the project.

7.2.13 The project team has, where appropriate, made explicit adjustments to the key project parameters affected by any potential understatement of the timings and costs of the programme. This section describes how Optimism Bias has been addressed within the framework of the risk management processes in place. The guidelines for the assessment of Optimism Bias are set out in the HM Treasury's Green Book and the Review of Large Public Procurement in the UK[25], both of which have been adhered and referred to throughout this section. There are three drivers to the assessment and calculation of OB:

- An assessment of the project risks most likely to contribute;
- The classification of a risk by project type, which in turn determines the specific upper and lower bounds for the contributing factors to optimism bias; and
- A realistic assessment of the progress made towards the mitigation of project risks, measured by risk mitigation factors.

7.2.14 The project team has reviewed all the contributing factors that may lead to cost and time overruns. Contributing factors have been assigned for every risk in the Risk Register.

7.2.15 There are three levels of disaggregation in the application of contributing factors:

- Contributing factors are divided into two main types of OB: capital costs and works duration;
- Contributing factors are grouped into five overarching project risk areas; Procurement, Project Specific, Client Specific, Environment and External Influences; and
- Each of the five overarching project risk areas are sub-divided into specific risk areas that may negatively impact capital expenditure and works duration forecasts.

7.2.16 For part of the EOBP route, particularly the sections to the west and east of the A720 Edinburgh by-pass, the options follow the current road alignment, and therefore do not require any special design considerations due to space constraints, unusual output specifications or innovative

[25] Mott MacDonald, July 2002

construction methods. However between these sections, there will be a fully segregated bus priority route layout. Therefore, based on this analysis the project was classed as a *Standard Civil Engineering* project and therefore has Upper Boundary starting values, based on the assumption of no risk mitigation, of 44%:

7.2.17 This value is based upon the values recommended, in the HM Treasury Green Book, for Standard Civil Engineering projects. The value above has been taken forward into the analysis and calculations which are summarised in the following section.

7.3 Analysis and Findings

Capital Costs and Areas of Risk Impact

7.3.1 The individual risks identified from the structured stakeholder workshop were entered into the EOBP Risk Register were considered to be very similar between the options, although the impact on risk derived values will, of course, differ. Each risk identified falls into one of the following seven categories of key impact areas:

- Ground Conditions;
- Land;
- Environment;
- Engineering Other;
- Construction Contractual; and
- Strategic Risks.

7.3.2 The distribution of the risk impact area is shown in Table 7.1 overleaf. These have been derived from the results of the Monte Carlo simulation exercise[26] carried out to determine the level and value of risks, the results of which are further described in the Risk Profile section below.

Table 7.1: Risk Impact Areas

Impact Area	Proportion of Risks (%)
Construction/contractual	28.7%
Strategic Risks	17.8%
Other Engineering Issues	23.0%
Ground Conditions	17.4%
Environment	3.6%
Land	9.5%

7.3.3 The most important group of risks are associated with engineering issues, both direct engineering risks and those associated with ground conditions.

Identification of Key Risks

7.3.4 The risks that are anticipated to have a potential impact on construction costs are recorded in the Project Risk Register, and are shown overleaf in Table 7.2, ranked in order of severity.

[26] The Monte Carlo method is a standard statistical tool based on the generation of estimates from multiple trials to determine the expected value of a random variable, in this case the likelihood of risks occurring and their monetised values.

Table 7.2: Details of Key Risks in order of Severity

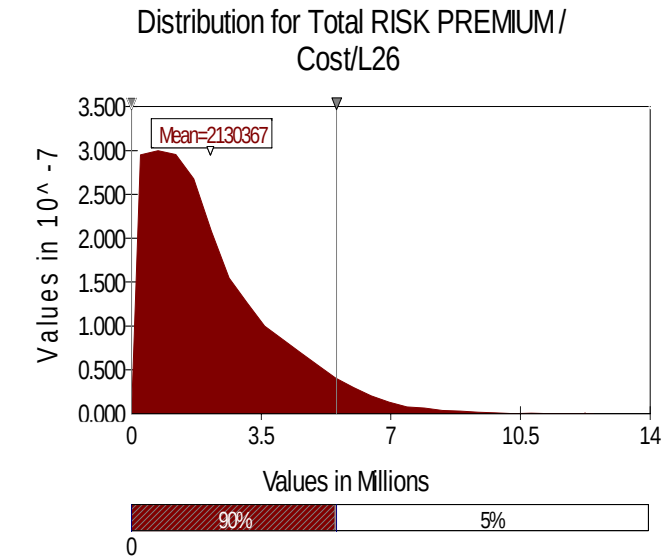
Ranking	Identified Risks
1	Construction escalation costs
2	Political risks
3	Mining
4	Drainage
5	Live trunk road works
6	Structural foundations
7	Structures
8	Junction layouts
9	Live P&R works
10	P&R disruption
11	ES Process
12	Statutory Process
13	Trunk road possession
14	Public access
15	Market value
16	Land take

7.3.5 It is worth noting that the risks associated with construction are the most potentially severe, although there is a high degree of political risk associated with the project. A number of environmental risks were also identified in addition to the above (apart from the Environmental Statement process), but the risks associated with these were considered negligible.

Risk Profile

7.3.6 The Monte Carlo simulation was undertaken on each of the category of risks identified and highlighted in the Risk Register to estimate the mean Risk Value Estimate and to give the risk profile. The one for option A5 is shown in Figure 7.1 overleaf.

Figure 7.1: Mean Value of Risk, Option A5



7.3.7 Figure 7.1 shows that for option A5, the mean value of risk is £4.1 million. However, the Monte Carlo simulation was undertaken for each major option (whether the route is fully segregated or hard shoulder running). The Monte Carlo simulation mean values of risk for the main options are shown in Table 7.3.

Table 7.3: Mean Values of Risk by Route Option

Route Option	Mean Value of Risk
Route A5	£4.1m
Route B17	£4.1m
Route B18	£3.7m
Route C5	£5.1m

7.3.8 The computer model undertaken for the Monte Carlo Simulation also carried out a regression analysis of all the risks in the Risk Register. It estimated a correlation co-efficient (R-squared value) of 0.918 for the risks which suggests a very good level of representation of the potential risks.

Risk Mitigation Strategy

7.3.9 Following the development of the Risk Register, a Risk Mitigation Strategy (RMS) was identified and tasked with various actions to militate against the remaining risk factors. The intention of the RMS is to take into account the rigorous capital costing methodology employed in this study.

7.3.10 Of the risks identified in the Risk Register, four risk areas (as defined by HM Treasury Guidance on Optimism Bias) were not appraised during the risk analysis hence are subject to uplift values for Optimism Bias. These are:

- Project Specific – Other;
- Client Specific – Poor Project Intelligence;
- Environment – Public Relations; and
- External Influences – Economic.

7.3.11 However, two of these risk areas are within the control of the project team and the team already has a wealth of understanding of the issues involved with these, and the understanding constantly being improved. These risks are:

- Client Specific – Poor Project Intelligence; and
- Environment – Public Relations.

7.3.12 In addition, there is significant information available on the potential risks in these two risk areas held by the team, due to the extensive studies and consultation exercises carried out to date on the project. Some of this existing information was used in the cost estimates shown in this report, and the project team believe a significant number of potential risks have been captured in the construction costs estimation and methodology produced.

7.3.13 Further suitable RMS actions were identified for these two risk areas with which to potentially extend the reduction in the level of Optimism Bias. Table 7.4 overleaf summarises these RMS actions.

Table 7.4: Risk Areas and RMS Actions

Risk Areas	Mitigation Actions
Client Specific – Poor Project Intelligence	• Further ground investigations including Borehole surveys will be carried out; • Further scheme development and design will be carried out, particularly for the segregated engineering elements; • Following on from the scheme design, more detailed cost estimates will be produced; and • Accordingly, the Risk Register will be updated and maintained throughout the above design/costings processes. This will include a Quantified Risk Assessment (QRA).
Environment – Public Relations	• Further consultation will continue including negotiations with private developers and landowners; and • Detailed Environmental Impact Assessment (EIA) of the plans will be prepared.

7.3.14 However, the mitigation factors identified in Table 7.3 have not been taken forward in the capital cost estimates in order that the analysis errs on the side of caution. Therefore the Optimism Bias values detailed below have not been adjusted by these mitigation factors so as to provide a more robust appraisal of capital costs.

7.3.15 Mitigation factors for the other risk areas have been unchanged, as the project team recognises that not all project risks can be mitigated at this stage. However, it is a key objective of the project team to improve mitigation factors and hence reduce further the optimism bias values and the overall resulting financial risk to the project. This will be done as the project progresses taking into account the increased knowledge and certainty gained from the outcomes of key decisions on, for example, the final procurement strategy, the commencement of advance works and the continued application of the risk management process.

7.3.16 The risk register will be developed further and maintained as the project moves into further stages of development and more detail is available on construction methodologies and their associated risks.

Investment Cost of the Options & Optimism Bias

7.3.17 To estimate Optimism Bias, the Upper Boundary levels of the Optimism Bias were reduced progressively by the removal of risks already identified and taken account of in the quantified risk assessment described above and the starting values for capital costs and costs associated with work duration as explained in Section 7.2.17 above. The process followed is the same as that used in the EARL project and the Waverley Station Redevelopment[27][28].

7.3.18 In order to achieve the appropriate uplift factor for Optimism Bias the following procedure was adopted:

- For Standard Civil Engineering Works – the upper boundary of 44% uplift factor from the HM Treasury Guidance was applied to the base construction costs;
- From this uplift factor the proportion of capital costs accounted for by both contingency and risk and uncertainty costs were deducted; and

[27] Edinburgh Airport Rail Link (Design Development Appraisal), Scottish Executive, May 2007
[28] Waverley Station Redevelopment: Final STAG Report, Scottish Executive, July 2004

- This results in an a net value for optimism bias value of between 15% and 17% of capital costs which is then applied to the capital costs in addition to those for contingencies and risk and uncertainty.

7.4 Sensitivity Tests

7.4.1 In order to analyse how sensitive the economic appraisal results are to key input variables, a number of tests have been carried out on Option B17. The sensitivity tests were identified by way of identifying potential risk areas associated with patronage/revenue forecasts and costs estimates developed for the scheme. This section provides a summary of the risk areas identified and their estimated level of impact. The main risk areas identified and associated tests carried out can be summarised as:

- Time savings in TEE Appraisal lower than predicted. A drop of 10% was tested;
- Vehicle operating costs savings in TEE Appraisal lower than predicted. A drop of 10% was tested;
- Forecast patronage/revenue on the service is lower (e.g. affected by competitor response). A drop of 10% was tested;
- Increase in capital costs (e.g. contractors tenders are higher than anticipated). An increase of 10% was tested;
- Increase in operating costs (e.g. operators' outturn costs are higher than anticipated). An increase of 10% was tested; and
- Increase in the construction programme (e.g. works duration delay). A delay of 1 year was tested, first on benefits only, and then on benefits and costs.

7.4.2 A series of TEE Appraisals were undertaken to enable the impact of risks on the Net Present Value (NPV) and Benefit-to-Cost Ratio (BCR) to be understood. The summary results of the sensitivity tests are presented in Tables 7.5.

Table 7.5: Results of Sensitivity Tests

Sensitivity Test	Identified Risks	NPV	BCR
	Base	£95.1m	1.83
(a)	Base minus 10% of time savings benefits	£84.2m	1.73
(b)	Base minus 10% of VOC benefits	£93.3m	1.81
(c)	Base minus 10% of revenues	£87.1m	1.76
(d)	Base plus 10% increase in Capital Costs	£92.1m	1.78
(e)	Base plus 10% increase in Operating Costs	£91.5m	1.77
(f)	Base plus 1 year delay to construction programme (delay on benefits only)	£89.5m	1.78
(g)	Base plus 1 year delay to construction programme (delay on benefits and costs)	£91.7m	1.81

Note: all NPVs are discounted to 2002 prices

7.4.3 As can be seen from Table 7.5, all sensitivity tests produced positive NPVs and BCRs greater than 1.0.

8 MONITORING AND EVALUATION

8.1 Introduction

8.1.1 STAG requires consideration to be given to the monitoring and evaluation of the option or options recommended as an outcome of the study process. This is because a process of monitoring and evaluation will be required for projects receiving financial support, in whole or in part, from the Scottish Government. The two processes can be distinguished as follows:

Monitoring –	An on-going process to measure progress towards a set of agreed targets.
Evaluation –	A specific one-off activity to investigate project performance in depth.

8.2 Key Performance Indicators

8.2.1 *"Monitoring is the process of gathering and interpreting information on the performance of a project. This process should be an on-going one and may take place in conjunction with other information gathering exercises"*[29]. The focus of monitoring will be on outcomes, and to assist in this it is necessary to establish key performance indicators (KPIs) to measure the impact of the options implemented. These KPIs should build on the study's *Planning Objectives* and be SMART. Table 8.1 sets out some suggested monitoring yardsticks for consideration.

Table 8.1: Suggested KPIs for Monitoring

Planning Objective/Criteria	*Key Performance Indicator*
Environment	1. monitor reduced veh-km of travel by car
Safety	2. no specific Planning Objective identified
Economy	3. monitor modal shares between car and bus trips, and the journey times and reliability of EOBP services
Integration	4. monitor the journey times and reliability of EOBP services
Accessibility & Social Inclusion	5. monitor numbers of annual trips on EOBP services

8.3 Evaluation

8.3.1 *"It is necessary to demonstrate at the post-implementation stage of a project how effectively that project has met the established objectives"*[30]. Evaluation can be divided into two types:

Process Evaluation	Primarily concerned with how well the project has been implemented.
Outcome Evaluation	Examines the performance of the project after completion, and measures its "success". It therefore cannot take place until sufficiently long after implementation for success to be measurable.

[29] STAG, section 14.2.46
[30] STAG, section 15.8.1

8.3.2 Process evaluation is concerned with implementation, and can be carried out by assessing how well the implementation has been delivered at key stages throughout the process, so that (for example), decisions on the scope and scale of the project can be reassessed in the light of experience. Chapter 7 has discussed some potential issues to consider in terms of risk and uncertainty, and these could form the basis for outputs upon which the process evaluation is based. In order to achieve this, it is recommended that the Project Risk Register is set-up at the start of the development and be continuously maintained throughout the project development lifecycle.

8.3.3 Outcome evaluation looks at the results of a scheme once it has been implemented, and can only take place when the scheme has "bedded down" sufficiently for realistic results to be measurable. With large schemes, this inevitably will be a number of years after the opening year. Outcome evaluation is often related to the so-called *"Four E's"*[31], and these are set out below:

Economy –	The costs of resources used, procurement and tendering issues.
Efficiency –	How well were inputs translated into outputs, and could more output have been achieved with less or different inputs or processes/management?
Effectiveness –	Did achieving the defined outputs then enable the wider policy objectives to be achieved; could these have been achieved through some alternative intervention or process?
Equity –	Were the gainers from the project, such as particular social groups or areas, as intended; is this in line with other policy intentions?

8.3.4 STAG sets out the following series of sequential steps for an outcome evaluation[32]:

- Step 1: definition of scope and purpose;
- Step 2: project rationale;
- Step 3: aims and objectives;
- Step 4: measures and indicators;
- Step 5: base case for comparison;
- Step 6: analysis and interpretation; and
- Step 7: reporting and recommendations.

8.3.5 Steps 1 to 3 will be carried forward from this STAG appraisal, along with the Base Case for Step 5. The analysis and interpretation of results could then form an "outcome evaluation" report structured around the suggested KPIs in Table 8.1, and culminating in recommendations for the future development of the project and that of similar schemes elsewhere in Scotland and the UK.

[31] STAG, section 15.11.11
[32] STAG, section 15.12.1

9 CONCLUSIONS

9.1 Findings of the Part 2 Appraisal

9.1.1 In accordance with normal STAG practice, Appraisal Summary Tables have been prepared. These are shown in Appendix F. The results of these are summarised in Table 9.1, using the key shown below.

Table 9.1: Summary of STAG Assessment

Criteria	Option			
	A5	B17	B18	C5
Objective 1 – RTS Mode Shift	✓✓	✓✓	✓✓	✓✓
Objective 2 – RTS Environmental	✓✓	✓	✓	✓✓
Objective 3 – Service Integration	✓✓	✓	✓	✓✓
Objective 4 – Service Accessibility	✓✓	✓	✓	✓✓
Objective 5 – Improved PT Times	✓✓	✓	✓	✓✓✓
Environment – Air Quality & noise	✓✓	✓	✓	✓✓
Environment – Other	✗✗✗	✗	✗	✗✗✗
Safety	✓	✓	✓	✓
Economy	✓✓	✓✓✓	✓✓✓	✓✓
Integration	✓✓	✓✓	✓✓	✓✓
Accessibility/Social Inclusion	✓✓✓	✓✓✓	✓✓✓	✓✓✓
Technical Issues	✓	✓✓	✓✓✓	✓
Operational Aspects	✓✓✓	✓✓✓	✓✓✓	✓✓✓
Public Acceptability	✓✓✓	✓✓✓	✓✓✓	✓✓✓
Cost to Government	✗✗✗	✗	✗	✗✗✗

Key:

✓✓✓	Major Beneficial Impact	✗	Minor Adverse Impact
✓✓	Moderate Beneficial Impact	✗ ✗	Moderate Adverse Impact
✓	Minor Beneficial Impact	✗ ✗ ✗	Major Adverse Impact
O	Neutral Impact		

9.2 Preferred Option

9.2.1 As can be seen from Table 9.1, the options are all very close in terms of meeting the STAG Part 2 requirements of the Government's five overarching objectives for transport. However, Options B17 and B18 (the south alignment from the Airport to Millerhill P&R) present the best economic performances of the four short-listed options. Of these two, Option B18 takes less land and therefore would expect to have less in the way of environmental impacts. Hence, option B should be considered as the preferred option.

9.3 Recommendation

9.3.1 Our chief recommendation is to look at Options B17 and B18 and their variations in more detail. This is because the only difference, in terms of infrastructure, between the two is B18 has section 4 which is segregated rather than using a hard shoulder. This is because Transport Scotland has not published plans to provide a hard shoulder along this section, but could do so in the future.

9.3.2 Hence, our recommendation is to develop further both options and take them forward into a detailed design.

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