Edinburgh Tram Project

Budget Appraisal

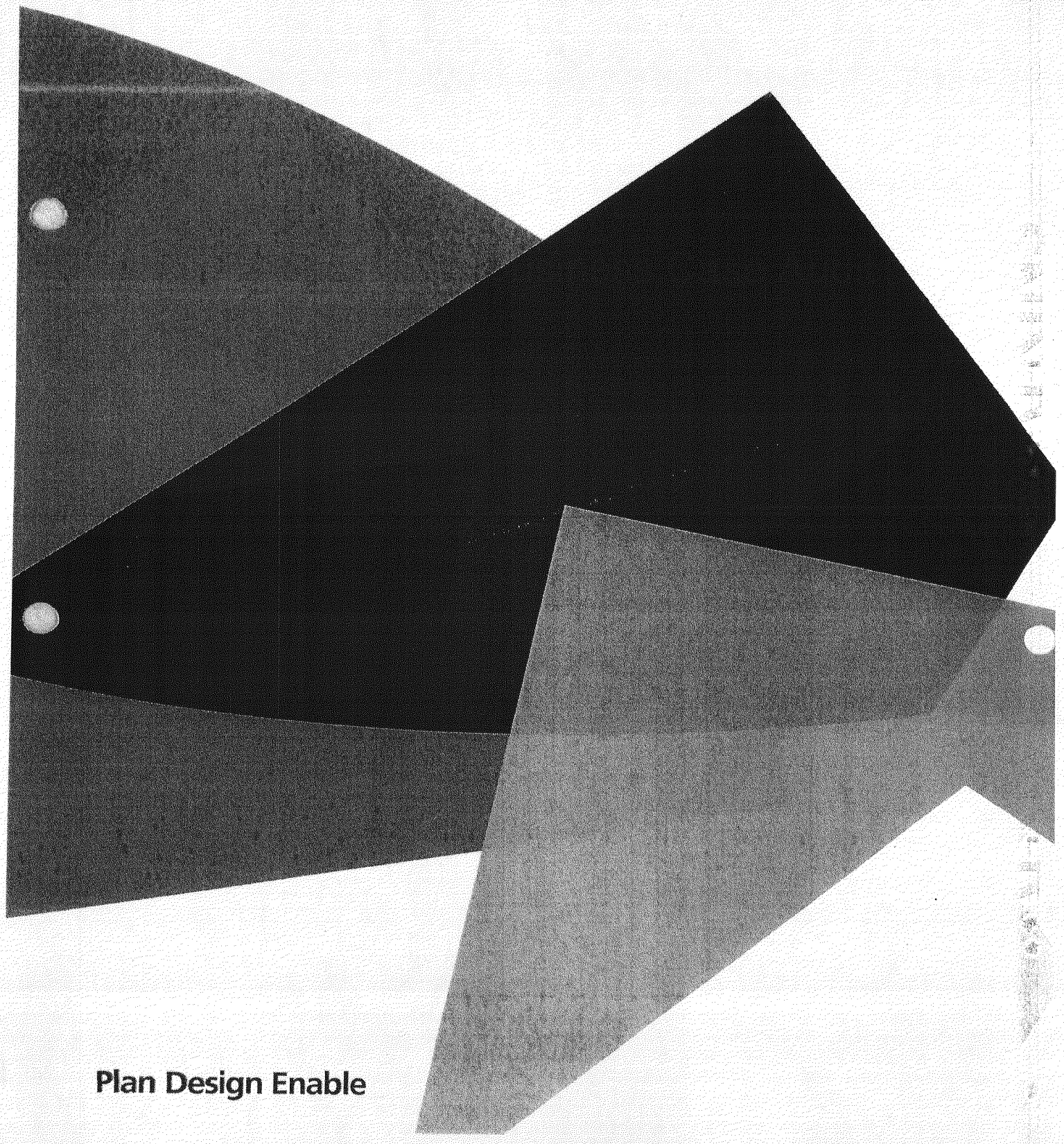
Based on Amounts Certified to Infraco on 6th June 2011

	Settlement Agreement (High)	Separation		Unsuccessful Termination	Continue with Infraco to York Place (High)	Continue with Infraco to York Place (Low)
		Mothball/Cancel Project (High)	Re-Procure (High)			
Milestones		176.4	176.4	176.4	176.4	167.8
Mediation Heads						
BB/S Airport to Haymarket Lump Sum	362.5					
CAF	62.9					
Haymarket to St Andrew Sq	22.5					
Settlement Agreement	447.9					
Infrastructure Costs to go (Reprocure of Grind on)			199.5	182.7	182.7	182.7
Claims		255.7	255.7	286.0	206.0	155.8
Risk and Contingency	77.5	3.0	262.1	8.0	248.1	178.4
Other Costs/Costs to Date	248.0	252.0	251.0	257.0	242.0	257.0
Total	773.4	687.1	1,144.7	910+	1,055.2	941.7

Atkins
Edinburgh Tram – Business Case Audit
Final Report

July 2011

ATKINS



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ATKINS

Edinburgh Tram – Business Case Audit Final Report

July 2011

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Glossary of Terms

BCR: Benefit / Cost Ratio

EALI: Economic Activity and Locational Impacts

EARL: Edinburgh Airport Rail Link

HLM: High Level Model

In Vehicle Time Weightings / Mode Coefficient: Representation in minutes / or as a factor of the relative attractiveness of a mode of transport

Interchange Penalty: Representation in minutes of an interchange during a passenger's journey

JRC: Edinburgh Tram Joint Revenue Commission

Outturn Cost: The final cost of a project

PV: Present Value

SDS: Systems Design Contract

STAG: Scottish Transport Appraisal Guidance

TEE: Transport Economic Efficiency

TEL: Transport Edinburgh Limited

TELMoS: Transport, Economic, and Land-Use Model of Scotland

tie: Transport Initiatives Edinburgh

TMfS: Transport Model for Scotland

VISUM / VISSIM: Transport modelling software

WebTAG: Department for Transport's Transport Analysis Guidance

WETA: West Edinburgh Transport Appraisal

1. Edinburgh Tram Business Case Audit

Atkins

1.1 Atkins is the UK's largest engineering and design consultancy and has extensive experience in the planning, design, and delivery of mass rapid transit projects in the UK and overseas.

Our Brief

1.2 We were commissioned by the City of Edinburgh Council (CEC) in April 2011 to undertake an independent review of the Edinburgh Tram Business Case. The audit's principal focus has been reviewing the work which the Joint Revenue Commission (JRC) has been undertaking in assessing the benefits that could be gained from the introduction of the proposed tram system in Edinburgh.

1.3 Key inputs to the audit have included: Edinburgh Tram Network Final Business Case Version 2 (2007), Edinburgh Tram – Business Case Update (2010), recent analysis on three route options undertaken by JRC in parallel with the audit, historic revenue and risk reports, and the current financial models for the tram.

Options Tested

1.4 The JRC was commissioned by the City of Edinburgh Council in April 2011 to provide updated TEE analysis[1] for the following three tram routes options:

- The full Phase 1a, Edinburgh Airport to Newhaven;
- Truncated Phase 1a, Edinburgh Airport to St Andrew Square; and
- Truncated Phase 1a, Edinburgh Airport to Foot of the Walk.

Business Case Components

1.5 Our business case audit has focussed on the updated TEE analysis that has been provided by the JRC during June 2011. In addition to quantifying the benefits and costs to Government via the TEE analysis STAG[2] requires that other relative benefits from a transport scheme are presented within the context of the following parameters:

- Environment;
- Safety and Security;
- Accessibility and Social Inclusion;
- Transport and Land Use Integration;
- Economic Regeneration; and
- Economic Activity and Locational Impacts (EALI).

1.6 The Edinburgh Tram Network Final Business Case Version 2 (2007), and Edinburgh Tram – Business Case Update (2010) provide evidence of the relative benefits within each of these parameters; while these elements have not been updated by the JRC team, or reviewed in detail as part of this audit, we have drawn our overall conclusions acknowledging this wider context for the scheme.

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[1] Transport Economic Efficiency, http://www.transportscotland.gov.uk/stag/td/Part2/Cost_to_Government/12.7

[2] Scottish Transport Appraisal Guidance (STAG), http://www.transportscotland.gov.uk/stag/home

2. Our Approach

Key Questions

2.1 The approach we have adopted to undertake the business case audit has been developed around answering three questions:

- The tools used – are they fit for purpose?
- The assumptions used – are they reasonable?
- The outputs – do they look credible?

Our Overall Approach

2.2 There are a number of overall principles that we adopted in undertaking the audit, which were essential in delivering the required outcome in the time available. These were:

- A pragmatic approach, avoiding the pursuit of technical purity for the sake of it, as opposed to where it relates materially to the strength of the business case;
- Open lines of communication with the JRC team. An open, co-operative approach that provided the outputs our work required without distracting them from developing three new BCRs[3]; and
- As with technical pragmatism (above), we needed to avoid being distracted with issues which are not material to the business case – we needed to review what had gone before but to ensure that our focus remained on issues that are contemporary, rather than those which are no longer significant in terms of the business case.

Our Methodology

2.3 Our methodology for the study focussed at delivering the following seven tasks over a ten week programme:

Task 1 - Data and report collation: Our review was completely dependent upon collating the right information, and ensuring that we maintained a focus on information that was still pertinent.

Task 2 – Review of the base year model: The model was subject to a detailed audit in 2008, and enhancements were implemented on the basis of recommendations made at that time. We have not replicated the technical depth of that audit, but have reviewed those aspects of the model to which the outputs (the benefits in the TEE/BCR calculations) are most sensitive.

Task 3 – Understanding the drivers of demand, revenue and benefits: An early action was to establish a very clear focus on the key business case drivers, we developed a thorough understanding of the scale, nature, and source of the component benefits within the business case.

Task 4 – Forecasting assumptions: Concurrently with task 3 we reviewed the evidence underpinning the forecast assumptions.

Task 5 – Review of appraisal parameters: We undertook a review of the appraisal framework used to establish the relative merits of the scheme.

Task 6 – Sensitivity testing: We identified key areas of risk and uncertainty, and requested sensitivity testing from the JRC to help quantify the impact of these risks on the business case.

Task 7 – Reporting: We reported our outputs in three increments; a presentation to senior City of Edinburgh official on 14th June 2011, an Executive Summary Report on 22nd June 2011, and this Final Report on 30th July 2011.

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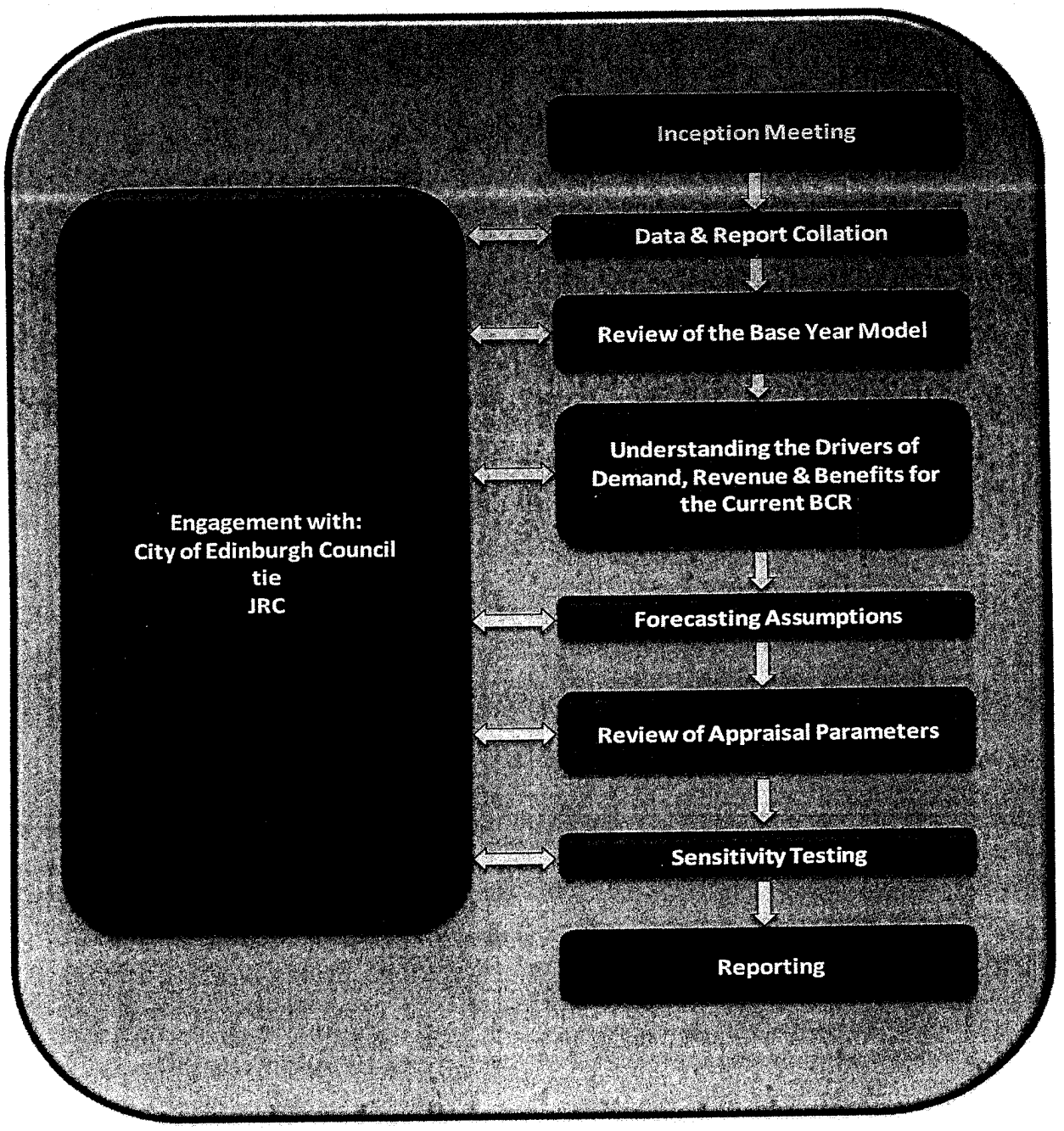
[3] Benefit/Cost Ratio (BCR), http://www.transportscotland.gov.uk/stag/td/Part2/Cost_to_Government/12.7

2.4 Our methodology is illustrated in Figure 2.1 below.

Figure 2.1 - Methodology



3. Audit Inputs

Key Inputs

3.1 The audit has reviewed a wide range of documents and these are listed in Appendix A.

3.2 Key inputs to the audit have included: Edinburgh Tram Network Final Business Case Version 2 (2007), Edinburgh Tram – Business Case Update (2010), recent analysis on three route options undertaken by JRC in parallel to the audit, historic revenue and risk reports, and the current financial models for the tram.

3.3 The figure below highlights some of the key sources of information used in the audit.

Figure 3.1 – Key Documents

Options Tested

3.4 The JRC was commissioned by the City of Edinburgh Council in April 2011 to provide updated TEE analysis for the following three tram routes options:

- The full Phase 1a, Edinburgh Airport to Newhaven;
- Truncated Phase 1a, Edinburgh Airport to St Andrew Square; and
- Truncated Phase 1a, Edinburgh Airport to Foot of the Walk.

3.5 Our business case audit has focussed on this updated TEE analysis.

JRC Standard Outputs

3.6 The JRC has produced standard outputs that contain information for the following:

- Tram patronage and revenue mode shift;
- Ramp up and recession impacts on patronage and revenue; and
- Patronage flows and capacity.

3.7 These outputs have also been recently refreshed for the three tram options listed above and are contained in Appendix B of this report for reference.

3.8 An early requirement of our work was to examine the distribution of forecast demand and benefits for the scheme. This was to provide a focus for later stages of review; in line with the principles of our approach (see section 2.2) we needed to focus our attention on those aspects of the performance of the scheme which were most influential in terms of the business case. Our initial review of the standard outputs highlighted the importance of the elements of demand discussed below.

Ingliston Park and Ride and Future Committed Development

3.9 When the standard outputs are analysed they clearly identify the importance of the Ingliston Park and Ride, and the future committed development (particularly in the north and west of Edinburgh) in driving demand for the tram.

3.10 The tram patronage and revenue mode shift tables in Appendix B show the modes which tram users are forecast to have used in the absence of the tram. These show that the predominant transfer is from bus, as might be expected, however, they also show that a large proportion of the total demand would otherwise have used car for their journey. Looking at these in combination with the boarding and alighting plots; show that the **Ingliston Park and Ride** is by far the busiest stop for eastbound trips in the AM peak, confirming the importance of the Park & Ride site as a source of peak hour demand for the each of the options tested. In particular it forms a very significant proportion of the AM peak demand for the St Andrew Square option.

3.11 The significance of the major **committed future developments** is illustrated in the boarding/alighting plots in Appendix B (the full Phase 1a outputs are particularly useful as they disaggregate demand along the whole corridor – extracts for these are provided in Fig 3.2 to 3.5 on the following pages), which show significant growth in use of stops associated with new committed development in the north and west of Edinburgh – such as stops at the east end of the route, and Edinburgh Park.

Figure 3.2 – Eastbound Boarding and Alighting 2011 AM Peak, Full Phase 1a (Source JRC - June 2011)

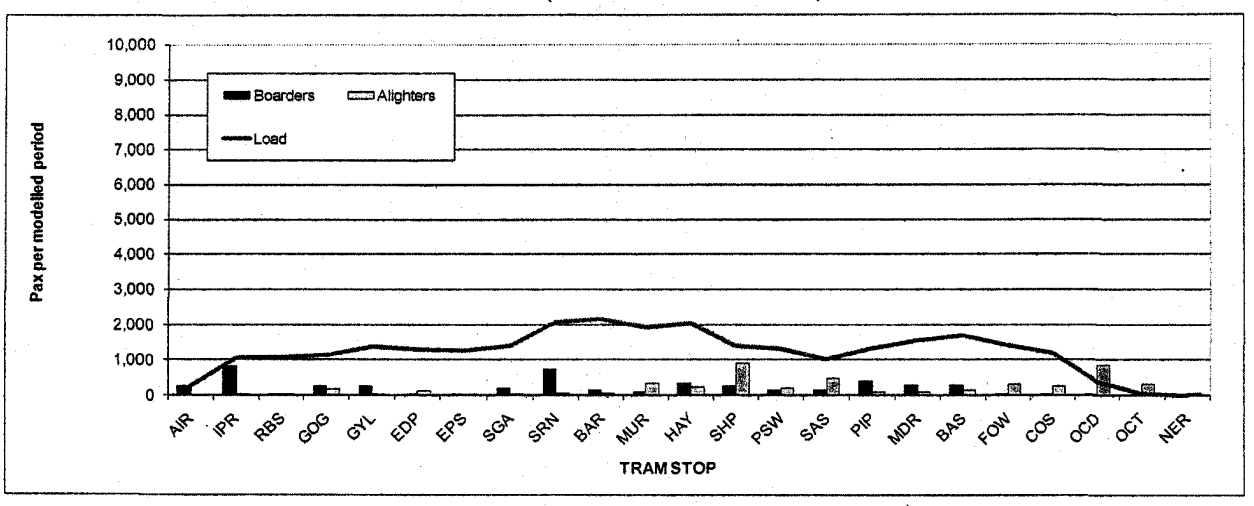


Figure 3.3 – Westbound Boarding and Alighting 2011 AM Peak, Full Phase 1a (Source JRC - June 2011)

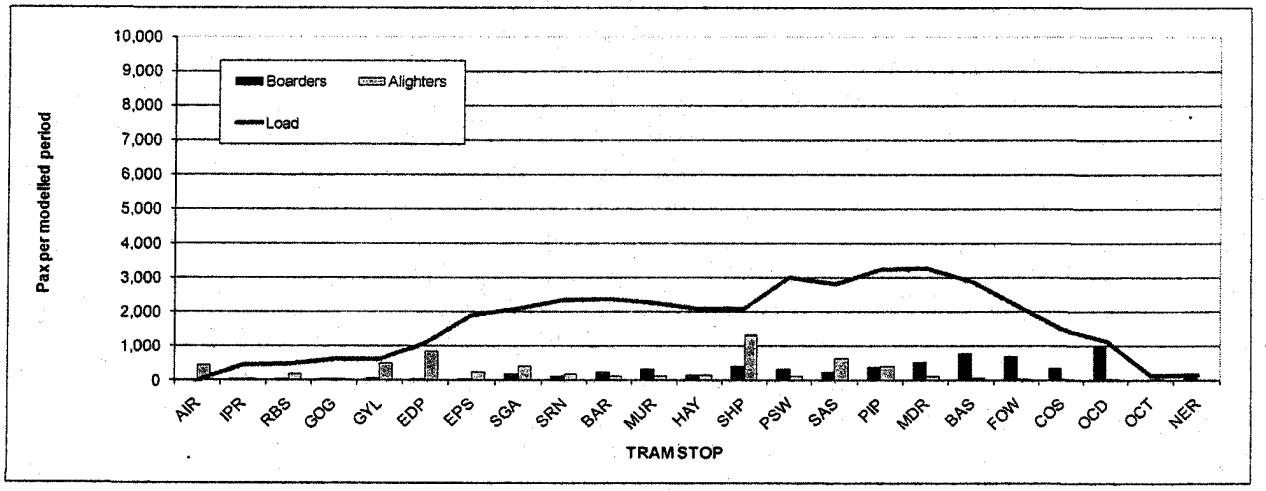


Figure 3.4 – Eastbound Boarding and Alighting 2031 AM Peak, Full Phase 1a
(Source JRC - June 2011)

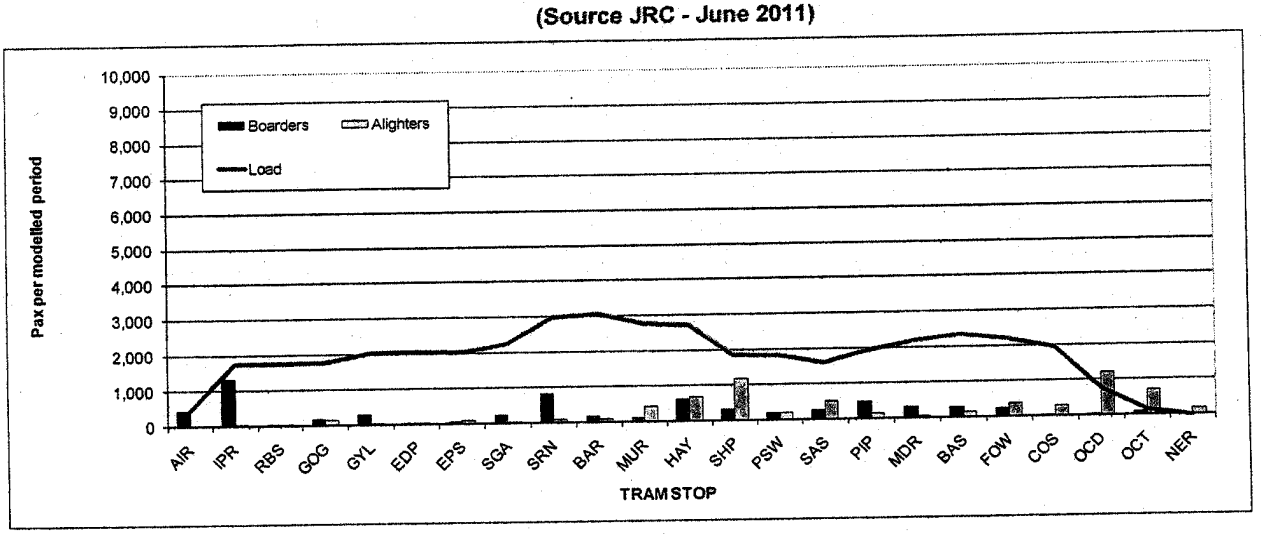
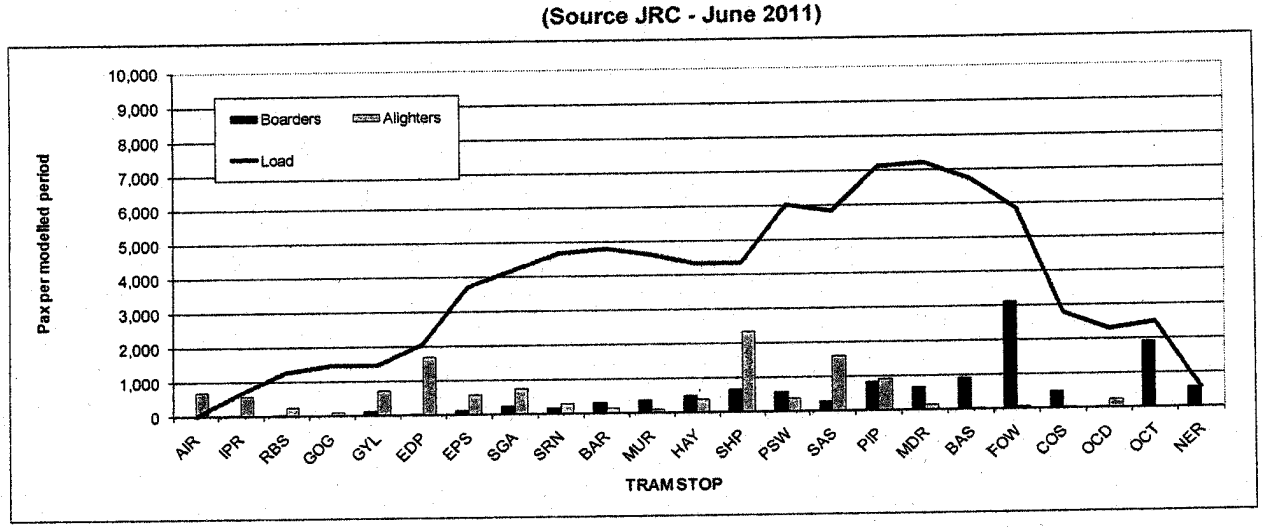


Figure 3.5 – Westbound Boarding and Alighting 2031 AM Peak, Full Phase 1a
(Source JRC - June 2011)



Business Case Components

3.12 In addition to quantifying the benefits and costs to Government via the TEE analysis STAG requires that other relative benefits from a transport scheme are presented within the context of the following parameters:

- Environment;
- Safety and Security;
- Accessibility and Social Inclusion;
- Transport and Land Use Integration;
- Economic Regeneration; and
- Economic Activity and Locational Impacts (EALI).

3.13 The Edinburgh Tram Network Final Business Case Version 2 (2007), and Edinburgh Tram – Business Case Update (2010) provide evidence of the relative benefits within each of these parameters; while these elements have not been updated by the JRC team, or reviewed in detail as part of this audit, we have drawn our overall conclusions acknowledging this wider context for the scheme.

Scheme Costs

3.14 The scheme's capital and revenue costs are a key input to the TEE analysis. The updated capital costs used by the JRC are presented in the table below. These have been an important input to our work, but we have not undertaken an audit of the costs. Tram operating costs and savings associated with reducing bus provision have been provided to the JRC from TEL.

Table 3.1 - Updated Capital Costs[4]

Outturn Costs £m	Phase 1a	St Andrew Square	Foot of the Walk
Infrastructure costs already spent (sunk costs)	461	405	461
Vehicle costs	62	42	50
Remaining infrastructure costs	294	262	264
Total capital costs	**817**	**709**	**775**

Clarifications

3.15 The timescales associated with the audit meant that it was necessary to work in parallel with the JRC team and dove tail the audit with the ongoing TEE analysis.

3.16 Throughout the audit a series of progress meetings were organised and attended by representatives from Atkins, the JRC, tie, and the City of Edinburgh Council. These meetings had two key objectives:

- To ensure that the audit was fully aligned with the JRC programme; and
- To provide a forum for addressing clarification questions that were raised by the audit team during May and June 2011.

Benchmarking

3.17 Atkins have extensive experience of working on mass rapid transit projects around the world and have brought together knowledge that is pertinent to Edinburgh to help us sense check the

[4] Provided by CEC, outturn costs.

Edinburgh Tram's Business Case. In particular it is important to be clear on what the risk factors actually are for a mass rapid transit system in the UK.

3.18 Experience of other tram systems in the UK has highlighted a number of areas of risk in relation to tram demand forecasts:

- Modelling uncertainty / Inaccurate model forecasts;
- Competitive response from other modes;
- Fares;
- Park and Ride;
- The size of the transport market;
- Tram performance and quality; and
- New developments.

3.19 Once areas of risk have been established it is common practice to quantify the potential impact of the risk through sensitivity testing, before identifying appropriate mitigation actions that are within the control of the scheme promoter and scheme operator – such as providing seamless interchange, high quality Park and Ride facilities, and competitive fares and journeys times.

3.20 As part of our audit we have paid particular regard to the known areas of risk for schemes of this nature outlined above, and our sensitivity tests have been defined accordingly.

4. The Tools Used – Are They Fit for Purpose?

The Tools Used

4.1 Our assessment of the appropriateness of the tools used has focussed on the modelling suite and the appraisal methodology.

The Modelling Suite

4.2 The modelling suite comprises a number of elements, including the High level Model (HLM), which is a strategic multi-modal demand, network assignment and distribution/mode choice model developed using VISUM software.

4.3 The HLM is the main source of data for the assessment of demand, revenue, and user and non-user impacts which drives the benefits side of the TEE/BCR calculations, and, as such, has been the focus of our review of the tools used.

4.4 The model was subject to a detailed audit in 2008, and enhancements were implemented on the basis of recommendations made at that time. We have not replicated the technical depth of that audit, but have reviewed aspects of the HLM to which the outputs (the benefits in the TEE/BCR calculations) are most sensitive. This has included the quality of the representation of highway and public transport network performance, and the behavioural parameters which drive mode choice.

Fit for Purpose?

4.5 Our overall assessment of the HLM is that it is an appropriate tool for the purposes of informing the TEE/BCR assessment. We have however identified some areas of relative weakness (not unusual in a model of this size and complexity), which we have used to interpret output and influence the focus of sensitivity testing requested, as shown in Section Six of this report .

Appraisal Methodology

Scottish Transport Appraisal Guidance

4.6 The Scottish Transport Appraisal Guidance (STAG) was first published in 2003 and it went through a major refresh in 2008.

4.7 STAG provides a best practice framework for:

- Identifying **problems and opportunities** with a transport and land-use system;
- Setting SMART **transport planning objectives** that express the outcomes sought;
- Generating, sifting and developing **options** that can deliver the transport planning objectives;
- **Appraising** the relative merits of options; and
- **Evaluating** completed strategies and schemes.

4.8 The appraisal element of STAG allows transport planners to provide decision makers with evidence of a scheme's relative merits against the following criteria:

- Transport Planning Objectives;
- Environment;
- Safety;
- Economy;
- Integration; and

- Accessibility and Social Inclusion.

Tram Scheme Appraisal

4.9 The STAG appraisal for the Phase 1a was finalised in 2007, and built upon STAG work done for tram lines 1 and 2. The table in Appendix C summarises the relative merits of Phase 1a as presented in 2007, and also comments on how this was updated for the Edinburgh Tram – Business Case Update (2010).

4.10 We have reviewed the STAG outputs and have found the scheme appraisal methodology to be in line with standard good practice, and with the requirements of STAG.

Appraisal Refresh

4.11 Atkins recognises that since the STAG appraisal was undertaken that there has been a number of changes in the context within which the appraisal was undertake; most notably within the policy context, and in particular the prominence of carbon abatement policies that have emerged as a result of the Climate Change (Scotland) Act 2009[5]. There has also been a change in the nature of the options being tested.

4.12 It is therefore recommended that consideration is given to refreshing the wider appraisal to ensure that the full benefits of the tram scheme are captured within a contemporary context.

[5] http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/climatechangeact

5. The Assumptions Used – Are They Reasonable?

The Assumptions Used

5.1 A number of assumptions have been made by the JRC in the development of the business case. The key assumptions that we consider to have the most significant influence on the business case relate to the following areas:

- The composition of the transport network – now and in the future;
- The demand for transport – now and in the future; and
- Traveller responses to the tram.

The Composition of the Transport Network – Now and in the Future

5.2 The modelling tools used by the JRC to generate outputs have been updated periodically to reflect changes in the existing transport network, and the nature of the network in the future. A number of assumptions have been made regarding the infrastructure and operational characteristics for both the highway and public transport components of the transport network.

5.3 In order to inform and validate these assumptions the JRC has engaged with a number of key stakeholders who are best placed to provide a view on the scale and magnitude of the variables associated with the transport network. Representatives for the following organisation contributed - CEC, SDS tie, Lothian Buses, and Transport Scotland.

5.4 On the basis that they had been validated by local stakeholders, we were broadly satisfied with these assumptions, however, it should be noted that we have not undertaken our own detailed review of the model's public transport network representations.

Competitive Response from Other Modes

5.5 The JRC ran a scenario test on an earlier version of the model (in 2006) to assess the impact of competition on the tram business case. The test assumed that (non-TEL) operators would continue to run the current level of bus service frequency. Tram demand and revenues were most sensitive to a competitive response on sections of the tram network around Leith Walk. There were, however, reductions in patronage on all sections, including the Airport – St. Andrew's Square route.

5.6 The view of the JRC is that such a competitive response is highly unlikely: the increase in operating costs far outweighed the potential benefits for a competing operator, and "the development of well-balanced bus/tram integration plans would appear to limit the scope for effective competition to a very significant degree."[6]

5.7 Given the history of bus operations in Edinburgh, we tend to share this view but with certain caveats. The reduction in bus services on corridors where the tram will run means the tram system must offer at least the same level of reliability as Lothian Buses – any failure to do so could quickly lead to dissatisfaction among public transport users, leaving the door open for competitive response from other operators. A 60 year appraisal period also means there is the potential for changes to take place in the operating agreement for bus and tram – the integrated approach to fares and overall operations could change in the future in a way that is not anticipated at present – leaving a high-cost tram operator exposed in a competitive market.

[6] JRC Revenue and Risk Report (Steer Davies Gleave / Colin Buchanan, December 2006)

5.8 We considered it prudent to recommend a sensitivity test that replicated potential competition for the tram from a bus operator between the city centre and the airport.

The Demand for Transport – Now and in the Future

New Development

5.9 The new tram system will open up development opportunities and is considered integral by the City of Edinburgh Council to the future growth of Edinburgh. In turn, the new development will add to the overall patronage of the tram system. Forecasts for the amount of demand that will stem from the new developments have recently been downgraded. This reflects the change in economic conditions since the original modelling was undertaken.

5.10 The original development assumptions which were utilised within the 2006 model were updated in 2010 to inform the Business Case refresh and again in 2011 for the most recent TEE analysis.

5.11 The existing assumptions reflect the current advice from CEC planners and reflect the need to take account of known changes in development figures and the current economic climate and its impact on development in Edinburgh. An adjustment has also been made to the predicted future patronage forecasts to reflect recession impacts on bus patronage in Edinburgh, this has been derived based on adjustments proposed by TEL that reflect Lothian Buses recent experience of the bus market in Edinburgh.

5.12 As identified in Section Three of this report, the delivery of committed major future development (particularly in the north and west of Edinburgh) will drive much of the future demand for the tram.

Development Assumptions

5.13 Key elements in developing the model included collecting data to input into a base year model and forecasting development in the future years of 2011 and 2031. The development assumptions were made using data available from the City of Edinburgh Council (CEC) via local plans, structure plans, planning applications, and workshops held with Council officials.

Future Year Planning Data and Model Development

5.14 The model suite the JRC developed was based upon a number of data input variants, these included:

- TELMoS[7] Data – the TELMoS data was used for background developments within the TMfS zones;
- Major Developments – The developments which were considered to be 'major' by CEC were input individually and overrode the TELMoS data for certain zones.

Table 5.1 shows the difference in 2011 development estimates assumed to occur by 2031 when the 'major' development data supplied by CEC overrode that of the TELMoS model.

[7] TELMoS (Transport, Economic and Land-Use Model of Scotland), is a multi-purpose forecasting toolkit developed by Transport Scotland to assist in the investigation and assessment of different policies and strategies on land-use and transport provision

Table 5.1 – Changes in Development Estimates[8]

Development Type	Development Estimates		Difference in Development
	Total Development Using TELMoS Data[9]	Total Development Using CEC Large Development Data	
Housing (Units)	50,397	49,992	**-400**
Office Business (GFA[10])	837,211	1,277,808	**440,598**
Retail (GFA)	305,847	353,955	**48,081**
Commercial / Leisure (GFA)	~	277,750	**277,750**
Hotel (Beds)	1,159	5,084	**3,925**

5.15 The JRC has established all development assumptions with input from CEC planners; using CEC Development Schedules, which set out all development occurring in the city, and track individual developments which are currently within the CEC planning system.

5.16 For each major development assumption the original data has come from a CEC document such as a Local Plan or Structure Plan and has been agreed with or updated by a CEC planning officer.

5.17 It was noted by the JRC that the CEC are in the process of producing a Strategic Plan for the city and that these plans often quote high development targets which are ambitious compared to past completion rates. It is the JRC's view that the completion rates utilised within the model replicated historic data rather than the Strategic Plan targets to ensure that prudent levels of growth were utilised within the model.

Changing Development Assumptions

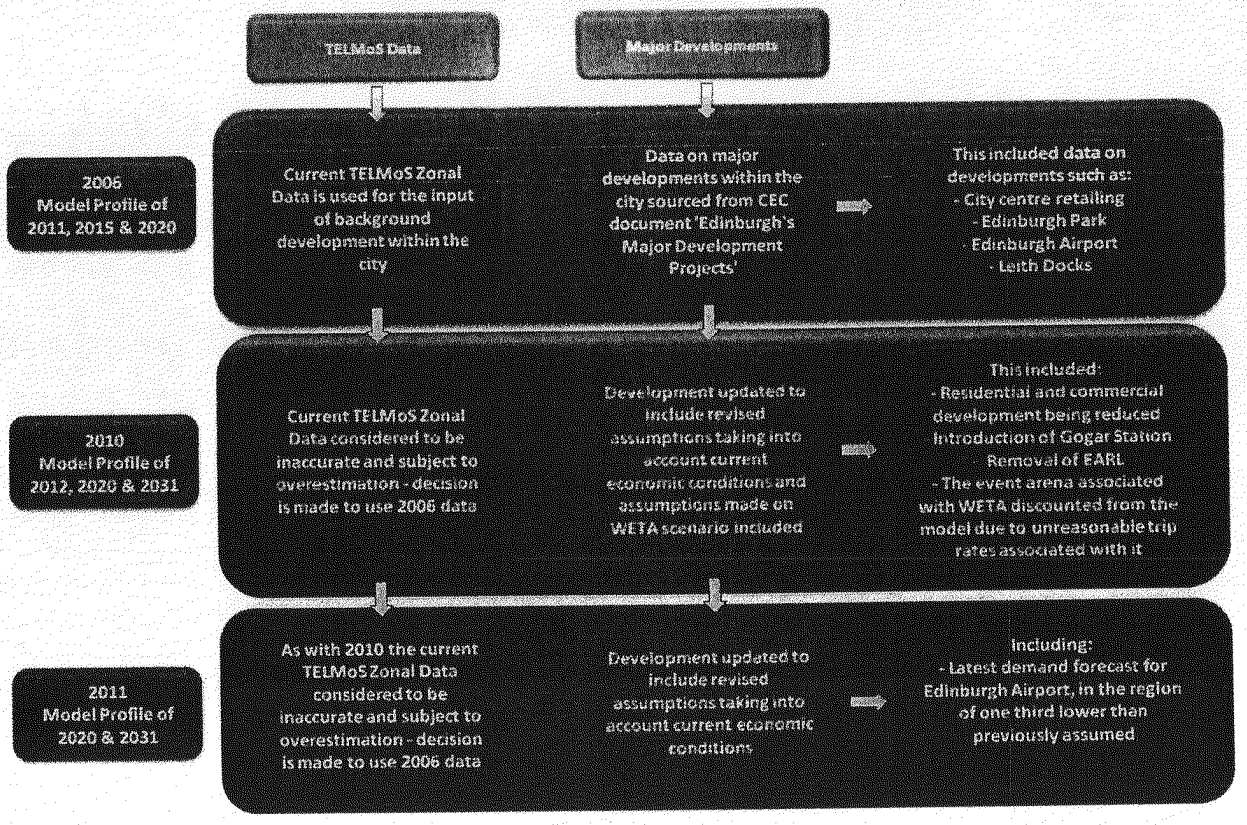
5.18 The original development assumptions which were utilised within the 2006 model were updated in 2010 to inform the Business Case refresh and again in 2011 when the model was used to obtain new BCRs.

5.19 The changes in development assumptions which have been incorporated into the business case and the period they were incorporated can be seen in Figure 5.1.

5.20 It can be seen from Figure 5.1 that a number of development assumptions have been updated from the original assumptions made in 2006 and the development assumptions being utilised within the 2011 analysis are different in many ways.

[8] All data from JRC document 'Future Year Planning Data July 2010 60% WETA.xls'
[9] The figures within this column are the total for each type of development if the developments considered to be 'major' by CEC are not used to overwrite TELMos data for the appropriate zones.
[10] Gross Floor Area is measures as metres squared

Figure 5.1 – Changes in Development Assumption



5.21 The development assumptions have been updated as it was necessary to take account of known changes in development figures and the current economic conditions and the effect on development induced. An example of this is the patronage forecast for Edinburgh Airport in 2031; patronage was originally estimated at 26 million[11] for the analysis undertaken in 2006 and has been reduced to approximately 17 million[12] for the current analysis.

5.22 The development assumptions have been updated in line with the current assumptions of CEC, proposed Masterplans for the area and current build-out assumptions. It has been assumed by the JRC, in consultation with CEC, that although the growth in development has been lowered due to recent economic conditions it is the rate of growth that is the main aspect which will change rather than actual development numbers / size.

5.23 Figure 5.2 and 5.3 show the change in residential and commercial development which has been assumed to occur from the original assumptions made for the 2007 business case and the amended assumptions in 2010 taking into account the current economic climate. The development is shown in relation to the west, north, and city centre areas.

[11] Source: Aviation White Paper published by the UK Government in 2003
[12] Figure interpolated from data supplied by BA for patronage in 2011, 2020, and 2041.

Figure 5.2 – Changes in Residential Development Assumption

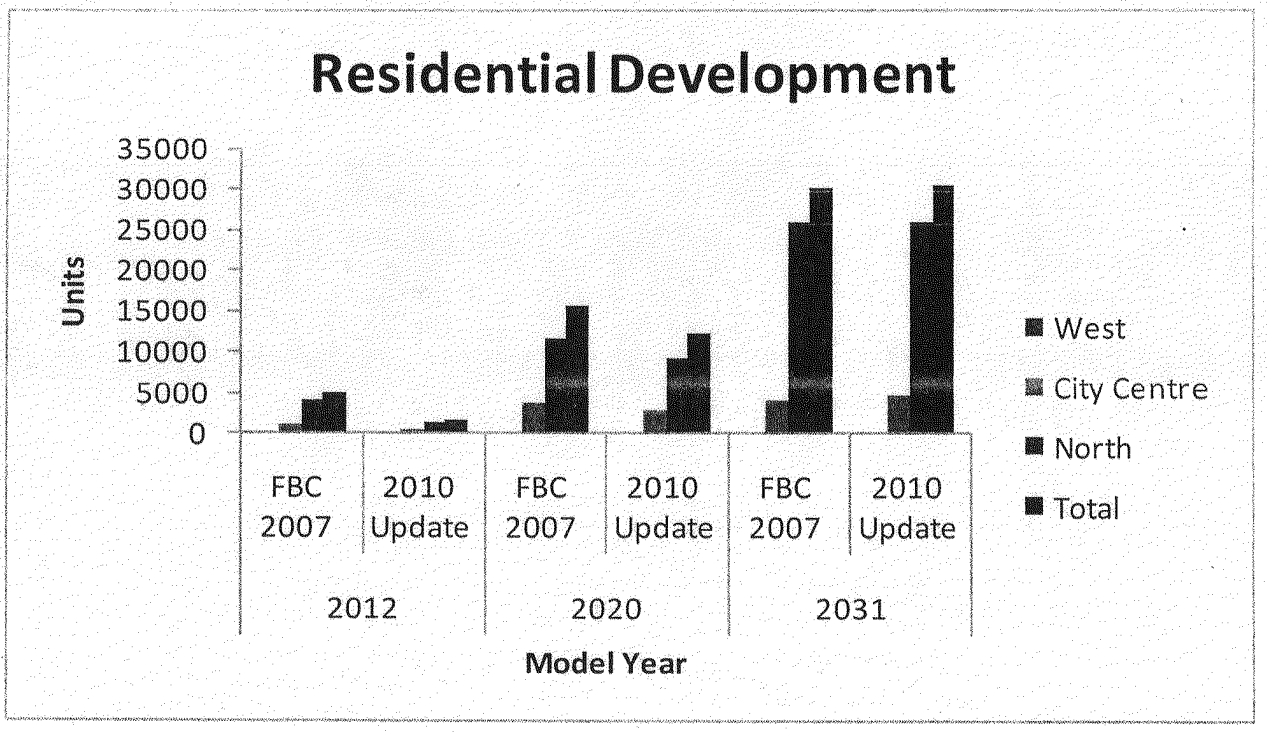
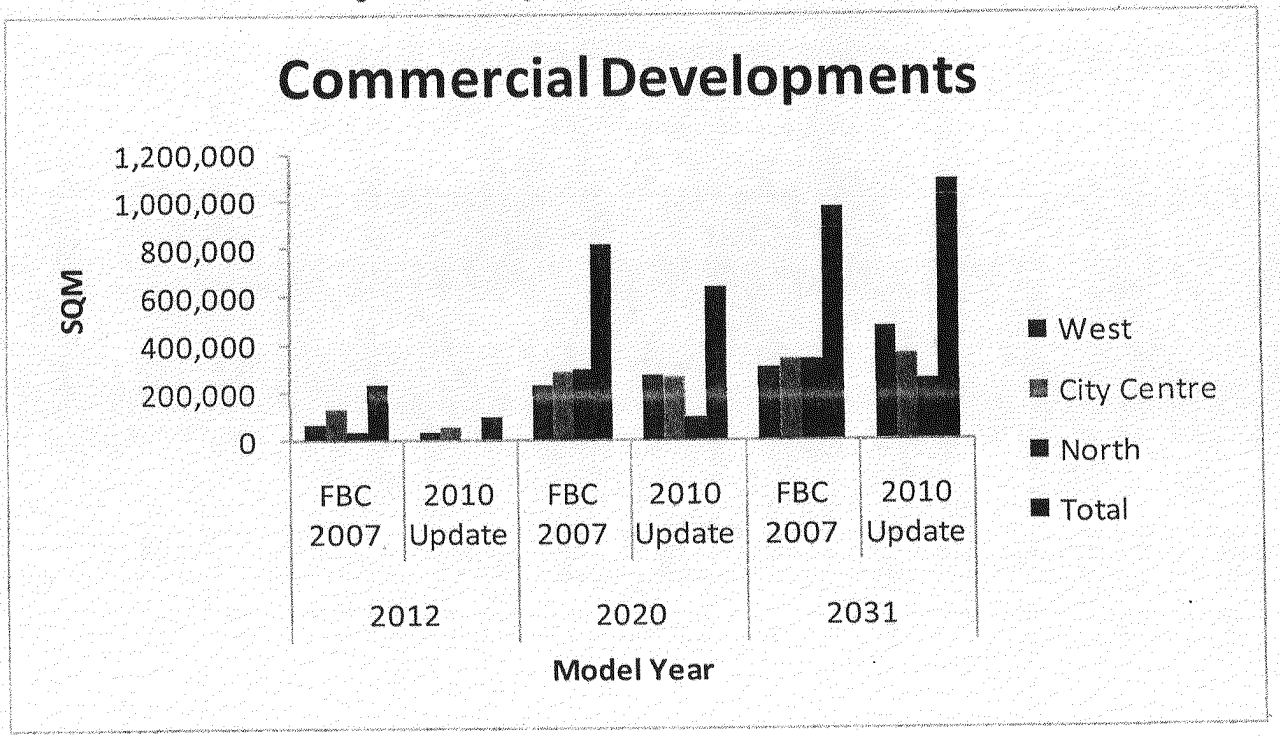


Figure 5.3 - Changes in Commercial Development Assumption



5.24 It can be seen from the graphs that the total development estimated to be complete by 2020 is lower for both commercial and residential developments in the 2010 Business Case update and that by 2031 it can be seen that the residential development has 'caught up' with the previous assumptions made in 2007 and that commercial development completions have increased slightly within the 2010 assumptions.

5.25 It should be noted that although it has been assumed, in general, that all forecast development will occur by the modelled year of 2031 with regards to the west of Edinburgh the decision made by the JRC was to utilise the 60% WETA estimates. This set of development inputs estimates that 60% of WETA development will be complete by 2031 rather than 100%. This was considered by the JRC and the CEC to be a conservative estimate of growth in the west of Edinburgh and most suitable for the model.

5.26 The assumption that development and build rates will increase as the economy recovers are fundamental to the achievement of the assumed development. Give the importance of the major developments (particularly in the north and west of Edinburgh) in driving future demand for the tram we have recommended that a sensitivity test is undertaken to replicate a 'worst case' development scenario.

5.27 Although it is accepted that this pessimistic scenario (where none of the major development is delivered) is unlikely to occur we do believe that this provides a tangible context for the assessment of this risk.

Ingliston Park and Ride

5.28 We have identified in Section Three of this report the importance of the Ingliston Park and Ride site in driving tram demand and we have focussed some of our attention at ensuring that the assumptions within the business case are robust.

5.29 The role of high quality Park and Ride, similar to the Ingliston Park and Ride site, in facilitating strong tram demand is apparent in schemes across the UK:

- The Sheffield Supertram showed the risk inherent in not providing high-quality Park and Ride facilities, which accounted for around 4% of the shortfall in Supertram patronage.

Subsequently, the Sheffield Supertram system has boosted patronage, helped in part by the opening of new Park and Ride sites directly on the Supertram routes: five sites offering a total of more than 1,500 spaces for tram-based park and ride, with trams every ten minutes;

- Nottingham Express Transit has over 3,000 spaces available for tram-based Park and Ride; and
- Tyne and Wear Metro achieves around 80% utilisation of its 2,200 Park and Ride spaces.

5.30 There are risks surrounding the forecasting of Park and Ride demand: it is a notoriously difficult to model accurately and can overestimate the abstraction from car where parking is left unconstrained at the city centre destination, or the total journey costs are inaccurately specified.

Forecast Park and Ride Demand

5.31 The Edinburgh Tram forecasts are based on a bespoke spreadsheet model out with the high-level VISUM model. The demand forecasts for the Ingliston Park and Ride are presented below:

Table 5.2 - Modelled Inglistion P&R Demand - Inbound to City Centre (Source JRC - June 2011)

	Opening Year AM Peak 0700 - 0900	2031 AM Peak 0700 - 0900	Opening Year Inter Peak 1000 - 1200	2031 Inter Peak 1000 - 1200
No Tram	432	790	27	62
With Tram	739	1166	63	69

5.32 The JRC modelled forecasts inbound demand in the year of opening to be in the order 460 passengers (432^{am} + $27^{inter\ peak}$). Using vehicle occupancy of 1.15 this gives the number of vehicles to be in the order of 400. Once the JRC applies the recession factor this gives an adjusted forecast of 350 cars parking and using a bus service to the city centre.

Current Bus Based Park and Ride Demand

5.33 The existing demand at Ingliston Park and Ride is in the order of 470 cars per day[13], this is equivalent to around 540 trips (again using occupancy of 1.15). The JRC have consulted with the Park and Ride operators and they estimate that 2/3 of current demand is destined for the city centre, which equates to around 350 cars parking and using Park and Ride bus services to access the city centre.

5.34 This suggests the forecasting model used is giving reasonable estimates of city centre Park and Ride demand.

Ingliston Park and Ride – Tram Forecasts 2011 & 2031

5.35 Table 5.4 also presents the JRC's forecast total demand from the Ingliston Park and Ride that will be generated by the introduction of the tram. The uplift in demand has been benchmarked against similar UK scheme and it is also recognised that the JRC have been prudent in assuming in the modelling that there will be no real increase in city centre parking charges, or a reduction in city centre parking capacity.

Traveller Responses to the Tram

5.36 Finally, the JRC has made a number of assumptions relating to various parameters that will influence a traveller's propensity to use the tram – these include factors such as the travellers' value of time, the relative attractiveness of the tram as a mode of travel, and the impact of having to interchange.

[13] JRC June 2011

Fares

5.37 In relation to fares, the main risk is that they are set too high relative to existing bus fares and for the level of service provided. Additionally, a lack of flexibility and/or integration with bus fares can reduce ridership. When Sheffield Supertram services commenced, premium fares greater than bus fares were charged, but there was an unwillingness to pay for a service that was not perceived as offering reliability. The original forecast of ridership had also assumed an integrated bus and Supertram fare structure that failed to materialise. Issues around fares explained around 3% of the shortfall in Supertram demand relative to forecasts.

5.38 The Edinburgh Tram system will benefit from being a fully-integrated system operated by TEL. A consistent approach to pricing means problems experienced in Sheffield are unlikely to be repeated. The potential for shortfall in Edinburgh depends on the quality of service provided, or if the responsiveness of passengers to fare increases is inaccurately forecast. Real fares growth of RPI+1% has been assumed for future year tram and bus forecasts. Average fares per kilometre are consistent with other tram systems: roughly £0.70/km, compared with £0.77/km in Sheffield and £0.75/km in Manchester.

5.39 The JRC assessed the elasticity of patronage to real fares growth as part of their risk and revenue forecasting work in 2008. The test assumed fares grow by RPI+1.5% and that the assumption would affect bus and tram users – the intention was to establish whether public transport users would switch to car as a result. The sensitivity test on fares showed that relatively few passengers switched to car (i.e. public transport users were unresponsive to small fare increases). The JRC acknowledges that this is due in part to the high mode share of bus in Edinburgh and the existing cost of motoring being high due to parking charges and fuel costs. The JRC also notes anecdotally that "Lothian Buses has experienced minimal patronage loss in response to modest fares rises historically".

Tram Performance

5.40 The performance of the tram system in terms of run times and frequencies is critical to its ability to achieve forecast patronage. Journey times and frequencies were key factors in explaining the poor performance of Sheffield Supertram, together accounting for 16% of the shortfall in demand[14]. Specifically, the model forecasts assumed 30% quicker journey times and 33% higher tram frequencies than were ultimately delivered – at the same time as competing bus operators increased substantially the frequency of buses on Supertram corridors. The poor run times relative to the forecasts were due to a number of factors: poor or no priority for trams at signals, over-cautious tram drivers, lengthy dwell times at stops, little run time monitoring, and the failure to take account of the steep gradients on parts of the Supertram network.

5.41 The Edinburgh Tram forecast run times are based on Parsons Brinkerhoff designs, supported by VISSIM microsimulation modelling. The models assume that delays to trams are minimised without a significant impact on other traffic, and that full priority is given to tram at junctions. Run times are held fairly constant into the future, reflecting this level of priority – a reasonable assumption based on experience elsewhere.

5.42 Table 5.5 compares forecast run times and frequencies on the Edinburgh Tram system with observed values on other UK tram systems.

[14] The Transport Economist Volume 26 Number 3, Autumn 1999

Table 5.3 – Comparison of Forecast Run Times with Actual Run Times on other UK Tram Systems

Journey time	Edinburgh Tram	Sheffield Supertram	Nottingham	Manchester Metrolink
Speed range, kph (shared track)	16.25 – 37.09	10.1 – 22.8	8.8 – 32.0	
Average speed, kph (shared track)		17.9	14.8	
Speed range, kph (segregated)		24.3 – 32.6	22.4 – 60.1	
Average speed, kph (segregated)		28.4	34.7	
Tram frequency	8/16tph	6-10tph	8tph	8-12tph

5.43 The proposed tram frequency of 8tph on the outer sections is in line with other systems – on the city centre (Haymarket to Ocean Terminal) section it is much higher than elsewhere, reflecting the desire to substantially improve the public transport service in this location, particularly along the congested Princes Street section. The high frequency is also required to ensure that the popular bus services removed from service are adequately replaced.

5.44 The run times also look reasonably consistent with other locations – although the Sheffield and Nottingham systems both have sections where speeds are substantially lower than the lowest Edinburgh tram, which in part reflects the relatively high proportion of the Edinburgh tram route (particularly for the St Andrew Square option) that runs off street.

Tram Modelling Parameters

5.45 THE JRC has derived key forecast behaviour parameters from stated preference surveys and these include:

- A value of time of 4.76 pence per minute;
- Weightings on walk and wait times of 1.91 and 2.55;
- In vehicle time weightings of 0.75 for rail, 0.77 for tram and 1.00 for bus; and
- Interchange penalty of 12 minutes.

5.46 We have benchmarked the assumptions used by the JRC and are content that they are appropriate for use in the development of the business case. The parameters used to assess the scope for transfer to tram from other modes are cautious compared to similar schemes elsewhere, and we note that there may be some scope for greater shift to tram than has been forecast.

5.47 However, in the interest of prudence we also recommended that a sensitivity test was undertaken to assess the impact of lowering the relative attractiveness of the tram as a mode of transport.

6. The Outputs – Do They Look Credible?

The Outputs From 2011 Analysis

6.1 The outputs which the 2011 analysis has supplied can be broken into the following main categories:

- Tram demand / revenue;
- Impacts on public transport users;
- Impacts on road users; and
- Value for money (TEE tables and BCR).

Tram Demand and Revenue

6.2 While we have not undertaken a detailed review of tie's 2010 Financial Model, we have sought to reassure ourselves that the demand and revenue figures emerging from the current JRC work can be reconciled with corresponding numbers informing the 2010 financial assessment. This is because the level and profile of demand is critical to the financial performance of the scheme. It is important to ensure that changes and enhancements to the model for the purpose of the current tests have not given rise to a significantly lower set of demand forecasts, potentially contradicting earlier conclusions from the Financial Model in relation to the financial viability of the scheme.

6.3 For the two options where a direct comparison can be made, Phase 1a and St Andrew Square, the new demand forecasts are broadly in line with (or – in later years – exceed) the demand levels in the Financial Model, and are therefore consistent with the demand inputs to the Business Case Review of 2010.

Impacts on Public Transport Users

6.4 In terms of overall public transport demand levels at 2011 we are also satisfied that these appear plausible relative to the observed figures that we understand to have been verified by Lothian Buses during a similar check undertaken at 2010.

6.5 In addition to the overall demand levels, we have also examined supporting material (contained within Appendix B, and discussed in Section Three of this report) relating to the scale, distribution and source of demand. We found these outputs broadly plausible, but noted:

- The unusually high proportion of those forecast to use tram whose previous mode was car (for the St. Andrew Square option of the order of 40%). This is only likely to be deliverable with the level of quality of service (both for those switching directly to tram, or those using P&R) envisaged within the model, in terms of comfort, journey time and reliability; and
- The prominence of 'counter-peak' movement with the St Andrew Square option, with a significant element of demand travelling outbound from the city centre in the morning peak to access areas such as Edinburgh Park.

Impacts on Road Users

6.6 We have reviewed the emerging TEE tables (as set on the next page) and a number of supporting outputs relating to the level and distribution of impacts upon both users and non-users of the scheme. We have found these broadly plausible, but as identified in Section Four when we discussed the model we would make the following observations:

- The distribution of non-user impacts (impacts upon car users) appears broadly in line with expectations. However, in our experience the overall level is difficult to quantify, and we would view this as particularly the case with the tools used for this assessment, given some of the weaknesses in the highway element of the model. For this reason we would express caution in comparing the relative merits of options where non-user benefits form a key

component. The JRC team has stated that no future junction optimisation has taken place to address specific points of congestion due to traffic re-assignment, and we accept that this may over-state disbenefits (particularly on the Phase 1a assessment).

- We believe the level and distribution of user benefits look broadly plausible. These benefits will however be driven directly by the level of demand for, and transfer to tram, and are therefore sensitive to issues such as future development and propensity to switch. This has been explored through sensitivity testing.

Value for Money

6.7 A benefit to cost ratio of less than one suggests that the economic return would be less that the investment, even when appraised over 60 years. The BCR of the options taking into account the full costs and benefits have been found in the current analysis to be less than 1. In other words completing the project will incur more expenditure with an overall return of less than one.

6.8 However, to abandon a scheme where such a large proportion of the costs have been sunk would represent a zero-return on a large investment. In this case when the analysis is being carried out after sunk costs have occurred it is conventional and reasonable (as set out in STAG and WebTAG appraisal guidance) to account for sunk costs in the scheme appraisal for a fair comparison between investment opportunities.

6.9 The analysis if JRC's updated business case also appraises the full benefits against only the costs of completion and operation then the BCRs for the three options are:

- The full Phase1a, Edinburgh Airport to Newhaven, **BCR = 1.30**
- Truncated Phase 1a, Edinburgh Airport to St Andrew Square, **BCR = 1.85**
- Truncated Phase 1a, Edinburgh Airport to Foot of the Walk, **BCR = 1.21**

6.10 We would however express caution in using the relative BCRs for the three options tested to inform decision-making on the relative merits of the alternative options, particularly in light of the significant differential performance in terms of non-user impacts , and the degree of confidence which can be attached to this element of the appraisal.

Table 6.1 - Updated TEE Outputs (Source – JRC, June 2011)

£m Present Value, 2002 prices	Revised Phase 1a		St Andrew Square		Foot of the Walk	
	Full Costs	Minus Sunk Costs	Full Costs	Minus Sunk Costs	Full Costs	Minus Sunk Costs
Public transport user benefits	541	541	340	340	493	493
Other road user benefits	-196	-196	74	74	-156	-156
Private sector provider effects	81	81	68	68	60	60
PV of Scheme Benefits	**427**	**427**	**482**	**482**	**397**	**397**
PV of Scheme Costs	**663**	**327**	**597**	**261**	**707**	**329**
Net PV	-237	100	-115	221	-310	68
Benefit Cost Ratio to Government	**0.64**	**1.30**	**0.81**	**1.85**	**0.56**	**1.21**

7. Risk and Uncertainty

Risks & Uncertainty

7.1 The audit has established that there are a number of specific areas in the business case where there is a degree of risk and uncertainty, as with any modelling work.

Sensitivity Testing

7.2 Below we summarise our areas of concern, and the outputs from the sensitivity testing that was undertaken to help quantify the impact of these risks on the business case.

New Committed Development

7.3 The analysis suggests that much of the future demand / benefit relates to new committed development, this is an area of inevitable uncertainty which could have a possible impact on revenue and the economic case for the tram scheme.

7.4 A 'worst case' zero growth sensitivity has demonstrated that the tram demand would reduce by around one-third in 2031.

Competition

7.5 There is a risk that a bus operator could establish a service to run in competition with the tram between the city centre and the airport, and a sensitivity test has been undertaken to replicate this by using the Service 100 as a proxy for competition.

7.6 The outputs from the sensitivity testing suggest that tram revenue would decrease by around 6%.

Levels of Service

7.7 Much will depend on the relative 'levels of service' the tram provides the travelling public. A sensitivity test has been undertaken to replicate a less favourable differential for the tram when compared with the bus.

7.8 The sensitivity shows that the tram demand and revenue could reduce by around 12%.

Impacts on Benefit Costs Ratio for St Andrew Square Option

7.9 The relative impacts of these sensitivity tests on the BCR are presented in Table 7.1 for St Andrew Square. It can be seen that even allowing for these downbeat assumptions, once sunk costs are taken account of, there remains an economic case for the St Andrew Square option, on the basis that each of these pessimistic tests still delivers a BCR of greater than 1.

Table 7.1 – Impact of Sensitivity Tests on BCR for St Andrew Square Option
(Source – JRC, June 2011)

£m Present Value, 2002 prices	St Andrew Square			
	Minus Sunk Costs	Mode Constant Increased	Competition	Zero Growth
Public transport user benefits	340	289	362	227
Other road user benefits	74	47	74	49
Private sector provider effects	68	64	76	45
PV of Scheme Benefits	**482**	**400**	**511**	**321**
PV of Scheme Costs	**261**	**281**	**358**	**290**
Net PV	221	119	154	32
Benefit Cost Ratio to Government	**1.85**	**1.42**	**1.43**	**1.11**

8. Conclusions

Business Case Audit

8.1 This audit has provided a review of historic and current business case work undertaken by the JRC for the Edinburgh Tram.

8.2 It has asked and answered three questions:

- The tools used – are they fit for purpose?
- The assumptions used – are they reasonable?
- The outputs – do they look credible?

The Tools Used – Are They Fit for Purpose?

8.3 Our overall assessment of the HLM is that it is an appropriate tool for the purposes of informing the TEE / BCR assessment. We have however identified some areas of relative weakness (not unusual in a model of this size and complexity), which we have used to interpret output and influence the focus of sensitivity testing requested.

8.4 We have reviewed the STAG outputs and have found the scheme appraisal methodology to be in line with standard good practice, and with the requirements of STAG.

8.5 Atkins recognises that since the STAG appraisal was undertaken that there has been a number of changes in the context within which the appraisal was undertake; most notably within the policy context, and in particular the prominence of carbon abatement policies that have emerged as a result of the Climate Change (Scotland) Act 2009. There has also been a change in the options being tested.

8.6 We believe that the STAG indicators that have not been updated as part of the recent work may be expected to be the same as before, or indeed, in some cases, stronger. It is therefore recommended that consideration is given to refreshing the wider appraisal to ensure that the full benefits of the tram scheme are captured within a contemporary context.

The Assumptions Used – Are They Reasonable?

8.7 We have benchmarked the assumptions used by the JRC and are content that they are appropriate for use in the development of the business case. The parameters used to assess the scope for transfer to tram from other modes are cautious compared to similar schemes elsewhere, and we note that there may be some scope for greater shift to tram than has been forecast.

The Outputs – Do They Look Credible?

8.8 We have reviewed the emerging TEE tables and a number of supporting outputs relating to the level and distribution of impacts upon both users and non-users of the scheme. We have found these broadly plausible, but would make the following observations:

- The distribution of non-user impacts (impacts upon car users) appears broadly in line with expectations. However, in our experience the overall level is difficult to quantify, and we would view this as particularly the case with the tools used for this assessment, given some of the weaknesses in the highway element of the model. For this reason we would express caution in comparing the relative merits of options where non-user benefits form a key component. The JRC team has stated that no future junction optimisation has taken place to address specific points of congestion due to traffic re-assignment, and we accept that this may over-state disbenefits (particularly on the Phase 1a assessment).
- We believe the level and distribution of user benefits look broadly plausible. These benefits will however be driven directly by the level of demand for, and transfer to tram, and are therefore sensitive to issues such as future development and propensity to switch. This has been explored through sensitivity testing.

Appendix A - Data and Report Inputs

Table A.1 - Data and Report Inputs

Year	Title	Author	Type	Date Received
Business Case Documents				
Oct 2006	JRC Edinburgh Tram – Overall Case Presentation	JRC	Doc	19.04.11
Dec 2007	Edinburgh Tram Network – Final Business Case Version 2	tie	Doc	07.04.11
2010	Edinburgh Tram – Business Case Update 2010	Edinburgh Tram	Doc	07.04.11
2007	Final Business Case Appendix IV Communications and Stakeholder Strategy	tie	Doc	28.04.11
Audit Scotland Documents				
June 2007	Audit Scotland Edinburgh Transport Projects Review	Audit Scotland	Doc	14.04.11
Feb 2011	Audit Scotland Edinburgh Trams Interim Report	Audit Scotland	Doc	14.04.11
CEC Documents				
Jan 2003	CEC Council Committee Report – Edinburgh Tram Network	CEC	Doc	28.04.11
Feb 2010	Edinburgh Tram – Council Decisions 2003 until 2010	Edinburgh Tram	Doc	28.04.11
2010	CEC Transport 2030 Vision	CEC	Doc	28.04.11
Apr 2011	West Edinburgh Draft Business Plan	CEC	Doc	04.05.11
2011	CEC Council Committee Edinburgh Tram Update 16.05.11	CEC	Doc	23.05.11
2011	CEC Council Committee Edinburgh Tram Update Committee Minutes 16.05.11	CEC	Doc	23.05.11
Development Documents				
2006	Edinburgh Major Development Projects 2006 – City Centre	CEC	Doc	05.05.11
2006	Edinburgh Major Development Projects 2006 – West Edinburgh	CEC	Doc	05.05.11
2006	Edinburgh Major Development Projects 2006 – South East Edinburgh	CEC	Doc	05.05.11
2006	Edinburgh Major Development Projects 2006 – North Edinburgh	CEC	Doc	05.05.11
2006	Edinburgh Major Development Projects	CEC	Doc	05.05.11

	2006 – Intro (summary)			
Feb 2010	Edinburgh Housing Market Monitoring Report	CEC	Doc	28.04.11
Apr 2011	Edinburgh International Action Plan	CEC	Xls	04.05.11
Apr 2011	Edinburgh International Implementation Plan	CEC	Doc	04.05.11
2006	Development Assessment for Tram Transport Model	JRC	Xls	06.05.11
2011	Development Monitor Tables Housing	CEC	Xls	06.05.11
Mar 2009	Scottish Enterprise East Region Economic Review	Scottish Enterprise	Doc	28.04.11
Mar 2011	Economic Performance Indicators (march 2011 Update)	Scot Govt	Doc	28.04.11
2010	Retail Development Schedule	CEC	PDF	06.05.11
2010	Student Housing Development	CEC	PDF	06.05.11
2010	Hotel Development Schedule	CEC	PDF	06.05.11
2010	Leisure Development Schedule	CEC	PDF	06.05.11
2010	Office Schedule	CEC	PDF	06.05.11
2010	Industry 2010 Completions and Planned Tables	CEC	PDF	06.05.11
2010	Industrial schedule 2010	CEC	Doc	06.05.11
STAG Documents				
Nov 2003	STAG2 Appraisal Line 1 - 2003	tie	Doc	28.04.11
Nov 2003	STAG2 Appraisal Line 1 - Appendices	tie	Doc	28.04.11
Dec 2007	Edinburgh Tram Network STAG2 Appraisal Report	JRC	Doc	28.04.11
Dec 2007	Edinburgh Tram Network STAG2 Appraisal Appendix	JRC	Doc	28.04.11
Miscellaneous Documents				
Dec 2008	Infraco Contract Summary	Edinburgh Tram	Doc	28.04.11
Dec 2005	Edinburgh Tram Noise and Vibration Policy	Edinburgh Tram	Doc	28.04.11
2006	TEL Planning of the Future – Strategic Business Plan	TEL	Doc	28.04.11

JRC Data				
Due Diligence				
Dec 2006	Model Construction and Application – Due Diligence Report	Scott Wilson	Doc	14.04.11
Dec 2006	Model Construction and Application – Due Diligence Summary Report	Scott Wilson	Doc	14.04.11
Mar 2008	Model Construction and Application – Due Diligence Update	Scott Wilson	Doc	14.04.11
~	Appendix A Highway Model Screenline Performance	~	Tab	14.04.11
~	Comparison Between Different Models	~	Tab	14.04.11
~	Appendix B – Low Level Models	~	Tab	14.04.11
June 2008	Modelling Technical Note	Halcrow	Doc	14.04.11
Planning Data				
2006	Future Year Trip Attraction	CEC / JRC	Xls	14.04.11
2010	Future Year Planning Data July 2010 60% WETA	CEC / JRC	Xls	14.04.11
2010	Future Year Planning Data July 2010 full WETA	CEC / JRC	Xls	14.04.11
2010	Future Year Planning Data July 2010 no WETA	CEC / JRC	Xls	14.04.11
Risk Revenue Reports				
2006	JRC Patronage & Revenue Risk Register	SDG	Tab	14.04.11
Dec 2006	Revenue & Risk Report 2006	JRC	Doc	14.04.11
Dec 2008	Revenue & Risk Report 2008	JRC	Doc	14.04.11
Validation Reports				
Nov 2006	VISUM model calibration and validation report 2006	JRC	Doc	14.04.11
Nov 2006	VISUM model calibration and validation report – Appendices 2006	JRC	Doc	14.04.11
Nov 2006	VISSIM model calibration and validation report 2008	JRC	Doc	14.04.11
Mar 2007	Scott Wilson Edinburgh Tram TSS – Response to JRC Comments on Due Diligence	Scott Wilson	Doc	14.04.11
Mar 2007	TSS Comment and	Scott	Doc	14.04.11

	Responses Table	Wilson		
Apr 2008	Vissim model calibration and validation report	JRC	Doc	14.04.11
Apr 2008	Visum model calibration and validation report	JRC	Doc	14.04.11
Apr 2008	Visum model calibration and validation report - Appendices	JRC	Doc	14.04.11
Other Reports				
Mar 2006	Edinburgh Tram Stated Preference Report	SDG	Doc	14.04.11
Oct 2008	Progression of forecasts from previous Revenue & Risk Report	SDG	Doc	14.04.11
Sep 2010	Updated Tram Patronage & Revenue Forecasting	JRC	Doc	14.04.11
Financial Model				
2010	TEL Business Plan 2010 St Andrew Square	JRC	Xls	
2010	TEL Business Plan 2010 Phase A1	JRC	Xls	
2010	Guide to Financial Model	TEL	PPT	
2004	Preliminary Financial Case – Line 1 2004	tie	Doc	28.04.11
2004	Preliminary Financial Case – Line 2 2004	tie	Doc	28.04.11
2010	TEL Business Plan Update 2010 - Presentation	TEL	PPT	14.04.11
2010	TEL Business Plan Update 2010 – Presentation Figures / Graphs	TEL	PPT	14.04.11
JRC 2011 Analysis				
2011	JRC Proposal for Updated Business case	JRC	Doc	14.04.11
2011	Programme for Edinburgh Tram Updated Business Case	JRC	Doc	19.04.11
2011	Key Modelling Appraisal Assumptions – High Level 2011	JRC	Doc	26.04.11
2011	Trip Ends (Zip File)	JRC	Zip	09.05.11
2011	Business Case Schedule & Key Assumptions	JRC	Doc	13.05.11
2011	P&R Summary	JRC	Xls	20.05.11
2011	JRC – Response to Atkins Memo of 11 May	JRC	Doc	23.05.11
2011	2011 AM DS Park & Ride	JRC	Xls	31.05.11

2011	Edinburgh Tram Business Case Update Draft Results Presentation	JRC	Doc	03.06.11
2011	Edinburgh Tram Business Case Update Draft Results Presentation	JRC	PPT	07.06.11
2011	JRC Forecast and Economic Output Phase 1a	JRC	Doc	06.06.11
2011	JRC Forecast and Economic Output St Andrew Square	JRC	Doc	06.06.11
2011	VISUM Tram Journey Times	JRC	Xls	06.06.11
2011	JRC Response to clarification questions - 7th June	JRC	Doc	08.06.11
2011	NUB Delay Plots	JRC	Doc	08.06.11
2011	Edinburgh Tram Business Case Update Draft results (Maps)	JRC	PPT	08.06.11
2011	Additional Information and Clarifications Presentation	JRC	PPT	08.06.11
2011	Edinburgh Tram Draft Appraisal Results as of Wednesday 15th June	JRC	PPT	15.06.11
2011	Edinburgh Tram Demand Growth Sensitivity	JRC	Xls	15.06.11
2011	Edinburgh Tram Financial Performance St Andrew Square	JRC	Xls	16.06.11
2011	Edinburgh Tram Draft Appraisal Results as of Wednesday 20th June	JRC	PPT	20.06.11
2011	Copy of bus cost comparisons	JRC	Xls	21.06.11
2011	Bus Savings Calculations	JRC	Xls	21.06.11
2011	Edinburgh Tram Draft Appraisal Results as of Wednesday 15th June	JRC	PPT	21.06.11
2011	Edinburgh Tram Summary Outputs for Atkins	JRC	PPT	21.06.11
2011	Edinburgh Tram Summary Outputs for Atkins	JRC	Xls	21.06.11
2011	Edinburgh Tram Financial Analysis St Andrew Square	JRC	Xls	22.06.11
2011	Edinburgh Tram Draft Appraisal Results as of Wednesday 28th June	JRC	PP	28.06.11
2011	Edinburgh Tram JRC Standard Outputs	JRC	Xls	28.06.11

Appendix B – JRC Standard Outputs

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Edinburgh Tram Joint Revenue Committee

Standard Output TEMPLATE

FILENAME:	Standard_Outputs_S80d_150611.xls	**User:**	ftorres
Test ID:	S80d		
Test Name:	Full Scheme (1a) Option		
Comment:	All revenues in 2005 prices		
	Full scheme (1a) option - With Gogar; With Egip		
Date/Time:	15 June 2011		

Parameters/Assumptions:

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Recesion and street works factors	88.7%	87.3%	88.7%	90.0%	91.4%	92.8%	94.2%	95.7%	97.1%	98.6%	100.0%
Ramp-up profile (2011 start date)	75.0%	85.0%	92.0%	97.0%	99.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Ramp-up profile (2014 start date)	0.0%	0.0%	0.0%	75.0%	85.0%	92.0%	97.0%	99.0%	100.0%	100.0%	100.0%

steer davies gleave

Edinburgh Tram Joint Revenue Committee
Forecasts and Economic Outputs

[redacted]

Test description:
Test ID: S80d
Test Name: Full Scheme (1a) Option
Date/Time: 15/06/2011
Ramp-Up: Included (2011 start)
Recession Impacts: Excluded

TRAM PATRONAGE AND REVENUE MODE SHIFT

2011 Forecast Patronage (Hierarchical) by Geographical Segment (1,000 pax per year)

Segment Number	Segment Description	Tram	Δ Bus	Δ Rail	Δ Car & Redistributed
SEG01	Airport to Catchment	328	-263	0	-65
SEG02	Catchment to Airport	281	-175	0	-107
SEG03	Ingliston to Catchment	449	-128	0	-321
SEG04	Catchment to Ingliston	17	-6	0	-11
SEG05	Granton Corridor to Catchment	183	-161	-2	-20
SEG06	Catchment to Granton Corridor	108	-92	-1	-16
SEG07	Leith Corridor to Catchment	3,518	-3,258	-18	-242
SEG08	Catchment to Leith Corridor	2,187	-2,074	-7	-106
SEG09	Gyle to Catchment	884	-699	-50	-136
SEG10	Catchment to Gyle	1,340	-1,030	-57	-254
SEG11	Murrayfield to Catchment	1,040	-895	0	-146
SEG12	Catchment to Murrayfield	503	-441	-4	-58
SEG13	City Centre to Catchment	1,744	-1,525	-55	-163
SEG14	Catchment to City Centre	3,709	-3,111	-57	-541
SEG15		0	0	0	0
SEG16		0	0	0	0
SEG17		0	0	0	0
SEG18	External to Catchment	1,914	-1,128	271	-1,057
SEG19	Catchment to External	1,614	-1,024	114	-704
SEG20	External to External	127	-412	166	118
SEG21	All journeys	11,802	-9,492	426	-2,736

2011 Forecast Revenue by Geographical Segment (£1,000 per year [2005 prices])

Segment Number	Segment Description	Tram	Δ Bus	Δ Rail
SEG01	Airport to Catchment	241	-199	0
SEG02	Catchment to Airport	206	-132	0
SEG03	Ingliston to Catchment	329	-97	0
SEG04	Catchment to Ingliston	12	-5	0
SEG05	Granton Corridor to Catchment	135	-122	-2
SEG06	Catchment to Granton Corridor	80	-70	0
SEG07	Leith Corridor to Catchment	2,584	-2,467	-26
SEG08	Catchment to Leith Corridor	1,607	-1,571	-10
SEG09	Gyle to Catchment	649	-529	-56
SEG10	Catchment to Gyle	984	-780	-69
SEG11	Murrayfield to Catchment	764	-677	0
SEG12	Catchment to Murrayfield	369	-334	-5
SEG13	City Centre to Catchment	1,281	-1,155	-80
SEG14	Catchment to City Centre	2,724	-2,355	-61
SEG15		0	0	0
SEG16		0	0	0
SEG17		0	0	0
SEG18	External to Catchment	1,406	-854	885
SEG19	Catchment to External	1,186	-775	357
SEG20	External to External	94	-312	-132
SEG21	All journeys	8,668	-7,187	965

2031 Forecast Patronage (Hierarchical) by Geographical Segment (1,000 pax per year)

Segment Number	Segment Description	Tram	Δ Bus	Δ Rail	Δ Car & Redistributed
SEG01	Airport to Catchment	602	-422	0	-180
SEG02	Catchment to Airport	590	-318	0	-272
SEG03	Ingliston to Catchment	1,241	-340	0	-901
SEG04	Catchment to Ingliston	300	48	0	-348
SEG05	Granton Corridor to Catchment	533	-360	-4	-169
SEG06	Catchment to Granton Corridor	321	-274	-3	-44
SEG07	Leith Corridor to Catchment	8,898	-8,186	-68	-645
SEG08	Catchment to Leith Corridor	4,724	-4,488	-21	-215
SEG09	Gyle to Catchment	2,083	-1,738	-135	-209
SEG10	Catchment to Gyle	3,373	-2,568	-186	-619
SEG11	Murrayfield to Catchment	1,682	-1,512	-3	-167
SEG12	Catchment to Murrayfield	923	-849	-8	-66
SEG13	City Centre to Catchment	3,575	-3,116	-157	-302
SEG14	Catchment to City Centre	8,384	-7,226	-149	-1,009
SEG15		0	0	0	0
SEG16		0	0	0	0
SEG17		0	0	0	0
SEG18	External to Catchment	4,991	-2,965	816	-2,842
SEG19	Catchment to External	3,618	-2,730	219	-1,106
SEG20	External to External	222	-822	132	467
SEG21	All journeys	27,446	-22,192	800	-6,054

2031 Forecast Revenue by Geographical Segment (£1,000 per year [2005 prices])

Segment Number	Segment Description	Tram	Δ Bus	Δ Rail
SEG01	Airport to Catchment	540	-390	0
SEG02	Catchment to Airport	526	-294	0
SEG03	Ingliston to Catchment	1,112	-314	0
SEG04	Catchment to Ingliston	269	44	-10
SEG05	Granton Corridor to Catchment	478	-333	-6
SEG06	Catchment to Granton Corridor	286	-253	-140
SEG07	Leith Corridor to Catchment	7,974	-7,563	-40
SEG08	Catchment to Leith Corridor	4,233	-4,147	-254
SEG09	Gyle to Catchment	1,866	-1,606	-375
SEG10	Catchment to Gyle	3,023	-2,372	-5
SEG11	Murrayfield to Catchment	1,508	-1,397	-16
SEG12	Catchment to Murrayfield	827	-784	-305
SEG13	City Centre to Catchment	3,204	-2,879	-278
SEG14	Catchment to City Centre	7,513	-6,676	0
SEG15		0	0	0
SEG16		0	0	0
SEG17		0	0	4,222
SEG18	External to Catchment	4,473	-2,739	1,637
SEG19	Catchment to External	3,242	-2,523	-1,144
SEG20	External to External	199	-759	4,000
SEG21	All journeys	24,595	-20,502	

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Edinburgh Tram Joint Revenue Committee
Forecasts and Economic Outputs

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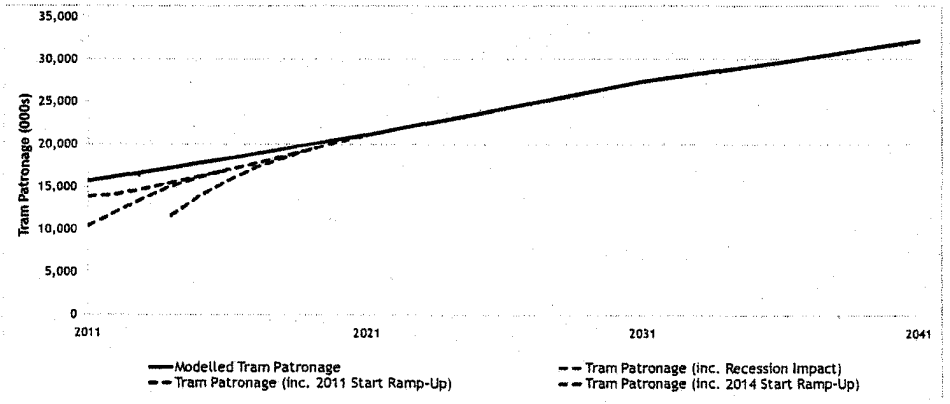
Test description:
Test ID: S80d
Test Name: Full Scheme (1a) Option
Date/Time: 15/06/2011
Ramp-Up: Included
Recession Impacts: Included

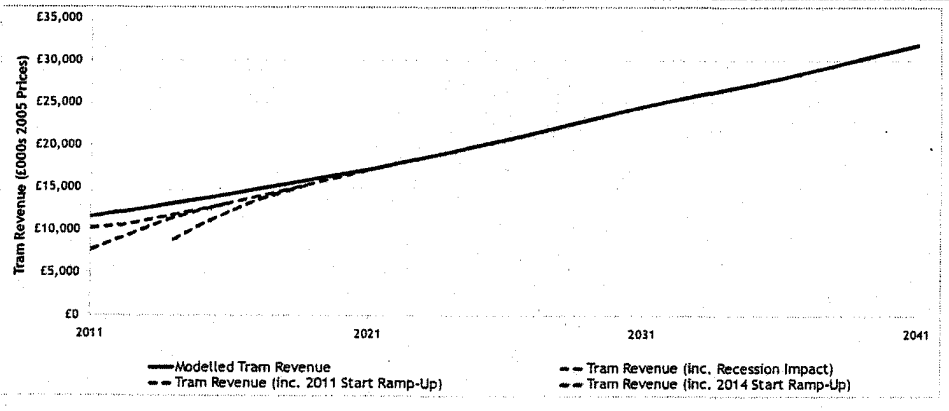
Tram Patronage (000s Boardings)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Modelled Tram Patronage	15,736	16,270	16,803	17,337	17,870	18,404	18,956	19,508	20,061	20,613	21,165	21,793	22,422	23,050	23,678	24,306
Tram Patronage (inc. Recession Impact)	13,958	14,208	14,887	15,603	16,327	17,070	17,857	18,660	19,479	20,314	21,165	21,793	22,422	23,050	23,678	24,306
Tram Patronage (inc. 2011 Start Ramp-Up)	10,468	12,078	13,706	15,135	16,164	17,070	17,857	18,660	19,479	20,314	21,165	21,793	22,422	23,050	23,678	24,306
Tram Patronage (inc. 2014 Start Ramp-Up)	0	0	0	11,709	13,878	15,704	17,321	18,473	19,479	20,314	21,165	21,793	22,422	23,050	23,678	24,306

Tram Patronage (000s Boardings)	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Modelled Tram Patronage	24,934	25,562	26,190	26,818	27,446	27,904	28,362	28,819	29,277	29,735	30,233	30,731	31,230	31,728	32,227
Tram Patronage (inc. Recession Impact)	24,934	25,562	26,190	26,818	27,446	27,904	28,362	28,819	29,277	29,735	30,233	30,731	31,230	31,728	32,227
Tram Patronage (inc. 2011 Start Ramp-Up)	24,934	25,562	26,190	26,818	27,446	27,904	28,362	28,819	29,277	29,735	30,233	30,731	31,230	31,728	32,227
Tram Patronage (inc. 2014 Start Ramp-Up)	24,934	25,562	26,190	26,818	27,446	27,904	28,362	28,819	29,277	29,735	30,233	30,731	31,230	31,728	32,227



Tram Revenue (£000s 2005 Prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Modelled Tram Revenue	11,557	12,068	12,589	13,118	13,657	14,205	14,798	15,391	15,985	16,578	17,171	17,881	18,592	19,303	20,013	20,724
Tram Revenue (inc. Recession Impact)	10,251	10,540	11,161	11,807	12,478	13,176	13,940	14,722	15,521	16,337	17,171	17,881	18,592	19,303	20,013	20,724
Tram Revenue (inc. 2011 Start Ramp-Up)	7,688	8,959	10,268	11,452	12,353	13,176	13,940	14,722	15,521	16,337	17,171	17,881	18,592	19,303	20,013	20,724
Tram Revenue (inc. 2014 Start Ramp-Up)	0	0	0	8,855	10,606	12,122	13,522	14,575	15,521	16,337	17,171	17,881	18,592	19,303	20,013	20,724

Tram Revenue (£000s 2005 Prices)	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Modelled Tram Revenue	21,498	22,273	23,047	23,821	24,595	25,277	25,959	26,641	27,323	28,005	28,785	29,564	30,343	31,122	31,901
Tram Revenue (inc. Recession Impact)	21,498	22,273	23,047	23,821	24,595	25,277	25,959	26,641	27,323	28,005	28,785	29,564	30,343	31,122	31,901
Tram Revenue (inc. 2011 Start Ramp-Up)	21,498	22,273	23,047	23,821	24,595	25,277	25,959	26,641	27,323	28,005	28,785	29,564	30,343	31,122	31,901
Tram Revenue (inc. 2014 Start Ramp-Up)	21,498	22,273	23,047	23,821	24,595	25,277	25,959	26,641	27,323	28,005	28,785	29,564	30,343	31,122	31,901



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Forecasts and Economic Outputs

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Test description:
Test ID: 580d
Test Name: Full Scheme (1a) Option
Print Date: 24/06/2011
Run Date: 15/06/2011
Ramp-Up: Excluded
Recession: Excluded

FLOWS AND CAPACITY

CHART 1

AM (Eastbound) | 2011 | Modelled Period

STOP	AIR	IPR	RBS	GOG	GYL	EDP	EPS	SQA	SRN	BAR	MUR	HAY	SHP	PSW	SAS	PIP	MDR	BAS	FOW	COS	OCD	OCT	NER
Capacity 8tph/16tph	3,240	3,240	3,240	3,240	3,240	4,860	4,860	4,860	4,860	4,860	4,860	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480
Boarders	264	804	18	242	246	18	25	190	728	164	98	362	242	130	150	393	291	283	44	26	10	0	0
Load	264	1,067	1,084	1,151	1,396	1,292	1,279	1,425	2,083	2,181	1,941	2,068	1,411	1,342	1,080	1,336	1,364	1,702	1,429	1,194	368	50	0
Alighters	0	1	5	174	1	122	38	44	80	87	336	226	897	199	472	77	73	136	317	259	837	319	50
Capacity 6tph/9tph/12tph	3,240	3,240	3,240	3,240	3,240	4,860	4,860	4,860	4,860	4,860	4,860	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480

FACTORS USED

Capacity	100%
Boarders	100%
Load	100%
Alighters	100%

CHART 2

AM (Westbound) | 2011 | Modelled Period

STOP	AIR	IPR	RBS	GOG	GYL	EDP	EPS	SQA	SRN	BAR	MUR	HAY	SHP	PSW	SAS	PIP	MDR	BAS	FOW	COS	OCD	OCT	NER
Capacity 8tph/16tph	3,240	3,240	3,240	3,240	3,240	4,860	4,860	4,860	4,860	4,860	4,860	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480
Boarders	0	1	18	4	26	12	37	178	132	254	313	147	406	350	254	383	515	771	700	344	999	0	179
Load	0	462	477	635	637	1,071	1,908	2,111	2,364	2,404	2,291	2,115	2,112	3,052	2,831	3,246	3,271	2,876	2,161	1,474	1,139	150	179
Alighters	462	26	174	7	491	850	240	422	182	120	137	144	1,327	128	649	408	120	56	13	10	10	29	0
Capacity 6tph/9tph/12tph	3,240	3,240	3,240	3,240	3,240	4,860	4,860	4,860	4,860	4,860	4,860	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480

FACTORS USED

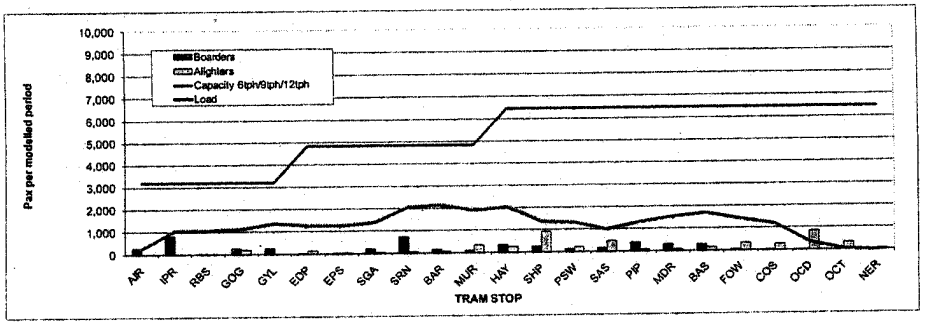
Capacity	100%
Boarders	100%
Load	100%
Alighters	100%

SUPER-PEAK FACTORS

	2011 CAP		2011 PAX		2031 CAP		2031 PAX	
AM	50%	0%	75%	0%	50%	0%	75%	
IP	0%	0%	0%	0%	0%	0%	0%	
PM	50%	0%	75%	0%	50%	0%	75%	

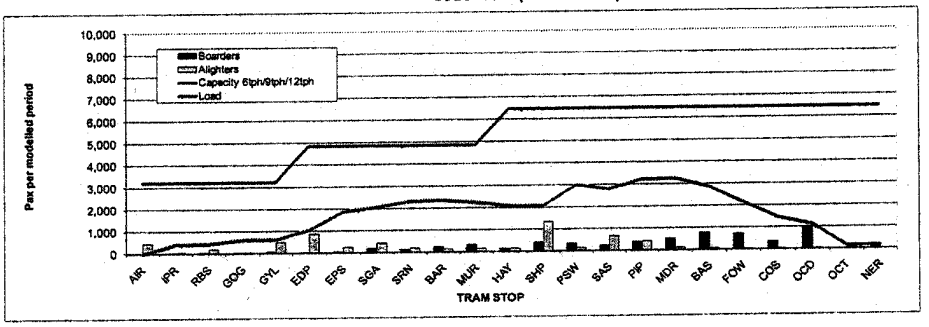
2011 AM (Eastbound)

CHART 1



2011 AM (Westbound)

CHART 2



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Edinburgh Tram Joint Revenue Committee
Forecasts and Economic Outputs

[redacted]

Test description:
Test ID: S80d
Test Name: Full Scheme (1a) Option
Print Date: 24/06/2011
Run Date: 15/06/2011
Ramp-Up: Excluded
Recession: Excluded

FLOWS AND CAPACITY

CHART 1

IP (Eastbound) | 2011 | Modelled Period

STOP	AIR	IPR	RBS	GOG	GYL	EDP	EPS	SGA	SRN	BAR	MUR	HAY	SHP	PSW	SAS	PIP	MDR	BAS	FOW	COS	OCD	OCT	NER
Capacity 8tph/16tph	3,240	3,240	3,240	3,240	3,240	4,860	4,860	4,860	4,860	4,860	4,860	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480
Boarders	301	27	41	91	254	123	145	132	200	60	39	230	250	120	174	241	43	61	67	0	23	38	0
Load	301	327	360	430	681	799	918	1,042	1,197	1,167	1,172	1,298	1,347	1,218	981	1,111	1,050	864	673	583	166	51	0
Alighters	0	1	8	21	5	6	27	7	46	90	35	104	267	249	411	111	104	217	286	51	439	183	51
Capacity 6tph/9tph/12tph	3,240	3,240	3,240	3,240	3,240	4,860	4,860	4,860	4,860	4,860	4,860	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480

FACTORS USED

Capacity	100%
Boarders	100%
Load	100%
Alighters	100%

CHART 2

IP (Westbound) | 2011 | Modelled Period

STOP	AIR	IPR	RBS	GOG	GYL	EDP	EPS	SGA	SRN	BAR	MUR	HAY	SHP	PSW	SAS	PIP	MDR	BAS	FOW	COS	OCD	OCT	NER
Capacity 8tph/16tph	3,240	3,240	3,240	3,240	3,240	3,240	4,860	4,860	4,860	4,860	4,860	4,860	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480
Boarders	0	1	7	41	15	58	58	19	38	53	29	60	172	180	129	92	168	209	383	77	6	530	50
Load	0	270	304	329	347	565	598	662	777	899	857	842	906	1,007	886	1,179	1,371	1,228	976	625	568	561	50
Alighters	270	34	32	58	234	60	139	114	160	41	13	144	273	61	420	268	62	57	33	19	0	19	0
Capacity 6tph/9tph/12tph	3,240	3,240	3,240	3,240	3,240	3,240	4,860	4,860	4,860	4,860	4,860	4,860	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480

FACTORS USED

Capacity	100%
Boarders	100%
Load	100%
Alighters	100%

SUPER-PEAK FACTORS

	2011 CAP		2011 PAX		2031 CAP		2031 PAX	
AM	50%	0%	75%	0%	50%	0%	75%	
IP	0%	0%	0%	0%	0%	0%	0%	
PM	50%	0%	75%	0%	50%	0%	75%	

CHART 1

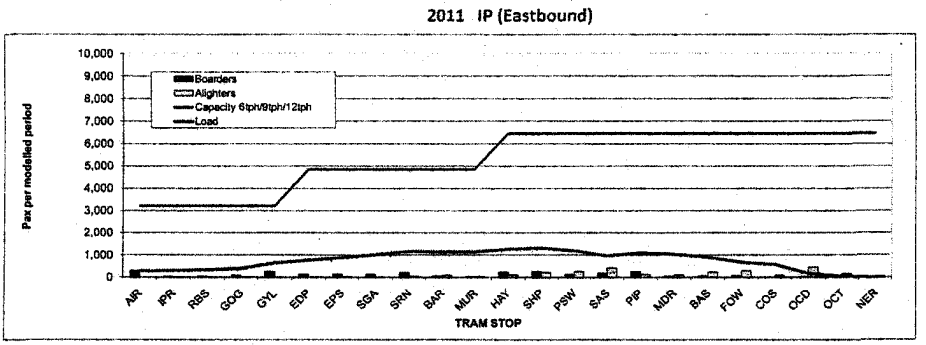
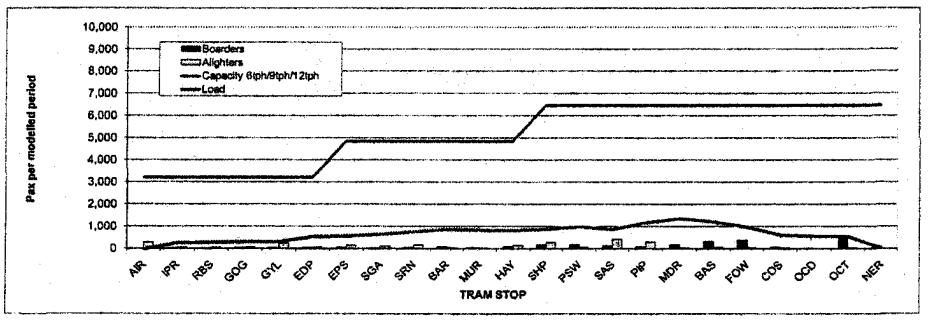


CHART 2



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Edinburgh Tram Joint Revenue Committee
Forecasts and Economic Outputs

[redacted]

Test description:
Test ID: 980d
Test Name: Full Scheme (1a) Option
Print Date: 24/06/2011
Run Date: 15/06/2011
Ramp-Up: Excluded
Recession: Excluded

FLOWS AND CAPACITY

CHART 1

AM (Eastbound) | 2031 | Modelled Period

STOP	AIR	IPR	RBS	GOG	GYL	EDP	EPS	SGA	SRN	BAR	MUR	HAY	SHP	PSW	SAS	PIP	MDR	BAS	FOW	COS	OCD	OCT	NER
Capacity 8tph/16tph	3,240	3,240	3,240	3,240	3,240	4,860	4,860	4,860	4,860	4,860	4,860	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480
Boarders	0	1,500	34	0	137	12	115	239	198	314	393	499	870	880	309	835	669	229	3,158	505	40	1,927	589
Load	0	692	1,275	1,472	1,472	2,069	3,738	4,217	4,715	4,812	4,667	4,366	4,359	6,041	5,842	7,145	7,227	6,734	5,855	2,763	2,302	2,496	589
Alighters	0	397	228	165	754	1,581	594	740	290	160	102	386	2,352	381	1,611	918	167	49	93	24	234	0	0
Capacity 8tph/9tph/12tph	3,240	3,240	3,240	3,240	3,240	4,860	4,860	4,860	4,860	4,860	4,860	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480

FACTORS USED

Capacity	100%
Boarders	100%
Load	100%
Alighters	100%

CHART 2

AM (Westbound) | 2031 | Modelled Period

STOP	AIR	IPR	RBS	GOG	GYL	EDP	EPS	SGA	SRN	BAR	MUR	HAY	SHP	PSW	SAS	PIP	MDR	BAS	FOW	COS	OCD	OCT	NER
Capacity 8tph/16tph	3,240	3,240	3,240	3,240	3,240	4,860	4,860	4,860	4,860	4,860	4,860	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480
Boarders	0	1	34	0	137	12	115	239	198	314	393	499	870	880	309	835	669	229	3,158	505	40	1,927	589
Load	0	692	1,275	1,472	1,472	2,069	3,738	4,217	4,715	4,812	4,667	4,366	4,359	6,041	5,842	7,145	7,227	6,734	5,855	2,763	2,302	2,496	589
Alighters	0	397	228	165	754	1,581	594	740	290	160	102	386	2,352	381	1,611	918	167	49	93	24	234	0	0
Capacity 8tph/9tph/12tph	3,240	3,240	3,240	3,240	3,240	4,860	4,860	4,860	4,860	4,860	4,860	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480

FACTORS USED

Capacity	100%
Boarders	100%
Load	100%
Alighters	100%

SUPER-PEAK FACTORS

	2011 CAP		2011 PAX		2031 CAP		2031 PAX	
AM	50%	0%	75%	0%	50%	0%	75%	
IP	0%	0%	0%	0%	0%	0%	0%	
PM	50%	0%	75%	0%	50%	0%	75%	

CHART 1

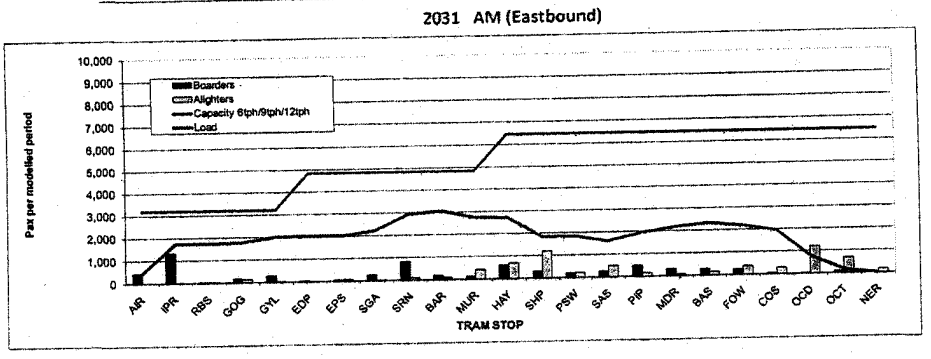
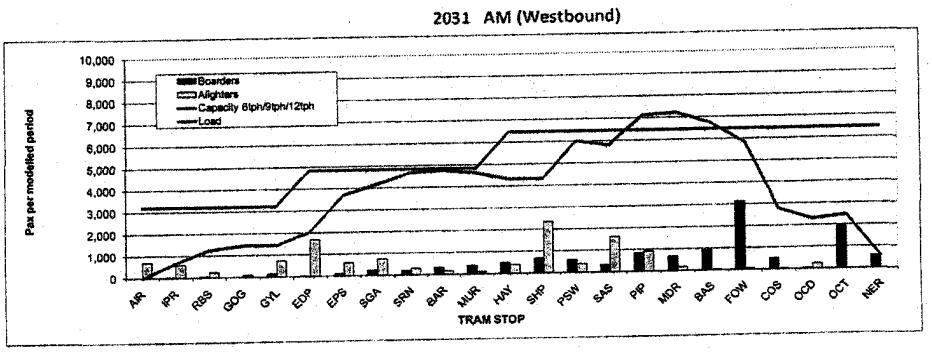


CHART 2



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Edinburgh Tram Joint Revenue Committee
Forecasts and Economic Outputs

[redacted]

Test description:
Test ID: SB1a
Test Name: St. Andrew Square
Date/Time: 13/06/2011
Ramp-Up: Included (2011 start)
Recession Impacts: Excluded

TRAM PATRONAGE AND REVENUE MODE SHIFT

2011 Forecast Patronage (Hierarchical) by Geographical Segment (1,000 pax per year)

Segment Number	Segment Description	Tram	Δ Bus	Δ Rail	Δ Car & Redistributed
SEG01	Airport to Catchment	318	-234	0	-84
SEG02	Catchment to Airport	267	-136	0	-131
SEG03	Ingliston to Catchment	449	-125	0	-323
SEG04	Catchment to Ingliston	17	-6	0	-10
SEG05	Granton Corridor to Catchment	111	-80	-2	-29
SEG06	Catchment to Granton Corridor	79	-62	-1	-16
SEG07	Leith Corridor to Catchment	258	-98	-1	-158
SEG08	Catchment to Leith Corridor	103	-90	-1	-12
SEG09	Gyle to Catchment	734	-564	-50	-120
SEG10	Catchment to Gyle	996	-730	-42	-224
SEG11	Murrayfield to Catchment	879	-784	0	-95
SEG12	Catchment to Murrayfield	391	-344	-4	-43
SEG13	City Centre to Catchment	922	-706	-53	-163
SEG14	Catchment to City Centre	1,818	-1,222	-58	-538
SEG15		0	0	0	0
SEG16		0	0	0	0
SEG17		0	0	0	0
SEG18	External to Catchment	1,210	-534	168	-844
SEG19	Catchment to External	708	-500	105	-313
SEG20	External to External	77	-142	154	-89
SEG21	All journeys	5,666	-3,767	321	-2,220

2011 Forecast Revenue by Geographical Segment (£1,000 per year [2005 prices])

Segment Number	Segment Description	Tram	Δ Bus	Δ Rail
SEG01	Airport to Catchment	233	-177	0
SEG02	Catchment to Airport	196	-103	0
SEG03	Ingliston to Catchment	329	-95	0
SEG04	Catchment to Ingliston	12	-5	0
SEG05	Granton Corridor to Catchment	81	-60	-3
SEG06	Catchment to Granton Corridor	58	-47	0
SEG07	Leith Corridor to Catchment	190	-75	-3
SEG08	Catchment to Leith Corridor	76	-68	-3
SEG09	Gyle to Catchment	539	-427	-62
SEG10	Catchment to Gyle	731	-553	-52
SEG11	Murrayfield to Catchment	645	-594	0
SEG12	Catchment to Murrayfield	287	-261	-5
SEG13	City Centre to Catchment	677	-535	-62
SEG14	Catchment to City Centre	1,335	-825	-69
SEG15		0	0	0
SEG16		0	0	0
SEG17		0	0	0
SEG18	External to Catchment	889	-404	823
SEG19	Catchment to External	520	-379	368
SEG20	External to External	57	-108	-230
SEG21	All journeys	4,161	-2,852	831

2031 Forecast Patronage (Hierarchical) by Geographical Segment (1,000 pax per year)

Segment Number	Segment Description	Tram	Δ Bus	Δ Rail	Δ Car & Redistributed
SEG01	Airport to Catchment	574	-372	0	-203
SEG02	Catchment to Airport	548	-246	0	-301
SEG03	Ingliston to Catchment	1,220	-311	0	-910
SEG04	Catchment to Ingliston	255	109	0	-365
SEG05	Granton Corridor to Catchment	280	-152	-5	-123
SEG06	Catchment to Granton Corridor	185	-130	-3	-52
SEG07	Leith Corridor to Catchment	498	-202	-8	-286
SEG08	Catchment to Leith Corridor	261	-133	-8	-120
SEG09	Gyle to Catchment	1,511	-1,139	-157	-215
SEG10	Catchment to Gyle	1,885	-1,402	-145	-338
SEG11	Murrayfield to Catchment	1,451	-1,276	-1	-174
SEG12	Catchment to Murrayfield	644	-551	-6	-87
SEG13	City Centre to Catchment	1,740	-1,239	-167	-334
SEG14	Catchment to City Centre	3,496	-2,339	-176	-982
SEG15		0	0	0	0
SEG16		0	0	0	0
SEG17		0	0	0	0
SEG18	External to Catchment	2,546	-1,051	701	-2,196
SEG19	Catchment to External	1,374	-951	160	-583
SEG20	External to External	99	-437	79	259
SEG21	All journeys	11,293	-7,131	602	-4,764

2031 Forecast Revenue by Geographical Segment (£1,000 per year [2005 prices])

Segment Number	Segment Description	Tram	Δ Bus	Δ Rail
SEG01	Airport to Catchment	515	-344	0
SEG02	Catchment to Airport	491	-228	0
SEG03	Ingliston to Catchment	1,094	-287	0
SEG04	Catchment to Ingliston	229	101	0
SEG05	Granton Corridor to Catchment	251	-140	-11
SEG06	Catchment to Granton Corridor	166	-120	-5
SEG07	Leith Corridor to Catchment	445	-187	-23
SEG08	Catchment to Leith Corridor	234	-123	-17
SEG09	Gyle to Catchment	1,354	-1,052	-305
SEG10	Catchment to Gyle	1,689	-1,295	-305
SEG11	Murrayfield to Catchment	1,301	-1,179	-2
SEG12	Catchment to Murrayfield	577	-509	-12
SEG13	City Centre to Catchment	1,559	-1,145	-338
SEG14	Catchment to City Centre	3,133	-2,161	-339
SEG15		0	0	0
SEG16		0	0	0
SEG17		0	0	0
SEG18	External to Catchment	2,281	-971	4,000
SEG19	Catchment to External	1,231	-879	1,410
SEG20	External to External	88	-404	-1,514
SEG21	All journeys	10,120	-6,568	3,217

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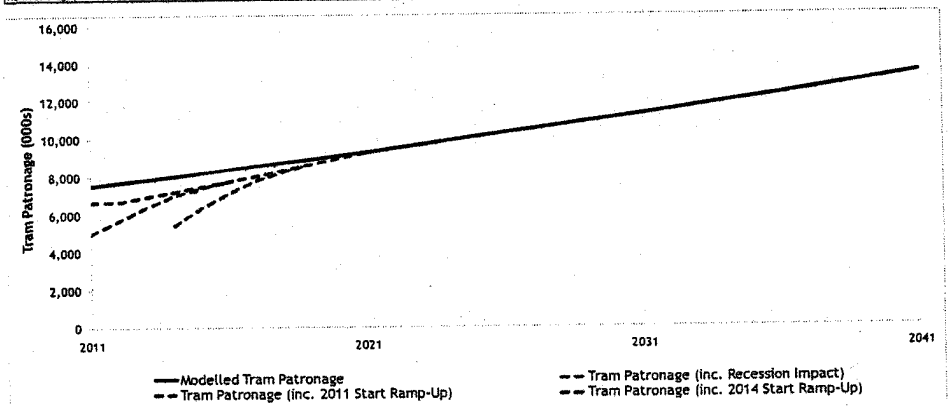
Edinburgh Tram Joint Revenue Committee
Forecasts and Economic Outputs

[redacted]

Test description:
Test ID: S81a
Test Name: St. Andrew Square
Date/Time: 13/05/2011
Ramp-Up: Included
Recession Impacts: Included

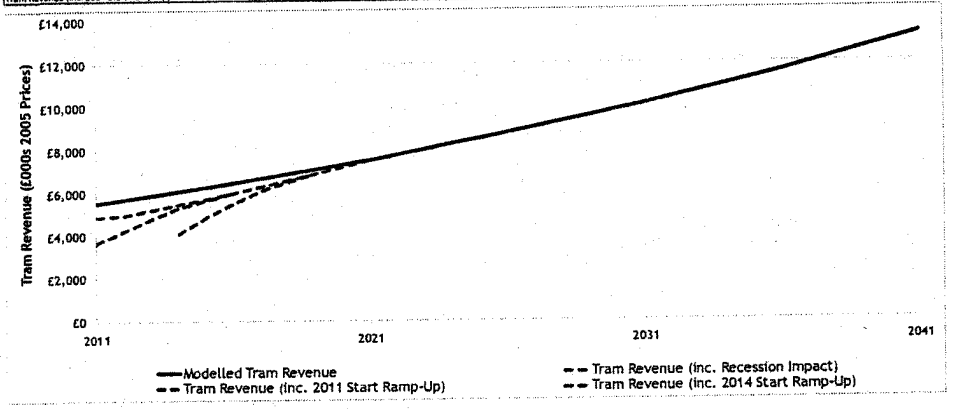
Tram Patronage (000s Boardings)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Modelled Tram Patronage	7,554	7,725	7,895	8,065	8,236	8,406	8,582	8,759	8,935	9,111	9,288	9,488	9,689	9,889	10,090	10,290
Tram Patronage (inc. Recession Impact)	6,700	6,746	6,909	7,259	7,525	7,797	8,085	8,378	8,676	8,979	9,288	9,488	9,689	9,889	10,090	10,290
Tram Patronage (inc. 2011 Start Ramp-Up)	5,025	5,734	6,439	7,041	7,449	7,797	8,085	8,378	8,676	8,979	9,288	9,488	9,689	9,889	10,090	10,290
Tram Patronage (inc. 2014 Start Ramp-Up)	0	0	0	5,444	6,396	7,173	7,842	8,294	8,676	8,979	9,288	9,488	9,689	9,889	10,090	10,290

Tram Patronage (000s Boardings)	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Modelled Tram Patronage	10,491	10,692	10,892	11,093	11,293	11,500	11,707	11,914	12,120	12,327	12,555	12,783	13,011	13,239	13,467
Tram Patronage (inc. Recession Impact)	10,491	10,692	10,892	11,093	11,293	11,500	11,707	11,914	12,120	12,327	12,555	12,783	13,011	13,239	13,467
Tram Patronage (inc. 2011 Start Ramp-Up)	10,491	10,692	10,892	11,093	11,293	11,500	11,707	11,914	12,120	12,327	12,555	12,783	13,011	13,239	13,467
Tram Patronage (inc. 2014 Start Ramp-Up)	10,491	10,692	10,892	11,093	11,293	11,500	11,707	11,914	12,120	12,327	12,555	12,783	13,011	13,239	13,467



Tram Revenue (£000s 2005 Prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Modelled Tram Revenue	5,548	5,730	5,915	6,103	6,294	6,488	6,698	6,907	7,116	7,325	7,535	7,783	8,030	8,278	8,526	8,774
Tram Revenue (inc. Recession Impact)	4,921	5,004	5,244	5,493	5,751	6,018	6,309	6,607	6,910	7,219	7,535	7,783	8,030	8,278	8,526	8,774
Tram Revenue (inc. 2011 Start Ramp-Up)	3,691	4,253	4,824	5,328	5,693	6,018	6,309	6,607	6,910	7,219	7,535	7,783	8,030	8,278	8,526	8,774
Tram Revenue (inc. 2014 Start Ramp-Up)	0	0	0	4,119	4,886	5,537	6,120	6,540	6,910	7,219	7,535	7,783	8,030	8,278	8,526	8,774

Tram Revenue (£000s 2005 Prices)	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Modelled Tram Revenue	9,043	9,312	9,582	9,851	10,120	10,418	10,716	11,014	11,312	11,610	11,954	12,298	12,642	12,986	13,330
Tram Revenue (inc. Recession Impact)	9,043	9,312	9,582	9,851	10,120	10,418	10,716	11,014	11,312	11,610	11,954	12,298	12,642	12,986	13,330
Tram Revenue (inc. 2011 Start Ramp-Up)	9,043	9,312	9,582	9,851	10,120	10,418	10,716	11,014	11,312	11,610	11,954	12,298	12,642	12,986	13,330
Tram Revenue (inc. 2014 Start Ramp-Up)	9,043	9,312	9,582	9,851	10,120	10,418	10,716	11,014	11,312	11,610	11,954	12,298	12,642	12,986	13,330



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Edinburgh Tram Joint Revenue Committee
Forecasts and Economic Outputs

[redacted]

Test description:
Test ID: S81a
Test Name: St. Andrew Square
Print Date: 24/06/2011
Run Date: 13/06/2011
Ramp-Up: Excluded
Recession: Excluded

FLOWS AND CAPACITY

CHART 1

AM (Eastbound) | 2011 | Modelled Period

STOP	AIR	IPR	RBS	GOG	GYL	EDP	EPS	SGA	SRN	BAR	MUR	HAY	SHP	PSW	SAS	PIP	MDR	BAS	FOW	COS	OCD	OCT	NER
Capacity 8tph/16tph	3,240	3,240	3,240	3,240	3,240	4,860	4,860	4,860	4,860	4,860	4,860	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480
Boarders	255	804	19	336	152	20	24	138	656	144	60	62	14	1	0	0	0	0	0	0	0	0	0
Load	255	1,058	1,069	1,366	1,508	1,417	1,401	1,495	2,079	2,155	1,877	1,553	586	489	0	0	0	0	0	0	0	0	0
Alighters	0	1	8	40	10	111	40	43	76	66	336	386	882	197	489	0	0	0	0	0	0	0	0
Capacity 6tph/9tph/12tph	3,240	3,240	3,240	3,240	3,240	4,860	4,860	4,860	4,860	4,860	4,860	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480

FACTORS USED

Capacity	100%
Boarders	100%
Load	100%
Alighters	100%

CHART 2

AM (Westbound) | 2011 | Modelled Period

STOP	AIR	IPR	RBS	GOG	GYL	EDP	EPS	SGA	SRN	BAR	MUR	HAY	SHP	PSW	SAS	PIP	MDR	BAS	FOW	COS	OCD	OCT	NER
Capacity 8tph/16tph	3,240	3,240	3,240	3,240	3,240	4,860	4,860	4,860	4,860	4,860	4,860	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480
Boarders	0	1	25	4	46	7	51	143	151	216	311	127	427	428	832	0	0	0	0	0	0	0	0
Load	0	432	455	573	570	949	1,722	1,868	2,089	2,071	1,952	1,717	1,613	1,259	832	0	0	0	0	0	0	0	0
Alighters	432	24	142	1	426	780	196	367	133	98	77	33	72	0	0	0	0	0	0	0	0	0	0
Capacity 6tph/9tph/12tph	3,240	3,240	3,240	3,240	3,240	4,860	4,860	4,860	4,860	4,860	4,860	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480

FACTORS USED

Capacity	100%
Boarders	100%
Load	100%
Alighters	100%

SUPER-PEAK FACTORS

	2011 CAP		2011 PAX		2031 CAP		2031 PAX	
AM	50%	0%	75%	0%	50%	0%	75%	
IP	0%	0%	0%	0%	0%	0%	0%	
PM	50%	0%	75%	0%	50%	0%	75%	

CHART 1

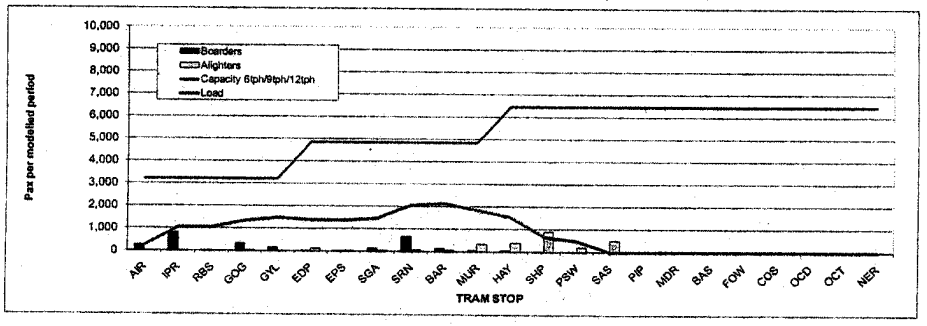
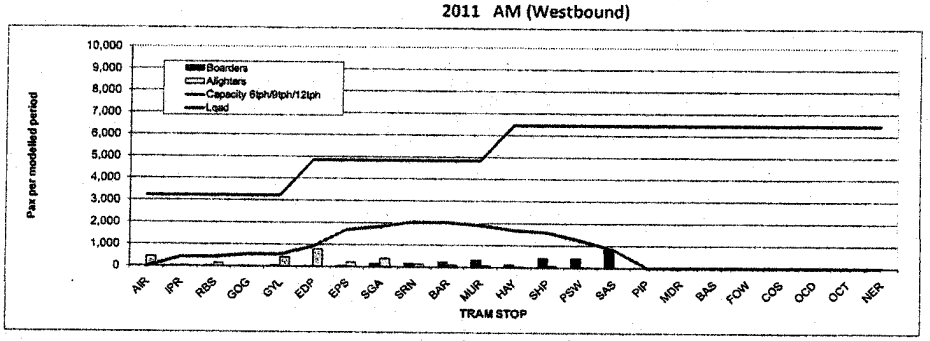


CHART 2



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Edinburgh Tram Joint Revenue Committee
Forecasts and Economic Outputs

Test description:	
Test ID:	SB1a
Test Name:	St. Andrew Square
Print Date:	24/06/2011
Run Date:	13/06/2011
Ramp-Up:	Excluded
Recession:	Excluded

FLOWS AND CAPACITY

CHART 1

IP (Eastbound) | 2011 | Modelled Period

STOP	AIR	IPR	RBS	GOG	GYL	EDP	EPS	SGA	SRN	BAR	MUR	HAY	SHP	PSW	SAS	PIP	MDR	BAS	FOW	COS	OCD	OCT	NER
Capacity 8tph/16tph	3,240	3,240	3,240	3,240	3,240	4,860	4,860	4,860	4,860	4,860	4,860	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480
Boarders	294	26	22	111	223	115	126	102	168	35	26	52	26	0	0	0	0	0	0	0	0	0	0
Load	294	320	331	421	640	751	849	932	1,055	992	981	917	707	450	0	0	0	0	0	0	0	0	0
Alighters	0	1	11	21	3	5	28	18	46	98	37	117	236	258	450	0	0	0	0	0	0	0	0
Capacity 6tph/9tph/12tph	3,240	3,240	3,240	3,240	3,240	4,860	4,860	4,860	4,860	4,860	4,860	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480

FACTORS USED	
Capacity	100%
Boarders	100%
Load	100%
Alighters	100%

CHART 2

IP (Westbound) | 2011 | Modelled Period

STOP	AIR	IPR	RBS	GOG	GYL	EDP	EPS	SGA	SRN	BAR	MUR	HAY	SHP	PSW	SAS	PIP	MDR	BAS	FOW	COS	OCD	OCT	NER
Capacity 8tph/16tph	3,240	3,240	3,240	3,240	3,240	3,240	4,860	4,860	4,860	4,860	4,860	4,860	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480
Boarders	0	2	11	76	0	13	19	32	38	120	29	56	99	197	304	0	0	0	0	0	0	0	0
Load	0	286	318	339	263	487	624	613	649	740	644	624	568	500	304	0	0	0	0	0	0	0	0
Alighters	286	34	32	0	224	60	108	68	129	24	9	19	11	0	0	0	0	0	0	0	0	0	0
Capacity 6tph/9tph/12tph	3,240	3,240	3,240	3,240	3,240	3,240	4,860	4,860	4,860	4,860	4,860	4,860	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480	6,480

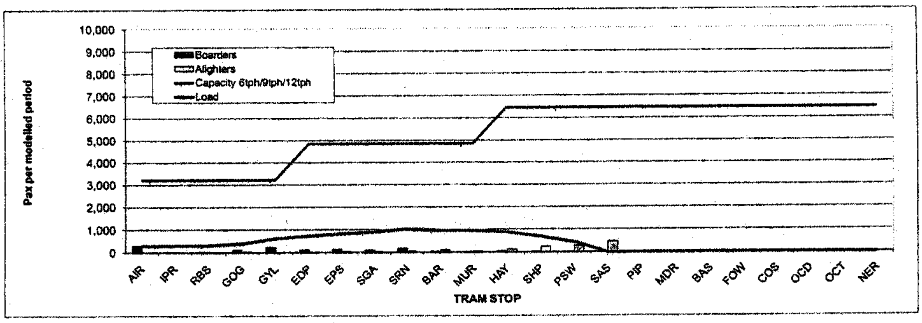
FACTORS USED	
Capacity	100%
Boarders	100%
Load	100%
Alighters	100%

SUPER-PEAK FACTORS

	2011 CAP		2011 PAX		2031 CAP		2031 PAX
AM	50%	0%	75%	0%	50%	0%	75%
IP	0%	0%	0%	0%	0%	0%	0%
PM	50%	0%	75%	0%	50%	0%	75%

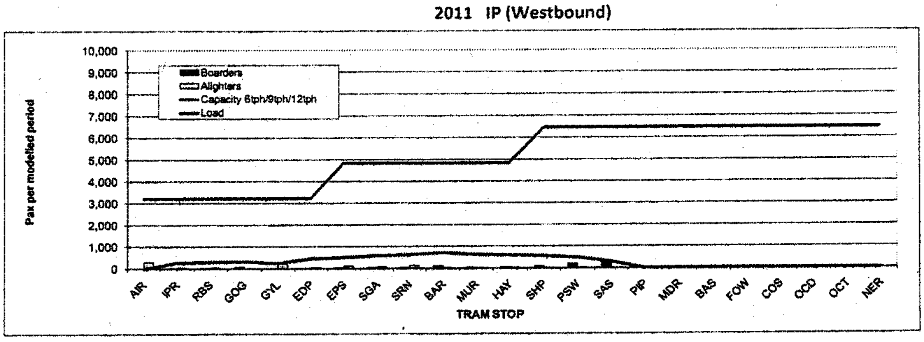
2011 IP (Eastbound)

CHART 1



2011 IP (Westbound)

CHART 2



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[redacted]

Edinburgh Tram Joint Revenue Committee

Standard Output TEMPLATE

FILENAME:	Standard_Outputs_SC1_130611.xls	**User:**	florres

Test ID:	SC1
Test Name:	Foot of the Walk Option
Comment:	All revenues in 2005 prices
	Foot of the Walk option - Without Gogar; With Egip
Date/Time:	13 June 2011

Parameters/Assumptions:

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Recesion and street works factors	88.7%	87.3%	88.7%	90.0%	91.4%	92.8%	94.2%	95.7%	97.1%	98.6%	100.0%
Ramp-up profile (2011 start date)	75.0%	85.0%	92.0%	97.0%	99.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Ramp-up profile (2014 start date)	0.0%	0.0%	0.0%	75.0%	85.0%	92.0%	97.0%	99.0%	100.0%	100.0%	100.0%

steer davies gleave

Edinburgh Tram Joint Revenue Committee
Forecasts and Economic Outputs

[redacted]

Test description:
Test ID: SC1
Test Name: Foot of the Walk Option
Date/Time: 13/06/2011
Ramp-Up: Included (2011 start)
Recession Impacts: Excluded

TRAM PATRONAGE AND REVENUE MODE SHIFT

2011 Forecast Patronage (Hierarchical) by Geographical Segment (1,000 pax per year)

Segment Number	Segment Description	Tram	Δ Bus	Δ Rail	Δ Car & Redistributed
SEG01	Airport to Catchment	328	-256	0	-72
SEG02	Catchment to Airport	281	-168	0	-112
SEG03	Ingliston to Catchment	455	-135	0	-321
SEG04	Catchment to Ingliston	17	-6	0	-11
SEG05	Granton Corridor to Catchment	154	-132	-2	-21
SEG06	Catchment to Granton Corridor	96	-77	-1	-18
SEG07	Leith Corridor to Catchment	1,808	-1,582	-18	-208
SEG08	Catchment to Leith Corridor	863	-789	-7	-67
SEG09	Gyle to Catchment	812	-641	-48	-123
SEG10	Catchment to Gyle	1,202	-915	-60	-228
SEG11	Murrayfield to Catchment	888	-789	0	-100
SEG12	Catchment to Murrayfield	391	-351	-3	-37
SEG13	City Centre to Catchment	1,330	-1,124	-57	-149
SEG14	Catchment to City Centre	2,925	-2,351	-55	-519
SEG15		0	0	0	0
SEG16		0	0	0	0
SEG17		0	0	0	0
SEG18	External to Catchment	1,346	-752	281	-876
SEG19	Catchment to External	972	-538	101	-535
SEG20	External to External	107	-429	154	168
SEG21	All journeys	8,201	-8,375	410	-2,236

2011 Forecast Revenue by Geographical Segment (£1,000 per year [2005 prices])

Segment Number	Segment Description	Tram	Δ Bus	Δ Rail
SEG01	Airport to Catchment	241	-194	0
SEG02	Catchment to Airport	206	-128	0
SEG03	Ingliston to Catchment	334	-102	0
SEG04	Catchment to Ingliston	13	-5	0
SEG05	Granton Corridor to Catchment	113	-100	-2
SEG06	Catchment to Granton Corridor	70	-58	0
SEG07	Leith Corridor to Catchment	1,328	-1,197	-26
SEG08	Catchment to Leith Corridor	634	-598	-9
SEG09	Gyle to Catchment	596	-485	-55
SEG10	Catchment to Gyle	883	-693	-73
SEG11	Murrayfield to Catchment	652	-597	0
SEG12	Catchment to Murrayfield	287	-265	-5
SEG13	City Centre to Catchment	977	-851	-63
SEG14	Catchment to City Centre	2,149	-1,780	-59
SEG15		0	0	0
SEG16		0	0	0
SEG17		0	0	0
SEG18	External to Catchment	989	-569	869
SEG19	Catchment to External	714	-407	368
SEG20	External to External	79	-324	-170
SEG21	All journeys	6,023	-4,827	921

2031 Forecast Patronage (Hierarchical) by Geographical Segment (1,000 pax per year)

Segment Number	Segment Description	Tram	Δ Bus	Δ Rail	Δ Car & Redistributed
SEG01	Airport to Catchment	600	-413	0	-187
SEG02	Catchment to Airport	588	-303	0	-286
SEG03	Ingliston to Catchment	1,255	-343	0	-911
SEG04	Catchment to Ingliston	297	66	0	-363
SEG05	Granton Corridor to Catchment	467	-247	-4	-216
SEG06	Catchment to Granton Corridor	271	-163	-3	-104
SEG07	Leith Corridor to Catchment	3,511	-2,663	-68	-781
SEG08	Catchment to Leith Corridor	1,489	-1,240	-20	-229
SEG09	Gyle to Catchment	1,842	-1,501	-143	-198
SEG10	Catchment to Gyle	2,786	-1,991	-192	-603
SEG11	Murrayfield to Catchment	1,423	-1,277	-4	-142
SEG12	Catchment to Murrayfield	677	-622	-7	-48
SEG13	City Centre to Catchment	2,490	-2,053	-160	-278
SEG14	Catchment to City Centre	5,480	-4,244	-156	-1,079
SEG15		0	0	0	0
SEG16		0	0	0	0
SEG17		0	0	0	0
SEG18	External to Catchment	3,002	-1,464	681	-2,220
SEG19	Catchment to External	1,836	-1,147	153	-842
SEG20	External to External	136	-849	124	589
SEG21	All journeys	16,562	-11,956	579	-5,186

2031 Forecast Revenue by Geographical Segment (£1,000 per year [2005 prices])

Segment Number	Segment Description	Tram	Δ Bus	Δ Rail
SEG01	Airport to Catchment	538	-382	0
SEG02	Catchment to Airport	527	-280	0
SEG03	Ingliston to Catchment	1,124	-317	0
SEG04	Catchment to Ingliston	266	61	0
SEG05	Granton Corridor to Catchment	419	-228	-10
SEG06	Catchment to Granton Corridor	243	-151	-6
SEG07	Leith Corridor to Catchment	3,146	-2,460	-140
SEG08	Catchment to Leith Corridor	1,335	-1,146	-38
SEG09	Gyle to Catchment	1,650	-1,387	-266
SEG10	Catchment to Gyle	2,496	-1,839	-389
SEG11	Murrayfield to Catchment	1,275	-1,180	-5
SEG12	Catchment to Murrayfield	607	-574	-14
SEG13	City Centre to Catchment	2,232	-1,896	-314
SEG14	Catchment to City Centre	4,911	-3,921	-289
SEG15		0	0	0
SEG16		0	0	0
SEG17		0	0	0
SEG18	External to Catchment	2,690	-1,352	3,663
SEG19	Catchment to External	1,646	-1,080	1,300
SEG20	External to External	122	-784	-1,347
SEG21	All journeys	14,842	-11,045	2,901

steer davies gleave

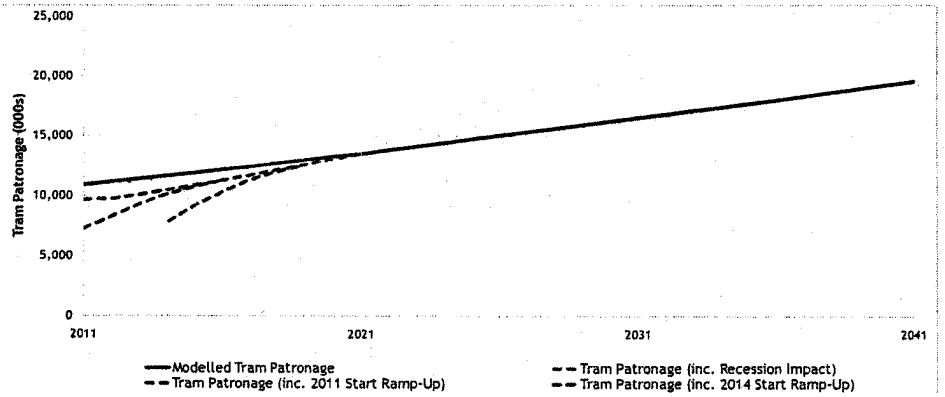
Edinburgh Tram Joint Revenue Committee
Forecasts and Economic Outputs

[redacted]

Test description:
Test ID: SC1
Test Name: Foot of the Walk Option
Date/Time: 13/06/2011
Ramp-Up: Included
Recession Impacts: Included

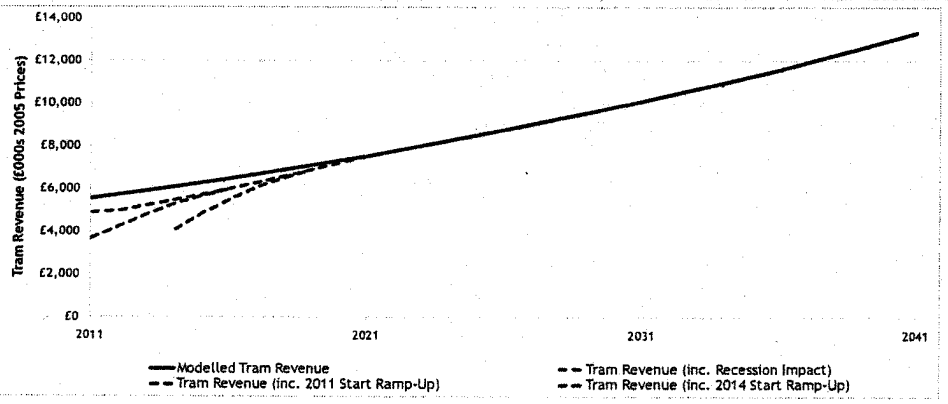
Tram Patronage (000s Boardings)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Modelled Tram Patronage	10,934	11,191	11,447	11,703	11,960	12,216	12,482	12,747	13,013	13,278	13,544	13,845	14,147	14,449	14,751	15,053
Tram Patronage (inc. Recession Impact)	9,696	9,773	10,149	10,333	10,987	11,331	11,758	12,193	12,635	13,086	13,544	13,845	14,147	14,449	14,751	15,053
Tram Patronage (inc. 2011 Start Ramp-Up)	7,274	8,307	9,337	10,217	10,818	11,331	11,758	12,193	12,635	13,086	13,544	13,845	14,147	14,449	14,751	15,053
Tram Patronage (inc. 2014 Start Ramp-Up)	0	0	0	7,900	9,286	10,424	11,405	12,071	12,685	13,086	13,544	13,845	14,147	14,449	14,751	15,053

Tram Patronage (000s Boardings)	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Modelled Tram Patronage	15,355	15,657	15,959	16,260	16,562	16,852	17,141	17,431	17,720	18,009	18,326	18,644	18,961	19,278	19,595
Tram Patronage (inc. Recession Impact)	15,355	15,657	15,959	16,260	16,562	16,852	17,141	17,431	17,720	18,009	18,326	18,644	18,961	19,278	19,595
Tram Patronage (inc. 2011 Start Ramp-Up)	15,355	15,657	15,959	16,260	16,562	16,852	17,141	17,431	17,720	18,009	18,326	18,644	18,961	19,278	19,595
Tram Patronage (inc. 2014 Start Ramp-Up)	15,355	15,657	15,959	16,260	16,562	16,852	17,141	17,431	17,720	18,009	18,326	18,644	18,961	19,278	19,595



Tram Revenue (£000s 2005 Prices)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Modelled Tram Revenue	8,030	8,301	8,576	8,856	9,140	9,429	9,741	10,053	10,364	10,676	10,987	11,357	11,726	12,096	12,465	12,835
Tram Revenue (inc. Recession Impact)	7,123	7,249	7,603	7,970	8,351	8,746	9,176	9,615	10,064	10,521	10,987	11,357	11,726	12,096	12,465	12,835
Tram Revenue (inc. 2011 Start Ramp-Up)	5,342	6,162	6,995	7,731	8,268	8,746	9,176	9,615	10,064	10,521	10,987	11,357	11,726	12,096	12,465	12,835
Tram Revenue (inc. 2014 Start Ramp-Up)	0	0	0	5,978	7,098	8,046	8,901	9,519	10,064	10,521	10,987	11,357	11,726	12,096	12,465	12,835

Tram Revenue (£000s 2005 Prices)	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Modelled Tram Revenue	13,236	13,638	14,039	14,441	14,842	15,266	15,690	16,114	16,538	16,962	17,449	17,936	18,423	18,910	19,397
Tram Revenue (inc. Recession Impact)	13,236	13,638	14,039	14,441	14,842	15,266	15,690	16,114	16,538	16,962	17,449	17,936	18,423	18,910	19,397
Tram Revenue (inc. 2011 Start Ramp-Up)	13,236	13,638	14,039	14,441	14,842	15,266	15,690	16,114	16,538	16,962	17,449	17,936	18,423	18,910	19,397
Tram Revenue (inc. 2014 Start Ramp-Up)	13,236	13,638	14,039	14,441	14,842	15,266	15,690	16,114	16,538	16,962	17,449	17,936	18,423	18,910	19,397



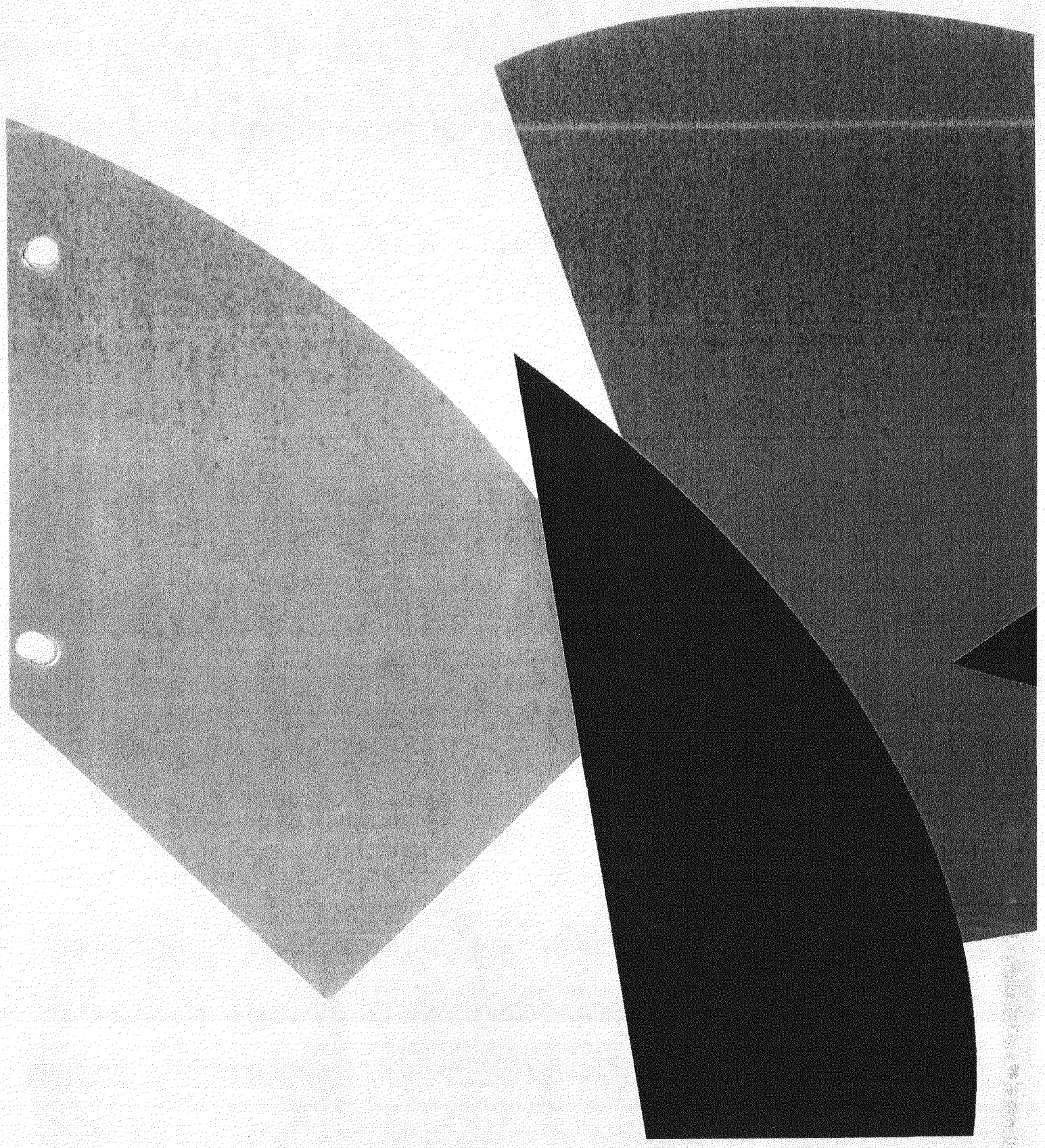
Appendix C – STAG Outputs

Table C.1 - STAG Outputs

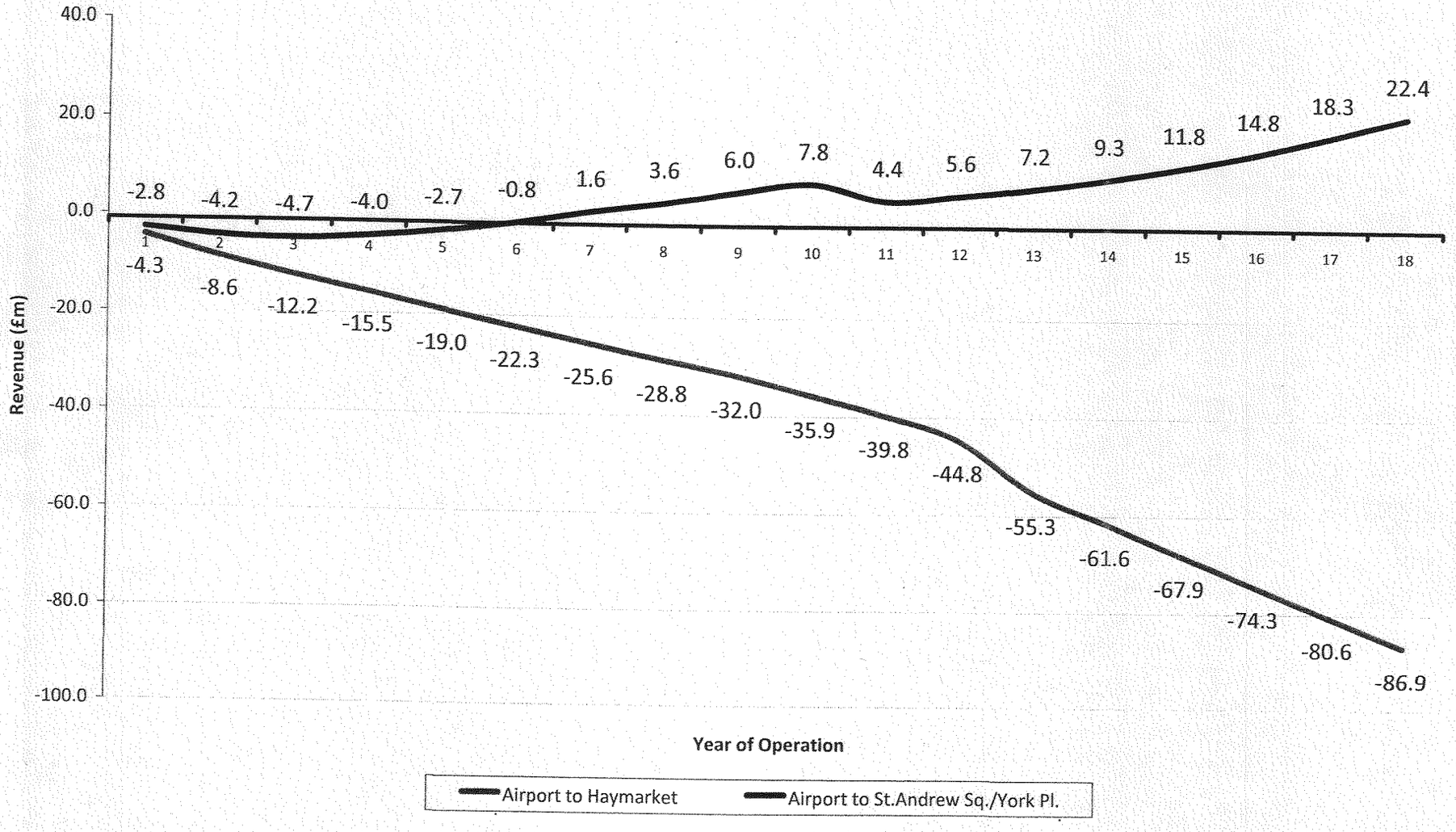
		2007 Business Case			Change in 2010 Update
Criteria	**Sub Criteria**	**Input Assumptions**	**Tools**	**Outputs**	
Environment	Emissions & Air Quality (Positive)	UK Air Quality Data and Statistics Database	DMRB empirical method	Changes in traffic emissions of NO2 and PM10 (Local Air Quality) Total change in Carbon Dioxide (CO2) emissions from road traffic (Global Air Quality) Generation of electricity to power the tram (Global Air Quality)	Need for reducing the carbon impact has increased New Air Quality Action Plan (AQAP) for city centre being created Economic viability of procuring sustainable electricity for tram being investigated
	Noise (Positive)	Code of Construction Practice Noise & Vibration Policy Link-by-link traffic flow Composition and speed Population catchment	Calculation of Road Traffic Noise GOMMMS noise annoyance-response relationships Calculation of Railway Noise	Changes in the number of people annoyed by noise Changes in the number of people experiencing significant changes in noise levels	No change
	Visual Amenity (Negative)		A Design Manual	Vehicles and tracks etc designed to minimise the visual impact of the tram	No change
	Habitats (Neutral)			Loss of some areas of habitat and sections of the wildlife corridor adjacent to the main Glasgow/Edinburgh Badgers at Gogar affected by both construction and operation	No change
	Water Quality (minor negative), Drainage (Neutral) Flood Defence (Neutral)	Water courses likely to be affected (SEPA classification); Gogar Burn (fair to poor), Water of Leith (good to fair)		Comprehensive mitigation programmes	No change

		2007 Business Case			Change in 2010 Update
Criteria	**Sub Criteria**	**Input Assumptions**	**Tools**	**Outputs**	
Safety and Reliability	Accidents (Negative)	JRC transport model on vehicle-kms travelled and the road types on which these occur. Standard accident rates by severity level: fatal, severe, slight and damage to property.	A spreadsheet model Standard rates and methodology from NESA	Estimate changes in personal injuries Resultant impact on accident levels the total accidents benefit as a result of changed traffic by year and in terms of a total present value benefit	No change
	Security (Positive)	Review of the street environment in the vicinity of potential stops/interchanges	Qualitative analysis using Webag 3.4.2	Lighting and street furniture will be designed to provide maximum safety and security CCTV system will be in place at all stops and on all vehicles Assumed that there will be help points at all stops Use of inspectors on the trams	No change
	Reliability / Capability (Positive)	Tram considered to be more reliable			Increased need for buses leads to increased congestion / reduced reliability
Accessibility and Social Inclusion	(Positive)		Modelled to show accessibility graphs	Increased accessibility across the city Increases access to jobs etc for certain areas of the city Service integration patterns with buses designed to maximise accessibility	No change
Transport and Land Use Integration	(Positive)		Qualitative Analysis	Phase 1A will enhance the opportunity for integrated ticketing arrangements. Scheme will enhance existing transport interchange facilities and also provide new transport interchange opportunities.	Cancellation of EARL now included; Inclusion of the Edinburgh Gateway

		2007 Business Case			Change in 2010 Update
Criteria	**Sub Criteria**	**Input Assumptions**	**Tools**	**Outputs**	
Economic Regeneration	(Positive)	Development and job market growth expected to grow or come online quicker due to tram			Reduction in development rate expected Introduction of WETA analysis Change in airport growth
Economic Activity and Locational Impacts (EALI)	150 jobs (Positive)		Analysis was undertaken of the gross employment impacts		No change



Cumulative Revenue Forecasts for Tram: Haymarket and St. Andrew Square/York Place

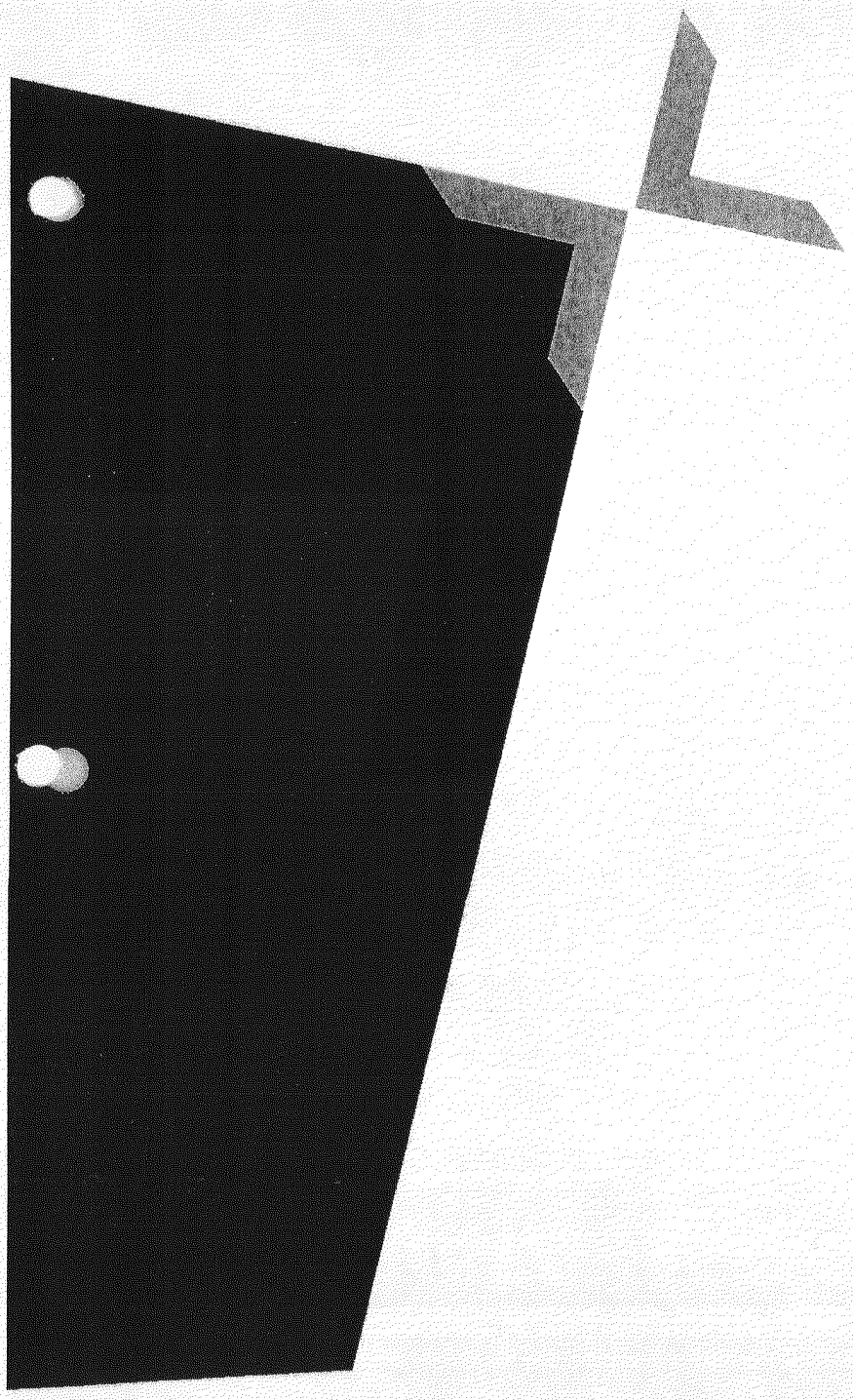


CITY OF EDINBURGH COUNCIL

Post Settlement Agreement Budget

Budget Report

19th August 2011



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CONSTRUCTIVE EXPERTISE

CITY OF EDINBURGH COUNCIL
Post Settlement Agreement Budget
Budget Report
19th August 2011

Document status					
Revision	**Date**	**Status or comment**	**Prepared by**	**Checked by**	**Authorised by**
	16.08.2011	First Draft	J Findlay	K Willins	P Sherry
01	17.08.2011	Rev A	K Willins		

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CONTENTS

1.0 INTRODUCTION

1.1 Faithful+Gould was asked to carry out a review of the Budget for the delivery of the Edinburgh Trams project following the Settlement Agreement.

1.2 The review would consider the robustness of the financial assessment as presented to the City of Edinburgh Council on the 30th June 2011. It would challenge the figures as presented and the assumptions made at arriving at those figures. Based on the findings a revised budget would be presented to the City of Edinburgh Council for its consideration.

1.3 Due to the time constraints (effectively 3 weeks) the review relied on previously quantified items and project data. This was then challenged, to assess its reliability and relevance. A risk workshop was also held to explore all areas of the project to ensure that all avenues of risk, that may have a financial impact of this project going forward, were considered.

1.4 Faithful+Gould did not review or analyse the contractual basis of the project, but did query certain aspects of the draft MOV5 (Settlement Agreement Memorandum of Understanding) and in particular took into account the 'exclusions' (see Appendix D) when evaluating the risk profile.

1.5 The report is written with the assumption that those reading it have a detailed knowledge of the project and the parties involved.

2.0 EXECUTIVE SUMMARY

2.1 Based on the analysis of base costs, review of associated risks and discrete risks Faithful+Gould would recommend the following budget level. This figure is made up of various budgets from various sources and Faithful+Gould are relying on these budgets being correct as time does not permit the final checking of these budgets.

Post Settlement Agreement Budget **£742.92M**

2.2 This value represents the 80th percentile – the 80% confidence level – for project funding or budget purposes.

2.3 The base costs values with regard to Infraco are all at an advanced stage and due to the tight timescales leaves very little negotiating room. This has been highlighted by the responses from the Contractor in the On-Street Works Section.

2.4 **Budget**
The budget has been arrived at by consultation with various parties and covers all costs associated with the completion of the Tram Project – see Appendix A

2.5 **Delay by Utilities**
The Re-routing of the utilities is still causing concern and is a high risk to the project in in cost and time, monies have been set aside to cover any delays but costs from this work is very much a floating cost. The work involved with the utilities must have good management on the client side to try and minimise any delays.

2.6 **Interface Risk**
The current costs presented for the on-street works for Siemens are extremely high and not value for money, as its well in excess of the original costs for the works. Unfortunately all the materials are on site and paid for by the client. To complete the works any change of contractor on this element of works probably creates a very high risk due to any fault with the existing materials and any warranty for the works.

2.7 **On-Street Works**
We are of the opinion that the on street work costs are grossly inflated by INFRACO both for the civil work and the Siemens works. The Siemens position is explained in paragraph 2.6 above. Siemens hold a "golden key" due to the materials being on site and already paid in full. With regards to the civil works the cost is also grossly inflated and the contractor has allowed for the very worst case scenario for all works. If this was a competitive tender then we would expect some of the risk to be taken by the contractor to secure the works. We have highlighted areas that we think are overpriced.

- Traffic Management Works
- Indirect Cost
- Capping Layer in Excavations
- Paving Slabs – all priced as new
- Seimens Package

2.8 **Recommendations**

Due to the circumstances and contractual agreement presently in place for this project it is almost impossible to change contractors. The grossly inflated prices from INFRACO for the on street works indicate that it would almost be more cost effective to carry out this section of works on a cost plus basis. If this was an option it would require more management from the clients side to closely monitor all the works being undertaken, to make sure the correct labour was on site and the contractor was working efficiently. If managed properly this can be quite successful but can lead to disputes on efficiency of labour etc. This should be considered, and would also nullify any costs that INFRANCO have built into their costs for carrying out the remedial works on Princess Street which is possibly part of the issue why their costs are grossly inflated (which should be INFRACO cost).

3.0 METHODOLOGY

3.1 The project falls into six main elements (listed below). Five of these elements relate to specified work areas with their own associated risks. The sixth element being for discrete risks that are either general risks or risks that affect the whole of the project.

- Off-Street Works (Lump Sum)
- On-Street Works
- Utilities
- CAF
- Project Management Costs
- Risk Allocation

3.2 Overarching these elements is the MOV5 or Settlement Agreement Memorandum of Understanding between the Client organisation tie Ltd and the Contractor organisation Infraco. Although, Faithful+Gould's scope of work did not cover a review of the revised contract in MOV5, Faithful+Gould was made aware of proposed 'exclusions' to that agreement and took those into consideration when evaluating the risk profile of the project.

3.3 The Off-Street Works (Lump Sum) relate to all costs and works prior to the MOV5 date of 1st September 2011 and a lump sum agreement to complete the works from Edinburgh Airport to Haymarket Station. These have been the focus of extensive mediation between the parties and as such it was felt that, in the available time, Faithful+Gould should concentrate on the risks associated with the agreed lump sum, insofar as future expenditure and specified risks that could effect this element of work.

3.4 The On-Street Works relates to works between Haymarket Station and York Place. At the time of this report the budget for this element of the works had not been agreed between the Client and Infraco. This allowed Faithful+Gould to carry out a more in-depth review of the figures being proposed by the contractor.

This review took the format of a 'tender review' where we considered the breakdown of the contractor's submission and were able to review sub-contract prices. We also compared the prices with the previously noted budget.

3.5 The Utilities element covered all areas of the project and by its nature could have a major effect on the project. A significant amount of work was ongoing to identify anticipated utility risks. This ongoing work was used as a basis for informed analysis of the risks in this area.

3.6 The CAF costs had been agreed and so the review of this element of the works was limited to associated risks that may occur.

3.7 The Project Management Costs relate to expenditure to date and future expenditure by the Client to all other parties excluding Infraco. Here the values of cost were provided by the Client. Faithful+Gould's role was to challenge these costs to ensure that consideration had been given to all aspects of this element and look for duplication of risk items.

3.8 Risk Allocation was the final element and covered two areas of work. Firstly 'Discrete Risks' were reviewed and assessed. Then finally all costs were modelled to achieve a risk profile for the project.

A Risk Workshop was then held on the 11th August 2011, to allow key individuals involved in the project (see Appendix A) an opportunity to challenge existing risks and

explore new risks. The workshop also allowed individuals attending to bring any new risks to the table.

As part of the Risk Allocation section, all items in all work elements were then risk profiled to give a probability of cost and to derive an anticipated budget for the Edinburgh Trams Project.

4.0 ELEMENTS OF WORK

4.1 Off Street Works

The value of the Base Costs for the On-Street Works, have been agreed at £362.5M. This has been achieved through extensive mediation (not part of the Faithful+Gould scope). Of this total value £194.99M has been committed in assessments with a further £19.68M committed as part of the ongoing 'Prioritised Works'. This leaves a total of £147.83M of works to be completed.

A saving against Forth Ports is anticipated and has been factored in to the risk profile.

4.2 On Street Works

4.2.1 Budget Price

4.2.1.1 The budget was compiled by tie Ltd, using the difference between the valuation of work carried out to the end of March 2011 and the estimated cost to complete from the contract sum. Following the submission of prices by the contractor the budget had to be revised so that a more like for like comparison could be carried out. These revisions are listed under the heading Revised Budget. The table below details both the original and the revised budget values:

Section	Original Budget (ob)	Revised Budget (rb)	Notes
Bilfinger Berger BoQ	£9,274,383	£9,274,383	A
Siemens	£3,974,427	£3,974,427	B
Risk allowance	£1,391,156	£2,517,000	C
Adjustments	£1,125,453	£6,810,000	D(ob) D(rb)
Traffic Lights		£1,700,000	E
Changes		£2,000,000	F
Prelims – BB	£2,550,455	£2,550,455	
Prelims - Siemens	£894,246	£894,246	
Deduct Siemens Materials		-£1,629,000	G
Sub total	£19,210,120		
Adjustments	£3,289,880		H
Total	**£22,500,000**	**£28,091,511**	

Notes:

A BB price was arrived at by pricing a contemporary BOQ to reflect the IFC drawings updated at that time using Contract Rates.

B Siemens value was derived pro rata from the Siemens contract Price analysis submitted at contract award stage.

C The risk allowance of £2,517,000 is a consolidation of risk plus adjustments from the original budget (£1,391,156 + £1,258,844).

D(ob) Allowance for risk on formation10% of civils plus risk of downtime disruption etc of 5%

D(rb) Revised Adjustment includes original budget price plus additional to cover capping layer to roads areas to cover poor ground conditions and new kerbing in lieu of re-use of existing.
It should be noted that the adjustment has been revised to reflect additional capping layer added by BB as worst case scenario. However, there is no evidence that should the worst case scenario not materialise, adjustment would be made to the remuneration value. It is our view that the additional cost of capping layer be treated as contingency and the actual requirement be based on re-measurement of the work carried out based on ground bearing capacity.
The kerbing allowance included in the revised adjustment figure is based on information that new kerbing has been included in the tender submission by BB. However, in the event that the existing kerbing is re-instated, there appears to be no mechanism to adjust remuneration to cover reuse. Again as with the capping layer, it is our view that remuneration is based on actual work done.

E Traffic lights are a Provisional Sum in the Contract. Provisional Sums for site wide works (as this work is) were included in the Off Street tie assessment. Now the scope is split this may well have been overlooked in the separate price for on street and has therefore been added to the revised budget.

F Includes work associated with turnback at St Andrews Square/ York Place and for a floating slab.

G Materials associated with Siemens contract have already been certified. The Siemens tender therefore covers labour and preliminaries costs.

H This was added by tie for budget purposes and partly reflects the adjustment to the slightly higher figure that Cyril Sweett arrived at.

4.2.2 Civils, Systems and Trackwork

4.2.2.1 The summary produced details the value of the Civil Works (Bilfinger Berger civil UK Ltd) together with the Systems and Trackwork (Siemens plc) is as follows:

Item	Description	Detailed Description	Amount
1	Bilfinger Berger civil UK Limited	Civils Work	£33,322,586
2	Siemens plc	Systems and Trackwork	£20,160,679
		Grand total	**£53,483,265**

4.2.2.2 Tenders for the on-street civil works were received from the following contracting companies:

- Lagan
- Crummock
- RJ McLeod
- Land Engineering
- Mackenzie

Contractor	Value
Lagan	£15,649,862
Crummock	£15,683,274
Land Engineering	£17,626,025
Mackenzie	£17,881,893
RJ McLeod	£20,462,868
Average of above	£17,460,784

The values noted are compiled from the tender values received together with the contractor qualifications on omissions, clarifications and exclusions.

The value used in compilation of the £33,322,586 total is the average of the tenders received, namely £17,460,784. From the table above, the lowest tender was received from Lagan in the amount of £15,649,862. The difference between the average and lowest tender is £1,810,922. With the addition of Overheads and Profit at 10%, the value is £1,992,014

Using the average in the summary gives a false picture. It is recommended that the lowest tender value be used in the compilation of the summary of all costs with the £1,992,014 noted as contingency.

An Enquiry Clarification (EC Nr 1) and covering the pavement types was issued by Bilfinger Berger to their Civil Works tendering sub contractors informing them that the bills of quantities were produced to the worst case scenario with a capping layer of 700mm over the roads areas. This clarification is not carried into the BB Civil Works proposal Pricing Assumptions therefore the actual depths shown on the contract drawings will be deemed to be the BB allowance. This could lead to BB pursuing variations for extra over costs should actual depth requirements be greater than indicated on the drawings despite the worst case scenario being included in the bills of quantities.
It is our view that this element of the works be treated as provisional and subject to adjustment with the actual value to be certified based on actual work carried out.

Enquiry clarification (EC Nr 8) and covering Kerbs, Setts & Paving was issued by Bilfinger Berger to their Civil Works tendering sub contractors informing them that the Bilfinger Berger measurement upon which the tender is based contains approximately 1500m of new kerbing and 2000m2 additional pavement over and above that measured by tie. The discrepancy requires more in depth investigation. However, it is our view that in order to reach some common ground to enable agreement, these works are also considered as provisional and subject to re-measurement.

4.2.2.3 The Civil Work value of £33,322,568 as contained in the report entitled 'Edinburgh Tram Network On Street Works Civil Price' and dated 20 June 2011 is compiled as follows:

Item	Description	Detailed Description	Amount	Observations
1	Main Subcontract Works	Sub-total	£15,668,623	A
2	Subcontract qualifications	Omissions	£735,255	A
		Clarifications	£487,082	A
		Exclusions	£569,824	A
		Resource Reconciliation	£769,903	B
		Late Changes	£632,456	C
		Sub-total	£3,221,521	
3	Other Subcontractors	Site Investigation Works	£400,000	D
		Logistics	£899,169	E
		Street lighting	£559,979	F
		Princes St. outstanding wks	£345,000	G
		Traffic & Pedestrian Management	£4,173,615	H
		Sub-total	£6,377,763	
		Total for direct costs (1-3)	£25,267,906	
4	In-direct costs (BBUK)	Total for in-direct costs (4)	£5,025,354	I
5	Risk, Overheads & Profit	Risk – Reer Schedule X Pricing Assumptions	£-	
		Overheads at 7%	£2,120,528	J
		Profit at 3%	£908,798	J
		Total for Risk Overheads & Profit	£3,029,326	
		Grand Total	**£33,322,586**	

Observations:

A: Values taken as an average of the five tenders received.

B: Value added to cover the difference between the Bilfinger Berger estimate of the works and the average of the tenders received. This value should be deleted.

C: The late changes are detailed in the report with the majority of the value associated with programme creep. For example section 1C is 5 weeks longer £208,820, 1D 3 weeks longer £125,292 and traffic management longer duration £280,000. The balance of the works in this section is associated with the Canning Street Traffic Light Junction. The rates for which are reasonable.

D: The value seems high considering the extent of works to complete the project. Further investigation required.

E: Logistical Support is based on 45 weeks duration for Princes Street works and 105 weeks duration for Haymarket/Shandwick/St Andrew/York Place.

F: Original rates used with uplift of 15%. The uplift % is high when viewed against current indices. A figure in the region of 5% would be more appropriate.

G: Represents works that were postponed on instruction and is a fair reflection of the value expected.

H: The value quoted is excessive bearing in mind the works scope. During the Princes Street works, the cost reimbursable element was £330,000. This covered approximately 1km of route and being on a cost reimbursable basis is likely to be higher than at fixed price. On a pro rata basis if that rate is applied to the whole on street works of 2.6km, including the remaining Princes Street works, the value would be in the region of £858,000. An additional £280,000 is included in the 'Late Changes' section for Traffic Management. It is our observation that an amount in the region of £1,000,000 would be more realistic for the Traffic & Pedestrian Management with a reduction on the quoted value of £4,173,615 of £3,173,615. With overheads and profit at 10%, the reduction would be £3,490,098

I: See item 4.2.2.4 below

J: The total for overheads and profit, although high in the current economic climate, reflect the values contained in the original project

4.2.2.4 The in-direct costs at £5,025,356 are as follows:

Item	Description	Target Price	Observations
1	Site Office at Haymarket	£763,341	
2	Consortium Office	£234,834	
3	Staff	£2,595,582	
4	Finance	£706,300	
5	Consultants	£706,300	
	In-direct costs Total	**£5,025,356**	**A**

Observations:

A: The value appears excessive when viewed against the programme timescales. In addition, although we do not have a breakdown of the off-street works agreed lump sum, it is conceivable that an element of in-direct cost is built into the lump sum.

4.2.2.5 Supplementary tenders for section 1D H chainage 130,818 – 131,247 West Maitland Street – Haymarket were received on 22 July as follows:

Contractor	Value
Lagan	£3,433,628
Crummock	£4,545,737
Mackenzie	£5,050,426

The lowest submission by Lagan in the amount of £3,433,628 should be added to the summary as noted in 4.2.2.3 above. The resultant total is therefore:

Section	Value
From 2.03	£33,322,586
From 2.05	£3,433,628
Total	**£36,756,214**

4.2.3 Systems and Trackwork

4.2.3.1 The Siemens costs exclude materials as these have already been certified.

The budget for the Siemens element of the project as prepared by tie was on a pro rata basis from the Siemens contract sum analysis provided at award stage. No programme was available and consequently a value based percentage was added to cover prelims (estimated at £894,246)

In meetings with Siemens, tie has established that Siemens have priced the preliminaries at full resource level for the current programme duration. Whilst it is accepted by tie that the programme is of a longer duration than anticipated by tie and that that would attract additional preliminary costs, original target price of £20,160,348.19 has been reviewed following observations made by tie. The target price has been adjusted to £14,480,150.03 following observations made by tie and is compiled as follows: