

**Edinburgh TRAM Project
(Commercial In Confidence)**

Paper to : Tram Project Board
Subject : Preliminary Design Stage Project Estimate Update
Date : 9th November 2006

1.0 Introduction

- 1.1 This report summarises the Project Estimate (November 2006) and explains the structure, basis and process adopted to prepare the estimate.
- 1.2 The estimate is based on the preliminary designs prepared by the Project's designers SDS.

2.0 Executive Summary

- 2.1 The estimate for the Edinburgh Tram Network Phases 1a and 1b is £592.4m, exclusive of VAT. This represents the core scope of the project, Phase 1a being Newhaven to Edinburgh Airport and Phase 1b being Roseburn to Granton Square.
- 2.2 This estimate is summarised for its principal elements as follows:-

	Phase 1a) £m	Phase 1b) £m	Risk Allowance £m	Total £m
Utilities	53.6	7.2	13.8	74.5
Tram Vehicles	55.2	8.3	3.0	66.5
Infrastructure	206.2	49.5	27.4	283.1
Other third party works	9.0	0.6	3.7	13.3
Land & Property	24.1	4.3	9.2	37.6
Design	24.3	2.0	1.7	28
Project management etc	81.3	3.1	5.0	89.4
Total	453.8	74.9	63.7	592.4

- 2.3 Further details of the build up to these figures are set out in Appendix A.
- 2.3 The key assumptions on which this estimate is founded are:-
- At outturn price levels (i.e. includes allowance for inflation)
 - Award of Infraco contract in early October 2007.
 - Completion of construction works by December 2010 for both phases 1a and 1b and commencement of revenue service in July 2011.
 - The risk allowance calculations are based on an updated risk register and quantified risk assessment at P90 level including Optimism Bias.
 - Phase 1a is delivered concurrent with Phase 1b

**Edinburgh TRAM Project
(Commercial In Confidence)**

- Appendix A details several exclusions from the cost estimate such as invasive species removal and Utility diversions associated with the EARL project.
- A 8/16 trains per hour (tph) service pattern

2.4 Principal exclusions from the estimate are:-

- Supply of depot vehicles. These will be procured on a lease basis and funded from operating costs.
- Invasive species removal – assumed to be undertaken by CEC as this is a statutory obligation.
- Edinburgh ‘Open For Business’ publicity campaign.
- Mock up of tram vehicle
- Ingliston Park And Ride temporary works which is to be separately funded by SESTRAN.
- Utility diversions for the EARL works.

3.0 Confidence in Estimate

3.1 Quality of Estimating Information

Based on the estimating methodology used, the level of certainty associated with the Project Estimate is considered to be relatively high, in view of the high proportion of the estimate being calculated from firm estimating data such as returned tender prices and rates or quantified design information. The certainty of the estimate has been further reinforced by benchmarking against tender return rates and prices obtained from the Mersey Tram Infrastructure project.

The table below, derived from the more detailed analysis contained in Appendix A1, shows the balance of estimate cost falling in the categories of high, medium and low confidence levels:

Confidence Category	Confidence basis	% of Project Estimate Total
Green – High Confidence	Estimate based on rates and prices derived from firm bids received or on known rates applied to work/resource quantities	31%
Amber – Medium Confidence	Estimate based on market rates applied to quantities derived from the Project preliminary designs. See also Note 1	67%
Red – Low Confidence	Lump sum allowances with little or no backup	2%

Note 1- Includes a small element of estimating allowances for unmeasured items

This analysis indicates a comparatively high level of confidence in the estimate total given that 98% of the total falls within the High and Medium confidence levels. This is further reinforced by the conclusion of the benchmarking exercise with Mersey Tram which shows that the Project Estimate compares favourably with returned bids for the infrastructure element of the Mersey Tram system in Liverpool.

**Edinburgh TRAM Project
(Commercial In Confidence)**

3.2 Benchmarking

Previous Project Estimates for the Edinburgh Tram Network have been established on the basis of a “first principals” approach as well as benchmarking against the Dublin, Nottingham and Croyden Tram projects. Cost data from returned tenders for the Mersey Tram Infrastructure project has subsequently been obtained for the purposes of benchmarking the Project Estimate.

Benchmarking has been undertaken against the Mersey Tram returned tender for infrastructure works. This has enabled a greater degree of certainty and confidence to be obtained in respect of the infrastructure element of the Project Estimate for the Edinburgh Tram Network.

The Mersey Tram tender price data provided is of sufficient detail to enable analysis and consolidation of prices into unit rates (Element Unit Rates) for key elements of the tram system e.g. tram stops, OHLE, track etc. These Element Unit Rates have then been compared to comparable Rates derived from the Project Estimate.

This has established that this infrastructure element of the Project Estimate for the Edinburgh Tram Network are generally comparable with those derived from the market tested tender received by Mersey Tram. The exception to this is in the area of contractor’s overhead and profit allowance was insufficient.

Having made appropriate adjustment within the updated Project Estimate (November 2006), for the Contractors Overhead and Profit, it is concluded that this exercise further reinforces confidence in the Project Estimate.

Further details of the benchmarking exercise are set out in Appendix B. This explains how the comparison has been made and the conclusions drawn.

3.3 Further Work

Notwithstanding the estimating work undertaken to date, and the reasonable high level of certainty obtained, the Edinburgh Tram team continues to refine the Project Estimate, as the project develops. Refinements will focus on:-

- A further value engineering exercise to be undertaken in November with a view to driving out further savings and increasing contingency allowances.
- Updating the estimate for emerging detailed design, particularly in respect of utilities diversion work.
- Firming up savings in the depot construction.
- Firming up on the Network Rail immunisations works estimate.
- Refining the estimates for the new and existing structures element of the infrastructure works.
- Further benchmarking against both Mersey Tram and Dublin Tram System price data for all elements of the Project Estimate.
- Exploring potential savings in adopting a steel solution for the Edinburgh Park Viaduct.
- Adjusting for the staged delivery of Phase 1b.

**Edinburgh TRAM Project
(Commercial In Confidence)**

4.0 Principal Elements of the Estimate

4.1 External and Internal Costs

The Edinburgh Tram Project work can be divided into the following principal elements:

- External Costs - Costs of works to deliver Edinburgh Tram Network under contract with third party contractors and suppliers
- Internal Costs - The management, supervision, design and legal costs, accommodation and general o/h costs (both directly employed and via consultancy)
- Risks – Allowances for the risk events contained in the Project Risk Register

A summary of the key sections of work, associated with both the External and Internal Costs is given in Section 4.2 and 4.3.

4.2 External Costs

The constituent elements of the External Costs are described in the following table.

Work Package	Key Element of Works
Infraco	Track, electrification, tram position indicator and comms systems, structures (bridges, retaining walls), tramstops, substations and miscellaneous buildings
Utilities - MUDFA	Diversion of water, gas and electrical works (MUDFA contract) principally under the street
Utilities – Ancillary	Diversion of high pressure gas mains, telecoms and HV cables – under direct contracts with utilities companies Power Upgrade works. Works to the Scottish Power infrastructure to provide required level of power to Edinburgh Tram Network substations.
Land & Property	Cost of purchasing the land over which the tram network passes
TRAMCO	Supply and commissioning into the Tram Network of the tram vehicle based on the contract being novated to Infraco
Advance Works	Various enabling works packages which have been identified to assist the timely completion and delivery into revenue service of the Tram Network.
Third Party Agreements	Network Rail immunisation works and other works associated with third party agreements

4.3 Internal Costs

The constituent elements of the Internal Costs are described in the following table.

Work Package	Key Element of Works
tie Project Management	tie's management cost tie corporate contribution, including internal project management, commercial

**Edinburgh TRAM Project
(Commercial In Confidence)**

	management, associated administrative support, IT and accommodation costs.
DPOFA	Resources of the operator, Transdev, up to delivery into revenue service.
Legal	External legal work and advice to deliver DOPFA, SDS, TramCo and InfraCo contracts (by DLA piper) and cost of legal support in respect of land acquisition, obtaining TTRO and TRO consents (by D&W).
SDS Design Services	The design of the Edinburgh Tram Network infrastructure and tram vehicle to detailed design stage by SDS.
JRC	Joint Revenue Committee – modelling and patronage and revenue forecasts undertaken by Steer Davies and Gleave Limited
TSS	Resources and services provided by TSS for the validation of designs by SDS, validation of the Project Estimate and general management, technical and commercial support.
Design Support	Costs incurred in previous years in respect of design
3 rd Party Negotiations	Costs incurred in previous years in respect of third party negotiations
Communications / Marketing	Communication and marketing activities undertaken in respect of the Project
TEL	Costs of TEL management personnel to support the project
Service Integration	Costs incurred in previous years
PUK	Costs of PUK resources to support the Project Board and DPD sub committee.
Financial Adv	Costs for work undertaken by PWC.
Insurance	Estimated costs of project wide insurance (Owner Controlled Insurance Programme)

5.0 Basis of Estimate

5.1 General

As noted in Section 3.0, the Project Estimate has been calculated based on different types and quality of information including received tender rates and design information. The following sections highlight noteworthy issues associated with the information upon which the Project Estimate has been based, for each of the main sections of works.

5.2 External Costs

5.2.1 Infrastructure Works

The estimate for infrastructure works to be delivered under the Infraco contract is based upon:

- Preliminary design drawings and specifications developed by SDS.

**Edinburgh TRAM Project
(Commercial In Confidence)**

- A Time Chainage Programme has been created by SDS, which provides greater certainty regarding the viability of the work and the robustness of the programme, and which informs the estimating process.

5.2.2 Utilities Diversions Works

The following issues are highlighted with respect to the estimate associated with the Utilities Diversions work (including MUDFA together with other Utilities diversions).

- Preliminary design drawings and specifications were prepared by SDS and these formed the basis of the MUDFA tender documentation.
- The rates, prices and allowances in the MUDFA contract have been used as the basis for the estimated cost of MUDFA utilities diversion works.
- Estimates from SGN and other telecoms utilities have been obtained which again form the basis of the Utilities – Ancillary works – estimate..

5.2.3 Power Network Upgrade

The Project Estimate has been updated to reflect the quotations received from Scottish Power in respect of the Power Network Upgrade.

5.2.4 Tram Vehicle

TRAMCO tenders have now been received and the Project Estimate has been updated accordingly based on the prices received.

5.3 Internal Costs

5.3.1 tie Project Management

A Project Management Team Structure has been developed for duration of project from which a resource schedule has been prepared. The cost allowed in the Project Estimate has been built up by applying known resource rates to this resource schedule.

5.3.2 Design Costs

SDS design costs are included on the basis of the SDS contract sum adjusted for known changes.

5.3.3 Legal Costs

The following issues are highlighted with respect to the estimate associated with legal costs.

- D&W have provided a costed resource forecast to support land acquisition, TTRO and TRO consent processes. This has been used as the basis for this element of the Legal Costs

**Edinburgh TRAM Project
(Commercial In Confidence)**

- The drafting of the Infraco Contract is fundamentally complete but allowance has been included for negotiation costs during the next stage.

5.3.4 TEL Costs

Estimate based on costed resource schedule.

5.3.5 Transdev Costs

Estimate based on costed resource schedule.

5.4 Assumptions Register

The Assumptions Register is contained within Appendix C. This contains detailed information with respect to basis on which the various elements of the estimate have been built up. This register is closely linked to the Project Risk Register based on which risk allowances are calculated.

6.0 Estimate Process

- 6.1 The Project Estimate has been derived using robust management and estimating tools to optimise the certainty of the estimate and to ensure that due allowance is made for all elements of the Project scope. In particular reference is made to the Budget Coding Process Diagram contained in Appendix D which is an indication of the consistent and co ordinated way in which the Project Estimate has been prepared.
- 6.2 SDS, the ETN designer, has through their QS (Corderoys) prepared quantified estimates for the Infrastructure Works (Infraco) and the Utilities Works. Cyril Sweett Limited have also produced independent estimates for both the infrastructure and utilities works (refer to CSL reports : Infraco Package – 21 September 2006 and MUDFA Works – 13 October 2006).
- 6.3 Estimates from both parties have been reviewed and reconciled by TSS (Turner & Townsend) the Project's cost estimating advisors. This Project Estimate has also been derived from separate estimates based on works outwith the Infraco and Utilities elements.
- 6.4 The Project Estimate has been further informed based on the following:-
- Power upgrade costs have been provided by Scottish Power
 - Land and property costs. These are estimated based on the District Valuer's estimate of the most likely compensation costs
 - Management costs have been prepared using a priced resource schedule
 - To these stamp duty and ancillary costs have been added
 - Design costs are the anticipated outturn costs for SDS, the projects designer, with the contract sum adjusted for current and anticipated charges ????

**Edinburgh TRAM Project
(Commercial In Confidence)**

- Legal Costs are the validated estimates for works by DLA Piper and D&W. The D&W estimated costs have been prepared using a priced resource schedule
 - Similarly the DPOFA and TEL estimated costs have been prepared on the basis of a priced resource schedule
- 6.5 As part of the project estimate update, the project risk register has been updated, with cost impacts and risks re-assessed. The cost allowance for the cost impacts are principally time related costs. These have been re-assessed using the estimated Infraco contract costs, Infraco time related costs and the Project's management costs. A QRA has then been applied to the risk and cost impacts to derive a risk allowance at the P90 level, to include for Optimism Bias. Risk represents 12% of the underlying costs. This is considered to be an appropriate allowance to allow for cost uncertainty at this stage of the Project.
- 6.6 The Tram Vehicle and MUDFA contract costs are fixed price at outturn cost levels. The base estimate costs for remaining items are estimated at (2nd Quarter 2006) current price levels. Costs have been inflated over the duration of the works to summer 2011 at an annualised rate of 5% with a further 1% allowed on risk given the uncertainty of forecasting future market price levels. This allowance is consistent with the forecasts assessed by the RICS Building Costs Information Services (BCIS).
- 6.7 The estimate build ups and summaries have been arithmetically checked and all transfers of figures checked as correct
- 6.8 The Project Estimate has been reviewed and validated by the project's technical advisors, TSS, using their sub-consultant, Turner & Townsend, who confirm that the estimate has been correctly prepared and that it represents a realistic assessment of the Project Costs.
- 6.9 The estimate contains lump sum allowance for various work items. These total £9m representing 2% of the underlying cost.

**Edinburgh TRAM Project
(Commercial In Confidence)**

7.0 Recommendation

7.1 The Board is recommended to endorse the Preliminary Design Stage Project Estimate Update as set out in this paper.

Proposed Gary Easton Date:- 9/11/06
On Behalf of Technical Support Services

Proposed Geoff Gilbert Date:- 9/11/06
Project Commercial Director

Recommended Andie Harper Date:- 9/11/06
Project Director

Approved Date:-
David Mackay on behalf of the Tram Project Board

APPENDIX A

COST SUMMARIES

(See separate Excel File)

APPENDIX B

BENCHMARKING REPORT

**RECONCILIATION OF EDINBURGH TRAM SYSTEM ESTIMATE WITH
COSTS OF MERSEY TRAM**

Scope

Review Mersey Tram Tender Return Information in bench mark exercise to validate SDS Edinburgh Tram Network Estimate.

Information Source

A copy of a Mersey Tram (MT) Tender Return (fax dated 24th October 2006) was made available for analysis. This constituted a hard copy summary of a tender for Mersey Tram - Line 1 together with soft copy supporting information generally comprising general arrangement drawings, geotechnical information and tram vehicle specification.

The hard copy summary contained some quantity information but this was not sufficient to allow a detailed comparison to be carried out. It was, however, sufficient to allow a high level review.

Methodology

The MT document was reviewed to identify areas of similarity to the Edinburgh Tram Network. It was decided that analysis would focus on items that could be defined as:

Linear - Track Work, Highways, Power Supply, OHLE and Signalling/Communications

Discrete - Tram Stops, Operations & Control Centre and Maintenance Equipment.

The MT document could be readily broken down to this level for comparison with the ETN estimate.

Analysis of Civil Works such as Structures, Retaining Walls and Culverts was disregarded as these elements are generally driven by the unique location of any particular network.

Base Information

Key quantities for MT have been identified and are summarised in Appendix A, Table 1. Due to the nature of the MT information received, only four elements are identified:

- Tram Length
- Tram Numbers (fleet size)
- Twin Track Route length
- Stops

This information has been used in the analysis of the Mersey Tram to provide high level comparisons with the Edinburgh Tram Network.

Results

Linear items

Analysis revealed that there was a degree of disparity between individual components within the identified linear items. Table 2 of Appendix A indicates the level of this disparity. This can be attributed to the fact that it is not clear exactly what scope is included within each sub element of the MT document. However, when viewed collectively there is a strong correlation between the two Projects with the variance of -2.17% falling within acceptable tolerance levels.

Discrete Items

Three main discrete elements were analysed - the depot, maintenance equipment and Tram Stops. Table 3 (Appendix A) high-lights the variances identified. The following observations should be borne in mind when reviewing this information.

1. The Edinburgh Tram Network (ETN) depot has been designed to accommodate a future fleet capacity of 40 number trams each 40 metres long
2. The Mersey Tram (MT) is only 30 metres long and the Line 1 fleet size consists of 21 tram sets
3. The MT Stops have been designed to allow 2 number 30 meter trams to stop simultaneously i.e. they are 60 metres long. ETN Stops are 40 metres long
4. Tram Maintenance equipment will, generally speaking, be of a similar nature for both Networks. There is insufficient detail included in the MT document to allow detailed comment.

Preliminary Items

Insufficient data was available for a detailed comparison of Prelim Items between the two Projects. The ETN Prelim amount has been independently confirmed using a "first principal" approach together with bench marking against other Tram Projects (Dublin, Nottingham and Croydon). However, the analysis of the MT document suggested that insufficient allowance for Contractors Overhead and Profit has been made within the ETN estimate. Table 4 refers.

Conclusion

The review of the Mersey Tram tender document has provided a reasonable level of confidence in the Edinburgh Tram estimate. In particular, linear items appear to correlate well between the two Projects. Discrete items also appear reasonably close given the differing nature of the respective Tram fleet numbers and physical dimensions of the Trams. In addition, it is unclear what element of "future proofing" has been built into the MT estimate. It is known that the current ETN design and base estimate contain provision for future Network expansion for Section 4 (Granton Square to Newhaven) and ultimately Phase 3 (Edinburgh Royal Infirmary).

tie Limited

**Edinburgh TRAM Project
(Commercial In Confidence)**

With regard to Preliminary Items, the identified shortfall within the ETN Prelims calculation for Contractors Overhead and profit has been addressed with an additional allowance being added to the INFRACO construction element.

Note:- See Separate Excel file for Table referred to in text above

APPENDIX C

ESTIMATE ASSUMPTIONS

(See separate Excel file)

APPENDIX D1 & D2 ESTIMATE CODING

(See separate Adobe files)