EDINBURGH TRAM PROJECT

INFORMATION TO SUPPORT AUDIT SCOTLAND REVIEW

BENCHMARKING OF PROJECT AGAINST OTHER SCHEMES

Introduction

This paper summarises the work that the Project has undertaken to benchmark its estimates and the caution that should be exercised in drawing conclusions from high level comparisons of rates per km route length.

Background

There are a limited number of tram schemes within the UK from which to obtain cost benchmarking data. These schemes are effectively bespoke projects in cities with differing topography, construction constraints and under differing procurement arrangements. For example Croydon and Nottingham were procured under PFI arrangements whereas the Edinburgh Tram Project is being procured under a more conventional procurement strategy. All schemes have differing proportions of on road and off road track. This affects the cost per metre quite significantly. However, there is value in making such comparisons at the elemental level, for example the comparable rates for tram vehicles, overhead line electrification and tram stops, after normalising for variable factors where these are known.

Drivers of Cost Variability

The cost drivers which create the variability in scheme costs expressed as a rate per metre are as follows:-

1. Market Condition prevailing at the time of bidding – The prevailing construction market conditions affect the levels of profit, labour and materials costs in contractor's bids. Conditions differ between schemes.

2. Procurement approach – PFI approaches will result in higher costs due to the magnitude of risk included in deals at the commitment stage.

3. Allocation of costs within each scheme – differing schemes tend to categorise costs in different ways – some schemes group overhead line electrification with power feeds whereas others provide them separately. In addition some schemes include for utilities diversion costs and others do as they are undertaken by separate agencies.

4. Topography of the location for schemes – This will drive the costs for structures required to support a tram network. For example the

Merseytram scheme has very few structures whereas the scheme in Edinburgh, particularly Phase 1a has a number of large bridges and underpasses which push scheme costs up.

5. Length, type and number of tram vehicles - Different schemes run to differing service patterns which in turn drives the vehicle length and number of vehicles required. This also drives:-

    a. the size and extent of depot required to service vehicles

    b. the length and cost of tram stops

    c. the extent of track crossovers.

6. Extent of tram routes running "on street" – Different schemes have differing proportions. On street works is considerably more expensive than off street as the working constraints are much greater in city centre on street locations.

7. Extent and type of road and paving finishing's – different cities have different sensitivities to the standard of finishes. This will affect scheme costs significantly.

8. The number of tram stops – Different schemes have different numbers of stops depending on the locations of the communities they are to serve.

The variability in these factors between schemes and the limited detail in cost data available mean that such high level cost comparisons are suitable for 'order of magnitude' cost estimating and where sufficient scope information is available for elemental cost comparisons. Therefore, direct comparison between the cost per km of schemes needs to be treated with some caution. The reasons for the wide variability in costs per km are acknowledged within the NAO Report – "Improving Public Transport In England Through Light Rail" dated 23 April 2004.

Edinburgh Tram Network Benchmarking

To support its estimating activities the Edinburgh Tram Network has undertaken benchmarking exercises. The level of information provided for Merseytram was better developed and readily applicable to ETP (Table 1) whilst whole construction costs have been benchmarked against National Audit Office data (Table 2) has been carried out utilising The comparisons are shown in the appended tables.

This shows that at £22.73m/km, as would be expected, the cost of the Edinburgh Tram Network is at the upper end of the range. This is as expected because the

following factors are particularly significant when comparing this scheme to others (in order of influence):-

1. The proportion of on street route is very high at 42% - The comparatively low productivity achievable on street, the requirement for extensive refinishing, junction work and associated utilities diversions for this element drives up the overall rate per km costs considerably. This accounts for £101m of total scheme costs or £4.3m per km route.

2. The high proportion of structures (bridges, underpasses and retaining walls) – This is due to the line of the route following and crossing the mainline rail line several times and the particular topography of Edinburgh.

3. The requirement for the depot to be constructed at reduced level given its proximity to the airport.

4. The need for expensive EMC immunisation works given that the route follows the mainline railway for a considerable proportion of its length.

Excluding these items the rate is £16.55m/km which is comparable with the costs of other schemes.

The more detailed comparisons with the Merseytram scheme that we made, in order to validate our estimates, show that the costs are comparable at element level. Details of this comparison are shown in Table 1. This provides confidence that the scheme is deliverable within our DFBC estimate.

EDINBURGH TRAM PROJECT

TABLE 1

BENCHMARKING OF PROJECT AGAINST MERSEYTRAM

	Edinburgh Tram Project					Mersey Tram				
	Element Cost	**EUQ**	**Other EUQ/EUR**	**EUR**	**EUQ Description**	**Element Cost**	**EUQ**	**EUR**	**EUQ Description**	**COMMENTS**
Infrastructure and Vehicle costs										
Design	26,346,342	23,352		1,128	£/m route					
Preliminaries	41,058,658	23,352	16%	1,758	£/m route	40,610,716	17,330	2,343	£/m route	
Track – on street	40,883,237	9,779	42%	4,181	£/m track	7,775,287	4,610	1,687		
Track - off street	42,551,941	13,573	58%	3,135	£/m track	29,060,560	12,604	2,306		
Highways	23,815,724	23,352		1,020	£/m track					
OLE	29,240,610	23,352		1,252	£/m track	7,333,749	17,330	423		
Tramstops	5,123,774	31		165,283	£/nr	4,757,740	26	182,990		
Vehicles	63,494,505	31	2,719	2,048,210	£/nr					
Depot	23,502,371	23,352		1,006	£	8,445,974	1	8,445,974		
Structures	30,296,039	23,352		1,297						None significant
Utilities	65,106,398	9,779		6,658						By others

COMPARISON

KEY:	
EUQ	ELEMENT UNIT QUANTITY
EUR	ELEMENT UNIT RATE

EDINBURGH TRAM PROJECT **TABLE 2**

BENCHMARKING OF PROJECT AGAINST COST INFORMATION GIVEN IN

NAO REPORT – IMPROVING PUBLIC TRANSPORT THROUGH LIGHT RAIL

SCHEME	ACTUAL CONSTRUCTION COST	CONSTRUCTION COST AT 03 / 04	LENGTH OF TRACK	CONSTRUCTION COST PER km 03 / 04	CONSTRUCTION COST PER km 2006
	(£ millions)	(£ millions)	(km)	(£m/km)	
Manchester Metrolink Phase 1	145	191	31	6	6.79
Sheffield Supertram	241	304	29	10	11.56
Midland Metro	145	160	21	8	8.40
Croydon Tram Link	200	218	28	8	8.58
Manchester Metrolink Phase 2	160	174	8.2	21	23.39
Sunderland Extension to Tyne & Wear Metr	98	101	18.5	5	6.02
AVERAGE	**165**	**191**	**23**	**10**	**10.79**
		ESTIMATED COST			
Edinburgh Tram Project*		555	24	23	22.73
			Adjust for:	Structures	1.30
				Depot abnormals	0.58
				EO On Street Works	4.30
*Excluding Land Costs					**16.55**

Table 2 - NAO Report - Improving Public Transport Through Light Rail

DETAILED COMMENTARY ON COMPARISSON WITH OTHER SCHEMES

Each tram project is unique and costs against these elements can vary widely. In the case of Edinburgh, the following areas are seen as key cost drivers.

- Third Party Interests – for example, a substantial part of the Edinburgh Tram Project (ETP) runs adjacent to Network Rail infrastructure which requires immunisation against electrical interference arising from the Tram Project

- Tram Vehicles – the ETP envisages the introduction of 44m Tram vehicles. This selection, in addition to actual fleet size, impacts on track alignment, tram stop size/capacity, Depot capacity (stabling of vehicles), etc

- Depot – the necessary capacity of the Depot has dictated that the Depot be located off the A8 Trunk Road adjacent Edinburgh International Airport's secondary runway. This location requires the design of the Depot to recognise the constraints imposed on it by BAA, namely the excavation of 300,000m3 of material in order to lower the profile of the depot to avoid the glide path of the secondary runway. Lowering the runway in this manner has forced the use of a major retaining wall adjacent to the A8 and the introduction of pumped drainage. These "abnormals" greatly increase the unit cost of the Depot in comparison to other projects.

- Highway Works – the World Heritage status enjoyed by the City of Edinburgh necessitates that due consideration be given to highway treatments in key areas such as Shandwick Place and Princes Street. In addition, the topography and layout of Edinburgh dictates that numerous busy signalised junctions need to be negotiated by the Tram route as it crosses the city. This, together with the need to deal with the public realm sympathetically, increases the cost of these works disproportionately.

  The proportion of on-street/off-street track also impacts on unit cost. Clearly, increased utilisation of on-street running will increase costs in catering for the disruption caused to existing traffic and the reduction in productivity in track works working within smaller work areas.

- Structures – again, the number, size and type of structures required to carry the necessary infrastructure varies considerably between differing Tram Projects. In addition to Network Rails immunisation issues mentioned above, the Edinburgh Tram Project is obliged to cross the High Speed Main Line at Edinburgh Park. This structure is also in a location where appearance and finish is required to be of a higher quality than normal, again increasing basic costs. Also mentioned above is the retaining wall required for the Depot construction. This structure has increased in scope from a relatively simple earth retaining embankment to a reinforced concrete retaining wall to accommodate the reduced level excavation.