

refurbishment. Evergreen 2 (Laing Rail), the first Design Build Finance and Transfer rail project, which is currently being constructed, is insured by an OCIP programme.

- 11.34 **tie** published an OJEU Notice for the commencement of the procurement of the OCIP programme on 27 October 2006 comprising professional indemnity (PI), construction all risks (CAR), delay in start-up (DSU), construction 3<sup>rd</sup> party liability (CTPL), operational material damage (MD), business interruption (BI) and operational 3<sup>rd</sup> party liability (OTPL) insurances. The negotiation of the construction phase insurances, including policy terms, cover, excess levels, limits, inclusions and exclusions, was concluded and insurances effected on 23 July 2007. Consideration is still being given to PI and operational insurances.

#### Terrorism and security risks

- 11.35 **tie's** advisers have recommended that an investment in security systems is made as part of the overall approach to system security including CCTV coverage to evidential standards for all stop platforms, passenger emergency / help points linked to an operations and control centre (OCC), together with public telephone facilities and appropriate levels of illumination via dedicated lighting. The tram vehicle costs include provision of CCTV coverage to evidential standards, passenger / driver communication facility and driver radio link to the OCC. Sums are included within signalling and communication costs for an automatic vehicle recognition system linked to the OCC.
- 11.36 Physical measures to protect the infrastructure, vehicles, interchanges and depot are part of the supply requirements set by the output specification for the tram vehicle and infrastructure contracts, including, the responsibility of the infrastructure provider to carry out system surveillance.
- 11.37 **tie** have considered the merits of insuring key tram assets to provide MD and BI coverage arising from the specific peril of terrorism. As part of the OCIP, terrorism insurance cover was placed with Pool Re, a government backed reinsurance pool, for the value of the construction works.
- 11.38 **tie** recognise that the confidence in the security of the tram system will have a direct relationship to the overall quality of the system and, therefore, potential patronage. **tie** appreciates that the risk of terrorism exists both during construction and operation. However, it should be accepted that the tram could continue to operate, albeit in a reduced capacity, if part of the line or depot were damaged due to a terrorist event.
- 11.39 Under DPOFA, terrorism is treated as a Force Majeure event. However, the operator is contractually responsible for the security of system operation, including incident management and security management under plans which are presented to, and agreed by, **tie** prior to system commissioning.

#### **Risk contingencies**

##### Specified contingencies

- 11.40 For the DFBC, cost estimates were built up by the SDS contractor based upon their completed preliminary design information. These had been verified by cost consultant inputs from the TSS contractor, as well as confirmation through an independent review by Cyril Sweett. Estimates had been provided without contingency and these are now being confirmed via the negotiated contract prices. Specified contingency were calculated from standard industry techniques using **tie's** detailed Project Risk Register.
- 11.41 The Project Risk Register has been developed since the instigation of the project. Each item in the risk register contains a probability of occurrence and the range of minimum, most likely and maximum financial impacts, where appropriate. The financial impacts are over and above

costs included in the base estimate. This allows a quantitative risk analysis (QRA), using Monte Carlo methodology, to be undertaken.

- 11.42 Analysis showed that a 'very high' confidence that the outturn of the project costs will be derived from the inclusion of risk contingencies as shown below. **tie** has extended this analysis in the period through the current stage of negotiations and conditional award recommendation. **tie** will continue to apply this analysis through to final negotiation and award of the Tramco and Infraco contracts in January and include inputs from the continuing design negotiation and MUDFA progress.

Table 10.4 – Risk allowances

Probability	Increase to base cost – DFBC	Increase to base cost - FBC
Very high confidence – P <sub>90</sub>	12%	16%

OB contingencies

- 11.43 By the time of the DFBC, OB was effectively eradicated, as per the findings explained in the Mott MacDonald Review of Large Public Procurement in the UK. This was in view of greater scheme certainty and the mitigation of factors built into the procurement process, as well as project specific risks and environmental and external risks. Instead of using OB, TS and CEC adopted a very high confidence figure of 90% (P90) in the estimate of risk allowances to cover for specified risk, unspecified risk and OB.
- 11.44 There are no proposed increased allowances for OB in addition to the above estimated risk allowances.
- 11.45 The level of risk allowance represents a significant proportion of the project estimate value. In addition, there remains £47m headroom between the project estimate and maximum funding available. This provides comfortable headroom of 26% over base cost estimates.

Risk allocation

- 11.46 The development of the Procurement Strategy was one of the key elements of risk mitigation for the tram project. Risk has been quantified following a detailed assessment process performed by **tie** and its advisors in accordance with industry best practice and experience.
- 11.47 There is no standard contract for use in tram schemes which embodies a settled approach to responsibility for risk and its financial implications. Bespoke forms of contract have been prepared to meet tram requirements and the proposed risk allocation, and bring consistency to the legal framework on key terms e.g. dispute resolution. **tie** and its advisors have used experience from previous tram schemes and the proposed risk allocation as a basis for settling contractual provisions where appropriate.
- 11.48 In the development of the contracts, **tie** and their advisors have designed risk allocation matrices to reflect the allocation of risks to private sector, public sector and those that are effectively shared. This is in order to construct the contracts, with clarity of those risks which the private sector will take (and allow for within their bids) and those risks which the public sector will need to manage.

Allocation during the Development Period

- 11.49 Set out below are the key risks that **tie** is responsible for managing up to award of Infraco.
- Model development, ticketing and fare strategy;
  - Tram priority in highway;
  - Land acquisition and compensation;



- Detailed Design development;
- Agreements with heavy rail parties;
- Public utility diversions;
- Consents and approvals;
- Project Management; and
- Programme and Cost Management.

11.50 During this period, **tie** has actively managed these risks both directly and through a number of key contracts identified comprising TSS, SDS, JRC and MUDFA. In addition, **tie** has been advised by the Operator, Transdev and **tie**'s legal team (namely, Dundas and Wilson and DLA Piper), procurement specialists (Partnerships UK) and insurance and risk advisers (Heath Lambert Group) on issues affecting risk.

11.51 Table 11.5 sets out the general allocation of risk during this period, and this is discussed further below. Where the table indicates risk allocated to the public sector, the risk is under the management of **tie**, but with consequences of risks being realised, impacting on both **tie** and its supplier.

Table 11.5 Development period risk allocation

Risk allocation during the Development Period				
Risk	Public sector	MUDFA contractor	SDS designer	Utilities
Land acquisition	✓			
Planning (Prior Approvals)	✓		✓	
Temporary and permanent TROs	✓		✓	
Design risks	✓		✓	
Major utility diversion quantity	✓		✓	✓
Major utility diversion cost	✓	✓		✓
Major utility diversion delay	✓	✓		
Delays to utilities agreement	✓			✓
NR related delays	✓			
Required approvals from HMRI	✓		✓	
Incorrect cost estimate	✓			
Incorrect timetable assumptions	✓			

11.52 Of the above, land acquisition, cost estimates and timetable assumptions were clearly driven by **tie** and CEC. **tie** has managed these risks through the experienced in-house team that it has assembled. The near-completed process of land assembly to budget, negotiated contract prices and agreed timetable for the project confirm the success of the mitigation approach.

11.53 Ultimately, the SDS contractor is responsible for planning consents being appropriate for the scheme, and there are sanctions under the SDS Contract for poor performance. However, the fundamentals of the success of planning applications will be determined by CEC's and **tie**'s preferences for the specification of the system. Therefore, the risk of the success of the planning process must remain at least partially with the public sector, albeit with some of the financial risk of increased costs passed to SDS, and ultimately to Infracore, during the Implementation Phase.

11.54 Design risk covers risks of failures in the design affecting the ongoing scheme. During the development period this could manifest itself as a problem with a planning matter, a utility diversion design or the instructions to bidders for the Infracore contract. This risk is partially transferred to the SDS contractor through their contract, although it is likely that some of the consequences of a significant problem with a design failure would be borne by the public sector. Up to Financial Close, **tie** is managing and mitigating this directly with the help of

TSS. A function of TSS is to validate that the SDS design meets the system performance requirements.

- 11.55 Risk for the execution of utilities diversions has been transferred under MUDFA. The scope of work has been specified by the utilities and designed by SDS and the risk that these are significantly greater than anticipated are covered by the public sector. **tie** had carried out detailed survey works under SDS to get a view of the quantity of works to be required. Additional survey and trial hole works have now been undertaken by AMIS to obtain greater clarity of both quantity and accuracy of the location. Together with the significant allowances included in the risk register, this approach mitigates the exposure of the public sector.
- 11.56 Should MUDFA fail to complete in time to allow Infraco on to the site, then the public sector will be responsible for delay to Infraco works. However, in certain locations, utility diversions will be undertaken by the Infraco contractor, as this provides practical advantages for construction works or traffic management reasons. **tie** is mitigating the risks to programme arising from delays in MUDFA by incentivisation of the MUDFA contractor to complete on time. This risk further minimised by:
- (i) The early involvement of the MUDFA contractor during design development with SDS;
  - (ii) The early scheduling of utilities diversion works which are anticipated to be significantly advanced, by the time that the Infraco contract is signed; and
  - (iii) Release to Infraco, as staged handovers, of completed sections.
- 11.57 Cost estimates and timetable estimates were developed by the Project supported by TSS and the SDS Contractor and have been informed by the tender returns from Infraco and Tramco. The responsibility for the consequences of increases in cost and programme will be borne solely by the public sector up to the date of Financial Close. **tie** has used the TSS Contractor, the operator Transdev and its internal resource to challenge assumptions and potential cost creep throughout this process and validate scheme deliverability within affordability limits as set out in section 10, Financial Analysis.
- 11.58 In summary, the public sector is exposed to significant, but diminishing and manageable, risks during the remaining period of scheme development. The introduction of the SDS contractor and MUDFA contractor in the procurement strategy reduced risk to an extent. However, as in all projects of this type, the major responsibility for identifying and managing potential risks during this period remained with the project team and their advisors. **tie** has assembled a team with significant experience in the tram industry and rail sector and, together with the TSS contractor, the operator, and its other advisors, has demonstrated that it has the necessary skills to manage risk during this period.

#### Allocation during the Construction Period

- 11.59 The financial risk that the Infraco contractor will be exposed to at any point in time is the amount of money that it has expended, less the amount it has been paid, along with bonding and warranty requirements, including relevant sectional liquidated damages. The payment mechanism will be against fine grained milestones and, subject to the achievement of those milestones, there will not be a large exposure for the contractor based on the difference between income and expenditure on the contract. The specific proposals for the payment mechanism under the Infraco contract are given in section 7. Table 11.6 shows the risk allocation in the Construction period.



Table 11.6 Construction period risk allocation

Risk allocation during the Construction Period				
Category	Risk	Public sector	Infraco contractor	MUDFA contractor
Design	Changes in fundamental design and performance requirements.	✓		
	Changes in construction design and failure of design post award of Infraco.		✓	
	Award of Prior Approval consents.	✓		
	Provision of adequate submissions necessary to obtain Prior Approval and TRO consents.		✓	
Utilities	Major utility diversion quantity.	✓		
	Major utility diversion unit cost.	✓		✓
	Major utility diversion delay.	✓		✓
	Minor utility diversion quantity.		✓	
	Minor utility diversion cost.		✓	
	Minor utility diversion delay.		✓	
Construction	Force Majeure.	✓	✓	
	3 <sup>rd</sup> party claims.	✓	✓	
	Ground condition.	✓	✓	
	Archaeology.	✓	✓	
	Site safety.	✓	✓	
	Technology risk.	✓	✓	
	Compliance with street possessions.		✓	
Commissioning	System integration failure.		✓	
	Failure to meet standards.		✓	
	Inappropriate vehicle.		✓	
	Required approvals from HMRI.		✓	
Contractual / Financial	Weaknesses in contractual interfaces.	✓		
	Incorrect cost estimate.		✓	
	Incorrect timetable assumptions.		✓	

11.60 **Design** – Changes in design which are required by the public sector after the signing of the Infraco contract will be at the risk of the public sector. The progress of detailed design has somewhat mitigated this risk. However, a significant failure in the agreed design will effectively be transferred to the Infraco contractor following novation. Provision of consents for Prior Approvals and Temporary and Permanent TROs by the statutory authorities remains a public sector risk, but provision of the necessary information in the required format and timescales will be at the risk of SDS and / or Infraco.

11.61 **Utilities diversion** – As discussed above the risk associated with utilities diversion under the swept path of the tramway remains with the public sector. The risk of the impact of any delays caused by incomplete utility diversions at the time of commencement of on-site work by Infraco will be carried by the public sector (but it is expected that they will be complete in key areas).

11.62 **Construction risks** – The strategy transfers all of the typical risks transferred under a construction contract, including the:

- Requirement to construct a scheme that complies with the Employer's Requirements;
- Risk of gaining required approvals and consents (Prior Approvals and TROs excepted);

- Risk of integrating an co-ordinating work with sub-contractors;
- Risk relating to interpretation of the provided information;
- Risk relating to non-performance; and
- Risk relating to 3<sup>rd</sup> party interfaces.

11.63 The financial consequences of failure by the Infraco contractor are covered either by OCIP or are borne by Infraco, up to a capped level as is usual in contracts of this nature. There are further sanctions in the unlikely event that such caps are exceeded.

11.64 **Commissioning risks** – These risks represent the situation whereby: once all of the assets have been delivered, they do not work properly together and need to be changed. Under the enhanced conventional approach these are transferred to the private sector by the institution of a robust regime of acceptance tests aligned to the payment mechanisms described in section 7.

11.65 **Contractual risks** – It is imperative that **tie** ensures that the risk of problems arising at the interfaces between contracts is minimised. This risk will be significantly reduced by **tie**'s decision to novate the SDS and vehicle contracts to the Infraco contractor, the principle of which has been agreed by the Infraco Preferred Bidder, subject to the conclusion of due diligence on the design.

11.66 **Financial risks** – If significant supply cost increases emerge these will be absorbed by the Infraco contractor other than those arising from certain statutory changes.

Allocation during the Operating Period

11.67 Under the Procurement Strategy, **tie** has sought to manage the infrastructure risks during the operating period based on contractual obligations as described in section 7. Table 11.7 shows the risk allocation during the Operating period.

Table 11.7 Operating period risk allocation

Risk allocation during the Operating Period			
Risk	Public sector	Infraco contractor	Tram operator
Revenue	✓		
Operating costs	✓		
Maintenance unit cost		✓	
Maintenance quantity		✓	
Latent defects		✓	
Failure of warranties on subcontracts		✓	
Supply chain failures		✓	
Operation resource provision			✓
Failure to meet standards		✓	✓
Operational safety		✓	✓
Inflation risk	✓		
Service running times	✓	✓	✓
Failure to provide promised tram priorities	✓		

11.68 Maintenance and latent defect risks are key risks which are effectively transferred under the payment and incentive mechanisms as explained in section 7. Allied to these are risks associated with the supply chain and failures in warranty provisions (e.g. due to bankruptcy of original subcontractors). For a significant system maintenance period of at least six years and up to 15 years from commencement of revenue service, it is intended that the Infraco contractor will bear not only the costs of correcting defects, but also performance deductions for the period during which the system is unavailable. There are also bonuses / penalties associated with the qualitative performance of the contractor.



11.69 A key driver for the eventual success of the system will be the delivery of the required service run-times. The risk of the tram system being capable of achieving the required service run times is passed to the Infraco, subject to delivery of the planned junction priorities and provision of operating resources by DPOFA. All other major risks associated with running times, are transferred to the Infraco contractor during the time it has a commitment to the project, save for standard contract carve outs which are covered through the OCIP insurance (e.g. interference).

#### Risks retained by Public Sector

11.70 The extent of public sector retained and shared risks has been assessed by **tie** and **tie's** procurement advisors and has been reviewed by CEC officials. This has identified the risks that will be retained through the proposed contractual arrangements and will need to be vigorously managed by the public sector. At the DFBC stage, the principal retained risks were associated with:

- The acquisition of land to allow construction to commence;
- The design development and advance utility diversion works;
- Granting of Prior Approvals and Temporary and permanent TROs;
- The completion of all necessary advance works prior to commencement of main construction works;
- The procedures for processing of potential stakeholder instructed changes during design development;
- Care in the selection of tram vehicle supplier in achieving compatibility with infrastructure (albeit integration risk is to be taken by Infraco); and
- Potential future VAT, tax and legislative changes that could influence the scheme.

11.71 At the current FBC stage, a number of the above risks have been either effectively mitigated or considerably reduced in their significance. This relates particularly to land acquisition, which is near complete, and the successful execution of some of the required advance works, currently progressing ahead of programme. Although agreement has been reached via established governance arrangements on stakeholder changes during design development, a risk remains if further changes are instructed. The risk relating to the selection of the tram vehicle supplier is mitigated through the programme of facilitated negotiations between Infraco and Tramco following selection of the respective preferred bidders and the novation of Tramco following contract award.

11.72 The following risks remain relevant as risks retained by the public sector as their exposure period extends beyond the timing of this FBC:

- Granting of Prior Approvals;
- Granting of permanent TROs (risk of obtaining Temporary TROs is transferred to Infraco);
- Stakeholder instructed design changes; and
- Potential future VAT, tax and legislative changes.

11.73 In addition to the above 'development' and 'construction' related risks, it is noted that the public sector will need to consider:

- The loss of project momentum and additional costs that may be incurred through delays to the consideration and approval of the Business Case;
- Underestimated management costs associated with the scheme;
- The financial governance arrangements to ensure timely and appropriate release of funds; and
- Procurement delays.

**Risk management strategy**

11.74 The following section briefly summarises the risk management strategy in the ‘short’, ‘medium’ and ‘long term’ including planning engagement, co-ordination of risks, the approach used achieve market commitments for deliverable packages of work and reaching financial close to commence Infraco construction activities.

Key Milestones for Risk Management

11.75 The key material risk to **tie** post contract signing relates to requests for changes to the scheme that result in cost increases. However, **tie** has significantly mitigated the risk of operator requested change through the early involvement of Transdev, through the DPOFA, and through early design work by SDS. As discussed above, four potential risk areas remain with CEC and **tie**, relating to utilities diversions, highways work, planning and service integration.

11.76 **tie** is confident that the scheme development work undertaken to date and the procedures it has to adopted on design sign-off captures design innovation and cost reduction but also minimises the potential for any change which will exceed planned overall expenditure.

11.77 **tie** continues to ensure that the appropriate governance controls are applied to the remaining stages of the development of the tram system. **tie** have identified the principles and commercial implications of the Procurement Strategy for Phase 1a of the tram with details of the consequential elements of management, design, procurement and construction activities that effectively de-risk the main infrastructure contract. The key project needs for risk management and the solutions proposed are summarised in Table 11.8.

**Table 11.8 – Risk management solutions**

<b>Project needs</b>	<b>Solutions</b>
Continued technical support.	<b>TSS</b> – technical reviewer, management and support to <b>tie</b> .
Early system design.	<b>SDS</b> – infrastructure and system designer novated to Infraco.
Refine revenue projections.	<b>JRC</b> – assessor and estimator of revenue generation from the operating tram network.
Control of infrastructure cost risk.	<b>SDS</b> – Advance survey works and design development.
Obtaining necessary consents.	<b>SDS</b> – Advance design development and modelling and agreement of process protocols with CEC by the project.
Reach agreement with key 3 <sup>rd</sup> parties.	Ongoing stakeholder management and Agreements e.g. NR, BAA.
De-risk the main infrastructure works.	<b>SDS / MUDFA</b> diversions – Advance design and utility single framework diversions .
Select an appropriate tram vehicle.	Vehicle manufacture, design and maintenance contract(s) novated to Infraco after negotiations between preferred Tramco and Infraco bidders to resolve all issues prior to novation.
Ensure system integration .	<b>Infraco</b> – implementation company, responsible for construction, integration and maintenance of the tram system.

11.78 A number of other potential supporting contracts and agreements are required in relation to planning supervisor, property and land acquisition, Roads Authority, NR, power and policing. A large number of these contracts are either implemented or at an advance stage of drafting. The risk profile of the project changes significantly when the commissioning of the system is

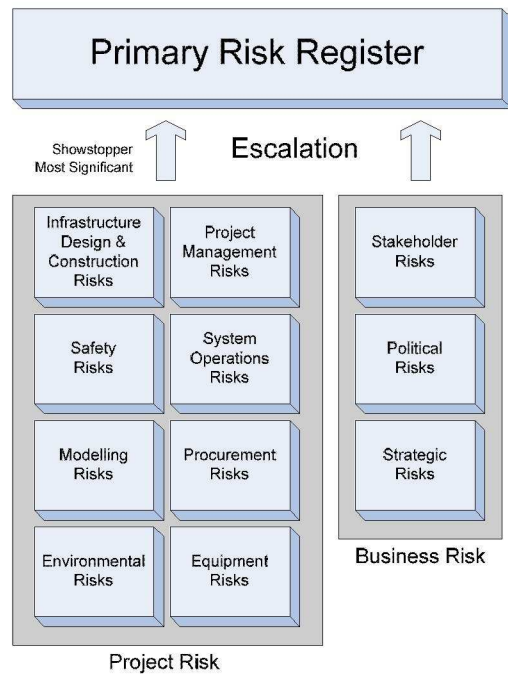


complete and the operations commence. The Infraco contractor's role as integrator for the system means that significant elements of the project risk will transfer to it.

Deliverables to support risk management

- 11.79 **tie** continue to hold risk management as a core value and have reflected this in the service provider contracts which include obligations to provide risk management deliverables including the following:
- **Project Risk Management Plan** to confirm the objectives, roles and responsibilities, definitions, risk management process and application throughout scheme development, procurement and construction phases;
  - **Assumption Register** to record all capital, operating and lifecycle costs, revenue, programme, quality, functionality and approvability assumptions and consequent risks to the project throughout scheme development, procurement and construction phases;
  - **Project Risk Register** to summarise all capital, operating and lifecycle costs, revenue, programme, quality, functionality and approvability risks to the Project and proposed mitigation;
  - **Risk Progress Report** on status of risk management and mitigation indicating summary of new risks identified, new assumptions, key matters to be resolved and achievements; and
  - **Project Estimate Reports** indicating the estimated capital cost and programme contingency allowances to be considered.
- 11.80 **tie** holds risk workshops and one-to-one meetings with those responsible for mitigating project risks. Regular risk management meetings and workshops have been held and **tie** will continue to do so during the remaining development and planned construction phases. The allowance for this in supporting the above deliverables has been included in all service provider remits.
- 11.81 **tie** reports on the emerging Tram Primary Risks to the TPB. This comprises Stakeholder Risks, based upon the severity of risk to project viability and immediacy to mitigate risks e.g. project affordability, availability of funding, approval of business case; and Project Risks based upon the magnitude of impact to cost and programme e.g. NR interface costs, late submission of TRO information, unforeseen ground conditions. Figure 11.1 summarises escalation drawn from the Project Risk Register.

Figure 11.1 – Project risk register and escalation



Key risk mitigation underway

- 11.82 **tie** will continue to identify, analyse, categorise and implement the planned mitigation for each identified and emerging risk. All of the risks identified have been discussed in detail between **tie** and their advisors and CEC, and are each subject to a risk mitigation strategy to minimise, where possible, their likelihood and severity of impact on project delivery and operation.
- 11.83 Further substantial risk mitigation will be effected through the ongoing involvement of Transdev, TSS, other specialist personnel and close liaison with CEC through all the planned phases of the project. **tie** is mitigating risks arising from tram funding issues and delay to the scheme through preparation of this FBC and its engagement with NR and public utility providers. The continued refinement of the integrated service strategy with TEL effectively mitigates these revenue risks.
- 11.84 **tie** have mitigated the risks associated with the potential market interest for the construction of the tram system by undertaking market sounding with potential Infraco consortia members; commencement of enhanced revenue model development; development of an integrated service plan with LB; commencing early design of critical areas of the system to achieve greater price certainty; engagement with the Planning Department; procuring advance survey works under SDS; and early involvement of MUDFA contractor. The successful progress to conclusion of the negotiated Infraco and Tramco contracts confirms the success of the risk mitigation approach.

Risk management process responsibilities

- 11.85 The project management responsibilities at Project Level are summarised in Table 11.9 below in a RACI chart.



Table 11.9 – Risk management responsibilities

Activity	Functional roles						
	Finance Director	Commercial Director	Risk Manager	Programme Manager	Estimating Manager	Procurement Manager	Project / Functional Managers
Development, implementation and maintenance of Project Risk Management Plan		A	R	C	C	C	C
Development of the risk management system including risk register and QRA		A	R				
Identification and assessment of risk to the Project	C	C	A	C	C	C	R
Development and delivery of risk mitigation plans	C	C	A	C	C	C	R
Update of the Project Risk Register		C	A	C	C	C	C
Quantitative QRA on estimated cost impact	I	A	R	C	C	I	I
Programme Risk Analysis	I	C	A	R	C	I	C
Allocation of risk and allowances to risk owners	I	C	A	C	R	C	C
Update of Project Estimate for Updated QRA	I	C	A	C	R	C	C
Update of Project Programme for Updated QRA	I	C	A	R	C	C	C
Reporting on Management of Risk – workstream review	I	I	A	C	C	C	R
Reporting on Risk – Project Overview	I	A	R	C	C	C	C
OB Estimate on Cost Estimates and Works Duration	I	A	R	C	C		C
Preparation and update of Contract Risk Allocation Matrices		A	C	C	C	R	C
Monitoring on Risk Management progress by Risk Owners	I	A	R	I	I	I	C
Quarterly / Milestone Risk Reviews – Risk Management Plan and Framework	I	A	R	C	C	C	C

RACI is an abbreviation for:

**R = Responsible** – owns the delivery of the activity

**A = to whom “R” is Accountable** – must sign-off (approve) the output of the activities

**C = to be Consulted** – has information or capability to contribute to the activity

**I = to be Informed** – must be notified of results

## 12. Programme summary

### Programme development

- 12.1 The original programme for the delivery of Line 1a of the tram was initially developed from a combination of SDS design and construction programmes, which in turn were based on past productivity and construction rates on other schemes in the UK, Europe and the US. To this, **tie** have added and integrated activities driven by the Procurement Strategy and key procurement dates, other stakeholder and 3<sup>rd</sup> party influences and the time allocation for other elements of the project. These were developed in conjunction with industry experience to provide a robust overall master programme. This process has then continued to evolve with the inclusion of AMIS agreed construction philosophy for utility diversions and a clearer understanding of the Infraco bidders construction programmes, aligned with the commencement of advanced works in the Gogar depot area, and of other works such as invasive weeds eradication.
- 12.2 The result of this continuous programme evolution is a robust schedule that is confidently supported by the fact that the submitted programmes from the Infraco bidders reflect almost identical timeframes.
- 12.3 The programme has been developed using standard work breakdown structures that can be aligned to the project cost breakdown structure to facilitate good project control and management application, providing data manipulation to detailed levels. This programme is built on the Primavera P3e software, generally regarded as the industry standard.
- 12.4 Many key criticalities and dependencies have been used to identify the critical path for the scheme. The criticality of much of the design activities mean the need for on-time delivery is particularly true for SDS design work and, although the delivery of design may be slower than desired, the progress on the ground is being maintained through a process of micro-management by the project team and prioritisation of the required data and information with design and construction teams to meet the execution programmes.
- 12.5 Key risks are delivery of design for construction for the utility diversion works and traffic modelling and junction designs, which form the basis of the TRO process. Also essential is the timely delivery of Detailed Design for structures to allow these key items in the Infraco contract can be de-risked and priced competitively. Other critical items identified in the schedule relate to NR activities associated with immunisation works and relocation of existing lineside equipment. The risks associated with these items are described in section 11. The full master programme is included at Appendix V to this FBC.
- 12.6 The programme is dependent on achievement of the programmed approval dates by the TPB, TEL and **tie** Boards, CEC and TS and is built on the staged delivery of Phases 1a and 1b, in line with the current affordability limits.
- 12.7 The programme identifies a number of key milestones, as detailed below, and assumes a staged delivery with Phase 1a entering revenue service in the first quarter of 2011. The programme for Phase 1b entering revenue service in Q4 2012.

### Milestone summaries

- 12.8 The summaries of milestones and programme assumptions below are shown on a work package basis and are fully integrated in the master schedule. Below each set of work package milestones are some of the key assumptions used, and decisions required in order to successfully deliver this programme.



Business Case

<b>Business Case approval milestones</b>	<b>Date</b>
Approval of DFBC by CEC and TS.	21.12.06 ✓
Confirmation of Infraco tender prices to CEC.	01.02.07 ✓
Approval of DFBC by Transport Minister.	15.02.07 ✓
Approval of FBCv1 by TB.	10.10.07
Approval of FBCv1 by Council.	25.10.07
Approval of FBCv1 by Council and TS.	20.12.07

Assumptions:

- Final facilitated negotiations result in a budget cost and construction programme that are within the desired ranges;
- Continued political support for the Project; and
- OGC Gateway 3 Review is successfully completed.

Utilities

<b>Utilities milestones</b>	<b>Date</b>
Completion of pre-construction period of MUDFA contract.	30.03.07 ✓
Commencement of utility diversion works trial site (Phases 1a).	02Apr07 ✓
Commencement of utility diversion works (Phases 1a).	09Jul07 ✓
Completion of utility diversion works (Phases 1a).	Nov 2008

Assumptions:

- Design can be issued in a timely manner to meet the construction schedule;
- There are no major archaeological discoveries that delay the programme;
- The utility diversions as designed can fit into the existing road structure; and
- There are no unknown utilities discovered that result in a delay or re-design.

Tramco

<b>Tramco milestones</b>	<b>Date</b>
Complete initial evaluation / negotiation (from 4 to 2 bidders).	07.03.07 ✓
Completion of Clarification and Refinement Process.	06.07.07 ✓
Selection of Preferred Bidder.	19.09.07 ✓
Facilitation of Tramco / Infraco novation negotiation complete.	16.11.07
Final negotiation of Tramco .	12.12.07
Award of Tramco contract following CEC / TS approval and cooling off period..	28.01.08
Delivery of tram 1.	Dec 2009
Delivery of all trams – Phase 1a.	Summer 2010

Assumptions:

- Delivery of 1<sup>st</sup> five trams during December 2009 to allow type testing during January 2010 and subsequent driver training in the depot to commence early February 2010; and
- Five trams only required to complete driver training programme for Phase 1a.

Infraco

Infraco milestones	Date
Return of Stage 1 bid ( Phases 1a and 1b core bid).	12.01.07 ✓
Commence depot works under pre-commencement agreement.	23.04.07 ✓
Completion of evaluation / negotiation of Stage 2 bid. (Phase 1a).	08.05.07 ✓
Selection of Preferred Bidder.	15.10.07
Facilitation of Tramco / Infraco novation negotiation complete.	16.11.07
Final negotiation of Infraco.	12.12.07
Negotiation and finalisation Phase 1b complete.	17.10.07
Infraco - Award Notification.	11.01.08
Award of Infraco contract following CEC / TS approval and cooling off period.	28.01.08
Infraco mobilisation commences.	01.11.07
Infraco mobilisation complete.	28.02.08
Construction commences Phase 1a.	01.02.08
Construction commences Phase 1b*.	06.07.09
Commencement of Trial Running Phase 1a.	27.08.10
Delivery into Revenue Service Phase 1a.	Q1 2011
Commencement of Trial Running Phase 1b*.	16.03.12
Delivery into Revenue Service Phase 1b*	Q4 2012

\*if decision to construct is made by late 2008.

Assumptions

- Construction completion includes commissioning;
- Working hours outside CoCP can be agreed with CEC as required particularly with regard to night working and long weekend closures at major city centre junctions;
- Traffic Management and TRO process is delivered to schedule and TRO is in place prior to on-street driver training;
- August Festival and Christmas Market exclusion periods apply between Haymarket and Picardy Place;
- NR infrastructure is progressed to meet Infraco programme;
- NR possessions as booked are available as programmed;
- No delays due to unforeseen archaeological or similar issues;
- Existing utilities i.e. Scottish Power 275kv cables at Leith Walk or British Telecom etc do not impact programme; and
- City centre construction constraints have been agreed with CEC and TEL and bidders confirmed recognition of these constraints whilst preparing the construction schedules.

Depot

Depot milestones	Date
Commence construction works (earthworks) under advance works.	23.04.07 ✓
Completion of construction drawings.	17.07.08 ✓
Commence building construction .	24.03.08
Commence yard and sidings.	16.06.08
Completion construction works (building).	27.03.09
Commence fit out.	06.02.09
Complete yard and sidings.	13.11.09
Complete fit out.	17.07.09
Commencing substation.	06.04.09
Complete substation.	19.06.09
Energise test track.	05.02.10
Commissioning of test track complete.	14.04.10
Test track available.	14.04.10
Complete building construction (fit out, tested and commissioned).	14.01.10



Assumptions:

- Depot is at reduced depth;
- Depot works have commenced with the exception of an exclusion zone around the SGN gas main diversions. SGN complete to programme at the end of January 2008;
- Drivers are recruited for a 6/12 service pattern and so there is no testing of the 8/16 patterns during extended periods;
- First five trams have been type tested before driver training starts;
- Driver training cannot commence until the depot is energised;
- Driver training in depot – total of 13 weeks;
- Driver training on Phase 1a – Off-street 13 weeks and on-street a further 13 weeks;
- Shadow running takes 13 weeks following completion of on-street driver training;
- Phase 1a opening Q1 2011; and
- Planning approvals are granted in the timescales anticipated.

Design and TROs

Design and TRO milestones	Date
TRO process commences.	13.08.07
Completion of construction drawings – MUDFA.	16.11.07
Completion of Planning Drawings Phase 1a.	03.06.08
Completion of Detailed Design Phase 1a.	12.09.08
Completion of construction drawings – Phase 1a Infraco.	12.09.08
TRO process complete.	17.11.09

Assumptions:

- Approvals and consents are delivered as required;
- SDS produce the TRO schedules and plans on time to meet the required programme;
- The TRO schedules and plans are right first time;
- The modelling is fit for purpose;
- There is sufficient modelling to satisfy the Roads Authority and to justify the measures;
- CEC can review the TRO package within two weeks and agree with the measures being sought;
- There is continued political support for the traffic measures;
- There are less than 5,000 objections, of which no more than 100 will be directly heard at a public hearing;
- There is no substantial technical objection considered by the hearing;
- The public hearing lasts for six weeks or less and the Reporters report will be presented within 90 days of the conclusion of the hearing;
- CEC will convene special Council meetings if required;
- If referred to the Scottish Government, they will respond within a month; and
- There is no judicial review.

Commissioning, training and overall completion

Commissioning and training and overall completion	Date
First tram delivered Phase 1a.	Dec 2009
Driver training commences for Phase 1a in depot.	07.12.09
Energisation Phase 1a off street.	26.06.10
Infrastructure commissioning complete for Phase 1a off-street.	26.07.10
Driver training commences for Phase 1a off-street.	27.07.10
Energisation Phase 1a total – on-street.	29.08.10
Infrastructure commissioning completion for Phase 1a.	27.09.10
Driver training commences for Phase 1a on-street.	28.09.10
Driver training completion for Phase 1a (excludes shadow running).	26.11.10
Tram commissioning complete for Phase 1a.	26.11.10
Shadow running complete for Phase 1a.	25.02.11
Revenue service commences Phase 1a.	25.02.11

Assumptions:

- Driver training programme can meet programme requirements (see assumptions under depot heading above);
- Control room, sidings yard and substation complete to allow energisation of test track; and
- Approval requirements under ROGS are met.

DRAFT



### 13. The case for Phase 1b

#### Purpose

13.1 The DFBC set out the economic, financial and operational Business Case for Phase 1 of the tram scheme. Details of the factors that led to the adoption of the staggered approach to construction are set out in section 3 of this FBC. This section summarises of the key aspects of the incremental economic and financial case for Phase 1b. It also includes details of the options for delivery of Phase 1b, as included in the Infraco and Tramco bids, together with potential opportunities to seek out additional funding to enable the implementation of this Phase.

#### Phase 1b justification

13.2 The STAG2 appraisal presented in the DFBC focused on Phase 1 in its entirety. However, the underlying detailed modelling work and assessments of cost and benefits identifies the incremental Business Case for Phase 1b. This case is embedded in the STAG appraisal and fully aligned to the planning objectives and Government's transport objectives which are presented in section 3. The following are the key elements from the economic assessment for Phase 1b.

#### Economic regeneration

13.3 In considering Phase 1b, the key 'driver' was the need to link the Granton waterfront with the rest of the network and the rest of the city / region. Granton is linked to the network at Haymarket via the Roseburn corridor, which also serves the new Telford College, the Western General Hospital, Craigmyle Retail Park and other key destinations. This section remains an important priority in social inclusion and economic development terms.

13.4 One of the biggest development opportunities in Edinburgh is the redevelopment of the Granton area (Table 13.1). The development potential is focused on residential use, with some 7,800 units envisaged.

Table 13.1. Potential development in the area served by Phase 1b of the tram.

Location	Residential (Units)	Office / Business (m <sup>2</sup> )	Retail (m <sup>2</sup> )	Hotel (Rms)	Commercial (m <sup>2</sup> )	Leisure (m <sup>2</sup> )	Other (m <sup>2</sup> )
Granton	7,800	0	40,400	0	130,000	8,800	65,000

#### Accessibility and social inclusion

13.5 An integrated, efficient, accessible and high quality public transport system is vital to promoting economic growth and improving the performance and competitiveness of local communities. Without Phase 1b of the tram it is unlikely the large scale redevelopment of Granton could go ahead in the same timescale or to the same extent. The new development will bring high quality living, leisure and employment opportunities. In addition to opening up brownfield land for redevelopment, it is highly probable that the tram will have a positive impact on the image of the area and hence help to stimulate further inward investment.

13.6 Mapping of the levels of economic deprivation, employment levels and levels of educational attainment show a considerable variance across the city. Areas of Granton and Pilton to the north have been identified as areas where socio-economic status is considerably less affluent than surrounding areas. Employment, income levels and car ownership tend to be comparatively low in these areas. Direct connection to the city centre and other employment areas which will be facilitated by Phase 1b of the tram will undoubtedly improve the situation

for these areas. Phase 1b of the tram will offer an attractive service to those areas, including all the features to support enhanced safety and reliability associated with tram.

### Transport and land use integration

- 13.7 Phase 1b sees trams, extend to the Granton Waterfront. It will provide an essential transport link for the planned developments at this important development site with other parts of the city. Regeneration of brownfield sites and protection of the greenbelt around the city boundaries form part of key planning strategies for Edinburgh. The likely success of the development in Granton, and thus the CEC strategy, will be strongly influenced by the provision of reliable, sustainable public transport network, of which tram plays an essential part.
- 13.8 In the absence of Phase 1b of the tram, the new development underway in North Edinburgh may contribute significantly more to city-wide congestion, and related environmental impacts, as a direct result of the failure to integrate land use and transport policies. It is also possible that the new development would be diverted to less sustainable locations with less potential for effective transport integration.
- 13.9 The introduction of tram will provide an opportunity to significantly improve integration between transport modes. The major advantage here is that integration can be planned before the start of services; this is much more effective than trying to achieve integration between already established services. As well as the interchange at Haymarket with heavy rail and buses, there will be an interchange with buses at Crewe Toll.

### Patronage and transport mode shift

- 13.10 The extensive work on forecasting models for usage of the tram as described in section 4 predicts an incremental 2m tram passengers in 2012 for Phase 1b. This rises to an incremental 8m in 2031. This growth includes a substantial increase in the overall travel market based on the predicted additional commercial and housing developments as well as a significant element of mode shift. The Granton / Muirhouse area in particular exhibits mode shift of greater than 5% (encompassing significant areas of development and growth which otherwise would be associated with higher levels of car travel).

### Economic activity and locational impacts (EALI)

- 13.11 The key EALI impacts of introducing Phase 1b of the tram are projected to be:
- **Employment development:** By 2015 more than 65,000 m<sup>2</sup> of employment development is anticipated to be advanced as a result of Phase 1b of the tram. Beyond 2015 this ultimately drops back to an additional 43,800 m<sup>2</sup> as the development pipeline catches up in the "without tram" scenario.
  - **Residential development:** The construction and occupation of more than 4,500 additional residential units is anticipated to be advanced as a result of Phase 1b by 2015, reducing to 3,800 by 2020.
  - **Employment generation:** More than 340 jobs, in present value terms, are expected to be generated or brought forward by the development impact of Phase 1b of the tram, after allowing for displacement of jobs elsewhere in Scotland.
- 13.12 Phase 1b is only operationally viable as part of a wider network under Phase 1a. Therefore, no separate assessment of the NPV and the benefits for every £1 of costs was undertaken for Phase 1b alone at the DFBC stage. However, in comparing the appraisal result for Phase 1a (BCR £1.77) to those of Phase 1 in its entirety (£2.31), it becomes evident that the incremental benefits of Phase 1b offer exceptional value for money in TEE terms (Table 13.2).



Table 13.2 Incremental Benefits and costs to Government from Phase 1b of the tram

<b>£m Present Value, 2002 prices</b>	<b>Incremental Phase 1b</b>
Public transport user benefits	254
Other road user benefits	116
Private sector provider effects	29
Accident effects	(12)
<b>PV of scheme benefits (incl. accidents)</b>	<b>388</b>
Investment costs	70
Public sector provider effects	19
<b>PV of scheme costs</b>	<b>89</b>

13.13 The principal reasons for the disproportionate level of net benefits afforded by construction of Phase 1b at the same time as Phase 1a are as follows:

- The assessed value of time benefits to public transport users arising from Phase 1a is limited by the existing high quality and frequency bus services provided on this corridor and the 'reference case' assumption that the application of CEC policy would seek to maintain, as far as possible, the existing level and travel time of the bus services by the introduction of bus priority measures. The Phase 1a tram provides the capacity on this corridor to deal with the predicted increases in public transport users;
- In relative terms, the Phase 1b corridor is not currently as well served by existing bus services, particularly for users travelling to Haymarket and to the west of the city, including the new employment opportunities at Edinburgh Park and the airport. For these users it is predicted that the Phase 1b tram will provide very positive time benefits, compared to the situation without the tram;
- Phase 1b is predicted to deliver relatively higher benefits to other road users because it has relatively few interfaces with the road network, being aligned for the most part on the Roseburn railway corridor and on the reserved tram corridor in the Granton development area; and
- The investment costs associated with Phase 1b are relatively low, reflecting the significant economies of scale which will be realised from the construction of this section of the tram. In addition, Phase 1a presents many complexities in terms of on-road running, including utility diversions, which are not so significant in the construction of Phase 1b. However, this opportunity to capitalise on economies of scale diminishes the longer the decision is delayed on whether to proceed with Phase 1b or not.

#### **Project scope**

13.14 The following section provides a summary of the key strategic functionality of Phase 1b and a high level description of the baseline scope for this Phase.

## Route alignment

### Granton Square to Ferry Road

- 13.15 The tram will run through the Granton Waterfront development area from Granton Square to the junction of West Granton Access and West Granton Road, at the northern edge of Pilton. Much of tram in this area will form part of a transport boulevard along the new spine road. This area is currently undergoing comprehensive redevelopment and as such the tram alignment has been determined primarily through the development master-planning process. The tram alignment continues along West Granton Access and through the junction at Ferry Road.
- 13.16 Stops are planned at Granton Square (centre platforms), Saltire Square (two side platforms) Caroline Park (two side platforms), West Pilton (midway along West Granton Access: two side platforms), and Crewe Toll (two side platforms). The Crewe Toll stop located next to the junction between West Granton Access and Ferry Road will form a bus - tram interchange between the north-south orientated tramway and the main road extending east-west.
- 13.17 The tram route adjacent to West Pilton is along a reserved corridor on the west verge of the newly constructed West Granton Access from West Granton Road to Ferry Road. The tram will be constructed along the broad grass verge to the new road. The track-bed will be in-filled with grass and the route will be landscaped with any vegetation removed during construction replaced with areas of trees and decorative shrub planting.

### Ferry Road to Haymarket

- 13.18 The tram will follow the former railway corridor on a fully segregated alignment from Ferry Road to the point where it meets the existing heavy rail corridor just west of Haymarket. Stops are planned at Telford Road, Craigleith, Ravelston Dykes and Roseburn (all two side platforms). Alterations will be required to all the smaller bridges that the tram runs over, including the bridge over the A8 at Roseburn. Works will be required to widen the Groathill Avenue and Craigleith Drive underbridges, and also the Coltbridge viaduct.
- 13.19 The tram and the replacement cycleway / footpath will be constructed on the line of the old trackbed. The tram will run on the east side of the track-bed and the cycle and foot path to the west, with formal crossings as required allowing public accesses to the east. The combined width of the tram tracks and the cycleway and footpath will be approximately 11m, compared to the original railway of 8m and the current cycleway of 3ms. Through the majority of the existing cutting and embankments, retaining structures will be required to accommodate the required widening.
- 13.20 Where the railway corridor passes under narrow and low arched bridges, the track bed will be lowered to allow the tram tracks to be offset from the bridge centre-line and thus allow room for a narrower cycleway / footpath. The cycleway and footpath will be surfaced in a fine grade blacktop as existing, while the tram track, with the exception of crossings, incorporating a grass finish.

## Interchange

### Crewe Toll

- 13.21 The interchange at Crewe Toll is essential to meet the commitment given during the parliamentary process to provide feeder buses linking the tram route with the Western General Hospital. The location has sufficient space to maximise the potential for good tram / bus interchange. All bus and tram movements into and inside the interchange are required to be controlled by traffic signals.



### Granton Square and Newhaven

- 13.22 Following on from the decision for phased construction of the tram, there is an opportunity to provide quality interchanges with bus at the end of Phase 1a in Leith and at the end of Phase 1b in Granton, thus linking the ends of the network along the seafront.

### **Interfaces with other projects and functional boundary**

#### **Granton Masterplan**

- 13.23 In order to facilitate the expected economic regeneration, the Granton Masterplan sets out the development aspirations for this area in North Edinburgh. There will need to be close interaction between the CEC Planning Authority and the tram project so that the project can help to maximise the redevelopment and regeneration of this area.

#### **Route capability**

- 13.24 The performance criteria for Phase 1b are in line with those of Phase 1a and include:
- Journey time of 16 minutes and 30 seconds (including layover and dwell times of 25 seconds at each stop); and
  - Achieving reliability targets where 99% of monitored tram departures are no earlier than one minute and no greater than two minutes late, compared to the scheduled headway. The reliability of the service will be measured at Crewe Toll (departure) and Granton Square (departure).
- 13.25 There will be turn back capabilities at Crewe Toll and layover facilities at Granton Square.

#### **Project workscope**

##### Track

- 13.26 The nature of tramline surfacing (track, swept path, affected roads and footpaths) is dependent upon its environment. On the Roseburn Corridor, the track finishes will be grass

##### Structures

- 13.27 The following structures will be required to be constructed or altered to accommodate the tram:
- Roseburn Corridor retaining walls;
  - Roseburn Terrace bridge;
  - Coltbridge viaduct;
  - St George's School access bridge;
  - St George's School foot bridge;
  - Ravelston Dykes bridge;
  - Craigleith Drive bridge;
  - Holiday Inn access bridge;
  - Queensferry Road bridge;
  - Groathill Road South bridge;
  - Telford Road bridge;
  - Drylaw Drive bridge;
  - Ferry Road retaining wall; and
  - Crewe Road Garden bridge.

##### Substations

- 13.28 The following substations will be built on line 1b:
- Craigleith substation;
  - Granton Mains East substation; and

- Granton Road substation.

#### Overhead line equipment

- 13.29 The OLE will utilise a single contact wire system, with additional parallel (buried) feeders. Standard materials will be used with the exception of the route sections from Caroline Park to Granton Square tramstops, where stainless steel material (for tubes and fittings) will be provided.

#### **Procurement approach**

- 13.30 The procurement strategy applied by **tie** is entirely compatible with the approach of a staggered implementation of Phase 1b. The key contracts relating specifically to Phase 1b are SDS, MUDFA, Infraco and Tramco. The contractual principles for each of these are the same as for Phase 1a and the elements which are specific to 1b are set out below:

#### SDS

- 13.31 The contract awarded in Sept. 2005 included the design for Phase 1b in its scope. At the time of developing the phased approach to construction of the ETN, design work for Phase 1b had sufficiently progressed to warrant its completions. This is now scheduled for December 2007.

#### MUDFA

- 13.32 The contract for utilities diversion includes the provision of diversionary works on the Phase 1b route. As large parts of the 1b route are confined to the Roseburn corridor, the quantum of works required is significantly lower than for Phase 1a. These works will therefore be considerably less intrusive to traffic. The AMIS programme currently schedules commencement of diversions for 1b at the end of the works for Phase 1a. A commitment to diversion work on Phase 1b will be required before AMIS demobilises to minimise the loss of benefits of scale. Alternatively, if no decision on Phase 1b is reached beforehand, utility diversions could be included under Infraco. However, this would result in additional costs for Infraco and the loss of economies of scale which are to be had under the AMIS contract.

#### Vehicle supply and maintenance (Tramco)

- 13.33 The contracts for the supply and maintenance of tram vehicles contain an option to purchase additional trams on the same principles as for the base bid. Such additional vehicles could be used for services on Phase 1b. Under the contracts, **tie** has the option to purchase an additional four trams on a fixed price basis, comparable to that for the original 27 trams, plus the right to order a further four trams on an indexed price basis. The option can be exercised at any point prior to March 2009 at **tie**'s discretion.
- 13.34 It should be noted that, although the Tramco contract will be novated to Infraco, the decision to purchase additional trams is not necessarily linked to a decision on whether to construct Phase 1b. This means that additional trams could be purchased under the above conditions to serve increased service demands if required. **tie** retains the right to exercise the purchase of additional trams, even if Phase 1b does not go ahead.

#### Infrastructure provider and maintenance (Infraco)

- 13.35 As with the Tramco contract, **tie** has the option to instruct the construction of Phase 1b on the same terms as for Phase 1a at any time to March 2009. This means that prices, programme for construction and key technical elements of this option will be agreed as part of the main contracts which will be awarded in January 2008. The final terms of the option have not been agreed yet. However, these will be finalised prior to Financial Close.