

Freedom of Information (Scotland) Act exempt and legally privileged

tie Limited

EDINBURGH TRAM NETWORK

PRELIMINARY REPORT ON CERTAIN DESIGN ISSUES

William J Marshall & Partners
Consulting Engineers and Architects
35 Westminster Palace Gardens
Artillery Row
London SW1P 1RR

5080\rpt\2
January 2010

CEC00579044_0001

tie Limited

EDINBURGH TRAM NETWORK

PRELIMINARY REPORT ON CERTAIN DESIGN ISSUES

List of Contents

TEXT

Section		Page
1.	TERMS OF REFERENCE	1
2.	INTRODUCTION	1
3.	REVIEW OF SCHEDULE PART 4	
	general	5
	interpretation	7
	conclusions	9
4.	ANALYSIS - BANKHEAD DRIVE RETAINING WALL	
	general	10
	design development and completion	11
5.	ANALYSIS - SECTION 7A TRACKSIDE DRAINAGE	
	general	14
	design development and completion	16
6.	SUMMARY AND CONCLUSIONS	18

APPENDICES

- A. BANKHEAD DRIVE RETAINING WALL
- B. SECTION 7A TRACKSIDE DRAINAGE
- C. CURRICULUM VITAE OF T R E BLOIS-BROOKE

tie Limited

EDINBURGH TRAM NETWORK

PRELIMINARY REPORT ON CERTAIN DESIGN ISSUES

1. TERMS OF REFERENCE

1.1 Acting in accordance with instructions received on 11th December 2009 from **tie** Limited I have investigated aspects of the design and construction of the Edinburgh Tram Network so that I may advise on certain specific issues in a dispute that has arisen between **tie** Limited and the design & build contractor for this project.

1.2 This Preliminary Report has been prepared by me, T R E Blois-Brooke, a Chartered Engineer and Senior Partner of William J Marshall & Partners. Details of my qualifications and experience are set out in Appendix C to this Report.

1.3 I have not visited the project and my views are therefore dependent solely on the documents that have been made available to me by **tie** Limited: they must remain subject to review in the light of any further information.

1.4 I confirm that I have made clear which facts and matters referred to in this Preliminary Report are within my own knowledge and which are not. Those that are within my own knowledge I confirm to be true. Subject to Clause 1.3 above, the opinions I have expressed represent my true and complete professional opinions on the matters to which they refer.

2. INTRODUCTION

2.1 **tie** Limited (**tie**) is the public sector body which was set up by the City of Edinburgh Council to complete the procurement of the Edinburgh Tram Network, that is, a new tram network linking Edinburgh airport with the city centre and onwards to Leith. By an Agreement dated 19th September 2005 **tie** arranged initial design information for this project to be prepared by a firm of Consulting Engineers, Parsons Brinckerhoff (also described as the "SDS Provider"), and tenders were sought.

2.2 In October 2007 **tie** selected a joint venture comprising Bilfinger Berger Civil UK Limited, Siemens plc, and Construcciones y Auxiliar de Ferrocarriles SA as the Preferred Bidder for the design, construction and maintenance of the tram network. No distinction has been drawn between the three firms in the joint venture which will be described in this Preliminary Report as "Infraco".

2.3 At this time the intended scheme was described in an Employer's Requirement document and about 6,500 drawings, together with Approval in Principle documentation for some elements of the scheme. However, **tie** has told me that at this stage the designs for the numerous components of the scheme had not yet all been finished and were at varying stages of completion, that is, ranging from Stage A (Appraisal) to Stage F (Production Information). **tie** and Infraco therefore agreed that Infraco's financial proposal would be based on the information that had been made available to Infraco by **tie** at 25th November 2007 (the Base Date Design Information).

2.4 After November 2007 Parsons Brinckerhoff continued to work on the designs for this scheme, in the course of which the original drawings were revised and further new drawings were prepared. I understand that between about mid-2007 and February 2008 Infraco carried out a "due diligence" exercise on the information that had provided to Infraco by **tie** up to 14th December 2007 to determine the status of the design prior to contract award.

2.5 Infraco noted in its February 2008 Report on this exercise that, contrary to the **tie**'s original intention for this stage of the project, the design was incomplete and would require significant further development. **tie**'s original procurement concept had envisaged that a complete and Issued for Construction design for this project would be novated to Infraco. However, Infraco concluded that, while parts of the design were far advanced and of acceptable quality, the design of other elements and sections was still at preliminary/concept stage or even completely missing: in addition, the current design for certain sections was being changed. A provision was subsequently agreed by the parties and incorporated into the contract to address these issues (see Clause 2.7 below), and I have therefore assumed for the purposes of this Preliminary Report that the outcome of this due diligence exercise does not affect the contractual position.

2.6 On 14th May 2008, **tie** entered into a contract with Infraco and on the same date Parsons Brinckerhoff's appointment was novated to Infraco. Schedule Part 2 to this contract comprised the Employer's Requirements which, although extensive, included only very limited information about the civils works (perhaps because the intention had been for Parsons Brinckerhoff to prepare a complete and Issued for Construction design for this project prior to novation - see Clause 2.5 above). Schedule Part 30 set out the Infraco Proposals for the civils works which were described as "*..... the SDS design, to be developed and finalised to Issued for Construction (IFC) status*". Generally, the Infraco Proposals under each element of the project simply stated "*Design to be completed to IFC status, all design consents and approvals obtained and [Infraco] will construct IFC Design*".

2.7 Both **tie** and Infraco acknowledged that the design of the scheme had not been completed at 25th November 2007 (see Clauses 2.3 to 2.6 above), and provision was therefore included in Schedule Part 4 of their contact whereby Infraco's price could be adjusted in certain circumstances. Schedule Part 4 contained the following relevant clauses:

1.0 **GENERALLY**

1.2 *The Construction Works Price is on a lump sum basis that is fixed until completion of the Infraco Works and not subject to variation except in accordance with the provisions of this Agreement.*

1.3 *This Part 4 of the Schedule sets out the various categories of items that may be subject to change, together with a mechanism for adjustment of the Contract Price including the Construction Works Price.*

1.4 *No provision within this Part 4 of the Schedule shall entitle the Infraco to more than one payment for any item or other entitlement under the Infraco Contract.*

2.0 DEFINITIONS USED IN THIS SCHEDULE

2.2 *The "**Base Case Assumptions**" means the Base Date Design Information, the Base Tram Information, the Pricing Assumptions and the Specified Exclusions.*

2.3 *The "**Base Date Design Information**" means the design information drawings issued to Infraco up to and including 25th November 2007 listed in Appendix H to this Schedule Part 4.*

2.8 *A "**Notified Departure**" is where now or at any time the facts or circumstances differ in any way from the Base Case Assumptions save to the extent caused by a breach of contract by the Infraco, an Infraco Change or a Change in Law.*

2.9 *"**Pricing Assumptions**" means the assumptions in respect of the Contract Price as noted in Section 3.4 below.*

2.10 *"**Specified Exclusions**" means items for which Infraco has made no allowance within the Construction Works Price as noted in Section 3.3 below.*

3.0 CONSTRUCTION WORKS PRICE

3.1 *The Construction Works Price is a lump sum, fixed and firm price for all elements of work required as specified in the Employer's Requirements as Schedule Part 2 and the Infraco Proposals as Schedule Part 31 (sic) and is not subject to variation except in accordance with the provisions of this Agreement.*

3.2.1 *It is accepted by **tie** that certain Pricing Assumptions have been necessary and these are listed and defined in Section 3.4 below. The Parties acknowledge that certain of these Pricing Assumptions may result in the notification of a Notified Departure immediately following execution of this Agreement. This arises as a consequence of the need to fix the Contract Price against a developing factual background. In order to fix the Contract Price at the date of this Agreement certain Pricing Assumptions represent factual statements that the Parties acknowledge represent facts and circumstances that are not consistent with the actual facts and circumstances that apply. For the avoidance of doubt, the commercial intention of the Parties is that in such circumstances the Notified Departure mechanism will apply.*

3.3 *Specified Exclusions from the Construction Works Price are*

- c) *Ground conditions that require works that could not be reasonably foreseen by an experienced civil engineering contractor based on the ground conditions reports provided to [Infraco] on 20th and 27th of November and 6th December 2007. Additionally the Constructions Works Price does not include for dealing with replacement of any materials below the earthworks outline or below ground obstructions/voids, soft material or any contaminated materials.*

3.4 *Pricing Assumptions are:*

1. *The Design prepared by the SDS Provider will not (other than amendments arising from the normal development and completion of designs):*

- 1.1 *in terms of design principle, shape, form and/or specification be amended from the drawings forming the Base Date Design Information (except in respect of Value Engineering identified in Appendices C or D to this Schedule Part 4);*
- 1.2 *be amended from the scope shown on the Base Date Design Information and Infraco Proposals as a consequence of any Third Party Agreement (except in connection with changes in respect of Provisional Sums identified in Appendix B); and*
- 1.3 *be amended from the drawings forming the Base Date Design Information and Infraco Proposals as a consequence of the requirements of any Approval Body.*

For the avoidance of doubt normal development and completion of designs means the evolution of design through the stages of preliminary to construction stage and excludes changes of design principle, shape and form and outline specification.

3. *The Deliverables prepared by the SDS Provider prior to the date of this Agreement comply with the Infraco Proposals and Employer's Requirements.*
- 3.5 *The Contract Price has been fixed on the basis of inter alia the Base Case Assumptions noted herein. If now or at any time the facts or circumstances differ in any way from the Base Case Assumptions (or any part of them) such Notified Departure will be deemed to be a Mandatory **tie** Change requiring a change to the Employer's Requirements and/or the Infraco Proposals or otherwise requiring the Infraco to take account of the Notified Departure in the Contract Price and/or Programme in respect of which tie will be deemed to have issued a **tie** Notice of Change on the date that such Notified Departure is notified by either Party to the other*

2.8 Construction work has begun on site and is ongoing. During this work various disagreements have arisen between **tie** and Infraco concerning the proper interpretation of Schedule Part 4. To date there have been three Adjudications to determine, inter alia, whether the changes that occurred in four parts of the project between the Base Date Design Information and the Issued For Construction information constituted Notified Departures under the contract.

2.9 In this Preliminary Report I have set out my opinion generally on the proper interpretation of Schedule Part 4, and considered specifically the meaning to be given to the words "*normal development and completion of designs*" in Pricing Assumption 1 in Clause 3.4 of this Schedule. I have also considered whether any of the matters shown on the Issued for Construction drawings for:

- (a) The Bankhead Drive Retaining Wall; and
- (b) Section 7A Trackside Drainage,

in my opinion constituted a Notified Departure in terms of Pricing Assumption 1.1 in Clause 3.4 of Schedule Part 4 of the Infraco contract. For the purposes of this Preliminary Report I have been instructed to assume, and have assumed that Pricing Assumptions 1.2 and 1.3 do not apply to the above two elements of the scheme.

3. REVIEW OF SCHEDULE PART 4

General

3.1 The design of a project of this type would develop in stages from initial feasibility through to the information that was required for construction. When preparing his tender, an experienced Design & Build Contractor would therefore carefully review all the information that had been made available to him and, if possible, would discuss the design with the Design Team so that he could determine the stage that had been reached in the design process for each element of the project. Alternatively or perhaps in addition, such a Contractor would carry out his own due diligence exercise to assess on the basis of his experience of projects of this type the extent to which the design, as it then stood, would need to be further developed and finalised.

3.2 This assessment would be critical, as it is in my experience normal for Design & Build Contractors to take account of designs that had yet to be finalised and the consequent residual risk, by allowing an appropriate contingency sum in his Construction Works Price. This sum would be based on the outcome of the Contractors' review of the information that had been provided to them and any discussions with the Design Team and on their experience of other similar projects, and would be intended to cover any such areas of design risk and the finalisation of the design for construction. At present I do not know what contingency Infraco included in the Construction Works Price tender for this project to cover such factors.

3.3 **tie** has told me that the scheme set out in the Base Date Design Information complied with the Employer's Requirements so far as it was shown on these drawings (but see Clause 4.13 below). However, both **tie** and Infraco were aware and have acknowledged that the design of the scheme had not been completed at 25th November 2007. Although the design of certain sections was far advanced, parts of the scheme were still at the preliminary/concept stage, while the design of some elements had not yet been made available to Infraco (see Clauses 2.3 to 2.6 above).

3.4 In these circumstances it was important for Infraco to determine, if necessary in consultation with Parsons Brinckerhoff, what level of design development was required for each element of this project to achieve Issued for Construction status. Inevitably there would be less design development and therefore less uncertainty (resulting in a smaller contingency sum), for an element whose design was substantially complete, than for an element whose design was clearly still at a preliminary/concept stage. What could therefore be classified as "normal design development" to achieve the Employer's Requirements and Issued for Construction status would therefore be given a much broader interpretation where the design of a particular element was clearly preliminary or limited details were available in the Base Date Design Information, than for an element whose design had been much more fully developed at the time of tender. This would have a corresponding effect on the allowance that an experienced Design & Build Contractor would make for such design development in the Construction Works Price.

3.5 Infraco has accepted that it has an over-riding obligation under the contract to complete the design and to construct the scheme in accordance with the Employer's Requirements and the Infraco Proposals. The key issue in dispute between the parties which has already been the subject of at least three adjudication decisions to date, is the basis on which changes that were made to the design shown in the Base Date Design Information

would constitute Notified Departures under the contract and therefore lead to Infraco being entitled to additional money and time.

3.6 Because at 25th November 2007 the designs for the various components that together make up this scheme were at varying stages of completion, ranging from Stage A (Appraisal) to Stage F (Production Information), the parties agreed that the Construction Works Price would be determined on the basis of certain pricing assumptions which were set down in Schedule Part 4 (see Clause 2.7 above). If and to the extent that any of these pricing assumptions did not apply to the final scheme, Infraco would be entitled to invoke the Notified Departure procedure under the contract.

3.7 The inclusion of Schedule Part 4 appears to have been intended to address the cost and programme risks associated with certain defined changes that might occur to the information that had been made available to Infraco at 25th November 2007 as the design of the project was developed to Issued for Construction status. This would mean that Infraco would not have to take account of the risks associated with these specific changes, and so could reduce the contingencies incorporated into its Construction Works Price.

3.8 Infraco was required to develop, amplify and ultimately finish off the initial design shown in the Base Date Design Information so that it complied in all respects with the Employer's Requirements and the Infraco Proposals, and provide the detail necessary to construct the works (ie. Issued for Construction status). Strictly this whole process would be classified as the "*development and completion of the design*": however, this process would include the following:

- (a) Amendments that an experienced Design & Build Contractor could reasonably have foreseen on the basis of the information that had been made available to him (that is, including the Base Date Design Information and the Employer's Requirements). As set out in Clause 3.4 above, the extent of these amendments would depend on the status of the initial design;
- (b) Amendments that an experienced Design & Build Contractor could not reasonably have foreseen on the same basis as (a) above; and
- (c) Amendments that were introduced by the Design & Build Contractor himself to reflect his preference, for example, materials, construction techniques, etc, and any value engineering.

3.9 I would expect that an experienced Design & Build Contractor, when determining the Construction Works Price for this project, to have included for the effect of the amendments set out in Items (a) and (c) in Clause 3.8 above. During this exercise such a Contractor would seek to take account of not only the information shown on the Base Date Design Information drawings, but also the Employer's Requirements and the Contractor's Proposals. As a result, the Construction Works Price would include for matters which, although not shown specifically on the Base Date Design Information drawings, a Design & Build Contractor would expect on the basis of his experience of this type of project to be required to comply with the Employer's Requirements.

3.10 However, in this instance the "*normal development and completion of the design*" would in my opinion exclude those amendments that an experienced Design & Build Contractor could not reasonably have foreseen on the basis of the information that had been made available to him, including not only the Base Date Design Information, but also the Employer's Requirements (that is, Item (b) in Clause 3.8 above). The intention of Pricing Assumption 1 in Schedule Part 4 to the contract was intended to address the effect of these particular amendments on the Construction Works Price for this project (see Clauses 3.11 to 3.18 below).

Interpretation

3.11 Schedule Part 4, as drafted, has resulted in the way in which it was intended to operate being not altogether clear. The interpretation of this clause has already featured in the adjudications to date and at least two significantly different conclusions have been drawn as to its interpretation (by Mr Hunter and Mr Wilson). Ultimately this may be a matter for a Court to determine, but because the interpretation of Schedule Part 4 is crucial to any assessment of Infraco's entitlement to invoke the Notified Departure procedure under the contract, I have set out my own views on this issue in Clauses 3.12 to 3.18 below.

3.12 Clause 3.1 of Schedule Part 4 states that:

The Construction Works Price is a lump sum, fixed and firm price for all elements of work required as specified in the Employer's Requirements as Schedule Part 2 and the Infraco Proposals as Schedule Part 31 (sic) and is not subject to variation except in accordance with the provisions of this Agreement.

3.13 On this basis I have concluded that Infraco's fixed lump sum Construction Works Price for this project was required to take account of the full cost of completing the initial design set out in the Base Date Design Information and subsequently constructing the scheme so that it complied with the Employer's Requirements and the Infraco Proposals, save only if and to the extent that any of the Pricing Assumptions set out in Schedule Part 4 proved to have been incorrect or any of the Specific Exclusions applied.

3.14 Pricing Assumption 1 in Clause 3.4 of Schedule Part 4 was defined as follows:

- 1 *The Design prepared by the SDS Provider will not (other than amendments arising from the normal development and completion of designs):*
 - 1.1 *in terms of design principle, shape, form and/or specification be amended from the drawings forming the Base Date Design Information (except in respect of Value Engineering identified in Appendices C or D to this Schedule Part 4);*
 - 1.2 *be amended from the scope shown on the Base Date Design Information and Infraco Proposals as a consequence of any Third Party Agreement (except in connection with changes in respect of Provisional Sums identified in Appendix B); and*
 - 1.3 *be amended from the drawings forming the Base Date Design Information and Infraco Proposals as a consequence of the requirements of any Approval Body.*

For the avoidance of doubt normal development and completion of designs means the evolution of design through the stages of preliminary to construction stage and excludes changes of design principle, shape and form and outline specification.

3.15 The parties acknowledged that Parsons Brinckerhoff's design at 25th November 2007 would have to be developed and completed to Issued for Construction status, but under Pricing Assumption 1.1, the parties agreed that the Construction Works Price had been prepared by Infraco on the basis that, other than amendments arising from the normal development and completion of designs, the design would not be amended from the Base Date Design Information in terms of "..... *design principle, shape, form and/or specification*" (except in respect of value engineering which has not been considered further in this Preliminary Report). Assistance as to what constituted the normal development and completion of designs and what was specifically excluded from this process was set out in the final paragraph of Pricing Assumption 1 as follows:

For the avoidance of doubt normal development and completion of designs means the evolution of design through the stages of preliminary to construction stage and excludes changes of design principle, shape and form and outline specification.

Although the two descriptions of the exclusions differ slightly, in my opinion these descriptions are in practical terms the same and the meaning of each term has been considered further in Clause 3.18 below.

3.16 As set out in Clauses 3.8 and 3.9 above, I would expect Infraco, when determining the Construction Works Price for this project, to have not simply priced for the work shown on the Base Date Design Information, but also have included for the effect of the following:

- (a) Amendments that an experienced Design & Build Contractor could reasonably have foreseen on the basis of the information that had been made available to him (that is, including the Base Date Design Information and the Employer's Requirements); and
- (b) Amendments that were introduced by the Design & Build Contractor himself to reflect his preference, for example, materials, construction techniques, etc, and any value engineering.

I would expect Infraco to have taken account of these factors by reference to measured works, estimates, contingencies, etc, but such back-up details of Infraco's fixed lump sum price for this project may not have been made available to **tie**.

3.17 In my opinion the amendments in (a) and (b) in Clause 3.16 above would be classified as the normal development and completion of the design in a project of this sort. It would therefore not be appropriate in my opinion simply to identify the changes that occurred between the Base Date Design Information and the Issued for Construction drawings: at least some of these changes ought to have been expected by Infraco and allowed for in the Construction Works Price. Only amendments arising during the process of developing and completing the design which could not reasonably have been foreseen by an experienced Design & Build Contractor and which comprised amendments in "*design principle, shape, form and/or specification*" would constitute a Notified Departure under Pricing

Assumption 1.1 in Clause 3.4 of Schedule Part 4 (see Clause 2.7 above). At present I have found no reason to take any account of the timing of these amendments, that is, whether they occurred before or after the date of the contract when Parsons Brinckerhoff's appointment was formally novated to Infraco.

3.18 In the past the Adjudicators, assisted by Parties' Experts, have sought to define "*design principle, shape, form and/or specification*". To an extent these definitions depend on a degree of engineering experience and judgement, but in broad terms I have, where necessary in Sections 4 and 5 below, adopted the following definitions which take account the submissions made by the other Experts to date:

- (a) The **design principle** is the design philosophy or way in which the intended objective is achieved.
- (b) The **shape** is the total effect produced by the outline of a component.
- (c) The **form** is the overall external appearance of a component.
- (d) The **specification** is the required characteristics of the component in terms of features such as performance, materials, etc.

Conclusions

3.19 Infraco's fixed lump sum Construction Works Price for this project was required to take account of the full cost of completing the initial design set out in the Base Date Design Information and subsequently constructing the scheme so that it complied with the Employer's Requirements and the Infraco Proposals, save only if and to the extent that any of the Pricing Assumptions set out in Schedule Part 4 proved to have been incorrect or any of the Specific Exclusions applied.

3.20 In order for there to be a Notified Departure under Pricing Assumption 1.1 in Clause 3.4 of Schedule Part 4 to the contract:-

- (a) There had to be an amendment to the Base Date Design Information and the provisions of the Employer's Requirements and Infraco Proposals; and
- (b) That amendment could not reasonably have been foreseen by an experienced Design & Build Contractor to be the result of normal development and completion of the design on the basis of the information that had been made available to him (including the Base Date Design Information and the Employer's Requirements), and the Infraco Proposals; and
- (c) That amendment was the result of a change in "*design principle, shape, form and/or specification*".

4. ANALYSIS - BANKHEAD DRIVE RETAINING WALL

General

4.1 The Bankhead Drive retaining wall is located along the northern side of Bankhead Drive, immediately to the west of the South Gyle access bridge. The retaining wall is a reinforced earth structure with blockwork facing that retains and limits the lateral extent of the southern slope of the new embankment that supports the tram tracks.

4.2 The level of information shown on the Base Date Design Information drawings would in my opinion lead an experienced Design & Build Contractor to conclude that the design of this element of the scheme was reasonably well-developed. The retaining wall was fully dimensioned and specified, but there remained some qualifications on these drawings, including:

- (a) The final alignment of the tracks was not yet confirmed.
- (b) The General Fill that was to be provided to create the new embankment was to be designed by others: in particular, the final gradient of the southern slope of the embankment was to be confirmed by others.
- (c) There was a possibility that, on excavating down to the formation levels shown on these drawings, soft spots might be encountered. These soft spots were to be excavated and replaced with granular fill.

No details of the reinforcement that was required in the reinforced concrete capping to the retaining wall were provided. In addition certain of the components of the retaining wall, such as the facing blocks and reinforcement, were specified as particular products "or equivalent".

4.3 The new scheme in this section had to be compatible with the existing level of Bankhead Drive and as a result both the vertical and horizontal alignments of the new tracks would have an effect on the height of the proposed retaining wall. The wall height would also be affected by the final gradient of the southern slope of the new embankment which was shown in the Base Date Design Information drawings to be at 1 in 2, but which was to be confirmed by others.

4.4 In my opinion the Base Date Design Information drawings would indicate to an experienced Design & Build Contractor that the design had reached, say, Stage E or F, but that there still remained some issues to be resolved as the design was developed and completed to Issued for Construction stage. In these circumstances, as set out in Section 3 above, I would expect Infracore to have included an allowance in its Construction Works Price for such design development and completion, as well as for general construction risks (such as Item (c) in Clause 4.2 above). I would expect an experienced Design & Build Contractor to be able to price these factors and, unless there was some reason for the Contractor to conclude that the track alignment was likely to have a significant effect on the retaining wall height that would not be covered by Pricing Assumption 1.1, a contingency of the order of 10% for resolving potential design issues would in my opinion have been appropriate.

4.5 The track alignment issue may merit further consideration in due course, but putting this to one side for the present, account should in my view be taken of the contingency that Infraco ought to have included, or did in fact include in its Construction Works Price for this particular element of this project so as to avoid any double-counting when assessing any claim put forward by Infraco in respect of the Bankhead Drive retaining wall.

4.6 There is no doubt that a requirement for a reinforced earth retaining wall along Bankhead Drive was identified in the Base Date Design Information and that this remained the overall position at Issued for Construction stage. However, this simple approach would in my opinion not be an appropriate way in which to interpret the Pricing Assumption 1 in Schedule Part 4, not least because this particular assumption refers specifically to such features as design principle, shape, form and specification which fall to be considered when assessing the possibility of a Notified Departure.

4.7 In the event that Infraco seeks to assert that particular items in this part of the scheme are Notified Departures under the contract, it seems to me that it must be for Infraco in the first instance to identify these items and it is important in my view not to pre-judge any claim put forward by Infraco. That having been said, in Clauses 4.8 to 4.15 below I have commented on the differences that arose in the design of this retaining wall between the Base Date Design Information and the Issued for Construction drawings.

Design development and completion

4.8 I have reviewed the sets of drawings that comprise the Base Date Design Information and the Issued for Construction drawings that have been made available to me by **tie** and have identified the following key amendments that occurred to the design of the Bankhead Drive retaining wall between the Base Date Design Information and Issued for Construction stage:-

- (1) The overall length of the wall changed from 35 metres to 53 metres. The wall increased in length by about 12 metres westwards and by about 6 metres eastwards.
- (2) The formation level was lowered. In the Base Date Design Information the formation level varied between 46.200m and about 48.100m, whereas at Issued for Construction stage the formation level was set lower at 46.000m throughout the length of the wall.
- (3) The average height of the wall increased from about 2 metres to about 2.7 metres, that is, by about 0.7 metres.
- (4) The type of sub-base to the wall changed. In the Base Date Design Information the sub-base layer comprised 1300mm or 1100mm of compacted suitable fill material along the deeper sections of the wall, and a minimum 600mm deep starter layer of granular fill (Class 6C) under the footprint of retaining wall. At Issued for Construction stage the sub-base comprised a 600mm thick layer of DoT Class 6C or 6H granular fill (between formation level at 46.000m and 46.600m) and selected

well-graded granular fill (DoT Class 6N) to the underside of the mass concrete levelling pad of the wall.

- (5) The dimensions of the mass concrete levelling pad to the wall changed. In the Base Date Design Information this pad was 600mm wide by 150mm deep, but by Issued for Construction stage the thickness of this pad had been increased to 200mm on the retained earth side of the wall.
- (6) The type of facing block to the retaining wall changed. In the Base Date Design Information the blocks were described as Tensar TW1 400mm x 220mm x 150mm high blocks (or equivalent), but by Issued for Construction stage, larger 455mm x 305mm x 200mm high blocks were shown.
- (7) The geogrid reinforcement changed. In the Base Date Design Information 3.8 metre long Tensar 40RE geogrid reinforcement (or equivalent) was required at 450mm vertical centres behind the retaining wall bedded in DoT Class 6I granular fill. Note that a different geogrid reinforcement specification was identified in Sections 3.2 and 3.8 of the Approval in Principle document for this wall dated October 2006, but for the purposes of this Preliminary Report I have assumed that this was superseded by the base date Design Information at 25th November 2007. At Issued for Construction stage the geogrid reinforcement was shown as Tensar 120RE or 40RE at 400mm vertical centres, varying in length between 4.25 and 5.30 metres and bedded in DoT Class 6I/6J fill.
- (8) The drainage in the vicinity of the wall changed. In the Base Date Design Information a 150mm (min) diameter porous pipe within an excavation backfilled with filter material was shown in front of the retaining wall. This was omitted in the Issued for Construction drawings and instead a 300mm wide vertical drainage blanket (DoT Class 6H) and a 150mm diameter perforated pipe were to be provided behind the retaining wall.
- (9) The wall coping and barrier detail changed. In the Base Date Design Information the retaining wall was shown to be topped by a reinforced concrete coping with a 1.45 metre high guardrail bolted to this coping: in addition the toe of the slope adjacent to the wall was to be formed in concrete. In the Issued for Construction drawings, the concrete toe had been omitted, and the wall was to be topped by a 455mm x 267mm x 100mm concrete coping unit. A free-standing timber post and rail fence was to be provided at the toe of the southern slope immediately behind the retaining wall, and a timber anti-climbing barrier "*where retained height of wall is 1.0m and 1.5m*" (sic).

The drawings, both in the Base Date Design Information and at the Issued for Construction stage, referred to specifications, including the Department of Transport's Specification for Highway Works, that I presume were prepared for this project. I have not seen these specifications and this may merit further investigation in due course.

4.9 The drawings that have been made available to me also show other elements of this project in the vicinity of the South Gyle access bridge including:-

- (a) The trackside drainage system; and
- (b) The embankment slope and retaining measures along the northern side of the tracks.

These matters are not directly related to the Bankhead Drive retaining wall and have therefore not been considered further in this Preliminary Report.

4.10 In the Table in Appendix A I have considered Items (1) to (9) in Clause 4.8 above in turn by reference to the matters set out in Section 3 above to determine whether in my opinion they constituted a Notified Departure under the contract, that is, an item that is an amendment and not foreseeable normal design development and one of the four types of exclusion. On this basis the following items would be Notified Departures:

- (a) The increase in the overall length and height of the retaining wall (part only).
- (b) The lowering of the formation level for the wall (part only).
- (c) The increase in the height of the retaining wall (part only).
- (d) The change in the sub-base to the wall.
- (e) The use of a larger facing block.
- (f) The type and extent of the geogrid to the retaining wall (part only).
- (g) The drainage to the retaining wall.
- (h) The coping and barrier detail.

4.11 The overall length of the retaining wall increased by about 50% and its average height by about 0.7 metres: in addition the formation level for the wall was lowered by between 200 and 650mm. While some changes to the overall length, height and formation level for this retaining wall would be expected as the design was developed and completed, the particular changes that were made were on a scale that in my opinion that exceeded that which could reasonably have been expected by an experienced Design & Build Contractor based on the information in the Base Date Design Information.

4.12 The design of the sub-base to the wall changed significantly from that shown in the Base Date Design Information and in my opinion these changes exceeded what would be considered to be the normal development and completion of the design that was shown on these drawings.

4.13 The size of the facing blocks to the retaining wall was increased, together with the type and extent of the geogrid. The change in vertical spacing of the geogrid from 450mm to 400mm was a direct consequence of changing from facing blocks that were 150mm thick (ie. geogrid every three courses) to blocks that were 200mm thick (ie. geogrid every two

courses). While some changes to the extent of the geogrid might reasonably have been expected as the design was developed and completed, the changes that were made to these key elements of the retaining wall suggest that the type of wall shown in the Base Date Design Information drawings may not have been adequate properly to retain this slope. The reasons for these changes may therefore merit further investigation because they may suggest that the Base Date Design Information did not in fact comply with the Employer's Requirements (see Clause 3.3 above), or that the Specified Exclusion relating to ground conditions might apply as set out in Item 3.3(c) of Schedule Part 4 (see Clause 2.7 above).

4.14 The omission of the filter drain at the front of the retaining wall and the addition of a vertical drainage blanket and perforated pipe behind the retaining wall in my opinion constituted a significant change in design principle that could not reasonably have been foreseen by an experienced Design & Build Contractor based on the Base Date Design Information. While a drainage blanket of this sort behind retaining walls would be common practice, I would expect such a Contractor to have concluded from the level of detail that was shown on the Base Date Design Information drawings that it was not required in this instance.

4.15 The type of coping and barrier at the top of the retaining wall changed significantly from that shown on the Base Date Design Information and in my opinion was a Notified Departure. However, I would expect the changes in the coping and perhaps in the barrier to have resulted in a cost saving or, if not, an increase that was within the contingency that an experienced Design & Build Contractor ought to have allowed when pricing this element of the works.

5. ANALYSIS - SECTION 7A TRACKSIDE DRAINAGE

General

5.1 Section 7A of the Edinburgh Tram Network extends from Gogaburn to Edinburgh Airport, that is, Chainage 710000 to about 712600. In this section a drainage system was to be provided as part of the scheme to manage the surface water on or adjacent to the new tracks. The Base Date Design Information drawings showing the trackside drainage that have been made available to me by **tie** do not cover the entire length of this section and I have therefore restricted my comments to that part of Section 7A between Chainage 710000 and about 711600.

5.2 The level of information shown on the Base Date Design Information drawings would in my opinion lead an experienced Design & Build Contractor to conclude that the civils design for this section of the project, including the trackside drainage, was far from being completed and would require very significant design development. For example:-

- (a) These drawings were either marked "*issued for external review*", or marked "*issued for external approval*" and stamped "*check print - not for issue*". In particular Drawing No ULE90130- 07-DRG-00103 Revision 1 had been marked up with several design issues that had still to be resolved.
- (b) Although the horizontal and vertical alignments of the tracks were shown, some of the cross-sections on these drawings showed the intended profile

of the proposed new embankment and drainage, while some cross-sections showed the embankment profile but no drainage. On certain of the cross-sections, neither the embankment profile nor the trackside drainage were shown.

- (c) The layout of the proposed drains in plan was shown only on Drawing No ULE90130- 07-DNE- 0001 Revision 2 for the southern part of Section 7A between Chainage 710000 and about 710400. However, this plan and the corresponding sections on Drawing No ULE90130- 07-DRG- 00103 Revision 1 had not been co-ordinated: for example, open V-ditches on the plan were shown as filter drains on the sections.
- (d) The layout of the proposed drains in plan for the rest of Section 7A was not shown on these drawings.
- (e) No details of the proposed drainage system (manhole details, pipe sizes, trenches, pipe bedding, etc) were shown, although Notes on these drawings referred to specifications, standard drainage construction details and the Drainage Design Plans (which I have not yet seen).
- (f) Note 11 on Drawing No ULE90130- 07-DNE- 0001 Revision 2 stated that approval for outfall connections to existing Scottish Water sewers was pending.

5.3 In my opinion the Base Date Design Information drawings would indicate to an experienced Design & Build Contractor that the design of the trackside drainage in Section 7A would require very significant development before it reached a state at which it was complete and could be issued for construction. I would expect Infraco to have identified this issue when preparing its tender for this project and, if possible, to have discussed this matter with Parsons Brinckerhoff so that Infraco could determine the nature and extent of the trackside drainage that was required where this was not shown or was inconsistent, and form a view on the likely cost of this element of the project.

5.4 Even an experienced Design & Build Contractor would have difficulty in pricing these factors because of the obvious preliminary and very limited nature of the information shown in the Base Date Design Information, but it may be that following discussions with Parsons Brinckerhoff, Infraco would have been better placed to determine an appropriate price for this element of the works. Nevertheless I would expect to have allowed a substantial contingency of, say, at least 20-25% to cover the subsequent development and completion of the design, as well as for general construction risks.

5.5 In Clauses 5.6 to 5.12 below I have commented on the differences that arose in the design of the trackside drainage in Section 7A between the Base Date Design Information and the Issued for Construction drawings. However, my comments in Clauses 4.6 and 4.7 above concerning the Bankhead Drive retaining wall would apply also to the trackside drainage in Section 7A.

Design development and completion

5.6 I have reviewed the sets of drawings that comprise the Base Date Design Information and the Issued for Construction drawings that have been made available to me by **tie** and have identified the following key amendments that occurred to the design of the trackside drainage in part of Section 7A (see Clause 5.1 above) between the Base Date Design Information and Issued for Construction stage:-

- (1) Track drainage: In the Base Date Design Information a carrier drain with periodic new manholes/catch pits running on one side and parallel to the tracks was shown in plan for the southern part of Section 7A between Chainage 710000 and about 710400 (see Drawing No ULE90130- 07-DNE- 0001 Revision 2). The drain was to discharge into a local watercourse.
- (2) Embankment drainage: In the Base Date Design Information open V-ditches running parallel with the tracks which were to discharge into local watercourses were shown in plan for the southern part of Section 7A between Chainage 710000 and about 710400 (see Drawing No ULE90130- 07-DNE- 0001 Revision 2). Along some sections these V-ditches were shown on both sides of the tracks, and along other sections a V-ditch was to be provided on only one side of the tracks. However, as stated in Clause 5.2(c) above, where track drainage had been shown in the cross-sections for this southern part of Section 7A, these details were not consistent with what had been shown on Drawing No ULE90130- 07-DNE- 0001 Revision 2.

5.7 The Issued for Construction drawing for the southern part of Section 7A (Chainage 710000 to about 710400) (Drawing No ULE90130- 07-DNE- 0001 Revision 8) showed in essence:

- (a) A carrier/filter drain on one or other, and in some place both sides of the tracks, again with periodic manholes and catch pits.
- (b) A filter drain with periodic manholes and catch pits at the bottom of each slope of the proposed new embankment.
- (c) Various pipe runs crossing beneath the tracks.

No details of the actual pipe sizes, inverts, manhole construction details, etc, were shown on the drawings that have been made available to me. However, the Issued for Construction drawings for the southern part of the Section 7A showed significantly more manholes than had been shown on the Base Date Design Information drawings.

5.8 The Base Date Design Information did not provide any information on the type and layout of the trackside drainage for the remainder of Section 7A between Chainage 710400 and about 711600 (see Clause 5.1 above). The only information about this drainage was that contained on the various cross-sections on the Base Date Design Information drawings, which were incomplete and clearly preliminary (see Clauses 5.2 to 5.4 above): on these

drawings carrier drains that were either large or small diameter were to be provided on either side of the tracks, together with filter drains on one or both sides of the new embankment.

5.9 The Issued for Construction drawings for the remainder of Section 7A showed either V-ditches or filter drains with periodic manholes and catch pits at the bottom of each slope of the proposed new embankment, together with a carrier/filter drain with periodic manholes and catch pits on one or other side of the tracks.

5.10 In the Table in Appendix B I have considered differences between the Base Date Design Information and the Issued for Construction drawings identified in Clauses 5.6 to 5.9 above in turn by reference to the matters set out in Section 3 above to determine whether in my opinion they constituted a Notified Departure under the contract, that is, an item that is an amendment and not foreseeable normal design development and one of the four types of exclusion. On this basis the following items would be Notified Departures:

- (a) The requirement for pipe crossings beneath the tracks between Chainage 710000 and about 710400.
- (b) The change from open V-ditches to filter drains at the bottom of the embankment slopes between Chainage 710000 and about 710400.

5.11 The track drainage between Chainage 710000 and 710400 at Issued for Construction stage differed in nature and extent from that shown in the Base Date Design Information drawings, but in my opinion these changes were in the main not greater than would be consistent with normal design development and completion of a scheme that clearly had not been fully developed in the Base Date Design Information. The exception was the introduction of pipe crossings beneath the tracks which in my opinion could not reasonably have been foreseen by an experienced Design & Build Contractor at tender stage.

5.12 Although the Base Date Design Information showed filter drains at the bottom of the embankments in the cross-sections between Chainage 710000 and 710400, the more recent plan of this part of the scheme (Drawing No ULE90130- 07-DNE- 0001 Revision 2) showed these drains were to be open V-ditches. In the event at Issued for Construction stage a filter drain with periodic manholes and catch pits was in fact to be provided at the bottom of each slope of the proposed new embankment. In my opinion, notwithstanding the inconsistencies in the Base Date Design Information, the requirement for such filter drains as opposed to the open V-ditches could not reasonably have been foreseen by an experienced Design & Build Contractor at tender stage.

5.13 In the remainder of Section 7A between Chainage 710400 and about 711600 (see Clause 5.1 above), the only information about the trackside drainage on the Base Date Design Information drawings was that contained on the various cross-sections, which an experienced Design & Build Contractor would have appreciated were incomplete and clearly preliminary. In these circumstances the trackside drainage that was shown on the Issued for Construction drawings (see Clause 5.9 above) was consistent with normal development and completion of such a design, and was therefore in my opinion not a Notified Departure.

6. SUMMARY AND CONCLUSIONS

6.1 TO BE EXTRACTED ESSENTIALLY VERBATIM FROM THE ABOVE TEXT

6.2 I understand that my duty in providing written reports and giving evidence is to assist the Court/Adjudicator, and that this duty overrides any obligation to the party who has engaged me. I confirm that I have complied with this duty and will continue to do so.

6.3 I also confirm that I am aware of the requirements of Part 35 of the Civil Procedure Rules, Practice Direction 35, the Protocol for the Instruction of Experts to give Evidence in Civil Claims and the Practice Direction on Pre-Action Conduct.

William J Marshall & Partners
Consulting Engineers and Architects
35 Westminster Palace Gardens
Artillery Row
London SW1P 1RR

5080\rpt\2

January 2010

CEC00579044_0020

APPENDIX A

BANKHEAD DRIVE RETAINING WALL

Edinburgh Tram Network

BANKHEAD DRIVE RETAINING WALL

Item	Amendment?	Not normal design development?	Exclusion				Notified Departure?
			Design principle	Shape	Form	Specification	
1. Length of wall	✓	✓ (in part)	x	✓	✓	x	Yes (in part)
2. Formation level	✓	✓ (in part)	x	✓	✓	x	Yes (in part)
3. Wall height	✓	✓ (in part)	x	✓	✓	x	Yes (in part)
4. Sub-base to wall	✓	✓	x	✓	✓	✓	Yes
5. Levelling pad	✓	x	x	✓	✓	x	No
6. Facing block	✓	✓	x	✓	✓	✓	Yes
7. Geogrid	✓	✓ (in part)	x	✓	x	✓	Yes (in part)
8. Drainage to wall	✓	✓	✓	✓	✓	✓	Yes
9. Coping and barrier detail	✓	✓	✓	✓	✓	✓	Yes

APPENDIX B

SECTION 7A TRACKSIDE DRAINAGE

Edinburgh Tram Network

SECTION 7A - TRACKSIDE DRAINAGE

Item	Amendment?	Not normal design development?	Exclusion				Notified Departure?
			Design principle	Shape	Form	Specification	
1. Chainage 710000 - 710400							
1.1 Trackside drainage	✓	✓ (in part) (see Note 1)	✓	✓	✓	x	Yes (in part) (see Note 1)
1.2 Embankment drainage	✓	✓ (in part) (see Note 2)	x	✓	✓	✓	Yes (in part) (see Note 2)
2. Chainage 710400 - 711600							
2.1 Trackside drainage	✓ (not shown)	x	?	?	?	?	No
2.2 Embankment drainage	✓ (not shown)	x	?	?	?	?	No

Note 1: In the main the changes to the trackside drainage (carrier/filter drains) between Chainage 710000 and 710400 was normal design development. Only the requirement for pipe crossings beneath the tracks was not normal design development.

Note 2: In the main the changes to the embankment drainage between Chainage 710000 and 710400 was normal design development. Only the change from V-ditches to filter drains at the bottom of the embankments was not normal design development.

APPENDIX C

CURRICULUM VITAE OF
T R E BLOIS-BROOKE

THOMAS ROBIN EARDLEY BLOIS-BROOKE

Oxford University, MA, Open Scholar
Chartered Engineer 1977
Chartered Arbitrator 1999

Fellow, Institution of Civil Engineers
Member, Chartered Institution of Water and Environmental Management
Fellow, Geological Society
Fellow, Chartered Institute of Arbitrators
Fellow, Academy of Experts
Fellow, Association of Consulting Engineers

Member, Chartered Institute of Arbitrators' Panel of Arbitrators
Member, Institution of Civil Engineers' List of Construction Mediators

Member, London Branch Committee, Chartered Institute of Arbitrators 1993 to 2000
(Chairman 1996/97)

Member, Institution of Civil Engineers' Advisory Panel on Legal Affairs 1995 to 2000

Year of birth: 1951

1979 to present Joined the practice of William J Marshall & Partners in 1979, becoming a Partner in 1985 and is now Senior Partner.

Besides general civil and structural design and construction work, the practice specialises in the examination, audit and appraisal of technical or administrative problems in the fields of general building, civil and structural engineering and materials science, many of which relate to disputes which have led to litigation both in the United Kingdom and abroad. This work involves the most advanced technical inquiries and often leads to the submission of Expert evidence to the High Court. The firm also advises major developers on the standards to be applied in the design and construction of new works.

Appointed as an Arbitrator and Mediator in various building disputes.

Particular experience of Design & Build contracts has included:

- NV Buildings, Salford Quays
- Westlink, Belfast
- Bristol Magistrates Court
- Radius Building, Prestwich
- Great Northern Tower, Manchester
- Coventry Arena
- Westfield Shopping Centre, London
- Baltic Place, Gateshead
- Broadway Plaza, Birmingham
- Millennium Stadium, Cardiff

Work in the civil engineering and geotechnical fields has involved the investigation of major failures and/or disputes concerning the following:

- geotechnical investigations
- ground improvement techniques
- land reclamation
- hillside stability
- irrigation works
- coffer-dams
- retaining walls
- bridges
- sewerage and stormwater drainage
- pipelines

Other structural and general building work has involved the identification of the causes of structural and foundation defects in more than three hundred buildings, ranging from major commercial and public developments to domestic dwellings, and has involved the following components:

- concrete and mortar generally
- concrete construction, durability and finishes
- steelwork design and installation
- brickwork design and construction
- screeds, tiling and other floor finishes
- building drainage
- site investigations
- foundations and superstructures for commercial, industrial and domestic developments
- waterproofing of basements
- sewerage and stormwater drainage

Retained by major property companies and others to advise on the design and installation of the external envelopes of a series of substantial developments that have included:

- cladding (precast concrete, metal, grc, grp, stone, fixings, proprietary framing systems and composite panels)
- curtain walling
- windows generally
- glazed roofs, canopies and screens
- double-glazing units
- external weatherproofing details
- roofing (metal profile, asphalt, felt, membrane and proprietary systems)

1973-1979 Engineer, Binnie & Partners, Consulting Engineers

1978-1979 Severn Tidal Power Study

Member of a six-man team investigating the feasibility and environmental aspects of the Severn Tidal Barrage for the Department of Energy.

1976-1978 Thames Tidal Defences

Supervision of a design team and design of the flood defences along two kilometres of the north bank of the River Thames.

Advice to section engineers and the site staff of current contracts on contractual and construction problems associated with the works.

1974-1976 Dinorwic Power Station, Alternative Water Supply

Supervision of the laying, testing and commissioning of eighteen kilometres of pipeline and of the remedial works to an earth-fill dam.

Production of a detailed analysis with recommendations to the Client on the Contractor's claims for an extension of time and for additional payments.

1973-1974 Thames Tidal Defences

Design of flood barrier foundations, temporary cofferdams and superstructures. Design of sheet pile wing walls, cut-offs and rockfill bed protection.