

In relation to the

Adjudication

between

Bilfinger Berger – Siemens - CAF
Consortium (the Referring Party)

and

tie Limited (the Responding Party)

Expert Report

regarding

Estimate in Respect of INTC No. 536

Access Dates Provided by **tie**

up to and including 31 July 2010 -

Delay Resulting from Incomplete Utilities Works

in relation to

The Edinburgh Tram Project

Prepared by:

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Specialist Fields: Planning, programming, contractual and financial aspects of construction contracts

On behalf of: **tie** Limited

under the instructions and directions of:

Susan Clark, Deputy Project Director, **tie** Limited

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Section 1 Executive Summary

1.1 Introduction

1.1.1 I have been instructed by **tie** to provide an **independent** expert report in respect of the Estimate submitted by the Infraco entitled “Estimate in Respect of Notice of **tie** Change Number 536 – Access Dates Provided by tie up to and including 31 July 2010 – Delay Resulting From Incomplete Utilities Works” (INTC 536 Estimate). I understand that my report is to be submitted as part of **tie**’s response to the Infraco’s referral of the Estimate for decision by adjudication.

1.2 Structure and contents of this report

1.2.1 In this report I provide my views on the Infraco’s contractual obligations in relation to programme, delay mitigation and the extent to which it has fulfilled these in relation to the matters in dispute.

1.2.2 I set out my observations, findings, analysis and opinions on the Infraco’s Estimate submission, highlighting its deficiencies and question its reliability.

1.2.3 I also provide my opinion on, and assessment of, what I consider to be the requirement to revise the Sectional Completion Dates as a direct result of the subject matter of the INTC 536 Estimate. I have not been asked to consider the quantum part of the Estimate and therefore it is not addressed in this report.

1.3 Subject matter of the INTC 536 Estimate

1.3.1 The INTC 536 Estimate is a claim by the Infraco for extensions of time and time related costs arising from the later than planned completion of the MUDFA Works and other utilities diversions carried out by, or on behalf of **tie**.

1.3.2 The Estimate considers that the later than planned completion of these works constitutes a Notified Departure which is defined in the Infraco Contract as a Mandatory **tie** Change. That being so, under the terms of Clause 80 of the Infraco Contract, the Infraco is required to submit an Estimate containing the details of any claim for extension of time and/or additional costs it considers arise from that Notified Departure.



- 1.3.3 The Estimate has been presented on that basis and is said to address delays to the planned completion of MUDFA Works and other utilities diversions as assessed at a base date of 31 July 2010.

1.4 Contractual process

- 1.4.1 Having studied the detail of the Infraco Contract, it appears to me that the Infraco may not be incorrect in notifying and pursuing claims for the subject matter of INTC 536 under Clause 80. If that is correct, I consider that the Estimate is invalid and should be rejected in its entirety. As I am not a qualified lawyer I leave that matter for others to debate and form opinion on.
- 1.4.2 I proceed on the presumption that the Estimate is valid and that it should be examined and assessed in accordance with the provisions and mechanisms set-out in Clause 80 of the Infraco Contract.

1.5 Notifications

- 1.5.1 INTC 536 was notified to tie on 22 January 2010. In the Estimate the Infraco states that another 14 INTCs are included within it. 9 of these pre-date INTC 536 and 5 post-date it. The inclusion of the subject matter of other INTCs in the INTC 536 Estimate appears to me to be contrary to Clause 80. I consider this particularly so with respect to the subject matter of INTCs that post-date INTC 536. It appears to me that by including within the INTC 536 Estimate matters that are outwith the scope of INTC 536, the requirements of Clause 80 have not been complied with. That being so, I would question the validity of the INTC 536 Estimate and suggest that this may be ground for its rejection.

1.6 Previous adjudication decision on later completion of MUDFA Works

- 1.6.1 I am aware that previously the Infraco pursued a claim for extension of time for later completion of MUDFA Work. This too was submitted under Clause 80 of the Infraco Contract and is referred to as INTC 429 (“MUDFA Revision 8”). The Infraco referred the INTC 429 Estimate for decision by adjudication. The adjudicator awarded 154 days for Section A and “Nil” each for Sections B, C and D.
- 1.6.2 In the narrative of the INTC 536 Estimate the Infraco states that it has taken into account that adjudication decision. For the reasons I explain in this report, it appears to me that this



is not the case. In effect, that decision has been ignored by the Infraco. I consider that it is wrong not taking into account a binding decision on matters that form a significant part of the subject of the Estimate. Such action contaminates the Estimate and in this particular set of circumstance renders the Infraco's analysis of delay incorrect. I consider this to be grounds for rejecting the INTC 536 Estimate, failing which appropriate adjustment is required to be made to implement within the assessment of extension of time, the Adjudicator's decision on the INTC 429 estimate.

1.7 Infraco delay analysis

1.7.1 The Estimate contains a delay analysis prepared by the Infraco. That analysis is used to support the extensions of time claimed by the Infraco. I consider that analysis to be inaccurate and unreliable for the following reasons.

- a) It uses inaccurate base information with respect to the actual dates for the MUDFA Works;
- b) It impacts the MUDFA dates into a delay analysis programme prepared only from the Infraco construction programme element of the Programme, ignoring all of the Programme's other parts;
- c) It contains many errors;
- d) It does not reflect the Infraco's current approach to the planned and actual order and manner for the delivery of the Infraco Works;
- e) It does not take into account other changes that have been instructed prior to the INTC536 base date;
- f) It has not been updated for actual progress on design and construction to the base date of the Estimate (i.e. 31 July 2010); and,
- g) It imposes certain resource constraints that cannot be justified by reference to the Infraco Contract. By this action is increases the delays projected.

1.7.2 For these and other reasons noted in the detail of this report I consider that it is an incorrectly prepared delay analysis that cannot be relied upon. I consider this to be grounds for rejecting the INTC 536 Estimate.



1.8 Alternative analysis of delay

- 1.8.1 In support of my assertions that I consider the Infraco's delay analysis to be incorrect and unreliable I have made some adjustments to it to address some of the criticism I have raised.
- 1.8.2 Using the Infraco's delay analysis programme as a starting point I updated it for actual progress and updated programme projections using Infraco reports and updates for design and construction, as presented in July 2010. By adding this actual data, the projections of delay far exceeded those claimed in the INTC 536 Estimate. I explain this work and the finding arising from it in some detail with the subsequent sections of this report
- 1.8.3 My overall finding was that at the INTC 536 Estimate base date of 31 July 2010, the Infraco Work had experienced a significant amount of delay and the programme was projecting considerable over-runs on the four Sectional Completion Dates. However, these delays and overruns were not being actually caused by late completion of MUDFA Works and utilities diversions. The critical delays were the result of, amongst other things, late delivery of design. While the MUDFA Work were, in many locations, being completed later than planned, they were in virtually every location, not actually causing delay. They were certainly not the dominant cause of delay and therefore, in my opinion, did not give rise for requirements for extensions of time.
- 1.8.4 I consider these findings to support my criticism of the Infraco's delay analysis and to evidence that the extensions of time claimed in INTC 536 are unjustified.

1.9 Corrections to the Infraco's delay analysis

- 1.9.1 Notwithstanding the fact that I consider that the Infraco's delay analysis is invalid I have been instructed to review and adjust it, as I deem appropriate, to account for apparent errors within it.
- 1.9.2 The product of this analysis identified that of the 461 days of extension of time claimed by the Infraco in the INTC 536 Estimate, at least 112 days should be deducted for errors within that analysis.
- 1.9.3



1.10 Conclusions

1.10.1 I consider the analysis of delay contained with the INTC 536 Estimate has not been prepared in accordance with the Infraco Contract and does not provide justification for awarding extension of time. The analysis is based on inaccurate and unreliable information used in, and produced from, an inappropriate method of delay analysis. It does not evidence actual delay arising from the later than planned completion of MUDFA Works and other utilities diversions. Consequently, it does not provide evidence to support the Infraco's claim.

1.10.2 Should I be proven wrong in my dismissal of the claim, and there is acceptance of the legitimacy of the Infraco's method of analysing delay, I consider that the periods of delay valued under that claim should be adjusted as per the summarised data in the table below
[TABLE STILL TO BE FORMATTED]

Section	EoT claimed in INTC 536	Adjusted assessment of EOT	Comment
A	241	154	As per the INTC 436 adjudication decision as there has been no further MUDFA Works delay affecting that section since.
B	286	0	As per the INTC 436 adjudication decision as there has been no further critical MUDFA Works delay affecting that section since.
C	461	349	Deduction of 112 days for correction of errors including the implementation of the adjudication decision on INTC 429.
D	461	349	Deduction of 112 days for correction of errors including the



implementation of the adjudication
decision on INTC 429.

1.10.3



Section 2 Introduction

2.1 Formal Details

Name:	Iain McAlister
Position:	Associate Director
	Acutus Merlin House Mossland Road Hillington Park Glasgow G52 4XZ
Nature of Business:	Construction Contracts Consultants
Specialist Fields:	Technical, contractual and financial aspects of construction contracts. Construction planning, programming and analysis of delay.

2.2 Synopsis

- 2.2.1 On 14 May 2008 **tie** Limited (“**tie**”) contracted with Bilfinger Berger UK Limited and Siemens PLC to carry out the Infraco Works on the Edinburgh Tram Project. On that same date Bilfinger Berger UK Limited and Siemens PLC entered into a minute of variation with Construcciones y Auxiliar de Ferrocarriles SA whereby the three companies became the consortium for the delivery of the Infraco Works (“the Infraco” and “BSC”).
- 2.2.2 From the outset, delivery of the Infraco Works has been subjected to various delays. As a consequence of these delays the Infraco is projecting significant over-runs on the four contractual Sectional Completion Dates and is claiming entitlement to extension of time. I am advised that **tie** acknowledges that there have been a number of delays for which it carries liability but also that there are many other delays that are the contractual responsibility of the Infraco.



- 2.2.3 The Estimate that is the subject of this report seeks **tie's** agreement to extensions of time (and associated increase to the Price which is a matter outwith the scope of my instructions) for later than planned completion of utilities works. I am advised that **tie** considers that the delay analysis contained within the Estimate has been incorrectly prepared, contains many inaccuracies and does not properly apply the contractual mechanisms for the preparation of such an Estimate. It also does not properly take into account a previous adjudication decision on the same subject matter.
- 2.2.4 The failure of the parties to agree the Estimate has resulted in the Infraco referring the matter for decision by adjudication in accordance with the Dispute Resolution Procedure contained within the Infraco Contract.

2.3 Appointment and Directions

- 2.3.1 On 8th April 2009 Acutus was appointed by **tie** to challenge the delay assessment work previously undertaken by its own planning team and to provide independent forensic planning analysis to inform and advise **tie** in its administration of the Infraco contract.
- 2.3.2 That brief was subsequently developed and extended to include:
- a) the analysis of subsequent programme submissions and claims by the Infraco;
 - b) the preparation of an expert report on the Estimate entitled "INTC 429 - MUDFA Programme Revision 8 – Delay and Disruption Resulting from Incomplete Utility Works"; and,
 - c) technical and contractual analysis and advice in relation to analysis of delay.
- 2.4 On 22nd September 2010 I was directed by **tie** to examine this Estimate and provide my views on its contents. Following subsequent meetings with **tie** and its advisors I was directed to prepare an expert report providing my views and opinion on the analysis of delay contained within it.

2.5 Report

- 2.5.1 In accordance with **tie's** directions, this report provides my:
- a) view on the Infraco's contractual obligations in relation to programme, delay mitigation and the extent to which it has fulfilled these;



- b) observations, findings, analysis and opinions on the Estimate submitted by the Infraco; and,
- c) opinion on what I consider to be a reasonable assessment of the requirement to revise the Sectional Completion Dates as a direct result of the later than planned completion of the MUDFA Works.

2.5.2 I have been assisted in the preparation of this report by following members of Acutus staff:

- i) Robert Burt, Director; and,
- ii) Hugo Dickson, Senior Consultant.

2.5.3 I was consulted with and sourced information from the following members of tie's staff:

- i) Tom Hickman, Programme Manager;
- ii) Susan Clark, Deputy Project Director;
- iii) Fiona Dunn, Strategic Commercial Manager;
- iv) Damian Sharp, Design Manager;
- v) Frank McFadden, Infraco Director;
- vi) Andrew Scott, Project Manager; and,
- vii) Malcolm Butchert, Project Manager;

2.6 Opinions Expressed in Relation to Law / Legal Matters

2.6.1 Opinions expressed in this report that touch upon the interpretation of the contract, or of the law, are given in my capacity as a construction contracts and construction planning expert with formal education in construction law. Those views are given only where it is necessary for them to explain the basis upon which I have come to my opinions. I am not qualified to provide legal advice.

2.7 Disclosure of Interests

2.7.1 I am unaware of any conflict of interest that would prejudice me in relation to providing independent and objective opinion in relation to this dispute.



2.8 Curriculum Vitae

- 2.8.1 A curriculum vitae detailing my experience, qualifications and specialist fields of knowledge is included at Appendix 2/1 of this report.



Section 3 Background to the Dispute

3.1 General

- 3.1.1 **tie** has contracted with the Bilfinger Berger – Siemens – CAF Consortium (the Infraco) to deliver the Infraco Works for the Edinburgh Tram Project. Separately, in general, **tie** has contracted with others to divert utilities away from the Infraco Works. The utilities diversion works are referred to in the various contracts and by the parties as the “MUDFA Works”. For many parts of the route the MUDFA Works required to be complete in advance of the construction elements of the Infraco Works.
- 3.1.2 It is my understanding that during the bidding process for the Infraco Contract, **tie** provided the Infraco with a MUDFA Works programme. The Infraco used this to inform the preparation of the Infraco construction programme. That programme is one of six elements that constitute the Programme, as defined within the Infraco Contract.
- 3.1.3 The Infraco’s method of aligning its planned order, sequence and timing of the Infraco Works with the MUDFA Works programme was to create 10 No. “MUDFA” milestones within the Infraco Works Programme. This arrangement is explained in the Infraco Contract Schedule Part 15 - “Programming Assumptions (12 May 2008)” at point 3.1 and noted in Schedule Part 4 – “Pricing” at point 3.4.24 as a Pricing Assumption.
- 3.1.4 The MUDFA Works have experienced delay and change at many locations along the route. Consequently, the MUDFA Works have not been completed in accordance with the MUDFA Works programme used by the Infraco in the preparation of the Infraco construction programme.

3.2 Previous Estimate and Adjudicator’s decision

- 3.2.1 On 6th August 2009, the Infraco submitted an Estimate, for late completion of utilities works, entitled “Estimate in Respect of Notice of **tie** Change Number 429 - MUDFA programme Revision 08 – Delay and Disruption Resulting from Incomplete Utility Works”. It sought extensions of time to the four Section Completion dates for delays to completion of utilities works up to 31 March 2009. The parties could not reach agreement on this Estimate and therefore the Infraco referred it to the DRP. Following a failed attempt at mediation it was referred for a decision by adjudication. The extensions of time sought by the Infraco and those awarded by the Adjudicator are set-out in the table below.



Section	Sought in the Estimate for INTC 429	Decision of the Adjudicator
A	195 days	154 days
B	193 days	Nil
C	257 days	Nil
D	257 days	Nil

3.3 Estimate for INTC 536

3.3.1 On 17 September 2010 the Infraco submitted an Estimate entitled “Estimate in Respect of Notice of tie Change Number 536 – Access Dates Provided by tie up to and including 31 July 2010 – Delay Resulting from Incomplete Utilities Works”. The extensions of time sought by the Infraco are set-out in the table below.

Section	Sought in the Estimate for INTC 536	Sought in addition to that determined by the Adjudicator for INTC 429
A	241 days	87 days (i.e. 241 – 154)
B	286 days	286 days
C	461 days	461 days
D	461 days	461 days

3.3.2 I am advised that tie subsequently requested additional information in relation to the price adjustment elements of the Estimate and that some of that information was provided by the Infraco. It is my understanding that tie also requested additional information with respect to the time information, programmes and analysis of delay prior to the Infraco initiating the Dispute Resolution Procedure (DRP) in respect of reaching agreement on this Estimate.



3.4 Referral to the Dispute Resolution Procedure

3.4.1 On 18 January 2011 the Infraco served notice referring the matter of agreeing the Estimate to the contract DRP.

3.4.2 On XXth and YYth March 2010 attempts were made to resolve this matter through mediation. This proved unsuccessful and the Infraco subsequently referred the matter for resolution by adjudication in accordance with the contract Dispute Resolution Procedure.

3.4.3 This report has been prepared for use in that adjudication.



Section 4 Contract provisions in relation to time and tie Change (to be reviewed and revised in light of the Clause 65 v 80 debate)

4.1 Review of contract provisions

4.1.1 I have reviewed the Infraco Contract and examined in some detail the sections that deal with matters of time, change, delay, access, mitigation, acceleration, liquidated and ascertained damages, pricing and programme. In relation to the matters I address in this report, I consider the following provisions and obligations of particular relevance. (It should be noted that in the interest of brevity I have elected not to quote entire clauses verbatim. I direct the reader to the contract documentation for the full wording of the clauses and the Schedule Parts referred to in them.):

4.1.2 General Obligations

a) Project Partnering

- i) Each party shall *“take reasonable steps to mitigate any foreseeable losses and liabilities”* (clause 6.3.5); and,
- ii) Each party shall *“take all reasonable steps to manage, minimise and mitigate all costs”* (clauses 6.3.6).

b) Duty of care and general obligations in relation to the Infraco Works

- i) *“The Infraco shall (and shall procure that the Infraco Parties) use reasonable endeavours to ensure that in carrying out the Infraco Works, it:”*
 - *“maximises productivity by reference to Good Industry Practice”* (clause 7.5.1)
 - *“minimises costs”* (clause 7.5.5)

4.1.3 Programme and Progress



- i) *“The Infraco shall progress the Infraco Works with due expedition and in a timely and efficient manner without delay, to achieve timeous delivery and completion”* (clause 60.1);
- ii) *“The Infraco shall update the Programme in accordance with the requirements of Schedule Part 2 (Employer’s Requirement).”;* and,
- iii) *“The Infraco shall take all reasonable steps to mitigate the effects of any delay to the progress on the Infraco Works.”* (clause 60.9)
- iv) *“Programme” means the programme set out in Schedule Part 15 (Programme) as developed and extended from time to time in accordance with this Agreement which shall include, the Maintenance programme, the Consents Programme and Design Delivery Programme but shall exclude any programme developed in respect of the completin of any Accommodation Works Changes”* (Schedule Part 1 – Definitions)
- v) *“The Programme consists of the following documents:*
 - *Infraco Construction Programme*
 - *The Programme Assumptions*
 - *Relaxations to the CoCp constraints assumed by the BBS in their construction programme as annotated and agreed with tie*
 - *On Street Construction Works Methodology*
 - *SDS Design Delivery Programme V26*
 - *SDS Consents Programme (derived from the SDS Design Delivert Programme V26)*”

4.1.4 tie Changes

- a) Clause 80 in its entirety, and in particular
 - i) *“The Estimate shall include the opinion of the Infraco (acting reasonably) in all cases on:*



.....

any impact on the Programme and any requirement for an extension of time”
(clause 80.4.3);

proposals to mitigate the impact of the proposed tie Change” (clause 80.4.8);

ii) *“The Infraco shall include in the Estimate evidence demonstrating that:*

the Infraco has used all reasonable endeavours to minimise (including by the use of competitive quotes where appropriate in the case of construction works and where reasonable in the circumstances that new or additional sub-contractors are required to deliver in the case of Maintenance Services or where construction works are undertaken during the maintenance phase) any increase in costs and to maximise any reduction of costs (clause 80.7.1);

the Infraco has investigated how to mitigate the impact of the tie Change (clause 80.7.3); and,

iii) *the proposed tie Change will, where relevant, be implemented in the most cost effective manner*” (clause 80.7.4)

iv) *“As soon as reasonably practicable and in any event within 20 Business Days of issue of a tie Change Order, or such other period as the Parties may agree acting reasonably, Infraco shall update:-*

- *The Programme in accordance with Clause 60;”* (clause 80.17.1)

4.1.5 Pricing¹

a) Relevant Pricing Assumptions are:

i) *“That in relation to Utilities the MUDFA Contractor and/or Utility shall have completed the diversion of any utilities in accordance with the requirements of the Programme save for utilities diversions to be carried out by the Infraco pursuant to the expenditure of the Provisional Sums noted in Appendix B.”*
(Schedule Part 4, clause 3.4.24)

¹ Schedule Part 4
J086-1002 Draft Ver.3



ii) *“That the programming assumptions set out in Schedule Part 15 (Programme) remain true in all respects.”* (Schedule Part 4, clause 3.4.32)

b) *“7.0 UTILITIES DIVERSIONS TO BE CARRIED OUT BY INFRACO*

7.1 Although tie has let the MUDFA Contract (Multiple Utilities Diversion Framework Arrangement) to carry out the diversion of utility apparatus in the path of the proposed tram route prior to Infraco Works, it will be necessary for some of these works to be delivered by Infraco for the reasons such as:

- *they may be unrecorded and not discovered until the Infraco Works are commenced*
- *they may be discovered during the MUDFA Works but left to avoid a programme overlap or other technical reason*
- *they may be intrinsically linked to the Infraco Works*
- *they may require such significant reinstatement work that to carry out under MUDFA may result in significant abortive works.*

7.2.1 Where Infraco has been advised of the existence of utility apparatus in advance, whether identified to date or following discovery during the MUDFA Works, any adjustment to the Contract Sum will be made by applying the provisions of Clause 80 (tie Changes).”

4.1.6 Programme assumptions²

a) Programming Assumptions (12 May 2008)

“3 MUDFA & UTILITIES

3.1 The programme is based on MUDFA having completed all works and all utilities being diverted that would conflict with INFRACO operations by the following dates;

1A 31 October 2008

² Schedule Part 15b – Section 3
J086-1002 Draft Ver.3



1B	01 August 2008
1C	31 October 2008
1D	19 December 2008
2A	16 May 2008
5A	No constraint
5B	11 April 2008
5C	16 May 2008
6	SGN Diversion, 18 April 2008
	Watermain Diversion 30 May 2008
7A	16 May 2008

Commented [IMcA1]: Programme states otherwise.

3.2 No enabling works shall be required to be undertaken by INFRACO before MUDFA (or other Utilities) can complete their works. The programme is based on the Utilities in the Victoria Dock Access Bridge and Tower Place Bridge area being temporarily diverted away from INFRACO works by MUDFA in advance of the INFRACO works.” (Schedule Part 15, clauses 3.1 and 3.2.)

4.1.7 Schedule Part 2 (Employer’s Requirements), Section 12 Project Management Processes

- a) I refer to this section in its entirety, and in particular:
 - i) Sub-section 12.1.2 Progress Reporting –
 - “Progress reports shall be submitted by the Infraco to tie no later than three Business Days before each progress meeting.”
 - The Infraco’s progress reports shall contain comprehensive information
 - Information provided within the progress reports shall include, but not be limited to, the following:



- *The activities commenced or completed since the previous report and upon what dates;*
 - *The expected remaining duration of all activities commenced but not completed;*
 - *Any other additional activities with expected durations, methods and resources requirements and sequence assumptions;*
 - *Any changes to expected durations, method, resource requirements and sequence assumptions;*
 - *Forecast completion dates for all Infraco Works in each geographic section and intermediate geographic section including any slippage or advance upon the Planned Service Commencement Date and/or the Planned Sectional Completion Dates (as appropriate);*
 - *Programme comparison between actual vs. Planned;*
- ii) Sub-section 12.2 Programme Management –
- iii) *“The Infraco shall undertake programme management including the implementation, regular updating and management of a fully detailed comprehensive Programme illustrating how the Infraco proposes to execute the whole of the Infraco Works in compliance with the Project Programme.*
- iv) *The Infraco shall update the Programme every four weeks in line with tie reporting periods to take full account of the Infraco progress in completing the Infraco Works.*
- v) *A hard and soft copy updated Programme and an Infraco Progress Report shall be submitted by the Infraco to tie no later than three Business days before each four weekly progress meeting.”*
- b)
- c)(Need to add terms referring to design review and approval?)

- d)(consider whether or not to include references to Clause 18/65 etc..)

4.2 Interpretation of these contract provisions

4.2.1 It appears to me that, read together, these clauses and the contents of the contract schedules provide the contractual basis from which the INTC 536 Estimate should be prepared, examined, discussed, assessed and agreed.

4.2.2 From all of the foregoing I consider that:

- a) The Programme consists of six elements, three of which are programmes.
- b) The Infraco construction programme that is included in Schedule Part 15 is based on the Intermediate Section Dates for completion of the MUDFA Works as set out in paragraph 3 of Schedule Part 4 and that if the MUDFA Works within each Intermediate Section are not complete by the date stated, that constitutes a Notified Departure which is, by definition, a Mandatory tie Change and hence tie is deemed to have issued a tie Notice of Change.
- c) In accordance with clause 80 the Infraco is required to submit an Estimate for this tie Change for discussion and agreement with tie.
- d) The specific requirements of the Estimate in relation to programme, delay and mitigation are set out in clauses 80.4 and 80.7. In particular, the Estimate is required to include the Infraco's opinion (acting reasonably) on any impact on the Programme and any requirement for an extension of time.
- e) The Infraco is obliged to update the Programme every four weeks in accordance with the Employer's Requirements. Such updating shall include, among other things, the recording of actual progress, actual and planned change and, issued tie Change Orders.
- f) With regard to the preparation of the Estimate and the proposed implementation of the tie Change, the Infraco shall:
 - i) take all reasonable steps to manage, minimise and mitigate all cost (clause 6.3.6);

- ii) progress the Infraco Works with due expedition and in a timely and efficient manner without delay, to achieve timeous delivery and completion (clause 60.1);
 - iii) take all reasonable steps to mitigate the effects of any delay to the progress on the Infraco Works (clause 60.9); and,
 - iv) implement the tie Change in the most cost effective manner (clause 80.7.4).
- g) The parties shall work in mutual co-operation and on a collaborative and Open Book basis to agree the Estimate (clauses 6.1 and 6.3.1).



Section 5 Review of the Infraco Estimate

5.1 Introduction

- 5.1.1 I have examined, in some detail, the delay analysis contained within the Estimate, as submitted by the Infraco under cover of its letter reference 25.1.201/KDR/6694, dated 17th September 2010.
- 5.1.2 tie has provided me with further information produced by the Infraco during the currency of the Infraco Contract. It has also provided me with; the Infraco Contract; legal opinion; and, extracts from the project record that are considered to be of relevance to the Estimate. (Specify in more detail?)
- 5.1.3 On the basis of all of this information I have been asked to provide my opinion on the manner in which the Estimate has been prepared and in particular whether the analysis of delay contained within it correctly and accurately projects requirements for extension of time, to each of the four Section Completion dates, which arise as a direct result of the tie Change cited in the Estimate. (DMack – “Setting aside any effect of the Infraco’s failure to observe the requirements of clause 65???”)
- 5.1.4 In the sub-sections of this report that follow I provide a critique of the Estimate.

5.2 Infraco Notice of tie Change

- 5.2.1 I observe that the Estimate purports to be that associated with Infraco Notice of tie Change (INTC) No. 536 (copy enclosed at Appendix 5/1). That INTC was issued on 22nd January 2010. Its subject / scope is described within it in the second paragraph and is repeated below for ease of reference.

“The issuance by tie of the Utilities Programmes for Section 1C – York Place (1C/WSI/005/001) and Section 1D – Haymarket (1D/WSI/001/001) under cover of letter dated 21 January 2010, reference INF CORR 3228/FMCF, is demonstrative of additional delays in the subject areas, and we record observance of additional delays to several other locations on the Project.”

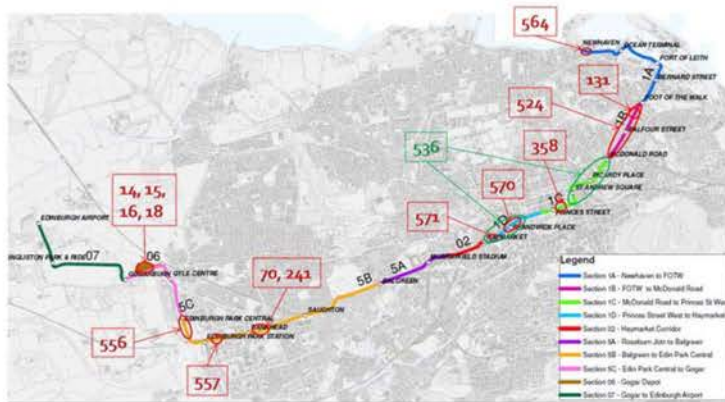
- 5.2.2 The scope of the INTC 536 Estimate encompasses the later than planned completion of utilities diversion works across the entire area of the Site.



5.2.3 The Estimate narrative states at Appendix A³

“As this INTC takes account of the information available to Infraco as at 31 July 2010, it supersedes INTC’s 14, 15, 16, 18, 70, 131, 241, 358, 524, 556, 557, 564, 570, 571 which addressed the information known at earlier dates.”

5.2.4 I have been provided with a copy of these INTCs and a summary of them, prepared by tie. I enclose a copy of these documents at Appendix 5/2. On the site plan below I have shown the location and approximate part of the Site referred to in each of these ITNCs.



5.2.5 As can be derived from the dates on the INTC summary schedule, enclosed at Appendix 5/2, and the numbering of the INTCs, nine of them pre-date INTC 536 and five post-date it.

5.2.6 I note that this listing of INTCs does not include INTC 429. The following paragraphs explain why I consider its scope and timing to be of importance with respect to my review of the Estimate for INTC 536.

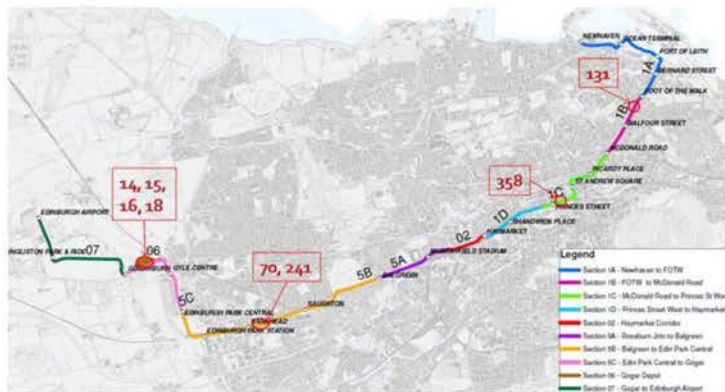
5.2.7 On 6th August 2009 the Infraco submitted an Estimate for INTC 429. It is entitled “MUDFA⁴ programme Revision 08 – Delay and Disruption Resulting From Incomplete Utility Works”. (A copy is enclosed at Appendix 5/3.) This Estimate became the subject of a dispute and, through the Infraco Contract Dispute Resolution Procedure (DRP), was decided by

³ Page 1, paragraph 3

⁴ MUDFA = multi-utilities diversion framework agreement which is an agreement separate from the Infraco Contract entered into by tie with a different contractor.



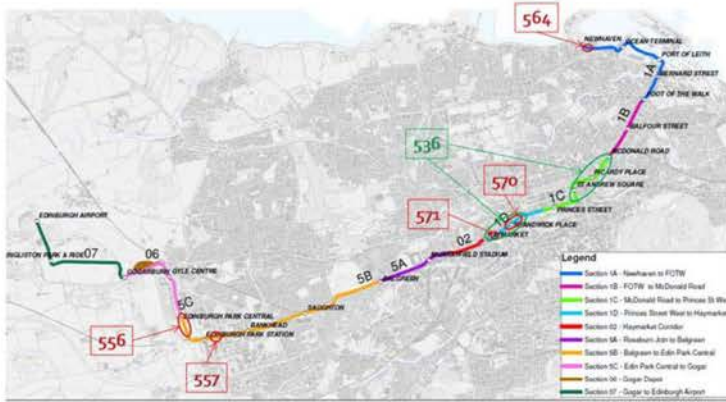
adjudication⁵. The Estimate was in relation to delayed completion of the MUDFA Works up to 28th March 2009⁶. It's scope covered the entire Site. Of the nine ITNCs that pre-date INTC 536, eight pre-date INTC 429. These are shown on the site plan below.



- 5.2.8 It appears to me that the utilities diversion works delays associated with all eight of these, as per their status at 28th March 2009, were included within the Estimate for INTC 429. I say that because that Estimate addresses utilities delays across the entire length of the Site and appears to include the scope of the matters referred to within these eight preceding INTCs. They were, therefore, within the scope of the adjudicator's decision, as issued on 16th July 2010. That being so, it would appear that the INTC 536 Estimate includes matters that have previously been decided by an adjudicator.
- 5.2.9 I am advised that that decision has not, at the date of this report, been superseded by subsequent legal proceedings or agreement between the parties. I conclude that the INTC 536 Estimate would appear to be invalid because of its apparent inclusion of such matters.
- 5.2.10 The five INTCs that post-date INTC 536 are shown on the site plan below.

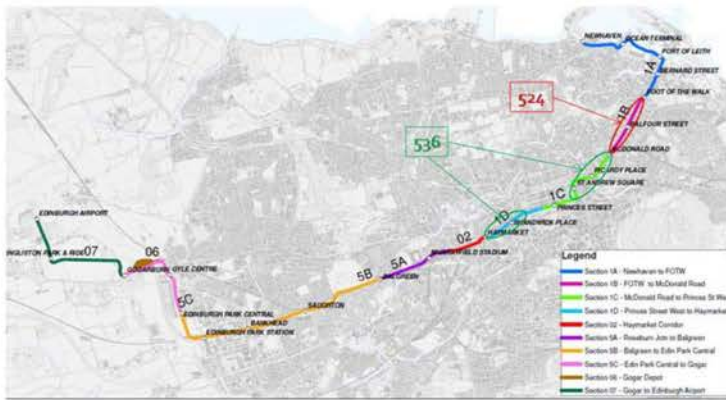
⁵ See Section 6 of this report for further information in relation to this decision and its implementation.

⁶ Referral for Delays Arising From Incomplete MUDFA Works, dated 23 April 2010, paragraph 4.6.



5.2.11 The fact that they are spread throughout the site and appear to impact on critical and near critical areas, as cited in the Estimate, lead me to question whether their inclusion in the INTC 536 Estimate is contractually correct. (Develop this line further?)

5.2.12 If the INTCs that pre-date INTC 429 and post-date INTC 536 should not be included within the INTC 536 Estimate, that leaves only INTC 524 as a potentially legitimate inclusion. The site plan below sets out the scope of these INTCs.





- 5.2.13 If the legitimate scope of the INTC 536 Estimate is limited to that notified within INTC 536, with or without the inclusion of that notified in INTC 524, it appears to me that the delay analysis contained within the Estimate significantly exceeds that legitimate scope. (Develop this line further or delete?)
- 5.2.14 I also note that the scope of all of the INTCs referred to in the Estimate, when taken together, does not cover the entire area of the Site, yet the Estimate impacts events throughout the length of the route. (Develop this line further or delete?)
- 5.2.15 On the basis of the preceding paragraphs it appears to me that all of the matters referred to in the Estimate may not have been properly notified in accordance with the Infraco Contract and that many should not be included as they have already been decided upon in adjudication. (DMack "Clause 18/65 question?") Consequently, I am led to question whether the Estimate is valid under the terms of the Infraco Contract. I leave that as a matter for others (more appropriately qualified than I) to consider, opine and decide upon. For the purpose of preparing this report, I proceed on the basis that the INTC 536 Estimate is valid.

5.3 Starting point for analysis of delay

- 5.3.1 The Estimate states that the starting point for the analysis of delay is the Revision 1 version of the Infraco construction programme. I note that this, on its own, is not the Programme as defined in the Infraco Contract. It is but one of six component parts that constitute the Programme. The approach adopted in the Estimate does not consider the impact of the tie Change on the Programme as a whole. This appears to me to be contrary to the requirements of Clause 80 of the Infraco Contract. I consider that such action introduces a significant risk that any analysis undertaken on what is only part of the Programme is likely to produce unreliable and/or misleading results.
- 5.3.2 I note that the version of the Infraco construction programme used in the analysis of delay is "Revision 1". I also note that the analysis is based on a version of this programme without any update, development or revision. I am aware that the Infraco updates the Infraco construction programme every four weeks (in accordance with the Employer's Requirements, as is required by clause 60.2 of the Infraco Contract). The updating actually undertaken appears to involve the insertion of actual progress data into the electronic copy of the Infraco construction programme, and its subsequent re-scheduling to produce

Commented [IMcA2]: DMack "Does clause 60.2 not require the whole Programme to be updated? Does this happen? (See IMcA comments at 5.7.3 below.)"



updated projections for all incomplete activities and the four Section Completion Dates. I am also aware that the Infraco routinely updates the SDS design development programme in a similar fashion. It appears to me that the analysis of delay undertaken in the preparation of a tie Change Estimate should be conducted using all of the updated elements of the Programmes. To do otherwise will most certainly produce entirely theoretical projections that will almost certainly not align with known fact and the Infraco's actual planned intent at the base date of the Estimate. It will, therefore, not produce a reliable analysis of causation.

5.4 Method of delay analysis

5.4.1 I note the method of delay analysis employed in the Estimate is "As-planned Impacted" (aka "Impacted as-planned"). I do not agree with the statement contained within the Estimate that this is "*the most appropriate form of evaluation*"⁷. I say that because, as a method of delay analysis, it is widely recognised as only suitable for use in particular and relatively simple circumstances. It has many shortcomings and is considered unsuitable for analysing delays on large and relatively complex contracts.⁸ (Expand on this or leave for legal team submission? Discuss with legal team about how much of the specific criticisms should be articulated in this report.)

5.4.2 It has been much criticised in the UK courts⁹ for the following reasons. It:

- i) takes no account of the effect of actual progress;
- ii) takes no account of any changed intentions, construction methods, re-sequencing or re-ordering;
- iii) ignores any duty to mitigate;
- iv) does not establish the actual effect of the delaying events;
- v) can be easily manipulated to give different results; and
- vi) tends to accrue relief to the author's benefit.

⁷ INTC 536 Estimate, Appendix A, first page, paragraph 6.

⁸ Ref. "*Delay and Disruption in Construction Contracts*", Pickavance K. (LLP: ISBN 1-85978-148-9), pages 315 – 319; "*Delay Analysis in Construction Contracts*", Keane P. J. & Caletka A. F. (Wiley-Blackwell: ISBN 978-1-4051-5654-7), pages 125 – 131.

⁹ *Great Eastern Hotel Company Ltd v John Laing Construction Ltd* [2005] EWHC 181 [TCC], *Henry Boot Construction (UK) Lts v Malmison Hotel (Manchester) Ltd* [1999] 50Con LR32 and others (Do we want to quote case law in this report?)



5.4.3 The as-planned impacted method is highly theoretical and is completely reliant on the accuracy of the as-planned programme to model the true effect of the proposed tie Change on what has and will occur on the project as a whole. Without taking into account actual progress, changes to the Infraco Works and changes to the Infraco's planned order and methods of delivery, this method of analysis will almost certainly produce unreliable and unrealistic results. I observe that this is indeed the case with the analysis contained within the INTC 536 Estimate. The analysis output (located in its Appendices F and G) show activities being undertaken during the period May 2008 (commencement of the Infraco Contract) to July 2010 (the base date of the Estimate) which are at odds with the actual facts. In particular there are major items of work shown on these programmes for execution during this period of time, in critical or near critical areas, which are shown as complete when in fact, at the present date, they remain incomplete and, in many instances, are yet to commence¹⁰.

Commented [IMcA3]: Refine wording for clarity.

5.4.4 I also note that the analysis does not take account of other forms of delay that have impacted on the Programme up to the base date of the Estimate. This is confirmed in the Appendix A narrative which states¹¹,

"The analysis remains devoid of any consideration for the other forms of delay incurred on the project to date. It is understood and accepted that the impacts associated therewith shall be treated under separate process and that nothing in this Estimate shall prejudice Infraco's right to compensation for extension of time, relief and/or cost associated therewith."

5.4.5 I am unaware of the basis upon which the Infraco makes this statement. It appears to me to be inconsistent with the requirements of the Infraco Contract and contrary to the principles established in relevant case law. (Review wording and consider if more should be said about this here.) I consider that not taking account of other forms of delay that have impacted on the Programme undermines the credibility of the delay analysis contained within the Estimate.

¹⁰ Examples include M& E Design, Haymarket Station Viaduct, Russell Road Underbridge, Roseburn Street Viaduct, Gogar Depot Building.

¹¹ Estimate Appendix A, page 10, paragraph 6.



5.5 Additions and adjustments to the Infraco construction programme

5.5.1 The base programme used in the Estimate to conduct analysis of delay is a heavily adjusted and amended version of the original Infraco construction programme Revision 1. It would appear that attempt has been made to explain and justify these changes at various places within the narrative of Appendix A. Included with the base programme print-out enclosed at Appendix D are various documents that purport to log all of the changes made. On closer inspection these documents do not provide an exhaustive list of changes. (Develop this line or argument further on completion of detailed programme comparison exercise. Highlight added activities and logic that were not in the Revision 1 programme, add to the overall duration, and are not subject to this INTC or matters for which the Infraco can seek extension of time.)

5.5.2

5.5.3 Aside from the logic changes that purportedly mitigate delay, new milestones and activities have been added. As far as I am aware, these are not associated with this or any other notified tie Change. Certainly, they are outwith the scope of INTC 536. Individually and together(collectively/cumulatively) they have significant durations and are linked into the logic network of the Infraco construction programme. I include below an extract from the electronic copy of the INTC 536 delay analysis programme showing an example of these new activities and their associated logic links.

Activity ID	Activity Name	Original Duration	Start	Finish
Tram		250	29 Oct 10	15 Mar 12
CAF-01	depot available for tram delivery	9	29 Oct 10	
CAF-02	delivery of the first tram (according CAF programme)	15	29 Oct 10	17 Nov 10
07-04-TRAM-20	commissioning of first 5 Trams on test track (according CAF programme)	44	10 Feb 11	12 Apr 11
CAF-100	test track available for tram commissioning	0	10 Feb 11	
07-04-TRAM-30	commissioning of tram 6 to 27 (according CAF programme)	227	13 Apr 11	15 Mar 12

Predecessors	Successors
Activity Name	Activity Name
Section Completion A	Commissioning of tram 6 to 27 (according CAF programme)
test track available for tram commissioning	Section Completion B

5.5.4 These activities under the heading “Tram” are not to be found in the Infraco construction programme Revision 1. Their predecessors and successors are linked into the delay analysis programme network. As can be seen in the programme extract above (ref. entries in white text on blue background), the commissioning of the first 5 trams is linked between the



“Section Completion A” and “Section Completion B” milestones. This new activity has a significant duration (44 working days). I note that if these activities were to be added, in the same way, to the original version of the Infraco construction programme (or Revision 1), the projected Section Completion B Date would over-run that stated in the Infraco Contract by 23 working days (44 working days less the 21 working days between Section Completion A and B Dates as per the Infraco Contract and the Programme within it). This equates to approximately 33 calendar days, depending on how the time falls with respect to weekends and holiday periods.

- 5.5.5 The consequence of the particular additions to the delay analysis programme, as shown in this example, is that the projection of delay to the Section B Completion Date is increased by at least 33 calendar days.
- 5.5.6 Together these additional activities and milestone, coupled with associated logic link additions and adjustments are extending the overall time for completion [and adding to the resource demand] that is modelled in the electronic copy of the base programme. However, they are not within the scope of the INTC 536 Estimate. I am advised that they have not been the subject of any other notices or claims under the terms of the Infraco Contract. I conclude that their inclusion in the INTC 536 Estimate delay analysis is unjustified and results in a distortion of the results produced from it.
- 5.5.7 [(DMack) This is only one example of (many) others ehic are more easily explained orally with graphical aids.]

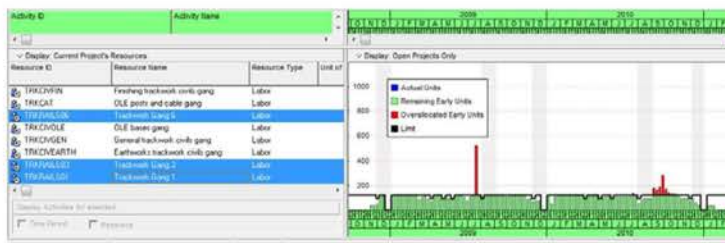
5.6 Resource constraints

- 5.6.1 I note that the delay analysis contained within the Estimate imposes a resource constraint on the number of track gangs (3No.) and overhead line (OHL) gangs (2No.) that can be allocated to particular tasks at any point in time. This constraint increases the projections of delay to some of the Section Completion Dates beyond that derived purely from a critical path analysis. I have searched the Infraco Contract and its associated schedules for justification for applying these constraints. I have found nothing to support their application.



5.6.2 I am advised that during the contract negotiation period the Infraco sought to have such a constraint written into the Infraco Contract but this was not accepted by tie. (Include this statement?)

5.6.3 I note that the demand for track gangs in the Infraco construction programme Revision 1, already exceeds the 3No. gang constraint. I include below the relevant resource histogram produced from that programme.



5.6.4 The vertical scale of the graph is gang hours per week. One gang equates to 40 units. The heavy horizontal black line shows the three gang allocation limit of 120 units (i.e. 3 No. gangs x 40 hours each per week). Where the three gang allocation is exceeded the histogram bars changes colour from green to red.

5.6.5 I acknowledge that the original version of the Infraco construction programme (i.e. the version preceding Revision 1 and included in Schedule Part 15 of the Infraco Contract.) does, on the face of it, have a planned requirement for only 3No. track gangs but that does not, in my opinion, justify strict adherence to that number in subsequent analyses of delay. To do so is, in my opinion, acting unreasonably. I note that the resource demand for track gangs in “Revision 1” of the Infraco construction programme exceeds 3No. by a considerable amount, as shown by the over-allocated units on the histogram shown below.

5.6.6 I also acknowledge that the 3No. track gang constraint in the original version of the Infraco construction programme was effected by the application of preferential logic. I note that in the final paragraph of the third page of Appendix A to the Estimate it is stated that the “preferred logic links” (or as alternatively described as “resource deployment links”) “were agreed by both parties”. I am advised that this statement is untrue.

Commented [IMcA4]: Is tie comfortable with this. Ref. pre-contract letters.



5.6.7 With regards to the imposition of resource constraints on the number of OHL gangs, I note that this was also effected in the Infraco construction programme by the inclusion of preferential logic links. I note in relation to this preferential logic it assumes that the same physical resource will be used to install OHL poles and building fixings as to install the overhead catenary lines. This does not appear to me to make sense as the skill sets and equipment required for these two types of task are quite different. I also note that where the tracks have been installed in Princes Street the poles have already been put in place. This leads me to question not only the correctness of applying such a resource constraint, but also the manner in which the delay analysis models it. I am of the opinion that the application of this resource constraint in the INTC 536 Estimate delay analysis adds unnecessarily to the projected delay to the Section Completion Dates. (Consider re-wording and expanding with more graphics to evidence the lines of argument.)

5.7 Intended order and method of delivery of the Infraco Works

5.7.1 The Infraco construction programme sets out the Infraco's proposed order and, to some extent, its method of delivering the Infraco Works. The intended order of carrying out particular activities can be observed from examination of the hard copy programme. The logic links that can be seen in the electronic copy provide further information. Clause 60.3 requires the Infraco to submit for tie's acceptance a revised Programme should the proposed order or manner be changed.

5.7.2 I have been advised that there have been several changes made to the proposed order and manner in which the Infraco intends to, or is delivering the Infraco Works. I cite as significant examples:-

- a) Section 1A - Lindsay Road and Lindsay Road Retaining Walls – Revised work scope, methods and sequencing (Compare “Base Design Date Information (BDDI) Drawings” and “Issued for Construction Drawings” enclosed at Appendix 5/X);
- b) Section 1B & 1C – Revised working areas, traffic management configurations and sequencing (Compare “On-street methodology as Proposed by Infraco” drawings (the contents of which are reflected in the Infraco construction programme Revision 1) with the subsequent “On-street Methodology as proposed by Infraco and approved by TMRP” drawings enclosed at Appendix 5/X);



- c) Section 5A – Revised construction methods and sequencing (insert reference to examples such as Roseburn Viaduct or Russell Road Retaining Walls);
- d) Section 5B - Revised construction methods and sequencing (insert reference to examples if appropriate);
- e) Section 5C - A8 Underpass – Revised construction methods, phases and sequencing (insert reference to evidence showing change); and,
- f) Section 7A – Revised construction methods(insert reference to evidence showing change. Landfill? Gogarburn retaining walls?).

5.7.3 I note that the Programme, and in particular the Infraco construction programme used as the basis for conducting the INTC 536 analysis of delay, has not been updated or revised to take account of these known, and in many cases historic, changes. Consequently, it appears to me that the Programme, as contemplated by the tie Change mechanism at clause 80, does not exist. I am of the opinion that the Infraco's failure to produce a revised Programme in accordance with clause 60.3 is a breach of its contractual obligations and is frustrating the proper operation of that mechanism.

5.7.4 I do not have access to sufficient information on the full detail of the Infraco's actual planned intent to prepare such a revised programme. (I am advised that neither does tie.) explain further However, it appears to me that many of these changes to the originally proposed order and manner of delivering the Infraco Works will result in significant changes to the activities, durations and programme logic. It is my opinion that to ignore the requirement for these changes when analysing delay will result in unreliable projections of works yet to be undertaken and, consequently, contractually and technically incorrect assessments of requirements for extensions of time.

5.8 tie Change Orders

5.8.1 (Develop criticism of Infraco's failure to update the Programme for other tie Changes. Cite examples using Change Register from Infraco Period Report and relevant drawings/programme extracts.) ? Clause 65???

5.8.2



5.9 Designated Work Areas

5.9.1 (Develop criticism of DWAs used by Infraco and evidence by example. Discuss further with tie and consider use of additional evidence provided by tie on 4 March 2011.)

5.9.2

5.10 Conclusion

5.10.1 It is appears to me that at the heart of the Estimate is an analysis of delay that is unreliable and does not appear to have been arrived at through the correct operation of the contractual mechanisms for assessing and seeking extension of time. I conclude that given the numerous and significant shortcomings in the analysis and the failure to take into account many other factors that I believe should be considered, the Infraco's substantiation for its opinion on the requirement for extension of time is unreliable. That being so, the Infraco has failed to prove its case.



Section 6 Effecting the Adjudicator’s decision on INTC 429

6.1 Background

6.1.1 On 6th August 2009 the Infraco submitted to tie an Estimate for INTC 429. The subject matter of that Estimate was the late completion of the MUDFA Works as assessed at 28 March 2009 and included the projected completion dates shown on the MUDFA Rev.8 programme. That Estimate sought substantial awards of extension of time to all four Section Completion Dates. The parties were unable to reach agreement on this Estimate. The Infraco considered that a dispute had crystallised and referred the matter for resolution through the DRP. Following unproductive meetings between the parties’ representatives and a failed attempt at resolution through mediation, the dispute was decided by adjudication. On 16th July 2010 the Adjudicator, Mr Robert B. M. Howie QC, issued his decision (copy enclosed at Appendix 6/1). That decision is summarised in the table below.

Section	Extension of time sought in the Estimate for INTC 429	Decision of the Adjudicator on the Estimate for INTC 429
A	195 calendar days	154 calendar days
B	193 calendar days	Nil
C	257 calendar days	Nil
D	257 calendar days	Nil

6.1.2 Under cover of letter reference 25.1.201/KDR/6803, dated 23rd September 2010 (copy enclosed at Appendix 6/2), the Infraco submitted a revised Infraco construction programme (referenced “Programme Revision 1A”) for acceptance by tie. The Infraco’s letter explains that as a result of Mr Howie’s decision tie is deemed to have issued a tie Change Order requiring the Infraco to update the Programme in accordance with Clause 60. The Section Completion Dates shown in the “Programme Revision 1A” are as shown in the table below.



Section	Projected Completion Date shown in “Programme Revision 1A”	Extension of time relative to the Rev.1 Infraco construction programme
A	2 nd November 2010	154 calendar days
B	30 th November 2010	152 calendar days
C	13 th September 2011	187 calendar days
D	11 th March 2012	187 calendar days

6.1.3 By way of letter reference INF CORR 6325 dated 30th September 2010 (copy enclosed at Appendix 6/3), tie rejected this programme on the basis that it failed to comply with Mr Howie’s decision. (This is readily apparent from a comparison of the two tables above.) tie requested that the Infraco provide a revised programme that did comply with the decision. I am advised that at the date of this report (check this remains correct immediately before publishing this report) no such revised programme has been submitted.

6.2 Review of INTC 536 delay analysis programme

6.2.1 In Appendix A of the INTC 536 Estimate it is stated¹² “This Estimate takes cognisance of the Decision of Robert Howie QC in respect of INTC 429 (Delays resulting from Incomplete Utilities Work MUDFA Programme Rev 8).”.

6.2.2 To test this statement I ran an analysis of delay using the base programme with mitigation from the INTC 536 Estimate. To do this I adjusted the “Commencement of Designated Work Areas (driven by MUDFA completion, Infraco status 31 July 2010)” milestones to reflect the equivalent information used as the basis of the INTC 429 Estimate. For the most part, the MUDFA Revision 8 programme provided the source of this data. I enclose at Appendix 6/Z a schedule showing the dates I have used. For each date I have included a cross-reference to its source. I made these adjustments to the electronic copy of the “mitigated programme” that was used to produce Appendices F & G of the INTC 536 Estimate. (These appendices contain the final version of the programmes that the Infraco relies upon to substantiate its opinion on the requirements for extension of time.) I then rescheduled that programme.

¹² Page 1, paragraph 7
 J086-1002 Draft Ver.3



6.2.3 Enclosed as Appendix 6/5 is a hard copy of the resulting programme in Gantt chart format. It projects requirements for extensions of time to the four Section Completion Dates as set-out in the table below.

Section	Projected Completion Date shown in “Mitigated programme” adjusted for INTC 429 MUDFA dates”	Projected extension of time requirement relative to the Infraco construction programme Revision 1
A	3 rd November 2010	155 calendar days
B	19 th January 2011	260 calendar days
C	13 May 2011	64 calendar days
D	9 November 2011	64 calendar days

6.2.4 A comparison of the data from the table above with the adjudicator’s decision on the INTC 429 Estimate is set out below.

Section	Projected extension of time requirement from the “Mitigated programme” adjusted for INTC 429 MUDFA dates”	Adjudicator’s decision on the INTC 429 Estimate
A	155 calendar days	154 calendar days
B	260 calendar days	Nil
C	64 calendar days	Nil
D	64 calendar days	Nil

6.2.5 From examination of the table above, it is apparent to me that the delay analysis programme used by the Infraco in the preparation of the INTC 536 Estimate **does not** take cognisance of the Adjudicator’s decision on the INTC 429 Estimate.



6.3 Conclusions

- 6.3.1 I note that under the terms of the Infraco contract¹³ an adjudicator’s decision is binding on the parties, and they shall comply with it until the dispute is finally decided by legal proceedings or by agreement between the parties. I am advised that there have been no legal proceedings or agreements associated with the late completion of MUDFA Works since the date that the INTC 429 Estimate decision was issued. From all of this, it appears to me that the INTC 429 adjudication decision remains binding on the parties, both at the base date of the INTC 536 Estimate and the date of this report. (Check that this remains correct at the date of publication.)
- 6.3.2 It appears to me that the Infraco **has not** taken cognisance of the adjudicator’s decision on the INTC 429 Estimate in the preparation of the base programme on which it conducted its delay analysis for the INTC 536 Estimate. In effect, it appears to have ignored the INTC 429 decision. I consider such an approach to be contrary to the terms of the Infraco Contract.
- 6.3.3 From the results of my analysis it is apparent that the programme used to conduct the delay analysis in the INTC 536 Estimate contains significant projections of delay arising from matters previously decided upon in the INTC 429 Estimate adjudication. These delays are included in, and form a substantial part of, the extensions of time sought in the INTC 536 Estimate. I conclude that if the programme analysis contained within the INTC 536 Estimate is to be used to form opinion on requirements for extension of time (and, for the avoidance of doubt, I am of the opinion that it should not), appropriate deductions should be made to give effect to the INTC 429 Estimate decision.
- 6.3.4 (Re-wording above before finalisation. Consider legal position and particular lines of argument.)

¹³ Schedule Part 9, paragraph 51.
J086-1002 Draft Ver.3



Section 7 Assessing the impact on the Programme

7.1 Introduction

- 7.1.1 The principal subject of this report is the assessment of the impact of a tie Change on the Programme. To make that assessment properly requires careful consideration of what constitutes the Programme, how it should be managed under the terms of the Infraco Contract and how it should be used in the tie Change mechanism set-out in clause 80.
- 7.1.2 The Infraco Contract requires the Infraco to deliver the Infraco Works in such a manner that it achieves four Planned Section Completion Dates, namely, A, B, C & D¹⁴. To achieve these dates the Infraco is required to design, construction, test and commission, particular parts of the Infraco Works. Each of the sections is defined, and its planned completion date prescribed, within the Infraco Contract definitions¹⁵. In simple terms Section A = the Tram Depot at Gogar; Section B = the Tram Test Track; Section C = the remainder of the Infraco Works including testing and commissioning; and Section D = 26 weeks after the certification of the completion of Section C.
- 7.1.3 Clause 60.1 requires the Infraco to progress the Infraco Works in accordance with the Programme so as to enable the four Section Completion Dates to be met.
- 7.1.4 The Infraco is required to develop and submit the Programme for approval by tie in accordance with the Review Procedure. It is part of the Deliverables as prescribed in the Infraco Services part of the Employer's Requirements¹⁶. The specification for the Programme and its subsequent treatment is set-out in the Programme Management part of the Employer's Requirements¹⁷.
- 7.1.5 Clause 10.1 requires the Infraco to develop and finalise the other Deliverables in accordance with the Programme. The Deliverables are defined in the Infraco Contract¹⁸. They encompass a wide range of matters required in relation to the delivery of the Infraco Works and include designs, specifications, drawings, specifications, method statements and programmes.

¹⁴ Ref. Infraco Contract clause 7 "Duty of care and general obligations in relation to the Infraco Works" and clause 60 "Programme"

¹⁵ Schedule Part 1

¹⁶ Schedule Part 2, section 3.2 and specifically sub-section 3.5

¹⁷ Schedule Part 2, section 12.2

¹⁸ Schedule Part 1



7.2 Defining the Programme

7.2.1 The Infraco Contract defines the Programme as that set-out in Schedule Part 15. It consists of six separate documents (as depicted graphically below).

The six elements of the Programme

(i) Infraco Construction Programme

(ii) SDS Design Delivery Programme

(iii) On Street Construction Methodology

(iv) Programming Assumptions (12 May 2008)

Plus:-

SDS Consents Programme derived from SDS Design Delivery Programme

(v) Programme

and

Relaxations to CoCP constraints as annotated and

(vi) agreed with tie

7.2.2 The Programme contains two detailed electronic PERT/CPM programmes that show the planned order and timing for the delivery of the Infraco Works. One covers the design that is to be delivered by the SDS Provider on behalf of the Infraco (SDS design delivery programme). The other (the Infraco construction programme), principally, covers consents, mechanical and electrical design, construction, installation, testing and commissioning of the infrastructure works that form part of the Infraco Works. These two programmes are not linked together electronically. The alignment that exists between them is effected by certain dates in the SDS design delivery programme being reflected in a series of “Finish Milestones” within the Infraco construction programme. These milestones are all named “Issue Construction Drawings”. [I am advised that this name is recognised by both tie and the Infraco as an abbreviation for the defined term “Issued for Construction Drawings”¹⁹] (Discuss this further with tie and the legal team wrt to ongoing work re. RTNs). I enclose below corresponding programme extracts as an example of this alignment. The aligned dates are circled in red.

¹⁹ Schedule Part 1
J086-1002 Draft Ver.3



Extract from SDS design delivery programme for Russell Road Bridge

Activity ID	Activity Name	Original Duration	Remaining Duration	Schedule % Complete	Start	Finish
SD562440	Issue Russell Road Bridge Design Package For Constraints	0	0	0%	08-Apr-08	08-Apr-08

Extract from Infraco construction programme for Russell Road Bridge

Activity ID	Activity Name	Original Duration	Remaining Duration	Schedule % Complete	Start	Finish
	Russell Road Underbridge (S29)	167	167	0%	09-Apr-08	09-Apr-08
10279	Issue Construction Drawings	0	0	0%	08-Apr-08	08-Apr-08
103	Excavation and piling	60	60	0%	08-May-08	07-Jun-08
238	Bases	30	30	0%	01-Aug-08	12-Sep-08
429	Abutments and wing walls	45	45	0%	01-Sep-08	31-Oct-08
439	Deck	50	50	0%	27-Oct-08	15-Jan-09
449	Bridge Finishes	60	60	0%	03-Nov-08	09-Feb-09

7.2.3 I note that the SDS consents programme consists entirely of extracts from the SDS design delivery programme and contains no additional information to that already contained within the SDS design delivery programme. For that reason I have found no reason to make no further reference to it in this report.

7.2.4 The “Onstreet construction methodology”, “Programme assumptions (12 May 2008)” and the “Relaxation to CoCP constraints as annotated and agreed with tie” are not in themselves programmes. They contain information that appears to have informed, influenced and formed the basis from which the Infraco prepared the Infraco construction programme.

7.3 Obligation to update the Programme

7.3.1 Clause 60.2 requires the Infraco to update the Programme in accordance with the Employer’s Requirements. Section 12.2 of that document, “Programme Management”, states at the first paragraph:-

“The Infraco shall undertake programme management including the implementation, regular updating and management of a fully detailed comprehensive Programme illustrating how the Infraco proposes to execute the whole of the Infraco Works in compliance with the Project Programme.”

and in the final two paragraphs:-

“The Infraco shall update the Programme every four weeks in line with tie reporting periods to take full account of the Infraco progress in completing the Infraco Works.”



A hard and soft copy updated Programme and an Infraco Progress Report shall be submitted by the Infraco to tie no later than three Business Days before each four weekly progress meeting.”

- 7.3.2 I am advised that the Infraco has produced updated programmes every four weeks. The updated Infraco construction programme forms a part the Infraco Period Report. The updated SDS design delivery programme is submitted under cover of a document transmittal.
- 7.3.3 I am advised that no other elements of the Programme have been updated or revised at the date of this report. (Check that this remains true at date of publication.)
- 7.3.4 I am also advised that the Programme has not been updated for the issuance of tie Change Orders, other than for tie Change Order No. 1 which resulted in the acceptance of the Infraco construction programme Revision 1. Clause 80.17 requires the Infraco to update the Programme within 20 business days of the issue of a tie Change. I note from the Change Master Register included within the Infraco Period Report No. 3-4 to 17 July 2010 (i.e. the Period Report immediately pre-dating the base date of the INTC 536 Estimate) that another 165 No. tie Change Orders (Check number against pie chart in the report) have been issued during a period of over two years yet the Programme has never been updated for any of them. (review and adjust accordingly following checks on TCO data provided by tie on 3 March 2011)

7.4 Observations on the completeness of the Programme.

- 7.4.1 As I have noted at paragraph 7.1.4 above, the Employer’s Requirements sets out the specification for the Programme and its required treatment with respect to the Infraco’s Programme Management obligations. Compared against the bulleted list of requirements set out in section 12.2 of the Employer’s Requirements, it appears to me that the Programme is significantly deficient in many respects. In particular I note that:-
- a) there is virtually no information on mechanical and electrical design;
 - b) there is very little detail to illustrate the integration of the Deliverables;
 - c) there are significant omissions with regard to the identification and timing of inputs and approvals required from tie, third parties and Approval Bodies;



- d) significant logic links and relationships between activities are missing, particularly between design, reviews, approvals and construction;
- e) for the most part, long lead times for materials and works have not been indicated; and,
- f) for the most part it is not cost and resource loaded down to coded activity level.

7.4.2 I am advised that **tie** has challenged the Infraco to address these deficiencies in the Programme but at the date of this report it has not done so. (Check that this remains true at date of publication).

7.4.3 I consider that **most, if not** all, of the deficiencies in the Programme are without justification. They are, in my opinion, most significant and have frustrated (or “hampered”?) **tie**’s ability to properly manage and monitor the delivery of the Infraco Works. The absence of important information, both in terms of what is planned and what is been reported as actual progress, appears to be compromising **tie**’s ability to manage the efficient and timely delivery of the Edinburgh Tram Network. I say that because without much of this information **tie** is being denied access to important knowledge that it requires to properly manage the Edinburgh Tram Project, operate the Infraco Contract, and act in the best interests of the Client. It also appears to me that some of the deficiencies are making it difficult to operate many of the Infraco Contract change mechanisms, as I explain below.

7.5 Pre-requisite to commencement of construction activities

7.5.1 Typically, the commencement of construction activities in any particular location requires the satisfactory achievement of the following pre-requisites:-

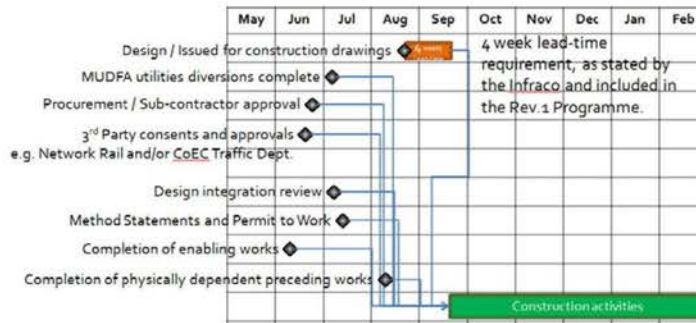
- a) A complete, formally approved and consented detailed design including integration of electrical and mechanical detailed design to the extent that it influences or dictates the construction work to be undertaken;
- b) Completion of the diversion of utilities that are to be undertaken (primarily by the MUDFA Contractor) in advance of the Infraco Works;
- c) Land access consents and third party agreements in place, and physical access provided;



- d) Third party approvals, including, where applicable, formal consents from the likes of City of Edinburgh Council (various departments including planning, roads and traffic), Scottish Water, SEPA and Network Rail;
- e) Procurement of materials and pre-fabricated components required for the construction operations and in particular those that have long lead-times;
- f) Approval²⁰ and appointment of the sub-contractors that are to undertake the activities; and,
- g) Approval²¹ of method statements, risk assessment and the issuing of Permits to Commence Work²²;

These pre-requisites (and others) are requirements of the Infraco Contract.

7.5.2 The graphic below indicates the manner in which all of these pre-requisites (and physically preceding activities) should, typically, be identified on and linked into the Programme. The requirement to prepare the programme in this manner is set-out in the Employer's Requirements.



7.5.3 The Infraco construction programme shows and links-in some, but not all, of these pre-requisites to commencement of the first construction activities in each area. For most

²⁰ Approval includes formal approval by tie.
²¹ Approval includes formal approval by tie.
²² Schedule Part 3, paragraph 3.4



elements of civil engineering and building works only the “Issue construction drawings” and “MUDFA completion” pre-requisites are shown on, and linked into, the Infraco construction programme logic network.

- 7.5.4 In the above example, the pre-requisite that determines the start of the construction activities is the “Issue construction drawings” with its associated 4 week lead-time. This scenario is commonly found throughout the “Revision 1” version of the Infraco construction programme. It evidences that for the most part it is delivery of design that is determining the start of the critical sequences of construction activities that drives each of the four Section Completion Dates projected in the Infraco construction programme. (Consider cross references to what is said about this in the INTC 536 Estimate.)
- 7.5.5 The actual start of each set of construction activities is determined by the actual date of the latest of these pre-requisites. (This is unless there are any other factors that determine the Infraco’s decision to commence.)
- 7.5.6 I have examined the project record²³ and note that a considerable number of these pre-requisites have not been delivered or achieved in advance of the planned commencement date for the start of construction activities. If considered individually, each would have delayed commencement of the first construction activities in a particular location. The actual start will, however, be determined by the latest of these. Delivery of the latest pre-requisite will be the dominant cause of pre-commencement delay. The impact of all of those preceding it will have been subsumed within that dominant delay.
- 7.5.7 The fact that the Infraco construction programme does not include milestones or activities for the majority of these pre-requisites means that if delay is analysed using only the Infraco construction programme (without this missing information which the Employer’s Requirements state that it shall contain), it will not produce a proper cause and effect analysis. It will produce output that misrepresents the true impact of the tie Change on the Programme.

7.6 Alignment of the individual programmes within the Programme

- 7.6.1 I note that there are no electronic linkages between the SDS design delivery programme and the Infraco construction programme. This means that changes in one are not

²³ In particular Infraco Period Reports (with include updated/progressed Infraco construction programmes, subcontractor procurement / register, change register, SDS design variance statements, Infraco design variance statements)



automatically reflected in the other. Keeping these two fundamental elements of the Programme in alignment, as the Infraco Works are progressed, requires careful and detailed co-ordination between the individual planners who are developing, managing and updating them.

7.6.2 It appears to me that such careful and detailed co-ordination has not occurred and the alignment between these two programmes that existed when the Infraco Contract was formed has been progressively eroded with the passage of time. I cite as an example the following extracts for Murrayfield Retaining Walls (S21B) from the July 2010 versions of these two programmes. I have circled in red the two dates that should be in alignment.

7.6.3 SDS design delivery programme²⁴ – July 2010 – “Issue construction drawings 11 Oct 10”

Modification to S21B Murrayfield Stadium Retaining Wall		107	10-May-10 A	11-Oct-10
VOB7430	Detailed Design & Check (started at risk)	46	10-May-10 A	30-Jun-10
VOB7450	Issue Detailed Design & Check Certificates to CEC & Network Rail	0		30-Jun-10
VOB7490	CEC & Network Rail Approval Period	38	30-Jul-10	27-Sep-10
VOB8050	IDC	9	30-Jul-10	13-Aug-10
VOB8090	Incorporate IDC Comments	9	13-Aug-10	27-Aug-10
VOB7470	Receive CEC Approval for Detailed Design	0		27-Sep-10
VOB7480	Incorporate CEC Comments & Prepare IFC Drawings	9	27-Sep-10	11-Oct-10
VOB7530	Receive Network Rail Technical Approval for Form B	0		27-Sep-10
VOB7490	Issue Construction Drawings - Murrayfield Stadium RW	0		11-Oct-10

7.6.4 Infraco construction programme²⁵ – July 2010 – “Issue construction drawings 27 Aug 10”

Murrayfield Retaining Walls (S21B)		10-Nov-08 A	26-Apr-11
110	Site Clearance	10-Nov-08 A	05-Oct-10
10760	Murrayfield Stadium Accommodation Works	12-Apr-10 A	01-Oct-10
10700	Issue Construction Drawings		27-Aug-10*
197	Demolition	24-Sep-10	08-Oct-10
378	Foundations	08-Oct-10	29-Oct-10
388	Reinforced Earth Wall	22-Oct-10	21-Mar-11
400	Coping	21-Mar-11	12-Apr-11
410	Handrail	12-Apr-11	26-Apr-11

7.6.5 I have found such mis-alignment in many places. It appears to me that the development and updating of the SDS design delivery programme has not be reflected in the Infraco construction programme. The two programmes are no longer properly aligned and therefore the evolving factual matrix is not being properly and accurately accounted for in the individual elements of the Programme.

²⁴ Enclosed at Appendix 7/XX

²⁵ Enclosed at Appendix 7/YY



7.6.6 I consider this situation to be further grounds for my criticism of the legitimacy of conducting analysis of delay using only the unmaintained version of the Infraco construction programme. To do so, does not show the true impact of a tie Change on the Programme and ignores significant facts that appear to be most significant and, potentially, determining factors in the proper operation of the change mechanisms in the Infraco Contract.

7.7 Order and manner of carrying out the Infraco Works

7.7.1 I am advised that the Infraco construction programme shows the order and, to some extent, the manner in which the Infraco originally proposed to carry out the Infraco Works. This was the basis on which the Infraco Contract was formed. The contract permits the Infraco to revise this proposed order and manner, subject to acceptance by tie²⁶. I have been made aware of many significant changes to the order and manner in which the Infraco has, is and/or proposes to carry out the Infraco Works. I cite as one example the phasing of the on-street works between Picardy Place and the Foot of the Walk.

7.7.2 (Explain changes using graphics being prepared by Alasdair Sim and Elaine Cropley)

7.7.3 These are major changes to the originally proposed order and manner. They were developed from May 2008 and formally approved by CEC in November 2009, save for further revision to Section 2 of Leith Walk which was approved in May 2010, all as shown on the extract from tie's TPM Proposals Tracker enclosed at Appendix 7/ZZ. They all pre-date the based date of the INTC 536 Estimate, however they are not included in the programme used in the delay analysis. [I note that these changes are not the subject of a separate INTC.]

7.7.4 These changes are to a series of activities that lie on or near the critical path to the Section C and D Completion Dates as set-out in the INTC 536 Estimate. I consider the failure to take them into account compromises the analysis of causation.

7.7.5 I am aware of several other parts of the Infraco construction programme that no longer reflect the Infraco's current planned or actual order and manner of delivering the Infraco Works. Some of these are also in critical or near critical parts of the Infraco construction programme. Consequently, they too have the potential to distort the analysis of delay.

²⁶ Infraco Contract clause 60.3 and 60.4
J086-1002 Draft Ver.3



7.8 Errors in the INTC 536 Estimate delay analysis programme

- 7.8.1 Although not articulated in the main narrative of the Estimate, I note that extensive changes have been made to the Infraco construction programme Revision 1 prior to its use in the INTC 536 Estimate delay analysis. These changes include what are described as “corrections”²⁷. These changes appear to me to be corrections of some of the errors that exist in it, but not all of them.
- 7.8.2 Given the volume and complexity of the information contained within the electronic versions of the various programme (which I estimate at over 100,00 pieces of data), it has not proven practical or proportionate for me to check every detail. However, where I have examined the critical and near critical sections of the delay analysis I have found more errors.
- 7.8.3 I cite the following two examples
- 7.8.4 Incorrect application of embargo calendars**
- 7.8.5 Within the electronic copy of the Infraco construction programme there are a number of different “Activity Calendars”. These have been used to model the number of working hours available each day during the contract period.
- 7.8.6 Typically, there are eight working hours available each day. Weekends and holidays are categorised as “Nonwork” days. However, not all activities are based on the same available work days. Some are based on a five day working week. Some are based on a six day working week. Some activities may have durations that are not affected by weekends (e.g. approval periods where the durations are based on a number of calendar days. To accommodate these different scenarios there are a number of different “calendars” set-up in the programmes. Each activity is allocated a calendar that matches its available working hours profile.
- 7.8.7 Parts of the Site have additional restrictions imposed on them by the terms of the Infraco Contract (insert reference.) This includes parts of the city centre where work is not permitted during the months of August and December (i.e. during the Edinburgh festivals periods). These restrictions are referred to as “embargos”. To allow the programmes to

²⁷ Ref. “log of file amendments of Programme Revision.01 to fully mitigate MUDFA July 2010 impact programme”, at Appendix D of the Estimate.

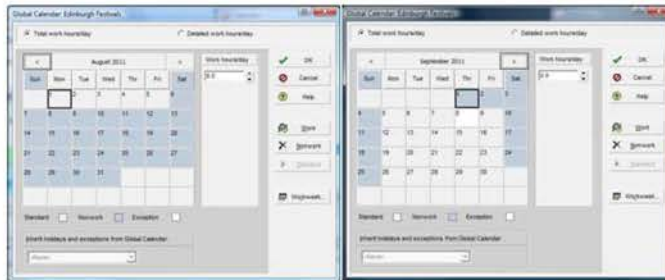


correctly model these embargos, an “Edinburgh Festivals” calendar has been created. It categorises all days during these months as “Nonwork”. The construction activities that are to take place within the areas covered by the embargos are allocated the “Edinburgh Festivals” calendar.

7.8.8 The programme extract below is from the delay analysis programme used in the INTC 536 Estimate Appendices F and G. The calendar allocation for the “London Road Ch 375-450 Dummy” activity is circled in red.



7.8.9 The calendars below shown the “Nonwork” dates in the “Edinburgh Festivals” calendar



7.8.10 The effect of applying the “Edinburgh Festivals” calendar can be seen by comparing the Start and Finish dates (shown in white on blue background) on the programme line with the Activity Name “Dummy” and the duration of 80 days shown on the same line. There are 140 calendar days between 27 May 2011 and 14 October 2011. The “Nonwork” days in the allocated calendar extend the overall duration from the allocated 80 days.

7.8.11 However, the section of the route London Road Ch 375-450 is not subject to the Edinburgh Festivals embargo. It should have been allocated the “Edinburgh Festivals” calendar. I note that this activity is on the critical path to the Section C and D Completion dates that are



projected in the INTC 536 Estimate. This error results in this path being 20 working days longer than it should be.

7.8.12 (INSERT OTHER EXAMPLES)

7.8.13 From all of the foregoing it appears to me that the delay analysis contained in the Estimate is fundamentally flawed. It does not provide a reliable and reasonable justification on which to base an opinion on requirements for extension of time. I conclude that the Infraco has failed to properly operate the Infraco Contract, particularly with respect to programme management, and has failed to prove its case.



Section 8 Updating and aligning the Programme

8.1 Introduction

8.1.1 Clause 60.2 of the Infraco Contract requires the Infraco to update the Programme in accordance with the Employer's Requirements. The Employer's Requirements state at paragraph 12.2

"The Infraco shall undertake programme management including the implementation, regular updating and management of a fully detailed comprehensive Programme illustrating how the Infraco proposes to execute the whole of the Infraco Works in compliance with the Project Programme."

8.1.2 As I have explained in sub-section 7.3 of this report, the Infraco has regularly updated two parts of the Programme, namely the SDS design delivery programme and the Infraco construction programme. I have been provided with copies of the July 2010 versions of each of these. They are the updates that immediately pre-date the base date of the INTC 536 Estimate. I enclose copied of them at Appendices 8/1 and 8/2.

8.1.3 In this Section I provide my observations on these updated programmes and explain why I believe the information contained within them should be taken into account in any consideration of the delay analysis contained within the INTC 536 Estimate.

8.2 Updated Infraco construction programme (Revision 1)

8.2.1 The July 2010 version of the Infraco construction programme (Revision 1) appears to have been updated, primarily, by adding actual dates and actual progress information to the activities and milestones contained within the original version. Whilst I recognise this programme as an update of one element of the Programme it does not appear to me to be an update in accordance with the Employer's Requirements. I say that because, among other things, it has not been updated for:-

- a) known changes to the Infraco Works (Infraco Changes, tie Change Orders, Compensation Events and the likes);
- b) revisions to the order and timing of the delivery of design;



- c) revisions to the Infraco’s planned / proposed order and manner for delivering the Infraco Works; and,
- d) adjustments required to allow additional time to accommodate the Infraco’s internal processes and procedures (including associated approvals and certifications).

8.2.2 Notwithstanding these shortcomings, it does provide a source of what I consider to be information and fact that should be taken into account in the analysis of delay associate with the INTC 536 Estimate. In particular this updated programme contains the Infraco’s report of actual progress to 17 July 2010. (I am advised that tie does not necessarily agree with the accuracy or all of this, however, it is considered, in general, to be representative of the factual position with respect to what has and has not been done at the point in time it was produced). **[Check with tie regarding the preceding sentence.]**

8.2.3 I observe that this updated Infraco construction programme projects the following delays to the four Section Completion Dates.

Section	Projected Section Completion Date shown on the July 2010 updated Infraco construction programme (Revision 1)	Projected delay beyond the current Section Completion Dates	Infraco opinion on requirement for extension of time as determined from the delay analysis in the INTC 536 Estimate

8.2.4 By inspection it is apparent that this updated programme is projecting much greater delays to the Section Completion Dates that those projected in the delay analysis programmes included in the INTC 536 Estimate. I have compared these two programme and note the following as accounting for the significant differences between them.

- a) The inclusion of actual progress to July 2010 adds greatly to the overall delay. Many major parts of the Infraco Works shown as progressing or complete in the INTC 536 Estimate delay analysis programme have not yet started in the updated Infraco



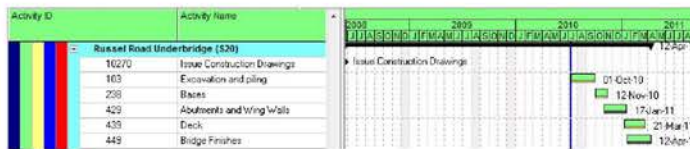
construction programme. I cite below as an example Russell Road Underbridge (S20). It is a significant structure located in Intermediate Section 5A. This is a critical or near critical section of the Infraco Works (depending on which programme is being considered). The programme extract below is from the INTC 536 delay analysis programme and shows its projection of when this structure is to be built.

Extract from INTC 536 Appendix G programme



- b) I note that this is no different from the planned sequence and timing shown in the original version of the Infraco construction programme Revision 1. I conclude that it has not been delayed by the later completion of utilities diversion cited in the INTC 536 Estimate.
- c) I observe this is programme extract is radically different to the projected build period for this structure as reported in the Infraco’s progressed (updated) version of the Revision 1 construction programme, as shown below.

Extract from Infraco construction programme Revision 1 updated to 9 July 2010



- d) The updated programme shows that the work on this structure has yet to commence. Its start date is shown as the “data date” (i.e. the date to which progress is reported) to which this updated programme has been progressed. On closer inspection of the electronic copy of this programme I note that this projected start date is not being driven by the programming logic. It is shown as starting on the progress “data date” (as shown by the vertical blue line on the Gantt chart) because according to the programme logic it could/should have started, but it has not. It is



shown as over two years behind programme. [I note that at the time of writing this report, over nine months later, it has not yet started.]

- e) Clearly, there is something impacting a very long delay to the commencement of this significant structure but, whatever it is, it is not being taken into account in the opinion on requirements for extension of time set-out in the INTC 536 Estimate. I note that this situation can be observed throughout the INTC 536 Estimate delay analysis programme. (List some more examples).
- f) I also note that this version of the Infraco construction programme (Revision 1) does not include the adjustments and delay mitigation measures included in the delay analysis programme used in the preparation of the INTC 536 Estimate. It retains much of the preferential logic contained in the original version of the “Revision 1” programme. Consequently, it does not reflect the delay mitigation measures that the Infraco has introduced into the INTC 536 Estimate delay analysis programme.

8.2.5 I consider that the large scale disparities between these two programmes as evidence in support of the unsuitability of using the as-planned impacted method of delay analysis. The analysis presented in the INTC 536 Estimate ignores what has actually happened. It projects entirely theoretical projections of completion that bear no semblance to the actual facts. It is not a credible analysis and is producing unreliable results.

8.3 Updated Infraco construction programme Revision 3

8.3.1 On XX YYYY 2010, the Infraco submitted, for tie acceptance under Clause 60.3, Revision 3 of the Infraco construction programme. According to the covering letter, it purported to be a programme that

8.3.2 It was rejected by tie by way of its letter ref. XXXXXXXXX dated YYYYYYY.

8.3.3 Despite its rejection, the Infraco used this programme as a basis for its July 2010 Period Report. Actual progress data was inserted into it resulting in projected Section Completion Dates that now included information on some of the changes that had been made to the Infraco Works, some of the revised order and manner for the proposed delivering the Infraco Works, and the mitigation measures that the Infraco intended to apply. (Review this wording before finalisation.)



8.3.4 I observe that this updated Infraco construction programme (Revision 3) projects the following delays to the four Section Completion Dates.

Section	Projected Section Completion Date shown on the July 2010 updated Infraco construction programme (Revision 1)	Projected delay beyond the current Section Completion Dates	Infraco opinion on requirement for extension of time as determined from the delay analysis in the INTC 536 Estimate

8.3.5

8.3.6 By inspection it is apparent that this updated programme is projecting even greater delays to the Section C and D Completion Dates than the updated version of the Revision 1 Infraco construction programme. I note no difference to the Section A Completion Date and an improvement of 199 days on the Section B Completion Date.

8.3.7 On closer inspection of this programme, and comparison with the other two I note that, like the updated (progressed) Revision 1 programme, the actual and projected dates for significant elements of the Infraco Works have been undertaken or are yet to be undertaken at dates several years later than that projected in the INTC 536 Estimate delay analysis programme. There appears to be no information in these updated programme to explain why these works are being delay. All I can conclude is that for a great number of them, their start is not being determined or driven by the completion date for utilities diversions. Something else is the dominant factor in determining when they will (or can) start.

8.3.8 I also note that despite the updated Infraco construction programme Revision 3 purportedly containing delay mitigation measures it is projecting greater delay than the updated Revision 1, based on the same actual progress data. It appears to me that the reason for this is that the Revision 3 programme contains some of the changed order and manner that the Infraco intends to apply and it includes varied and additional work that was known of prior to the base date of the INTC 536 Estimate. That being so, I consider



that such information should be taken into account in any delay analysis conducted with a base date of 31 July 2010. It is clear to me that the delay analysis contained in the INTC 536 Estimate does not do this.

8.3.9

8.4 Updated SDS design delivery programme (V60)

- 8.4.1 The SDS design delivery programme is updated every four week, as is required by the Employer's Requirements. It is submitted to tie along with a schedule entitled "IfC Variance Schedule. I enclose at Appendix 8/ZZ copies of both of these documents a updated to XX July 2010.
- 8.4.2 This update appears not only to record progress but also to add information for ongoing change and the addition of new work. I consider this to be a form of updating that more fully and correctly complies with the programme management requirements of the Infraco Contract. It includes historic factual information and up-to-date projections for yet to be complete Infraco Works.
- 8.4.3 All of that said, the updated data contained within this programme does not appear to be aligned with that in the updated Infraco construction programmes. I consider this to be a most significant matter. It appears to me that this important information about the design of the Infraco Works, contained within one of the elements of the Programme, is not being taken into account in the Infraco's analysis of delay and assessment of requirements for extensions of time. The result is that the Infraco's analysis cannot be relied upon.



Section 9 Section A Sectional Completion

9.1 Introduction

9.1.1 This section of this report examines the parts of the Programme that relate to and project the Section A Sectional Completion Date. It also considers the Adjudicator’s decision on the INTC 429 Estimate with respect to Section A and compares that with the analysis in the INTC 536 Estimate that projects a requirement for extension of time.

9.2 Background

9.2.1 Schedule Part 1 of the Infraco Contract defines Section A as follows:-

“Section A” means completion of the Depot (including energisation) and the first Tram delivered to the Site and assembled and the completion of all tests required by the Employer’s Requirements in relation to that Section:”

9.2.2 The Infraco Contract states the Planned Sectional Completion Date for Section A (Depot) to be 25 March 2010²⁸.

9.2.3 **tie** Change Order No. 1 revised this Planned Sectional Completion Date to 1 June 2010.

9.2.4 The Adjudicator’s decision on the Estimate for INTC 429 further revised this Planned Sectional Completion Date to 2 November 2010. I am advised that at the date of this report that decision remains binding on the parties.

9.3 Infraco construction programme Revision 1

9.3.1 The Infraco construction programme “Revision 1” details the Section A activities under the programming Work Breakdown Structure (WBS) heading of “Section O6 Gogar Depot”²⁹. The first Infraco Works activity to be undertaken on Section A is “Issue Construction Drawings Earthworks (Activity ID 13130)”. This is the driving activity to the commencement of the first on-site Infraco Works activity; “Earth Works (Activity ID 1149)”. The following extract from the electronic version of the Infraco construction programme “Revision1” shows the first on-site activities and this driving relationship.

²⁸ Schedule Part 1 - Definitions

²⁹ Ref. Appendix XX, page YY.



Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
SECTION 08 GOGAR DEPOT					
139	SECTION 08 GOGAR DEPOT	415	30 Mar 08	01 Jun 10	258
	Operating Sequence A (Airport to Haymarket)	732	30 Mar 08	01 Jun 10	482
151	Operating Sequence A (Airport to Haymarket)	415	30 Mar 08	01 Jun 10	258
	USA Gogar Depot	732	30 Mar 08	01 Jun 10	482
152	USA Gogar Depot	415	30 Mar 08	01 Jun 10	258
	Earthworks	116	30 Mar 08	05 Dec 08	0
13130	Issue Construction Drawings Earthworks	0	30 May 08	0	0
13140	Issue Construction Drawings Drainage	0	30 Jun 08	0	0
1200	Drainage and Culvert	90	29 Jul 08	05 Dec 08	4

Predecessor	Activity ID	Activity Name	Start	Finish	Duration	Lag
Craving	edstram-9a-2	Issue Construction Drawings Earthworks	30 May 08	30 May 08	1d	20
W	edstram-9a-2	Depot Watermain Diversion	30 May 08	30 May 08	1d	0
W	92	British Airports Authority	29 Sep 07	24 Jan 08	175d	20

9.3.2 I note that there is a 20 working day lag from the “Issue Construction Drawings Earthworks” milestone to the commencement of the “Earth Works” activity. This 20 day (4 week) lag is explained at paragraph 2.5 of the “Programming Assumptions (12 May 2008)” that form part of Schedule Part 15 of the Infraco Contract. It is a typical relationship that is to be found throughout the Infraco construction programme.

9.3.3 I also note that there are two other predecessor links to the “Earth Works” activity, namely “Depot Water Main Diversion” and “British Airports Authority”. Both of these are scheduled to be complete in advance of the commencement date for the “Earth Works”.

9.3.4 At sub-section 7.5.7.5 of this report I make reference to the deficiencies in the Programme and, in particular, the absence of milestones and activities for many pre-requisites to the commencement of construction activities. This programme extract is a typical example of such deficiencies. The Infraco construction programme contains three pre-requisites to commencement of the first on-site construction activity, yet there are at least two more that require to be fulfilled. These include:-

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- a) Procurement / Sub-contractor approval; and,
- b) Method statements and permits to work.
- c) (Review/consider if this is worth including in this section?)

9.3.5 As can be seen from the extract from the electronic version of the Infraco construction programme “Revision 1”, below, the latest finishing activities on the Depot are linked to



the finish milestone entitled “Section Completion A” which is under the WBS heading of “Key Dates”³⁰.

Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
Key Dates					
170	AWARD CONTRACT	0	15 May 09*	00 Sep 11	0
270	Mobilisation	20	15 May 09	12 Jun 09	28
280	Commence Phase 1a	0	15 May 09		1209
311	Section Completion A	0		01 Jun 10	40
314	Section Completion B	0		01 Jul 10	432
360	Construction Completion Phase 1a Edinburgh A	0		20 Dec 10	79
311	Construction Completion Phase 1a Newcastle A	0		10 Mar 11	0

Driving	Project ID	Total Float	WBS	Activity ID	Activity Name	Start	Finish	Relations	Lag
199	edstram-3a-2	367	edstram-3a-2.6.6.1.6	1199	Finishes	24-Nov-09	07-Sep-09	FS	0 h
199	edstram-3a-2	432	edstram-3a-2.6.6.1.6	1209	Car Park & Handstanding	06-Oct-09	05-Jul-09	FS	0 h
199	edstram-3a-2	130	edstram-3a-2.6.6.1.6	AC200	Inspection and Testing	30-Apr-10	01-Jun-10	FS	0 h

9.3.6

9.3.7 The driving activity is the predecessor highlighted in blue. It is the Inspection and Testing” activity that follows the E&M workshop equipment installation in the Depot building. The other two predecessors relate to completion of the access roads, car park and handstanding, all of which are completed earlier than the “Inspection and Testing” activity.

9.4 Implementing the Adjudicator’s decision on INTC 429

9.4.1 The Adjudicator’s decision on INTC 429³¹ awarded an extension of time to the Section A Planned Sectional Completion Date of 154 calendar days (i.e. revising the date from 1 June 2010 to 2 November 2010).

9.4.2 In the reasons for that decision the Adjudicator explained the manner in which he arrived at this award³². The pertinent details can be summarised as follows.

- a) The part of the Water Main Diversion works that impacted on the Depot earthworks should be considered to have been completed by 18th February 2009.
- b) The Depot earthworks could have / should have started 28 working days before that date.
- c) There should be no other adjustment made to the planned durations, sequencing and inter-dependencies between the various activities that lead to the programme projection of the Section A Completion Date.

³⁰ Ref. Appendix XX, page ZZ.

³¹ Ref. Appendix BB

³² Ref. Appendix BB, paragraphs FF-GG

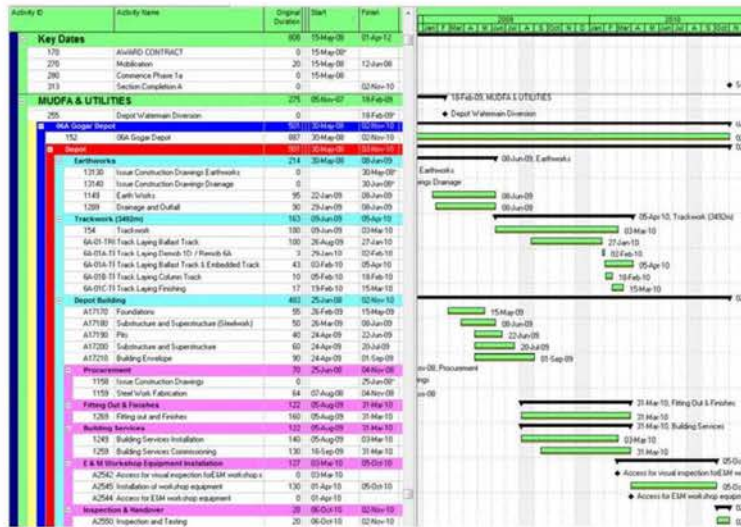


9.4.3 To effect this decision in the Programme requires two adjustments to the Infraco construction programme (that being the only part of the Programme where information relating to the aforementioned reasons are to be found). These adjustments are as follows.

- a) The “Depot Watermain Diversion” finish milestone (Activity ID 255) should be revised from 30 May 2008 to 18 February 2009; and,
- b) A negative lag of 28 calendar days should be introduced to the “finish-to-start” relationship link that exists between the “Depot Watermain Diversion” finish milestone and the start of the Depot earthworks activity (Activity entitled “Earth Works”, Activity ID 1149 in the Gogar Depot section of the Infraco construction programme).

9.4.4 By making these two adjustments and rescheduling the Infraco construction programme, the projected date for Section A completion is revised to 2 November 2010. This accords with the Adjudicator’s decision.

9.4.5 The programme extract below shows these change and the revised timings for the Depot activities that result from them.





9.4.6

9.5 Projection of Section A Completion Date in the INTC 536 Estimate

9.5.1 The delay analysis programmes contained within the INTC 536 Estimate project a Section A Completion Date of 28 January 2011. This is 87 days later than the date decided by the Adjudicator for the INTC 429 Estimate.

9.5.2 I am advised that since the base date of the INTC 429 Estimate (i.e. 31 March 2009) there has been no change to the factual details associated with the diversion of utilities that had impacted, or have the potential to impact, upon the overall construction of the Depot. Consequently, there would appear to be no reason why the INTC 536 should project a different Section A Completion Date from that decided upon in the INTC 429 Estimate adjudication.

9.5.3 On closer inspection of the INTC 536 Estimate delay analysis programme I have identified the following reason why it projects a further increase, as explained below.

- a) Within the group of new finish milestones introduced into the INTC 536 Estimate delay analysis programme is one entitled “Earth Works” (Activity ID 1260). It can be seen on Page 4 of 37 of the programme enclosed at Appendix G of the Estimate. It has a finish date of 30 April 2009.
- b) That finish milestone is linked “finish-to-start”, with a negative lag of 28 calendar days, to the start of the Depot earthworks activity. It can be seen on Page 34 of 37 of the programme enclosed at Appendix G of the Estimate. It is entitled “Earth Works” (Activity ID 6A-01-TRCK-30). It is understood that this is, for all intents and purposes, the same activity as the similarly entitled activity in the Infraco construction programme Revision 1 (Activity ID 1149), as referred to at paragraph 9.4.3b). It is understood that in preparing the INTC 536 Estimate delay analysis programme from the basis of the original Infraco construction programme Revision 1, the Infraco has introduced a new activity ID referencing system.

9.5.4 The new milestone and its relationship to the start of the “Earth Works” activity effects a similar programme adjustment to the one described at paragraph 9.4.3b) above. The difference in the projected Section A Completion Dates arises solely from the difference in the finish date set for the milestone. Whereas the Adjudicator decided that the milestone



date should be 18th February 2009, the INTC 536 Estimate uses 30th April 2009, a difference of 71 calendar days. This increased delay to the start of the Depot works projects its completion across the 16 non-working days allowed for the Christmas and New Year holidays in 2010/2011. Adding these two periods together accounts for the 87 calendar day difference referred to at paragraph 9.5.1.

9.5.5 In Appendix C (tab 17) of the INTC 536 Estimate the Infraco refers to tie letter reference 1472 in support of its use of the 30th April 2009 date for the finish milestone. I am aware that that letter and date were referred to (but not produced, as I recall) in the INTC 429 Estimate adjudication but they were not accepted by the Adjudicator. I also note that in the INTC 429 Estimate the Infraco's cited the relevant date to be 2nd March 2009.

9.5.6 In his first set of reasons for his decision the Adjudicator explained his consideration of the parties disparate views on what this date should be and decided to base his decision on 18th February 2009.

9.5.7 I have since been provided with a copy of tie's letter to the Infraco reference INF CORR 793, dated 27th February 2009³³. That letter is a contemporaneous record stating that the water main was decommissioned on 17th February 2009, thereby permitting commencement of the Depot earthworks on 18th February 2009. I am advised that the letter referred to by the Infraco in support of its assertion that the date should be 30th April 2009, is in fact reference to completion of all water main works in the vicinity of the Depot and not those elements that had the potential to impact on the critical work associated with the completion of the Depot itself.

9.6 Conclusion

9.6.1 From all of the foregoing I conclude that:

- a) The Adjudicator's decision on the INTC 429 Estimate remains binding on the parties.
- b) That decision resulted in the Section A Sectional Completion Date being revised to 2 November 2010.

³³ Ref. Appendix 9/DD
J086-1002 Draft Ver.3



- c) There has been on change to the material facts associated with completion of utilities diversions impacting on the Section A works from the INTC 429 Estimate to the INTC 536 Estimate.
- 9.6.2 For these reasons I consider that there is no legitimate justification within the INTC 536 Estimate to extend the Section A Completion Date beyond that decided upon by the Adjudicator on the INTC 429 Estimate.
- 9.6.3 I also note that in the decision on the INTC 429 Estimate, no consideration appears to have been give as to whether or not the water main diversion actually caused a requirement to extend the Section A Sectional Completion Date. I refer to of this report with respect to the further questions associated with the manner in which the Infraco has prepared its delay analysis in the INTC 536 Estimate. [Including the question of dominance!]
- 9.6.4 (Should the issue of dominant cause be raised here with respect to the Depot and tie's option to use it to challenge, through litigation, Mr Howie's 154 day award?)



Section 10 Review of Section Completion Date B

10.1 Introduction

10.1.1 This section of this report examines the parts of the Programme that relate to and project the Section B Sectional Completion Date. It also considers the Adjudicator's decision on the INTC 429 Estimate with respect to Section B and compares that with the analysis in the INTC 536 Estimate that projects a requirement for extension of time.

10.2 Background

10.2.1 Schedule Part 1 of the Infraco Contract defines Section B as follows:-

"Section B" means completion of the test track (including energisation), assumed as Depot to the airport, and five Trams delivered to the Site and assembled with the first Tram to have completed the Tram Type Test and the remaining Trams to have completed the Tram Commissioning Routine Tests, such tests as described in the Employer's Requirements and the completion of all tests required by the Employer's Requirements in relation to that Section, including those System Acceptance Tests required to enable the commencement of Driver Training."

10.2.2 The Infraco Contract states the Planned Sectional Completion Date for Section B (Test Track) to be 23 April 2010³⁴.

10.2.3 tie Change Order No. 1 revised this Planned Sectional Completion Date to 1 July 2010.

10.2.4 The Infraco claimed a further extension of time for Section B as part of the Estimate for INTC 429. The Adjudicator's decision on that claim was that no further extension of time should be awarded. I am advised that at the date of this report that decision remains binding on the parties.

10.3 Infraco construction programme Revision 1

10.3.1 The Section B Sectional Completion Date milestone (Activity ID 314³⁵) is driven in the Infraco construction programme "Revision 1" by a link from the completion of the "Overhead Catenary Line" activity (Activity ID 074-04/05-OHLE-60³⁶). This activity is for the Section 7 Gogar to Edinburgh Airport section of track. That section, on its own, does not

³⁴ Schedule Part 1 - Definitions

³⁵ Ref Page 3 of 59 of the Infraco construction programme Revision 1 enclosed at Appendix 9/EE

³⁶ Ref Page 56 of 59 of the Infraco construction programme Revision 1 enclosed at Appendix 9/EE



constitute the Test Track as defined in the contract³⁷. The Infraco Contract definition of the Test Track states that it is assumed as “... Depot to the airport”. For that assumption to be valid the Depot to Gogarburn part of the track and overhead catenary is also required to achieve Section B completion. The Infraco construction programme Revision 1 does not link the Depot to Gogarburn Overhead Catenary Line directly to the Section B finish milestone. However it does link it, in a “finish-to-start relationship”, to the Section 7 Installation of poles and building fixings activity (Activity ID 07A-04/05-OHLE-50), which in turn is linked “finish-to-start” to the Section 7 Overhead Catenary Line activity (Activity ID 074-04/05-OHLE-60) referred to at the start of this paragraph. By this arrangement the entire length of the assumed Test Track is linked into the Section B finish milestone. In the interest of clarity I set out below the activity relationships I have just described.

10.3.2 (Insert graphic)

10.3.3 The reason I have explained this in detail is to identify that these relationship links contained in the Infraco construction programme Revision 1 are not exactly as one might expect to find them. There would appear to be a “finish-to-start” link missing from the end of the Section 5C Overhead Catenary Line to the Section B finish milestone. The link from the end of the Section 5C Overhead Catenary Line to the beginning of the Section 7 Installation of poles and building fixings, while serving to link the Section 5C works into the chain of activities driving the Section B finish milestone, would appear to be a preferential logic link. [define preferential logic link in general elsewhere in the report.] It is not a physical interdependency link. I understand that it, like many other preferential logic links, was inserted by the Infraco to effect its preferred sequence of resource movements for certain types of resource. [Insert cross ref. to criticism elsewhere of the use of these links in subsequent analyses.]

10.3.4

10.4 Implementing the Adjudicator’s decision on INTC 429

10.4.1 The utilities delays impacted into the Infraco construction programme Revision 1 that was used as the basis of the analysis of delay in the INTC 429 Estimate are encircled in red on the extracts below from the Appendix D programme contained within that Estimate.

³⁷ Ref. paragraph 10.2.1 of this report.
J086-1002 Draft Ver.3



10.4.2 Extract from INTC 429 Estimate Appendix D page 2 of 37 (Reference to area 9 is in fact to Section 7 [TH to confirm..])

MUDFA & UTILITIES		500	28-Sep-07	18-Dec-09
220	MUDFA & Utilities work area 5	0	28-Sep-07*	
245	Depot 50N Diversion	0	23-May-09*	
266	Pipeoff Woburns Dr	6	07-May-09*	
200	MUDFA & Utilities work area 9 completion	0	14-May-09*	
290	MUDFA & Utilities work for sub section 2	0	14-May-09*	
230	MUDFA & Utilities work for sub section 5B	0	23-May-09*	
240	MUDFA & Utilities work for sub section 5C	0	05-Aug-09*	
190	MUDFA & Utilities work area 2 completion	0	24-Sep-09*	
210	MUDFA & Utilities work for sub section 1D	0	25-Sep-09*	
100	MUDFA & Utilities work area 1 completion	0	17-Dec-09*	
200	MUDFA & Utilities work for sub section 1C	0	18-Dec-09*	

This identifies later utilities diversions affecting Section 5C as the date used in the analysis for area 5 (which I understand is the milestone covering Sections 5A, 5B and 5C) is earlier than the Section 5C date stated in the Programming Assumptions (12 May 2008)³⁸.

10.4.3 Extract from INTC 429 Estimate Appendix D page 36 of 37

Gogarburn Underbridge (S29)		254	15-Jun-08	10-Jun-09
7A-04-S29-30	Temporary Access Roads-Sub Excavation-Pile	10	16-Jun-08	09-Jun-08
7A-04-CRTH-30	Threat area of pre-constructed sewer diversions	10	16-Jun-08	15-Dec-08
7A-04-S29-40	Diversion (additional works)	10	17-Nov-08*	01-Dec-08
7A-04-S29-40E	East Abutment-Piles and Columns	26	16-Jun-08	07-Feb-09
7A-04-S29-40W	West Abutment-Piles and Columns	36	09-Dec-08	10-Feb-09
7A-04-S29-50E	East Abutment-Reinforced Earth	15	04-Feb-09	24-Feb-09
7A-04-S29-50W	West Abutment-Reinforced Earth	15	25-Feb-09	17-Mar-09
7A-04-S29-60	Bridge Deck	41	18-Mar-09	15-May-09
7A-04-S29-70E	East Abutment-Parapets and Run on Slabs	29	11-May-09	19-Jun-09
7A-04-S29-70W	West Abutment-Parapets and Run on Slabs	29	02-Jun-09	10-Jul-09

This sewer diversion impacted on the construction of the Gogarburn Underbridge (S29) although it was not a pre-commencement delay, as can be seen from this programme extract.

10.4.4 The Adjudicator’s decision on INTC 429³⁹ awarded “Nil” extension of time to the Section B Planned Sectional Completion Date (i.e. it remained as 1 July 2010).

10.4.5 The INTC 536 Estimate delay analysis impacts the following alleged utilities delays by way of the “Commencement of Designated Work Areas (driven by Mudfa completion, in ...)” milestones, as shown on the following extracts from the delay analysis programme at Appendix G of that Estimate.

³⁸ Ref. Schedule Part 15 of the Infraco Contract
³⁹ Ref. Appendix BB



Activity ID	Activity Name	Original Duration	Start	Finish
Intermediate Section 5C		591	28-Sep-07	18-Jun-10
1210	A8 Underpass (w28) Phase 4	0		28-Sep-07*
1220	Depot Access Bridge	0		28-Sep-07*
1250	Track Work Depot to Gogarburn (Ch 1322 to 1328)	0		19-Dec-08*
1200	A8 Underpass (w28) Phase 3	0		17-Apr-09*
1190	A8 Underpass (w28) Phase 2	0		13-Oct-09*
1180	A8 Underpass (w28) Phase 1	0		01-Feb-10*
1230	Track Work Edinburgh Park to Gyle (Ch0 to 760)	0		20-May-10*
1170	Gyle Retaining Wall (w19)	0		26-May-10*
1240	Track Work Gyle to Depot (Ch 760 to 1322)	0		18-Jun-10*
Intermediate Section 6A		0	30-Apr-09	30-Apr-09
Intermediate Section 7A		504	28-Sep-07	14-Feb-10
1300	Gogar Culvert 1 (S30)	0		28-Sep-07*
1320	Gogar Culvert 3 (S34)	0		28-Sep-07*
1360	Ingliston Sub Station	0		28-Sep-07*
1270	Access Roads	0		21-Dec-07*
1280	Gogar Landfill (Contaminated Land)	0		21-Dec-07*
1340	Trackwork Gogarburn to Ingliston (Ch 0 to 1750)	0		21-Dec-07*
1290	Gogarburn Bridge (S29)	0		24-Jul-08*
1310	Gogar Culvert 2 (S31)	0		05-Feb-09*
1330	Gogarburn Retaining Walls (w14)	0		14-Feb-10*
1350	Track Work Ingliston to Airport (Ch 1750 to 2580)	0		14-Feb-10*

10.4.6

10.4.7 The milestone activities encircled in green are outwith the parts of the Infraco Works that are required to achieve Section B Completion. Those encircled in red are within the scope of Section B. Of all of those encircled in red, only three, Activity IDs 1240, 1330 and 1350 post date the dates presented by the Infraco in the INTC 429 Estimate.

10.4.8 Addressing each of these in turn.

- a) “1240 – Track Work Gyle to Depot (Ch 760 to 1322)” – The date applied to this milestone does not appear to be correct. Both the “MUDFA Effect on DWA” spreadsheet in Appendix B and the DWA supporting narratives in Appendix C of the Estimate indicate that the date should be 26 September 2008 but the milestone in the programme has been set at 18 June 2010. On the understanding that the correct date is 26 September 2008, that delay pre-dates the INTC 429 Estimate. [Review following receipt of email from TH. This activity now appears to be inapplicable and can be deleted from this Report]



b) “1330 – Gogarburn Retaining Walls (W14)” – The date applied to this milestone is stated to be derived from the information contained in INF CORR 4031⁴⁰. The subject of that letter is “Reduction of Resources on On-street Work Areas”. It encloses a set of site plans (referred to in the letter as a “complete schedule”) “which gives the up-to-date facts on access to work areas”. I note that site plan entitled “Designated Work Areas : Section 5C/6 & 7” indicates that a section of the Site close to the airport is not available until 14/02/10. The precise wording of the note on the drawing is:

i) “Site Availability Pending Completion Handover of Burnside Road to BAA Earliest Possession Date 14/02/10”.

I understand this is not a matter directly related to late completion of MUDFA Works and did not involve the MUDFA Contractor. As such it is not within the scope of INTC 536 and therefore should not be included within the Estimate.

c) “1350 – Ingliston to Airport (Ch 1750 to 258...)” – As at sub-paragraph b) above, the date allocated to this milestone is based on the tie letter ref. INF CORR 4031. For the same reasons I consider it should not be impacted as a MUDFA delay in the INTC 536 Estimate.

10.4.9 On the basis of the preceding paragraphs I conclude that the Infraco has provided no evidence to indicate that there have been any further MUDFA (utilities delays) impacting on Section B works since those considered and addressed in the INTC 429 Estimate. Consequently, there is no new matter to be considered in relation to this Sectional Completion Date. The Adjudicator’s decision remains in force and, as I understand it, the matter of Infraco requirement for EoT cannot be adjudicated upon again.

10.4.10 [Although not apparently articulated in the INTC 536 Estimate, it is understood that the Infraco considers that the second set of reasons provided by Mr Howie on XXXXX , in relation to his decision on the INTC 429 Estimate, provides grounds for re-visiting his decision on the Section B Sectional Completion Date. I disagree for the reasons explained below.

⁴⁰ Copy enclosed at Appendix 10/XX



- a) The reasons are not part of the decision. The decision remains binding at the date of this report.
- b) In, what are in effect, his supplementary reasons Mr Howie discusses a matter put to him after his decision had been issued. That matter relates to the Infraco’s assertion regarding the “physical” relationship between the Section A and Section B Completion Dates. (i.e. that there is a hard logic link of 28 days between these two dates.) As Mr Howie notes in his supplementary reasons⁴¹, this was not a matter discussed before him. It appears to me that he has been misled in this matter by the content of Pinsent Masons letter dated VVVVV⁴². There is no such logic link in the Infraco construction programme Revision 1, as evidenced by the extracts from the electronic copy of that programme shown below.

10.4.11

Activity ID	Activity Name	Original Duration	Start	Finish
170	AWARD CONTRACT	0	15 May 08	
270	Mobilisation	20	15 May 08	12 Jun 08
200	Commence Phase 1a	0	15 May 08	
313	Section Completion A	0		01 Jun 10
314	Section Completion B	0		01 Jun 10
281	Construction Completion Phase 1a Edinburgh A	0		20 Dec 10

Driving	Project ID	Total Float	WBS	Activity ID	Activity Name
No	edintram-9a-2	432	edintram-9a-2.6.6.1.6	1209	Car Park & Handstanding
Yes	edintram-9a-2	190	edintram-9a-2.6.6.1.6	A2050	Inspection and Testing

10.4.12

Activity ID	Activity Name	Original Duration	Start	Finish
170	AWARD CONTRACT	0	15 May 08	
270	Mobilisation	20	15 May 08	12 Jun 08
280	Commence Phase 1a	0	15 May 08	
313	Section Completion A	0		01 Jun 10
314	Section Completion B	0		01 Jun 10
281	Construction Completion Phase 1a Edinburgh A	0		20 Dec 10

Driving	Project ID	Total Float	WBS	Activity ID	Activity Name
No	edintram-9a-2	10	edintram-9a-2.7.7.1.1	07A.9A95.0	Overhead Category List

10.4.13 It would appear to be the case that the Infraco is suggesting that Activity ID A6380 “Tram Testing of Tram”, as referred to at paragraph 10.5.3 below, should be linked between the

⁴¹ Ref. Mr Howie’s reasons dated XXXXX, paragraph YYYY.

⁴² Ref. Appendix 10/NN.



Section A and Section B milestones. Clearly that is not the case and I am advised that there would appear to be no justification for imposing such a strict relationship.

- 10.4.14 For each of these reasons I consider that there is no justification for revisiting Mr Howie's decision on the INTC 429 Estimate. There have also been no new matters arising in relation to the subject matter of INTC 536 since the base date of the INTC 429 Estimate.

10.5 Projection of Section B Completion Date in the INTC 536 Estimate

- 10.5.1 Notwithstanding the matters I refer to in sub-section 10.4 above, I have examined the INTC 536 Estimate programme in relation to the critical path analysis that leads to the projection of a revised (and much later) date for Section B completion.
- 10.5.2 I observe that there has been considerable revision to the programme network logic that links together the various activities that are driving the Section B finish milestone. I also note that there have been new activities introduced and some activity durations increased. Appendix D for the INTC 536 Estimate contains a "log of changes in undertaking the analysis contained within this Estimate. As I have notes at paragraph XX above, I have found this log to be incomplete. Changes have been made to the Infraco construction programme Revision 1 that have not been identified. Some of these affect the activities associated with the Section B works.
- 10.5.3 I cite as an example Activity ID 07-04-TRAM-20 entitled "Commissioning of first 5 Trams on test track (according to CAF programme)". It is identified as being a renamed activity although the original name and Activity ID from the original version of the Infraco construction programme Revision 1 is not readily apparent because of the wide-spread revision of the Activity IDs, as referred to in paragraph XXX above. Cross referring to the programmes included in the INTC 429 Estimate it would appear that it is the renaming of Activity ID A6380 "Tram Testing of Tram". I note that in the original version of the Infraco construction programme Revision 1 this activity has a duration of 20 working days and is not directed linked to the Section A or Section B finish milestones. Its relative timing shows that it starts following the Section B Completion Date (i.e. 1 July 2010). This is driven by completion of the Section 7 overhead catenary line. That activity is linked "finish-to-start" to the Section B finish milestone. Enclosed below is an extract from the electronic version of the original Infraco construction programme Revision 1 showing this information.



10.5.4

Activity ID	Activity Name	Original Duration	Start	Finish
14	Track Testing of Trains	14	01-Jul-10	21-Jul-10

Driving	Project ID	Total Float	WBS	Activity ID	Activity Name	Start	Finish	Relation	Lag
No	edintram-9a-2	196	edintram-9a-2.7.7.1.7	A2326	Fencing & Trackside Fences	12-Mar-10	04-May-10	FS	0
No	edintram-9a-2	234	edintram-9a-2.6.6.1.6	A5968	Install Telecom and Scada	26-Jan-10	16-Feb-10	FS	0
No	edintram-9a-2	234	edintram-9a-2.6.6.1.6	A5978	Testing and Commissioning	16-Feb-10	06-Mar-10	FS	0
No	edintram-9a-2	273	edintram-9a-2.6.6.1.6	A6348	Commissioning of SG interlocking cubicle	26-Jan-10	02-Feb-10	FS	0

10.5.5

Activity ID	Activity Name	Original Duration	Start	Finish
21	Track Testing of Trains	21	01-Jul-10	21-Jul-10

Driving	Project ID	Total Float	WBS	Activity ID	Activity Name	Start	Finish	Relation	Lag
No	edintram-9a-2	196	edintram-9a-2.7.7.1.7	A2326	Fencing & Trackside Fences	12-Mar-10	04-May-10	FS	0
No	edintram-9a-2	234	edintram-9a-2.6.6.1.6	A5960	Install Telecom and Scada	26-Jan-10	16-Feb-10	FS	0
No	edintram-9a-2	234	edintram-9a-2.6.6.1.6	A5970	Testing and Commissioning	16-Feb-10	06-Mar-10	FS	0
No	edintram-9a-2	273	edintram-9a-2.6.6.1.6	A6240	Commissioning of SG interlocking cubicle	26-Jan-10	02-Feb-10	FS	0

10.5.6 A

10.5.7

In the electronic version of the INTC 536 delay analysis programme this re-named activity has a duration of 44 working dates, yet this change has not been stated in the “log of changes”. Its relationships with other programme activities have also changed. It is now linked “finish to start” from the Section A finish milestone and “finish-to-start” to the Section B finish milestone. Enclosed below is an extract from the electronic version of the INTC 536 Estimate delay analysis programme showing this information.

10.5.8

Activity ID	Activity Name	Original Duration	Start	Finish
290	CAF-01 depot available for train delivery	290	28-Oct-10	15-May-11
15	CAF-02 delivery of the first train (according CAF program)	15	29-Oct-10	17-Nov-10
44	CAF-03 commissioning of first 5 Trains on test track	44	10-Feb-11	10-Apr-11
0	CAF-100 test track available for train commissioning	0	10-Feb-11	

Driving	Project ID	Total Float	WBS	Activity ID	Activity Name	Start	Finish	Relation	Lag
Yes	MUDFA710-8	102	MUDFA710-8.18	CAF-100	test track available for train commissioning	10-Feb-11		FS	0



Activity ID	Activity Name	Original Duration	Start	Finish
Tram		230	28-Dec-10	15-Mar-12
CAF-01	depot available for tram delivery		0: 26-Oct-10	
CAF-02	delivery of the first trams according CAF program	15	28-Dec-10	12-Nov-10
CAF-03	commissioning of first test track (according CAF programme)	4	10-Feb-11	12-Apr-11
CAF-100	test track available for tram commissioning	0	10-Feb-11	

Driving	Project ID	WBS	Activity ID	Start	Finish	Activity Name	Relations	Leg
Yes	MUDFA710-0	MUDFA710-0-12 Key D	CAF-03	11-Apr-11	16-Mar-12	Commissioning of trams according CAF programme	FS	0
Yes	MUDFA710-0	MUDFA710-0-12 Key D	CAF-03	11-Apr-11	16-Mar-12	Section Completion B	FS	0

10.5.9

10.5.10 I note that no detailed explanation has been provided for these changes. They do not appear to be as a consequence of the subject matter of the INTC 536 Estimate (i.e. later than planned completion of utilities diversions). There are clearly not delay mitigation measures as their effect is to increase the projected delay for Section B. I also note that if the same changes were to be made in the original Infraco construction programme, or the original version of Revision 1 of that programme, both programmes would project Section B finish milestone dates that did not comply with the requirements of the Infraco Contract.

10.5.11 I therefore consider that these changes are not part of the direct consequences of the subject matter of INTC 536 and therefore should not be included within it. Their inclusion is distorting the delay analysis presented by the Infraco resulting in incorrect and unjustifiable projections of requirements for extension of time.

10.5.12

10.6 Conclusion

10.6.1 From all of the foregoing I conclude that:

- a) The Adjudicator's decision on the INTC 429 Estimate remains binding on the parties.
- b) That decision resulted in the Section B Sectional Completion Date remaining, as per the Infraco construction programme Revision 1, at 1 July 2010.
- c) There has been on change to the material facts associated with completion of utilities diversions impacting on the Section B works from the INTC 429 Estimate to the INTC 536 Estimate.



- d) The reasons issued in relation to the INTC 429 Estimate adjudication decision do not provide legitimate grounds for re-visiting the subject matter of that decision. Even if they did, the reasons appear to be inconsistent with the facts of the case; are based on misleading information provided to the Adjudicator by the Infraco’s lawyers after his decision had been issued; and, if this matter were to be properly addressed, would not provide substantiation for any allegation that the adjudicator’s decision was wrong or unreasonable. (Do we wish to address this issue here in this in this report?)

10.6.2 For these reasons I consider that there is no legitimate justification within the INTC 536 Estimate to extend the Section B Completion Date beyond that decided upon by the Adjudicator on the INTC 429 Estimate.

10.6.3 xx



Section 11 Review of Section Completion Date C

11.1 Introduction

11.1.1 This section examines the parts of the Programme that relate to and project the Section C Sectional Completion Date. It also considers the Adjudicator’s decision on the INTC 429 Estimate with respect to Section C and compares that with the analysis in the INTC 536 Estimate that projects a requirement for extension of time.

11.2 Background

11.2.1 Schedule Part 1 of the Infraco Contract defines Section C as follows:-

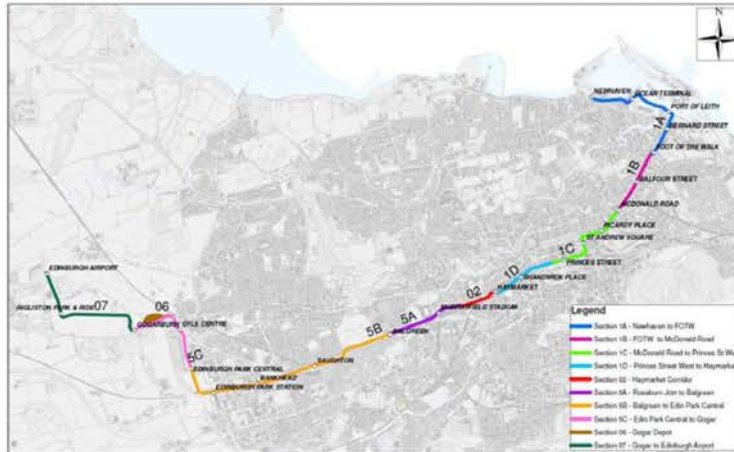
“Section C” means the carrying out and completion of Phase 1a to Newhaven (including energisation) and the spur or delta at Roseburn Junction and the completion of all tests required by the Employer’s Requirements in relation to that Section, including those System Acceptance Tests that must be successfully complete prior to shadow running as provided for in the Employer’s requirements.”

11.2.2 It is my understanding that “Phase 1a to Newhaven”, as referred to the Section C definition above, is the entire length of the route covered by the Infraco Works. It covers all of the Infraco Works other those items that are post-commissioning. It encompasses the scope of the Infraco Works required for Sections A and B. In effect, it is the delivery to the entire tram network within the scope of the Infraco Works, (i.e. Newhaven to Edinburgh Airport). With respect to the work breakdown structure in the Programme, it includes all design, construction, installation, testing and commissioning for intermediate sections (referred to as sub-sections on the route alignment map below⁴³) 1A, 1B, 1C, 1D, 2A, 5A, 5B, 5C, 6 and 7.

⁴³ Copy enclosed at Appendix 11/1
J086-1002 Draft Ver.3



11.2.3 Route Alignment Map showing, in general terms, the geographic scope of the Infraco Works required to achieve Section C Sectional Completion (Large scale copy included at Appendix 11/1).



11.2.4 The Infraco Contract states the Planned Sectional Completion Date for Section C (Testing and Commissioning) to be 17 January 2011⁴⁴.

11.2.5 tie Change Order No. 1 revised this Planned Sectional Completion Date to 10 March 2011.

11.2.6 The Infraco claimed a further extension of time for Section C as part of the Estimate for INTC 429. The Adjudicator’s decision on that claim was that no further extension of time should be awarded. I am advised that at the date of this report that decision remains binding on the parties.

11.3 Infraco construction programme Revision 1

11.3.1 The Section C Sectional Completion Date finish milestone (Activity ID 315) is driven in the Infraco construction programme “Revision 1” by a long string of activities. I enclose at Appendix 11/2 a filtered view from the original electronic copy of that programme. It shows this long string of activities that form the “critical path” to the Section C finish milestone.

⁴⁴ Schedule Part 1 - Definitions
 J086-1002 Draft Ver.3



11.3.2 From closer examination of this filtered programme I observe the following.

- a) The critical path starts from the “Issue Construction Drawings” milestone⁴⁵ for a section of trackwork in Section 2A.
- b) From the Section 2A trackwork the critical path moves through the following parts of the Infraco Works in the sequence listed.
 - i) Part of Section 1A trackwork
 - ii) Part of Section 5B trackwork
 - iii) Part of Section 1D trackwork
 - iv) Another part of Section 1D trackwork
 - v) Part of Section 1B trackwork
 - vi) Part of Section 2A trackwork
 - vii) Part of Section 1B trackwork
 - viii) Part of Section 1A trackwork
 - ix) Part of Section 2A trackwork
 - x) Part of Section 1B trackwork
 - xi) Part of Section 6 trackwork
 - xii) Part of Section 1B trackwork
 - xiii) Part of Section 1A trackwork
 - xiv) Part of Section 1D trackwork
 - xv) Three parts of Section 1C trackwork
 - xvi) Part of Section 1D trackwork
 - xvii) Part of Section 5C trackwork

⁴⁵ Appendix 11/2, page 2, Activity ID 10340.
J086-1002 Draft Ver.3



- xviii) Part of Section 5C E&M installations
 - xix) Part of Section 1B E&M installations
 - xx) Part of Section 1C E&M installations
 - xxi) Commissioning of SIG interlocking cubicles on Section 1C
- c) This string of activities concludes with the “Construction Completion Phase 1 Haymarket to Newhaven” finish milestone which is in turn connected to the “Section Completion C” finish milestone.

11.3.3 From all of this it is apparent to me that the critical path to Section Completion C is:-

- a) initially driven by delivery of design;
- b) linked together by a considerable number of “Physical⁴⁶” and “Preferential⁴⁷” (Soft) logic links;
- c) routed through a great number of different sections of the route in a manner that is not indicative of any physical interdependency between adjacent or related elements of the Infraco Works; and,
- d) not indicative of the shortest possible time in which Section Completion C could be achieved.

11.3.4 The Infraco has previously explained that it inserted “Preferential” links into this programme to effect resource smoothing/limitation. I acknowledge that there is nothing untoward in doing so, providing the resulting programme projects completion in accordance with the requirements of the Infraco Contract. That said, I do consider it necessary and correct to remove this preferential logic before using the programme in any form of delay analysis.

11.3.5 I note that if the preferential logic is removed there will not be a critical path to the Section Completion C finish milestone, i.e. there will be float throughout the programme, other than, possibly, on those activities associate with Section Completion A and B.

⁴⁶ Also referred to as “Hard” logic. This is logic that models the unavoidable physical interdependency between individual activities. e.g. it is physically necessary to construction a wall foundation before the wall itself can be built.

⁴⁷ Also referred to as “Soft” logic. This is logic that is not required for unavoidable physical interdependency but is applied to model an elected preference, usually that of the Contractor.



- 11.3.6 I consider that it is very important for anyone considering the impact of delays on this project to understand the points made above. The Infraco Works are spread over a very long site (approximately 18km). They have to be designed and built in several hundred discrete parts. All of these parts come together to form the completed Infraco Works. Some of these parts require to be designed and built in particular sequences but not all of them. There is no one sequence that must be adhered to. What is required that all of the parts are completed within the overall time allowed. With respect to achieving the Section C Sectional Completion Date it is the completion of the last of these parts that will determine the date. It is to be expected, and indeed the Programme shows, that a great number of these parts will be completed well in advance of the Sectional Completion Date. That is the very nature of the project.
- 11.3.7 The Programme sets out how the Infraco intended to deliver the design, construction, installation, testing and commissioning of the Infraco Works. It projected compliance with the Sectional Completion Dates specified in the Infraco Contract. It represents the Infraco's original the planned order and manner for delivering the Infraco Works, but that planned order and manner is not, in my opinion, mandatory and binding. (What is McG's view on this statement? Some might say that it conflicts with Mr Howie's reasons.) The very nature of designing and delivering works such as the Infraco Works is that there will be change to the original plan. The Infraco Contract contemplates that and makes provisions for dealing with it. That change may arise from a considerable number of different causes including Infraco changes⁴⁸, tie changes⁴⁹, changes caused by others⁵⁰ and changes causes by matters that are outwith human influence or control⁵¹. Such change may cause delay and/or require changes to the planned order and manner in which the Infraco Works are delivered. Where such change arises, the Infraco is obligated to act reasonably to mitigate the delaying effect of such changes.
- 11.3.8 The means by which delay, arising from change, can be mitigated will depend on the particular circumstances associated with such change. I note that in a programme where there is no critical path determined by physically interdependent activities, there is a avaialbel means to mitigate such delay. It is either to use the float that is available within

⁴⁸ Changes instigated by the Infraco through choice or as a result of other matters, for which it is responsible, that have arisen and create the need for change.

⁴⁹ Changes instigated by tie or as a result of matters for which it is responsible and liable under the terms of the Infraco Contract.

⁵⁰ Changes that impact on the Infraco Contract that are neither caused the Infraco or tie.

⁵¹ Changes such as adverse weather conditions, natural physical conditions and the likes.



the programme and/or make revisions to the planned order and manner of delivering the overall project works. The application of such means is a requirement of the Infraco Contract and, as I understand it, is supported by principles established in common law and case law.

11.3.9 I note that in its preparation of its delay analysis programme for use in the INTC 536 Estimate the Infraco appears to have recognised the correctness applying such means of mitigation. This is evident from its statements that it has removed much of the preferential logic from its delay analysis programme⁵². From my own examination of that delay analysis programme I acknowledge that a considerable amount of the preferential logic has been removed but not all of it. I cite the following examples:-

- a) The completion of the superstructure on the Haymarket⁵³ is linked “finish-to-start” to the start of the Pile Caps for the Russell Road Retaining Walls (W3 and W4)⁵⁴. These two structures are located over 1km apart and there is no apparent physical interdependency related to their construction.
- b) The completion of the A8 Underpass (Phase 4 and Subway Construction activities⁵⁵) has been linked “finish-to-start” to the commencement of the Depot Access Bridge⁵⁶. These two structures are several hundred meters apart and, again, there is no apparent physical interdependency related to their construction. (This is supported by the fact that at the time of writing this report construction of the Depot Access Bridge is well underway yet the A8 underpass is less than 50% complete.) [TH to confirm and, perhaps, suggest different %age?]

11.4 Implementing the Adjudicator’s decision on INTC 429

11.4.1 In the INTC 536 Estimate the Infraco states that it has taken cognisance of the Adjudicator’s decision from the INTC 429 Estimate⁵⁷. With respect to the Section C Completion that decision awarded “Nil” extension of time. On that basis, the Planned Sectional C Completion Dates remains as that revised by the Change Order No. 1 and reflected in the original version of the Infraco construction programme Revision 1, i.e. 10 March 2011.

⁵² Ref. INTC 536 Estimate Appendix A, page 7, paragraphs 2 and 3.

⁵³ Activity ID 570 in Infraco construction programme Revision 1 and Activity ID 2A-13-s19-60 in the INTC 536 delay analysis programme.

⁵⁴ Activity ID 370 in Infraco construction programme Revision 1 and Activity ID 5A-12-W3-50 in the INTC 536 delay analysis programme.

⁵⁵ Activity IDs 539 and 549 in Infraco construction programme Revision 1 and Activity IDs 5C-03-W28-93 and 94 in the INTC 536 delay analysis programme.

⁵⁶ Activity ID 144 in Infraco construction programme Revision 1 and Activity ID 5C-03-S32-100 in the INTC 536 delay analysis programme.

⁵⁷ Ref. INTC 536 Estimate Appendix A, page 1, paragraph 7.



11.4.2 My initial examination of the delay analyses contained in the INTC 536 Estimate suggested to me that INTC 429 had not been implemented. It appeared to me that it had, in effect, been ignored. To test whether or not this was true I conducted a “what if” scenarios using the INTC 536 delay analysis programme.

11.4.3 I wanted to check what Sectional Completion Dates would the Infraco’s delay analysis programme project if I impacted into it only the utilities dates information that formed the base data for the INTC 429 Estimate and the adjudication discussion associated with it. If it projected Sectional Completion Dates that coincided with, or were earlier than the dates determined by the Adjudicator that would indicate that his decision had been taken cognisance of in the preparation of the INTC 536 Estimate. If it did not, it would indicate to me that the delay analysis programme used in the preparation of the INTC 536 Estimate included delays that were pursued in the INTC 429 Estimate but for which the Adjudicator had decided no extension of time was due.

11.4.4 I have described in ~~Section 6~~ Section 6 of this report the exercise I undertook and the findings from it. In the paragraphs below I further explain this work with particular reference to the activities driving the Section C Completion Date.

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11.4.5 To do this I took the Infraco’s listing of Designated Work Areas (DWAs) that it was using in the delay analysis programme and related each of them to the equivalent utilities completion dates that formed the base data for the INTC 429 Estimate. For the most part, that base data was taken from the MUDFA Revision 8 programme. Enclosed at Appendix 11/3 is the schedule I produced. It lists the DWA milestones used to impact utilities completion dates into the Infraco’s delay analysis programme against both the dates applied by the Infraco in the INTC 536 Estimate and their equivalent dates from the INTC 429 base data. The exception to this is in relation to the parts of intermediate sections 1C and 1D covered by the Princes Street Supplemental Agreement. For these DWA milestones I have used dates I have been advised by tie. These are all identified as such on the schedule.

11.4.6 I then took the Infraco’s INTC 536 Estimate delay analysis programme and changed the dates on the “Commencement of Designated Work Areas (driven by MUDFA completion, in ...) finish milestone to the INTC 429 dates from the Appendix 11/3 schedule. The programme produced from this “what if” scenario is enclosed at Appendix 11/4.



11.4.7 In the table below I summarise a comparison of the four Sectional Completion Dates produced from this “what if” scenario against the equivalent dates as decided by the Adjudicator and also as current at the the date of this report.

11.4.8 [Possibly remove the foregoing paragraphs as their content is repeated in Section 6?]

Section	Sectional Completion Date decided by the Adjudicator in relation to INTC 429 and current at the date of this report	Projected Section Completion Dates form the “what if” scenario described above	Difference (calendar days)

11.4.9

11.4.10 With respect to the Section C Sectional Completion Date, it is apparent that the Infraco’s delay analysis programme (without the application of any resourcing level which would certainly further delay the Section C Sectional Completion Date) models (and therefore contains) at least 64 calendar days of delay for which the Adjudicator decided “Nil” to be due. I consider this to be reliable evidence that the Adjudicator’s decision on the INTC 429 Estimate has not been acknowledged or taken account of in the INTC 536 Estimate.

11.5 Projection of Section C Completion Date in the INTC 536 Estimate

11.5.1 The Section C Completion Date claimed in the INTC 536 Estimate has been projected using the delay analysis programme prepared by the Infraco. Above and in the preceding sections of this report I have cited a number of reasons why I consider this programme to be inappropriate and unreliable for use this analysis of delay. For ease of reference I summarise these, as follows.

- a) It has been derived from the Infraco construction programme Revision 1. This is not the Programme, as defined by the Infraco Contract, but one part of it;



- b) It takes no account of actual progress on the Infraco Works (including in particular design, construction, installation, testing and commissioning) to the base date of the INTC 536 Estimate;
- c) It does not reflect historic changes to the Infraco's planned or actual order and manner for delivery of the Infraco Works (Cross ref. to example);
- d) It contains;
 - i) errors;
 - ii) superseded logic;
 - iii) preferential logic;
 - iv) unsubstantiated changes to the logic;
 - v) added activities and revised durations;
- e) The method used to impact the MUDFA / utilities delays is by creating impact date milestones for individual parts of the Infraco Works using the work breakdown structure contained within the Infraco construction programme. It is apparent from the Estimate that the Infraco promotes its case on the basis that each of those parts of the Infraco Works is a Designated Work Area, as defined by the Infraco Contract. I consider this to be inconsistent with the contractual definition and therefore do not agree with it. It is my opinion that for some parts, at certain points in time, the work breakdown structure in the Infraco construction programme's division of the Infraco Works might align with a correct and reasonable interpretation of what constitutes a DWA, however, that is not the case for the entire WBS. (Would adding an example be helpful?) It is therefore my opinion the manner in which the later than planned completion of MUDFA Works / utilities diversions has not been correctly and accurately impacted into the delay analysis programme.

11.5.2 I also note that the Infraco's delay analysis concludes by applying an automated resource constraint exercise the delay analysis programme, thereby projecting further delay to the Section C Completion Date. As I have explained at (insert cross ref.) I consider that there is no justification, under the terms of the Infraco Contract, for the application of this



constraint and therefore the additional delay it projects cannot be relied upon. That is not to say that I consider that the Infraco Works should be planned, and delay analysed, without consideration to the availability of resource, but that the constraints being applied by the Infraco are inconsistent with the Infraco's previously indicated intent and, in my opinion, are unreasonable in the particular circumstances this project finds itself in.

11.5.3

11.5.4 For each and all of their reasons I consider that the delay analysis contained in the INTC 536 Estimate is inaccurate and produces unreliable results. It does not consider all relevant matters in relation to assessing the actual impact of the later than planned completion of the MUDFA Works /utilities diversions and, consequently, it does not provide evidence that such delays actually had an effect the critical path to the Section C Completion Date.

11.6 Refinement of the INTC 536 Estimate delay analysis

11.6.1 To demonstrate the significance of the matters I have raised in the preceding paragraphs I took the Infraco's delay analysis programme and adjusted to take into account some of my criticism, as I explain below.

11.6.2 I temporarily removed the "Commencement of Designated Work Areas (driven by MUDFA completion, in)" finish milestones to free the base delay analysis programme from the MUDFA delays impacted by the Infraco.

11.6.3 To address the issue that the Infraco construction programme, from which the delay analysis programme was developed, is only part of the Programme, I updated it, as best I could from the information available, to align with the updated SDS design delivery (that being another element of the Programme and the only other significant element that provided information on order, timings, interdependencies within the Programme as a whole. I took the V60 SDS design delivery programme (i.e. the update immediately preceding the INTC 536 Estimate base date) and identified when individual elements of design had been or were planned to be complete. I then added, and linked-in, finish milestones to reflect the V60 design delivery programme in the Infraco delay analysis programme. This, in effect, added the actual progress on design into the delay analysis programme.



11.6.4 I then took the Infraco’s reported actual progress from the 9 July 2010 updated Infraco construction programme Revision 1⁵⁸ and added that information to the delay analysis programme that already contained the V60 SDS design delivery programme data. I now had what I considered to be an updated programme that reflected the actual data as at the INTC 536 base date of 31 July 2010. I enclose a copy of this programme at Appendix 11/11. That programme projects the following Sectional Completion Dates.

Section	Sectional Completion Date decided by the Adjudicator in relation to INTC 429 and current at the date of this report	Projected Section Completion Dates from the Infraco delay analysis programme updated for actual progress on design and construction	Projected delay to Sectional Completion Date (calendar days)

11.6.5

11.6.6 Whilst I consider that this programme, along with the V60 SDS design delivery programme falls somewhat short⁵⁹ of the what I consider should exist as the Programme to be maintained in accordance with Clause 60.2 of the Infraco Contract, it is, in my opinion, a more accurate and factually based delay analysis programme than the one used by the Infraco in its preparation of the INTC 536 Estimate. It reflects the factual position at the base date of the INTC 536 Estimate (31 July 2010) and projects as yet incomplete work on the basis of the data contained within the delay analysis programme relied upon by the Infraco to support its EoT claims.

11.6.7 It appears to me readily apparent that at the INTC 536 Estimate base date of 31 July 2010, the Infraco Works were significantly behind programme and that is before impacting the MUDFA delays that are the subject of INTC 536.

11.6.8 The table below compares the projected Sectional Completion Dates from that updated delay analysis programme with equivalent dates claimed in the INTC 536 Estimate.

⁵⁸ Copy enclosed at Appendix 11/HH.
⁵⁹ (Insert reasons by way of explanation.)



Section	Projected delay to Section Completion Dates from the Infraco delay analysis programme updated for actual progress on design and construction	Projected delay to Sectional Completion Date claimed in the INTC 536 Estimate (calendar days)

11.6.9

11.6.10 From this comparison I conclude that with respect to Section C there would appear to be other matters reported by the Infraco that are causing much greater delay (i.e. 607 – 461 = 156 calendar days) to the Sectional Completion Date. To check the actual impact of the MUDFA delays cited by the Infraco on this updated programme I re-inserted the “Commencement of Designated Work Areas (driven by MUDFA completion, in)” finish milestones into it. This action resulted in no effect on the projected Sectional Completion Dates. It appeared to me that any delays that these MUDFA delay impact milestones are causing are not creating delays to the critical path. There must be other matters that are determining the actual start dates and rates of progress for the Infraco Works and they are the dominant cause of delay.

11.6.11 To check this was correct I examined the critical and near critical strings of activities that are driving the projected Section C Completion Date. The critical path starts from delivery of design for Russell Road Underbridge. Its construction leads onto Roseburn Viaduct. On completion of these structures, the trackwork and overhead lines in this area (part of Section 5A) are completed thereby allowing “Tamping Ballast” and “Grinding” that then lead to the Section C Completion Date milestone. I enclose at Appendix 11/KK an extract from this programme showing this critical path.

11.6.12 I note that the construction of neither of these structures had started on-site at 31 July 2010 (and that remains the case at the date of this report). The “Commencement of Designated Work Areas (driven by MUDFA completion, in)” finish milestones for each of them are as shown below.



Structure	MUDFA date from the Programme Assumptions	MUDFA date from the INTC 536 Estimate "MUDFA effect on DWA" spreadsheet

11.6.13

11.6.14 The dates in the table above indicate that, according to the information provided by the Infraco within the INTC 536 Estimate, the Russell Road Underbridge has not been delay by MUDFA Works (the date of 28 September 2007 being over eight months before the Infraco Contract was signed). The MUDFA date cited for Roseburn Viaduct is later than that stated in the Programme Assumptions (12 May 2008) but is still over three months in advance of the original planned commencement date for the first on-site activity for Roseburn Viaduct (Ref. Original Infraco construction programme and Revision 1 of same, Activity ID 109 "Bankseat at Grid line A".) I conclude that in the INTC 536 Estimate the Infraco is claiming no MUDFA delay to either of these structures yet using the Infraco's delay analysis programme they are the actual drivers of the critical path to Section C Completion.

11.6.15 Recognising that there some errors and shortcomings in the Infraco delay analysis programme I have examined where these might affect activities that are on or close to the critical path. I have considered the potential effect on the projected Section C Completion Date should they be corrected/addressed, as I explained below.

- a) There is a "finish-to-start" link between the Russell Road Underbridge "Deck" and the Roseburn Viaduct "Bankseat at Grid Line A". There would appear to be no physical reason for this. If it is removed the critical path is shortened by 13 days and starts from Murrayfield Retaining Walls, continuing on to Roseburn Viaduct, as before. Like Russell Road Underbridge, Murrayfield Retaining Walls are noted as not being affected by the cited MUDFA delays (i.e. they, like Russell Road Bridge, have been allocated a "MUDFA effect on DWA" date of 28 September 2007).
- b) The longest programme network paths to two of the four On-street sections (1B and 1C) are approximately 100 calendar days shorter than the equivalent works in Section 5A. Each of them has experienced late completion of MUDFA Works. The longest programme network path through Section 1B is not driven by the



“Commencement of Designated Work Areas (driven by MUDFA completion, in)” finish milestones that are impacted on the works in that section. Consequently, the delays to MUDFA Works are not actually causing the delay. The longest network path through Section 1C is driven by a “Commencement of Designated Work Areas (driven by MUDFA completion, in)” finish milestone. It is the milestone for Road and Track Works Ch 0 to 375 (Activity ID 590) with a forecast completion date of 1 February 2011. I am advised by **tie** that that date is incorrect. It appears to be based on superseded set of GIS maps and is not representative of the factual position at the base date of the INTC 536 Estimate. I am advised that the date used was erroneously reported in the supersede GIS maps and that it should be approximately three months earlier. From all of this I conclude that the projected completion dates for the On-street sections are not driving, or nearly driving critical delay. I also note that if the errors that I have found in the Infraco’s delay analysis programme are taken into account, the amount of available float on these activities will increase.

11.6.16 All other sections show earlier completion dates and therefore, with respect to the delay analysis being consider here, any adjustment to the programme to correct errors are, in my opinion, most unlikely to bring them close to the projected critical path to the Section C Sectional Completion Date.

11.6.17 On the basis of this refinement to the Infraco’s INTC 536 Estimate delay analysis and my examination of its output, it appears clear to me that the Infraco Works have been the subject of considerable delay but that delay is not being driven or determined by the later than planned completion of the MUDFA Works or other utilities diversions.

11.7 Actual and dominant cause of delay

11.7.1 As I have noted in the preceding paragraph, it is readily apparent that the Infraco Works have experienced considerable delay. Through the INTC 429 and INTC 536 estimates the Infraco has sought considerable awards of extension of time for later than planned completion of the MUDFA Works and other utilities diversions under by, or on behalf of **tie**. Based on my examination of these estimates and the other information I have been provided with, including but not limited to Period Reports and updated programmes produced by the Infraco, it appears to me that the subject matter of both these INTCs are not actually causing delay. There appear to be other matters that are the dominant cause



of delay. That being so, I believe that it should be a proper consideration of these that determines whether or not extension of time are due to the Infraco.

11.7.2 I have been asked if I can identify what is the dominant cause of delay. I have found it difficult to be certain in my answer for the following reasons.

- a) The Infraco has not properly and routinely updated the Programme in accordance with the requirements of the Infraco Contract;
- b) Much required information has not been included in the reports and programme updates provided by the Infraco and therefore I have somewhat limited information on what appear to be significant matters. In particular I cite lack of detailed information on E&M design, third party consents and approvals, procurement of resources and, preparation and approval of pre-requisites to commencement of construction activities.
- c) The Programme has not been updated to reflect change to date, including instructed change and changes to the Infraco's actual or planned order and manner for the delivery of the Infraco Works.

11.7.3 Having said all of that, with the passage of time and lack of progress on many significant work fronts, it appears to me that the following matters are, or most likely to be the actual dominant causes of delay.

- a) Much later than planned delivery of the M&E design for the entire scope of the Infraco Works. The Infraco construction programme Revision 1 shows this being complete in November 2008, yet the July 2010 update of this programme projects this completion to July 2010, all as shown on the programme extracts below.



Extract from Infraco INTC 536 delay analysis programme – base date 31 July 2010
 (this is the same as the equivalent extract from the original "Revision 1" programme.)



(I note that at the July 2010 SDS design delivery programme indicates that this design will continue beyond that date. This has become evident through the passage of time and at the date of this report the M&E design still remains incomplete.)

The M&E design is fundamental part of the Infraco Works. It drives and greatly influences the building and civil engineering design. Without it, the Infraco Works cannot be fully designed, checked, certified and authorised for construction. Without design the construction cannot be properly planned and many of the pre-requisites to commencement of construction put it place.

I am unaware as to why the M&E design is running so late but it certainly appears to me to be having a most significant delaying effect on the delivery of the Infraco Works. I am aware that some elements of the Infraco Works have been delivered without a complete (or sufficiently complete) integrated design⁶⁰ being in place. I am advised that that is not in accordance with the terms of the Infraco Contract. That aside, I am aware that the consequences of such action has given rise for the need to redesign and modify much of the works delivered to date. There are also parts of the Infraco Works delivered for which the final design has yet to be determined and approved. Not only do I consider this to be very poor practice, it is likely to give rise to further design related design to the full delivery of the Infraco Works.

⁶⁰ A design that incorporates and aligns all elements of the design including, but not necessarily limited to, civil engineering, mechanical engineering, electrical and electronic engineering, controls and communications.
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- b) Much later than planned delivery of the civil engineering and building design for a considerable proportion of the Infraco Works. In some instances this appears to have been delayed as a consequence of the later than planned delivery of the M&E design, as noted above. The civil engineering and building design requires to be integrated with the M&E design and without that information it cannot be delivered. In other instances it appears to have been delayed by changes. Some of the changes appear to have been instigated by the Infraco and some by tie.
- c) Much later than planned commencement of many elements of the Infraco Works arising from the actual time taken to complete the processes required by the change mechanisms contained in the Infraco Contract and the resolution of disputes associate with same.

11.7.4 At the time of writing this report have been unable to form an opinion of where culpability for these delays lies. For the purposes of this report I consider that matter of no consequence. What is, in my opinion, important is that these matter do appear to be the dominant causes of delay and that the later than planned completion of the MUDFA Works and other utilities diversions are not. For that reason, I consider that the extensions of time claimed by the Infraco as part of the INTC 536 Estimate are without justification and should be rejected. That is not to say that the Infraco may be due extensions of time for matters that are associated with the dominant causes of delay. If that is the case then I believe it is for the Infraco to pursue such claims through the appropriate contractual mechanisms. I am advised that, to-date, it has failed to do so.

11.8 Corrections to the INTC 536 Estimate delay analysis.

11.8.1 Should it be considered that the Infraco's claim for extension of time contained within the INTC 536 Estimate is a valid approach, which for the avoidance of doubt I consider it is not, I note that it appears to contain a number of errors, particularly in relation to the projection of the Section C Sectional Completion Date. I have explained these in the preceding sections of this report and list below those of particular relevance to the Infraco's projection for Section C.

- a) Incorrect MUDFA dates;



- b) Physical scope, order, sequence, and duration for the On-street activities does not accord with the Infraco's stated, and now authorised⁶¹, planned intent; and,
- c) The scope allocation to each "Commencement of Designated Work Areas (driven by MUDFA completion, in)" finish milestone, in certain situations, effects the completion date over a greater area than that which is physically necessary.

11.8.2 I have addressed the MUDFA dates error by revising the milestones in the Infraco's delay analysis programme to the dates advised to me by tie, as noted in the MUDFA Dates schedule enclosed at Appendix 11/aa.

11.8.3 I find that I am unable to make appropriate and reliable adjustments to that same programme for the other two sources of error noted above. This is because although the errors are readily apparent I do not have sufficient information to make an informed judgement on the effect they might have on this programme.

11.8.4 To demonstrate the effect of the corrections to the MUDFA dates I have adjusted the "Commencement of Designated Work Areas (driven by MUDFA completion, in)" finish milestones to the values contained in the MUDFA Dates schedule. This resulted in a reduction of the projected delay to the Section C finish milestone of 48 calendar days. (i.e. from 13 June 2012, as projected by in the INTC 536 Estimate to 26 April 2012.) Enclosed at Appendix 11/ss is a copy of the adjusted delay analysis programme.

11.9 Conclusions

11.9.1 I conclude that if the analysis of delays arising from later than planned completion of the MUDFA Works and other utilities diversions is properly analysed it is apparent that these delays are not actually causing delay to the achievement of Sectional Completion Date C.

11.9.2 The dominant cause of delay is as a result of matters other than later than planned completion of the MUDFA Works and other utilities diversions. It would appear that the actual cause of overall delay arises from delayed deliver of design and delays arising from contractual processes, including the resolution of disputes associated with same. If the Infraco has a contractual right to the awarding fo extensions of time, it should pursue claims for such based on these dominant causes and not non-critical delay.

⁶¹ The scope and sequence of traffic management arrangements promoted by the Infraco and subsequently formally approved by City of Edinburgh Council does not align with that used in the analysis of delay.



11.9.3 If I am wrong in relation to the two preceding paragraphs and the Infraco's approach to legitimately assessing extension of time, as set out in the INTC 536 Estimate, is considered to be correct, then the Infraco's delay analysis requires various adjustments to correct errors and properly analysis delay. While I have been unable to conduct what I consider to be an accurate and reliable adjusted version of the Infraco's delay analysis, I have indentified the following periods of time that I consider should be deducted, as a minimum, from the Infraco's claim.

- a) Corrections to MUDFA Dates (ref. paragraph 11.8.4 above) = 48 days
- b) Projected delay from the base data for the INTC 429 Estimate, incorrectly included in the INTC 536 Estimate (ref. paragraph 11.4.10) = 64 days

11.9.4 On that basis, if the Infraco's approach is considered legitimate the extension of time for Section C should be reduced by at least 112 days (i.e. 48 + 64). This would revised the Infraco's claim from 461 days to 349 days.

11.9.5 Xxx



Section 12 Review of Section Completion Date D

12.1 Introduction

12.1.1 This section of this report examines the parts of the Programme that relate to and project the Section D Sectional Completion Date. It also considers the Adjudicator's decision on the INTC 429 Estimate with respect to Section D and compares that with the analysis in the INTC 536 Estimate that projects a requirement for extension of time.

12.2 Background

12.2.1 Schedule Part 1 of the Infraco Contract defines Section D as follows:-

12.2.2 *"Section D" means the completion of shadow running and commencement of revenue service approval obtained and the completion of all tests required by the Employer's Requirements in relation to that Section, including those System Acceptance Tests that must be successfully completed to enable Service Commencement."*

12.2.3 The Infraco Contract states the Planned Sectional Completion Date for Section D is *"the date which falls 26 weeks after the issue of the Certificate of Section Completion in respect of Section C"*⁶².

12.2.4 In the original and Revision 1 Infraco construction programmes the activities that link together the Section C and Section D finish milestones create and maintain a 26 week time frame between them. This relationship is maintained through the various delay analysis programmes produced by the Infraco and myself.

12.2.5 I am advised by **tie** that it considers that it may be possible to mitigate delay to the Section D Sectional Completion Date by reducing the time required to complete the activities required to achieve the issue of the Certificate of Section Completion in respect of Section D. I understand that the overall duration that will actually be required for many of these activities can, potentially be reduced by **tie**. That being so, the requirement for extension of time to the Section D Sectional Completion Date might prove to be less than the 26 weeks envisage in the original Programme.

⁶² Schedule Part 1 - Definitions
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12.3 Conclusion

- 12.3.1 The Infraco Contract envisages that the Section D Sectional Completion Date will be achieved 26 weeks after the Section C Sectional Completion Date. The Programme and the various delay analysis programme models that relationship through a series of activities that have an overall total duration that matches that 26 weeks.
- 12.3.2 The activities that link the Section C and Section D finish milestones in the various programmes are not directly impacted upon by the subject matter of the INTC 536 Estimate. They are most likely only to be impacted upon by any overall delay to the Section C Sectional Completion Date.
- 12.3.3 As concluded in Section 11, it is apparent that the Section C Sectional Completion Date has not been impacted upon by the subject matter of the INTC 536 Estimate. Consequently, I conclude that the Section D Sectional Completion Date is likewise unaffected.
- 12.3.4 For these reasons I find no evidence or justification for extending the Section D Sectional Completion Date because of the impact on the Programme of the matters cited in the INTC 536 Estimate.



Section 13 Opinion and Conclusions (not used)

13.1 [This section not used but keep in draft document meantime]

13.1.1 xxx



Section 14 Statement of Truth

I Iain McAlister declare that;

- 14.1.1 I understand that my duty in providing written reports and giving evidence is to assist the Adjudicator and this duty overrides any obligation to the party by whom I am engaged. I confirm that I have complied with and will continue to comply with my duty.
- 14.1.2 I confirm that, insofar as the statements made within my report are within my own knowledge I have made clear which they are and I believe them to be true and that the opinions I have expressed are correct, are within my field of expertise, and represent my true and complete professional opinion.
- 14.1.3 I have endeavoured to include in my report those matters of which I have knowledge or of which I have been made aware that might adversely affect the validity of my opinion. I have clearly stated any qualifications to my opinion.
- 14.1.4 I have not, without forming an independent view, included or excluded anything which has been suggested to me by others including my instructing client's (tie's) representatives.
- 14.1.5 I will notify those instructing me immediately and confirm in writing if for any reason my existing report requires any correction or modification.
- 14.1.6 I confirm my understanding that this report is to be submitted by into an adjudication between the Bilfinger – Siemens – CAF Consortium and tie Limited, and that this matter, if it goes further, may ultimately be taken into litigation.
- 14.1.7 I confirm that I have not entered into any arrangement where the amount or payment of my fees is in any way dependent on the outcome of this adjudication.
- 14.1.8 This report is submitted in compliance with, and acknowledgement of, my responsibilities and associated obligations.

Signed

Date: XX February 2011



Iain McAlister, ACUTUS



Section 15 Appendices

Section 1 – (none)

Section 2 -

Appendix 2/1 – Initial brief from tie to Acutus.

Appendix 2/2 – Curriculum Vitae for Iain McAlister

Section 3 – (none)

Section 4 – (none)

Section 5 -

Appendix 5/1 – Time-Chainage programme showing actual impact of MUDFA Rev.8 dates in Section 1A.

Appendix 5/2 – Schedule of periods of inactivity between roadworks/groundworks and the start of track laying.

Section 6 -

Appendix 6/1 – Summary of Assessment of Delay Mitigation Opportunities and requirements for extension of time.

Section 7

Section 8

Section 9

Section 10

Section 11

Section 12



Section 13

Section 14



Appendix 2/1 – Initial brief from tie to Acutus



Appendix 2/2 – Curriculum Vitae for Iain McAlister



Appendix 5/1 – Time-Chainage programme showing actual impact of MUDFA Rev.8
dates in Section 1A.



Appendix 5/2 – Schedule of periods of inactivity between roadworks/groundworks
and the start of track laying.



Appendix 6/1 – Summary of Assessment of Delay Mitigation Opportunities and requirements for extension of time.