Audit under Clause 104 of the Infraco Contract

Executive Summary

A requirement to carry out and audit of Changes and Differences in Design was identified by **tie** in January 2010. The scope of the audited focussed on 4 particular areas of the Infraco design:-

- Roads and Drainage design for section 1D
- Structures Baird Drive retaining wall
  Bankhead Drive retaining wall
  Depot Access Bridge
  A8 Underpass
- Track design and improvement layers
- OLE system and foundations

This report details the process, observations and findings of the audit.

Each audit comprised of core members from the audit team plus technical experts recruited from "independent" consulting groups. Each team is identified within the subsection dealings with the specific audits.

A number of emerging themes were identified by the audit team. The majority of these themes were common to all of the audits.

The main themes identified by the team were:-

- Little evidence that BSC have properly managed the design process in a timely manner.
- Lack of evidence that BSC have paid serious attention to best value design solutions.

These themes and others are commented on in detail within this report.

Initially BSC refused to co-operate fully with the audit team. After discussion with **tie** and having taken advice within BSC this position changed early on in the audit. The BSC response to the audit changed again later in the process. Citing legal advice, their response to certain audit questions was that "Provision of this information was not an obligation under Clause 104 the Infraco contract". BSC were formally advised that we disagree with their position on this matter and a final attempt will be made at retrieving the information **tie** have requested.

The audit team were not provided with the level of documentary evidence that would be expected in such circumstances leading the team to two conclusions:

- that not all documentation has been provided to them as required under the contract,
- that the expected level of management engagement evidenced through documentation that would be expected to exist on a contract of this nature, does not exist.

The audit team also identified a number of areas which can be improved to help **tie** in its administration of the contract and these are detailed within the report.

The subsections of this report have been developed in manner that allows relevant subsections to be delivered to BSC to allow them to comment and confirm that the evidence gathered is full and complete.

A number of actions on BSC remain outstanding and will be progressed through the final stage of the audits.

The audit was based on a set of questions posed to Infraco by **tie**[1]. Minutes were taken of the audit meetings and the evidence obtained was scheduled.

Joanne Glover of DLA Piper attended each audit as a member of the core team and produced transcript records of each meeting. These are included within the evidence files in each subsection.

[1] Attached to tie's letter of 14 January 2010 (ref: INF CORR 3178/RB), notifying Infraco of the intent to audit, outlining the scope of the audit, and here appended.

Emerging Themes

The main Emerging Themes identified by the audit team with respect to BSC's management of the areas audited were:

- Little evidence that BSC have properly managed the design process.
- Lack of evidence to suggest that BSC have paid serious attention to Best Value design solutions.
- The output of design Development Workshops have produced designs that appear to be in excess of the needs of the Client.
- No Liability for Pre-Novation Issues.
- Lack of Engagement with the Audit Process.

These are discussed further below:-

Little evidence that BSC have properly managed the design process.

BSC are obliged to carry out all required management activities in order to manage the performance of the SDS Services in accordance with the Infraco Contract Clause 11 and the SDS Novation Agreement Clause 6.1.

Despite numerous requests throughout the audit meetings, BSC were unable to produce evidence of positively managing SDS in the areas within the scope of the audit. The audit team has no reason to believe this lack of engagement would be different in other areas of the design management. BSC were unable to produce any letters, memos, emails and minutes of meetings to substantially evidence this obligation. Searches of their BIW document archive system conducted by Colin Brady (BSC Director of Engineering) failed to reveal any supporting documentation, save for only two letters in which they press SDS for information relating to Trackform design. Further follow up meetings asking for any information or details of how BSC have managed the design programme did not produce anything that demonstrates the discharge of this contractual obligation.

BSC advised that on occasion they did use priority lists to expedite design production for the design of the OLE bases and poles, however the only evidence was an e-mail advising Bob Bell (**tie** Construction Director) of certain Roads and Drainage priorities with respect to Scottish Water approvals. **tie** queried why his evidence had been presented as demonstration of their prioritising OLE design programme, and were advised by BSC that this documentation implied that the OLE design programme was being similarly prioritised. Given the amount of design required off street for OLE, this was not considered as a credible explanation. There was nothing that clearly directed SDS to produce designs to a programme and manage their progress against such.

The prospect of the On Street Supplemental Agreement and the delay in achieving such was referred to as something that was preventing the Consortium from delivering against its current obligations.

BSC have taken a comfortable position over their position with managing the design programme by referring to the ongoing delays with reference to MUDFA issues as the overarching reasons not to be putting energy into completing the process.

Output from Design Development Workshops (established to address mis-alignment issues) has taken considerable time to be developed. eg. with respect to road design, the Highways Standards Appendix 7.1, **tie**'s independent engineers (Aecom) considered an appropriate work content of approximately two weeks but SDS took over a year to produce. This document now stands at Revision 6, with a further revision imminent. Even assuming this number of revisions was required; this should have been produced in a period of 12 to 16 weeks.

There was no evidence (from responses to questions or documentary) that BSC has put any pressure on SDS or has used, or threatened to use any of the contractual mechanisms available to it, in particular the exercise of the Liquidated Damages which are contained in the SDS agreement, as amended by the SDS Novation Agreement (Clause 27.7). The audit team will seek confirmation on this matter at follow up meetings. The audit party has given BSC a number of opportunities to confirm that there is other documentation or correspondence which demonstrates that it has managed the design process, to which the response has always been negative.

For example: Some of the questions Bob Bell asked in the roads audit follow up on Tuesday 2nd February include:

RB : "Can you demonstrate that the programme introduced at V45 was agreed with SDS or that you instructed SDS to work to this programme?".

CB: "No, other than accepting the programme. There is no correspondence".
.....
CB: "tie's hypothesis is that BSC failed in managing the programme. Are there records of the management of this particular process? I think there aren't".
.....
RB; "Is there anything else regarding programme management which we're not aware of, that BSC would want to put up as demonstration of this?".

CB: There is no regular class of correspondence that you're not aware of".
.....

Note: At the time of writing this report it has become apparent that BSC advised in a separate audit, being carried out by Nichols Group on behalf of **tie,** that they had implemented a "Focus and Prioritisation" process with respect to their design programme. Further details will be sought from BSC in this respect.

Lack of evidence to suggest that BSC have paid serious attention to Best Value design solutions

BSC are obliged to prepare Best Value performance plans and conduct Best Value reviews in relation to the works. *(Clause 73)*
[Essentially, they are:

1. Throughout the project to make arrangements to secure improvements in the conduct of the works in particular regard to economy, efficiency and effectiveness,
2. prepare best value performance plans and reviews and support **tie** in its preparations for that,

   [Comply with requests for information, data or other assistance by **tie** in pursuance of BV assessment.]

There was no evidence in any of the audits to suggest that these plans and reviews had taken place. BSC were unable to produce any credible letters, memos, emails of minutes of meetings to evidence this obligation. [In fact, at the audit, BSC stated (as an aside) that Best Value for **tie** and for BSC were two different things and appeared unaware of the existence and relevance of Clause 73 of the Infraco Contract.]. Searches of their BIW document archive system conducted by Colin Brady failed to reveal any supporting documentation. Further follow up meetings asking for the details of how they have considered Best Value in their design activities did not produce anything that demonstrated the discharge of this contractual obligation.

BSC may disagree with this finding, citing the design for Roads as a demonstration of their delivery of Best Value. Whilst **tie** would agree that the current design intent presents better value now than the design from earlier in the programme, it has been **tie** who has promoted practical ideas leading to this design which now offers better value.

BSC have exploited some situations to their benefit and cannot demonstrate how they have attempted to safeguard their Clients interests. Eg Baird Drive claims.

The outputs of design Development Workshops have produced designs that appear to be in excess of the needs of the Client.

As an example, the design of the ground improvement layer beneath the track has produced a product that appears to be in excess of the needs of the tramway but does provide a significant amount of civil works for the BB part of the consortium. BSC have designed a reinforced concrete ground improvement layer capable of spanning 1 metre voids. Whilst **tie** agrees there may be a requirement for void spanning in some areas, **tie** does not accept this is required throughout the on-street route as proposed by BSC. There was no evidence to demonstrate that Best Value had been considered nor that any risk analysis had been undertaken and presented to the Client as an opportunity to reduce cost of both of the direct construction of the tramway and the diversion/protection of utilities.

The development of the design of the OLE has produced a final product but again does not have any evidence to suggest that the current design offers Best Value

There was no evidence to suggest that the contract incentives contained in Clause 81 have prompted any positive behaviour in this area.

No Liability for Pre-Novation Issues

BSC have taken a position with regard to pre-novation matters of design by allowing designs to be finalised without any intervention by themselves as the new owners of the design process. They have not demonstrated evidence to suggest that unresolved legacy issues prior to novation should warrant any management or direction by the consortium and that they have attempted to mitigate the impact of changes to the Client. Eg. Depot Access Bridge.

Outstanding design issues have been allowed to draw to a conclusion based upon pre-novation design decisions and they have not tried to add any value to the process. There was very little evidence to suggest that they have challenged pre-novation decisions and conclusions to try and make a difference to the outcome and thus add value to the process.

Lack of Engagement with the Audit Process

BSC have displayed a reluctance to engage positively with the audit process although they have generally managed to field the necessary personnel to support the audit when required. Access to their BIW system has always been available and any relevant results printed, however the searches have all been carried out by Colin Brady. Many of the requests for information have been prefaced by reference to there being a lack of understanding of the relevance of the request.

BSC consider e-mail to be an informal means of communication and that they do not have any obligation to provide such although this has not been confirmed in writing. That said, they have on a couple of occasions produced an email in support of their position when it suits.

Design Change Audit – Roads (Section 1D)

1. Scope of audit

During January and February 2010 **tie** ltd undertook an audit of the ETN Infraco Contract under Clause 104 in relation to Changes to the design of roads construction in Section 1D of the Infraco Works following Development Workshops.

The critical success factors / objectives of the audit were to:-

Item 1 – Understand the rationale and source of the Design Change

Review of evidence to substantiate why the IFC design constitutes a Change under the Infraco Contract

Review of evidence as to whether change emanated from Infraco, an approval body, or client instruction.

Item 2 – Understand the process for design programme management in terms of time, cost and value management

Confirm and evidence that delivery of the IFC was not delayed by late or inadequate instruction or information from Infraco members or subcontractors (including SDS) or any other third party.

Confirm and evidence that Infraco and the SDS Provider considered how a change could be mitigated in terms of cost and time and how they considered best value.

Item 3 – Identify how the design approval process has been followed

Review of evidence that Planning, technical approvals and close out of informatives was completed prior to IFC

Provide evidence that the Programme obligations for the changed design have been discharged.

Demonstrate process for carrying out an Inter Disciplinary Review [IDR] including how integration of the Siemens design was carried out.

Provide copy of Buildability reports and evidence of CDM & ROG's compliance.

2. Audit findings

2.1 Item 1 – understand the rationale and source of the Design Change

The audit sought to understand why the design of the Roads in Section 1D had changed and how the change had transpired.

Findings

It is understood that the original design had been a standard detail upon which Pricing Assumption 14 was based. The parties acknowledged, from the outset of the contract, that this standard detail did not represent best value and that economies could arise from redesign.

Infraco were obliged to re-design the roads following Development Workshops. The result of Development Workshops was the production of revised pavement options ('the palette')[2] and a flow-chart showing four stages of procedure, agreed by the parties, to address the differing requirements that may arise during the works associated with Roads, including those of Section 1D and culminating in the production of the final design based on the selected palette option. The final version of the palette is currently expected from Infraco.

The Design Development Workshops caused a Design Change Order to be raised changing the methodology by which the road works would be repaired and / or reconstructed. IFC can now no longer be achieved for Roads prior to the start of construction as the final design solution cannot be determined until works have commenced and the road opened up for analysis.

2.2 Item 2 – understand the process for design programme management in terms of time, cost, and value management

Infraco were unable to demonstrate, to **tie**'s reasonable satisfaction, any degree of pro-active management of the design process in terms of time. In terms of cost and value management, it is considered that procurement of Best Value has, partially, been met.

Findings

A design change process was agreed between **tie** and Infraco in Development Workshops, and which was then instructed by **tie** to be followed by Infraco. This process was explained graphically in a flow-chart. Briefly, an initial design for each section of road would be developed following initial testing of the ground. The parties would collaborate on the condition of existing pavement and on what further

[2] *'Appendix 7.1'.*

soil testing would be suitable. Test results would be analysed and an agreed choice would then be made from the palette of pavement options, suitable for the conditions found.

Design prioritisation and Design programme was evidenced as a basic process to achieve completion dates. This programme could not be linked in or coordinated with an overall master programme. There was no evidence of [reviewing/updating/putting pressure on SDS to adhere to] the prioritisation list identified in April 2009.

In terms of cost and value, Infraco is of the view that the palette of pavement options demonstrates that best value has been sought and obtained. **tie** is of the view that the design process represents Best Value in that it permits the most suitable option for any given condition to be obtained, however, the current palette does not. The reasons for this is that it could be improved in that it does not provide guidance on where non-full-depth reconstructions could be used nor on where specific options should be used in terms of those within any given category (the categories could be more defined).

The IFC information for the roads had been due for issue in June or July 2009, based on testing being done up-front. Infraco considered that any delay in the process is the result of a failure to agree (a joint responsibility) the product of the Development Workshops and other aspects such as drainage, traffic signalling and Traffic Regulation Orders. In terms of programming, no programme was being maintained but, rather, a priority list was developed and used for reference. (Evidence of this comprised an email from BSC to Bob Bell in relation to the Prioritisation Order for Drainage Approval and Roads Close out Report, dated 1 April 2009, and table "Design Completion" listing each section and the quarter date by which the design is required) Infraco relied on this, together with the occurrence of the weekly Design Meetings, as evidence that the programme had been managed.

tie's view is that Infraco have been obstructive in continuing to refuse to consider suggestions to use a cement-bound sub-base to improve bearing capacity and to develop a further option to cater for an intermediate CBR rating of between 5 and 10%. This could have been easily done within circa. ½ hour but, after one year's passage of time, it is still outstanding. Infraco appear to have been significantly dilatory in the execution of the palette of pavement options. This may not achieve Best Value for **tie**.

Item 3 – Identify how the design approval process was followed

As this arises from Development Workshops, the approval process is not the same as general changes.

Findings

With respect to buildability reports, those for the roads do not exist as no AIP process has been followed: they will form part of the CDM compliance[3]. Infraco intend to demonstrate ROGS compliance at the end of the construction works, before revenue running starts.

There is an internal inconsistency within Infraco in that SDS Provider considers that additional initial testing would be conducive to improving the process. Costs for this would be in the region of £230,000. The alleged benefit of this proposal is not appreciated by **tie**[4]. Bilfinger Berger considers that the frequency of the proposed initial testing is too high.

3.0 Review of Evidence

Review of evidence provided in the audit 21st January 2010 and follow up meeting 2nd February 2010.

Pavement Evaluation Report, reference 718376/R/01/A – Mouchel 8th September 2008. This report was commissioned by Bilfinger Berger UK Ltd to undertake a pavement investigation of four sections of carriageway; Haymarket Junction, Shandwick Place, Princes Street and St Andrews Square. The aim was to determine the structural condition of existing pavements and assess their pavement life and propose structural treatments to bring them up to the required design life. Whilst the sample size compared with the length of the 'on street' section was limited a range of conditions was observed from 'deep Inlay or reconstruction' through to area 'no treatment'.

As a consequence of the Design Development Workshop, Design Change Order DCO-019, dated 17th February 2009 instructed the production of a Construction Methodology statement to define the management process of a) Testing insitu to determine ground conditions, & b) Selection of Road Construction details, in accordance with tie letter 18th December 2008 547. *(Letter not presented in the audit as evidence)*.

As a consequence of the Design Development Workshop, Design Change Order DCO-020, dated 17th February 2009 instructed the Analysis of Roads Construction.

IDR/IDC meeting minutes – 30th September 2009, 9th November 2009, 16th November 2009 were presented as evidence of the IDR process for section 1A and that it is complete. The completeness of the process is not evidenced by these documents, only that there is a forum attended by Consortium members (not CAF) for IDR/IDC discussion.

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[3] Under the Road Safety Audit.

[4] CN/DF (??) advised, separate from the audit, that further initial testing ought also to assist in programming traffic management and that other benefits could arise to tie in facilitating other actions.

Email dated 1st April 2009 from BSC to tie confirming the prioritisation order for SW and CEC Roads close out reports, listing the order of the sections of the tram route to be designed from highest to lowest priority . Table entitled "Design Completion" (undated) provides target dates for design completion broken down in to sections of the tram route and quarters (from 1 April 2009 to 1 July 2010).

SDS Design Programme dated 18th May 2009 provided as evidence of how the Roads IFC design process links in with the BSC requirements. *Not clear from the evidence how this demonstrates link with BSC programme?*

Letter dated 29th January 2010, 4525 BSC write to tie with responses and enclosing supporting evidence to close outstanding actions from the audit.

Technical report dated 4th February 2010 from Aecom discussion design protocol and a commentary on Appendix 7/1. Design Protocol considered to be an appropriate methodology and if implemented correctly should provide 'best value'. Opinion is expressed that it is unclear why Appendix 7/1 has taken so long to develop, it being reasonable to suggest that it could have taken a fraction of the time. The development appears to have been led by suggestions from tie or CEC with little evidence of a proactive design by BSC. The band width of options within the design palette has not been narrowed sufficiently to provide economic selection options.

Design Change Audit – Structures

1. Scope of audit

During January and February 2010 **tie** ltd undertook an audit of the ETN Infraco Contract under Clause 104 in relation to changes to the design of four structures:- Baird Drive Retaining Wall, Bankhead Drive Retaining Wall, Depot Access Road Bridge & A8 Underpass.

The critical success factors / objectives of the audit were to:-

Item 1 – Understand the rationale and source of the Design Change

Review of evidence to substantiate why the IFC design constitutes a Change under the Infraco Contract

Review of evidence as to whether change emanated from Infraco, an approval body, or client instruction.

Item 2 – Understand the process for design programme management in terms of time, cost and value management

Confirm and evidence that delivery of the IFC was not delayed by late or inadequate instruction or information from Infraco members or subcontractors (including SDS) or any other third party.

Confirm and evidence that Infraco and the SDS Provider considered how a change could be mitigated in terms of cost and time and how they considered best value.

Item 3 – Identify how the design approval process has been followed

Review of evidence that Planning, technical approvals and close out of informatives was completed prior to IFC

Provide evidence that the Programme obligations for the changed design have been discharged.

Demonstrate process for carrying out an Inter Disciplinary Review [IDR] including how integration of the Siemens design was carried out.

Provide copy of Buildability reports and evidence of CDM & ROG's compliance.

2.0 Baird Drive Retaining Wall

2.1 Item 1 – Understand the rationale and source of the Design Change

The audit sought to obtain an understanding from the consortium why the design of the retaining wall had changed to its current design.

The audit team requested that the consortium provide details and evidence in support of the design rationale and details of calculations that drew them to the current design conclusions.

It was anticipated that the consortium would be able to outline and demonstrate the design processes they had gone through and the selection of options with risk assessments they had carried out to bring them to the current IFC design solution.

Findings

The change was instructed by **tie** following the review of an options report and negotiations with Network Rail to agree the routing of the tram tracks adjacent to a maintenance access road.

The change is a shift in the track away from the NR tracks. The picture is complicated by a change in foundation depth at IFC stage and an apparent change in survey information. The IFC geometry maintains access along the corridor at the toe of the wall. This will provide access for the maintenance of the wall and so is a desirable feature.

2.2 Item 2 – Understand the process for design programme management in terms of time, cost and value management

The audit sought to obtain an understanding from the consortium how they managed the design process in terms of ensuring that the designs were economic, of good value, approved and delivered in a timely manner to support the overall construction programme.

The audit team requested that the consortium provide details and evidence to show how they directed the programme to ensure that it remained on target showing details of how they ensured that good value management had been included to achieve best value to the client.

It was anticipated that the consortium would be able to outline and demonstrate the design programme and demonstrate how they had introduced best value options into the process to deliver an efficient and economic end product.

Findings

The options report focused on the layout options and did not consider cost benefit. The final solution was based upon what was achievable and agreeable with Network Rail and the local residents.

There was no evidence to suggest that the design and/or variations were undertaken to achieve Best Value.

2.3 Item 3 – Identify how the design approval process has been followed

The audit sought to obtain confidence from the consortium that the design process has been fully integrated and had obtained all the necessary approvals and consents so as not to delay the construction programme and deliver best value.

The audit team requested that the consortium provide details and evidence in support of the system integration processes, change control, design reviews and close out.

It was anticipated that the consortium would be able to produce an activity schedule along with evidence to demonstrate that the necessary steps had been taken to achieve a fully integrated and compliant design.

Findings

The final design was developed from a previous IFC design and was varied and approved for IFC.

The final design was presented in the audit as the result of a design process to achieve IFC but not evidenced.

3.0 Bankhead Drive Retaining Wall

3.1 Item 1 – Understand the rationale and source of the Design Change

The audit sought to obtain an understanding from the consortium why the design of the retaining wall had changed to its current design.

The audit team requested that the consortium provide details and evidence in support of the design rationale and details of calculations that drew them to the current design conclusions.

It was anticipated that the consortium would be able to outline and demonstrate the design processes they had gone through and the selection of options with risk assessments they had carried out to bring them to the current IFC design solution.

Findings

The relocation of the tramstop caused several consequences in the structural design of the retaining walls.

The principle changes from BDDI and IFC are increases in the height and length of the south wall with an increase in depth to a foundation for compacted fill below that wall and the addition of the north retaining wall which replaces an embankment.

The driver for the change to the south wall was an increase in footway width to incorporate its use as a cycleway. The wall was re-positioned further back into the embankment.

The foundation level at IFC has been taken at a lower level over the western end of the wall, where the wall is of lesser height.

The north wall was added at IFC. The Consortium stated that this addition was to resolve the need to satisfy Network Rail in relation to the BDDI arrangement where the embankment encroached upon their land.

3.2 Item 2 – Understand the process for design programme management in terms of time, cost and value management

The audit sought to obtain an understanding from the consortium how they managed the design process in terms of ensuring that the designs were economic, of good value, approved and delivered in a timely manner to support the overall construction programme.

The audit team requested that the consortium provide details and evidence to show how they directed the programme to ensure that it remained on target showing details of how they ensured that good value management had been included to achieve best value to the client.

It was anticipated that the consortium would be able to outline and demonstrate the design programme and demonstrate how they had introduced best value options into the process to deliver an efficient and economic end product.

Findings

The South Gyle tramstop was requested by CEC and instructed by **tie** to be relocated despite a report by SDS recommending that it remain in its original designed location. These instructions were made by **tie** prior to BDDI.

The consequences of this relocation in terms of design alterations and cost were not considered in the report and do not appear to inform the decision to instruct the change.

There was no evidence to suggest that the Consortium attempted to advise the Client of the consequences of the change decision and / or any attempt to mitigate the impact of this change.

There was little evidence to demonstrate that Best Value and Value Engineering has been applied to the Design Changes to minimise the cost impact of variations.

3.3 Item 3 – Identify how the design approval process has been followed

The audit sought to obtain confidence from the consortium that the design process has been fully integrated and had obtained all the necessary approvals and consents so as not to delay the construction programme and deliver best value.

The audit team requested that the consortium provide details and evidence in support of the system integration processes, change control, design reviews and close out.

It was anticipated that the consortium would be able to produce an activity schedule along with evidence to demonstrate that the necessary steps had been taken to achieve a fully integrated and compliant design.

Findings

The final design was developed and modified during the IFC process with the North wall being added at this stage.

The height of the retaining walls was raised as an original consequence of relocating the tramstop although there was little evidence to confirm this difference between BDDI and IFC details.

The final design was presented in the audit as the result of a design process to achieve IFC but not evidenced.

4.0 Depot Access Road Bridge

4.1 Item 1 – Understand the rationale and source of the Design Change

The audit sought to obtain an understanding from the consortium why the design of the structure had changed to its current design.

The audit team requested that the consortium provide details and evidence in support of the design rationale and details of calculations that drew them to the current design conclusions.

It was anticipated that the consortium would be able to outline and demonstrate the design processes they had gone through and the selection of options with risk assessments they had carried out to bring them to the current IFC design solution.

Findings

The revised designs developed post BDDI as a result of moving the Depot northwards resulted in reducing the length of the A8 retaining structures from 380m to 75m. This greatly reduced the construction work adjacent to the A8 Slip Road and was probably the main objective for moving the Depot northwards. The retained height was also reduced from typically 6 - 8m to around 2m. The nearest rail on the outbound running lines is now around 17m from the nearest kerb line of the Gogar roundabout compared with around 6m with the pre BDDI v3 design. In theory this should mean a simpler bridge deck in plan shape because there should be less flare at the roundabout end, and at least 10m more working space to construct the South Abutment. The change from secant bored piles to a conventional abutment on 900 dia bored piles combined with the temporary anchored wall and associated working space has eaten into at least 5m of the additional working space created by moving the Depot northwards.

- There would appear to be no reason why secant (or contiguous) bored piles could not have been used for the abutments and retaining walls of the post BDDI v4 design in a similar way to the pre BDDI v3 design.
- Permanent ground anchors could probably have been eliminated by making the deck fully integral with the abutments and pier. This would also eliminate bearings and have other maintenance benefits as well.
- As an alternative to embedded piles for the abutments, spread foundations on the boulder clay would seem to be a feasible option eliminating the need for bored piles.
- Another option could have been a two cell reinforced concrete box which would have a low bearing pressure and would take the south side excavation further away from the Gogar roundabout and reduce the height of the temporary earth support required.

4.2 Item 2 – Understand the process for design programme management in terms of time, cost and value management

The audit sought to obtain an understanding from the consortium how they managed the design process in terms of ensuring that the designs were economic, of good value, approved and delivered in a timely manner to support the overall construction programme.

The audit team requested that the consortium provide details and evidence to show how they directed the programme to ensure that it remained on target showing details of how they ensured that good value management had been included to achieve best value to the client.

It was anticipated that the consortium would be able to outline and demonstrate the design programme and demonstrate how they had introduced best value options into the process to deliver an efficient and economic end product.

Findings

There was no evidence to suggest that the Consortium attempted to advise the Client of the consequences of the change decision and / or any attempt to mitigate the impact of this change.

There was little evidence to demonstrate that Best Value and Value Engineering has been applied to the Design Changes to minimise the cost impact of variations.

4.3 Item 3 – Identify how the design approval process has been followed

The audit sought to obtain confidence from the consortium that the design process has been fully integrated and had obtained all the necessary approvals and consents so as not to delay the construction programme and deliver best value.

The audit team requested that the consortium provide details and evidence in support of the system integration processes, change control, design reviews and close out.

It was anticipated that the consortium would be able to produce an activity schedule along with evidence to demonstrate that the necessary steps had been taken to achieve a fully integrated and compliant design.

Findings

The final design was presented in the audit as the result of a design process to achieve IFC but not evidenced.

5.0 A8 Underpass

5.1 Item 1 – Understand the rationale and source of the Design Change

The audit sought to obtain an understanding from the consortium why the design of the structure had changed to its current design.

The audit team requested that the consortium provide details and evidence in support of the design rationale and details of calculations that drew them to the current design conclusions.

It was anticipated that the consortium would be able to outline and demonstrate the design processes they had gone through and the selection of options with risk assessments they had carried out to bring them to the current IFC design solution.

Findings

The consortium was not prepared to provide any evidence to support the audit on this topic.

5.2 Item 2 – Understand the process for design programme management in terms of time, cost and value management

The audit sought to obtain an understanding from the consortium how they managed the design process in terms of ensuring that the designs were economic, of good value, approved and delivered in a timely manner to support the overall construction programme.

The audit team requested that the consortium provide details and evidence to show how they directed the programme to ensure that it remained on target showing details of how they ensured that good value management had been included to achieve best value to the client.

It was anticipated that the consortium would be able to outline and demonstrate the design programme and demonstrate how they had introduced best value options into the process to deliver an efficient and economic end product.

Findings

The consortium was not prepared to provide any evidence to support the audit on this topic.

5.3 Item 3 – Identify how the design approval process has been followed

The audit sought to obtain confidence from the consortium that the design process has been fully integrated and had obtained all the necessary approvals and consents so as not to delay the construction programme and deliver best value.

The audit team requested that the consortium provide details and evidence in support of the system integration processes, change control, design reviews and close out.

It was anticipated that the consortium would be able to produce an activity schedule along with evidence to demonstrate that the necessary steps had been taken to achieve a fully integrated and compliant design.

Findings

The consortium was not prepared to provide any evidence to support the audit on this topic.

6.0 Review of Evidence

Review of evidence provided in the audit 19th January 2010 and follow up meetings 27th January 2010 and 22 February 2010.

SDS Client/Design Meeting Minutes provided on request to demonstrate the development of the design.

17th July 2008
30th July 2008
6th August 2008
13th August 2008
20th August 2008
27th August 2008
3rd September 2008
10th September 2008
17th September 2008
24th September 2008
1st October 2008
5th October 2008
8th October 2008

Letter 11th August 2008, SDS write to BSC forwarding CD copies of IFC drawings for A8 Underpass.

Letter 18th August 2008, SDS write to BSC forwarding further CD copies of IFC drawings for A8 Underpass. – Previous copy was corrupt.

Letter 9th September 2008, SDS write to BSC issuing Change Estimate DCR0010 for Additional Prior Approvals for Depot Access Bridge.

Baird Drive Retaining Wall

SDS report (PB) dated 21st December 2007 – Network Rail Balgreen Road Options Report. Three options considered. Report assumes a minimum clearance of 2.5m between toe of embankment and the garden fence. A vertical retaining wall is proposed where the clearance would fall below this minimum.

Letter circa 25th April 2007, **tie** write to Network Rail confirming that the design is proceeding on the basis of the "high level" option.

Letter 16th May 2007, 373A **tie** write to SDS confirming that they should be continuing to progress the design based upon alignment option 3.

Letter 21st August 2007, Network Rail write to **tie** confirming that the current alignment is the best all round option. The current position affords Network Rail at

least a 3m wide access road and permission to reverse maintenance road vehicles over the tram tracks.

Project Change Order dated 24th January 2008 issued by **tie** to SDS with the intent of changing the alignment in accordance with letter 16th May 2007 373A .

Change Estimate CES231 dated 29th November 2007 issued by SDS for the change of alignment in accordance with letter 16th May 2007 373A .

Document Transmittal Form dated 1st August 2008, SDS to **tie**, issues IFC drawings for Baird Drive.

Email 22nd January 2010, SDS write to **tie** with audit briefing notes for the Baird Drive, Bankhead Drive and Depot Access Bridge. Also confirms that A8 Underpass details will be responded to separately.

Bankhead Drive Retaining Wall

Letter 26th October 2006, 44229 **tie** write to SDS enclosing SDS report (PB) dated 5th October 2006 – South Gyle Tramstop Design Approval Panel Comments & Appraisal of proposed move of Tramstop Report. The report concludes that there is no justification for removing or locating the Stop further east at Broomhouse Drive.

Letter 3rd November 2006, CEC write to **tie** informing them of their requirement for the tramstop to be relocated to improve the bus interchange with the tram. *(Not presented as audit evidence)*

Letter 1st December 2006, 51226 **tie** write to SDS instruct an adjustment in the tramstop location. *(Not presented as audit evidence)*

Letter 23rd March 2007, 59046 **tie** write to SDS confirming agreement to proposed location. *(Not presented as audit evidence)*

Letter 25th September 2007, 810 **tie** write to SDS return the Change Notice (24th September 2007) and Change Order asking for them to be signed and returned.

Depot Access Road Bridge

Change Order dated 31st July 2007 issued to SDS to undertake a study and review the moving of the depot building within the Gogar site.

SDS report (PB) dated 16th August 2007 – Gogar Depot Report "Possible Adjustments" recommends that **tie** should instruct for the relocation of the depot building within the Gogar site.

Change Order dated 12th September 2007 issued to SDS to carry out the recommendations to relocate the depot building within the Gogar site.

A8 Underpass

The Consortium were not prepared to provide any evidence on this topic.

Design Change Audit – Track Design and Improvement Layers

1. Scope of Audit

During January and February 2010 **tie** undertook an audit of the ETN Infraco Contract under Clause 104 in relation to Changes and Differences in Design as it pertains to the Track Design and Improvement Layers.

The critical success factors / objectives of the audit were to:-

Item 1 – Understand the rationale and source of the Design Change

Review of evidence to substantiate why the IFC design constitutes a Change under the Infraco Contract

Review of evidence as to whether change emanated from Infraco, an approval body, or client instruction.

Item 2 – Understand the process for design programme management in terms of time, cost and value management

Confirm and evidence that delivery of the IFC was not delayed by late or inadequate instruction or information from Infraco members or subcontractors (including SDS) or any other third party.

Confirm and evidence that Infraco and the SDS Provider considered how a change could be mitigated in terms of cost and time and how they considered best value.

Item 3 – Identify how the design approval process has been followed

Review of evidence that Planning, technical approvals and close out of informatives was completed prior to IFC

Provide evidence that the Programme obligations for the changed design have been discharged.

Demonstrate process for carrying out an Inter Disciplinary Review [IDR] including how integration of the Siemens design was carried out.

Provide copy of Buildability reports and evidence of CDM & ROG's compliance.

2. Audit Findings

2.1 Item 1 – Understand the rationale and source of the Design Change

The audit sought to obtain an understanding from the consortium why the design of the trackform had changed and what the thinking was behind the current proposal of constructing a reinforced concrete slab underneath the trackslab.

The audit team requested that the consortium provide details and evidence in support of the design rationale and details of calculations that drew them to the current design conclusions.

It was anticipated that the consortium would be able to outline and demonstrate the design processes they had gone through and the selection of options with risk assessments they had carried out to bring them to the current IFC design solution.

Findings

The consortium has not followed the tie instruction to produce a suite of design options for a track improvement layer.

The consortium has considered that the current design of track and ground improvement layer is a result of the Infraco Proposal and the design Development Workshop to identify and resolve design mis-alignments.

BSC's track design is the Rheda City sleeper system which comprises pre-cast concrete bi-block sleepers with exposed interconnecting reinforcing bars for insitu concrete casting in position on site. The design requires a ground bearing capacity of 120MN/m^2.

Four mis-alignments between Base Date Design Information and the Infraco Proposals were identified and dealt with in the design Development Workshop (Report Issued 12th March 2009).

1. Rail Sections.
2. Vibration Performance.
3. Ballast Shoulder Dimensions.
4. Ground Improvement Layer.

tie instructed the consortium to produce a menu of generic designs for a Ground Improvement Layer to meet the need for the 120MN/m2 ground bearing capacity. The suite of designs was to provide alternatives based upon perceived level of risk and consequences for both void spanning and non-void spanning. They were to assume void spanning in the city centre and no void spanning for out of town areas for design purposes and subject to confirmation. A specific design option was to be selected based upon the discovery of ground conditions as works proceed.

The consortium have only produced one ground improvement design option based upon their unsubstantiated assumption that the entire length of the on-street section

will have a sub-standard ground bearing capacity and will require void spanning of 1M in any direction. This design comprises a reinforced concrete ground bearing slab to the underside of the insitu concrete track slab along the entire length of the on-street section. The suite of options has not been produced and the consortium has confirmed to **tie** that they are not going to consider any other ground improvement options.

The consortium has however recently issued a design proposal to **tie** for a floating slab arrangement to deal with specific noise and vibration issues in certain areas. The noise and vibration issue has arisen from the stiffer track parameters required by the Rheda City system as well as the large mass of concrete as a consequence of the reinforced concrete ground improvement layer. Whilst this proposal is intended for short and specific lengths of the tramway it does introduce reinforcing bars into the track slab thus reducing the need for such a strong improvement layer. This proposal has been submitted to **tie** for consideration.

2.2 Item 2 – Understand the process for design programme management in terms of time, cost and value management

The audit sought to obtain an understanding from the consortium how they managed the design process in terms of ensuring that the designs were economic, of good value, approved and delivered in a timely manner to support the overall construction programme.

The audit team requested that the consortium provide details and evidence to show how they directed the programme to ensure that it remained on target showing details of how they ensured that good value management had been included to achieve best value to the client.

It was anticipated that the consortium would be able to outline and demonstrate the design programme and demonstrate how they had introduced best value options into the process to deliver an efficient and economic end product.

Findings

A design programme has not been utilised or maintained to deliver the trackform in a timely manner.

The consortium does not have an agreed design programme for trackform and consider that they are carrying out the design work on a priority basis. They cite the absence of an agreed Programme with **tie** as being the reason for a lack of design programme.

In the absence of an agreed design programme delivering this design to a programme is not evidenced. There are some examples of an exchange of letters urging attention to specific matters that need attention but nothing to suggest that key dates and deliverables were agreed with the SDS design team.

A review of correspondence and minutes of meetings would suggest that the SDS design team are being instructed to produce designs and variations on the basis of letters. Design reviews are being undertaken when a design is ready and recorded in a set of meeting minutes. It could not be verified from the evidence presented that the reviews considered Best Value or value engineering alternatives in the discussions.

Changes in design have been communicated within the consortium by an exchange of letters. There was no evidence to suggest that the design and/or variations were undertaken to achieve Best Value.

The audit team were unable to verify that the design has been managed against a set of programme requirements or deliverable expectations. There was no evidence presented to suggest that value engineering has been applied and Best Value options have been considered to the benefit of the Client. It cannot therefore be confirmed that the current designs provide an efficient and economic end product.

2.3 Item 3 – Identify how the design approval process has been followed

The audit sought to obtain confidence from the consortium that the design process has been fully integrated and had obtained all the necessary approvals and consents so as not to delay the construction programme and deliver best value.

The audit team requested that the consortium provide details and evidence in support of the system integration processes, change control, design reviews and close out.

It was anticipated that the consortium would be able to produce an activity schedule along with evidence to demonstrate that the necessary steps had been taken to achieve a fully integrated and compliant design.

Findings

The audit determined that the process to manage design integration was not applied to the trackform design until it was too late in the process to inform the design.

The selection and design of the trackform appears to have been determined without due consideration on how the sub-base would be designed and achieved to meet the requirements of the trackform.

Interface Control Forms (ICF) have been generated during the design process but were not able to evidence that an iterative integrated process of review and rework had taken place to achieve the most effective and economic design suitable for the ground conditions and environment of the ETN.

The evidence suggests that a design has been dictated based upon an “engineering judgement” and the specific requirements of another Tram project (Nottingham) rather than any technical rationale based upon risk assessment or consequential

analysis. The "engineering judgement" has not been supported by Industry Standards, Design Guidance Notes, Technical Papers or operational/statistical evidence gathered from other Tram projects. The experience of opening up Princes Street was cited as the justification of the design but there was no evidence to suggest that there is a continuous improvement process in place to capture previous findings and inform future design.

3.0 Review of Evidence

(BSC internal review document dated 19th November 2008 states "Where the condition of 120MN/m^2 is not achieved an improvement layer is required. It can be omitted if testing indicates sufficient strength at the Trackform base. However this layer shall be designed for the entire tram line to reduce time loss for design and consent in case testing does require the improvement layer". This document also refers to track stiffness of 30MN/m per m of rail, not being adequate because it results in a rail deflection of >2mm. Reference is made to the Rheda City system based on the German light rail experience and the increase of stiffness to 60MN/m per m of rail afforded by this system. Note, the BSC response in the Design Review (17th July 2009) refers to the German High Speed Rail design, not light rail) *This document was <u>not</u> part of the evidence presented by BSC.*

Letter 18th December 2008, 548 **tie** instructs BSC to provide generic options of design solutions for ground improvement layer to suit Rheda City track design.

Letter 11th March 2009, 1887 BSC write to **tie** enclosing copies of the output from the Trackfrom Design Development Workshop held to address mis-alignments. Mis-alignment No. 4 confirms the 120MN/m^2 requirement and the need for an improvement layer. SDS to design "menu" of improvement layers to be instructed on site as excavation proceeds. Design to include for vibration isolation. Mis-alignment No. 2 instructs SDS to investigate the consequences of Vibration with the change of trackform to Rheda City. The report indentified that BSC may require an instruction to install floating track mitigation.

(May 2009 – **tie** lead a design review of the track design and raise questions over the adequacy of the proposed design including improvement layer.) *This document was <u>not</u> part of the evidence presented by BSC.*

Letter 27th March 2009, 050469 BSC write to SDS with reference to some important activities have slipped SDS attention.

Letter 16th April 2009, 052911 BSC write to SDS expressing concern that SDS have not been acting upon or responding to important matters raised in previous letters.

(Letter 17th July 2009, 053198 BSC write to **tie** with responses as required from the tie Design Review (May 2009)). *This letter was <u>not</u> part of the evidence presented by BSC.*

Letter 28th July 2009[1], 3154 BSC write to **tie** confirming details of a general issues meeting on 27th July requesting an auditable trail of documentation leading to the RC

slab as the only solution for the improvement layer. They confirmed that this documentation exits in an email and are checking their records.

Letter 28th July 2009 3155 BSC write to SDS contending that only one solution has been provided, contrary to change request 0125. SDS asked to document the design development process including copies of calculations.

(Letter 11th August 2009, 1946 **tie** write to BSC in response to the answers provided (27th July 2009) in the Design Review complaining about the lack of integration of design and their concern for the adequacy of design and makes specific reference to the track design and their expectation of a fuller and integrated response to the review question. BSC have not responded to this letter.) *This letter was not part of the evidence presented by BSC.*

(Email 14th August 2009, BSC send **tie** a copy of an internal BSC briefing document which refers to the BDDI design, a Two Stage Slab Trackform which has a RC slab underneath a RC slab containing the rails. The sub-base is conditioned with a cement bound granular material. Reference is made by BSC this being as per Nottingham tram with a capability of void spanning of 1m. The document highlights the Infraco proposal of Rheda City track form and its benefits such as warranty of track quality and reliability as well as its adaptability for all alignments and its ability to be covered with various finishings. Minimization of structure-borne noise is also cited as a benefit.) *This email was not part of the evidence presented by BSC.*

Advance copy Letter 24th August 2009, SDS reply to above letter advising the rationale for the RC slab being the only solution for void spanning and prevention of catastrophic collapse of the track. They confirm to BSC that calculations are available for inspection and audit off site. They also state that tie requested BSC at a meeting on 20th August 2009 to do further investigation into the design concept of using reinforcement in the track slab. SDS contended that this would not achieve 120N/m2 and asked BSC to resolve this anomaly.

Letter 25th August 2009, 3347 + attachment BSC write to **tie** to confirm that contrary to previous statement, they do not have email confirmation (by implication any confirmation) from SDS that the RC improvement layer is necessary – only an advance copy of a letter of the previous day (24th) which was in response to the immediate request. - **tie** have not responded to this letter – Draft now prepared.

Letter 1st September 2009, 3402 BSC write **tie** to confirm that they are producing three options/solutions for the track improvement layer. They also confirm that Princes' Street construction will proceed on basis of existing design. (note earlier suggestion that the selection of the improvement layer will be based on site inspection, 11th March 2009) – **tie** have not responded to this letter – Draft now prepared.

Letter 13th November 2009, 2792 **tie** write to BSC acknowledging receipt of BSC letter 28th July 2009[1] and asking for BSC to confirm that "the designers only workable option is for reinforced concrete". Refers to a joint Track technical meeting with an action for BSC to table a draft design based on LUAS light rail system. It summarises by concluding that "it would appear that the only workable solution may

be RC slab but not necessarily throughout the whole route". Recommends a follow up workshop once BAM produce draft design.

Letter 23rd November 2009, 057067 BSC write to **tie** with reference to the possibility of putting reinforcing bars in the track slab following a Track Technical meeting on 20th August 2009. BSC raise a number of disadvantages/risks associated with this idea and confirm that as a consequence they will not be proposing any general use of a reinforced track slab. Note - All the arguments put forward by BSC against this proposal are demolished by the floating slab design for specific areas submitted on 1st February 2010. **tie** have not responded to this letter (23/11/09) pending an internal meeting FMcM/WB/David Batemen. Draft now prepared.

Letter 1st February 2010, 057200 BSC write to **tie** inviting review comments on a Floating Slab Design proposal to reduce noise and vibration in certain areas. This design demolishes all the arguments put forward in letter 23rd November 2009 against a reinforced concrete track slab. This appears to be in response to mis-alignment No.2. **tie** have not responded to this letter.

Design Audit – OLE and Foundation Design

1. Scope of Audit

During January and February 2010 **tie** ltd undertook an audit of the ETN Infraco Contract under Clause 104 in relation to Changes and Differences in Design as it pertains to the OLE and Foundation design

The critical success factors / objectives of the audit were to:-

Item 1 – Understand the rationale and source of the Design Change

Review of evidence to substantiate why the IFC design constitutes a Change under the Infraco Contract

Review of evidence as to whether change emanated from Infraco, an approval body, or client instruction.

Item 2 – Understand the process for design programme management in terms of time, cost and value management

Confirm and evidence that delivery of the IFC was not delayed by late or inadequate instruction or information from Infraco members or subcontractors (including SDS) or any other third party.

Confirm and evidence that Infraco and the SDS Provider considered how a change could be mitigated in terms of cost and time and how they considered best value.

Item 3 – Identify how the design approval process has been followed

Review of evidence that Planning, technical approvals and close out of informatives was completed prior to IFC

Provide evidence that the Programme obligations for the changed design have been discharged.

Demonstrate process for carrying out an Inter Disciplinary Review [IDR] including how integration of the Siemens design was carried out.

Provide copy of Buildability reports and evidence of CDM & ROG's compliance.

2. Audit Objectives

2.1 Item 1 – Understand the rationale and source of the Design Change

The audit sought to obtain an understanding from the consortium why the design of the OLE and associated foundations had changed to its current design.

The audit team requested that the consortium provide details and evidence in support of the design rationale and details of calculations that drew them to the current design conclusions.

It was anticipated that the consortium would be able to outline and demonstrate the design processes they had gone through and the selection of options with risk assessments they had carried out to bring them to the current IFC design solution.

Findings

The OLE design changed as a result of the Infraco Proposal and the instruction issued by **tie** arising from the OLE Development Workshop. A change was anticipated under the SDS Novation Agreement, however the nature of the change in design with respect to the size of the OLE foundation (it has increased in size and weight) requires a detailed understanding. Apart from the additional cost associated with the construction of an individual pole foundation, the design has an impact on utilities local to its position. A technical audit of the OLE pole foundation design is scheduled for Tuesday 23rd February. The audit will be undertaken using appropriate technical expertise from AECOM.

2.2 Item 2 – Understand the process for design programme management in terms of time, cost and value management

The audit sought to obtain an understanding from the consortium how they managed the design process in terms of ensuring that the designs were economic, of good value, approved and delivered in a timely manner to support the overall construction programme.

The audit team requested that the consortium provide details and evidence to show how they directed the programme to ensure that it remained on target showing details of how they ensured that good value management had been included to achieve best value to the client.

It was anticipated that the consortium would be able to outline and demonstrate the design programme and demonstrate how they had introduced best value options into the process to deliver an efficient and economic end product.

Findings

A design programme has not been utilised or maintained to deliver the OLE and/or foundation civil design in a timely manner.

The consortium does not have an agreed design programme for OLE and consider that they are carrying out the design work on a priority basis. They cite the absence of an agreed Programme is being the reason for a lack of design programme.

In the absence of an agreed design Programme delivering to a programme is not evidenced.

Based on the explanations offered at the audit, and a review of correspondence it appears that the design team are being instructed to produce designs and variations on the basis of meetings, without formal minutes. Design reviews are being undertaken when a design is ready and recorded in a set of meeting minutes. It could not be verified from the evidence presented that the reviews considered value engineering alternatives in the discussions.

Changes in design have been communicated within the consortium by an exchange of a BSC (Siemens) spreadsheet.

There was no evidence to suggest that the design and/or variations were undertaken to achieve Best Value. It cannot therefore be confirmed that the current designs provide an efficient and economic end product.

2.3 Item 3 – Identify how the design approval process has been followed

The audit sought to obtain confidence from the consortium that the design process has been fully integrated and had obtained all the necessary approvals and consents so as not to delay the construction programme and deliver best value.

The audit team requested that the consortium provide details and evidence in support of the system integration processes, change control, design reviews and close out.

It was anticipated that the consortium would be able to produce an activity schedule along with evidence to demonstrate that the necessary steps had been taken to achieve a fully integrated and compliant design.

Findings

The audit determined that the process to manage design integration was applied in a manner which was limited by the different (and opposing) commercial considerations between the consortium members, including the commercial consideration of SDS, controlled on a day to day basis by Bilfinger Berger.

Interface Control Forms (ICF) have been generated during the design process but were not able to evidence that an iterative integrated process of review and rework had taken place to achieve the most effective and economic design suitable for the ground conditions and environment of the ETN.

3.0 Review of Evidence

OLE design lead by Siemens with SDS addressing the design of the foundation bases.

Design Development Workshop held to address mis-alignment between Infraco Proposal and current requirements.

Change 4 – Location of Poles
Change 5 – Lighting Pole locations
Change 6 – OLE soffit fixing to Depot Access Bridge

Calculation Summary sheets for OLE Pole Loadings

OLE conflict schedule never provided by BSC. In the absence of a schedule Tie instructed SDS to provide a schedule for Leith Walk. (ref Colin Neil)

Numerous Correspondence BSC - SDS re number and location of poles.

Correspondence BSC – tie with reference to mis-alignments

Letter 13th January 2009, 050294 BSC writes to SDS enclosing detailed design document "OCL Layout Drawings and Table of Foundation.

Letter 19th January 2009, 050338 BSC writes to **tie** confirming a previous discussion w.r.t. changes impacting the location of OLE infrastructure – mainly Forth Ports requirements and road layout changes. BSC propose to minimise cost and programme impacts that all changes up to 19th January be incorporated in a single design revision. . *(**tie** reply 12th March 2009)*

Letter 30th January 2009, BSC writes to SDS with Design Change notice 087.

9th February 2009, SDS issue change notice to BSC.

23rd February 2009, SDS issues a revised change notice to BSC.

Letter 26th February 2009, BSC writes to SDS withdrawing RDC 059 (Gogar Landfill Embankment).

6th March 2009, BSC agree estimates with SDS

9th March 2009 – 25th June 2009, correspondence BSC, SDS, Siemens regarding estimates.

Letter 12th March 2009, **tie** writes to BSC in response to their letter of 19th January 2009 and accepts the BSC proposal as a pragmatic way forward for dealing with design changes. *(Not provided as audit evidence by BSC)*

Letter 17th March 2009, BSC write to SDS complaining that SDS have allowed three and half months to elapse since they sent **tie**'s comments to them rejecting CEC comments as grounds for a **tie c**hange. BSC confirm that they are holding SDS responsible for delays that may arise in the progress of the works due to late response.

Letter 20th March 2009, 1889 BSC writes to **tie** enclosing issue one of the output of the Design Development Workshop. **tie** asked to accept the conclusions in respect of the identified mis-alignments. . *(**tie** reply 29th April 2009)*

Letter 25th March 2009, BSC writes to SDS regarding Airport Prior Approvals including poles.

Letter 9th April 2009, BSC writes to **tie** enclosing a copy of the Design Development Workshop report. *(Not provided as audit evidence by BSC)*

Letter 17th April 2009, tie writes to BSC confirming their acceptance of the Design Development Workshop report. *(See **tie** letter 29th April which seems to open up the discussion again). (Not provided as audit evidence by BSC)*

Letter 27th April 2009, 2403 BSC writes to SDS with request for design change No. 113 to redesign OLE pole foundations and layout due to increased loadings, identified as mis-alignment. Estimate requested.

Letter 27th April 2009, 2404 BSC writes to SDS with request for design change No. 114 to amend OLE System Design Documents, identified as mis-alignment. Estimate requested.

Letter 27th April 2009, 2405 BSC writes to SDS with request for design change No. 115 to amend OLE Building Fixings Load and Layout drawings, identified as mis-alignment. Estimate requested.