

Design

An Historical Overview

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Glossary

SDS – Systems Design Service Contract (the design contract)

PB – Parsons Brinkerhoff

BSC – Bilfinger Berger, Siemens, CAF – the consortium who were awarded the Infraco Contract

Infraco – the Infraco Contract

RD – Requirements Definition

PD – Preliminary Design

DD – Detailed Design

ICP – Independent Competent Person

IDC – Integrated Design Check

DAP – Design Approval Panel

TSS – Technical Support Services Contract

DAS – Design Assurance Statement

RoR – Record of Review

ROGS – Rail and Other Guided Systems Regulations

V&V – Verification and Validation

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1.0 Introduction

The procurement strategy for Edinburgh Tram was to award a design contract as advance works, get the design to the stage where it could be used for the tendering of the infrastructure works (Infraco) and once awarded, novate the design contract to the Infraco contract. This procurement strategy was implemented, however, from early on in the design process there have been a number of key issues of concern in relation to design:

- The ongoing slippage in the design programme;
- Assurance of the design;
- Management and impact of the development workshops following award of the Infraco contract to align the ER's/Infraco Proposals and design ;
- Integration of the Infraco design into SDS design, and
- the difference in design between the “Base Date Design Information” (BDDI) and what has been finally issued for construction by SDS in the form of “Issued for Construction” (IFC) packages. Currently, **tie** has limited information from BSC relating to the reasons for changes.

This overview document explores the history behind the design process as part of the ongoing work to identify any relationship between design, design integration, late issue of designs and design changes.

2.0 SDS (Parsons Brinckerhoff) Contract with tie

2.1 Contract Obligations

tie awarded the design contract known as “SDS” (System Design Services) to Parsons Brinckerhoff in September 2005. The scope of the SDS contract was a fully integrated civil engineering and systems design that was developed to the point where the chosen systems supplier could use SDS’s systems specification to select its own systems components and complete the systems design. This approach was necessary to have a sufficiently developed design without constraining competition for the systems supplier.

The core obligation of the SDS Provider was to “undertake all design and produce the Deliverables necessary to enable the Edinburgh Tram Network to be procured, constructed, tested and commissioned (taking account the need to fully co-ordinate these activities, including with other physically-related projects, so as to minimise overall disruption) to meet the requirements of the Master Project Programme, and then operated and maintained.” (SDS Agreement, Schedule One, Para 2.1.1)

In the contract this comprehensive obligation is qualified and broken down further to the following core obligations. Note this is not a comprehensive list but picks out the most significant obligations:

- design to deliver overall system functionality, capability & performance requirements
- all necessary research, surveys and investigations necessary to support the provision of a cost effective design
- ensuring there are no gaps or omissions
- most advantageous whole life cost

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- detailed alignment and associated civil & structural works
- specifications of sub system functionality and technical requirements for E&M systems
- design of civils infrastructure for E&M systems
- design such that the section from Haymarket to Ocean Terminal provides a look & feel that is at one with its surroundings
- design to provide satisfactory interaction of trams, buses, pedestrians and other road users

Clause 4.11 of the SDS contract states:

“The SDS Provider accepts all risks arising from any conflicts, ambiguities, discrepancies, errors or omissions that subsequently appear within or between any of the Functional Requirements Specifications, the Technical Specifications, and any of the other Deliverables, and the SDS Provider shall not be entitled to make any claim against the Client for an extension of time, payment or otherwise in respect of any such conflicts, ambiguities, discrepancies, errors or omissions.”

As this indicates, from the start of the SDS contract, the responsibility for delivery of an assured design lay with SDS. What the contract does not specify is how SDS should evidence that their design submission achieves these requirements. However, as a minimum, there was a requirement for SDS to achieve approvals and consents from CEC as Planning, Roads and Structures Authority, as well as from the HMRI or equivalent.

Normally, the outputs of a competent contractor would be such that it would not be necessary to undertake any extra work or provide any additional evidence of an assured design because it would be self-evident through the design deliverables that the finished result provided the required operational outputs in a safe manner. A fit-for-purpose design would include all the relevant documentation to enable any level of audit to establish that all the relevant items had been competently designed, interfaced and integrated and that they provided a system which was safe to build, operate and maintain.

Unfortunately, from as early as the Requirements Definition (RD) phase, it was difficult to see how the SDS design deliverables would provide sufficient evidence to support self-assurance and audit. Hence, in later phases **tie** had to request specific design assurance evidence from SDS.

In addition to these requirements, the final contract clarification note provided to SDS included a relevant section:

EDINBURGH TRAM NETWORK

Clarification Note to Tenderers participating in the procurement for the provision of System Design Services (SDS)

29 April 2005

The obligation on the SDS Provider to be responsible for obtaining the Consents is a fundamental requirement of the SDS Agreement. (See clarification question).

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2.2 Design Organisation

When the contract was awarded, the SDS management team co-located with **tie** in Edinburgh under the direction of a Project Director. The contract was awarded to Parsons Brinkerhoff but their main sub-contractor was Halcrow who were responsible for xxxx. Additionally, the scope included utility diversion design and this was to be done by XXXX

Whilst the management team was co-located with **tie** in Edinburgh, this team consisted of PB personnel only.

The teams carrying out much of the design itself were scattered throughout the UK with design team leaders in Edinburgh responsible for co-ordination of the overall design for different sections of the route.

Initial mobilisation and handover from the Parliamentary stage designers to SDS was slow and after requests by tie, the PB Project director was replaced in 2007.

2.3 Design Process and Progress/Programme

It was originally intended that the design would be undertaken in 3 distinct phases:

- Requirements definition(RD)
- Preliminary Design(PD)
- Detailed design(DD)

In addition, this contract provided for the utility diversion design – which is not covered in this overview. Once SDS design had been completed, Infracore would ‘take it over’ by SDS being novated to them, and complete it, principally in the areas of track design, tramstop detailing and electrical systems, but not utility design.

The RD phase was originally due for completion Jan 2006, although it had been agreed that some elements could be carried forward into the PD phase. Around September 2006 **tie** requested evidence from SDS to enable **tie** to issue a completion certificate for the RD phase.

For the PD phase, SDS began trying to close it out in Jan 2007.

The earliest programme which **tie** possesses indicate that the overall design was to be complete as follows:

Version	Data Date	Latest Detailed design delivery date
V 0	30/11/05	01/08/07

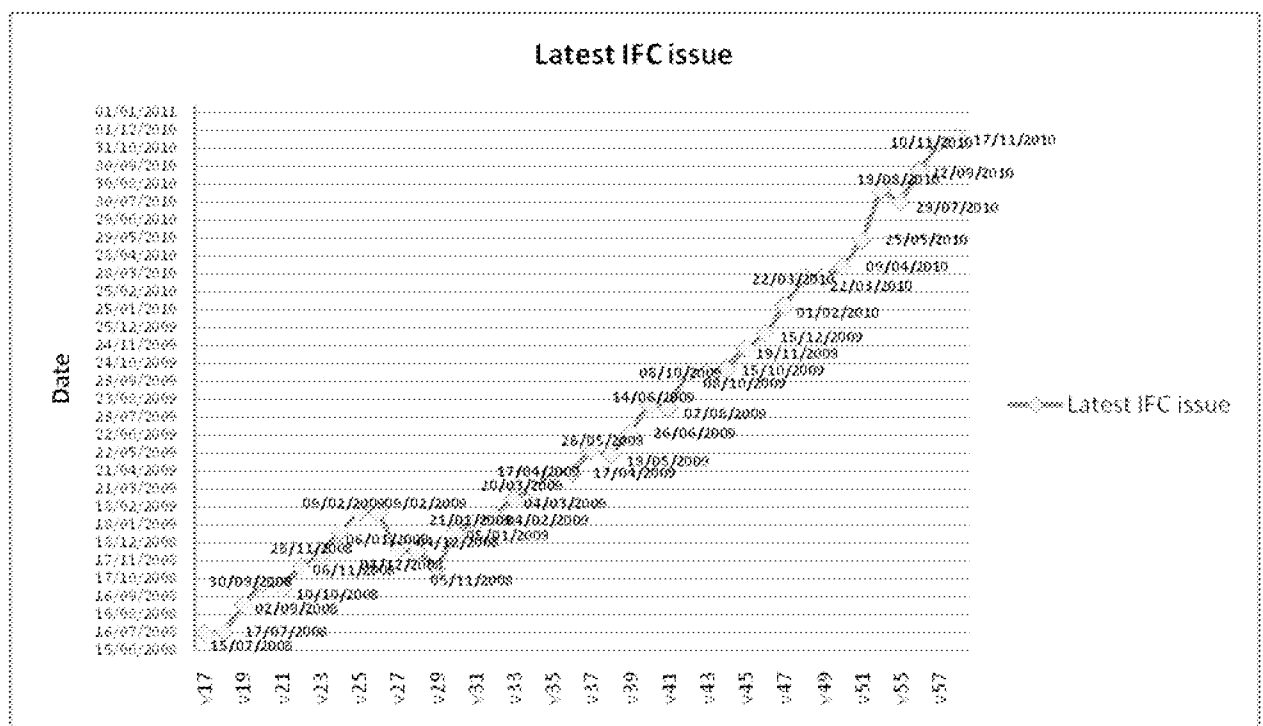
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Emails around Jan 2007 make reference to the PD submission documents not being consistent with documentation provided for issue to Infraco tenderers under the 'Invitation to Negotiate' heading. The completion of the PD phase was eventually, and reluctantly, agreed to by **tie** in mid 2007. This was on the basis that, just as with the situation at the end of the RD phase, outstanding issues would be properly closed out during SDS' DD phase.

DD is still incomplete because it requires all approvals to have been gained, including Prior and Technical approvals from CEC and "No Objections" from the Independent Competent Person (ICP) to the completed, self-assured design.

In the RD phase, a complete review was undertaken of all submitted documents (numbering 47 in total, including the Quality Assurance and the Validation and Verification Plan).

The programme for delivery of design has continually slipped as is shown on the graph below:



2.4 SDS quality management

In response to a request by **tie**, and in order for **tie** to understand better their management system following quality concerns, SDS made a presentation to **tie** on 7th November 2006 on their Quality Management System, Design Assurance and Approval and Design Production processes

This included three slides relevant to this overview:

The process and proposals for assurance of quality:

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- ❖ are part of PB’s standard offering,
- ❖ Tailored and adapted for the SDS project
- ❖ were included in our original submission to tie,
- ❖ and have been implemented (and refined) since day one

PB’s normal processes are based upon:

- ❖ documented generic and customised procedures and processes
- ❖ Focus on processes and procedures that “work”
- ❖ being managed in, policed, audited and corrective actions applied
- ❖ SDS Detail Design Phase Process
 - *Structured assurance evidence*
 - *Progressive assurance*
 - *Assurance against the requirement specs*
 - *Assurance against industry standards*
 - *Section Design approval*
 - *Overall Tram Network System design approval*

Design Assurance and Approval Key Assurance activities:

- ❖ Intermediate Design Reviews
- ❖ Drawing reviews and sign off
- ❖ Document reviews and sign off
- ❖ Interdisciplinary Checks
- ❖ Design Verification Statements
- ❖ System Detail Design Review

2.5 Design Assurance responsibilities

Section 1 of this report outlines the responsibilities of SDS in respect of design assurance. However, SDS consistently has failed to produce positive evidence of effective design assurance and design integration across all disciplines and there is evidence that integration has never taken place effectively. An example of this is the on street section where we have seen OLE poles placed in front of traffic signals, in the middle of pedestrian crossings and tramstop drawings that physically don’t match with the roads drawings.

The key requirements within PB’s own Quality Management System had been summarised by tie on 23rd February 2007 and are included as Appendix A to this overview.

The content of self-assurance and the associated responsibilities were discussed extensively with SDS and are summarised in the key email trail within Appendix B to this overview.

In early 2007 it became obvious that clarity needed to be brought to the responsibilities for design assurance. This was as a result of emerging quality problems and was principally to ensure that SDS’ own QMS processes were effective, visible and produced the evidence required to underpin their self-assurance of detailed design. Without this assurance it would have been impossible to gain “No objections” from the approval authorities.

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The SDS work breakdown structure for the ETN has always built up from an elemental, discipline by discipline design that is then aggregated to individual structures / stretches of track and then aggregated to individual sub sections, sections and finally to a completed design for the system. As a result of this bottom up approach to design a key element of self-assurance was for SDS to carry out rigorous Interdisciplinary Design Reviews (IDRs) and Interdisciplinary Design Checks (IDCs), thereby bringing together all of the widely geographically spaced Design Team leaders to review progress and discuss issues which were affecting the design and its integration across the whole route. This approach was only evident to **tie** over a very brief period early in 2007, which was just prior to the sudden and unexpected departure of their Chief Engineer, Kim Dorrington, who was transferred by PB to the Manchester Metrolink project, without discussion with **tie**.

Subsequently to Kim Dorrington’s departure, it appeared that SDS became reliant on IDC meetings which were carried out at the end of the design process - with little evidence of interface checks or reviews having been performed prior to that.

2.6 **tie** Design Review

Once well into the PD phase it became clear that SDS would require assistance in obtaining approvals. **tie** agreed to help with this and, to that end, the various design packages were presented by SDS to a **tie**-led Design Approval Panel (DAP), which was attended by all relevant parties (e.g. CEC Transport and Planning, TEL, Transdev). Design Review sessions had been held prior to February 2007 and had been led by Trudi Craggs and Gavin Murray, calling upon the then quite large group of TSS resources. The whole point of these was to assist SDS with maintaining progress when their own efforts were proving to be inadequate, largely through the poor quality of their own design.

Prior to each DAP meeting, each of these parties reviewed the design documentation to enable the DAP meeting to make suitable judgements on the offered design. The results of this process were then detailed in the TSS Outline Design Closeout report.

In relation to the PD phase, there were several factors to consider:

1. there had been considerable concern over the quality and interface of the RD phase design
2. there was a concern over consents and approvals and the need to manage the process of CEC/TEL and Lothian Bus involvement.

There had been considerable debate throughout the RD and PD stages as to why **tie** had let a contract which required SDS to produce a Quality Assured Product with full approval from all relevant bodies, but where **tie** was still conducting a detailed assessment of each submission. As a result, it was agreed by **tie** in early 2007 that there would instead be a *partial* review process, on the basis that all SDS design was in any case properly and thoroughly self-assured. This meant that only a proportion of SDS design packages would be subjected to detailed scrutiny of the evidence demonstrating that the self assurance was effective.

Accordingly, **tie** informed SDS that all draft DAS packs were to be submitted for review and this was done, with the associated Records of Review (RoR’s) being returned. These reviews demonstrated that

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the emerging design was far from being effectively integrated, and most offered design, albeit still in development, was full of errors and omissions.

The principle was that each package of SDS' final detailed design would be accompanied by a so-called "Design Assurance Statement" or DAS. The DAS content was agreed with **tie** and accordingly **tie's** Design Management Plan (DMP) was issued in June 2007. Section 2.2 of this Plan noted that the design packages to be offered by SDS for review would be complete DAS packs. Virtually the same DMP content became enshrined in Schedule 14 to the Infraco Contract. The DAS was intended to demonstrate how the offered SDS design met all the requirements, fulfilled standards, was cost effective and mitigated applicable safety hazards, as well as being a fundamental configuration control document – showing which documents and design drawings when taken together comprised an integrated design package for each route subsection plus a separate package covering system-wide issues.

There are several clauses within the SDS contract which are especially relevant to this overview:

- Section 3 of the Contract set out the required service. Inter alia, it required SDS to (perform the services):

- 3.3.3 – "in accordance with the SDS provider's quality management system and plans". These 'plans' included the provision of "Design Verification Statements" by SDS – which, through discussion and refinement, became the DAS' which were to be accepted by **tie**.

- 3.3.7 - "so as to ensure compliance with all applicable Law and Consents."

'Consents' were defined within the Contract, and included all such "from the Approval Bodies" – 'Approval Bodies' also being defined within the Contract as including HMRI. Experience has shown that, despite a promising early start, SDS became extremely reluctant to liaise with and follow HMRI (in practice "HMRI" became the ROGS-required "Independent Competent Person" – ICP) advice and requirements, and only very recently, and following intervention by **tie**, has SDS resumed presentations to the ICP for the purpose of seeking his "No objection" to their detailed design proposals.

- Schedule 9 includes key wording:

- In Clause 1.1 that "Except where otherwise agreed in writing, the provisions of this Schedule 9 (*Review Procedure*) shall apply whenever any Deliverable or course of action is required to be reviewed, approved, agreed, consented to or otherwise processed in accordance with the Agreement". Note that it is perfectly clear from this that there was no assumption that EVERY deliverable was to be reviewed.

- In Clause 5.1 the disclaimer "No review, objection, comment or silence by the Client shall operate to (i) exclude or limit the SDS Provider's obligations or liabilities under this Agreement ...".

These clauses are extremely important because, as the design-issuance delay problems worsened with SDS, it was decided that "Issued For Construction" (IFC) packs produced by SDS would be issued to Infraco on the basis that they were fully self-assured by SDS. This enabled them to be issued in advance of the **tie** review which had been intended to take place as part of the overall DAS-pack review. Had

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SDS reliably fulfilled the terms of their Contract, **tie's** confidence in its ability to permit this early issue by SDS would not have been misplaced.

IFCs were included as internal deliverables within the SDS programme from early 2007. However, the change in strategy was that **tie** and BSC agreed that construction could start when an individual IFC was ready rather than all IFCs for a subsection were ready and the associated DAS completed. This agreement was reached in late 2007. Suggest this may not be needed in this paper now.]

Again, it is important to note that **tie** was not obliged to review anything at all. Naturally, in view of its ROGS obligations, it was incumbent upon **tie** to ensure specifically that safety risks were identified, ranked and mitigated appropriately. This was the core safety duty on **tie**. Design reviews in general were thus a method of **tie** gaining certainty of design QUALITY rather than safety, per se.

From Feb 2007 onwards, **tie's** design reviews were conducted on the basis of SDS being required to explain, demonstrate and justify their design according to the Client's requirements – this approach was the same as that included within Schedule 14 of the Infraco Contract. Indeed, as previously noted, from this point on, the intention was that **tie** would only review completed SDS packs, each to be accompanied by a "Design Assurance Statement", on the basis that these would not only cover all design but also that they would be completed before construction commenced.

Early design reviews, of supposedly complete and integrated design within 'draft' DAS packs, revealed a multitude of areas where SDS design was unsatisfactory as far as **tie** and CEC were concerned, some where TSS expert scrutiny required more explanation and some (e.g. the safe control of trams reversing in the streets) where the Operator was concerned about safety. There were always many issues concerning non-integration due to ineffective co-ordination of the various disparate design teams within SDS. In most cases, CEC were at a loss to know what and how to review, because of the gross errors and omissions that were immediately obvious in the design being offered for review.

By May 2007, SDS had produced a supposedly better draft pack with its associated DAS, for route section 5C, which, whilst appearing to be comprehensive, was really only a list of documents comprising the design of a route section. It did not demonstrate how the design fulfilled its requirements and it did not demonstrate how safety hazards had been mitigated – these two factors being critical to the ultimate acceptance of design as being fit for purpose and acceptably safe for operation.

In 2Q07, SDS started to issue schedules of when design packages would be ready for review. In practice, these schedules never worked, simply because SDS was never ready to fulfil them! A key reason for this was the massive volume of CEC comments on offered design, resulting in a continual hiatus within SDS design sections in attempting to determine whether the comments were valid and, if they were, to address them – these SDS processes being invisible, but very obviously slow. Of course, this massive volume of CEC comments arose principally because of the obviously poor quality of the SDS design.

In the absence of completed packages, **tie** set up review sessions to examine the various packages in whatever state that they happened to be at the time of review. Before the joint review sessions took place the design packages were made available to reviewers (stakeholders) so that they could examine their areas of interest and get their questions ready. Each review session started with a presentation by the SDS Design Team Leader, together with key design experts, and enabled all stakeholders to raise

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their questions. The questions and answers were recorded in Records of Review which were supplied to SDS. These reviews were done on a route sub-section basis, e.g. sections 1A, 2A, 6 etc and covered the entirety of the route.

Dates for the submission to **tie** of completed DAS packs continually slipped. In SDS' view this was principally due to their continuing and seemingly endless dialogue with CEC as part of the progress to closure of CEC Technical and Prior Approvals issues. This is graphically illustrated in the following embedded spreadsheet which shows the situation between the slippage between SDS programmes V17 and V44 . . .



The incomplete designs for the whole route were reviewed in this way. Following that, the plan was that the next formal reviews of SDS design would be conducted on completed DAS', i.e. when the design had been completed and the associated underpinning safety hazard mitigation arguments assembled. **tie** is are still awaiting a schedule of the submission dates for these. BSC has said that they will add their input and submit overall integrated DAS packs in due course. Despite formal letters to BSC asking for a programme for submission of these packs, so far only verbal advice has been received by **tie** that the first such pack 'might be available in 3Q10.

2.7 ROGs/Independent Competent Person

The Independent Competent Person (ICP), John Dolan, was appointed in June 2007 and started working with **tie** in July 2007. From that point on, he was present at most design review sessions and took an active and most beneficial part in this activity. When issues arose where **tie** required his formal opinion on matters of concern, we were able to get his formal opinion in the form of an ICP's RFO ("Request For Opinion"). Where he required a formal response from us on a matter of concern to him he would issue us with an ICP's RFI ("Request For Information") or, alternatively, an ICP's ANC ("Advice of possible Non-Compliance") if he felt the matter was of more significant concern. These ICP's RFOs and RFIs have proved to be a most useful way of bringing pressure to bear on an otherwise unresponsive SDS.

2.8 Issued for Construction Drawings (IFC's)

During the preferred bidder stage of the contract negotiations for Infracore, BSC assumed that they could start work 20 days after receiving an IFC drawing and this was built into the Infracore programme. Additionally, as part of the novation negotiations, SDS were incentivised to complete these IFC drawings , although it was anticipated that these would be completely assured drawings . At the point of novation SDS had been incentivised for the timely production of IFC packs so that construction could commence in earnest. At that time SDS had adopted an exceptionally hard commercial stance, claiming that the 'change' work being demanded of them was outwith their contract. SDS demonstrated definite focus on those IFC packages that could be produced in time to claim incentivisation and this is likely to have had an impact on the production of any other deliverables including completion of DAS packs (which actually are essentially IFC packs but with the addition of the critical inbuilt safety self-assurance information) thus leading directly to the unfortunate de-linking of SDS design from the

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production of their self-assured DAS packs and possibly reducing their vigilance and coverage in performing the critical interdisciplinary (and indeed 'sense') checks required by their own QMS before issuing any 'complete' design.

3. Design since Novation

3.1 Contract

At the time of contract award, the SDS contract was novated over to Infraco. Clauses 10, 11 and Schedule Parts 22 & 23 cover this agreement. This includes the requirement to comply with Schedule Part 14 of the contract – Design Review and Design Management Plan.

BSC has produced a process to cover the IDR/IDR and DAS activity, which fits within their recently completed suite of System Assurance documents. Inter alia, it provides for DAS' being produced to cover ALL design, not just that by SDS. Such DAS' will be reviewed by the Infraco Contract Schedule 14 process. We are still awaiting a programme for the submission of these to **tie**.

3.2 Design Review under Clause 10 and Schedule Part 14 of the Infraco Contract

This schedule requires Infraco to submit deliverables for review by **tie**.

Infraco has submitted its electrical systems and track work for review in accordance with Clause 10 and Schedule Part 14 of the Infraco Contract. (These are the design review provisions of the Infraco Contract.)

Infraco has not submitted any of the civil engineering design prepared by SDS for review in accordance with Clause 10 and Schedule Part 14 despite the fact that these provisions do not distinguish between who has prepared the design, ie Infraco directly or through its subcontractor SDS.

Hence, construction is now proceeding to allegedly self-assured (by BSC) but unreviewed (by **tie**) IFC packs without their having been demonstrably fully integrated within themselves and with BSC design. BSC has recognised this and is now conducting IDRs and IDCs in an attempt to pick up errors of integration. There is hence a risk that some constructed works might be flawed in design terms and also that there might be design errors that preclude closure of safety hazard risks. Fortunately, the latter is unlikely to occur because the early design review activity by **tie** was specifically aimed at covering all credible safety risks. However, should it occur, then it will result in abortive works and subsequent corrective action.

3.3 Integration/Development workshops

Infraco is responsible for the management of SDS under this arrangement and Infraco is responsible for providing the Infraco design to SDS for integration into the overall design. In **tie**'s opinion, many of the delays associated with design are due to the lack of Infraco design being provided to the SDS provider for incorporation into the design.

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Alignment of the Employers Requirements/Infraco proposals/SDS design was agreed as part of the overall contract negotiations. **tie** would be liable for any design costs associated with this alignment process. A series of development workshops were set up to kick off this process and progress to date is

3.4 BDDI - IFC

Since 2008, Infraco has been submitting Infraco notices of **tie** Changes in relation to design changes which they say change the design outwith the contract parameters from the Base Date Design Information (BDDI) to the final IFC drawings.

A number of these have been the subject of the dispute resolution process (DRP), but neither Infraco, nor SDS have to date provided substantiation as to the reasons for these changes. However, it is worthy of note that none of the civils elements have been through the design review process as required under Schedule Part 14.

Because of the lack of information provided by Infraco into the reasons for the movement from BDDI – IFC, **tie** cannot ascertain if the changes are being driven by client related drivers or are related to the Infraco proposals, or Infraco buildability issues.

3.5 Multiple Revisions of IFC's

As previously mentioned, SDS were incentivised at novation to deliver the 112 contract IFC packages to programme. To date, **tie** believes that xx of these have been delivered to time. However, since they were delivered, yy have been re-issued. The reason for this is not clear and so it is not certain that the IFC packages were complete and would allow construction to commence at the time SDS claimed the package was complete.

3.6 Design Programme

The production of an assured design – especially by SDS – has consistently fallen behind programmed dates and has not been aligned to the construction programme for the Infraco Works. The main issues have arisen from:

Client biased issues

- approvals
- third party requirements
- CEC/TEL changes and/or conflicting requirements

Infraco/SDS issues

- approvals
- SDS productivity and lack of design co-ordination
- Integration of SDS design with Infraco Proposals (including Infraco detailed design)

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- Assurance of integrated design
- Absence of an integrated, prioritised programme for completion of an assured design which supports the construction programme.
- slow resolution of change issues including production of design estimates

3.7 Cases for Safety

BSC is required to produce Cases for Safety at various stages of the project. These bring together all the work that SDS and they have done to demonstrate that the overall tram system will be fit for purpose and acceptably safe. They will be reviewed by the Infraco Contract Schedule 14 process.

3.8 Current work on safety hazard mitigation arguments (evidence)

After Infraco contract let, BSC established their System Assurance team and took stock of the SDS Hazard Log status. It became apparent by late 2008 that much work needed to be done to enable the safety arguments in support of hazard mitigation to be located, such that those hazards could be proposed to **tie's** Programme Safety Certification Committee – PSCC - for closure. This was because SDS documents which were needed to facilitate this were not evident.

Much preliminary work was done by BSC working with SDS during 2009. During the first half of 2010 further such joint work will be done to detail the available evidence and identify where gaps exist that need closure; **tie** will work closely with BSC on this critical activity.

3.9 Requirements management/V&V

Since the DAS' cover design ONLY, the need arises for BSC to demonstrate how they have verified that the design has indeed been constructed and commissioned. It is expected that fulfilment of BSC's Requirements Management and V&V processes will fulfil this need and include the verifiable evidence to support it.

4.0 Audit

tie has a design management audit underway at present. This started in May and evidence from this audit is being collected to substantiate the opinion formed by tie in relation to the design slippage and root causes of this.

5.0 Conclusions

- Throughout the life of the design the programmed delivery dates have continually slipped.
- Since the novation of the design to Infraco, it is **tie's** opinion that this has be exacerbated by:
 - the integration of the Infraco design
 - the alignment of the Infraco proposals

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- SDS has claimed incentivisation for xx IFC's delivered on time – however, it is not clear if these were complete or not
- Infraco has failed to date to deliver the agreed Design Assurance packages – this is probably due to the incomplete design status
- Infraco has failed to comply with the requirements of Schedule Part 14 by not submitting the IFC's through the design review process
- Infraco have submitted xxx compensation event notifications due to SDS delivering the design late – many of these may not be valid if Infraco have been liable for the design delay
- Infraco has submitted a number of compensation events for late delivery of IFC's where these are revisions of IFC's and the cause of the revision is not apparent.

6.0 Recommendations

- **tie** brings the IFC tracker up to date to track dates of delivery for all IFC's and subsequent revisions
- **tie** correlates these to the compensation events submitted to **tie** and refutes those which appear to be invalid and seeks additional information
- **tie** to continue gathering evidence from the ongoing audit to provide evidence to confirm the opinions expressed in this report
- **tie** to write to Infraco asking them to confirm how they have complied with Schedule Part 14 in respect of IFC packages

Appendix A

tie's 23rd Feb 2007 summary of the key requirements of PB's own Quality Management System

1. Proposal:

1.1. To introduce a design assurance process for SDS output such that it is inherently self-assured.

2. Method:

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- 2.1. The process builds upon the SDS (PB) Project Management Plan already produced for the project, document ULE 90130-SW-SW-PPN-00001, Version 5. This document details the Procedures for Control and Monitoring, - section 4 - and includes processes for:
 - 2.1.1. Issue to SDS' own Review Process – section 4.1.2
 - 2.1.2. The SDS Approvals Manager agreeing documents for submission to tie and third parties, and the scheduling thereof, including details of for what purpose the document has been submitted for review – sections 2.5.1 and 4.1.2
 - 2.1.3. The construction of a System Integration Matrix to be managed by SDS' Systems Integration Management team – section 2.7.1.
 - 2.1.4. Interface management and systems integration – section 4.4

- 2.2. For this purpose, the key elements within the Project Management Plan are the:
 - 2.2.1. Quality Management Plan – document ULE 90130-SW-SW-PPN-00003, version 5. This document includes processes for:
 - 2.2.1.1. Design Review – section 6.4. Inherently, this embraces IDC and IDR activity
 - 2.2.1.2. Design Verification and Validation – section 6.7

 - 2.2.2. Configuration Management Plan – document ULE 90130-SW-SW-PPN-00004, version 5. This document includes processes for:
 - 2.2.2.1. The required tram system build configuration, including configuration audits

 - 2.2.3. Approvals & Consents Management Plan – document ULE 90130-SW-SW-PPN-00007, version 5. This document includes processes for:
 - 2.2.3.1. Constructing an approvals and consents management plan
 - 2.2.3.2. Obtaining consents for planning, Roads, environment, construction
 - 2.2.3.3. Detailing Parliamentary Agreements and Third-Party undertakings

 - 2.2.4. Verification and Validation Plan – document ULE 90130-SW-SW-PPN-00005, version 5. This document includes processes for:
 - 2.2.4.1. Compilation of the test requirements database, which details how every system requirement is to be met through V&V activity – section 2, including:
 - 2.2.4.1.1. Design checking – the first defence against error!
 - 2.2.4.1.2. Design proving against requirements
 - 2.2.4.1.3. RAM management
 - 2.2.4.1.4. EMC
 - 2.2.4.1.5. Constructability
 - 2.2.4.1.6. Audits
 - 2.2.4.1.7. Testing and commissioning

- 2.3. Currently, SDS is responsible for design, TSS for design check and tie for final design approval and client decision-making on behalf of CEC and TS. *1 (see below)

- 2.4. The proposal is that henceforth, for each project element the following responsibilities are taken:
 - 2.4.1. Production of design to requirements - by SDS designer
 - 2.4.2. Production of sufficient supporting information to support design verification and validation (V&V) against requirements – by SDS designer
 - 2.4.3. Independent review of design and its associated V&V documentation – by SDS design management.

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2.4.4. Demonstration of V&V effectiveness – by SDS project management

2.4.5. Where specific requisite knowledge is held by experts outwith the current SDS organisation, those experts are used appropriately by SDS to embed their knowledge within the design process from the very outset, or otherwise as early as is possible. These experts will probably reside currently within the Transdev and the TSS organisations. It is imperative that their input is used in support of achieving the documented system requirements and not as a means of inputting “preferential engineering”.

2.5. Additionally, that a risk-based approach is used to sample a small proportion (determined initially by tie’s Engineering Directorate) of SDS output by independent staff probably drawn from within the present TSS organisation. The results of this work will be fed back into the SDS Quality Management System and the independent sampling approach reviewed and, if necessary, modified by agreement with tie’s Engineering Directorate.

Tony Glazebrook

Deputy to David Crawley,
 Engineering, Approvals and Assurance Director,
 tie Ltd

*1 section 2.3 above is incorrect and should have read “Currently, SDS is responsible for self-assured design. tie, assisted by TSS where necessary, is responsible for design review and client decision-making on behalf of CEC and TS”. Note that this point was never in contention and at no time did tie or SDS ever claim that anyone other than SDS was responsible for the accuracy, compliance with requirements or self-assurance of design.

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Appendix B

Email trail between tie and SDS relating to their Self-Assurance responsibility and content *NB: in reverse chronological order*

From: Reynolds, Steve [mailto:ReynoldsS@tie.ltd.uk]

Sent: 08 May 2007 10:11

To: Tony Glazebrook

Cc: David Crawley; Chandler, Jason

Subject: RE: Design Assurance implementation

Tony

Thank you for the clarification. From now on deliverables will be provided as self-assured packages

Steve

Stephen C Reynolds

Director

PB

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From: Tony Glazebrook [mailto:Tony.Glazebrook@tie.ltd.uk]

Sent: 03 May 2007 13:23

To: Reynolds, Steve

Cc: David Crawley; Susan Clark; Ailsa McGregor; Geoff Gilbert; Matthew Crosse; Andy Steel - TSS; steel_andy@compuserve.com; Chandler, Jason; Dolan, Alan; Trudi Craggs; Jim Harries (Transdev)

Subject: RE: Design Assurance implementation

Hi Steve,

For the avoidance of doubt, and ref note 4 in David's email below:

As we agreed at the SDS progress meeting on 24th April 2007, you are no longer to submit disparate design details for review. Designs are to be grouped into self-assured packages to a programme supplied by you asap.

The point that David is making is that, exceptionally and because of external process necessity, some key elements might be absent when packaging up for review; an obvious example being TTRO's. However, that should not be used as a reason for precluding the submission of an otherwise completed, self-assured

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package for review. Such a gap shall, of course, need to be clearly identified, together with a note that explains the process and timescale for ultimate completion.

Best regards,
Tony Glazebrook

From: David Crawley
Sent: 26 April 2007 18:30
To: 'Reynolds, Steve'
Cc: 'steel_andy' Geoff Gilbert; Tony Glazebrook; Ailsa McGregor
Subject: Design Assurance implementation

Steve, -To confirm our conversation today I have produced the notes below.
 (Andy, -This is for your information and to inform the TSS comments below.)

I had a useful visit to the PB offices in Birmingham yesterday which confirmed, as best as can be done in a short visit, that you have in place all the building blocks required to deliver design assurance as specified in my note to you of 11 April 2007 (the system has 11/4 logged but the letter date is 13/4 - see link <https://wss.tie.ltd.uk/tram/development/Correspondence/DEV-COR-246.pdf>) or attached documents for the letter). It is clear that those I spoke to understood what was required.

The overall concept is that you will deliver design 'packages' containing logically grouped designs (in order to address interdependencies) and will add a covering statement which provides competent assurance that the design is fit for purpose. This will cover the issues identified in the checklist in the attachment and is intended to add value by ensuring that reviewers have a summary of important issues with the supporting evidence to inform their review. To deliver this in practice requires some supporting actions.

1. An important consideration in implementing this way of working is to understand what the details of the design deliverable packages will be. At present there are a large number of design elements to be completed against your programme. These elements require packaging to ensure that they appear together with associated elements (e.g. track and roads together). I need to make available to TSS an indication of how many top level packages are relevant to the detailed design stage. For example, there may be, say, 60 top level packages, each consisting of up to 5 asset groups, with each asset group containing up to 30 design drawings.
2. The base data for the design packages is also relevant to the production of the progress 'dashboard' as detailed in the attachment.
3. To cover the assurance checklist issues requires a simple pro-forma to accompany design packages in which you should indicate for each item whether or not assurance is being 'claimed' Where it is, a reference to the location of the supporting evidence should be provided. Where it is not, statements of the issues giving rise to this should be provided. I understand that Martin Conroy is already engaged on this activity. This checklist will follow final production of the Design Verification Statement (DVS) which is part of your existing processes.
4. Notwithstanding the need to package inter-dependent designs for review, designs should still be submitted to the extant programme as individual items even though their status cannot be confirmed until after receipt of the design assurance information.
5. No change is proposed to payment against the extant schedule noting that the 20% retention could be released on successful completion of the design assurance checklist associated with the groupings of designs. This is for final agreement with Geoff Gilbert.

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6. No change will be made to any current meetings or consultation processes.

I hope that we can get to a point where everything is substantially in place to deliver in the new format by Monday 7 May, and certainly not later than Monday 14 May.

In order to demonstrate successful implementation it is likely that we will subject each design package to significant scrutiny in the first instance. There will also be audits of both process and product to confirm that confidence is well placed. When confidence has been established there will be the presumption of self-assurance with effort focused only on issues where there is no claim for an item being assured or on high risk items.

TSS will be asked to construct a review programme around these concepts which offers competent assurance to **tie** that we are receiving assured designs which are fit for purpose and which represent value for money. TSS will also work in support of **tie** in designing and conducting the audit programmes and in defining high risk items requiring detailed review.

I would be grateful for your comments and confirmation of each of these points and also a formal reply to my attached letter of 11 April.

Many thanks,
David

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