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10th August 2009

limited
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Bilfinger Berger Civil-EDI			
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For the attention of Steven Bell – Tram Project Director

Dear Sirs,

Edinburgh Tram Network Infraco
Development Workshop Report: Roads, Issue 2

We refer to your letters, ref INF CORR 1075 dated 23rd March 2009 and INF CORR 1503/RB dated 22nd May 2009.

We now attach document no BSC/25.1.201/DWR/RD001, Development Workshop Report: Roads, Issue 2, which has been amended in accordance with your comments.


We have not amended the introductory remarks in Sections 1 and 2.1 regarding status of base date design, which have a significant implication of works affected by resolution of misalignments but acknowledge that you have advised this aspect of the report is not agreed. We therefore request your confirmation that the technical content of the report is agreed, with a qualification that resolution of the commercial issues are outstanding.

Yours faithfully,

[REDACTED]
M Foerder
Project Director
Bilfinger Berger Siemens CAF Consortium

cc: KRu, CBr, SRo

Development Workshop Report Roads

BSC Consortium		
Position	Date	Approval
BSC Project Director	7/8/09	
BSC Deputy Project Director	7.8.09	

Inter Discipline Checking Process				
	Name	Position	Date	Signatures
Checked by (Siemens)	M WILKIN	SYS ENG MGR	7.8.09	
Checked by (BB)	CMB BRADY	TECH DIR	6.8.09	
Author	Ralf Honeck	Design Manager	27/2/09	

Document History			
Rev.	Issue Date	Description of Change	Author
1	27/2/09	First Issue	R Honeck
2	7/8/09	Second issue	C Brady

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Revision	Summary of Changes	
	Reference	Description
1		First issue
2		June-July Meetings and Mouchel Report added

Revision	Record of Agreement (ref Schedule 23, clause 4.8)		
	Name	Party	Signature
		Tie	
		Tie	
		BSC	
		BSC	
2		Tie	
		Tie	
	<i>M. Förde</i>	BSC	<i>10.08.2009</i>
	<i>H. Barrage</i>	BSC	<i>10.08.2009</i>
3		Tie	
		Tie	
		BSC	
		BSC	

DEVELOPMENT WORKSHOP REPORT : ROADS

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- 2 Misalignments
- 3 Conclusions
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- 5 Tie Change orders
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 - 6.1 Process
 - 6.2 Pavement Evaluation Report, Shandwick Place & Princes Street (Mouchel)
Document No 718376/R/01/B dated 18 September 2008

1 INTRODUCTION

The ETN Infraco Contract became effective on 14/5/08, at which time it was known that misalignments existed between the Base Date Design Information produced by SDS, on which the civil works price was generally based, and the Infraco Proposals for certain systems, such as trackform, on which the Systems price was based. The process for resolving such misalignments is described in Contract Schedule 23 (Novation Agreement) which requires that Development Workshops are held to determine the development of the Infraco Proposals and any consequential amendment to the design deliverables. The relevant section of Schedule 23 (clauses 4.6, 4.7 and 4.8) are contained in Appendix 5.1, Process.

The product of the Development Workshop shall be a report signed by each of the Parties (i.e tie, Infraco and SDS), to detail the conclusions in respect of each matter and payments to be made to the SDS provider in respect of the work to be carried out by the SDS provider as a result of the conclusions set out in the report.

This document, no BSC/25.1.201/DWR/RD001, is the report of the Development Workshop for Roads.

In respect of any given system, such as roads, the matters to be determined at the Development Workshop are set out in Schedule 23, Appendix 7, Part C (the Misalignment Report), together with any items to be finalised in SDS/BBS alignment workshops, in Schedule 23, Appendix 4.

In respect of any given system, such as roads, the matters to be determined at the Development Workshop are set out in Schedule 23, Appendix 7, Part C (the Misalignment Report), together with any items to be finalised in SDS/BBS alignment workshops, in Schedule 23, Appendix 4.

In the case of roads, there are no relevant items in Sch 23, App 4, so the matters to be resolved in the Development Workshop are as set out in Sch 23, App 7, pt C. The relevant section of App 7, Pt C is reproduced below :-

Roads												
Design to be completed to IFC status, all design consents and approvals obtained and BBS will construct IFC Design	Complete Design	x	x	x	x	x	x	x	x	x	x	
Subject to survey, pavement design to be developed and finalised to minimise work scope	Pavement design is to be revised to a plane and re-surface (new regulating and surface course only) when survey information is available and where it confirms the feasibility of this design solution Note This activity is an alternative to the Vertical Alignment activity above)	x	x	x	x	x	x	x	x	x		
Further pavement surveys and assessments are required.	GPR and/or Pavement Condition surveys as required by xxx (above)	x	x	x	x	x	x	x	x	x		
											Clarification sought from be.	

This report is structured as follows :-

- Identified misalignments are detailed in section 2

- Conclusions are scheduled in section 3
- The notes of the workshop, in minute form, are provided in section 4
- Supplementary information is provided as Appendices in section 5

2 MISALIGNMENTS

2.1 General

Misalignments arise due to differences between the Base Date Design Information and the Infraco Proposals, which are bound into the ETN Infraco Contract as Schedule 30. The Schedule of Infraco Proposals is essentially the same information for roads as is contained in Sch 23. App7, Pt C, but repeated for each relevant section of the project. Additional information is included in respect of drainage. The table of roads related misalignments for section 1A is reproduced below; the information is repeated for other sections.

1A.10	Roads			
1A.10.1	Design to be completed to IFC status, all design consents and approvals obtained and BBS will construct IFC Design			Complete Design

				Information from BBS to SDS	Description of Design completion activities
1A.10.2	Subject to survey, pavement design to be developed and finalised to minimise work scope				Pavement design is to be revised to a plane and re-surface (new regulating and surface course only) when survey information is available and where it confirms the feasibility of this design solution Note This activity is an alternative to the Vertical Alignment activity above)
1A.10.3	Further pavement surveys and assessments are required.				GPR and/or Pavement Condition surveys as required by 1A.10.2 (above)
1A.11	Drainage				
1A.11.1	Design to be completed to IFC status, all design consents and approvals obtained and BBS will construct IFC Design				Complete Design
1A.11.2	Requirements for maximising use of and connection to existing drainage network to be confirmed.				Review and complete design

2.2 Misalignment No 1 : Road Construction

The Base Date Design for roads is based on full depth reconstruction in all areas. The Infraco proposals, as clarified in the preceding section of this document, are based on plane and resurface (new regulating and surface course only) when survey information is available and where it confirms the feasibility of this solution.

3 CONCLUSIONS

3.1 General

Development meetings confirmed that a design solution was required to allow most economical road construction but to ensure robust and auditable design to applicable standards.

3.2 Misalignment No 1 : Road Construction

Instruct SDS to :-

- Produce a construction methodology to define the management of testing, selection of road construction details from a "menu" of options and production of appropriate records
- provide of resources to agree testing, interpret results, provide construction details

4 DEVELOPMENT WORKSHOP NOTES



MINUTES

ROADS & DRAINAGE ALIGNMENT WORKSHOP

29th MAY 2008: 09.00 – 11.30

MacADAM ROOM, CITY POINT I

Attendees:

Steven Bell	tie
Dennis Murray	tie
Bob Bell	tie
Tom Hickman	tie
Ken Mosley	TSS
David Taylor	Infraco
Steve Sharp	Infraco
Tom Murray	Infraco
Ian Goldie	Infraco
Alan Johnstone	Infraco
Scott McFadzen (P/T)	Infraco
A Dolan	Infraco(SDS)
J Chandler	Infraco(SDS)
Duncan Fraser	CEC

Introduction

SB welcomed everyone and advised that the purpose of the meeting was to identify any misalignments between the Infraco proposals and the SDS design for Roads and Drainage; and to agree the necessary actions to achieve and aligned coherent design solution. This was laid out in the SDS Novation Agreement as part of the Infraco Contract Suite.

The primary aim of today was to look at the technical matters associated with any mis-alignment. Any Cost and Programme consequences will be addressed thereafter.

Mis-alignment issues associated with Roads

- Original design was carried out by SDS (Halcrow), which resulted in current design having taken account of Roads Working Party forum.

- DF stated that any design must take account of the fact that load profiles change when going from 4 lanes to 2 lane carriageways -- More traffic, particularly buses now in less lanes.
- DF stated that CEC considers that performance based solutions may address problem areas.
- Areas of mis-alignment were identified / suggested as:-
 - Geometry of road surface
 - Pavement Capacity and Capability
 - Footway arrangements
- BBS/SDS agreed that any change should be designed fully, then review construct methodology.
- All agreed that the interface between road design and track to be picked up in Trackform workshop (planned for 4 June 2008).

Roads – Geometry

Current road design was carried out to [Bob check with Ken Mosley / Duncan but it uses a design manual] specification.

David Taylor outlined BBS' proposal as per their pricing assumption, which was to build the track above the current surface level and make up new surface to the track level. This may have an impact on the crossfall of the road surface and on kerb freeboards.

DF advised that any change in design had to consider Safety Audits, Planning, & Maintenance issues.

A proposal based on generic points is to be prepared by BBS/SDS for review and acceptance in principle by CEC/tie. This is to be circulated before Monday 2 June 2008.

This would then be refined further on a section by section basis utilising drawing and survey information, commencing Monday 2 June. A programme to conclude such works would be a specific output requirement of the 2 June meeting.

Pavement Capacity & Capability

- Infraco propose planning as opposed to full depth reconstruction.
- Scott McFadzen stated that principles need to be agreed (and supported by suitable justification) in relation to derogations or departures from standards or changes would not be accepted. All agreed.
- SM advised that the basis for their proposal was that City Centre roads in Edinburgh were not overburdened by HGV's
- DF advised that buses were more of a burden than HGV's
- SDS – JC advised that Halcrow's concern would be the risk to them as designer if new design fails!! SB agreed that a debate on this may follow, but if an analytical approach is followed, Halcrow should not have any difficulty with this.
- A proposal based on generic points is to be prepared by BBS. This is to include testing and verification criteria. SDS would then need to feedback on acceptance of approach and identify areas to implement in conjunction with BBS.

This can then be explained to CEC to determine if they can agree to the principles as presented.

- Any agreement would be subject to surveys and testing confirming the technical basis of the proposals.
- SB stated that a programme for managing the realignment process would be required. After the technical evaluation was completed this should include impact on consents, construction activities safety audits and commercial agreement being reached.

DRAINAGE

After a short discussion, it was agreed that there were no misalignment between SDS and BBS wrt these works.

FOOTWAY PARAMETERS

After a short discussion, it was agreed that there were no misalignment between SDS and BBS wrt these works.

Mis-Alignment in BBS/SDS Solutions (1)

Roads & Drainage

- Road Cross-Section Geometry

	Planned	Programme	Actual	Comments
Initial Meeting			29 May 2008	Complete
Initial BBS Proposal			30 May 2008	Complete
Initial CEC Response			3 June 2008	Complete
Detail BBS/SDS proposal				
Princes Street	30 June 2008			As agreed
Shandwick Place	30 June 2008			As agreed
Haymarket Jct	30 June 2008			As agreed
St Andrews Sq.	30 June 2008			As agreed
1week for CEC to approve				
CEC Comments				
Princes Street	7 July 2008			As agreed
Shandwick Place	7 July 2008			As agreed
Haymarket Jct.	7 July 2008			As agreed
St Andrews Sq.	7 July 2008			As agreed
Submit detailed design to CEC (in conjunction with pavement design)				
Princes Street	24 Nov 2008			
Shandwick Place	TBA			
Haymarket Jct	24 Nov 2008			
St Andrews Sq	TBA			
CEC Approval period 3 weeks				
CEC Approval				
Princes Street	15 Dec 2008			
Shandwick Place	TBA			
Haymarket Jct	15 Dec 2008			
St Andrews Sq	TBA			
One week for SDS to convert to IFC				
Issue IFC Design				
Princes Street	22Dec 2008	22 Aug 08(v31)		
Shandwick Place	TBA	08 Jul 08(v31)		

Haymarket Jct St Andrews Sq	22 Dec 2008 TBA	08 Jul 08 (v31) 22 Aug 08 (v31)		
2 weeks for Infraco to prepare (Design concept is known)				
Construction Commence				
Princes Street	5 Jan 2009	5 Jan 2009		
Shandwick Place	TBA	9 Sept 2009		
Haymarket Jct	5 Jan 2009	5 Jan 2009		
St Andrews Sq.	TBA	9 Sept 2009		

Road Pavement Design

	Planned	Programme	Actual	Comments
Initial Meeting			29 May 2008	Complete
Initial BBS Proposal			30 May 2008	Complete
Initial CEC Response			3 June 2008	Complete
Detail BBS/SDS proposal				
Princes Street	09 Aug 2008			Split Report
Shandwick Place	23 Aug 2008			
Haymarket Junction	09 Aug 2008			Split Report
St Andrews Sq.	23 Aug 2008			
4 weeks for CEC to comment				
CEC Comments				
Princes Street	09 Sept 2008			Part report
Shandwick Place	23 Sept 2008			
Haymarket Junction	09 Sept 2008			Part report
St Andrews Sq.	23 Sept 2008			
Submit detail design to CEC (worked back)	11 weeks to design 1 ST two areas.			
Princes Street	24 Nov 2008			
Shandwick Place	TBA			
Haymarket Jct	24 Nov 2008			
St Andrews Sq	TBA			
3 weeks for CEC to approve (partial submission ie 2 out of 4 areas)				

CEC Approval				
Princes Street Shandwick Place Haymarket Jct St Andrews Sq	15 Dec 2008 TBA 15 Dec 2008 TBA			
1 week to convert to IFC				
Issue IFC Design (Worked back from Construct programme)				
Princes Street Shandwick Place Haymarket Jct. St Andrews Sq.	22 Dec 2008 TBA 22 Dec 2008 TBA	22 Aug 08(v31) 08 Jul 08(v31) 08 Jul 08 (v31) 22 Aug 08 (v31)		
2 weeks for Infraco to prepare (design concept now known)				
Construction Commence				
Princes Street Shandwick Place Haymarket St Andrews Sq.	5 Jan 2009 TBA 5 Jan 2009 TBA	5 Jan 2009 9 Sept 2009 5 Jan 2009 9 Sept 2009		

ROADS & DRAINAGE ALIGNMENT MEETING No. 2

Held on 2nd June 2008 10.30 – 14.00

MacAdam, City Point II

Attendees:	B Bell	tie
	P Dobbin	tie
	W Biggins	tie
	S Wallace	CEC
	D Fraser	CEC
	D Fordyce	CEC
	D Taylor	Infraco
	A Johnstone	Infraco
	I Gold	Infraco
	J Chandler	Infraco SDS (P/T)
	A Dolan	Infraco SDS (P/T)
	K Morely	TSS

1.0) Meeting was held as a follow-up to Road & Drainage Alignment Workshop of 29th May 2008.

As an action from the previous meeting, Infraco have issued two proposals with respect to carrying out works:-

- i. Road Cross Section Geometry
- ii. Road Pavement Design

2.0 Road Geometry

Ian Gold explained the basis of the Infraco proposal and confirmed that the proposal was intended to ensure full compliance in respect of noise, comfort and surface texture.

Duncan Fraser advised that CEC's approach to the proposal was that it had to be fit for purpose, maintainable and take account of any consequential effect.

Sandy Wallace advised that as the roads maintainer, he didn't have a problem with the principle of the proposal if it was acceptable from a design perspective, but that the proposal should be based on National guidelines where possible. Where National guidelines couldn't be met, these areas should be identified and reviewed on an individual basis.

Jason Chandler reminded the meeting that issues such as track alignment, run times, designers P1 and QA procedures all had to be addressed.

It was agreed that Infracore would develop a table identifying the following:-

- drivers for original design
- drivers for proposed design
- impact on consents, run times
- programme for change
- standards adopted
- residual risk of design

DF felt that the Roads Design Working Group would be the best way to determine the suitability of any proposed changes. DT had some concerns as to how this would impact on the proposal detail and programme. After considering the make-up of the working group and given CEC's support of the principle of "fit for purpose", it was agreed that the Working Group would be reconvened and would meet regularly to aid progress.

A discussion was held on the approvals required and it was felt the detail of the proposal needed to be developed before the impact on approvals could be determined.

3.0) Road Pavement Design

The proposal for the pavement design was discussed.

- It was agreed that the best way forward was for CEC to review and comment on the proposal. DF undertook to return comments by Wednesday 4th June. Infracore would then review the comments and if broadly acceptable, the next stage would be to again breakdown the proposal on a section by section basis as per the Roads Geometry proposal.

BBS

Edinburgh Trams

Design Amendment Proposal 2 – Road Pavement Design

5th June 2008

Introduction

As part of the design refinement process outlined in Design Amendment Proposal 1 we have produced outline proposals in relation to the road pavement reconstruction adjacent to the tram lines to develop an approach that would enable as much as possible of the existing road pavement to be retained where the conditions permitted. This would also have additional benefits of reducing construction times and the disruption to the public and adjacent traders. We have outlined two approaches to the reuse of the existing pavement: The first we have called the "Reference Proposal" which is based on the use of performance designs for foundations and pavements in accordance with the DMRB, MCHW and published TRL Reports. The second we have called "Analytical Design of Inlays and Overlay" and this based on full analytical design of the pavement following detailed assessment of the condition of the existing pavement construction. The most appropriate design approach would be selected based on the change in level between the existing and new finished road levels and the thickness/condition of acceptable quality existing pavement structure that can be retained. We have also included Appendix A which outlines additional requirements to the current testing proposals to enable the most effective use possible of the existing pavement construction.

1. Reference Proposal

This proposal is based on the current design standard for Trunk Roads from the DMRB HD26/06, the Foundation Standard IAN 73/06 and TRL Report PPR127. This approach would be adopted where the pavement was found to be in a condition that it was not suitable for overlay or inlay. This would be due to poor condition of the pavement structure or that due to a change in finished road levels there was insufficient depth of existing construction that would remain below the new finished road level for an overlay to be successfully constructed. The remaining construction would be evaluated to determine what level of foundation support it could provide, this would be confirmed by an extensive range of preconstruction testing and assessment. The thicknesses of new construction provided would then be in accordance with HD26/06. These outline proposals are summarised in Table 1 of this document along with the performance requirements for the existing pavement which would be utilised as a "Performance Design" foundation in accordance with IAN73/06. Defects or issues arising from utility works that result in a variable support would be dealt with by localised repairs or other techniques to provide a relative uniform support platform to the new road construction.

As a reference for this proposal we have adopted a traffic loading of 30msa (millions of standard axles) over the pavement design life. In order to produce a pavement with excellent rut resistance and durability to the channelised traffic that it will encounter from commercial vehicles and buses, we would propose a Hot Rolled Design Mix Asphalt

Surface Course over a combined Binder Course and Base Layer of EME2. EME2 was developed in France as a repair material for existing carriageways and has been used there for many years.

This material has been used successfully on two recent projects: the online widening and improvements to the A90 as part of the A8000/M9 project and currently the Toll Abolition at the Forth Road Bridge. These projects have given an excellent working knowledge of EME2 and foundation materials in use in Central Scotland and the associated specialist testing requirements. On the M9 Project the City of Edinburgh Council were the client and therefore closely involved in approving the departure from standard applications for the use of EME2 (the contract was based on HD26/01 which predated EME2) and the use of non-standard foundations below the EME2. The existing carriageways were tested to determine their condition and due to their age and condition they were used as a "Performance Design" foundation, Class 3 in accordance with IAN 73/06 and departure approval was sought and received from the City of Edinburgh Council who also had discussions with Transport Scotland who funded the project.

Table 1.					
30msa Options	Foundation Design Surface Modulus (Mpa)	Maximum Foundation Deflection under a 40Kn Load (mm) (3)	Surface Modulus of Foundation prior to Construction of EME2	EME2 Thickness (mm)	HRA surface Course (mm)
Class 3 Foundation	200	0.74	200	195	45
Class 2 Foundation	100	1.48	120	215	45
Note 1: There is no negative tolerance on the EME2 Thickness					
Note 2: Maximum subgrade strain in accordance with Figure 5.7 IAN 73/06					
Note 3: Maximum Deflections in accordance with IAN 73/06 paragraph 5.14					
Note 4: Class 4 conditions unlikely to be obtained					
Note 5: Combined EME2 and HRA thickness in accordance with HD26/06					

2. Analytical Design of Inlays and Overlay Proposal

This approach has been used successfully on a number of projects in the UK and Ireland on Trunk and other Roads. This approach was used on the tie-in section for the M9 Spur for the City of Edinburgh Council, it is also being used on the M50 Orbital motorway Upgrade in Dublin and the 45km Dishforth to Barton A1 upgrade for the Highways Agency.

As in the example 1 above, we would propose the use of EME2 and an Asphalt Surface course for their rut resistance and durability. EME2 has the added advantage in this situation in that it is a combined Binder Course and Base material and can be laid at thicknesses between 60 and 140mm. It is envisaged that in order to ensure an acceptable running surface a Binder Course will be required in all locations, its thickness will vary to suit the vertical geometry and the condition of the existing pavement that is retained. Table 2 below gives a summary of possible overlay thicknesses for a range of existing asphalt construction thicknesses. The subgrade condition has been taken as 5% which is fairly typical. The stiffness of the existing asphalt has been taken as 4000Mpa which is reasonable for an aged material. The design loadings for traffic have been set the same as the previous proposal at 30msa.

30msa Options	Existing Asphalt Remaining (mm)	Existing Sub-base (Assumed Type 1) (mm)	Existing Subgrade CBR and surface modulus	Existing Asphalt Design Stiffness (MPa)	Overlay Thickness EME2 (mm)	Asphalt Surface Course (mm)
Option 1	300	150	5%, 49Mpa	4000	60	45
Option 2	250	150	5%, 49Mpa	4000	70	45
Option 3	200	150	5%, 49Mpa	4000	110	45

Note 1: New EME2 Design Stiffness 5.8Gpa
 Note 2: an allowance for construction tolerances to be added to the EME2 thicknesses (10mm)

A suite of additional testing would be required in order to determine the actual condition of the existing asphalt. This would require the following testing on a selection of the cores: ITSM at varying frequencies, RLAT, Fatigue, Air voids and Binder Penetration. A detailed assessment of the condition of the pavement would then be made using the results of the laboratory testing, FWD analysis and detailed visual assessments.

The Fatigue life adopted for the existing asphalt would be reduced from that in LR1132 based on the laboratory results and previous experience (Proceedings of the ICE, Transport, May 2003 and November 2004, Paper 12814 and 2312814: Influence of layer bonding on the prediction of pavement life; K. Khweir and D. Fordyce).

Repairs would be scheduled to the existing carriageway following analysis of the detailed visual condition survey; this would involve repairs around existing services, poor reinstatements and other areas of damage such as rutting, cracking or delaminations. In areas of rutting or cracking additional cores would be taken to determine the depth of the

damage so that the repairs could be scheduled to provide as uniform as possible a support to the new pavement construction. All planed areas would be inspected for other damage not visible from the original surface prior to the application of the bond coat and any required repairs carried out. The minimum depth of cold planing would be to remove the existing surface courses. A polymer modified bond coat would be used between all planed and new asphalt surfaces.

Summary

We believe that with the appropriate intensity and specification of investigations both invasive and non-destructive, laboratory testing and detailed visual inspections a robust assessment of the condition of the existing road pavement can be developed and used as the basis of the design of the treatments to the remodelled carriageway. The FWD information will be assessed both in terms of direct and back analysis and used to determine the equivalent design sections in conjunction with the radar and core information. The material assessments will be made largely on the basis of the invasive and laboratory testing and local experience of the materials.

We believe that approaches outlined above will provide a robust pavement that makes the best use of the existing construction. Using it as an improved foundation in the first option where there is insufficient existing pavement remaining or it is of too poor a condition for overlay and in the second as effectively a pavement at base level with a structural overlay. Both of these options give the contractor the opportunity to reuse the maximum amount of the existing pavement, reduce the carbon footprint of the pavement construction process and minimises the disruption from the construction process to the local traders and the general public with a reduced construction programme.

Appendix A - Testing Issues

1. Pre-works testing to be carried out to determine the required FWD loadings to achieve an acceptable response from all geophones and an acceptable reducing profile. Particular attention to be made to the outer geophones to ensure that the reduction between geophones is significant.
2. FWD Loadings to be sufficient to engage all pavement layers and given the age, likely thickness and possibility of buried setts and concrete the loadings will have to be increased from the standard 50Kn probably to as much as 100Kn.
3. Where more than one loading value is adopted for the FWD testing in a location at least two and preferably three readings to be taken at each loading to enable checks to be made for consistency.
4. Visual condition survey (Chart - Detailed Visual Condition) to be carried out by a pair of surveyors to manually record structural defects and rutting at regular intervals using a 3m straight edge. Particular attention to be made in relation to Utility Reinstatements, condition of service covers and other repairs. The defects and other information should be recorded in location as accurately as possible. The position of the service covers should also be recorded.
5. Cores to be taken at 20m centres longitudinal spacing and across carriageway cross section.
6. There needs to be a suitable representation from the designer on site at the time of the testing in order to ensure that additional cores are instructed as required and FWD set ups changed as required etc.
7. Consideration to taking several parallel Ground Penetrating Radar longitudinal depth profiles and also possibly some cross sections also.
8. Prima100 LWD testing – trials to be carried out to determine most appropriate loadings and the methodology for achieving a uniform support below the loading plate.
9. Road Pavement cores to be photographed at time of recovery and also the core hole wall with scale rule and any issues relating to problems with the coring.
10. The cores should also include the following testing on selected samples:
 - a. BS DD ABF, 1995 Asphalt Indirect Tensile Fatigue Testing
 - b. Mixture Composition and Grading
 - c. Binder Recovery and Determination of Penetration
 - d. Bulk, Rice Density and determination of Air Voids
 - e. BS DD 213, 1993, Indirect Tensile Stiffness Modulus Measurements to varying rise times equivalent to 2.5, 5 and 10Hz
11. A selection of the core samples should be sent to a second laboratory for blind verification of the results, there are particular issues with the ITSM and Fatigue testing. The laboratory needs to have extensive recent experience of these types of testing, UKAS accreditation on its own is not sufficient.



FW: Edinburgh Trams Pavement Proposals
Robert Bell to: Colin.Brady@civil.bilfinger.co.uk

05/08/2009 14:00

-----Original Message-----

From: Robert Bell
Sent: 09 June 2008 09:05
To: 'David.Taylor@bilfinger.co.uk'
Subject: FW: Edinburgh Trams Pavement Proposals

David,

Given the comment in the first paragraph, are you happy for me to pass this on to CEC?

Bob.

-----Original Message-----

From: David.Taylor@bilfinger.co.uk {mailto:David.Taylor@bilfinger.co.uk}
Sent: 09 June 2008 07:50
To: Robert Bell
Cc: Alan.Johnstone@bilfinger.co.uk; Iain.goldie@██████████
Subject: Edinburgh Trams Pavement Proposals

Bob,

Please find attached our response to the questions raised by CEC regarding our proposals for the pavement construction on the ETN. The way forward can be discussed at the follow up meeting tomorrow.

From: Durie, Malcolm
Sent: 05 June 2008 18:09
To: Goldie, Iain
Subject: Edinburgh Trams Pavement Proposals

Iain,

I have updated the proposal to clarify a few points and also answered the questions from Derek Fordyce, the extract from his Email is included below. Our responses are in red. I have also included a few extra notes here for the contractor not for issue to the client City of Edinburgh

The points that he raised were largely covered in the original document but I have clarified the points in relation to the material assessments and included a paper reference that he published with Kadhim which we use for the Fatigue assessment. His other issues about the discontinuities in the pavement will be dealt with the detailed visual assessments both at the investigation stage and after planning during the construction.

CEC00793517_0023

I have also included references to other projects where we have used these approaches recently.

It is of critical importance that our concerns relating to the investigations are addressed or we could be in the situation in a few months time where there is insufficient information available to permit the design to proceed. There needs to be a presence from the designer team on site who know the likely issues with the testing and can react by increasing the number of cores or other changes to the processes such as changing the FWD or Primal100 loadings. The specification of the laboratory testing is also important and a number of additional tests need to be added to your current proposals. We can assist with these issues from the Edinburgh Office.

We can also provide you the service for the detailed visual assessment and the Primal100 testing from our Edinburgh office.

Derek Fordyce Email :

PROPOSAL

The proposal relates to the roadway reconstruction between the tramway slab and the footway kerb.

The proposal is to provide a surface course and binder course, or surface course and combined binder and base course, over the residual roadway construction.

The design criterion for the combined surface course and binder/base course is resistance to canalised rutting.

STRUCTURAL MODEL

It is unclear what the structural model of the reconstructed roadway pavement is. There are two structural models.

Model 1: The reference proposal suggests that the residual roadway construction is a foundation platform to the combined surface course and binder/base course. With this model there can be no bond assumed between the overlay and the existing construction.

Model 2: The alternative is where the surface course and binder/base course is bonded to the residual construction; this is a significantly different structural model.

With Model 1, the thickness of the binder/base course will relate to the stiffness of the foundation platform formed by the residual roadway construction. The key structural issue here is the value of foundation platform stiffness and the continuity of the stiffness value. Where there is discontinuity in the stiffness at discrete points, such as utility repairs, the fatigue capability of the overlay requires limiting crack propagation.

With Model 2, the thickness of the binder/base course will relate to the residual stiffness and residual fatigue life of the remaining pavement structure.

Model 1 has been used in Edinburgh in the 1990's with the maintenance of Burdiehouse Road, Cowgate and West Port. Each situation had a performance designed thin overlay bonded to the existing pavement structure. These roadways have not been maintained in up to 15 years. In all cases utility works were repaired to achieve a uniform stiffness of remaining pavement structure, minimising the potential for crack initiation. The fatigue capability of the surface course minimised the potential for crack propagation. The thin surface overlay design criteria were fatigue and rutting; the material had the characteristics of an EME 2.

QUESTIONS

With Model 1 the fatigue life of the overlay structure is relevant at foundation platform discontinuities, and not as a general characteristic. How is this being designed for?

Answer: The new asphalt thicknesses in this proposal are in accordance with HD26/06 for various classes of Performance Foundations in accordance with IAN 73/06. This option will be used where the remaining thickness of the existing pavement is too thin or the condition is otherwise unsuitable for overlay. We have proposed the use of EME2 and an Asphalt surface Course which has considerably better fatigue life than the standard bound macadam's and surface courses. Where there are discontinuities such as damage to the carriageway from poor reinstatements these will be dealt with local repairs to ensure uniform support. The items are outlined in more detail in the updated proposal document.

With Model 2 the remaining fatigue life of the residual structure is relevant to the performance of the final structure. How is this being calculated?

Answer: The remaining fatigue life of the existing structure will be assessed in accordance with the paper: (Proceedings of the ICE, Transport, May 2003 and November 2004, Paper 12814 and 2312814: Influence of layer bonding on the prediction of pavement life; K. Khweir and D. Fordyce) and other associated laboratory testing, the effect is to reduce the fatigue line from that in TRL1132 and related documents.

Model 2 is the more complex model in terms of defining the remaining life of the residual structure as this will vary depending on whether the existing surface level is the same, is raised, or, worst case scenario, is lowered.

The FWD as a tool can measure deflection, which is real. The structural capability of the structure that is interpreted from deflection is not precise as material performance and composite action requires being defined, or at worst assumed. Interpreting structural capability of what remains of the structure is even more complex. How is this being defined?

Answer: The issues of what thickness of existing pavement that remain and the assessment of the condition is based on the invasive testing and the associated laboratory testing and is covered in the updated proposal document. The FWD will be used as part of the pavement condition assessment and to assist with the determination of the variability of the existing pavement construction. The FWD assessment will be a mixture of direct and back analysis to assist the interpretation of condition of the existing pavement. Back analysed data will not be used to determine the design stiffness values of the existing construction layers, this information will be derived from the laboratory testing of the cores. The FWD testing will be analysed to assess the overall response of the pavement to loading and its suitability for overlay or as performance foundation. This procedure has been expanded further in the updated proposal document.

Urban roadways that have existed for decades and centuries will be multilayered structures, with vertical discontinuities. Not only will there be a residual tram slab within the roadway structures in Edinburgh, but there will be setts that are flexible material layers. There is currently no ability to model such layers. So, how is the analysis of the FWD signals to be made?

Answer: The FWD will be used as part of the pavement condition assessment and to assist with the determination of the variability of the existing pavement construction. The FWD assessment will be a mixture of direct and back analysis to assist the interpretation of condition of the existing pavement. Back analysed data will not be used to determine the design stiffness values of the existing construction layers, this information will be derived from the laboratory testing of the cores. The FWD testing will be analysed to assess the overall response of the pavement to loading and its suitability for overlay or as performance foundation. This procedure has been expanded further in the updated proposal document.

Radar has proven difficulty in penetrating natural stone layers; radar also has difficulty in locating small diameter plastic pipes that rise vertically within a roadway structure. Such scenarios are relatively common in Edinburgh. Utility damage and delays and disruption are an issue cause by lack of detailed information. How is this to be minimised with the assessment approach? Coring will locate setts, but plastic pipes?

Answer: The use of Ground Penetrating Radar (GPR) can provide a good picture of the existing pavement construction and identify changes in construction and moisture and some voids but we agree it has limitations in complex situations. The basis in assessing the thickness and type of construction will of course be the invasive investigations (coring and trial pits) with the GPR giving an overall construction profile. Other issues with the pavements will be identified from the detailed visual condition assessments and utility investigations. The contractor will have procedures for checking for utilities in the bound road pavement construction during the investigations and the construction process. There will also be close visual inspections as the layers of pavement are exposed by planning during the construction process to identify other issues.

Kind Regards,
Grontmij

Malcolm J Durie
BSc (Hons), CEng, MICE, MIAT
Principal Engineer
Transportation Infrastructure

Spectrum House, 2 Powderhall Road, Edinburgh, EH7 4GB

T: [REDACTED]

D: [REDACTED]

F: [REDACTED]

E: malcolm.durie@[REDACTED]

W:

<http://www.grontmij.co.uk/site/engb/Services/Transportation/Pavement+Technology/Pavement+Technology.htm>

W: <http://www.pavement-consultants.com>

Registered Office: Grontmij Limited, Grove House, Mansion Gate Drive, Leeds, LS7 4DN, Company Registration No 2888385 - a wholly owned subsidiary of Grontmij Group Limited (Reg No 2237772).

Following our acquisition in August 2006, Carl Bro has now evolved to Grontmij.

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(See attached file: BBS Design Proposal 2a.doc) Regards,

David Taylor
Project Manager

Bilfinger Berger UK Limited
Lochside House
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Edinburgh
EH12 9DT
United Kingdom

Tel: [REDACTED]

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CEC00793517_0026

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BBS Design Proposal 2a.doc

CEC00793517_0027



ROADS & DRAINAGE ALIGNMENT WORKSHOP 3

10th June 2008: 08.30 – 09.30

2ND Floor Break-Out Area, Citypoint

Attendees:

Bob Bell	tie
Phil Dobbin	tie
Andy Scott	tie
David Taylor	Infraco
Alan Johnstone	Infraco
Duncan Fraser	CEC
Derek Fordyce	CEC

Introduction

Follow up meeting on mis-alignment issues between BBS proposal and SDS design on Roads and Drainage.

Bob Bell apologised for minutes not being available for the meeting, but given that the previous meeting was just last week and he had complete notes, he was sure matters could be progressed.

Road Geometry

1) It was agreed at the previous meeting that Infraco would develop a table identifying the following:-

- drivers for original design
- drivers for proposed design
- impact on consents, run times
- programme for change
- standards adopted
- residual risk of design

This remains outstanding. Infraco to action this as a matter of urgency.

Road Pavement

- 1) Duncan Fraser advised that info had still to be recovered from MUDFA on their surveys and As Built documentation – Phil Dobson to obtain this.
- 2) Allan Johnstone commented that looking at various MUDFA excavations in Shandwick Place showed that cross sections were very variable.



- 3) The meeting agreed that Infraco should progress their surveys upon concluding the commercial arrangements with Dennis Murray / Mike Paterson. Typically, cores to be taken to give information on depths (50 cores) @ 100m apart.
- 4) Infraco advised that Grontmij were providing a consultation service for their surveys and that SDS/Mouchel's have specified testing. SDS will interpret the test results.
- 7) Infraco advised that a Bitumen Analysis not being done
- 8) Infraco to provide a Flowchart, Organisations & Programme to IFC to demonstrate how all parties will contribute, and who will be responsible for final outcomes by end of week.

Any Other Business

It was evident that some of the working group were not aware of the contractual position of all parties with respect to these works. Bob Bell reminded everyone of the fact that all parties were required to co-operate in this matter and that provisions were made within the contract that had advantages and/or disadvantages for all parties.

Robert Bell

From: Robert Bell
Sent: 26 June 2008 17:06
To: Duncan Fraser - CEC; 'David.Taylor@bilfinger.co.uk'
Cc: Steven Bell; 'Colin.Brady@bilfinger.co.uk'; Phil Dobbin; Michael Jesuarui; Tony Glazebrook
Subject: Roads Mis-Alignment Programme
Attachments: Mis-Alignment in BBS SDS Solutions (1).doc

Gents,

Please find attached my proposed programme for moving the Roads mis-alignment issues forward to a conclusion that maintains our current contract programme dates. Note the following:-

- 1) I have worked forward from the initial dates we discussed and agreed for proposals and survey results etc, and also worked backwards from commence construction dates to determine the bit in the middle ie the actual design period we have available.
- 2) Given that Geometry and Pavement design will be concurrent design issues, I have developed the programme with this in mind for the design period.
- 3) I have shaved some time off of some activities based on the fact that we will be developing some reports and designs for different sections at different times, and also to reflect the fact that by the time we approach the commence construction date, we should all have a good idea of scope etc.
- 4) Our next agreed target date is to receive the Infracore Geometry proposal by 30th June. I propose we meet on 2nd July at 10.00 am to review the proposal and this programme. Hopefully we can also get initial feedback on the road survey progress ,

Please confirm your availability, and comments on the programme in advance if possible,

Bob.

ette, Please confirm meeting room,

Bob.

tie limited

Citypoint
1st Floor
65 Haymarket Terrace
Edinburgh
EH12 5HD

Tel: 

...ob 

CEC00793517_0030



ROADS & DRAINAGE ALIGNMENT WORKSHOP 4

31st July 2008: 08.30 – 10.30

Isambard Room 2ND Floor, Citypoint

Attendees:

Frank McFadden	(FM)	tie
Phil Dobbin	(PD)	tie
Gavin Murry	(GM)	tie
Alan Johnstone	(AJ)	Infraco
Stefan Rotthaus	(SR)	Infraco
Holger Plate	(HB)	Infraco
Duncan Fraser	(DF)	CEC
Derek Fordyce	(Df)	CEC
Tom Kelly	(TK)	SDS
Alan Dolan	(AD)	SDS

Introduction

Frank, Stefan and Holger introduced themselves to the group and a round robin introduction with responsibility followed from the remaining members.

Existing Road Construction

- 1) AJ stated testing consisting of FWD, GPR and coring were all completed from Haymarket to Saint Andrews Place on the 22nd of July.
- 2) The intuitive results support the case that the roads for the most part are in fair to good condition with the exception of utility reinstatement trenches.
- 3) AJ stated the testing of the core samples had commenced and would be complete by 15th August. From this a draft report would be produced by Mouchel for the 5th of September and a final report would be available from the 15th of September.
- 4) FM requested the report be split to give information on Princess Street as early as possible to facilitate early conclusions on this critical area of works.
- 5) BSC requested trial hole information collected by the Mudfa works be provided to assist the design consideration. PD has already issued this information to David Taylor of BSC but it can be reissued if required.
- 6) BSC asked for assurance that trench reinstatements are adequate to carry the loadings imposed by the final roads design.
- 7) AJ stated a digital film of the GPR testing will shortly be forwarded to CEC for information.



Road Pavement

- 1) SR stated BSC proposed to alter the proposed design to achieve the employer's requirements without requiring full road reconstruction throughout the works.
- 2) AJ tabled a pictorial level survey which indicated the departures from existing level that would be required to achieve the current proposed design.
- 3) BSC stated they wished to revise the proposed levels to improve road profile within the proposed works.
- 4) FM reminded BSC that all disciplines within the Tram project must be involved in any level adjustment, track, OLE etc.
- 5) DF presented an overview of the design process in the form of Prescription verse Performance and counselled against the dangers of a mix and match with the two approaches.
- 6) BSc were asked to produce a who/what/when diagram to indicate the areas which will be redesigned, what deviation from standard is required and when they will be ready for review.
- 7) DF on behalf of CEC asked for confirmation of which organisation would be providing PI insurance for the proposed design.
- 8) FM stressed the end date for works within Princess Street will be 25th July 2009 and to maximise the available time Infracore must be ready to commence operations on the 5th of January 2009 this will require IFC drawings to be issued by 5th December 2008. BSC were requested to update the timetable for design review which has been included at the end of these minutes.

Any Other Business

A summary of the site investigation works was tabled this has been added as an appendix.

Next meeting due 14th August time and venue to be confirmed.



Mis-Alignment in BBS/SDS Solutions (1)

Roads & Drainage

- Road Cross-Section Geometry

	Planned	Programme	Actual	Comments
Initial Meeting			29 May 2008	Complete
Initial BBS Proposal			30 May 2008	Complete
Initial CEC Response			3 June 2008	Complete
Detail BBS/SDS proposal				
Princes Street	30 June 2008			As agreed
Shandwick Place	30 June 2008			As agreed
Haymarket Jct	30 June 2008			As agreed
St Andrews Sq.	30 June 2008			As agreed
1 week for CEC to approve				
CEC Comments				
Princes Street	7 July 2008			As agreed
Shandwick Place	7 July 2008			As agreed
Haymarket Jct.	7 July 2008			As agreed
St Andrews Sq.	7 July 2008			As agreed
Submit detailed design to CEC (in conjunction with pavement design)				
Princes Street	24 Nov 2008			
Shandwick Place	TBA			
Haymarket Jct	24 Nov 2008			
St Andrews Sq	TBA			
CEC Approval period 3 weeks				
CEC Approval				
Princes Street	15 Dec 2008			
Shandwick Place	TBA			
Haymarket Jct	15 Dec 2008			
St Andrews Sq	TBA			
One week for SDS to convert to IFC				
Issue IFC Design				
Princes Street	22 Dec 2008	22 Aug 08(v31)		
Shandwick Place	TBA	08 Jul 08(v31)		
Haymarket Jct	22 Dec 2008	08 Jul 08 (v31)		
St Andrews Sq	TBA	22 Aug 08 (v31)		
2 weeks for Infraco to prepare (Design concept				



is known)				
Construction Commence				
Princes Street	5 Jan 2009	5 Jan 2009		
Shandwick Place	TBA	9 Sept 2009		
Haymarket Jct	5 Jan 2009	5 Jan 2009		
St Andrews Sq.	TBA	9 Sept 2009		

Road Pavement Design

	Planned	Programme	Actual	Comments
Initial Meeting			29 May 2008	Complete
Initial BBS Proposal			30 May 2008	Complete
Initial CEC Response			3 June 2008	Complete
Detail BBS/SDS proposal				
Princes Street	09 Aug 2008			Split Report
Shandwick Place	23 Aug 2008			
Haymarket Junction	09 Aug 2008			Split Report
St Andrews Sq.	23 Aug 2008			
4 weeks for CEC to comment				
CEC Comments				
Princes Street	09 Sept 2008			Part report
Shandwick Place	23 Sept 2008			
Haymarket Junction	09 Sept 2008			Part report
St Andrews Sq.	23 Sept 2008			
Submit detail design to CEC (worked back)	11 weeks to design 1 st two areas.			
Princes Street	24 Nov 2008			
Shandwick Place	TBA			
Haymarket Jct	24 Nov 2008			
St Andrews Sq	TBA			
3 weeks for CEC to approve (partial submission ie 2 out of 4 areas)				
CEC Approval				
Princes Street	15 Dec 2008			
Shandwick Place	TBA			
Haymarket Jct	15 Dec 2008			
St Andrews Sq	TBA			
1 week to convert to IFC				
Issue IFC Design				



<p>(Worked back from Construct programme)</p> <p>Princes Street Shandwick Place Haymarket Jct. St Andrews Sq.</p> <p>2 weeks for Infraco to prepare (design concept now known)</p> <p>Construction Commence</p> <p>Princes Street Shandwick Place Haymarket St Andrews Sq.</p>	<p>22 Dec 2008 TBA 22 Dec 2008 TBA</p> <p>5 Jan 2009 TBA 5 Jan 2009 TBA</p>	<p>22 Aug 08(v31) 08 Jul 08(v31) 08 Jul 08 (v31) 22 Aug 08 (v31)</p> <p>5 Jan 2009 9 Sept 2009 5 Jan 2009 9 Sept 2009</p>		
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**Bilfinger Berger – Siemens – CAF Consortium : Edinburgh Tram Network
Meeting Notes**

Subject	Roads Development Workshop	Location	City Point
Date	5/1/09	Time	
Attendees	Representing	Attendees	Representing
R Bell	Tie	A Dolan	SDS
P Dobbin	Tie	J Chandler	SDS
D Sharp	Tie	S Rotthaus	BSC
D Fraser	CEC	C Brady	BSC
T Spence	Consultant		
Distribution			

		Action	Date
1	General		
	Meeting held as follow-up to Roads Development Workshop on 25/11/09		
2	CEC Issues		
2.1	<p>Design Concept</p> <p>Road design based on DMRB, which is performance based. This is acceptable in areas of cut, but in areas of fill the condition of the substructure must be verified.</p> <p>The testing regime developed by SDS as part of the redesign/construction management process must fully define testing, including use of FWD testing as well as CBR tests. Particular attention must be paid to areas where existing road substructure is left in place.</p>	SDS	
2.2	<p>Utility Works</p> <p>MUDFA Utility reinstatement has been specified to RAUC Class 1 requirements, but some of the roads are in fact subject to the heavier Class 0 loading. Some existing reinstatement is non compliant.</p> <p>During the general testing which will be defined in the redesign/construction process to be developed by SDS, additional in-situ testing may be required to establish the rigidity/capacity of existing MUDFA reinstatement works.</p>	Tie/CEC	
2.3	<p>Setts at Ocean Terminal and other Locations</p> <p>CEC drew attention to the expertise they have developed in this area.</p>		

	working with academic research partners, over a long period of road construction and maintenance in Edinburgh. T Spence will contact BSC directly to ensure the existence of this expertise is understood.	TS	
2.4	Leith Walk BSC existing proposal to construct carriageway before centre trackform was queried by Tie. BSC to review and confirm/amend.	BSC	
	Tie to issue instruction to carry out FWD survey on Leith Walk asap to provide some information on condition of MUDFA reinstatement.	Tie	
2.5	Technical Approval CEC advised that TA is subject to comments, including the comment that design life of existing IFC roads design is not yet approved. SDS to review and comment as required.	SDS	

Date	Description	Debit	Credit

**Bilfinger Berger – Siemens – CAF Consortium : Edinburgh Tram Network
Meeting Notes**

Subject	Roads and Trackform Development Workshop Issues	Location	Project Office
Date	5 th February 2009	Time	
Attendees	Representing	Attendees	Representing
Frank McFadden	Tie	Steve Reynolds	SDS
Robert Bell	Tie	Jason Chandler	SDS
Colin Brady	BSC	Alan Dolan	SDS
Stefan Rotthaus	BSC	Kate Shudall	SDS
Baltazar Ochoa	BSC		
Distribution	Attendees R Brueckmann M Wilken		

		Action	Date
1	<p>General</p> <p>The meeting was held to review the design estimates produced in response to Tie Instructions arising from the Development Workshop process for Roads & Drainage and for Trackform (Tie letters no INF CORR 548 and INF CORR 547 respectively, both dated 18th December 2008), and further necessary work not covered by these instructions (see section 2.4 below).</p> <p>The meeting resulted in agreement to proceed to issue of instructions by Tie to implement the design activities (which relate to civil works scope only), and these notes will therefore be incorporated into the relevant Development Workshop Reports.</p>		
2	<p>Roads & Drainage</p>		
2.1	Status of current documentation reviewed and format explained (see attached notes).	Note	
2.2	<p>Proposed process for road design is described on flowchart (attached). SDS to remove references to CEC on flowchart and reissue.</p> <p>CEC acceptance of process will be managed by Tie. Approval of detailed road design in different locations will be by discharge of conditions to existing approval, a full resubmission for approval is not required.</p>	KSh	asap
2.3	SDS confirmed that, if instructed, roads design will be undertaken by additional resources, that resource is available to meet the likely	FMcF	ongoing

	programme and that resource will not be reallocated from other tasks already in progress.	JCh	Ongoing
2.4	<p>SDS explained the basis of their estimates no DCR 0126 and DCR 0140 (attached).</p> <p>DCR 0126 covers the work described in letter no CORR INF 548, but the bulk of the design work necessary is to assess test information for each specific area, select the appropriate solutions and produce construction drawings which provide clear direction for implementation, and will be updated by the site team to reflect as-built details. This scope is detailed in estimate no DCR140.</p> <p>BSC will collate the workscope to be instructed, including any necessary clarifications, and produce a draft instruction for Tie consideration.</p> <p>Tie agreed that the overall workscope covered by DCR126 and DCR140 is required, and will issue instructions accordingly.</p>	<p>CBr</p> <p>FMcF</p>	<p>w/c 9/2/09</p> <p>w/c 9/2/09</p>
2.5	<p>SDS will commence work on the overall scope prior to issue of formal BSC instruction, on basis of email confirmation from BSC that initial work carried out on this basis will be reimbursed in event instruction from Tie is not received.</p> <p>Initial priority is Princes Street, working eastwards from Charlotte Street junction. Assess existing test information and advise any further testing required.</p>	<p>JCh</p> <p>ADo</p>	<p>6/2/09</p> <p>6/2/09</p>
2.6	Testing will be carried out in accordance with scope identified by SDS, but procured and managed by BSC. Testing is not included in existing SDS estimates, and BSC to advise costs when scope known. This will require additional instruction from Tie.	<p>CBr</p> <p>FMcF</p>	<p>asap</p> <p>asap</p>
3	Trackform		
3.1	<p>SDS estimate no DCR125 comprises three distinct work streams :-</p> <ul style="list-style-type: none"> • Revision of existing drawings to incorporate Infracore trackform proposals • Production of a suite of ground improvement design solutions and Production of a construction methodology for the process of implementation of ground improvement • Analysis of vibration performance of Infracore trackform proposals 		

.../2

	and Production of vibration mitigation design solutions		
3.2	<p>Revision of Existing Drawings</p> <p>BSC/SDS agreed that the drawings would show all relevant details of the Siemens trackform, including any physical infrastructure provided for track drainage etc, and in particular details such as the road surface-track joint. The drawings will not be the record of EMC or stray current design, but will show relevant details (such as connection points) if any.</p>	CBR/JCh	ongoing
	Tie agreed to instruct the drawing revision scope as contained in estimate DCR125.	FMcF	w/c 9/2/09
3.3	<p>Ground Improvement Design</p> <p>Design Parameters are confirmed to be 120MN/m² on-street and 80MN/m² off-street, as shown on relevant drawings.</p> <p>Void spanning design criterion is confirmed as 1m span in any direction at any location, as advised by SDS.</p> <p>It was confirmed that no reinforcement is to be provided for stray current collection/containment. All reinforcement is to be protected against stray current corrosion, in same way as any other structural reinforcement.</p>	Ado	ongoing
	Tie agreed to instruct the ground improvement design scope as contained in estimate DCR125.	FMcF	w/c 9/2/09
3.4	<p>Vibration Analysis and Mitigation Design</p> <p>SDS confirmed that the reference design, which does not include any specific mitigation measures other than the identified rail and coating) satisfied the requirements of the Project Noise and Vibration Report.</p> <p>SDS are to analyse the Infracore Proposal for trackform, and identify any exceedences, above the requirements of the Project Noise and Vibration Report. They are then to produce construction designs to mitigate these exceedences, such that the requirements of the Report are achieved.</p>	Note	
	Tie agreed to instruct the ground improvement design scope as	Ado	ongoing

<p>contained in estimate DCR125.</p>	<p>FMcF</p>	<p>w/c 9/2/09</p>
<p>Tie advised that they might instruct further vibration mitigation in specific locations, to satisfy other undertakings. Tie to advise BSC when requirements are known.</p>	<p>FMcF</p>	<p>ongoing</p>

5 tie CHANGE ORDERS



Our ref: 25.1.201/JHi/1648

18 February 2009

Parsons Brinckerhoff
CityPoint
65 Haymarket Terrace
Edinburgh
EH12 5HD

Bilfinger Berger-Siemens- CAF
Consortium

BSC Consortium Office
9 Lochside Avenue
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United Kingdom

Phone: +44 (0) 131 452 2800

For the attention of Jason Chandler

Dear Sirs,

**Edinburgh Tram Network Infraco
INTC 271 – Road Construction Methodology
Your Reference DCR0126 and DCR0140**

We refer to your Estimate Reference DCR0126 issue 2 amended 27th January 2009 and DCR0140 issue 1a amended 10 February 2009 relating to the design portion of Methodology Statement and Analysis of Roads Construction.


We hereby authorise you to proceed with the design works as detailed in the SDS Design Change Estimate and enclose our Design (Client) Change Order No DCO-019 and DCO-020.

Please acknowledge receipt of this Change Order and confirm the timescales to implement this additional work with specific reference to Leith Walk and Princess Street.


Yours faithfully,


CHB Brady
Project Director
Bilfinger Berger Siemens CAF Consortium

Design (Client) Change Order

Project: Edinburgh Tram Network		Date: 17 February 2009
From: Bilfinger Berger Siemens CAF Consortium		Ref. Number: DCO-020
To: Parson Brinckerhoff - Jason Chandler		
INTC No.271	Change Estimate No.	DCR0140
Scope of Change	Analysis of Roads Construction Details.	
Reason for Change	Outcome of Roads and Drainage Development Workshop.	
Change Value (Programme Implications are Included in the Value)	Change :- 32 Packages at £9,357.50 = £299,440.00.	
Relief required from compliance with SDS obligations under the agreement:-	None	
Impact on Performance of the Services:-	None	
Impact on Master Programme and Programme:-	None	
Any additional Consents, Land Consents and/or Traffic Regulation Orders:-	None	
Any amendment required to the Agreement or the Key Subcontracts as a result of this Change:-	None	
Any new agreements with third parties:-	None	
Proposed Method of Delivery of this Change:-	Additional Design Resources	
Effect on Milestone and / or lump sum Payments:-	Lump Sum Payment	
Proposals to mitigate:-	None	
Period for Delivery of Change Order	7 Days from testing results for each section of the road	
Authorised:	Date: 17 Feb 2009	
(CN) Title/Name: Stefan Rotthaus - Engineering Manager	Signature: 	
Received:	Date:	
Name:	Signature:	

Design (Client) Change Order

Project: Edinburgh Tram Network		Date: 17 February 2009
From: Billfinger Berger Siemens CAF Consortium		Ref. Number: DCO-019
To: Parson Brinckerhoff - Jason Chandler		
INTC No.271	Change Estimate No.	DCR0126
Scope of Change	Produce a construction methodology statement to define management of the process of a) Testing in-situ to determine ground conditions b) Selection of Road Construction details.As tie letter dated 18 December 2008 reference INF CORR 547	
Reason for Change	Outcome of Roads and Drainage Development Workshop.	
Change Value (Programme Implications are included in the Value)	Change £ 17,125.50	
Relief required from compliance with SDS obligations under the agreement -	None	
Impact on Performance of the Services -	None	
Impact on Master Programme and Programme -	None	
Any additional Consents, Land Consents and/or Traffic Regulation Orders -	None	
Any amendment required to the Agreement or the Key Subcontracts as a result of this Change -	None	
Any new agreements with third parties -	None	
Proposed Method of Delivery of this Change -	Additional Design Resources	
Effect on Milestone and / or lump sum Payments -	Lump Sum Payment	
Proposals to mitigate -	None	
Period for Delivery of Change Order	TBA	
Authorised:	Date: 17 February 2009	
Title/Name: Stefan Rothaus - Engineering Manager	Signature: 	
Received:	Date:	
Name:	Signature:	



Bilfinger Berger UK Limited EDI	
Date Received	16 FEB 2009
File Name	
Pages	
Distribution	

For The Attention of Colin Brady
Project Director
Bilfinger Berger Siemens CAF Consortium
9 Lochside Avenue
Edinburgh EH12 9DJ

Our Ref: INF CORR 755

Date: 13th February 2009

Dear Sirs,

**Edinburgh Tram Network – Infraco
Road Construction Methodology – Design Only
Change Order Number 19**

We refer to your letter dated 10th February 2009 reference 25.1.201/BOc/1548 enclosing your revised Estimate associated with additional works to determine the condition of existing roads, analysis and interpretation of data and the provision of detailed pavement design / specification.


In response please find attached Change Order Number 19 for gross £372540.13 (Breakdown attached).

Please acknowledge receipt of this Change Order and confirm the timescales to implement this additional work with specific reference to Leith Walk and Princess Street.

Yours faithfully



Steven Bell
Project Director – Edinburgh Tram

Title CHANGE ORDER	
Project:	INFRACO
Date:	13th February 2009
Change Estimate No:	
Change Order No:	19
Change Description:	Road Construction Methodology (Design Only)
Change Value	£372640.13 (Excl VAT)
	Final value of Consortium Prelims to be reviewed on completion of the Contract Head Office Overhead and Profit to be determined in accordance with Clause 4.7.2 of Schedule Part 4
Scope of Works:-	<p>1 Produce methodology / flowchart to define the management of:- Determination of existing road condition from visual survey and available information. Determination of existing road condition from in-situ test results (Testing by others) Analysis and interpretation of data Provision of detailed pavement design and specification</p> <p>2 Stage 1: Determination of existing road condition from visual survey and available information</p> <p>3 Stage 2: Determination of existing road condition from in-situ test results (testing by others)</p> <p>4 Stage 3: Analysis and interpretation of data</p> <p>5 Stage 4: Provision of detailed pavement design and specification</p>
Relief required from compliance with Infraco obligations under the contract:-	None
Programme Impact and required Extension of Time:-	None
Impact on Performance:-	None
Any additional Consents, Land Consents and/or Traffic Regulation Orders:-	None Required
Any amendment or revision required to existing Consents, Land Consents and/or Traffic Regulation Orders:-	None Required
Any new agreements with third parties:-	None Required
Any amendment required to the Agreement or the Key Subcontracts as a result of this Change:-	None
Proposed Method of Delivery of this Change:-	Method Statements / Risk Assessments to be submitted for approval.
Any Changes required to the terms of the Agreement and/or the SDS Contract:-	None
Effect on Milestone Payments:-	BSC to update Milestone Schedule
Authorised:	Date: 13/2/09
Title/Name: DENNIS MURRAY	Signature: 
Received:	Date:
Name:	Signature:

Design Only - Methodology Statement and Analysis of Road Works

Item	Description	Qty	Unit	Rate	Amount
A	SDS Estimate Costs			Sum	£380.00
B	SDS Estimate Number DCR0126 Methodology Statement as attached - Appendix 3			Sum	£17,125.50
C	SDS Estimate Costs			Sum	£380.00
D	SDS Estimate Number DCR0140 Analysis of Roads Construction Details as attached - Appendix 4	32	packages	£9,357.50	£299,440.00
	Note: Coring, CBR value testing and FWD testing Not Included in this Estimate.				
Total					£317,325.50
	Consortium Overheads Prelims	7.4%		£317,325.50	£23,482.08
	Sub-total				£352,865.96
	Head Office Overheads and Profit	10.00%		£317,325.50	£31,732.55
Total					£304,090.51

- * Consortium Prelims to be reviewed on completion of the Contract /372540.13
- * W/o overheads & Profit to be determined in accordance with clause 4.7.2 of Schedule Part 4.



SIEMENS



Our ref: 25.1.201/BOc/1548

10 February 2009

file limited
CityPoint
65 Haymarket Terrace
Edinburgh
EH12 5HD

Bilfinger Berger-Siemens- CAF
Consortium

BSC Consortium Office
9 Lochside Avenue
Edinburgh Park
Edinburgh
EH12 9D
United Kingdom

Phone: +44 (0) 131 452 2800

For the attention of **Steven Bell – Tram Project Director**

Dear Sirs,

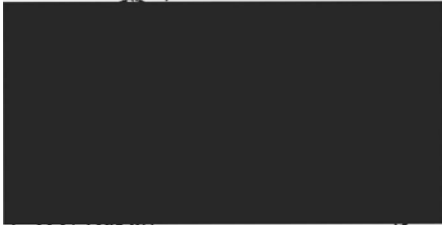
**Edinburgh Tram Network Infraco
Infraco Contract – Infraco Notification of tie Change (INTC) No 271
Road Construction Methodology – Design Only.**

Further to our letter reference 25.1.201/BOc/1508, dated 06 February 2009, we attach a revised SDS estimate in the sum of £ 384,598.51 exclusive of V.A.T, which has been reduced in response to comments made by our engineering team.

We also attach a proposed draft instruction, which we believe incorporates the agreements reached in the Supplementary Development Workshop on 5 February 2009 and accurately describes the agreed scope of design work required. A copy of the Supplementary Development Workshop notes is also attached.

We would be grateful for your urgent issue of a Change Order to continue with this design work..

Yours faithfully,



C H B Brady
Project Director
Bilfinger Berger Siemens CAF Consortium

Design Only - Methodology Statement and Analysis of Road Works

Item	Description	Qty	Unit	Rate	Amount
A	SDS Estimate Costs			Sum	£380.00
B	SDS Estimate Number DCR0126 Methodology Statement as attached - Appendix 3			Sum	£17,125.50
C	SDS Estimate Costs			Sum	£380.00
D	SDS Estimate Number DCR0140 Analysis of Road's Construction Details as attached - Appendix 4	32	Packages	£9,357.50	£299,440.00
	Note: Coring, CBR value testing and FWD testing Not Included in this Estimate.				
Total					£317,325.50
Consortium Overheads		11.20%		£317,325.50	£35,540.46
Sub-total					£352,865.96
Head Office Overheads and Profit		10.00%		£317,325.50	£31,732.55
Total					£384,598.51



CHANGE ESTIMATE
SDS CONTRACT

Project:	Edinburgh Tram Network		
Date:	23 rd January 2009 (revised 27 th January 2009)	Issue:	2
Change Estimate Number:	DCR0126		
Change Notice Number	RDC075		
Change Estimate Title:	Methodology Statement for Road works		

Change Estimate Description:

Pavement assessment includes 4 stages as shown in the attached flowchart.

This estimate covers the production of the flowchart/ methodology and Stage 1 & Stage 4 of the flowchart.

The first stage consists of existing road condition visual survey and review and collect of existing information from as build drawings, existing core information and CEC condition report. Based on this information, damage to the existing pavement caused with heavy construction loading will be assessed. The details of first stage has shown as A to G of attached flowchart. All existing information such as existing core information, as build drawings and CEC condition report need to be provided prior to visual survey.

The fourth and final stage as shown in attached flowchart will include the preparing the detail pavement design and specification (e.g construction joint details, Appendix 7/1) for pavement disturbed by track construction for the generic condition.

Stages 2 & 3 (DCR0140) will consider specific areas of design.

Basis for the Change Estimate:

RDC075 received 08th January 2009 and tie letter dated 18th December 2008.

Meeting with SDS and BSC 27th January 2009.

Schedule Impact:

To Be Confirmed by when instruction is received.

Cost Impact:

Preparing Estimate £380.00 This amount to be paid irrespective of work being instructed

Change Work; £17,125.50

Other Impacts/Issues:

This Change will not utilise any staff which are currently being utilised under Design and Construction Support.

There are no savings incurred by SDS due to this change.

SDS Authorisation (print name and function below)	Date:	23/1/09
Jason Chandler Project Manager	Signature:	



CHANGE ESTIMATE
SDS CONTRACT

BSC Authorisation		Date:	
Change cancelled <input type="checkbox"/>	SDS to revise Estimate <input type="checkbox"/>	Refer to tie board <input type="checkbox"/>	Prepare Change Order <input type="checkbox"/>
Colin Brady		Signature:	

CHANGE ESTIMATE DCR0126 v2

Contract Name	EDINBURGH TRAM		Bullet point 1 of change: Produce methodology/ flowchart for Pavement design	Bullet point 1 of change: Stage 1 of flowchart: Visual Survey	Bullet point 1 of change: Stage 1 of flowchart: Assessment and review of existing information	Bullet point 1 of change: Stage 1 of flowchart: Assessment of damage to the existing pavement during construction as identified in Sections B&D of attached flowchart		
Contract No	OLE90390A							
Location								
Section	SW							
Change title	Methodology Statement for Road Works	DCR0126 v2						
Change Description	Road construction methodology and assessment							
DETAILED DESIGN STAGE								
Title	Name	Contract Rate	Hours	Cost	Hours	Cost	Hours	Cost
Technical Support	Technical Support	£ 38.00		£ -		£ -		£ -
CAD Technician	CAD Tech	£ 38.00		£ -		£ -		£ -
Graduate Designer	Graduate Designer	£ 55.00		£ -	25.00	£ 1,375.00		£ -
Principal Designer	Principal Designer	£ 95.00	9.50	£ 902.50	25.00	£ 2,375.00	45.00	£ 4,275.00
Senior CAD Technician	Senior CAD Technician	£ 49.00		£ -		£ -		£ -
Senior Designer	Senior Designer	£ 78.00		£ -		£ -		£ -
Material				£ -		£ -		£ -
			9.50	£ 902.50	50.00	£ 3,750.00	45.00	£ 4,275.00
							25.00	£ 2,375.00

CHANGE ESTIMATE DCR0126 v2

Contract Name		EDINBURGH TRAM		Bullet point 1 of change: Stage 1 of flowchart: Meeting	Bullet Point 2 of change: Stage 4 of flowchart: Preparing Pavement strengthening design specification (e.g Appendix 7.1) for different condition scenarios	Coordination of modifications to SDS design due to instruction from tie resulting from roads development workshop	TOTALS	
Contract No		ULE90390A						
Location								
Section		SW						
Change title		Methodology Statement for Road Works		DCR0126 v2				
Change Description		Road construction methodology and assessment						
DETAILED DESIGN STAGE								
Title	Name	Contract Rate	Hours	Cost	Hours	Cost	Hours	Cost
Technical Support	Technical Support	£ 38.00		£ -		£ -	0.00	£ -
CAD Technician	CAD Tech	£ 38.00		£ -		£ -	0.00	£ -
Graduate Designer	Graduate Designer	£ 55.00		£ -		£ -	25.00	£ 1,375.00
Principal Designer	Principal Designer	£ 95.00	15.00	£ 1,425.00		£ -	140.00	£ 13,300.00
Senior CAD Technician	Senior CAD Technician	£ 49.00		£ -	50.00	£ 2,450.00	50.00	£ 2,450.00
Senior Designer	Senior Designer	£ 78.00		£ -		£ -	0.00	£ -
Material				£ -		£ -	0.00	£ -
			15.00	£ 1,425.00	50.00	£ 2,450.00	215.00	£ 17,125.00

Project:	Edinburgh Tram Network		
Date:	27 th January 2009 (amended 10 February 2009)	Issue:	1a
Change Estimate Number:	DCR0140		
Change Notice Number	N/A		
Change Estimate Title:	Analysis of Roads Construction Details		
Change Estimate Description:			
<p>Pavement assessment includes 4 stages, as shown in the attached flowchart.</p> <p>This estimate covers the production of the flowchart/ methodology and Stage 2 & Stage 3 of the flowchart.</p> <p>The <u>second stage</u> shown in attached flowchart details the process for assessment of pavement condition survey in areas disturbed by tram construction. Coring, CBH value testing, GPR and FWD testing to be undertaken by others. These will be based upon tests carried out for each section of road produced. The SDS scope for this section will be the determination of the by the location of tests to be carried out to inform the interpretation and analysis in Stage 3.</p> <p>The <u>third stage</u> is the analysis of testing results as the output of stage two. The pavement assessment consists of pavement analysis, interpretation and reporting and would include:-</p> <ul style="list-style-type: none"> • Back-analysis of all data to determine the effective stiffness and condition of the various pavement and subgrade layers; • Assessment of the residual life of the pavement based on structural considerations and the results of the laboratory testing; • Assessing areas of carriageway requiring overlaying or partial/full reconstruction. <p>The required time to complete the above tasks for each section of road will be approx. 7 days from testing results received to provision of the revised design (excluding approvals). SDS will then approach CEC to secure agreement on the solution as designed. The enclosed cost is based on preparing a design for each area of the scheme that testing is received for, not per section or sub-section. It is assumed testing will proceed in accordance with the priorities driven by the BSC construction programme.</p> <p>Stages 1 & 4 are covered under DCR0126.</p>			
Basis for the Change Estimate:			
<p>RDC075 received 08th January 2009 and his letter dated 18th December 2008.</p> <p>Draft instruction rev01 handed to SDS in meeting on 27th January 2009 with Colin Brady and Stefan Rothhaus.</p>			

Schedule Impact:

The required time to complete the above tasks for each section of road will be approx. 7 days from testing results received to provision of the revised design plus approval period.

Cost Impact:

Preparing Estimate: £380.00 This amount to be paid irrespective of work being instructed

Change Work: £9,357.50 per area of the scheme that testing is received for, not per section or sub-section. It is assumed testing will proceed in accordance with the priorities driven by the BSC construction programme.



CHANGE ESTIMATE
SDS CONTRACT

BSC have advised that testing will take place at intervals of 250m (approx. 32 discreet packages of work for 8km of on-stream running).
Therefore Change Work total based on assumption above: £299,440.00

Other impacts/Issues:

This Change will not utilise any staff which are currently being utilised under Design and Construction Support.
There are no savings incurred by SDS due to this change.

SDS Authorisation (print name and function below)		Date:	10 Feb 09
Jason Chandler Project Manager		Signature:	
BSC Authorisation		Date:	
Change cancelled <input type="checkbox"/>	SDS to revise Estimate <input type="checkbox"/>	Refer to tie board <input type="checkbox"/>	Prepare Change Order <input type="checkbox"/>
Colin Brady		Signature:	

CHANGE ESTIMATE DCR0140

Contract Name	EDINBURGH TRAM		Stage 2 of flowchart: Site visit for each area	Stage 3 of flowchart: Analysis of testing results	Stage 3 of flowchart: Checking of data and revised design	Stage 3 of flowchart: Reporting
Contract No	OLE90190A					
Location						
Section	SW					
Change title	Methodology Statement for Road Works	DCR0140				
Change Description	Analysis of Road construction details Stage 2 & 3 of flowchart					

DETAILED DESIGN STAGE

Title	Name	Contract Rate	Hours	Cost	Hours	Cost	Hours	Cost	Hours	Cost
Technical Support	Technical Support	£ 38.00		£ -		£ -		£ -		£ -
CAD Technician	CAD Tech	£ 38.00		£ -		£ -		£ -		£ -
Graduate Designer	Graduate Designer	£ 55.00	10.00	£ 550.00		£ -		£ -		£ -
Principal Designer	Principal Designer	£ 95.00	6.50	£ 760.00	19.00	£ 1,805.00		£ -	9.50	£ 902.50
Senior CAD Technician	Senior CAD Technician	£ 48.00		£ -		£ -		£ -		£ -
Senior Designer	Senior Designer	£ 78.00		£ -		£ -	5.00	£ 390.00		£ -
Material				£ -		£ -		£ -		£ -
			18.00	£ 1,310.00	19.00	£ 1,805.00	5.00	£ 390.00	9.50	£ 902.50

CHANGE ESTIMATE DCR0140

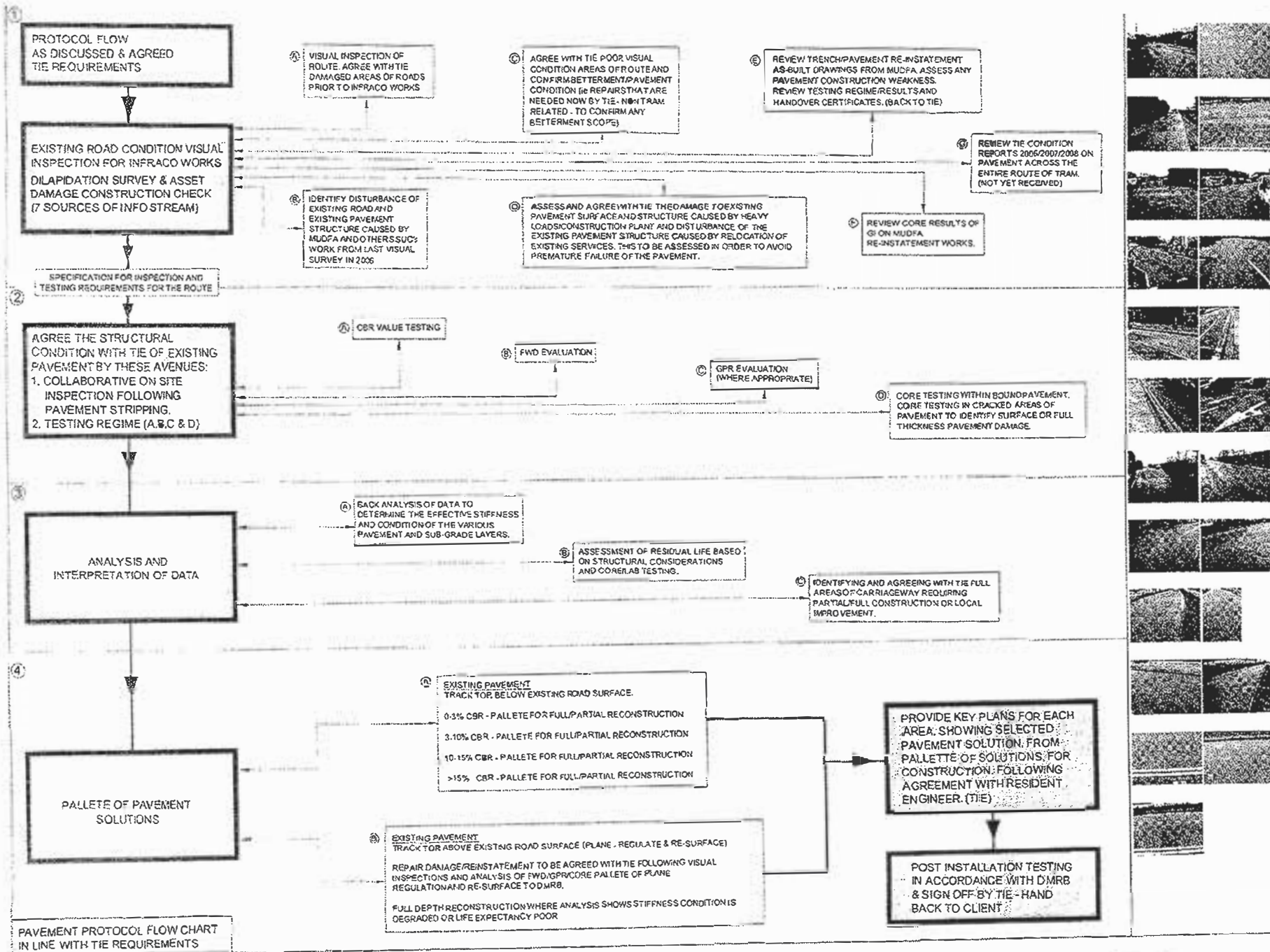
Contract Name	EDINBURGH TRAM		Stage 3 of flowchart: Pavement strengthening design and preparing construction details	Stage 3 of flowchart: CAD preparation of associated sketches and details	Stage 2 of flowchart: Additional meetings and site visit expected to discuss Technical Approvals with CEC	Stage 3 of flowchart: Design Assurance	Stage 3 of flowchart: Printing and Courier costs	TOTALS							
Contract No	DL90390A														
Location															
Section	SW														
Change title	Methodology Statement for Road Works														
Change Description	DCR0140 Analysis of Road construction details Stage 2 & 3 of Rowchart														
DETAILED DESIGN STAGE			Hours	Cost	Hours	Cost	Hours	Cost	Hours	Cost	Hours	Cost	TOTAL Hours	TOTAL Cost	
Title	Name	Contract Rate													
Technical Support	Technical Support	£ 38.00		£ -		£ -		£ -		£ -		£ -	0.00	£ -	
CAD Technician	CAD Tech	£ 38.00		£ -		£ -		£ -		£ -		£ -	0.00	£ -	
Graduate Designer	Graduate Designer	£ 55.00		£ -		£ -		£ -		£ -		£ -	10.00	£ 550.00	
Principal Designer	Principal Designer	£ 95.00	19.00	£ 1,805.00		£ -	12.00	£ 1,140.00	8.00	£ 760.00		£ -	35.50	£ 3,372.50	
Senior CAD Technician	Senior CAD Technician	£ 49.00		£ -	5.00	£ 245.00		£ -		£ -		£ -	5.00	£ 245.00	
Senior Designer	Senior Designer	£ 78.00		£ -		£ -		£ -		£ -		£ -	5.00	£ 390.00	
Material				£ -		£ -		£ -		£ 1,000.00		£ -	0.00	£ 1,000.00	
			19.00	£ 1,805.00	5.00	£ 245.00	12.00	£ 1,140.00	8.00	£ 760.00	0.00	£ 1,000.00	35.50	£ 3,357.50	

ROADS AND DRAINAGE DEVELOPMENT WORKSHOP

DRAFT INSTRUCTION FOR DESIGN

1. Produce methodology / flowchart to define the management of:
 - Determination of existing road condition from visual survey and available information;
 - Determination of existing road condition from in-situ test results (testing by others);
 - Analysis and interpretation of data;
 - Provision of detailed pavement design and specification
2. Stage 1: Determination of existing road condition from visual survey and available information
3. Stage 2: Determination of existing road condition from in-situ test results (testing by others)
4. Stage 3: Analysis and interpretation of data
5. Stage 4: Provision of detailed pavement design and specification.

All as detailed in attached SDS Estimates DCR0126 and DCR0140 and the notes of the Supplementary Development Workshop (tie/BSC/SDS) held on 5 February 2009.



**Bilfinger Berger – Siemens – CAF Consortium : Edinburgh Tram Network
Meeting Notes**

Subject	Roads & Drainage and Trackform Development Workshop Issues	Location	Project Office
Date	5 th February 2009	Time	
Attendees	Representing	Attendees	Representing
Frank McFadden	Tie	Steve Reynolds	SDS
Robert Bell	Tie	Jason Chandler	SDS
Colin Brady	BSC	Alan Dolan	SDS
Stefan Rotthaus	BSC	Kate Shudall	SDS
Baltazar Ochoa	BSC		
Distribution	Attendees R Brueckmann M Wilken		

		Action	Date
1	<p>General</p> <p>The meeting was held to review the design estimates produced in response to Tie Instructions arising from the Development Workshop process for Roads & Drainage and for Trackform (Tie letters no INF CORR 548 and INF CORR 547 respectively, both dated 18th December 2008), and further necessary work not covered by these instructions (see section 2.4 below).</p> <p>The meeting resulted in agreement to proceed to issue of instructions by Tie to implement the design activities (which relate to civil works scope only), and these notes will therefore be incorporated into the relevant Development Workshop Reports.</p>		
2	<p>Roads & Drainage</p>		
2.1	Status of current documentation reviewed and format explained (see attached notes).	Note	
2.2	Proposed process for road design is described on flowchart (attached). SDS to remove references to CEC on flowchart and reissue. CEC acceptance of process will be managed by Tie. Approval of detailed road design in different locations will be by discharge of conditions to existing approval, a full resubmission for approval is not required.	KSh FMcF	asap ongoing
2.3	SDS confirmed that, if instructed, roads design will be undertaken by additional resources, that resource is available to meet the likely		

	programme and that resource will not be reallocated from other tasks already in progress.	JCh	Ongoing
2.4	<p>SDS explained the basis of their estimates no DCR 0126 and DCR 0140 (attached).</p> <p>DCR 0126 covers the work described in letter no CORR INF 548, but the bulk of the design work necessary is to assess test information for each specific area, select the appropriate solutions and produce construction drawings which provide clear direction for implementation, and will be updated by the site team to reflect as-built details. This scope is detailed in estimate no DCR140.</p> <p>BSC will collate the workscope to be instructed, including any necessary clarifications, and produce a draft instruction for Tie consideration.</p> <p>Tie agreed that the overall workscope covered by DCR126 and DCR140 is required, and will issue instructions accordingly.</p>	<p>CBR</p> <p>FMcF</p>	<p>w/c 9/2/09</p> <p>w/c 9/2/09</p>
2.5	<p>SDS will commence work on the overall scope prior to issue of formal BSC instruction, on basis of email confirmation from BSC that initial work carried out on this basis will be reimbursed in event instruction from Tie is not received.</p> <p>Initial priority is Princes Street, working eastwards from Charlotte Street junction. Assess existing test information and advise any further testing required.</p>	JCh	6/2/09
		ADo	6/2/09
2.6	Testing will be carried out in accordance with scope identified by SDS, but procured and managed by BSC. Testing is not included in existing SDS estimates, and BSC to advise costs when scope known. This will require additional instruction from Tie.	CBR FMcF	asap asap
3	Trackform		
3.1	<p>SDS estimate no DCR125 comprises three distinct work streams :-</p> <ul style="list-style-type: none"> • Revision of existing drawings to incorporate Infracore trackform proposals • Production of a suite of ground improvement design solutions and Production of a construction methodology for the process of implementation of ground improvement • Analysis of vibration performance of Infracore trackform proposals 		

.../2

and Production of vibration mitigation design solutions

<p>3.2</p>	<p>Revision of Existing Drawings BSC/SDS agreed that the drawings would show all relevant details of the Siemens trackform, including any physical infrastructure provided for track drainage etc, and in particular details such as the road surface-track joint. The drawings will not be the record of EMC or stray current design, but will show relevant details (such as connection points) if any.</p> <p>Tie agreed to instruct the drawing revision scope as contained in estimate DCR125.</p>	<p>CBR/JCh</p> <p>FMcF</p>	<p>ongoing</p> <p>w/c 9/2/09</p>
<p>3.3</p>	<p>Ground Improvement Design</p> <p>Design Parameters are confirmed to be 120MN/m² on-street and 80MN/m² off-street, as shown on relevant drawings.</p> <p>Void spanning design criterion is confirmed as 1m span in any direction at any location, as advised by SDS.</p> <p>It was confirmed that no reinforcement is to be provided for stray current collection/containment. All reinforcement is to be protected against stray current corrosion, in same way as any other structural reinforcement.</p> <p>Tie agreed to instruct the ground improvement design scope as contained in estimate DCR125.</p>	<p>Ado</p> <p>Ado</p> <p>Ado</p> <p>CBR</p> <p>FMcF</p>	<p>ongoing</p> <p>ongoing</p> <p>ongoing</p> <p>ongoing</p> <p>w/c 9/2/09</p>
<p>3.4</p>	<p>Vibration Analysis and Mitigation Design</p> <p>SDS confirmed that the reference design, which does not include any specific mitigation measures other than the identified rail and coating) satisfied the requirements of the Project Noise and Vibration Report.</p> <p>SDS are to analyse the Infracore Proposal for trackform, and identify any exceedences, above the requirements of the Project Noise and Vibration Report. They are then to produce construction designs to mitigate these exceedences, such that the requirements of the Report are achieved.</p> <p>Tie agreed to instruct the ground improvement design scope as</p>	<p>Note</p> <p>Ado</p>	<p></p> <p>ongoing</p>

contained in estimate DCR125.

FMcF w/c 9/2/09

Tie advised that they might instruct further vibration mitigation in specific locations, to satisfy other undertakings. Tie to advise BSC when requirements are known.

FMcF ongoing

APPENDIX 2



Bilfinger Berger UK Limited EDI		
Date Received	18 Dec 2008	Scanned
File Number	CI-01309	
Action		See Bill
Distribution		S

For The Attention of Colin Brady
Project Director
Bilfinger Berger Siemens CAF Consortium
9 Lochside Avenue,
Edinburgh Park,
Edinburgh EH12 9DJ

Our Ref: INF CORR 547

Date: 18th December 2008

Dear Sirs,

Edinburgh Tram Network
"Infraco – Instructions arising from Roads and Drainage Development Workshop"

Following our recent Roads and Drainage Development Workshop, we hereby instruct you to carry out the following;

1 Road Construction Details

Based on latest IFC drawings produce a construction methodology statement to define management of the process of:-

- testing in-situ to determine ground conditions:
- selection of road construction details from Design Schedule ULE90130-SW-SPN00139, Appendix 7.1 : Permitted Pavement Options, or as otherwise applicable where reduced depth construction is feasible;

Please forward an Estimate for these works in accordance with clause 80.4 and on receipt we will review and issue a change order.



Steven Bell
Project Director – Edinburgh Tram

6 APPENDICES

6.1 Development Workshop Process

Extract from Schedule 23, clauses 4.6, 4.7. 4.8

4.6 tie warrants that it has received a report from the SDS Provider (annexed at Part B of Appendix Part 7) setting out the misalignments between the Deliverables completed prior to the date of this Agreement and the Employer's Requirements and that it has issued initial instructions (in the form of the letter annexed at Part A of Appendix Part 7) to the SDS Provider in relation to addressing all such misalignments. Upon completion of the work entailed to resolve the misalignments, the SDS Provider confirms to tie and the Infraco that such Deliverables shall be consistent with the Employer's Requirements.

4.7 As soon as reasonably practicable, the Parties shall commence and expeditiously conduct a series of meetings to determine the development of the Infraco Proposals and any consequential amendment to the Deliverables (the "**Development Workshops**"). The matters to be determined at the Development Workshops shall be those set out in the report annexed at Part C of Appendix Part 7 (the "**Misalignment Report**"), together with any items identified as "items to be finalised in the SDS/BBS alignment workshops" in Appendix 4 to be dealt with in the following order of priority and objective unless otherwise agreed:

1. Roads and associated drainage and vertical alignment with the objective of minimising the extent of full depth reconstruction for roads thus minimising cost and construction programme duration
2. Structures value engineering, including track fixings to structures with the objective of enabling BBS to realise the Value Engineering savings for the structures identified in Schedules 4 and 30 of the Infraco Contract (Pricing and Infraco Proposals respectively)
3. OLE Design with the objective of identifying and agreeing the actions, responsibilities and programme to enable Infraco to implement their proposals for OLE as identified in the Infraco Proposals
4. Trackform with the objective of completing an integrated design to enable BBS to implement their proposals for trackform
5. Sub-station buildings with the objective of resolving the misalignment between Infraco Proposals and SDS Design with the minimum of changes to accommodate the Infraco Proposals for substations.

The following to be reviewed at the end of the Development Workshop to identify any issues arising from the above items:

1. Earthworks

2. Landscaping
3. OLE Foundations
4. Alignment
5. Site Clearance
6. Tramstops
7. all other items in the Misalignment Report together with any items identified as "items to be finalised in the SDS/BBS alignment workshops" in Appendix 4.

At the Development Workshop, the Parties shall also develop a strategy for co-operation between the SDS Provider and the Infraco to manage design development and the necessary interface between the Infraco's design and the design developed by the SDS Provider.

- 4.8 The product of the Development Workshops shall be a report signed by each of the Parties to detail the conclusions in respect of each matter and the payments to be made to the SDS provider in respect of the work to be carried out by the SDS Provider as a result of the conclusions set out in the report. Any consequential ~~the~~ Change Orders or instructions shall be appended to such report as and when the same are issued. ~~the~~ shall pay the SDS Provider for the work required for the Development Workshop on an hourly rate basis in accordance with the hourly rates set out in Appendix Part 8 and the SDS Provider agrees that the infraco shall not be liable to make such payments to the SDS Provider. For the avoidance of doubt, the Infraco and ~~the~~ agree that any amendment to the Deliverables completed prior to the date of this Agreement as set out in this report will be a Mandatory ~~the~~ Change under the Infraco Contract, and a Client Change under the SDS Agreement.

**6.2 Pavement Evaluation Report, Shandwick Place & Princes Street (Mouchel)
Document No 718376/R/01/B dated 18 September 2008**

	<h2>Document Transmittal</h2>	Form : F25-6
		Rev : A
		Page : 1 of 1

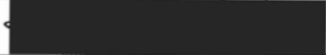
Project: Edinburgh Tram Network Infracore	Transmittal No: 0224
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Addressee: **ATTN. MS. L. MELVILLE,**
Tie Ltd, Citypoint, 65 Haymarket Terrace, Edlnburgh EH12 5HD

<p>Dear Sir / Madam, Please find attached the documents listed below which are forwarded to you for your action /information as appropriate. Please confirm receipt of the documents indicated by signing and returning a copy of this transmittal to the sender.</p>	<p>Transmittal Issued by: Stefan Rotthaus</p> <p>Signature: <i>S. Rotthaus</i></p>
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Originators Drawing Document No.	Rev/ Date	Status	Document Title	No. Copie	Reason for Issue	Response Required by
	Sept. 08	Draft	ETN Pavement Investigation	1	For Information	

Note: Failure to respond by the date stated will be construed as meaning "no comments "or drawing approved" as appropriate, unless otherwise stated in writing.

Reason for Issue Codes		Acknowledgement of Receipt	
Drawing Status Codes A - Approved B - Approved Subject to Comments C - Not Approved D - Issued F - No Comment	Action Codes 1 - For Construction 2 - For Comment 3 - For Approval 4 - For Design 5 - For Information 6 - Revise And Resubmit 7 - Refer To Covering Letter 8 - Return To Originator 9 - As Built	Name:	<i>ROBERT BEU</i>
		Title :	<i>CONST DIRECTOR</i>
		Signature :	
		Date :	<i>9/9/08.</i>

✓