

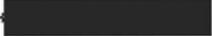
Our ref: 25.1.0201/CHBB/2239

9<sup>th</sup> April 2009

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Bilfinger Berger-Siemens- CAF  
Consortium

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

Phone: 

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

Dear Sirs,

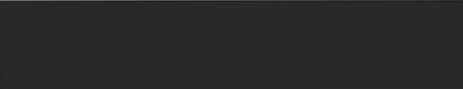
**Edinburgh Tram Network Infracore  
Development Workshop - OLE**

Further to the Development Workshop meeting on 3<sup>rd</sup> April 2009, we now enclose 2 copies of document no BSC/25.1.201/DWR/OLE, Issue 2, dated 9<sup>th</sup> April 2009. This document has been revised to incorporate the actions identified in the meeting on 3<sup>rd</sup> April 2009; the meeting notes are included. The report is submitted unsigned – we are circulating the front pages for signature within the Consortium and will provide those pages to you as quickly as possible.

To complete the Development Workshop process for OLE, the report needs to be agreed by the parties (by completing the signatures on page 2, and the relevant instructions from tie to BSC and BSC to SDS included. We will provide the SDS design estimate for the necessary work to you as soon as possible, so it can be used as the basis for a tie instruction.

In the meantime, we would be grateful to receive your confirmation that the content of the Development Workshop report is acceptable in principle, subject to completion of the process as described above.

Yours faithfully,

  
**M Foerder**  
Project Director  
Bilfinger Berger Siemens CAF Consortium

cc: CBr, RBr, SRO

# Development Workshop Report Overhead Line Equipment

BSC Consortium		
Position	Date	Approval
BSC Project Director		
BSC Deputy Project Director		

Inter Discipline Checking Process				
	Name	Position	Date	Signatures
Checked by (Siemens)				
Checked by (BB)				
Author	Ralf Honeck	Design Manager		
Document History				
Rev.	IssueDate	Description of Change	Author	
1	11/3/09	First Issue	R Honeck	
2	9/4/09	Amended following Development Workshop on 3/4/09	S Nesbitt	

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Revision	Summary of Changes	
	Reference	Description
1		First issue
2		As indicated by sidebar in text

Revision	Record of Agreement (ref Schedule 23, clause 4.8)		
	Name	Party	Signature
NOT USED			
2		Tie	
		BSC (BB)	
		BSC (Siemens)	
		SDS	
3		Tie	
		BSC (BB)	
		BSC (Siemens)	
		SDS	

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## DEVELOPMENT WORKSHOP REPORT : OVERHEAD LINE EQUIPMENT

### CONTENTS

- 1 Introduction
- 2 Misalignments
- 3 Conclusions
- 4 Notes of Development Workshop
- 5 Tie Change orders
- 6 Appendices
  - 6.1 Process
  - 6.2 Combined OLE/Lighting Loadings

## 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/OLE, is the report of the Development Workshop for Overhead Line Equipment.

In respect of any given system, such as overhead line equipment, 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.

The relevant sections of App 4 are reproduced below :-

Civils	OLE	OLE support foundation design	Yes	workshops To be finalised in SDS/BBS alignment workshops
-	Accommodation			

OLE	OLE	Outline design and approvals	Yes	
OLE	OLE	Detailed design - catenary	Yes	To be finalised in SDS/BBS alignment workshops
OLE	OLE	Approvals - catenary	Yes	SDS to be instructed to manage this process and all approvals that are not in current SDS scope
OLE	OLE	Detailed design - auto tensioned	Yes	To be finalised in SDS/BBS alignment workshops
OLE	OLE	Approvals - auto tensioned	Yes	SDS to be instructed to manage this process and all approvals that are not in current SDS scope
OLE	OLE	Building Fixing Report including design/approvals (excluding detailed wiring design and detailed building fixings locations)	Yes	To be finalised in SDS/BBS alignment workshops
OLE	OLE	Pantograph interface and performance characteristics	Yes	To be finalised in SDS/BBS alignment workshops
OLE	OLE	Typical cross sections and detailed cross sections	Yes	To be finalised in SDS/BBS alignment workshops
OLE	OLE	Proposal for poles, wiring arrangements and the tensioning equipment	Yes	To be finalised in SDS/BBS alignment workshops
OLE	OLE	Technical and performance specification for the OLE	Yes	To be finalised in SDS/BBS alignment workshops
OLE	OLE	Proposal for equipment type and method of supporting the equipment along the route, including the wall fixings	Yes	To be finalised in SDS/BBS alignment workshops

OLE	OLE	Detailed pole and wall fixing locations (easting and northing coordinates) and the detailed wiring design		Yes	Provided auto-tensioning used in city centre
OLE	OLE	Detailed wiring layout design	Yes		To be finalised in SDS/BBS alignment workshops
OLE	OLE	Detailed survey work including building fixing location, height and condition; ground condition and pole location surveys		Yes	To be finalised in SDS/BBS alignment workshops
OLE	OLE	Depot OLE Design	Yes		To be finalised in SDS/BBS alignment workshops
OLE	OLE	Specify forces & moments for masts	Yes		To be finalised in SDS/BBS alignment workshops
OLE	OLE	Mast foundations		Yes	To be finalised in SDS/BBS alignment workshops
Power	Power Supplies	Substation external and Distribution design and approvals		Yes	To be finalised in SDS/BBS alignment workshops
Power	Power Supplies	Substation internal and Distribution design and approvals	Yes		To be finalised in SDS/BBS alignment workshops
Power	Power Supplies	Specify ducting requirements & mast to receive power supply	Yes		To be finalised in SDS/BBS alignment workshops
Power	Power Supplies	Design ducting from substation to specified mast		Yes	To be finalised in SDS/BBS alignment workshops
Power	Power Supplies	Substation and Distribution design		Yes	To be finalised in SDS/BBS alignment workshops
Power	Power Supplies	Substation and Distribution design		Yes	To be finalised in SDS/BBS alignment workshops

The relevant sections of App 7, Pt C are reproduced below :-

<b>OLE Foundations</b>	Design to be completed to IFC status, all design consents and approvals obtained and BBS will construct IFC Design	Information from BBS to be issued on OLE poles, including loadings	Design: OLE Foundations	x x x x x x x x x x	PI is preparing a suite of standard OLE base designs which should cover the requirement
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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 as is contained in Sch 23. App7, Pt C, but repeated for each relevant section of the project. The table of OLE related misalignments for section 1A is reproduced below; the same information is repeated for other sections.

<b>1A.7</b>	<b>OLE Foundations</b>				
<b>1A.7.1</b>	Design to be completed to IFC status, all design consents and approvals obtained and BBS will construct IFC Design	Information from BBS to be issued on OLE poles, including loadings.	Design OLE Foundations		

## 2.2 Misalignment No 1 : OLE System

The Base Date Design Information for the OLE system (in terms of generic type) is described, among other references, on drawings no ULE 90130-SW-OLE-00001 and 0002, in drawing note 10 as follows :-

10. The type of equipment recommended for the network throughout the route is Auto-Tensioned (AT) trolley single wire equipment and Fixed Termination (FT) trolley wire equipment. The AT is proposed for the sections between Haymarket Yards and the Airport, and also along the Roseburn Corridor to Granton Square. The FT equipment is proposed for the remainder of the route and the city centre sections.

The Infraco proposals for OLE system, in terms of generic type are that the on-street (Newhaven – Haymarket) section will be auto-tensioned trolley wire and off-street (Haymarket - Airport) section will be auto-tensioned catenary.

The misalignment arises from the technical differences between these different systems.

## 2.3 Misalignment No 2 : OLE Pole Foundation Loads

The Base Date Design Information for OLE Pole Foundation Loads is shown in outline on drawing ULE 90130-SW-OLE-00005, and in more detail on drawings ULE ULE 90130-SW-OLE-00015 to 00022, which references design document no ULE90130-SW-SCH-00092v4, Overhead Line Equipment Pole Loading Schedule. Document 00092v4 references a number of separate pole loading calculations, but drawings 00015 to 00022 clarify that a single standard load case has been taken for design purposes, to simplify the process and reduce the number of foundation types. The reference design, unfactored load case is as follows :-

$$\begin{aligned}V &= 9\text{kN} \\ H &= 10\text{kN} \\ M &= 61\text{kNm}\end{aligned}$$

i.e all foundations are designed for a moment of 61kNm acting in any direction.

The Infraco proposals described in 2.2 above impose higher loads on the OLE foundations. Loads for line poles on straight track are in the range from 62kNm to 137kNm, and loads on special poles in the range 161kNm to 220kNm. The misalignment is that where these higher loads apply, larger foundations and larger diameter, longer, holding down bolts will be required

## 2.4 Misalignment No 3 : OLE Building Fixing Loads

OLE building fixing loads increased as a result of 2.2 above, if any.

## 2.5 Misalignment No 4 : OLE Pole and Building Fixing Locations

OLE pole foundation and building fixing locations (if any) amended as a result of 2.2 above.

4A : OLE Pole Locations have been amended, in that a number of poles have been deleted and some locations amended. Existing drawings require amendment to show actual pole locations. In some cases, approval for the revised locations is required.

4B : Building Fixing Locations

Location amendments (if any) to be shown on SDS drawings

## 2.6 Misalignment No 5 : Combined OLE/Lighting Poles

The IFC design is based on provision of combined OLE/Lighting poles at a number of specified locations. Four areas of misalignment exist

5A : the number and/or location of OLE poles is changed as result of 2.2 above. The reference design for lighting is affected in that any pole locations previously identified as combined OLE/Lighting poles but now not required by the Infraco OLE system will require the provision of alternative lighting, possibly in a form similar to OLE poles for Planning Consent reasons.

5B : The specific details of the combined OLE/Lighting poles now to be provided need to take into account any relevant aspects of the OLE system (eg tensioning equipment) which was not part of the reference design. The combined poles will comprise two elements :-

- basic OLE pole, adapted as necessary to permit use for lighting (access cover and extension connector
- lighting extension

5C : The Base Date Design Information for pole foundations does not reflect the loading of combined poles. Increased loads, reflecting combined poles, where applicable, are included in the revised design. Refer to Appendix 6.2 for detailed assessment of loadings arising from OLE system misalignment and from Combined OLE/Lighting.

5D : Additional design changes are required to accommodate revised earthing, bonding and insulation requirements.

## 2.7 Misalignment No 6 : OHLE Fixings at Depot Access Bridge

The reference design for trolley wire at the Depot Access bridge allowed for adequate clearance to be achieved on all spans without additional fixings.

The Infraco Proposal for auto tensioned catenary at the Depot Access bridge requires that the catenary be fixed directly to the bridge soffit, on the Depot Access route, to achieve acceptable fixity at this low headroom span .

Note for information : the requirement for direct fixed catenary in the A8 underpass is a result of the Value Engineering measures to reduce structure height, not a misalignment with Infraco Proposals, and will be resolved as part of the VE design process.

## 2.8 Confirmation of Status of Issues Identified in Schedule 23, Appendix 4

Schedule 23 Issue	Status
OLE Support foundation design	Included in misalignments identified in this report
Outline design and approvals	Included in misalignments identified in this report
Detailed design - catenary	Included in misalignments identified in this report
Approvals - catenary	Included in misalignments identified in this report
Detailed design – auto tensioned	No misalignment
Approvals – auto tensioned	No misalignment
Building fixing report, including design/approvals (excluding detailed wiring design and detailed building fixing design)	No misalignment
Pantograph interface and performance characteristics	No misalignment
Typical cross sections and detailed cross sections	Included in misalignments identified in this report
Proposal for poles, wiring arrangements and the tensioning equipment	No misalignment
Technical and performance specification for the OLE	Included in misalignments identified in this report
Proposal for poles, wiring arrangements and	No misalignment

the tensioning equipment	
Technical and performance specifications for the OLE	Included in misalignments identified in this report
Proposal for equipment type and method of supporting the equipment along the route, including the wall fixings	Included in misalignments identified in this report
Detailed pole and wall fixing locations (easting and northing coordinates) and the detailed wiring design	Included in misalignments identified in this report
Detailed wiring layout design	Included in misalignments identified in this report
Detailed survey work, including building fixing location, height and condition, ground condition and pole location surveys	Included in misalignments identified in this report
Depot OLE design	Included in misalignments identified in this report
Specify forces and moments for masts	Included in misalignments identified in this report
Mast Foundations	Included in misalignments identified in this report
Power issues, included in issue 1 of this document	Not Applicable

### 3 CONCLUSIONS

#### 3.1 General

The issue of technical approval of the OLE system is outwith the scope of the Development Workshop Process, but any consequential requirements for redesign or revision of civil works drawings by SDS fall within the process. The specific areas of misalignment are detailed in sections 3.2 to 3.6 below.

#### 3.2 Misalignment No 1 : OLE System

Instruct SDS to amend their design documents including any relevant reports, to either record the details of the or to render them superseded by system documentation produced by Infraco. A second objective is to ensure that no design documentation which refers to the previous reference design remains current or is carried forward to the Design Assurance/Record Documentation stage unamended.

#### 3.3 Misalignment No 2 : OLE Pole Foundation Loads

Instruct SDS to revise OLE foundation designs to be suitable for the loads and locations imposed by the Infraco OLE system.

#### 3.4 Misalignment No 3 : OLE Building Fixing Loads

Instruct SDS to amend Building Fixing designs for any amended loads.

#### 3.5 Misalignment No 4 : OLE Pole and Building Fixing Locations

##### 4A : OLE Pole Locations

Instruct SDS to amend layout drawings to show actual pole locations, and where necessary, obtain approval for the revised locations

##### 4B : Building Fixing Locations

Instruct SDS to amend drawings to show any amended actual building fixings and where necessary, obtain approval for the revised locations

#### 3.6 Misalignment No 5 : Combined OLE/Lighting Poles

5A : Instruct SDS to design provision of alternative lighting where OLE poles are now not to be provided, possibly in a form similar to OLE poles for Planning Consent reasons.

5B : Instruct SDS to design the lighting system to take account of any relevant aspects of the OLE system (eg tensioning equipment) which was not part of the reference design.

5C : Foundation loads, included in 3.3 above

5D : Instruct SDS to design revised earthing, bonding and insulation requirements for lighting, as 5B above.

### **3.7 Misalignment No 6 : OHLE Fixings at Depot Access Bridge**

Instruct SDS to amend Depot Access bridge design to incorporate requirements for direct fixed catenary on low headroom span.

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**4 DEVELOPMENT WORKSHOP NOTES**

<b>Bilfinger Berger Civil</b>	<b>MINUTES OF MEETING</b>	 <b>BILFINGER BERGER</b> CIVIL DIVISION
Project: Project No.:	Cost Centre: 0370	

<b>Meeting No.:</b>	OLE Development Workshop No 1
<b>Date:</b>	17 November 2008
<b>Location:</b>	Consortium Office
<b>Time:</b>	12:00-15:30

<b>Participants</b>		
	<b>Name</b>	<b>Company/Department</b>
1	Robert Bell	tie
2	Gail Blythe	tie
3	Damien Sharp	tie
4	Lindsay Murphy	tie
5	Jon Monk	tie
6	Gavin Murray	tie
7	Stephen Hajducki	CEC
8	Francis Newton	CEC
9	John Newton	BSC
10	Gary Bromley	BSC
11	Knut Prelop	BSC
12	Stefan Rotthaus	BSC

Item	Issue	Resp.	Date
1	Development Workshops are the contractual title and replace the title misalignment workshops. The sequence as per Novation Agreement is Base design, Infraco Design, Mis-alignment. BSC lead the workshops.	Note	
2	The Development Process started on 15 July 2008 with Siemens-paper and subsequent visit to Berlin/Potsdam.	Note	
3	The Infraco design proposal consists of auto tensioned trolley-wire (Newhaven to Haymarket inclusive), building fixings, auto tensioned Catenary (Haymarket exclusive to Airport), , combined OLE-Lighting poles and tapered poles rather than stepped-poles for the Newhaven – Haymarket section.	Note	
4	Combined poles lead to higher loads resulting in bigger or deeper foundations.	Note	
5	Combined poles proposed to consist of two elements, OLE pole and mounted spike with attached lantern. Proposal to be formally issued for planning acceptance	JN	28/11

Project:

Project No.:

Cost Centre:  
0370

9	OLE-details, incorporating revised building fixings previously submitted to support planning process. Formal submission of OLE outline designs to be submitted for planning approval.	JN	28/11
10	CEC suggested a simplified variation approvals procedure, considering extent of change	FN	
11	Prior and technical approval process to be initiated by BSC. tie request documents and will facilitate the process. BSC have to seek consent from CEC directly, keeping Tie informed.		
12	CEC requested the documents in the same packages, format and batches as per original design where possible.		
14	CEC request detailed information of the feeding points.		
15	Details of typical structures, including pulley wheels for tensioning to be supplied with OLE outline designs	JN	28/11
16	Lighting has been technically accounted for but not in terms of maintenance or operation. To be clarified (needs to be addressed for hazard analysis)	BB	
17	OLE layout in section 1a (Ocean Terminal area) likely to change as final road layout is not available. Pole locations are likely to change at road junctions. When will road layout be fixed?	BB	
18	tie consider Forth Port as main possible objector		
20	CEC/tie require visibility in terms of design and approvals programme.	JN/SR	4/12
21	BSC proposed revised electrical sectioning design for the depot. tie to speak to transdev who will advise on operational issues. BSC to submit revised depot sectioning proposal for review and comment	BB JN	 4/12
22	Pole foundations have to be redesigned. BSC will propose 3-4 different options for gravity foundations and piled foundations.	SR	
23	SDS will be involved according to contractual obligations, including options as defined in Novation Agreement where appropriate		
24	BSC have to propose building fixings.	JN	28/11
25	Building condition not yet surveyed. Survey to be carried out by SDS when building fixings accepted.	SR/JN	
26	BSC to produce a workflow showing design and approval process in relation to the construction programme. Flowchart shall be prepared for Haymarket, Princes Street and Leith walk.	SR	
27	Next meeting 01 December 2008. SDS to be invited.		

<b>Bilfinger Berger Civil</b>	<b>MINUTES OF MEETING</b>	 <b>BILFINGER BERGER</b> CIVIL DIVISION
Project: Project No.:	Cost Centre: 0370	

Recorded by: Stefan Rotthaus

Date: 17 November 2008

Ø Participants  
Colin Brady  
Roland Brueckmann  
Ralf Honeck



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<b>Bilfinger Berger Civil</b>	<b>MINUTES OF MEETING</b>	 <b>BILFINGER BERGER</b> CIVIL DIVISION
Project: Project No.:	Cost Centre: 0370	

<b>Meeting No.:</b>	OLE Development Workshop No 2
<b>Date:</b>	03 December 2008
<b>Location:</b>	Consortium Office
<b>Time:</b>	14:00-16:30

<b>Participants</b>		
	<b>Name</b>	<b>Company/Department</b>
1	Gail Blythe	tie
2	Damien Sharp	tie
3	Gavin Murray	tie
4	Colin Kerr	tie
5	Steven Francey	CEC
6	Stephen Hajducki	CEC
7	Francis Newton	CEC
8	John Newton	BSC
9	Gary Bromley	BSC
10	Bruce Ennion	SDS
11	Alan Dolan	SDS
12	Stefan Rotthaus	BSC

Item	Issue	Resp.	Date
1.	<b>General</b>		
1.1.	CEC agreed that there is only a planning issue when changes occur. Omitted poles and building fixings are no planning issue.	Note	
1.2.	Changes to the catenary system will be considered as small amendment (un-material variation).	Note	
1.3.	Changes of pole location by less than 1.00m will be considered as small amendment.	Note	
1.4.	OLE in Princes Street shall be used as test-case to establish planning protocol	BSC, SDS	18/12/08
1.5.	Prior approval required for combined lighting poles. SDS to provide profiles	SDS	18/12/08
1.6.	If prior approval is required then the design has to be submitted in packages and batches as per original submittal.	SDS	
1.7.	SDS will produce spreadsheet of changes for discussion with CEC	SDS	18/12/08

<b>Bilfinger Berger Civil</b>	<b>MINUTES OF MEETING</b>	 <b>BILFINGER BERGER</b> CIVIL DIVISION
Project: Project No.:	Cost Centre: 0370	

1.8.	There are no major changes in Princes Street and Leith Walk. With regard to cross over arrangements BSC have had to undertake design adjustments from the SDS outline design to achieve pantograph security. This has resulted in in the pole position at the point opening being adjusted.	Note	
1.9.	OLE design at Foot of the Walk shows unprotected poles in the middle of the road. SDS to arrange Road Safety Audit.	SDS	18/12/08
1.10.	Investigate if poles can be replaced be side-poles or building fixings at locations that are subject to Road Safety Audits.	JN, SDS	18/12/08
1.11.	OLE design for 1A will be completed after agreement with Forth Port has been finalised.	CEC, tie	15/12/08
1.12.	Arrangement for tramstop termination poles need to be revised and agreed - Newhaven	SDS, CEC	15/12/08
1.13.	At Shandwick Place investigate the possibility of aligning the mid point anchor arrangements (opposite rather than staggered). Investigate the possibility of changing the anchor for the cross over wire to reduce the OLE visual impact upon the monument.	SDS, JN, GB	18/12/08
1.14.	The current version of the OLE design will be submitted for approval	BSC, SDS	18/12/08
2.	<b>Components</b>		
2.1.	BSC propose multiples of smaller diameter parallel feeder cable rather than a single cable. This will assist in bending radi. Within the city centre all track side isolators will be mounted within a cubical.	Note	
2.2.	CEC require detail of anchor-pole arrangements	JN	18/12/08
2.3.	BSC has presented pole loading schedule based upon associated OLE detailed design. – Misalignment between BSC & SDS designs. This will require the recalculation of pole-foundations	SDS	15/01/09
2.4.	Instruction for misalignment required from tie	tie	05/01/09
3.	<b>Lighting</b>		
3.1.	Where the BSC OLE design has been able to reduce the number of OLE poles Because OLE poles have been removed the spacing has changed which requires recalculation of lighting design	SDS	15/01/09
3.2.	Instruction for misalignment required from tie	tie	05/01/09
3.3.	If necessary the omitted OLE poles can be substituted by lighting poles	Note	

Recorded by: Stefan Rotthaus

Date: 03 December 2008

Ø Participants  
Colin Brady

Roland Brueckmann  
Robert Bell

Ralf Honeck

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

<b>Subject</b>	OLE Development Workshop No 3	<b>Location</b>	Project Office
<b>Date</b>	3 <sup>rd</sup> April 2009	<b>Time</b>	
<b>Attendees</b>	<b>Representing</b>	<b>Attendees</b>	<b>Representing</b>
Robert Bell	Tie	Colin Brady	BSC
Jon Monk	Tie	Stefan Rotthaus	BSC
Gavin Murray	Tie	Simon Nesbitt	BSC
Gail Blythe	Tie	Katie Stones	BSC
Francis Newton	CEC	John Newton	BSC
Sinead Scott	Transdev	Michael Wilken	BSC
Alan Dolan	SDS	Garry Bromley	BSC
Chris Pope	SDS		
Mike Coupe	SDS		
<b>Distribution</b>	Attendees		

		Action	Date
<b>1</b>	<b>Purpose</b>		
	This meeting was the third in a series to identify misalignments relating to the Infraco proposals for OLE, and agree how the misalignments would be resolved by SDS		
<b>2</b>	<b>OLE Development Workshop Report, Issue 1</b>		
2.1	Issue 1 of the Development Workshop Report (DWR) was reviewed and discussed, as the basis for clarification of misalignments and necessary actions.  BSC confirmed that the format of the report was equivalent to that already submitted for roads and for trackform. The potential areas of misalignment are contained within Schedule 23 and Schedule 30, and are reproduced in section 1 of the report. The misalignments are identified in detail in section 2 of the report and proposals for resolution are provided in section 3.	<b>Note</b>	
<b>3</b>	<b>Review of Identified Misalignments</b>		
3.1	Misalignment No 1 : OLE System Alan Dolan described the base OLE design, which comprised auto-tensioned trolley wire equipment between the airport and Haymarket, and fixed tension trolley wire equipment between Haymarket and	<b>Note</b>	



	<p>The scope of redesign work under the Development Workshop process is to be strictly limited to any load changes arising from the Infraco proposals.</p>	<b>BSC</b>	<b>ongoing</b>
	<p>Verification of structural capacity of buildings to withstand building fixing loads are outwith the scope of the Development Workshop process and are to be deleted from the DWR. If there is an actual issue of amended loading, this will be dealt with separately.</p>	<b>BSC</b>	<b>next DWR</b>
3.4	Misalignment No 4 : OLE Pole and Building Fixing Locations		
3.4.1	<p>Pole Locations</p> <p>Infraco proposal does include revised pole locations, and some reduction in pole numbers. Primary task for SDS is to amend drawings to show Infraco pole locations – these drawings will be used to support the Planning Approval process and as construction drawings. Approval process is partly dealt with under DWR process and partly under Design Support. BSC to ensure that SDS estimate is clear what is included in DWR process.</p> <p>R Bell requested BSC to maintain the existing spacing of poles along the Guided Busway to minimise foundation redesign. BSC confirmed spacing would be maintained and redesign would be limited to that required for revised loadings.</p> <p>Tie (Gail Blythe) emphasised the importance of working in advance with the Planning Authority to obtain informal agreement before submitting location design for approval. BSC (J Newton) confirmed this was their preferred approach also.</p>	<b>BSC</b>	<b>ongoing</b>
		<b>BSC</b>	<b>ongoing</b>
		<b>BSC</b>	<b>ongoing</b>
3.4.2	<p>Building Fixing Locations</p> <p>As above, design intent is to avoid any changes to fixing locations. Where appropriate, BSC will replace double fixings with single wire fixings, to reduce number of span wires.</p> <p>Remove references to verification of building capacity from DWR.</p>	<b>BSC</b>	<b>next DWR</b>
3.5	<p>Combined OLE/Lighting Poles</p> <p>Foundation issues recorded in section 3.2 above.</p> <p>BSC explained that the lighting design needed to be reworked to allow</p>		

	for pole relocation or removal, to ensure that light levels at road surface were maintained. BSc requested Tie to agree to suitable instructions to SDS.	<b>Tie</b>	<b>DWR review</b>
	Similar technical compatibility issues need to be resolved to ensure any interface with Siemens specialist equipment on poles is resolved and that earthing and bonding/electrical safety in fault conditions is maintained, requiring instruction to SDS	<b>Tie</b>	<b>DWR review</b>
3.6	<b>Misalignment No 6 : OHLE Fixings at Depot Access Bridge</b> Siemens identified a further minor misalignment in that the change from trolley wire to catenary at the Depot Access Bridge required amendment of the structural drawings to show a suitable soffit fixing detail. This to be instructed to SDS	<b>Tie</b>	<b>DWR review</b>
	The equivalent situation at the A8 underpass arises from reduction of the structure height as a value engineering exercise. Any redesign costs will be reflected in the net VE saving.	<b>BSC</b>	<b>ongoing</b>
<b>4</b>	<b>Scope of the Development Workshop Report</b>		
4.1	Tie require that the DWR and associated redesign estimate covers all issues associated with OLE misalignment. The DWR is to be amended to confirm in detail that all the items identified in section 1 have been included or that no misalignment exists.	<b>BSC</b>	<b>next DWR</b>

## 5 tie CHANGE ORDERS

## 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 ~~tie~~ Change Orders or instructions shall be appended to such report as and when the same are issued. ~~tie~~ 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 ~~tie~~ 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 ~~tie~~ Change under the Infraco Contract, and a Client Change under the SDS Agreement.

## 6.2 Combined OLE/Lighting Loadings

Combined Lighting/OLE pole locations in accordance with the Base Date Design Information are shown on the On-Street Lighting drawings, series ULE90130-01-LTG-00001-00024, generally at revision 2, issued between mid and late 2007. The drawings show combined poles in the required locations ( eg Princes Street, Leith Walk etc).

Base Pole foundation designs have been based on a generic load of 61kNm, acting in any direction. This loading is based on the base OLE design and does not take account of the additional loadings (principally wind loading) arising from the light fittings and column extension. The Infraco proposals are based on combined OLE and lighting loadings. The following load cases illustrate the magnitude of the difference in loadings :-

Description	SDS base design (8.8 m pole)	Infraco Proposal excluding lighting (8.5m pole)	Infraco combined loading (10m pole)
<b>Centre Pole, 2 Cantilevers</b>			
Moment, cross track	60.60 kNm	60 kNm	65.0 kNm
Shear, cross track	9.84 kN	15.0 kN	15.0 kNm
Moment, longitudinal	Moment above acts in any direction	15.0 kNm	35.0 kNm
Shear, longitudinal	Shear above acts in any direction	5.0 kN	5.0 kNm
Moment, resultant	60.60 kNm	61.9 kNm	66.8 kNm
Shear, resultant	9.84 kNm	15.9 kNm	15.9 kNm
<b>Side (or Centre) Pole, Single Cantilever</b>			
Moment, cross track	39.0 kNm	40.0 kNm	50.0 kNm
Shear, cross track	6.75 kN	10.0 kN	10.0 kNm
Moment, longitudinal	Moment above acts in any direction	15.0 kNm	35.0 kNm
Shear, longitudinal	Shear above acts in any direction	5.0 kN	5.0 kNm
Moment, resultant	60.60 kNm (generic load case)	61.9 kNm	66.8 kNm
Shear, resultant	9.84 kNm (generic load case)	15.9 kNm	15.9 kNm

### Side Pole, 2 Cantilevers

Moment, cross track	42.3 kNm	60.0 kNm	65.0 kNm
Shear, cross track	6.95 kN	15.0 kN	15.0 kNm
Moment, longitudinal	Moment above acts in any direction	15.0 kNm	35.0 kNm
Shear, longitudinal	Shear above acts in any direction	5.0 kN	5.0 kNm
Moment, resultant	60.60 kNm (generic load case)	61.9 kNm	66.8 kNm
Shear, resultant	6.95 kNm (generic load case)	15.9 kNm	15.9 kNm

Thus the worst case incremental loading associated with lighting is an increase in the resultant moment from 61 kNm to 69 kNm and an increase in resultant shear from 7kN to 16 kN. The impact on pole foundations of these incremental loads is anticipated to be small.

The current Infraco proposal is to use foundations suitable for the generic combined loadings on groups of equivalent poles, to reduce the number of foundation types and thus reduce design costs, and to preclude site errors which could result in construction of an undersize foundation. It is our proposal that foundation design should be procured from SDS on this basis, which has a benefit that the reduced number of foundation types will reduce design costs somewhat.

The impact on construction costs of foundations to accept the incremental lighting loads or of providing slightly oversized foundations at locations where combined poles are not required will be assessed when designs are available, and will be reflected in the evaluation of the relevant Tie Change Order for construction. If review of construction costs shows that suitable economies can be achieved by designing additional foundations for poles without lighting loads, Infraco will procure this design at its own cost.