

BRIDGE OWNERS FORUM

**MINUTES OF MEETING BOF 46:
TUESDAY 19 MAY 2015 AT
THE SALTMARSH ROOMS, KING'S COLLEGE, CAMBRIDGE**

PRESENT

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| Campbell Middleton | Chairman & Cambridge University Engineering Department (CUED) |
| Nick Burgess | London Underground |
| Graham Cole | ADEPT |
| Barry Colford | Large Span Bridge Group |
| Rob Dean | Network Rail |
| Richard Fish | Technical Secretary |
| Tomas Garcia | HS2 |
| Keith Harwood | ADEPT |
| Jason Hibbert | Welsh Government |
| Rod Howe | Canal and River Trust |
| Neil Loudon | Highways Agency (HA) |
| John McRobert | DRD (NI) |
| Paul Monaghan | LoBEG |
| Jacqueline Mynott | CSS Wales |
| Stephen Pottle | Transport for London |
| Paul Fidler | CUED |

Introduction

The Chairman welcomed everyone to BOF 46, noting that there were a number of new members who would be given a chance to introduce themselves later in the meeting. He also introduced Anne Debenham, his PA who was mostly only known to BOF members through her emails, who was present for the start of the meeting.

For the benefit of new members, the Chairman gave a brief résumé of BOF's history, vision and terms of reference.

1. Apologies

Apologies had been received from the following:

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| Liam Duffy | NRA |
| Wayne Hindshaw | Transport Scotland |
| David MacKenzie | SCOTS |
| Paul Thomas | Railway Paths Ltd. |

The Chairman noted that Graeme Muir had recently changed jobs and could no longer represent SCOTS. David Mackenzie, Chair of SCOTS Bridges Group, had been hoping to attend and will represent SCOTS until a replacement for Graeme has been identified. Unfortunately, David had had to give apologies for this meeting.

The Chairman also reaffirmed that Dana Skelley was the new Chair of UKBB and that Liz Kirkham had recently taken over as Chair of the ADEPT Bridges Group. He noted that Neil Loudon now represented Highways England following the transition from the Highways Agency.

2. Previous Minutes – BOF 45: 27th January 2015

The Chairman clarified the issue of having both public sections of the BOF website and those areas which were accessible only to BOF members. He advised, however, that BOF records should be as open and transparent as possible.

Corrections to the BOF 45 minutes were noted as follows:

- Page 4, Item 3, Action 11, Paragraph 2, Line 4: Insert “(although not thought to be a bolt problem)” between “Arch” and “and”.
- Page 6, Item 3, Actions 20 & 21, Paragraph 1, Line 7: After “...20 years”, insert “which might inform the review of the Grand Challenges Document” and delete last two sentences of paragraph 1 and the Action 15 box.

With the above changes, the minutes of BOF 45 were accepted and it was agreed that they could be placed on the BOF website:

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| ACTION 26: Paul Fidler |
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3. Actions from BOF 45

References in the text below refer to the numbered actions on the BOF 45 Action Sheet. Boxed reference numbers relate to the BOF 46 Actions:

Action 1, Temporary Bridge AIP Guidance:

Neil Loudon reported that progress continued to be made but there were some commercial issues to be considered as well as the relevance of Eurocodes in the Technical Approval process. He agreed to continue to update at future BOF meetings.

ACTION 1: Neil Loudon

Actions 2, Automating Bridge Inspections:

Richard Fish gave an update on (the lack of) progress at the last UKBB and, after discussion, it was agreed that this specific case should no longer be pursued. The Chairman emphasised, however, the importance of robust contract management in research project contracts.

Action 4, Atkins Study into Bridge Deck Water Management:

Neil Loudon reported that he was not happy with the draft report but agreed to provide updates at future BOF meetings.

ACTION 2: Neil Loudon

Action 5, Guss Asphalt Surfacing:

Neil Loudon noted that there had been several issues with this material on the HE network, including the M5 Avonmouth Bridge, some of which were associated with the aggregate being used, but all were commercially sensitive. He agreed to report to a future BOF meeting.

ACTION 3: Neil Loudon

The Chairman suggested that trials should determine the suitability of surfacing materials but Barry Colford pointed out that this was a luxury that could seldom be afforded if a bridge manager had immediate problems that had to be fixed.

John McRobert reported that he had had feedback on some of the Avonmouth issues but noted that the material had been used successfully on Foyle Bridge in Northern Ireland.

Action 6, Guest speakers at future BOF meetings

The Chairman noted that there had been a number of suggested speakers at BOF meetings and he agreed to review these with Richard Fish.

ACTION 4: Chairman/Richard Fish

Post Meeting Note: The following list of recorded possible invites has been taken from BOF minutes from the last two years:

- BOF 45 – CIRIA on Hidden Defects Research Project
- BOF 45 – Atkins on HE Bridge Deck Water Management Study
- BOF45 – Chairman on CUED research
- BOF 43 – EPSRC and TSB representative on research funding
- BOF 43 – HE expert (plus another) on Protective Paint Systems
- BOF 43 – Mersey Gateway Project

- *BOF 43 – DfT on Research Policy and Funding*
- *BOF 43 - Queensferry Crossing*
- *BOF 43 - Hugh Brooman (ex Surrey CC) on Data Collection and Asset Management*
- *BOF 42 – Mersey Gateway and Queensferry Crossing*
- *BOF 40 – CIRIA on Scour Manual*

Action 7, Hidden Defects in Bridges: CIRIA Research Proposal:

Members of the Project Steering Group (chaired by Dr Donald Pearson-Kirk) reported on recent progress. It was agreed that the list of steering group members and updates from meetings should be posted on the BOF website

ACTION 5: Rod Howe/Paul Fidler

As the Chairman, Richard Fish and Graham Cole had featured in the organisational structure put forward by the successful bidder, Arup/Aecom, relevant interests were suitably declared (although the it was noted that some had not given explicit permission to be included). Richard Fish noted that he had been asked to review early draft outputs.

Action 8, Hidden Defects in Bridges: Transport Scotland Procedure:

As Wayne Hindshaw was not present, the action for him to issue the Transport Scotland procedure was carried forward.

ACTION 6: Wayne Hindshaw

Actions 9 & 10, Premature Bolt Failures:

Barry Colford revealed that his investigation into bolt failures on the Forth Road Bridge had identified a phenomenon now known as “Environmental Hydrogen Embrittlement” in which highly stressed bolts absorb hydrogen from the atmosphere. It seems that bolts with an ultimate tensile stress greater than 1000N/mm² are susceptible and he understood that similar failures, such as the San Francisco Bay Bridge, could also have been attributed to this issue.

Neil Loudon questioned whether any research or issues papers had been published on the topic. Barry agreed that something needed to be written but he was not aware of any level of expertise in the UK or overseas. Both agreed to consider how an issues paper might be written and promulgated.

ACTION 7: Neil Loudon/Barry Colford

The Chairman referred to bolt failures at London’s Leadenhall Building which had been discussed at BOF 45; he noted that legal proceedings were in progress but understood that failed bolts in this case had been manufactured in China and wondered whether this was another symptom of less than adequate quality control. Barry Colford confirmed that the Forth bolts had been made in the UK. He also noted that failures had been identified when the bolts had been in place

for about 10 years but it was impossible to determine when the problems had started. He understood that the Leadenhall bolts had failed after only 2 or 3 years.

The Chairman reported that CUED had been asked to install sensors on some of the Leadenhall bolts but it was proving difficult to measure exact tensile loads. He suggested that this was area of research which might be worth pursuing.

Paul Monaghan noted that he was being made aware of developments at Leadenhall and agreed to advise the Chairman, Neil Loudon and Barry Colford of further developments.

ACTION 8: Paul Monaghan

Action 11, SCOSS and CROSS

Neil Loudon reported that he had recently attended a CROSS committee meeting and urged all BOF members to sign up for email alerts and disseminate the information within their organisations.

ACTION 9: All

Barry Colford will consider whether the bolt issue should be a matter for SCOSS once he has acquired more information.

ACTION 10: Barry Colford

Action 12, Train Borne Geometry Measuring System:

Paul Fidler will check whether the reports are on the BOF website.

ACTION 11: Paul Fidler

Action 14, Presentation to Parliamentary Infrastructure Groups:

With the outcome of the election now known, the Chairman agreed to follow up the possibility of a presentation to this group.

ACTION 12: Chairman

Action 16, Bridge Consultants Forum and/or Bridge Contractors Forum:

The Chairman gave a short résumé on BOF meetings which had involved other parties and the proposal to host a Bridge Contractors' Forum. It was agreed that this should be fixed for BOF 47 or 48.

ACTION 13: Chairman

All BOF members were asked to send details of high level contacts from Contractors with bridge specialisms to the Chairman, as well as possible topics for the agenda.

ACTION 14: All

Stephen Pottle suggested the following:

- Quality of Construction
- Supervision

- Design and Build vs Longevity and Maintenance
- Use of overseas fabricators

Others added:

- Standardisation
- Modularisation
- Procurement and profit margins
- New Build vs Retro- works

Tomas Garcia noted the French example of the contractor (Vinci) leading all design and development as well as construction on the TGV.

The Chairman suggested that financing and budget discussions should be part of the discussion, including political pressures.

Neil Loudon and Rob Dean noted that their respective organisations were developing ideas which would see more work being brought back in house rather than use external providers.

The Chairman aired the idea that BOF might have a session focussing on procurement but it was generally felt that bridge engineers would have little impact as it was clear that procurement was becoming a recognised profession in its own right.

Action 17, BOF Grand Challenges Document:

There was a need to enable secure access to the document so that changes could be proposed. Although a number of suggestions were put forward (Dropbox, GoogleDocs, Sharepoint), there was nothing which suited all members. Paul Fidler will review options.

ACTION 15: Paul Fidler

Action 18, Tagging Technology:

Neil Loudon advised that this work was nearly complete and agreed to provide an update at a future BOF meeting.

ACTION 16: Neil Loudon

Action 19, Technical Approval Guidance on Phased Works:

Neil Loudon agreed to review Highways England's position on this issue and give an update at a future BOF meeting.

ACTION 17: Neil Loudon

Action 20, Parapet Research and Testing:

As Wayne Hindshaw was not present, the action to update BOF on Transport Scotland's initiatives in this area was deferred to the next meeting.

ACTION 18: Wayne Hindshaw

Action 21, Scottish Road Research Board

The Chairman will discuss possible research funding bids with Wayne.

ACTION 19: Chairman/Wayne Hindshaw

Action 22, De-icing Materials:

Barry Colford described trials he had been undertaking at the Forth Road Bridge, assisted by the Institute of Corrosion, using glycol and a saline solution as a de-icing agent. He agreed to report the results to BOF 47, together with a comparison of results from the Great Belt Bridge.

ACTION 20: Barry Colford

Action 24, Northern Ireland Rail Representation on BOF:

The Chairman will invoice NI Rail for BOF membership.

ACTION 21: Chairman

Action 34, CIRIA Scour Report:

A link to this report will be placed on the BOF website.

ACTION 22: Paul Fidler

Action 36, Network Rail Research Programme:

Rob Dean will give an update at BOF 47.

ACTION 23: Rob Dean

Action 37, Parapet Heights for Suicide Prevention:

Rob explained that this was part of a wider project concerning safety and trespass on the railway. A study was being undertaken by Mott MacDonald and he suggested that they should attend a future BOF meeting to present their findings; this was agreed.

ACTION 24: Rob Dean

Action 38, CUED CSI Projects

The Chairman briefly described the work of Cambridge's Centre of Smart Infrastructure and Construction: as there was to be a forthcoming contract review, he was collating all recent developments and the draft report could become a best practice guide for performance monitoring of bridges. Although still only work-in-progress, the Chairman offered to make the draft available for review. Neil Loudon noted that Highways England was a partner in the project and Tomas Garcia also volunteered to review. The Chairman wanted to continue to challenge the added value from monitoring and Barry Colford suggested that system and sensor robustness was crucial, especially those attached to cables where regular inspection/replacement/maintenance was impractical.

The Chairman stated that the draft report would also include a list of categories of elements which would benefit from monitoring, some of which had been taken

from earlier proposals for the new Walton on Thames Bridge. Stephen Pottle reflected that just knowing what was available would be very useful. The Chairman agreed to issue whatever material was currently available.

ACTION 25: Chairman

The Chairman also noted that CUED were monitoring sensor development in the biological sector as there could be ideas which might be transferrable to engineering.

All unrecorded actions from BOF 45 had either been completed or were discussed as part of the BOF 46 agenda.

4. Membership Update & Subscriptions for 2015-16

The Chairman handed out reminder letters for those organisations that had yet to pay their 2015/16 subscriptions.

ACTION 27: All

He noted that some payments had very recently been received and thanked members for chasing their financial counterparts. He was concerned that DfT had now declined to pay their agreed contribution and this was especially problematic as DfT had previously agreed to cover ADEPT's membership. Graham Cole and Keith Harwood agreed to discuss this with Liz Kirkham.

ACTION 28: Graham Cole/Keith Harwood

The Chairman noted that Transport Scotland and the Welsh Government were covering the subscriptions for SCOTS and CSS Wales respectively. Neil Loudon reminded members that Highways England still held responsibility for the BR Residual Bridges.

At this point, Tomas Garcia was asked to leave the room. The Chairman then proposed that HS2 should be invited to join BOF and this was unanimously agreed. Tomas returned and was formally welcomed as a full BOF member.

5. Introduction to New Members

The Chairman formally welcomed Tomas Garcia of HS2, Keith Harwood (Hertfordshire CC and Arup) who was to be the second ADEPT representative and Jacqueline Mynott of Caerphilly County Borough Council who was representing CSS Wales.

Each gave a short résumé of their careers and interests. Keith Harwood specifically pointed out the fact that he was employed by Arup but seconded to Hertfordshire and promised to declare any interest when there was a potential

conflict. He also had a list of possible research suggestions which he agreed to email to the Chairman.

ACTION 29: Keith Harwood

Post meeting note: The following is an extract from Keith's notes on his views on BOF priorities, as sent to the Chairman:

- *Coordinated approach across bridge owning organisations. Particularly important to local authorities who interface with all the other owners, yet are a divided and disparate bunch. Do the risks lie in stock owned by the big bridge owners – what about Luton, or Thames Water?*
- *Understanding the long-term deterioration of structures. Whether we have a looming crisis in concrete bridges.*
- *Understanding risk – How to manage structures based on risk rather than condition. Maintaining network performance. We often mention risk of collapse, but there are other risks to network operation which are more likely but less severe.*
- *Extending the service life of structures whether through improved maintenance, better inspection and investigation, or more robust risk management*
- *Long life expansion joints, making existing bridges integral, management of half joint structures*

6. BOF Bridge Research proposals for UKRLG/Bridges Board

Richard Fish reported on developments since BOF 45 and the fact the three projects put forward by BOF had been broadly accepted by UKBB at its meeting in February:

1. *A Strategic Guidance Document on the introduction of BIM for existing bridge operation and management. (What do we need to know and what data do we need to measure and/or collect?)*
2. *A Best Practice Guide to installation and management of safety critical fixings.*
3. *Methods of assurance of deterioration models and deterioration rates for bridge assets.*

He had completed the forms as required, giving details of possible steering groups, project leads and estimates. BOF was today charged with firming up those commitments.

Project 1: It had been agreed at UKBB that TfL would lead on this as it neatly fitted into other BIM work that was being undertaken on other highway assets.

Project 2: Neil Loudon confirmed that he was the lead in Highways England's Capable Asset Portfolio and that he had already established a budget line for

supporting BOF research. He was especially keen on the safety critical fixing project as it would complement IAN 104 already in place, and offered HE as a lead party and to procure the research contract. Stephen Pottle agreed to offer someone from TfL to act as Steering Group Chair and to map out the project requirements.

ACTION 30: Stephen Pottle

Stephen also agreed to consider what support might be forthcoming from industry. Rob Dean and Jason Hibbert agreed to be represented on the Steering Group. Graham Cole offered to secure a representative from ADEPT.

ACTION 31: Graham Cole

With regard to funding, it was not clear how far DfT would go in terms of matching contributions of others but 50/50 was assumed. After discussion, it was also agreed that the total estimate should be increased to from £75,000 to £90,000. With commitments as offered at BOF 45, it appeared that 50% of this estimate could be met by BOF members.

Project 3: Stephen Pottle questioned whether this project might benefit from CIPFA input but he agreed to discuss with TfL's asset management team.

ACTION 32: Stephen Pottle

Steering Group members would come from Network Rail, Highways England, Canal & River Trust and HS2. Keith Harwood offered to act as Steering Group chair. It was decided that the budget estimate of £100,000 should not be changed and that probable funding could be met from BOF members on the same assumption of a 50/50 match from DfT. There was no organisation offering to procure.

The Chairman expressed concern that these projects would only happen with DfT buy-in and commitment. Richard Fish agreed to forward the outcomes from the BOF discussions back to UKBB.

ACTION 33: Richard Fish

Reflecting on the BIM issues in the above discussions, the Chairman felt there was a need to understand BIM in terms of bridge maintenance and management. He suggested, therefore, that BIM might be the focus of BOF 47 and that he would confirm BOF 48 as the Bridge Contractors' Forum. He would consider inviting Mark Bew, Chair of the Government's BIM task force to BOF 47.

ACTION 34: Chairman

7. Presentation on HS2 Bridges.

Tomas Garcia gave a confidential presentation of the bridge design and construction concepts that were being developed by HS2. The Chairman thanked Tomas for his informative and thought provoking update.

8. Discussion: Bridge Standardisation and Offsite Manufacture

NB. This Item was taken at the end of the meeting.

The Chairman had located Department of Transport advice documents on standardisation dating from the 1970s and suggested that updated versions would help drive down costs, especially if linked with BIM or whole life costing issues.

Neil Loudon remembered the original publication and recalled that standard bridges proposed had proved to be too inflexible and it had transpired that almost every new bridge had unique issues in terms of skew, road alignments, foundations etc.

Richard Fish also recalled trying to use the 1979 document and had met the same issues as Neil had described. He also pointed out, with some notable exceptions, that the ratio of new build to maintenance and retro-fit was now too low for standardisation initiatives to be worthwhile.

Rob Dean noted that Network Rail's attempt at standardising steel footbridges had led to whole life costing issues being missed at the conceptual/preliminary design stage.

Stephen Pottle thought that standardisation would stifle innovative ideas at a time when these were most needed.

9. Presentation on Business Improvement

The Chairman introduced Graeme Shaw, TfL's Business Process Improvement Leader who gave a presentation on this topic which will be uploaded onto the BOF website.

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| ACTION 35: Paul Fidler |
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The Chairman invited questions and comments:

Stephen Pottle asked whether the process of procurement could be improved using techniques outlined in the presentation. Graeme Shaw was confident that this was achievable as long as supply chain partners were engaged.

Neil Loudon expressed concerns about quality of the output: if time and money were cut, did quality not suffer? Graeme Shaw suggested that this was avoidable.

The Chairman asked whether whole life costing could benefit from this process. Graeme Shaw suggested that analysing impacts on both Capex and Opex should ensure that one did not achieve savings at the expense of the other.

Discussion then extended into the issue of unit costs for bridges and the problems of benchmarking when there were different approaches and different factors built in to estimates.

The Chairman also noted the Government's Construction 2025 initiative which targeted savings of 33% in ten years' time. Larger organisations were embracing Lean methods: for example, Highways England was now working on a fence to fence basis for all asset maintenance interventions and Network Rail were similarly concentrating on optimising rail possession time.

The Chairman thanked Graeme for his presentation and agreed to consider a proposal for a possible BOF sub-group looking at Lean Construction issues.

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| ACTION 36: Chairman |
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10. BOF Sponsored Research Projects - Update

10a. Bridge Inspector Competence

Stephen Pottle reported on progress with establishing accreditation through LANTRA. UKBB was the client and a steering group had been set up on which several BOF member organisations were represented. The focus of current work was to identify base competencies and to design the process of assessment. Letters to the Chief Executives of all bridge owning organisations were due to be issued soon and a date of December 2015 was still targeted for launching the accreditation. He emphasised that the scheme was predicated on practical, vocational experience and not on academic qualification.

Neil Loudon noted that the revisions to the Code of Practice and also to BD 63 would contain references to the new requirements. This would clarify the fact that the scheme must be seen as best practice. He also gave more details as to how the scheme would operate with successfully accredited inspectors being given a smart card which would require review and renewal every three years. There were presently three universities offering training: UWE, Sheffield and Dublin. Rob Dean gave the analogy that the difference between training and accreditation was like learning to drive: once competent, there needed to be a test.

The Chairman asked about client take-up; Rob Dean promised that Network Rail would be undertaking a gap analysis to see how closely this scheme aligned with

their present inspection regime. Nick Burgess offered to undertake a similar analysis for LUL and would liaise with Network Rail.

ACTION 37: Rob Dean/Nick Burgess

Stephen Pottle asked if LUL could be persuaded to join the steering committee.

ACTION 38: Nick Burgess

11. New Bridges and Major Projects Update

Barry Colford reported that the new operating contract for the Queensferry Crossing and the Forth Road Bridge (plus adjacent road network) had been awarded to Amey and had started on 31st May 2015. FETA (Forth Estuary Transport Authority) would be dissolved and Barry would become an employee of Amey. This may also mean that he might have to stand down as the Big Bridge Group representative on BOF; this would be discussed at their next meeting and the Chairman would be advised of the outcome.

ACTION 39: Barry Colford

Barry also confirmed that the opening of the Queensferry Crossing was set for December 2016.

12. Other Bridge Research Update

12a. TfL: Nothing further to report since the last meeting.

12b. Network Rail: Rob Dean reported that Network Rail were funding a project on half-through lattice girder footbridges. They were also working with RSSB on dynamic response of structures to high speed trains and with Exeter University on their EPSRC funded project looking into issues of debris impact on bridges under flood conditions. With respect to the last of these, Richard Fish noted that he had been asked to chair the steering group and that the first meeting was to be held on 3rd July 2015.

12c. Highways England: Neil Loudon gave a confidential briefing on some failures of assets on the HE network.

12d. LUL: Nick Burgess had no major research topics to report.

12e HS2: Tomas Garcia reported that HS2 were funding research into modeling long curved viaducts with the hope of avoiding the need for large number of expansion joints.

12f ADEPT: Graham Cole reported on the EPSRC funded research on Arch Bridge dynamic loading being undertaken by Salford and Sheffield Universities to be launched at the IStructE on 7th July 2015.

12g LoBEG: CIPFA had approved an asset valuation and prioritisation methodology linked to Bridgestation.

12h CSS Wales: Jacqueline Mynott reported on a joint initiative with SCOTS on asset management; Jacqueline was a member of the steering group.

12i DRD (NI): John McRobert reported on two bridges in Northern Ireland dating from the 1930s which had experienced rapid deterioration in the last five years, probably due principally to leaking joints. John agreed to provide more information at BOF 47.

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| ACTION 40: John McRobert |
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12j CUED: The Chairman described two CUED projects:

- Digitising bridges: concerned with standardisation and off-site manufacture, in partnership with Tony Gee and Partners and Laing O'Rourke.
- Two projects on computer visualisation/BIM:
 1. BIM and bridge sensors
 2. Photographic/LIDAR surveys with attributes linked to images.

Neil Loudon noted that HE had issues with LIDAR as their road based surveys did not pick up under- or over-bridges nor retaining walls. Rob Dean noted that Network Rail utilised a train mounted LIDAR system and agreed to give the Chairman the name of the NR contact.

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| ACTION 41: Rob Dean |
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13. Any Other Business.

13a. Froxfield Bridge: Rob Dean advised of an incident in Froxfield , Wiltshire, in which a masonry bridge parapet was demolished by a reversing HGV and landed on the railway. Rob noted that this might inform possible further research into masonry parapet containment.

13b. Power Harvesters: The Chairman described power harvester devices which were charged by vibration in order to keep sensors running for longer periods of time without the need to replace batteries.

13c. National Network Rail Agreement: Paul Monaghan reported a Network Rail region was trying to change the nationally agreed protocol originally agreed

between CSS and Railtrack and in use throughout the country since the late 1990s. It was agreed that this should be raised at UKBB but Rob Dean agreed to investigate further.

ACTION 42: Paul Monaghan/Rob Dean

14. Proposed Dates for Future BOF Meetings

The Chairman will advise if the proposed re-arranged date for BOF 47 of 3rd November 2015 can be fixed

ACTION 43: Chairman

14. Closing/Summing Up

The Chairman thanked all members for their attendance and contributions to the discussions.

Richard Fish
Technical Secretary
16th June 2015