

## **BRIDGE OWNERS FORUM**

### **MINUTES OF BOF 67: TUESDAY 20 APRIL 2021 ZOOM MEETING**

#### **PRESENT:**

Bill Bryce	SSE
Nick Burgess	TfL/LUL
Malcolm Cattermole	Forestry England
Kevin Dentith	ADEPT
Liam Duffy	Transport Infrastructure Ireland
Andy Featherby	C&RT
Richard Fish	Technical Secretary
Tomas Garcia	HS2
Colin Hall	Network Rail
Keith Harwood	ADEPT
Nicola Head	TfL
Daniel Healy	Infrastructure Northern Ireland
Jason Hibbert	Welsh Government
Trish Johnson	Big Bridge Group
Neil Loudon	Highways England
Hazel McDonald	Transport Scotland
Campbell Middleton	Cambridge University Engineering Department (Chairman)
Ian Norriss	Environment Agency
Osian Richards	CSS Wales
Paul Thomas	Railway Paths Ltd.
Sue Threader	Rochester Bridge Trust
Paul Fidler	CUED

#### **Guests:**

Neil Guthrie (Part)	Environment Agency
Nick Trump	Welsh Government
Henry Clarke	TfL
Conor McGroarty	Transport Infrastructure Ireland
Tercia Jansen van Vuuren	CUED

#### **1. Welcome and Meeting Outline/Protocols**

The Chairman welcomed everyone to BOF 67, noting the excellent attendance which continued at the level set since Zoom meetings had been initiated. He reiterated the

usual meeting protocols, including the use of the chat box, relevant comments from which were now included in minutes of BOF Zoom meetings.

Noting that the agenda had now been aligned not only to BOF Grand Challenges but also to UN SDGs, the Chairman remarked that this was entirely appropriate considering the focus of this meeting on Carbon issues.

On a sad note, the Chairman advised the meeting of the untimely death from cancer of Steve Berry who for many years had been the principle link between BOF and the DfT and had always appreciated the value of BOF's support to UKBB and the wider bridges community. The meeting shared the Chairman's sentiments.

## 2. Introductions and Apologies

Richard Fish noted that apologies had been received from the following:

Graham Cole	Heritage Railway Association (potential new member)
Henry Dempsey <sup>1</sup>	SCOTS

Richard Fish again noted that no replies to emails ahead of this meeting had been received from Jasdeep Bhachu (LoBEG). As Hugh Brooman (ex-surrey CC) regularly represented LoBEG on UKBB, it was agreed that this issue should be discussed with Hugh with a view to reinstating LoBEG's BOF representation.

ACTION 1: Chairman/Richard Fish
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Following now standard practice, the Chairman noted that two colleagues of BOF members were attending this meeting as observers, including Nick Trump who had also attended BOF 65 in October 2020. He also welcomed Neil Guthrie from the Environment Agency who was attending for the morning session. He invited introductions from Neil and the other new observer attendees:

Neil Guthrie is the Carbon Manager for the Environment Agency, mostly looking at the Agency's own infrastructure developments and advising on how to capture, predict and minimise carbon throughout the lifecycle of a project. Neil had initially trained as an ecologist, joining the National Rivers Authority in a regulatory role before it was subsumed into the Environment Agency.

Henry Clarke works with Nicola Head as a structures engineer at TfL. Although starting a civil engineering degree at Leeds, Henry had left to become a builder and dry stone waller in his native Yorkshire. On moving to London, he had been taken on as an apprentice with TfL and, through part time learning, had gained BTech and BEng qualification.

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<sup>1</sup> Henry had planned to attend but had to deal with some urgent work on site which prevented him from doing so.

Conor McGroarty worked with Liam Duffy at TII and was the Bridge Manger for the Leinster region. He had previously worked for Arup in Dublin and Australia and later moving to Roughan O'Donovan, also in Dublin, as a bridge designer, before joining TII.

The Chairman also reported that he had just appointed a new Research Assistant, Tercia Jansen van Vuuren, who was starting work that day and majoring on carbon issues. He had asked Tercia to attend when she was able to do so. *[Note: Tercia joined the meeting soon after this item.]*

### 3. Matters Arising from BOF 66 Minutes

Reflecting on Bill Harvey's input to BOF 66, the Chairman advised the meeting of more sad news in that Bill had been diagnosed with inoperable pancreatic cancer. It was agreed that BOF's good wishes should be passed on.

ACTION 2: Richard Fish

In accordance with the recently introduced practice, Richard Fish noted that the accuracy of the minutes had been agreed via email and the final version was now on the BOF website.

The Chairman referred to the BOF 66 Action Update sheet that had been issued with the BOF 67 agenda. Sue Threader complimented the sheet's layout which she hoped to mirror for updating actions from her own meetings. Richard Fish thought that it was still possible for actions previously marked as ongoing to be "lost" and would review this for BOF 68.

ACTION 3: Richard Fish

#### **Action 2: Grand Challenges and BOF in the Media**

Richard Fish confirmed that the editor of Transportation Professional (the journal of the CIHT) was planning to feature a piece on Grand Challenges with two case studies: Rochester Bridges with Sue Threader and from Ewan Angus on Queensferry Crossing and Forth Road Bridge SHM. Sue reported that she was to be interviewed by a journalist this week.

#### **Action 7: Research Funding Options**

Richard Fish reported that this had been aired at UKBB but with no decision made. It was agreed that this should be brought up again at the next meeting.

ACTION 4: UKBB Members

#### **Action 8: IABSE Group looking at Bridge Collapses**

Richard Fish reported that he had twice emailed Alastair Soane expressing an interest in connecting with this group but had not received replies. He agreed to keep trying.

ACTION 5: Richard Fish

### **Action 13: Bridge Inspector Competency Schemes Comparison**

Richard Fish reported that he now had access to all four schemes: BICS, ADEPT (Devon CC), SCOTS and CSS Wales. He would aim to complete an objective comparative analysis in advance of BOF 68.

ACTION 6: Richard Fish

### **Actions 22: 3-D printing Presentation**

In Henry Dempsey's absence, Richard Fish agreed to follow this up with Henry and issue the link.

ACTION 7: Richard Fish/Henry Dempsey

## **4. Carbon Management in the Environment Agency**

The Chairman noted that the carbon agenda in the UK was now a top priority with several parallel strategies being developed and promoted, including one from the Construction Leadership Council – CO<sub>2</sub>nstruct Zero<sup>2</sup>. He considered it timely, therefore that BOF should be focussing on carbon and welcomed the range of presentations arranged for the morning session.

Before inviting Ian Norriss and Neil Guthrie to present, the Chairman asked if all the presentations could be uploaded to the BOF website. This was agreed.

ACTION 8: Paul Fidler

Ian Norriss began by explaining that, although he had started to explore the various Environment Agency initiatives with respect to carbon, he quickly recognised the scale of the topic and had asked Neil Guthrie to assist with the presentation.

Ian then set out the wider context by referring to the Intergovernmental Panel on Climate Change (IPCC) report<sup>3</sup> which identifies the need to keep global temperature rise at <1.5°C by reducing emissions from human activity. Ian emphasised both the scale and speed of change required to meet this target and the level of investment that will be needed throughout all sectors. He also noted that the EA was going to take a strategic role in the UK's drive to Net Zero and cited the Environment Agency's own commitment to become Net Zero by 2030 and Absolute Zero by 2050.

Neil Guthrie began his part of the presentation by concentrating on the EA's capital works, for the most part flood defence schemes, which accounted for some 54% of the Agency's emissions. The move to become carbon neutral (Net Zero) by 2030 would require a 45% reduction across the whole of the Environment Agency. For infrastructure this was to follow the principles in PAS 2080<sup>4</sup> which advised a carbon

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<sup>2</sup> <https://www.constructionleadershipcouncil.co.uk/wp-content/uploads/2021/03/COconstruct-Zero-Summary-Document.pdf>

<sup>3</sup> <https://www.ipcc.ch/sr15/>

<sup>4</sup> <https://www.carbontrust.com/what-we-do/assurance-and-certification/pas-2080-carbon-management-in-infrastructure>

assessment for the whole life of a project from inception to demolition; for this purpose, in the Environment Agency's case, a period of 100 years. The scope of the assessment would cover energy and materials but not, as yet, people behaviours which may change as a result of the infrastructure investment.

The Environment Agency follow the carbon reduction hierarchy: *Build nothing > build less > build clever > build efficiently*. This is now considered as part of every business case assessment process, beginning with the initial, strategic phase, then at outline and final business cases, and lastly during construction.

Neil explained that the Environment Agency also follow their own Carbon Assessment Tool (ERIC<sup>5</sup>) which is both a carbon modelling, and a carbon calculator tool which has been in use for the last five or six years. It is freely available for others to use but is due to be replaced later in 2021 with a new Cost and Carbon Tool (CCT) to be used for estimating carbon and cost at the same time, and provide a link to asset management systems.

Neil went on to discuss the subject of offsetting carbon, either through tree planting or other means of sequestration. Although at first sight this seems an attractive option, it is actually a complicated process especially when considering inputs from the supply chains.

The Chairman thanked Ian and Neil for the presentation and invited questions.

Paul Thomas asked if the Environment Agency would have to rely on sequestration to meet their targets; Neil replied that this was a concern for the Environment Agency, and it was something they were actively engaged with at the moment.

Tercia Jansen van Vuuren commented on the importance of measuring carbon from agreed base lines; should they be set at the level of the lowest carbon option and all comparators measured from there? Other, less arduous, options may appear to achieve better results and there is a risk of false reporting. She agreed, however, that good progress was being made, not least in raising carbon awareness.

In the debate of carbon versus cost, Keith Harwood questioned how one could choose between the two in a business case, presuming that low carbon equated to higher cost. Neil Guthrie accepted that was the assumption everyone made but recent evidence suggested that this need not be the case. He pointed out, however, that much of both cost and carbon is derived from energy used in material production processes.

Via the chat for this item, Malcolm Cattermole questioned how the Environment Agency were driving the principles and decision making through the organisation. Neil Guthrie accepted that significant cultural change was required as well as more obvious

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<sup>5</sup>[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/571707/LIT\\_7067.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/571707/LIT_7067.pdf)

changes, for example, in the vehicle fleet and buildings<sup>6</sup>. This year the Environment Agency were also piloting carbon budgets for projects as well as cost budgets. There was also a challenge for designers in the “glide path” towards 2030: the longer spent on a design, the more carbon would probably be saved but that would also lead to a stiffer carbon target to be met.

The Chairman concluded the discussion by thanking Ian and Neil for their presentation.

## **5. Net Zero Carbon – For Structures**

The Chairman then invited Neil Loudon to present on Highways England’s position.

Neil began by pointing out that he was not leading on this initiative within Highways England but, although the development of a net zero plan was in its early stages, a draft action plan was presently out for consultation within the organisation. Neil also pointed out that the Highways England work had to fit with the DfT decarbonisation plan which included the target of net zero from construction by 2040.

There were three strands to the Highways England plan: supporting clean travel, optimising network capacity, and road operation in a zero-carbon way (everything from lighting to fleet vehicles to biodiversity on verges etc.). It was estimated that almost 98% of carbon emissions associated with the motorway and trunk road network come from road users and Neil acknowledged that this was an area in which HE could only ever have low levels of influence. There was more opportunity to influence operation and maintenance and it was here that Highways England was already starting to work with their supply chains.

Neil listed several actions needed to move the net zero agenda forward but noted that engagement with procurement teams was essential in order to ensure that all contracts met the decarbonisation requirements. He pointed out, however, some bridge specific actions such as maximising service life of bridge elements but also a consideration of structure service life based on comparative whole life carbon calculations. In terms of new builds, options for “green carbon bridges” were being considered by possibly building in renewable energy generation, using solar panels or wind turbines, as well as the development of low carbon materials for bridges. In all of this, however, there would be the need to balance safety, durability, cost, carbon, and other environmental concerns.

Neil echoed the Environment Agency mantra (Build nothing, build less, build clever, build efficiently) which was also being applied in Highways England but pointed out that the implication of this was the need to better manage existing structures through improved data collection and the application of both asset and risk management

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<sup>6</sup> In the chat, Ian Norriss referenced this video on the new cost and carbon tool: <https://youtu.be/Rx4rmzrk1Y>

principles. He also suggested that sharing knowledge on carbon issues was imperative, not least from examples such as TRIB, HS2 and Network Rail.

In terms of standards, Neil recognised that CG 300, the new technical approval standard in the DMRB, would need to be revised to include references to carbon and net zero. He recognised, however, the need to provide guidance on how to evaluate, measure, and compare carbon options. He also questioned whether there should be a requirement for a carbon accreditation scheme for materials being used in construction and maintenance operations.

Neil concluded by noting that all of this was likely to require additional funding and resources in Highways England and its partners on top of what was currently a very busy period of “business as usual”. He did not underestimate the ambition within this plan but cautioned against initiative overload.

The Chairman thanked Neil and invited questions. Sue Threader wondered how the Highways England plan sat with some of the recent political decisions, not least in terms of the programme of new construction which seemed to be the Government’s favoured policy at the moment. As an example, she cited the Lower Thames Crossing which seemed to be being pushed ahead with little consideration of net zero. Neil accepted that there was always going to be political influence and reversing previous decisions on scheme commitments was politically difficult. He suggested that this point emphasised the need for procurement to incorporate net zero into projects at the early stages of planning.

## **6. Gross Replacement Carbon Footprint Toolkit**

The Chairman invited Jason Hibbert and Nick Trump to present on this piece of work being undertaken by the Welsh Government.

Jason began by reminding the meeting of the context of net zero and some of the recent moves by PEIs to highlight the problem. Nick Trump then explained the concept of the Gross Replacement Carbon footprint toolkit (GRCf). Nick also described the objectives which were to create a tool which was both open-source and scalable, and one which might help to improve procurement processes towards a net zero agenda.

The tool considers each structure on an element by element basis and seeks to measure the amount of embedded CO<sub>2</sub> equivalent (CO<sub>2</sub>e) based on like for like replacements of elements or the whole structure. The tool also considers element deterioration against maintenance intervention activities. Bearing in mind that the Welsh Government’s 4,029 highway structures stock includes 1,211 bridges with 60 types of construction form, Nick explained that an automated calculation process had had to be used. Simplistically, the product of the bridge (or element) dimensions and rates equated to the volume of CO<sub>2</sub>e. Whilst this approach was thought to give a sufficiently accurate picture, there were some possibly unknown dimensions (such as web or flange thicknesses in a concrete box, diameter of voids in a voided deck, arch ring thicknesses

etc.). Deriving some of this information has relied on contemporary manufacturers' literature and comparisons of similar bridges in the stock.

Once this stage is complete and a baseline GRCf established, work will then proceed to:

- a. measure the impact of maintenance interventions (including consequential carbon production from additional vehicle movements on a diversion);
- b. consider how to reduce CO<sub>2</sub>e; and
- c. consider offsetting options.

Ultimately, Nick suggested that CO<sub>2</sub>e reduction should be part of the tender evaluation process, alongside cost and quality. Nick concluded with a slide of a draft Carbon Management Plan Dashboard which mirrored that as used on SAVI<sup>7</sup>.

The Chairman thanked Jason and Nick for their presentation and invited questions.

Osian Richards asked if the toolkit would be able to consider timings for road space, such as lane closures for longer, versus total closures for shorter, periods. Nick confirmed that this would be the case. Although recognising the benefits of the tool, Ian Norriss questioned the assumption that any replacement structure would have to be on a like for like basis. Nick confirmed that this was the current position for consistency, but a more detailed evaluation of options, including fundamental decisions on whether to replace or repair, might well follow. Keith Harwood welcomed the link to SAVI but questioned the ease of calculation of CO<sub>2</sub>e for maintenance activities when it was difficult enough simply to estimate costs. Nick acknowledged that this was work in progress but noted that he was in discussions with Mike Smith at Arup who had helped to develop SAVI. Hazel McDonald asked how long the data acquisition phase had taken. Nick replied that the first pass depended on availability of information, and the extent of any existing knowledge, but estimated up to two months for a stock of this size.

## **7. Rochester Bridge Trust Carbon Reduction Plan**

The Chairman invited Sue Threader to give the final presentation of the morning on how Rochester Bridge Trust (RBT) had managed carbon as part of the recent bridge refurbishment project.

Sue began with the RBT's carbon statement which explained a commitment to carbon reduction and to demonstrate leadership in this field. The Trust had agreed targets for their bridge management and operations activities to be carbon neutral by 2022 and to be carbon negative by 2030. The context of the presentation was the recently completed, once in a generation bridge refurbishment project. Although the Trust's commitment to net zero had seen carbon reduction move from almost nothing to

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<sup>7</sup> [Structures Asset Management Valuation Toolkit | UKRLG \(ciht.org.uk\)](https://www.ukrlg.org.uk/Structures-Asset-Management-Valuation-Toolkit)

maximum in the last six months, the lead-in time for the project had meant that early decisions had been taken as far back as 2012.

Although Sue's approach to carbon reduction was a bespoke framework, which allowed for the development of some in-house ideas, it generally followed PAS 2060:2014<sup>8</sup> and utilised the measure, reduce, offset, document, and validate methodology. Using a simple matrix, various activities had been rated in terms of the Trust's ability to influence against the volume of carbon. This then enabled a prioritisation exercise in order to hit the big carbon generators, followed by the easier activities and then everything else. In terms of offsetting, Sue acknowledged that the Trust was in a fortunate position of having a considerable land portfolio relatively close to Rochester where it could allocate areas for planting about 10,000 trees with minimal impact on tenants. This followed the principle that offsetting should be as near as possible to where the pollution had been generated. The tree planting policy was to use only traditional native species to deliver what Sue described as an "ancient woodland of the future".

Referring to a slide lifted from BS EN 15978<sup>9</sup> that denoted activities under life cycle headings of Product, Construction, Operations, and End of Life, Sue reflected that the Trust could do little about the embodied carbon in the bridges so she was mostly interested in operations. And, as the sub-heading "use" was in the hands of the neighbouring highway authority, this left the activities of Maintenance, Repair, Replacement and Refurbishment, the boundaries of which clearly overlapped and were not entirely helpful in the carbon calculation.

Sue had also researched the carbon in the "product" category both in terms of its start of manufacture (cradle) to the gate of the factory and then from gate of the factory to the gate of the site. This utilised carbon factors based on the ratio of tonnage of material to the tonnage of CO<sub>2</sub>. This also identified potential savings between virgin and recycled materials; for example, newly manufactured aluminium's carbon factor was 12.79 whereas recycled aluminium was 1.81. Similar principles had also been applied to construction plant, including both journeys to and from site as well as whilst on site.

A key finding in this work was that carbon emissions from the workforce travelling to and from site totalled 197t of CO<sub>2</sub>e, about 16% of the total of 1,200t from the project. Offsetting the 1,200t required 7,640 trees to be planted in a 3.11ha plantation.

Turning to more practical day to day issues, Sue noted the Term Maintenance Contractor had been very helpful in addressing the carbon issues but in future she would ask for all smaller works activities to have carbon budgets. She also noted that the bridge lighting had been enhanced (and, as above, due to long lead-in times for the refurbishment, this had been a pre-carbon decision) but the new systems were all LEDs, powered by renewables. As the enhancement had led to a marginal increase in carbon

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<sup>8</sup> [PAS 2060 Carbon Neutrality | BSI \(bsigroup.com\)](https://www.bsigroup.com/standards/pas-2060-carbon-neutrality)

<sup>9</sup> Also in the IStructE document "How to Calculate Embodied Carbon". [How to calculate embodied carbon - The Institution of Structural Engineers \(istructe.org\)](https://www.istructe.org/publications/how-to-calculate-embodied-carbon)

emissions, a decision had recently been taken to decrease the number of days on which the aesthetic lighting was to be used. Lastly in terms of operations, Sue had calculated that a year's worth of sweeping the bridge was the equivalent of 63 trees, so she was now considering fuel options and likely to soon switch to a bio-fuel machine.

The Chairman thanked Sue for her presentation and invited questions, which were taken as part of the following item.

## 8. Carbon Discussion/Summary

There were many plaudits for the approach that had been followed by Sue at Rochester and especially how carbon generation and sequestration issues had been broken down into easily understood numbers. Sue confirmed that she was effectively self-taught on carbon which had been a challenge as it was on top of the day job.

In the context of upscaling for bigger projects, the Chairman asked if the offsetting of carbon by tree planting was an acceptable policy. For the Trust, Sue confirmed that this was a short-term solution, taken as part of the route to become carbon negative.

Ian Norriss welcomed the policy of tree planting close to the pollution source but also asked if the bridge refurbishment project had contributed to reduced car use. Sue confirmed that cycle lanes were present on the bridge, one being fully segregated, but recognised that this might not lead to a modal shift as there were no cycle lane facilities at either end.

Henry Clarke asked if there was a centralised carbon database which could be used by all. Sue had found the ICE (Inventory of Carbon and Energy) database<sup>10</sup> to be helpful but agreed that it would be a good idea if there was one which could be populated by practitioners.

Trish Johnson noted that she had made very little progress at Clifton but also faced the dilemma shared by other tolled crossings of needing income from traffic to fund the maintenance of the bridge.

Liam Duffy recognised that procurement was a key factor in developing any carbon saving policies. At Transport Infrastructure Ireland, a sustainable procurement guide was being prepared and Liam agreed to report on this at a future BOF meeting.

ACTION 9: Liam Duffy

Hazel McDonald confirmed that Transport Scotland were developing a Carbon Management Tool for Maintenance which she hoped to be able to share at BOF 68.

ACTION 10: Hazel McDonald

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<sup>10</sup> [Embodied Carbon Footprint Database - Circular Ecology](#)

Colin Hall reported that Network Rail were also engaged with the carbon agenda, but this was presently limited to research and high-level strategies with nothing tangible as yet in terms of asset management.

Tomas Garcia noted that HS2 had put much emphasis on carbon reduction but agreed with Liam that the main issue was procurement. Even if carbon was included in a quality submission it was difficult to make any judgement as some contractors were saying their emissions were much lower than others.

*The chat box from the morning's items included the following:*

*Campbell Middleton: <https://withouthotair.com/download.html>*

*Nicola Head: TfL's new maintenance contracts have effectively moved the vast majority of operational vehicles to electric - this does bring operational challenges around life of batteries and charging infrastructure issues but is a big step change*

*Tomas Garcia: HS2 website includes a summary of what we're doing to manage and minimise carbon emissions <https://www.hs2.org.uk/why/carbon/>*

*Neil Guthrie: Environment Agency are working on a new set of Minimum Technical Requirements where we are requiring use of lowest carbon alternative wherever possible as part of all construction contracts.*

*Bill Bryce: COP26 is going to be held in Glasgow in November, which should hopefully give a high-level steer from Government*

*Nicola Head: Government often uses construction to 'drive' its way out of economic down term. The response to recovering from Covid impacts seems to be build, build build, which runs contrary to the carbon agenda*

*Paul Thomas: Cycling facilities are never perfect, but they look pretty good on the Rochester bridges*

## **9. Further Carbon Discussion and Next Steps**

The Chairman began this post-lunch item by asking whether BOF might be able to facilitate, or at least contribute to, carbon collaboration between bridge owners.

Neil Loudon pointed out that there were other highway assets which were also being considered by client bodies, not just bridges. Kevin Dentith confirmed that carbon would be on the ADEPT Bridges Group agenda for its May meeting. Confirming Neil's point, his own authority, Devon, had made some progress but this was mainly being driven by his highways colleagues. He also questioned an earlier comment that masonry arch bridges were no longer being built and suggested that this might no longer be the case if carbon was to be measured over the whole life of a new masonry

arch in comparison with other forms and materials. Sue Threader agreed that there could be some benefit in exploring this idea; there had been a discussion at the ICE Archive Panel about taking an approach to consider CO<sub>2</sub> over the life span of a structure as a way of demonstrating the value of protecting historic structures for as long as possible.

The Chairman also asked what metrics could be adopted to measure carbon: perhaps the number of passenger miles or tonne of freight miles per bridge? Sue Threader advised not to wait until everything was perfect, suggesting that it was better to have some data than all the data. Any database could be refined as more figures became available. She also noted that it was not easy to obtain consistent information from suppliers; some were very helpful, others not.

The Chairman returned to the issue of procurement and asked whether anyone was yet incorporating carbon as part of the tender submission requirements.

Hazel McDonald agreed that this would be a good move and, whilst noting that Transport Scotland make references to carbon in their strategy documents, suggested that there should be a process of making tenderers submit bids based not only on quality and price but also carbon. Sue Threader agreed, suggesting that tender evaluation models were over-complicated and in need of an overhaul. Contractors' quality submissions had a tendency to promise everything and were almost indistinguishable; she suggested a preference to specify exactly what the requirements were and for those to be priced. Tomas Garcia endorsed this view, supporting the idea that making enough time for design development to client requirements in the early stages of a project would lead to not only greater client input but also better client satisfaction in the long term.

The Chairman asked if anyone had ever received a "perfect" quality return. Nicola Head noted the excellent collaboration between Westminster City Council and Conway, their Term Maintenance Contractor. Sue Threader also praised Conway who was also the Rochester Bridge Trust's contractor and had worked hard on collaboration, although this had been largely after their appointment and not as part of the project tendering process.

Liam Duffy suggested that procurement was never straightforward and did not always give the right result. He supported the idea of including carbon as part of the process but questioned how best to measure it and make comparisons. There was a risk that it would just become another quality question and the answers would be hard to assess. The Chairman reported that the Construction Leadership Council (CLC) and TRIB were working on this, recognising that any carbon metric had to be usable and measurable. He went on to ask whether any of the BOF work might be shared as case studies, in a similar way to those used by Tercia Jansen van Vuuren in her previous work on off-site manufacturing.

Paul Thomas suggested that the carbon discussions at today's meeting made a strong case for rethinking the Grand Challenges. This was agreed in principle with the Chairman suggesting it should be the top challenge, overarching the others. It was agreed that this idea should be progressed.

ACTION 11: Chairman/ Richard Fish/ Keith Harwood

The Chairman also believed that there was a need to align the various stands of carbon work, drawing on comparisons with Victorian railway gauges or the various electrical plugs/sockets availability. His primary call, however, was for leadership which seemed to be missing at a political level. Sue Threader agreed, suggesting that political will and drive was essential. In contrast, Liam Duffy reported that TII had a Green Party Transport Minister, Eamon Ryan, although his input had yet to make any noticeable difference.

Nicola Head suggested that a BOF working group might be the best way of developing these ideas in order to derive a consistent approach. Other options might include a website on which best practice proposals might be uploaded and, eventually, a best practice guide. Sue Threader thought that PAS 2060 would present a good framework for such an initiative. Colin Hall welcomed this suggestion and agreed that the sharing of ideas, data etc. was important. The idea of a working group was widely supported, and it was agreed that any volunteers should advise the Chairman and/or Richard Fish by 30<sup>th</sup> April 2021.

ACTION 12: All

Recognising that this work would require additional resources, the Chairman agreed to investigate the possibility of using Tercia Jansen van Vuuren as part of her work on mapping the carbon landscape, which already included links to CLC and TRIB work.

ACTION 13: Chairman

To this end, it was agreed that Tercia could contact any member of BOF to gather information.

ACTION 14: Chairman/ All/Tercia Jansen van Vuuren

Henry Clarke asked about the carbon impact of diversions when planning works. Kevin Dentith reported that Devon CC were actively considering this and making decisions on whether it was better to have lane closures for longer construction periods or full closures, but with long diversions, for a shorter duration. Before concluding this item, the Chairman acknowledged that this was a good example of the many considerations that needed to be taken into account in any carbon management process.

## **10. Feedback from the Transport Research and Innovation Board (TRIB)**

The Chairman gave a brief overview of the TRIB Board (of which he is a member), and also the various working groups. Neil Loudon confirmed that he had attended a recent TRIB meeting on carbon issues.

The TRIB Carbon Action Plan for bridges and viaducts had been derived from “deep dive” interviews followed by two workshops, covering very similar ground to that covered in the morning session of this BOF meeting. Although issues such as scope and consistency needed to be established, the emphasis was that carbon could not be a bolt-on consideration but needed to cover the whole life of a structure; although how to deal with the existing bridge stock had yet to be resolved. As covered in Neil’s earlier presentation, the possibility of shorter design life elements or structures, as well as new materials, needed to be part of the wider analysis. Overall, specifying any construction activity needed to include a thorough assessment of all the implications.

The Chairman also reported on the Infrastructure Working Group, on which he also sits, and which presently has two full time secondees as a resource. A report on bridges has been commissioned from Mott MacDonald which is due to be submitted to TRIB in early May. The Chairman agreed to update BOF on this, either via Richard Fish or at future meetings, and hopefully to have it uploaded to the BOF website.

ACTION 15: Chairman/ Richard Fish
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As well as the Motts report, the Chairman also noted other work being undertaken by Expedition Engineering on the PAS 2080 implications. He endorsed others’ views, however, that it was better to start these initiatives with the available data rather than wait for everything to be in place.

## **11. Feedback from UKBB on 17<sup>th</sup> February 2021**

Richard Fish reflected on this meeting which had had a very long agenda and several items had suffered from only a short discussion or had not been taken at all. Other UKBB members agreed. Kevin Dentith advised that he had contacted Liz Kirkham and proposed longer meetings stretching into the afternoon to enable more time for presentations and/or debate.

Nicola Head recalled that the carbon management toolkit had been discussed and this was to be escalated to UKRLG. Hazel McDonald mentioned that LoBEG had proposed changes to the element inventory on BridgeStation which appeared to be undertaken in isolation. Richard Fish suggested that this had needed to be considered as part of his item on document ownership which had been covered only briefly and effectively deferred to the next UKBB meeting.

It was agreed that the next UKBB meeting should have an update on the BOF carbon discussions.

ACTION 16: Richard Fish
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The Chairman noted that UKBB minutes could now be accessed from the CIHT/UKRLG website. Keith Harwood noted that the feedback from BOF had been welcomed as part of resolving this issue.

## 12. BICS Update

Hazel McDonald reported on the survey results which were to be considered by UKBB. The headlines included criticism of LANTRA's clunkiness in processing applications and some questions about the competency framework, especially for some local authorities who only conduct General Inspections with in-house resources. Hazel confirmed that a meeting with LANTRA had been fixed for 6<sup>th</sup> May to be attended by Neil Loudon and Stephen Pottle as well as Hazel herself. There was no news on the long overdue assessor standardisation event, but Graham Cole had reported that the revised assessor guide was not yet ready. There had been only a marginal increase in numbers of applications and successful outcomes since the last BOF meeting. Hazel also suggested that LANTRA had made some progress on dealing with e-portfolios but acknowledged that there was room for improvement in their communications.

Neil Loudon confirmed this position but was hopeful of a positive outcome from the 6<sup>th</sup> May meeting. It was agreed that this should be reported either at BOF 68 or via email.

ACTION 17: Neil Loudon/Hazel McDonald/Richard Fish
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The Chairman asked for updates from BOF organisations:

For Transport Scotland, Hazel McDonald noted that all agents were now required to have BICS accredited inspectors. In three of the units, some senior inspectors are almost at the point of submitting their e-portfolios and Transport Scotland have assisted with this in the short term by organising some mock interviews. Jason Hibbert confirmed that the Welsh Government's agents were also making progress on providing BICS qualified inspectors.

In Northern Ireland, Daniel Healy confirmed that private sector agents are now required to have inspectors with BICS accreditation. In-house equivalents had only to demonstrate competency, but Daniel was continuing to argue that this was best achieved through BICS. Nicola Head advised that new TfL framework contracts would require a demonstration of competence which she hoped would also be through BICS.

Andy Featherby noted that CR&T had three levels of competency for internal inspectors and any inspection undertaken by external parties are checked by in-house staff. He also confirmed that both of CR&T's full-time inspectors are now registered on the BICS system.

## 13. Implementation of CIRIA Guide C764 Hidden Defects in Bridges

Nicola Head had originally requested an update on this topic at BOF 67, but she was hoping to gain an insight as to how other organisations were implementing the guidance.

Hazel McDonald spoke for most when she said that Transport Scotland were waiting for guidance in the DMRB. Neil Loudon replied that Highways England would incorporate C764 into a standard on vulnerable structures on which work was currently underway. As well as hidden defects, both safety critical fixings and fatigue prone structures would also be included.

Colin Hall recalled how the initiative behind C764 had partly arisen as a result of the Stewarton bridge collapse<sup>11</sup> in 2009. The RAIB report had highlighted hidden corrosion traps and Network Rail guidance now required all such areas to be inspected as part of a Detailed Examination. Network Rail were also focusing on structural elements buried under ballast and cladding to arches in which tenants have their businesses. They also had a programme of breaking out jack arches although this had now been scaled back as there did not appear to have been many problems. Nick Burgess confirmed that LUL had similar issues as Network Rail, not least inspecting arches with tenants.

Osian Richards reflected on Colin's reference to jack arches and questioned whether the majority could be assumed to be in reasonable condition. Colin replied that the sample testing undertaken by Network Rail proved that this should be the case but also warned that reinstatement of breakouts seemed to be more of a maintenance liability than the original elements.

The Chairman asked for feedback on the development of the DMRB guidance at the next meeting.

ACTION 18: Neil Loudon

## 14. Updates on Current Bridge Issues and/or Research

The Chairman began by referring to the Horizon 2020<sup>12</sup> research budget which, although EU based, the UK can apply for funds now that we have "associate country" status. The total EU budget was €90m plus contributions from associate countries (although it was possible that the UK would choose to deduct its contribution from the Innovate UK budget). He suggested that all organisations needed to be aware of this source of funding and to consider applications, not only because it was a significant budget but also the fact that it could exercise leverage from other funding streams. He also mentioned another EU initiative, the COST (Cooperation in Science and Technology) programme<sup>13</sup> which could provide funding for some 40 to 50 Research Assistants.

Finally, the Chairman noted that CROSS had recently launched a new website<sup>14</sup>. Richard Fish pointed out that the acronym now stood for Collaborative Reporting for Safer Structures and now covered fire safety in response to the Hackitt Report. Alastair

<sup>11</sup> RAIB report: [Derailment of a freight train near Stewarton - GOV.UK \(www.gov.uk\)](http://www.gov.uk)

<sup>12</sup> [Horizon 2020: what it is and how to apply for funding - GOV.UK \(www.gov.uk\)](http://www.gov.uk)

<sup>13</sup> [COST | European Cooperation in Science and Technology](http://www.cost.eu)

<sup>14</sup> [Collaborative Reporting for Safer Structures UK \(CROSS-UK\) \(cross-safety.org\)](http://cross-safety.org)

Soane had now taken on a consultancy role within SCOSS/CROSS but would still be the link with BOF for the time being.

The Chairman then invited updates from the meeting:

**a. Highways England**

Neil Loudon referred to the HE “moonshot” research programme and in particular a focus on post-tensioned bridge management<sup>15</sup>. This had been prioritised by a Grand Challenges type exercise and would concentrate on methods for the detection of corrosion. Calls had been requested (as per the footnote) and the Chairman reported that Cambridge University had submitted a proposal with the intention of pulling together parallel technologies to help find a solution.

Neil also referred to work on the redrafting of the MCHW, which had to be completed within the next two years, and a project to see if bridge inspection reporting could be improved through the use of tablets.

The Chairman also mentioned the recently announced DigitalRoads and FutureRoads projects on which Cambridge University and Costain were collaborating with Highways England. Neil agreed to investigate this and report to a future BOF meeting, as appropriate.

ACTION 19: Neil Loudon

**b. ADEPT - Devon CC**

Kevin Dentith reported that he was supporting a research bid by Exeter University on structural health monitoring for a population of similar bridges within a bridge stock.

The Chairman praised the link that Kevin had established with Exeter, and the other examples of links to universities, where this was regularly reported at BOF meetings such as Hazel McDonald reported on behalf of Transport Scotland. He encouraged all BOF members to take up any opportunity which might present itself.

ACTION 20: All

Kevin also noted the bridge collapse statistic from the RAC Foundation survey (11 full or partial collapses across the UK in 2020) and agreed to follow up the respondents to try to gather more feedback and information, liaising with Richard Fish. Via the chat, Osian Richards also offered to assist with this

ACTION 21: Kevin Dentith/Richard Fish/Osian Richards

The Chairman asked for the RAC Foundation survey to be uploaded to the BOF website.

ACTION 22: Paul Fidler/Kevin Dentith

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<sup>15</sup> [Highways-England-Moonshot-Call-for-Research-Ideas-for-Post-Tensioned-Bridge-Management.pdf \(mininginstitute.org.uk\)](https://www.mininginstitute.org.uk/Highways-England-Moonshot-Call-for-Research-Ideas-for-Post-Tensioned-Bridge-Management.pdf)

### c. Welsh Government

Jason Hibbert mentioned the EPSRC RM4L<sup>16</sup> (Resistant Materials for Life) project, which was being led by Cardiff University, supported by Costain. This had been granted an extension due to Covid.

He also noted that the A465 DBFO-style project was utilising a mutual investment model for procurement. Jason offered a presentation on this at a future BOF meeting.

ACTION 23: Jason Hibbert/Richard Fish
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Jason also reported on a review of scour management on the Welsh Government's Trunk Road network. Arcadis were undertaking this and had found inconsistencies in the way that BD 97 had been interpreted and implemented. They had proposed a mini-guide, complete with video, to assist. Neil Loudon suggested that he and Jason should have a separate conversation about this as Highways England are preparing a webinar for the new DMRB scour standard.

Discussion then extended into other scour issues:

Liam Duffy noted that TII had been advised that diving inspections for scour were no longer necessary. Colin Hall and Andy Featherby confirmed that their organisations use divers to inspect underwater defects, although Network Rail also use technology to detect the presence of scour. Noting the very high tidal range and speeds on the Medway, Sue Threader uses bathometric survey techniques as supplied by the Port of London Authority (PLA). Nicola Head and Nick Burgess confirmed that they too use the PLA for their Thames bridges. As Network Rail, Hazel McDonald reported that Transport Scotland use a combination of remote detection, using sonar, and diving inspections.

Paul Thomas questioned the safety of diving inspections. Kevin Dentith, as a qualified and experienced diver, replied that safety was paramount; but a well-planned dive should present minimal risk. He pointed out, however, that utilising a dive team was an expensive option. That said, Devon CC use divers where necessary, and/or inspectors in dry suits, but normally relying on touch rather than visuals.

Ian Norriss reported that the updated CIRIA guide on scour, C742, was shortly due to be published and he was planning to attend the launch event. Hazel McDonald noted that Transport Scotland had contributed to the CIRIA study.

Finally, the Chairman asked if anyone was aware of recent developments on the Gaist BridgeCat device. Richard Fish recalled that this had been presented by Jenny Roberts from Gaist at the "scour special", BOF 54 in October 2017. This was a project which had been commissioned directly by the DfT following the 2015

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<sup>16</sup> [Home - M4L \(rm4l.com\)](http://Home - M4L (rm4l.com))

floods and consequent bridge failures in Cumbria in 2015. He agreed to find out more and report back at BOF 68.

ACTION 24: Richard Fish

#### **d. Transport Scotland**

Hazel McDonald noted that collaborative research projects with Strathclyde and Glasgow Universities, as previously reported, had also been delayed due to Covid.

### **15. Bridges 2021 Conference and Awards**

Richard Fish gave a brief update on the eBridges conference<sup>17</sup> to be held virtually on May 26<sup>th</sup> and 27<sup>th</sup>. He had been liaising with José Sanchez who had recently advised that delegate numbers were already promising. He encouraged attendance and reported that discounted early bird booking was open until 30<sup>th</sup> April.

ACTION 25: All

The event would include the first Bridge Awards ceremony on the evening of the 26<sup>th</sup>, at which the winner of the BOF lifetime achievement award would be announced. Entries for other categories had also exceeded expectations and it was hoped that the awards scheme would become a permanent fixture of the conference.

### **16. BOF Subscriptions**

The Chairman was pleased to report that all outstanding BOF subscriptions had now been paid and thanked those who had applied pressure within their organisations.

### **17. Any Other Business**

#### **a. CIRIA Masonry Arch Assessment Guide**

Richard Fish had been asked to pass on a message from Graham Cole advising that the final draft of this guide was to be considered by the steering group on 26<sup>th</sup> April and a version ready for publication to be with CIRIA was expected by 1<sup>st</sup> June.

#### **b. AustRoads Bridges Task Force**

The Chairman reported on the ongoing collaboration between BOF and the AustRoads Bridges task Force. He had attended part of the recent meeting and was also planning to join the one scheduled for May. An agreement had been reached to share respective minutes<sup>18</sup> and they were establishing working groups on a “Guide to Bridge Technology” and “Bridge Inspection and Harmonisation”. Any BOF member interested in volunteering to join either of these as a corresponding member should contact him or Richard Fish.

ACTION 26: All/Chairman/Richard Fish

<sup>17</sup> [Bridges - Design and Engineering Conference \(tn-events.co.uk\)](https://www.tn-events.co.uk/bridges-design-and-engineering-conference)

<sup>18</sup> Post meeting note: At the request of the AustRoads Bridges Task Force, their minutes are not to be widely shared and will only be accessible on the members only page of the BOF website.

**c. European Connections**

Kevin Dentith reported that he had been contacted by the French Embassy with a view to share best practice on bridge inspections and invited anyone who might be interested to participate.

ACTION 27: All

**d. International Cable Supported Bridge Operators Association (ICSBOA)**

From the Big Bridge Group, Trish Johnson reported that a meeting of ICSBOA was due to be held on 16th June and specific topics included ways of managing ice accretion and suicide prevention.

**e. Invitation for BOF 70 to be hosted by Rochester Bridge Trust**

Sue Threader proposed that, once clear of pandemic uncertainties, a future BOF meeting could be hosted by the RBT and might include a tour of the bridges and a dinner in one of Rochester's mediaeval chapels. This was widely and warmly welcomed and a date in May or June 2022 would be fixed<sup>19</sup>, which will be BOF 70. Details of the meeting and other activities to be decided in due course.

ACTION 28: Sue Threader/Richard Fish

**f. VicTrack Bridge Sensor Project**

The Chairman reported that he had been approached for assistance with this project in Victoria State in Australia and agreed to provide more details at a future meeting.

ACTION 29: Chairman

## 18. Next Meetings

BOF 68 will be on 19<sup>th</sup> October 2021 and hopefully in Cambridge.

BOF 69 will be a Zoom meeting to be held on 25<sup>th</sup> January 2022.

ACTION 30: All

## 19. Close

The Chairman closed the meeting, thanking everyone for their contributions.

Richard Fish,  
BOF Technical Secretary,  
20<sup>th</sup> May 2021

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<sup>19</sup> Post meeting note: BOF 70 date will be 14<sup>th</sup> June 2022.