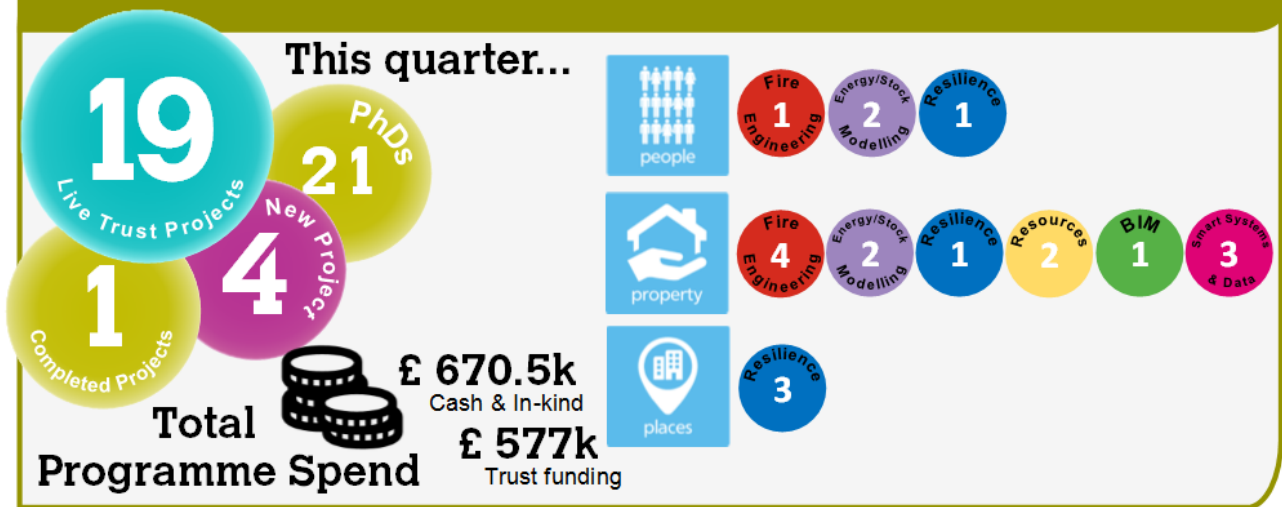


BRE Trust Programmes Quarterly Review October - December 2018

Prepared by the BRE Trust Secretariat



Executive Summary



This review summarises the progress of the BRE Trust's Project, Outreach and Partnership Programmes during October-December 2018, and reports on the BRE Trust Conference held on 24 January.

Annual Conference – speakers and delegates analysed the key challenges facing the industry to help the Trust direct its resources in ways that deliver the most positive impacts.

Projects - we report on four new projects:

The Cost of Poor Housing in Wales 2018 – producing new figures on the cost of poor housing in Wales, based on the 2017/18 Welsh House Condition Survey, for a report on the relationship between housing and health.

Specifying timber for healthy buildings – writing a Wood Information Sheet that will reach 10,000 TRADA members and be widely promoted.

Applying SDGs to infrastructure projects – the UN's Sustainable Development Goals (SDGs) have not been written with infrastructure projects in mind. This project will identify SDG targets relevant to infrastructure

Measuring dementia homes adaptation – creating a consistent, measurable approach to adapting homes for dementia, using parameters identified in Phase 1 of the dementia house project on the BRE Innovation Park.

There are updates on three projects about:

- The performance of indoor air quality monitors and sensors.
- Circadian lighting – health & wellbeing and solar shading.
- Protecting people from fire death and injury.

Outreach and dissemination

The review includes reports on:

The BRE Academy's activities with regards the new BIM International Standard, fire training and international opportunities.

Construction Excellence – reports of the National Awards and the CE Annual Conference, and support for research on the impact of CO₂ levels on cognitive capability.

Schools Programme – we are aiming to have an updated school programme ready for launch in summer 2019.

Partnerships - we report on our:

Humanitarian Programme, including our relationship with Article 25, a charity focused on improving health, livelihood and resilience to disaster through built environment design.

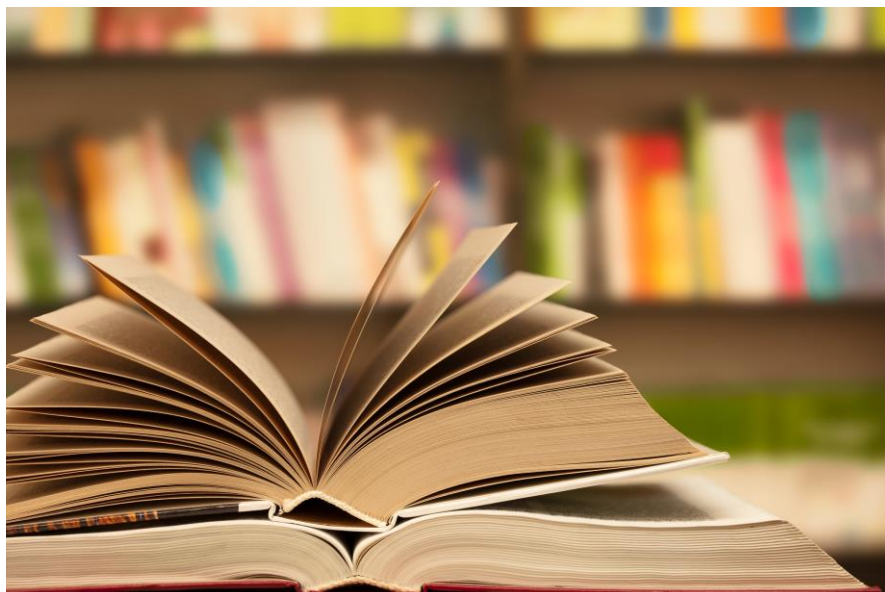
Two new PhD studentships on:

- Maximising information from product fire tests
- Blockchains for traceability assurance.

The quarterly report from the Centre for fire safety engineering at the University of Edinburgh.

Contents

The BRE Trust Annual Conference	4
New Research Projects	10
Research Project Progress	12
Outreach and Dissemination	14
University Summary Q3 2018/19	18
Partnership Programme	19
Appendix A: Project Status	22
Appendix B: Current Studentships	23



BRE Trust Annual Conference

24 January 2019. Kings Place, London

Welcoming the wide range of leading industry figures attending the 2019 BRE Trust Conference, Trust Chairman James Wates said:

“It is vital that the Trust remains relevant to the needs of the industries we support. Our invited speakers will give their perspectives on some of the industry’s current challenges, opportunities and capability gaps, but this event is largely one of open discussion, so we also look forward to hearing from you.”

The single most important driver of investor behaviour

The conference opened with discussions on key issues for clients investing in built assets, and those occupying them.

“Most real-estate-sector driving forces are now market led,” said Alan Somerville, Head of BRE’s Building Performance Group, “it’s the market pulling, rather than government or policy and lawmakers pushing.

“For investors, the *single* most important driver is ESG (Environmental, Social and Governance matters), partly as a response to global issues – such as climate change – but principally because they want the non-financial performance of their investments to be measured, demonstrated and backed up with clear evidence.

“A key way of doing this is by benchmarking performance using GRESB, the ESG benchmark for real assets. Started just a decade ago, every investor of any consequence across the globe will now be signed up and reporting in to GRESB. This reflects investors’ concerns about possible obsolescence, and the strong evidence that more sustainable buildings offer better value, capital and revenue prospects – with less risks and a more stable income.



More than just location, location, location

“The expectations of occupiers have also changed,” said Somerville. “In fact, they see themselves not so much as building occupiers but more as purchasers of a service, and are far more specific about the buildings they will – and will not – use.

“There is much more to their requirements than *location, location, location* these days. If someone, for example, had been talking about health and wellbeing in a commercial meeting five years ago, people might have sniggered. Today issues such as this are on a par with commercial factors. In addition, occupiers are now very protective of their brand reputation. Building owners and developers must therefore be equally conscious of their brands, and those of their buildings, if they are to attract clients.

Using data to drive change

“Many asset owners and developers are now wrestling with the issues of how to deliver projects better, faster and more profitably,” said Somerville. “BRE is a delivery partner of the Construction Innovation Hub, which is part of the Government’s Industrial Strategy Challenge seeking to drive this sort change in construction markets.

“New technologies and the growing availability of data will have big roles to play. Over the last five years real estate owners have been collecting large quantities of data and are now looking at the nitty gritty of how they can use this and technology to improve performance.”

The collection and use of data was an issue highlighted by conference delegates, who felt that while there has been great progress in developing industry standards, the monitoring and recording of actual performance is not as well regulated or high profile – and perhaps in many cases not captured. The question is, how do we ensure that performance data is properly gathered and used in a way that the whole industry can learn from this intelligence?

Making data available

Data is critical to the work of Stuart Chalmers, Head of the BRE Digital team and lead in BRE's Digital Strategy, which puts data and analytics at the heart of built environment decision making. The data work of the team has grown from a Trust funded project to explore ways of opening BRE datasets to the industry, into an integrated part of BRE's Digital offering – sharing data through APIs (Application Programme Interfaces) and collecting information through BRE products in a re-usable format.



“We have been promoting and developing the use of APIs,” said Chalmers (pictured above), “in our Digital Products to share live and relevant data with members of the public, other organisations (such as GRESB) and 3rd party software. Opening access to our data in this way can deliver value to the industry and provide real opportunities for collaboration and innovation. At this event, for example, I’ve met delegates who have already gained access to BREEAM data as a result of this initiative, and others who are thinking of how they can use this data in their own products and tools.”

It’s not my problem it’s yours!

The issue of collaboration was addressed by Suzannah Nichol, CEO of Build UK which brings together the construction supply chain in collective problem solving. “We can’t continue to run an industry with the traditional attitude of ‘it’s not my problem it’s yours,’” she says, “particularly after this last very difficult year that has led us to question

the financial viability of our sector. If we are going to continue delivering the most amazing construction projects we have to transform our industry.

“The sector *is* already changing,” say Nichol, “there are some great things going on, but only in pockets. Construction is not generally good at sharing data and we keep any great ideas so tied to ourselves that they don’t become mainstream.”

Pockets of Passion

Delegates described this phenomenon as ‘pockets of passion’, – examples of good practice scattered throughout country and industry sectors. They argued that the wholesale embracing of these practices was often hindered by a lack of confidence in the industry to take on new techniques. The effective communication of such innovative good practices to the whole industry is critical to them becoming mainstream.

Cutting through the noise

“Our industry is fantastic at issuing reports – but who is reading them?” asks Nichol. “Our whole world has changed in the way it communicates and construction has to follow suit. People now source their information and read on screen – this has to be delivered in a short, sharp and engaging way to stand a chance of having any impact.

“At the moment there is just too much ‘noise’ in the industry – a confusing mass of representational and research groups and organisations producing disparate information. Companies with problems to solve don’t know where to turn in all this noise, and end up adding to it by trying to answer their questions themselves.

Industry’s best kept secret?

“BRE has a great opportunity to cut through the noise,” said Nichol, “particularly with the development of the Construction Innovation Hub – and position itself as one of the key organisations to turn to for those needing to plug their knowledge gaps in anything related to construction knowledge, innovation, research and testing.

“But BRE is currently one of the industry’s best kept secrets, a key partner and resource to those who know it, but little known to much of the wider sector. To fully capitalise on all the great things that BRE does, these must be concisely communicated with clarity to an audience that will not respond to lengthy reports and guidance notes. BRE must

become part of the mainstream – one of the first ports of call for all with construction questions.”



BRE should be one of the industry's first ports of call for knowledge, innovation and research information.

Charlene Clear, BRE's Manager for New Homes, Communities and BREEAM, said "I think it is fair to say that although BRE has always looked to engage with the wider industry, it is only in the last couple of years that we have given our full attention to the sort of intelligent thinking that will help us to do this properly and develop it to the maximum.

"For example, I spend lot of time talking to our stakeholders, understanding their needs and challenges, and helping them to understand us, our products and services, and how they can get the most from working with us. But our stakeholder groups also offer an important opportunity to carry these messages to a much wider audience through their contacts in the industry. There are, for instance, 10,000 qualified BREEAM assessors that are already promoting the benefits of BREEAM all round the world."

On the cusp of a change

Director of the BRE Academy, Pauline Treatto, believes that in one aspect in particular, BRE is on the cusp of a major break-through in the way it communicates its capabilities to the industry and wider built environment sectors.

"The Academy has been delivering training for many years and three years ago invested in a digital training platform. In the first six months this achieved significant growth, providing training for 9000 students in 42 countries. However this growth trailed off in the face of a barrier in the industry in the form of a lack of knowledge and understanding of digital channels and their capabilities.

"Many companies think they don't have the infrastructure to deliver digital training, but digital delivery is hugely flexible and can use many different media. Once this barrier has been overcome, the opportunities are vast – Forbes predicts that by 2025 digital education will be mainstream and globally worth \$300 billion a year.

"With its high quality courses (many based on BRE research and knowledge), digital platform, learning management system and wide range of partners, the Academy has the critical mass and outreach to take full advantage of this market – and to widely disseminate BRE capabilities in accessible formats."

Showing what can be done

Tim Embley described to the conference how Costain has made fundamental changes to enhance its business and secure its future – a few of his comments are briefly outlined here.

Ten years ago Embley joined Costain as its Innovation and Knowledge Manager. "I joined a contracting organisation," he said, "led by a chief executive with a very clear ambition of what he wanted to do in terms of turning the organisation into a services provider. That clarity has allowed us to do different things with our business, including developing research programmes that have helped us to serve our clients better and improve people's lives.

"My work in developing innovation in the Group has been made easier by Costain's clear purpose to serve clients in three markets – transport, energy and water – and by the inspiration provided by leaders in our own and other industry sectors. My first role was to understand the value of research in our business – on a visit to Rolls Royce I saw engineers working next to scientists and resolved to drive this approach in our industry.

"This led to a business model with research at its heart, looking 50 years ahead to ensure we understand how to sustain our business. Critical to shaping our future is a programme of PhD research studentships and our partnerships with 30 universities across the UK. Our research group is divided into three parts:

Transport – allowing Costain to understand how new transport systems are going to work,

Green energy – working with our clients to address the critical issues around decarbonisation,

Intelligent infrastructure – helping clients to understand how their infrastructure is performing.

“Another issue we have recognised is the need for greater automation in our business. We are making growing use of robots in many different forms, and they are starting to deliver increased productivity. Currently, for example, we’ve got a million-pound robot going across London fitting out Crossrail, and robots on contracts completing basic tasks – allowing the team to be focused on high value activities.

“A further initiative to foster innovation is that of ‘unlocking the ecosystem’. The UK is awash with start-up technology companies and many others with great ideas. Costain has initiatives to find and foster these capabilities, and is also working closely with client groups that are taking a lead in unlocking innovation. For instance, Costain has just completed a significant project called London Bridge Train Station to improve journeys to and through London. On the station concourse we are engaging end users to generate innovative ideas for future stations, and how we can improve customer experience. The Innovation Hub allows clients to present major challenges, and the rail industry to collaborate and develop new ideas which will go into new stations in the future. The technology road mapping will assist the transformation and acceleration of innovation into engineering systems.”

The delegates have their say

Our conference delegates represented a wide range of built environment sectors, including contractor, client/owner, manufacturer/product supplier, consultant, researcher and educator. Throughout the day they provided their thoughts – via a conference app – on issues such as the key knowledge, skills, resources and challenges facing the industry. A small selection of their comments is summarised here.

Data sharing in a more open industry

Delegates echoed the views of conference participants on the need for a more open and sharing culture in the industry. Suggestions included the redefining of contracting models to advocate collaborative, open, transparent and long-term relationships where joint learning and continuous improvement are at the core.



The need for post-construction evaluation tools to detect issues with built assets was also raised – along with the open availability of resulting data to allow the performance of different buildings to be compared. It would also help to have a central point for collating information on the issues needing consideration, such as what clients are looking for, what is working (e.g. good design decisions) and what isn’t. Complementing this should be a more effective system for getting validated, collective information out to the industry so we can learn more quickly and deal with systemic issues.

Other suggestions included a set of anonymised live building performance dashboards. The view was also expressed that BRE could play a greater role in making anonymised buildings and infrastructure data available.

Skills and training

We must have the skills needed to embrace digital and modern methods of construction (MMC) techniques, particularly in view of the potential loss of EU construction professionals following BREXIT, and the competition we face from other sectors in attracting digital talent.

But delegates also cautioned about the risk, in the drive to digital and MMC, of de-skilling the sector. While there is no doubt that these tools/skills could help address quality and productivity challenges, there is a growing reliance on digital methods and tools telling us what to do – which younger generations tend to take for granted – rather than us having the skills and knowledge to ask the right questions at the right time.

Competence in construction skills and an understanding of construction processes and teamwork is needed, but the UK lacks professional training programmes in construction for all basic trades. Strong vocational education and recognised qualifications through apprenticeships would help.

Challenges and resource needs

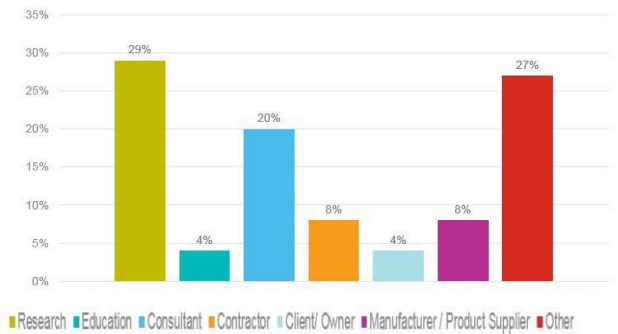
The information gap – a key challenge lies in delivering complicated information from the design team, which increasingly uses digital tools, to construction sites with largely unreformed delivery approaches – “While designers use BIM, builders will barely use hard copy 2D drawings,” said one delegate. We must get the right information in the right usable format to site – “If BIM is the way forward, everybody should be using it!” Example schemes that have successfully integrated digital and cutting-edge technology throughout should be recognised and highlighted.

Keeping faith with MMC – we need to make a manufactured/modular building approach work (and keep industry faith) in a volatile economic and political environment.

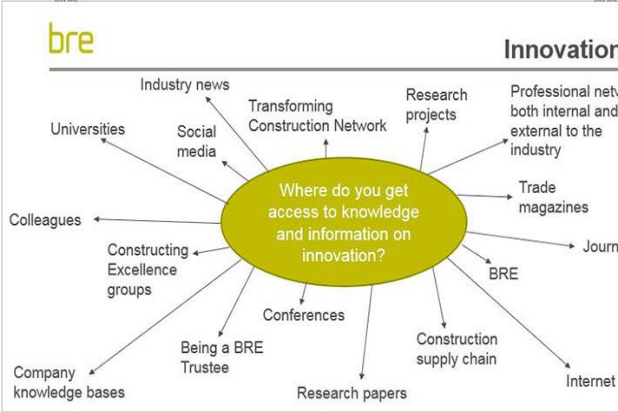
Other issues raised included the need for:

- better cost-benefit analysis tools for all aspects of building or infrastructure projects,
- making greater use and reaping the benefits of automation and robotics,
- centralised innovation funding – innovation funding for a sector the size of construction is very low and a barrier to progress. A centralised funding pot and simple bid and fund process, which de-risks uptake of innovations by tier ones, would be a valuable resource.

bre Delegate profile - supply chain position



The conference delegates represented a wide range of construction industry sectors.



Delegates were asked where they currently go for information on innovation.

Suggestions for future learning content or innovation awareness topics?

The day's final question asked delegates to consider future learning needs.

- BRE should have an objective, informed view on the effect of procurement strategies on the performance of the construction sector
- Modular asset design at consultant stage for factory built assets, not off site, that is a house in a field with a roof over it.
- Blue green infrastructure with perhaps landscape institute involvement including NHBC and insurers regarding innovation understanding risk and resilience.
- Cloud based infrastructure data management performance outcomes against design security of data and access of data for occupants
- Infrastructure asset management
- Comfort, thermal, noise, visual.
- UN Sustainable Development goals as an overarching approach to what BRE delivers - encompasses all that has been discussed today
- Intergenerational housing design
- Balancing building lifecycles vs the environmental impact when the building is initially constructed
- BRE could inform procurement routes which share these requirements with suppliers and asset owners alike.
- Broken links between challenge owners and innovators.

The BRE Trust perspective

The BRE Trust's Executive Director, Deborah Pullen, introduced the final presentation of the day with a brief film marking nearly 100 years of BRE achievements and more than 20 years of the BRE Trust.

Looking to the future she said, "The BRE Trust will build on its successes over the last 20 years by partnering with other organisations who can help us to deliver positive and demonstrable social impacts, using the outputs from our research and education programmes.

"A primary focus for us will be on demonstrating and validating potential solutions to many of the challenges highlighted today, and on collecting and sharing the resulting data – an issue frequently raised during the conference – to support the increased uptake of innovation and technology. Our now extensive and growing international outreach and connections will maximise the value of this data and knowledge across a wide climatic and economic spectrum.

"As part of the drive for greater openness and collaboration in our industry, the BRE Trust needs to be clear on the specific support it can provide to the sectors which manufacture and operate physical assets in the built environment. To maximise the impact of the Trust's resources we will focus its programmes on the three key themes outlined below."

Health, safety and wellbeing of building users, including issues such as:

- the quality of lighting, acoustics and heating provision and their impacts on health and wellbeing in the home and workplace, including the health, safety, societal and financial costs of poor housing,
- building design that prioritises vulnerable people, such as the elderly and those living with dementia, and extends their ability to live independently,
- design that enhances the workplace, such as the people-focused biophilic approach,
- innovations and technologies that improve construction site safety, enhance security and fire safety measures, and ensure the ethical sourcing of products and the wellbeing of all those in supply chains.

Affordability of sustainable construction materials and of efficiently performing built assets:

Materials – accessible and renewable materials that meet building performance requirements and extend asset life and value. The Trust is providing guidance on materials selection and use, and on innovative construction methods that meet both climatic and economic needs.

Assets – monitoring and control systems that ensure buildings perform for the people and businesses occupying them, and reduce running costs. Validating working buildings in real time and analysing data to improve our understanding of current performance is a key priority.

Resilience to changing conditions and needs, involving issues such as:

Extreme weather – the mitigation of flooding impacts in the UK and abroad through demonstrating novel barrier and water extraction products, and optimised designs to reduce damage and speed up the recovery of livelihoods.

Adaptable structures/communities – the use of novel joining and assembly systems and installation methods to support effective change of use and rapid construction – demonstrating innovative approaches and validating their performance.

A vital catalyst

In his concluding remarks James Wates welcomed this focus on the key areas. "It's easy to fall into the trap of trying to address too many issues and not really achieving much," he said, "and far better to focus clearly on what you are doing and do it really well. This is a key driver of the BRE Trust, which has made an enormous contribution to the construction sector through its investments over the last 20 years. The Trust will continue to be a vital catalyst for creative thinking and innovation, and for long-term improvements in our industry."

New research projects

4 new research projects: £57.7k BRE Trust, £84.5k cash contribution. £3k in-kind contribution

Specifying timber for healthy buildings

£5.2k Trust, £2k cash contribution, £3k contributions in kind.

The issue

The critical importance of the internal built environment's impact of on people – particularly their health and wellbeing – is now widely recognised and an increasing focus of concern. BRE has considerable experience and expertise on the role of wood in interiors and in the health and wellbeing of building users.

The project

This project involves writing a TRADA Wood Information Sheet (WIS) on 'Specifying timber for healthy buildings', framed around existing research and evidence, the research BRE has been involved with, the unknowns, and how this all comes together in certification schemes (such as BREEAM, WELL and FitWel).

Publication of the WIS will reach 10,000 members of TRADA and be widely promoted well beyond in the construction media, including by Wood4Good the Timber Trade Federation and other ambassador organisations, providing an authoritative document that is well cited and underpins growth in this area.

The publication has been drafted and circulated for comment, and is being launched at the TTJ Wood & Wellness industry event in London on 13 February.

The benefits

This provision of accessible expertise will help readers to learn directly and source further information on the issues of timber in healthy buildings, raising knowledge levels in the construction sector – especially among specifiers – and promoting BRE's expertise in this area.

The cost of poor housing in Wales 2018

£7.5k Trust, £7.5k cash contribution.

The issue

In 2010 The BRE Trust sponsored research to calculate 'the real cost of poor housing' using English Housing Survey (EHS) and NHS data. It estimated the poorest housing to be costing the NHS some £600m per annum in first-year treatment costs alone. This research was widely quoted in academic and parliamentary papers making the case for investment in better housing.

In 2011 the Trust supported a well-received project applying the same methodology to 2008 Welsh Housing Conditions Survey data. A further Trust project in 2016 used the latest EHS/NHS data and widened the remit to the total cost to society of poor housing, showing it to be £18.6bn per annum.

The project

The 2017/18 Welsh House Condition Survey, the first since 2008, prompted interest from Public Health Wales in producing new figures on the cost of poor housing in Wales for a report on the relationship between housing and health, and suggested interventions.

The project team has completed the modelling and analysis, and drafted a report now being considered by the Welsh Government and Public Health Wales. The report is due for publication on 1 March 2019.

Simon Nicol will be disseminating the findings at a CIEH (Chartered Institute of Environmental Health) Wales conference on 14 March 2019.

The benefits

This work has been – and will be – used to support housing interventions that promote health and wellbeing, and to make the case for building better quality housing.

Interpreting SDGs for application at infrastructure project level

£15k BRE Trust

The issue

In 2015 all of the world's governments committed their countries to achieving the United Nation's Sustainable Development Goals (SDGs) by 2030. The SDGs are focused on monitoring, evaluation and accountability across society at a nation level. However, they and their associated targets have not been written with infrastructure projects in mind. So whilst infrastructure development has the ability to make the biggest impact, it is not immediately obvious how to apply, measure and monitor the SDG targets at a project level.

The project

This project will identify SDG targets relevant to infrastructure and then map them onto existing frameworks such as CEEQUAL and the Global Reporting Index (GRI). The research will investigate which of the 169 targets defined under the 17 SDGs apply to infrastructure projects, and how they can be efficiently measured and monitored. It will submit a paper to a peer-reviewed journal, produce an internal report that defines possible next steps for BREEAM/CEEQUAL to consider, and will:

- review current international trends in sustainability reporting, including measuring and reporting infrastructure projects' SDG impact,
- analyse what UK engineering firms are seeking to do to report more effectively against SDGs,
- assess GRI and its rapid growth to become the leading methodology for corporate reporting across developed countries,
- compare different sustainability reporting methods, including CEEQUAL, GRI and SDGs,
- propose next steps and timeframe, and resource implications for implementation.

The project started work in November 2018 and is due for completion at the end of March 2019.

The benefits

This research will provide knowledge of which SDG targets apply to infrastructure projects, raise awareness across the industry, and enable BRE to understand how CEEQUAL and other products might need to evolve.

Measuring dementia homes adaptation

£30k BRE Trust, £75k cash contribution

The issue

With 1 million sufferers of Dementia in the UK predicted by 2025, careful thought is needed on how we develop homes, communities and towns. Home adaptation for an ageing population and dementia does not currently recognise or use research-based information – it is often driven by grant fund availability and the marketing of individual products.

The demonstration 'Chris & Sally's house' on BRE's Innovation Park in Garston has been designed and constructed with input from a team with backgrounds in architecture, supportive environments, clinical healthcare and refurbishment. The project also identified 14 parameters, common in most housing, that can have both negative and positive effects on someone living at home with dementia.

The project

This project is creating a consistent and measurable approach to home (and building) adaptation for dementia. It is using the 14 parameters identified in Phase 1 (Chris & Sally's house) to develop a matrix for guiding adaptation, with a view to providing positive outcomes for individuals, families, and building owners.

This project will:

- 'test' parameters for dementia design with stakeholder groups,
- develop version 1 of a home adaptation guide methodology and scoring mechanism,
- 'road-test' the adaptation methodology on pilot projects,
- finalise home adaptation methodology and scoring mechanisms,
- prepare and launch a BRE Trust Report on this project.

The benefits

The project will lead to greater efficiencies in delivering home adaptation for dementia. It could also lead to greater consistency in refurbishment, potentially creating market growth. Further benefits will come from greater levels of resilience in housing that can accommodate varying needs of owners and occupiers.

Research project progress updates

Setting standards for IAQ sensors and monitors

£50k BRE Trust, £25 In-kind

The issue

Invisible indoor pollutants can cause harm that may be particularly serious in childhood and for those with respiratory disease or allergies. Some of the effects have the potential to be additive over the course of a lifetime.

Addressing Indoor Air Quality (IAQ) can be served by the use of continuous monitoring, but the quality of the growing numbers of sensors and monitors available is extremely variable and robust protocols for testing them are needed.

The project

This project is investigating the performance of various commercially available VOC (volatile organic compound) and CO₂ sensors/monitors in a controlled environmental chamber at BRE. It will provide the basis for test protocols for use when developing standards against which sensors/monitors can be certificated.

The programme of testing the sensors/monitors and establishing their required attributes for monitoring indoor environments includes:

- Identifying a range of 'commercial' (i.e. for use on building performance assessment/verification) and 'consumer' (i.e. monitors, watches, smartphones, etc) devices.
- Developing an appropriate test protocol using one or both of BRE's room-sized environmental chambers. This protocol may later be applied to other indoor environment quality issues such as humidity, carbon monoxide, NO_x (nitrogen oxides) and particulate matter.



BRE's 30 m³ environmental chamber.

- Using this protocol to test the devices. Also, investigating what might be fit for purpose for future BREEAM and BREEAM In-Use products, and potentially paving the way to BRE Standards for such monitoring technology.

Progress to date

Procuring IAQ monitor/sensor devices for testing – ten types of commercially available monitors/sensors have been procured, some measuring CO₂, some VOCs, and some both.

Developing the IAQ chamber test protocol – the first iteration of the test protocol for testing the IAQ devices in the 30 m³ chamber has been developed, using Toluene as the VOC.

Next steps

The project will test the wireless connectivity of the sensor/monitor devices in the test chamber, and then test the devices at different levels of toluene and CO₂ concentration using the test protocol.

Protecting people from fire death and serious injury

£9.5k BRE Trust, £5k cash contribution

The issue

For the last three decades domestic fire deaths in England and Scotland have been decreasing, but in recent years this appears to have stalled. While there were concerns that such deaths may have increased in 2017/18, the data suggests that fire deaths have in fact plateaued.

In this three-part investigation a group of fire experts is analysing data gathered by Fire and Rescue Services (FRS) in Scotland, and examining the underlying conditions surrounding fire deaths and serious fire related injuries in domestic dwellings in the period from April 2013 to March 2017. The outputs will be used to produce guidance on the use of innovative solutions and digital technologies to increase the safety of people and protect them from the dangers of fire.

Progress

The first phase of this investigation has gathered data using the Incident Recording System and provided by the Scottish FRS. It comprised 19,645 accidental domestic fire incidents in which there were 147 serious injuries and 126 fatalities.

A review of the data identified the key factors and common conditions under which fatalities and serious injuries were occurring. This enabled a profile of a person involved in a typical fatality or serious injury to be formed, and the associated demographic profile and background conditions identified.

Fourteen recommendations have been made for developing existing technologies to safeguard the wellbeing of vulnerable people, and generally reduce future fatalities and serious injuries. They include:

- providing additional warnings from smoke alarms,
- extending combined detection and suppression water mist systems,
- developing video analytic techniques,
- reviewing fires from electrical items and proposing ways of reducing their occurrence.
- making greater use of appropriate detection systems in homes.

The next phase of the work will focus further on the specific details of fire investigation reports from each of the 126 domestic fire fatalities.

Circadian lighting – health & wellbeing and solar shading

£35k BRE Trust, £30k In-Kind, £15k cash contribution

The Issue

Levels of exposure to light, particularly blue light, can maintain or alter the body's circadian clock. Circadian lighting systems aim to improve people's alertness during day or working hours using bright light – then switch to lower brightness and warmer colours during relaxation times.

A field study in an open-plan office with 23 participants is investigating various lighting conditions over several weeks in winter, combining monitoring, computer modelling and occupant reaction. It is developing circadian lighting strategies and guidance to maximise health and wellbeing benefits.



The field-study office with LED lighting

Report on first phase of the project

A paper entitled 'Circadian lighting effects on health and wellbeing' has been prepared for submission to the journal 'Lighting Research and Technology'. It presents the findings of the first phase of this investigation into the effects of variable lighting, and its timing, on the subjective assessments, activity and reported sleep of the occupants. The effects of two types of lighting – constant fluorescent lighting and variable LED lighting – on subjective reactions and performance are compared.

Further research is planned in the office space to explore the relationship between the settings for variable lighting and the various performance and wellbeing metrics.

Outreach and Dissemination Activities

Sales and downloads

BRE Bookshop

There was a higher than usual number of Bookshop retail sales in October-December 2018, partly thanks to the sale of seven packs of Good Building and Repair Guides and a bulk sale of 100 copies of *A surveyor's guide to MMC* (FB11).

The sale of three complete sets of printed *Good Building Guides* and four complete sets of printed *Good Repair Guides* again illustrates the fact that customers continue to buy concise guidance on good building practice in core areas, such as building retaining walls and treating damp. In addition, eight DVDs on identifying non-traditional houses in the UK (AP 294) were sold in the quarter.

There were a total of 820 sales via IHS Press and BRE Bookshop in this quarter, an increase of 42% compared to the last quarter (589).

Construction Information Service (CIS)

Analysis of the Top fifty CIS downloads reveal that CIS users value:

- BRE guidance on ground engineering and related subjects with the top four titles being related to geotechnics
- the Expert Collections for their convenient format with five collections in the Top 20 downloads
- reference books on core subjects, e.g. the building elements: foundations, walls, roofs, floors, which are all in the Top 20.

The top 5:

1. *Soils, ground investigation and foundations – a collection of BRE expert guidance* – 706 downloads.
2. *Concrete in aggressive ground* – 519 downloads.
3. *Soakaway design*. 2016 Ed – 399 downloads.

4. *BRE building elements: foundations, basements and external works* – 394 downloads.

5. *Condensation and dampness - a collection of BRE expert guidance on assessing and treating dampness in buildings*– 366 downloads.

Designing Buildings Wiki

General performance

By the end of this quarter there were 7,655 articles on Designing Buildings Wiki, and the site was visited 2,020,572 unique users.

Designing Buildings Wiki received 5,304,572-page views, a 94% increase compared to the same quarter in the previous year. The BRE Trust logo appears on every page of the site and so was viewed 5,304,572 times.

BRE articles

By the end of the quarter, there were 352 BRE articles on Designing Buildings Wiki. These can be seen at:

www.designingbuildings.co.uk/wiki/BRE_articles_on_Designing_Buildings_Wiki

www.designingbuildings.co.uk/wiki/BRE_Buzz_articles_on_Designing_Buildings_Wiki

This content was viewed 34,333 times during the quarter.

The top 5 BRE articles were:

- BREEAM (2,847 views).
- The daylight factor (1,743 views).
- Damp in buildings (1,194 views)
- BRE Digest 365 Soakaway design (1,158 views).
- Electricity supply (983 views).

BRE Academy

New International BIM Standard

The recent publication of the International BIM standard, ISO 19650, has implications for the Academy's BIM training portfolio. Although ISO 19650 closely follows the UK standards, the PAS 1192 series, the Academy is looking to revise its current training pathway: BIM Essentials and BIM Information Management (which can lead to certification).

The situation will become clearer with the launch of the UK Annex supporting ISO 19650, but in the meantime the Academy has prepared an introductory online course *BIM Principles ISO 19650* which explains the key issues. This will be integrated into existing training, but individuals who have already taken Academy BIM courses, as well as those who have gone onto certification, will be offered the course.

Fire training

The Academy already offers fire training courses on fire door inspection and fire stopping, etc. It aims to develop these further by offering them as qualifications, and is in discussion with the Institute of Fire Engineers (to recognise the courses) and the qualifications awarding body, ABBE. Specifically, the Academy is looking at a BTEC Level 4 Diploma in Fire Risk Assessment and a Level 3 qualification for fire door inspection.

In addition, the Academy is developing a one-day course looking at the issues surrounding poor installation of external cladding systems, which includes an overview of BR135 (*Fire Performance of external thermal insulation for walls of multistorey buildings*) and the relevant test standards it references (BS 8414 series).

International opportunities

The Academy is pursuing two international initiatives relating to BREEAM training.

Russia

The first is in Russia where it has granted Russia's largest civil engineering institute, the MGSU, the right to incorporate BREEAM AG (Approved Graduate) into



The BRE Academy is pursuing two international initiatives relating to BREEAM training, one in Russia and one in Brazil.

its courses from 2019. BREEAM AG is a programme that has been designed to provide students with a practical guide to sustainability and the technical aspects of BREEAM – and its application to master planning and new construction in the UK and internationally.

This is part of a major skills initiative in which several programmes having been launched by the Academy in support of the BREEAM International Scheme, and in partnership with the MGSU and UK-based Planet 2030.

It is part of several measures that are being implemented to penetrate the market which includes a Russian version of the online 'Introduction to BREEAM' course. The Academy is currently arranging translation of the BREEAM International New Construction course so that it can offer localised BREEAM Assessor training courses from April.

Brazil

In addition, the Academy is working with Univali university in Brazil to offer BREEAM Associate and responsible sourcing training to its students.

Both are online courses that have been translated into Portuguese, and will be made available through a dedicated platform. It is hoped that this can be developed to also provide BIM training – there will be updates on this in future reports.

Constructing Excellence

Events

2018 Constructing Excellence National Awards

The Constructing Excellence National Awards are an annual showcase for excellence in the built environment sector across England and Wales. It brings together nine regional winners in each of thirteen categories to celebrate the very best of the best.

The 2018 winners were announced in November and celebrated at the eleventh annual awards event on 16 November. Visit here for more information:

<http://constructingexcellence.org.uk/winners-of-the-2018-constructing-excellence-national-awards-revealed/>

CE Annual Conference

The CE Annual Conference – *20 years of Re-thinking Construction* – was held on 12 December. A conference app was used to gather opinions from the participants, key findings of which include:

- Participants reported very little change on client's procuring for value, but some limited progress in digitally-enabled collaboration and standardisation and pre-manufactured value.
- Procurement and contracting models, client capability and appetite to change, and agreement on new standards and regulations, were viewed as the top three barriers to embedding manufacturing technology in the built environment.
- Almost 90% of participants were supportive of a platform approach to building, but over one third were unsure whether the market will accept a platform approach.

For more information visit:

<http://constructingexcellence.org.uk/presentations-ce-annual-conference-20-years-of-rethinking-construction/>



Celebrating built environment sector excellence at the 2018 Constructing Excellence National Awards.

CE supported research

The effects of high CO₂ concentrations on cognitive capability

Constructing Excellence supported research shows that high CO₂ concentrations in offices are decreasing people's cognitive capability. Office temperature and humidity levels can also undermine people's productivity and wellbeing.

Whole Life Performance Plus (WLP+) is a three-year study of people's performance in real world environments. Between February 2017 and October 2018, the project monitored two office buildings representing UK working conditions – one modern and one older building.

Better performance with lower CO₂ levels

Workers from the two case study buildings took proofreading, numerical, and Stroop tests in a variety of indoor temperatures, CO₂ levels and relative humidity conditions. The research found that when CO₂ levels were lowered, people completed the tests faster and scored better – test scores improved by up to 12%. and where test speed was measured in one building people worked 60% faster in lower CO₂ concentrations.

The research report can be accessed from:

<http://constructingexcellence.org.uk/constructing-excellence-supported-research-shows-high-co2-concentrations-in-offices-are-decreasing-peoples-cognitive-capability/>

Schools programme update

Review

The schools programme has been hugely successful – since 2008 more than 525 education institutes and almost 17,000 pupils have visited the BRE Innovation Park free-of-charge. However, it is now in need of reviewing and updating.

Actions taken so far include:

- engaging with BRE Schools Ambassadors to better understand the current schools outreach programme,
- fully reviewing the National curriculum, identifying any touch-points with BRE expertise,
- surveying past visitors to gain insight into their experience of the current programme, and to better understand the changing needs of children and education groups.

Key findings

The review has found the current scheme to be well thought of, with many Ambassadors and visitors rating it as above-average/excellent.

The review also found numerous National Curriculum areas that could be included in an updated scheme, ranging from geography topics

such as urbanisation and climate change, and science subjects such as noise and heat transfer, to engineering topics such as structural integrity and material chemistry.

In addition the review concluded that:

- The style of education engagement is changing. Children learn better from more hands-on learning rather than lecturing. Therefore we must create a programme that mixes various styles – questioning, creating, live experiments, tours, etc.
- We need to use digital technologies to expand our outreach beyond those who visit us (we rely heavily on word-of-mouth which doesn't get far beyond local education institutes), by creating online outreach content.
- We must better promote our scheme – creating a leading example of how to engage the next generation and then marketing it to maximise impact.

The aim is to have new scheme ready by summer 2019, in time for a launch in conjunction with University College of Estate Management's 'Building for the Future' event aimed at secondary school children.

What the punters think

Here is a small selection of comments from just one of the hundreds of visits by education institutes as part of the Schools Programme – in this case a primary school:

"When I walked into the Renewable House it smelled a bit, but that was just the glue and the hemp." Lucy

"I learned a lot of things like turning off TVs, computers and game consoles can save about £37 – and if all the ice melts in the Arctic London will flood." Callum

"I learned a bit more about solar panels." Harry

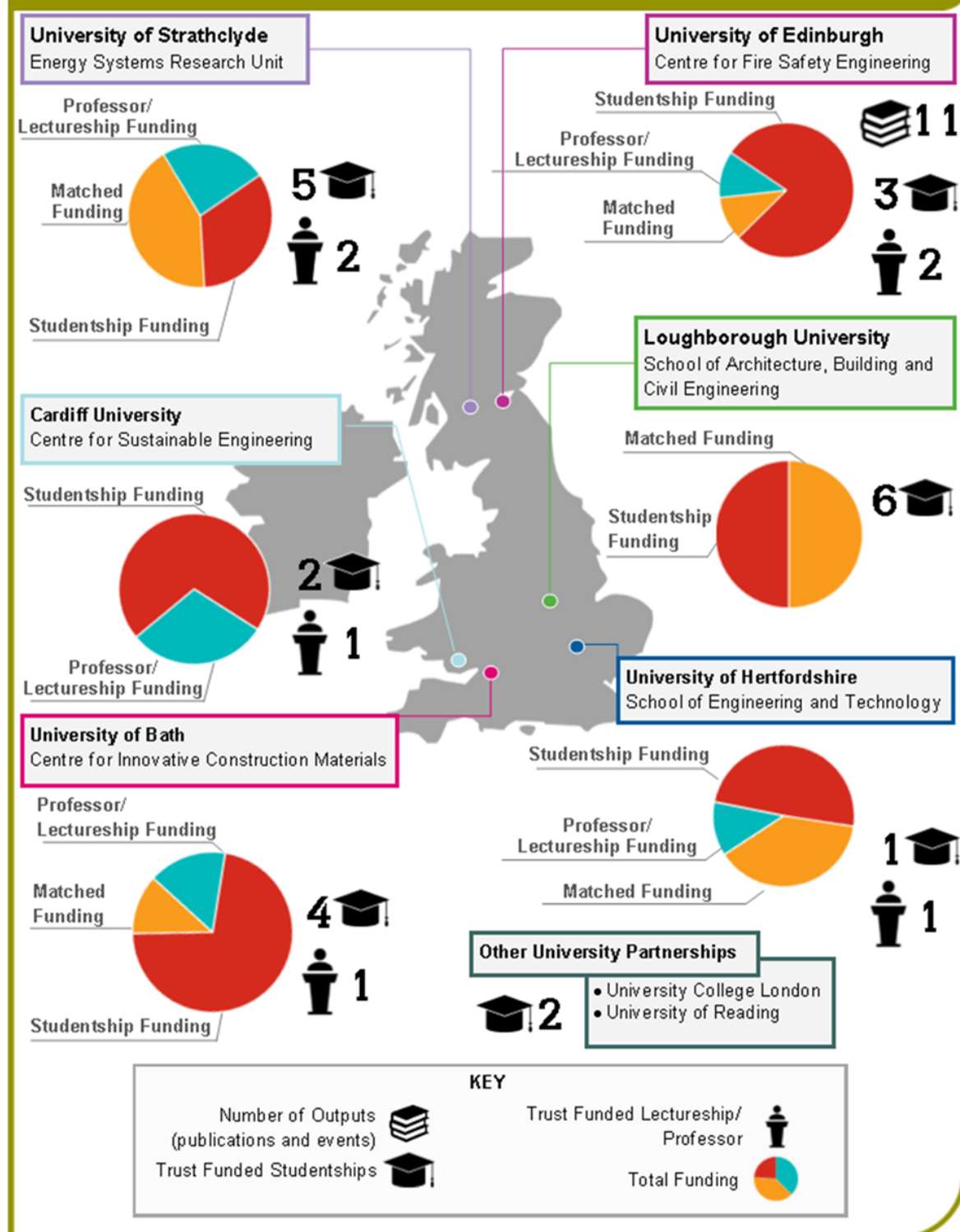
"Now at home I won't watch as much TV and I'll switch off my computer." Phillip

"I thought it was quite cool, thanks for the squash and biscuits." Lara

"My favourite house was the Hanson Eco-House because Danny and me could sit and watch the TV." Ben

"I really enjoyed it and I'll probably come again." Francesca

University Summary Q3 2018/19



Partnership Programme

Humanitarian programme

Review

We have carried out a review of the humanitarian-construction landscape to better understand what that covered, which 'players' were working in that area, and what opportunities for meaningful collaboration and research there were.

Not only in developing countries

We found that 'humanitarian' applies to far more than developing-world disasters. For example, there are 2.55million households in England that are in fuel poverty. That is not to say there isn't a genuine and huge need in for the industry's help in areas such as parts of Africa and Asia, but the scope for positive impact goes far beyond that.

Promoting awareness of our services

Much of what was found suggested that by focusing efforts in this area we could create an awareness of our services in countries (often growing economies such as many in African and Asian countries) where we are otherwise unknown.

By entering those spaces at the beginning, and providing our expertise to ensure there is safe, appropriate, health shelter and settlement from the outset, we could create a future market for our other products and services.

Article 25 relationship

The BRE Trust has been fostering a relationship with Article 25 – a global architectural charity focused on improving health, livelihood and resilience to disaster through built environment design – ever since the Cycle Myanmar Expedition in Autumn 2017.

This has seen the BRE Trust supporting a series of monthly inspirational lectures called *Make Design Matter*, which showcase humanitarian design initiatives from across the globe. Go to www.article-25.org/events/ for more information.

We are also integrating our BRE housing and energy experts into this relationship, to help design a project around improving the health of homes for those renting in the private sector. This is based on a previous Article 25 project in the London Borough of Newham, and would see an expansion of that work to help tenants address issues such as excess cold, unsafe stairs and air quality, etc.



The BRE Trust has developed an important relationship with Article 25 since the Cycle Myanmar Expedition in Autumn 2017

Studentship Programme

There are currently 21 active PhD studentships including two newly approved studentships in this quarter.

Maximising information obtained from construction products fire tests

Arjan Dexters, University of Edinburgh

BRE Trust contribution - £60k

The issue

Current fire testing procedures for demonstrating the compliance of construction materials with regulations, are benchmarks against a specific hazard scenario – so any actual fire exposure will inevitably differ from the test situation (duration, maximum temperature, etc).

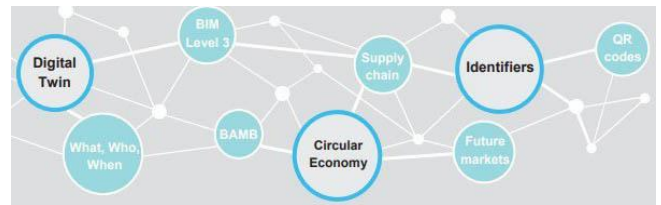
The project

This project aims to provide a more complete picture of construction products' fire performance by developing a procedure to help define performance in a broader range of hazard scenarios. The approach uses information from preliminary tests and available comparable tests to develop surrogate models using advanced regression (machine learning) techniques.

The benefits

This project will emphasise the importance of targeted testing of materials to characterize their performance during a fire.

It is envisaged that the obtained procedure for targeted testing and broad material characterisation will provide much need input to further the scientific rigour of fire engineering and computational prediction of fire initiation growth and development methods.



Blockchains for traceability assurance

Alastair Wilson, Loughborough University

BRE Trust contribution – £30k

The issue

There is growing interest in being able to track and trace products – and information about them – through complex global, supply chains. The literature on traceability is varied, imprecise and confused, and an existing BRE Trust supported PhD project is now focussing on traceability in construction.

A previous BRE Trust study identified the potential for blockchain technology (BCT) in digital material passports, smart contracts, and resourcing and connected systems, and its relevance has been recognised by research leaders (e.g. UCL have set up a 'Construction Blockchain Consortium'). Blockchains are customised, transaction exchange mechanisms that are secure and cannot be tampered with or altered.

The project

This project aims to address an immediate research need to understand and evaluate BCT, and identify possible application options for the built environment sector, and specifically construction supply chains. As part of this the applicability of BCT to selected BRE products and services, such as BREEAM and Red Book certification, will be examined.

The benefits

This work will build on the original theoretical work on traceability already completed at Loughborough, by developing cases studies to examine the practicalities and potential for applying BCT.

University of Edinburgh
BRE Centre for Fires Safety Engineering
Quarterly Report – Q3 2018/19

Overview

The group continues to be involved in a wide range of activities, including the following:

- Various group members remain active in committee and standardisation work related to Grenfell Tower, cladding materials, British Standards updates (e.g. BS 8414 and BS 9414), and the Ministry of Housing, Communities & Local Government.
- Deborah Smith, Vicky Brown, Roger Harrison and Deborah Pullen were hosted for the Annual Review in Edinburgh on October 23 (a report of which was included in the Q2 2018/19 report). It was agreed that the University of Edinburgh team would provide a list of PhD topics for review by BRE and BRE Trust.
- Dave Rush and the Intensive Recovery Intervention Service (IRIS) team carried out experiments in South Africa in November, with an array of 20 dwellings being used for fire spread experiments.
- Group members participated in Characterization of TRAVelling FIREs in large compartments (TRAFIR) experiments (Led by RISE and Liege) in Sweden in November.
- The IMFSE Fire Safety Day was held at BRE on October 15 – it was a very successful day with excellent feedback from participants (students, sponsors and academics).
- Jamie Maclean (supervised by Bisby and Stratford) completed his PhD entitled 'The Structural Response of Reinforced Concrete Columns During and After Exposure to Non-Uniform Heating and Cooling Regimes.'

Planned activities include:

- A team led by David Rush carrying out single dwelling experiments at Underwriters Laboratories in Illinois, USA,
- TRAFIR workshop at the University of Edinburgh,
- Rory Hadden planning to submit a NERC Wildfires proposal, and initiating a collaboration with Sandia National Labs on CFRP materials.



Dr Angus Law – BRE Lecturer in Fire Safety Engineering

Dr Law visited BRE with a team of PhD students to present recent EPSRC grant research on the completed Fire Spread from Mass Timber Buildings project and interim conclusions from Phase 1 of the BRE resilience project. Abstracts were submitted to various conferences on both of these activities, and the recent cladding fire large-scale and medium-scale experimental work continued in the lab.

Dr Law completed the delivery of the master level class Structural Design for Fire and continued to work with colleagues on developing the University of Edinburgh's Undergraduate curriculum.

Vasileios Koutsomarkos – PhD student: 'Developing a Fire Resilience Assessment Methodology for the Built Environment' – reported "a high degree of confidence that all existing methodologies and schemes that could provide insight in outlining the Assessment Methodology have now been located."

Simon Santamaria – PhD student: 'Analysis of ignition of solid fuels under transient heating scenarios' – completed his third year as a PhD in October and this quarter focused on what is required to successfully complete the project, including additional experiments being conducted in February, and additional theoretical analysis based on non-dimensional heat transfer parameters.

Arjan Dexters – PhD student: 'Testing for knowledge: maximising information obtained from fire tests by using machine learning techniques' – started his PhD on 1 October. See page 20 of this report.

Appendix A: Project Status

People

Research

- The use of innovative solutions and digital technologies to increase safety and wellbeing of people and protect them from the dangers of fire. **Trust Contribution** - £12.5k. **Other Contribution** - £72.5k. **Status** – In Progress
- Life-long health effects of poor indoor air quality. **Trust Contribution** - £15k. **Other Contribution** - £140k. **Status** – In Progress
- The cost of poor housing in Wales, 2018, **Trust Contribution** - £7.5k. **Status** – In Progress

Demonstration & Dissemination

- Measuring dementia home adaptation. **Trust Contribution** - £30k. **Other Contribution** - £75k. **Status** – In Progress

Property

Research

- Suppression of Biomass Fires. **Trust Contribution** - £5k. **Other Contribution** - £35k. **Status** – In Progress
- Centre for Smart Homes. **Trust Contribution** - £53.6k. **Other Contribution** - £81k. **Status** – In Progress
- Circadian lighting effects on health and wellbeing & Solar shading. **Trust Contribution** - £35k. **Other Contribution** - £45k. **Status** – In Progress
- 3 Resilience - Tackling overheating in urban dwellings. **Trust Contribution** - £40k. **Status** – Postponed until January 2019
- Optimum replacement of detectors. **Trust Contribution** - £30k. **Other Contribution** - £37.5k. **Status** – In Progress
- Lancaster Grange: Living Legacy. **Trust Contribution** - £15k. **Other Contribution** - £25k. **Status** – Completed
- Investigation of the use of TGA for fingerprinting analysis on insulating foams. **Trust Contribution** - £12.5k. **Other Contribution** - £3.5k. **Status** – In Progress
- Setting standards for IAQ sensors and monitors. **Trust Contribution** - £50k. **Other Contribution** - £25k. **Status** – In Progress
- Redevco real estate asset performance. **Trust Contribution** – 80k. **Status** – In Progress
- Redevco QSAND bringing sustainability to post disaster relief. **Trust Contribution** – 100k. **Status** – In Progress

Demonstration & Dissemination

- BIM Case Studies. **Trust Contribution** - £24k. **Other Contribution** - £46k. **Status** – In Progress
- The development of performance tests to assess fire detectors video. **Trust Contribution** - £5k. **Status** – In Progress

Skills & Learning

- Disseminating knowledge through digital training. **Trust Contribution** - £40k. **Other Contribution** - £20k. **Status** – In progress

Places

Demonstration & Dissemination

- Building Resilience to Natural Disasters. **Trust Contribution** - £12k. **Other Contribution** - £145k. **Status** – In progress
- Contribution to the “Guide to creating Positive spaces using pre and Post Occupancy Evaluation”. **Trust Contribution** - £7.7k. **Other Contribution** - £15k. **Status** – In Progress

Research

- Implementing and measuring social value. **Trust Contribution** - £20k. **Other Contribution** - £15k. **Status** – In Progress

Appendix B: Current Studentships

People (Health, productivity, safety and wellbeing)
Measuring and modelling overheating in domestic buildings, <i>Kostas Mourkos, Loughborough University</i>
Places (community resilience, climate affects)
Social innovation systems for building resilient communities, <i>Donagh Horgan, University of Strathclyde</i>
Development strategies for future cities to ensure energy resilience, <i>Ciaran Higgins (Part-time), University of Strathclyde</i>
Measuring the resilience of communities, <i>Madaleine Edgeworth, Loughborough University</i>
Future City Transport Strategy Development, <i>Konstantina Bimpou, University of Strathclyde</i>
Property (efficiently and sustainably, resource efficiency, further proof, house quality)
Low cost approach for characterization of Residential Building stock for energy labelling, <i>Ioanna Vrachimis, University of Strathclyde</i>
Bringing big data into building energy modelling - building energy focused geodemographic classification, <i>Steven Zhang, Loughborough University</i>
Dynamic energy analysis for the built environment, <i>Valentina Bonetti, University of Strathclyde</i>
Ignition of solid fuels exposed to transient incident heat fluxes, <i>Simon Santamaria, University of Edinburgh</i>
Embedding a circular economy in the building sector, <i>Katherine Adams, Loughborough University</i>
Traceability in the construction supply chain (productivity), <i>Asselya Katenbayeva, Loughborough University</i>
Smart meter data analytics for efficient energy management, <i>Anthimos Ioannidis, University of Bath</i>
Automatic generation of BIM models by semantisation of building data, an application in the energy retrofitting domain, <i>Matthew Courtney, Cardiff University</i>
Whole-Timber Structural Systems, <i>Aurimas Bukauskas, University of Bath</i>
Next generation natural fibre reinforced geopolymers, <i>James Bradford, University of Bath</i>
Optimising phase change material use for energy- efficient buildings, <i>Ahmad Wadee, University of Bath</i>
Developing a Fire Resilience Assessment Methodology for the Built Environment, <i>Vasileios Koutsomarkos, University of Edinburgh</i>
District heating and cooling optimization and enhancement, <i>Yu Li, Cardiff University</i>
Testing for knowledge: maximizing information obtained from fire test, using machine learning techniques, <i>Arjan Dexters, University of Edinburgh</i>
Self-healing concrete, <i>Lorena Skevi, University of Bath</i>
Building energy and environment: measurement, data, analysis and interpretation, <i>Daniel Franks, Loughborough University</i>

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BRE Trust

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