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BRE Trust Review Spring 2016

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Foreword

I am delighted to have been appointed as Chairman of the BRE Trust. Since its establishment in 2002 the Trust has established itself as the UK's leading charity dedicated to research in the built environment for public benefit. Attaining and maintaining high standards in the built environment and the industry that supports it has long been important for me.

My predecessor Sir Neville Simms handed over a thriving BRE Trust with excellent strategic partnerships and strong research and publications programmes. The BRE Trust will continue to build on these solid foundations and rise to meet the next series of challenges that face the built environment, not least by supporting the underpinning research that will help our industry to excel.

I'm particularly pleased to welcome some new Trustees, including Francesca Berriman, Professor Nick Jennings, Ashley Pocock and Ashley Wheaton, who bring with them a fresh perspective on the work of the Trust. I would also like to thank Michael Ankers for the many years of support and input he has provided during his tenure as a Trustee.

Highlights of 2015 include the emerging strategic research partnerships which expand the existing University Centres of Excellence that were established in 2006. The partnerships now include a broader range of institutions whose research expertise and capabilities are closely aligned with the emerging challenges facing the built environment.

The five University Centres at Cardiff, Bath, Edinburgh, Strathclyde and Brasilia continue to excel in research excellence, building on their outstanding results in the 2014 Research Excellence Framework. They have built upon core funding from the BRE Trust to deliver significant research programmes from funders including the European Union and the Engineering and Physical Sciences Research Council (EPSRC), demonstrating the impact that core funding and direction from an organisation like the BRE Trust can have in developing flourishing research centres. I'm particularly pleased that the BRE Trust has funded the Royal Academy of Engineering Centre of Excellence in Sustainable Building Design at Loughborough University to deliver a programme of applied research in high performance buildings, sustainable construction and resilient buildings and communities. In addition, the emerging work with the University of Hertfordshire on smart energy demonstrates how our industry needs to embrace the emerging world of data and digital technology.

The BRE Trust Research Programme continues to deliver strong and valuable research outputs. The 26 projects that were completed in 2015 will be incorporated into the products, tools and skills that will deliver a safer, more sustainable and resilient built environment.

The Future Cities Thematic Research Programme came to an end in 2015 and has provided the robust research that is needed to underpin the growing urbanisation that is taking place right across the globe. These research outputs are now feeding into new products and tools that will support our future cities. The Resilience Research programme that was launched in 2015 has tremendous potential to marshal the underpinning research that is needed to help us shape a built environment that is more resilient to the ever increasing events that have a detrimental impact on people's lives.

The Publications and Dissemination Programme has made progress as it adapts to meet the challenges and opportunities offered by our increasingly digital world. I am delighted to see the significant enhancement of industry skills through the delivery of more and more training and development content through the BRE Academy. As the BRE Academy embraces digital delivery mechanisms, the potential for the outputs of BRE Trust research to be more widely and effectively embedded in industry practice in the UK and across the world is significant.

I very much look forward to being Chair of the BRE Trust as it progresses through its next stage of development and executes its strategy of driving change in the built environment, developing state-of-the-art skills and knowledge, and creating world-class research capabilities.

James Wates
Chairman

Introduction

Introduction

The BRE Trust is the largest UK charity dedicated specifically to research and education in the built environment. The Trust uses all profits made by the BRE Group to fund new research and education programmes that help to meet its goal of 'building a better world together.'

The Trust funds research to drive improvements, change and delivery in the built environment. It shares knowledge and delivers active learning on its findings which provide authoritative guidance to the construction industry.

Through its funded programmes, the Trust aims to:

– Drive change in the built environment

– Develop state-of-the-art skills and knowledge in industry

– Create world class research capabilities

Programme overview 2015

The Trust's objectives of providing research and education for the public good in the built environment are supported by targeted funding for the development of a world class research organisation with wide outreach and contribution.

This is achieved by working in partnership with other organisations to support enhanced capabilities through focussed and collaborative research. The education programmes through strategic research partnerships continue to provide funding for PhD students and those studying for Masters degrees.

Funding provision is also provided for effective dissemination of research outputs via the publications programme, providing relevant data and knowledge needed by the wider industry and those who implement change in the built environment.

The overall expenditure by the Trust on all its programmes was £1.58 million, with progress on the individual programmes summarised as follows:

University Programme

The BRE Trust has extended its formal partnerships to 8 Universities, with 8 studentships completed and 13 new studentships started in the year. This brings the total number of active students funded by the BRE Trust to 27. The total spend for the year was £522k, including the part-funding of 5 Professors focused on growing the global research base supporting the built environment.

Research Programme

The delivery of the Research Programmes was commissioned principally, but not exclusively, through the Trust's trading subsidiaries. At the beginning of 2015 there were 20 active research projects within the established managed programme and the Research Committee also approved 11 new projects during the year. The total spend for the year was £710k, which included £300k on the thematic programmes focused on future cities and resilience.

Thematic Research Programmes

The Future Cities Research Programme ended in June 2015. During the three year programme £1.5 million of BRE Trust investment leveraged £5.8 million of external funding for BRE and £1.6 million of in-kind contributions to BRE and its UCEs. The programme had over 70 partners with a total project value of over £30 million.

In April 2015 the BRE Trust launched the Resilient built environment Thematic Research Programme. The priority focus for the programme is climate resilience and the BRE Trust has provided a budget of £1 million over two years. 5 new projects were approved in 2015 with a collective value of £300,000 covering flooding, overheating, wind loads, disaster relief and Community Resilience within Brazil.

Publications Programme

The BRE Trust Publications programme has moved very much towards finding new and engaging formats to disseminate research outputs and knowledge. At the beginning of 2015 there were 64 publications in preparation with 13 new projects approved in the year, 11 of which were new formats. Of these, 40 were completed in year, with the total spend for the year at £320k.

Working closely with the BRE Academy the BRE Trust is producing research outputs as online and classroom based learning modules in order to facilitate industry uptake and lifelong learning. 3 new training courses were developed with support from the BRE Trust. BRE's digital knowledge hub BRE Buzz (www.brebuzz.net) is growing as a significant mechanism for outputs to be disseminated quickly in digital formats and to signpost outputs that have been delivered in partnership with other organisations. The partnership with IHS BRE Press continues to play an important role in BRE Trust dissemination.

Highlights 2015

January

James Wates appointed Chairman of BRE Trust

Chairman of Wates Group, James Wates CBE was appointed as Chairman of the BRE Trust. James is a highly respected and influential figure in the industry. He understands the challenges faced by the sector and the key role that research and science can play in helping meet them.

Along with his role at Wates Group, James is also Chairman of Construction Industry Training Board (CITB) where his remit is to encourage new talent into construction with stimulating skills training programmes and initiatives. He is also Chairman of the UK Contractors Group (UKCG), the primary association for contractors and their supply chain partners in the UK.

He takes over from Sir Neville Simms who has been in the role since 2005.

February

Joint winners for the Royal Charter International Research Award

This award is presented by the Worshipful Company of Constructors (WCC) in collaboration with the BRE Trust, the largest charity dedicated to research and education in the built environment. It goes to outstanding individuals from the construction sector to undertake innovative and topical research in a country of their choice, with the aim of enhancing the resilience of the built environment.

In 2015 two awards were presented. Vera Bukachi of Arup and UCL, for a project addressing the provision of safe and sustainable water, and sanitation in informal settlements in Kenya. Richard Look and Caroline Field of BuroHappold, for research on developing a diagnostic programme to support more resilient cities.

March

New Home Quality Mark puts consumers at the heart of house building

BRE introduced a national quality mark for new housing that brings together many of the research outputs developed through the BRE Trust. Using a simple 5-star rating, the Home Quality Mark will give home buyers and renters a clear indication of the quality and performance of a new home. It will illustrate the home's overall running costs at a time when average annual energy bills top £1000. It will show the impact of the home on the occupant's health and wellbeing as homes become more airtight, respiratory conditions rise and our population gets older. It will also demonstrate the home's environmental footprint and its resilience to flooding and overheating in a changing climate. Additionally the mark will evaluate the digital connectivity and performance of the home as our reliance on new technology becomes ever more critical.

Key future city challenges are tackled by BRE Trust research programme

The BRE Trust has issued a report on the results of its three year Future Cites research programme, created in recognition of the complex challenges facing urban development in the 21st century as the global population and urban migration continues to rise. Involving over 20 research studies that addressed issues from the interoperability of smart building technologies to developing a circular economy for cities, the programme delivered tangible outputs in the form of tools, guidance and standards that will benefit a range of stakeholders across the built environment.

The programme, which was delivered in collaboration with over 70 partner organisations, explored four critical future city components: 'smart cities' supported by life enhancing technology; 'liveable cities' that underpin good quality of life; 'healthy cities' that support wellbeing and equality, and 'resilient cities' that can withstand and mitigate extreme weather, natural disasters, social upheaval, and cyber and security threats.

April

New BRE Trust research programme tackles built environment resilience

The BRE Trust launched a Resilient built environment themed research programme with a focus on climate resilience. Earlier research and consultations have highlighted three major climatic impacts with associated gaps in existing knowledge – flooding, wind and overheating – which are the priority areas for this programme. The research will be closely aligned with the work of the BRE Centre for Resilience, created in 2014 to address adverse weather effects, as well as social, security and disaster issues. The BRE University Centres of Excellence are an integral part of the Centre and will also be fully integrated into the programme.

BRE Trust seeks students for 5 PhDs at Loughborough University

The BRE Trust launched its new partnership with Loughborough University by announcing funding for five PhDs in the School of Civil and Building Engineering. This marks the first stage in a programme of collaborative research between BRE and the university which aims to advance built environment knowledge at a time of significant development in the UK and around the world. The core themes are high performing buildings, sustainable construction and resilient buildings and communities.

June

Chair of BRE Trust Research Committee Dr Liz Goodwin receives OBE

The CEO of the Waste & Resources Action Programme and Chair of the BRE Trust Research Committee, Dr Liz Goodwin, has been recognised with an OBE 'for services to Business Resource Efficiency and the Environment' in the Queen's Birthday Honours 2015.

BRE Trust welcomes 3 new Trustees

In June the BRE Trust welcomed Francesca Berriman MBE HonDTech, Ashley Pocock and Ashley Wheaton as Trustees. Francesca has been CEO of the Chartered Institute of Architectural Technicians since 1995. Ashley Pocock has been Head of Industry, Regulation and External Affairs for Smart Metering at EDF Energy since 2002. Ashley Wheaton has been Principal and CEO, College of Estates Management, since 2013. Francesca and Ashley Wheaton both join the BRE Trust Publications Committee, whilst Ashley Pocock joins the BRE Trust Research Committee.

September

BRE Trust welcomes Professor Nick Jennings CB as Trustee

Nick is Chief Scientific Adviser to the UK Government on National Security and Regius Professor of Computer Science at the University of Southampton. Nick is an internationally-recognized authority in the areas of artificial intelligence, autonomous systems and agent-based computing. His research covers both the science and the engineering of such systems. He has undertaken fundamental research on automated bargaining, mechanism design, trust and reputation, coalition formation, human-agent collectives and crowd sourcing. He has also pioneered the application of multi-agent technology; developing real-world systems in domains such as business process management, smart energy systems, sensor networks, disaster response, telecommunications, citizen science and defence.

Highlights 2015

BRE, Tsinghua University and Evergrande sign a £200m built environment science deal at UK-China business summit

Designed to support China's sustainable urbanisation and national green building programme, the £200 million research programme will focus on energy, materials, technology, monitoring and construction processes. The programme will also include the development of green standards and improved processes for planning, design, procurement, construction and management of buildings. The partners will carry out R&D on new green materials, low carbon products and technologies and a programme of post occupancy evaluation studies. Phase 1 will involve demonstration projects at building and community level.

BRE Trust Funds over 100 students

Three new PhD studentships started in October 2015, bringing the total number of PhDs funded directly by the BRE Trust to 101 since the Trust was launched in 2002. In addition to those funded through the BRE Trust Centres of Excellence and strategic research partnerships. By the end of 2015 there were more than 100 academic staff and technicians associated with the Centres, the portfolio of completed and active research now exceeds £60m and over 1000 papers and conference proceedings have been published.

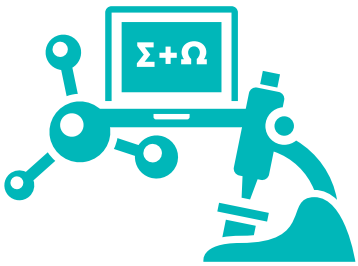
BRE acquires CEEQUAL in move to develop new sustainability rating scheme for infrastructure

BRE and CEEQUAL (the Civil Engineering Environmental Quality Assessment and Award Scheme) brought together two successful schemes – BREEAM and CEEQUAL – to create a single, science based sustainability standard and certification tool for civil engineering and infrastructure projects in the UK and around the world. The new scheme will also address the need for integration with building related schemes so that clients with mixed developments can have a single combined rating for their asset.

Simple changes to homes of older people could save the NHS over £600 million per year

A briefing paper 'Homes and Ageing in England', prepared by BRE on behalf of Public Health England, builds on the earlier BRE Trust research 'The cost of poor housing to the NHS' and was launched at the 'Healthy Places for People' conference on 10 December. Using data collected by the English Housing Survey, and the methodology from the earlier report, the findings show that there are over a million homes occupied by those over 55 where there is a significant risk to health.

Strategic research partnerships



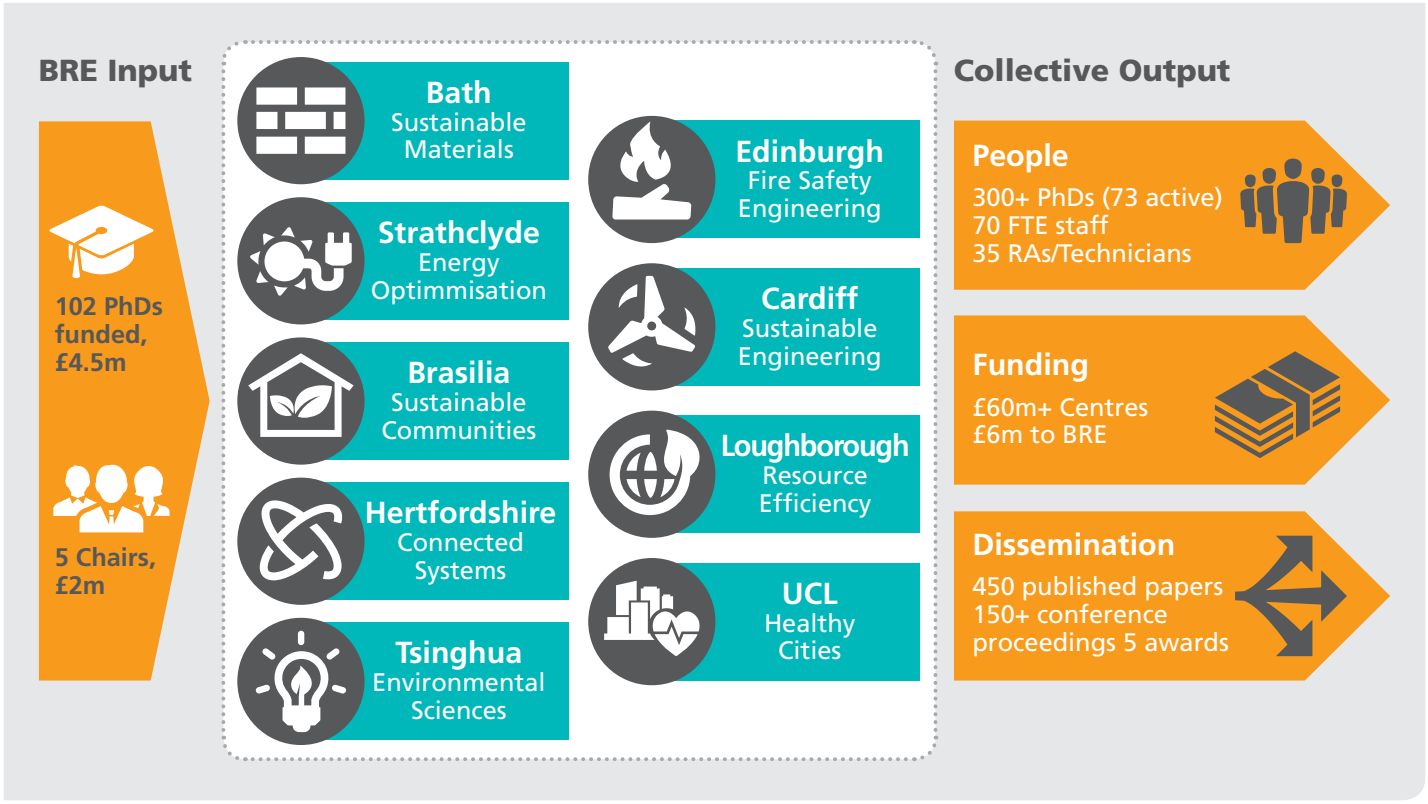
During 2015 the BRE Trust continued to provide grants to support five centres at Bath, Cardiff, Edinburgh, Strathclyde and Brasilia, in addition the BRE Trust developed strategic research partnerships with Loughborough University, University of Hertfordshire, University College London and Tsinghua University whose research expertise are strongly aligned with the aims of the BRE Trust.

The nine strategic research partnerships are:

- **University of Strathclyde**: BRE Trust University Centre of Excellence in Energy Utilisation
- **Bath University**: BRE Centre for Innovative Construction Materials
- **Cardiff University**: BRE Centre in Sustainable Engineering
- **Edinburgh University**: BRE Centre for Fire Safety Engineering
- **University of Brasilia**: BRE Centre for Integrated and Sustainable Communities
- **Loughborough University**: Resource efficiency
- **University of Hertfordshire**: Connected systems
- **Tsinghua University**: Environmental sciences
- **University College London**: Healthy Cities

In October 2015 the 101st studentship funded directly by the BRE Trust got underway. In addition to those funded by the Trust over 300 studentships have now been completed or are in progress through the strategic research partnerships supported by the BRE Trust. By the end of 2015 there were more than 100 academic staff and technicians associated with the partnership, the portfolio of completed and active research now exceeds £60m and over 600 papers and conference proceedings have been published.

The active engagement with strategic research partnerships with the wider BRE group has increased, with more integration of student projects with relevant BRE research, which ensures good knowledge transfer both ways. There are also increasing numbers of externally funded collaborative projects from EU sources such as Horizon 2020 and UK sources including Innovate UK and EPSRC increasing the reach and breadth of the overall research activities.



University of Strathclyde Glasgow

University of Strathclyde: BRE Trust Centre of Excellence in Energy Utilisation

The BRE Trust Centre of Excellence in Energy Utilisation undertakes fundamental and applied research into sustainable energy utilisation within the built environment in partnership with BRE. The focus is on responsive demand as a means to assist the accelerated deployment of new and renewable energy solutions at both the local and national scale. The intention is to create and disseminate new approaches to well-grounded energy solutions in the context of future cities and rural communities. The Centre aims to demonstrate how the built environment can play an active role in the energy mix, becoming a facilitator of better energy control in the future.

2015 saw the Centre expand its staff with the appointment of a BRE Lecturer, and increase its cross-discipline capability through engagement with academics from Architecture, the Business School, Civil Engineering, Electrical & Electronic Engineering and Mechanical Engineering.

Centre for Doctoral Training

The Centre, in collaboration with the Institute for Future Cities and the School of Architecture, established a Centre for Doctoral Training in built environment Futures. This has resulted in a substantial gearing of the investment being made by the Trust in PhD studentships, while at the same time extending the scope and depth of the research topics being pursued. Three new PhD students commenced in the period:

1. Maddalene Iovene on 'Making the connection happen – a community regeneration framework for energy systems and low carbon solutions'.

   Research into low carbon processes in the built environment has only partially addressed the wider aspects of their potential for community regeneration. This research focuses on processes for community regeneration and capacity building that revolve around low carbon methods and techniques of construction. The aim is to embed solutions for sustainable neighbourhoods in a manner that ensures local economic development, cohesive communities, robust businesses and a better environment.

2. Valentina Bonetti on 'Strategies for low carbon building design in response to the increased electrification of homes'.

   Exergy is a state function which quantifies the quality of energy, allowing meaningful comparisons of different energy sources and their suitability to match demand in the most effective way. This research aims to include dynamic exergy calculations and exergy indexes within state-of-the-art building performance simulation as a means to ensure that future building designs are more resilient and effective.

3. Ciaran Higgins on 'Development strategies for future cities to ensure energy resilience'.

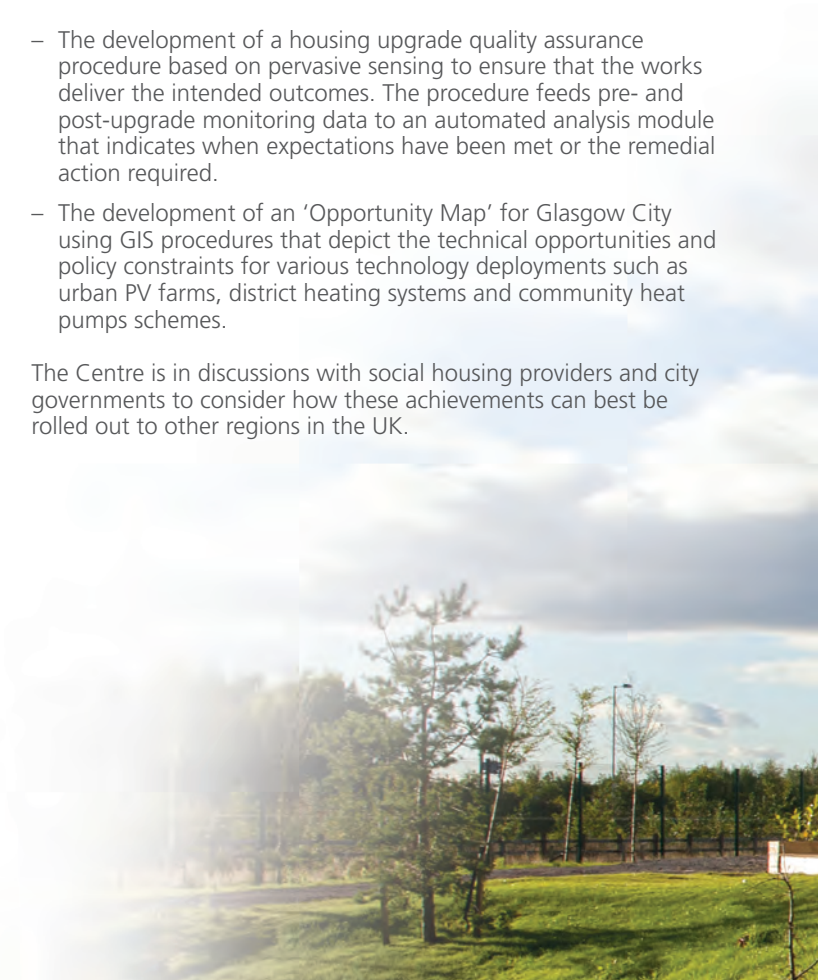
   This project is developing strategies that cities can adopt to ensure energy resilience based on consideration of the current energy landscape, city authority planning policies, technical constraints, and available technology options over different scales. Specifically, the project is developing new tools for the assessment of the energy landscape of cities that derive their power and flexibility from embedding energy systems simulation within a GIS framework.

Future Cities

The Centre has fostered new collaborations with the Institute for Future Cities and the Innovate UK funded Glasgow Future City Demonstrator to ensure that energy and resilience are effectively understood in future cities developments and applications. Key achievements include:

- The development of a housing upgrade quality assurance procedure based on pervasive sensing to ensure that the works deliver the intended outcomes. The procedure feeds pre- and post-upgrade monitoring data to an automated analysis module that indicates when expectations have been met or the remedial action required.
- The development of an 'Opportunity Map' for Glasgow City using GIS procedures that depict the technical opportunities and policy constraints for various technology deployments such as urban PV farms, district heating systems and community heat pumps schemes.

The Centre is in discussions with social housing providers and city governments to consider how these achievements can best be rolled out to other regions in the UK.



Leveraging funding

The Centre used its core funding from the BRE Trust to leverage additional funding from funders such as EPSRC, Horizon 2020 and Industry. Some typical projects include the following.

- 'Hit2Gap', a Horizon 2020 project that is developing a 'big data' platform for facilities management with the intention of bridging the gap between design intent and the operational reality.
- A 'Digitally Mediated Facilities Management' project, funded by EPSRC and undertaken in collaboration with Newcastle University, which is researching how pervasive sensing of indoor environmental conditions can facilitate timely problem identification and the routine engagement of occupants in problem alleviation.
- The 'NINES' project on Shetland, funded by OfGem and undertaken in collaboration with Scottish and Southern Energy, which examined how centralised load management applied to 300 homes can minimise the curtailment of renewable energy sources within a smart grid.
- 'Building Stock Modelling' projects, funded by UK/Korean government and industry that established a mechanism for the automatic generation of detailed stock models. The approach was then utilised to investigate the potentials for upgrading the Scottish housing stock and to quantify the impact on the electricity demand of commercial buildings in Glasgow and Seoul when deploying technologies such as heat pumps and electric vehicles.

Innovation Park activities

The Centre assisted with the development of a standard performance assessment method for all Innovation Parks within the BRE global network. Specific assessments were then undertaken for several innovative house designs located at the Ravenscraig and Garston parks, and new heat pump and weather station equipment acquired and installed at the former location.

Focus for 2016

The Centre will sustain its national and international research activities through new and existing projects with particular focus on China in support of BRE's growing engagement in that part of the world. In particular, effort will be directed to the commercialisation of Centre project outcomes, most notably relating to the multi-physics simulation of city districts, developments in BIM, and new courses for CPD delivery through the BRE Academy.

Joint working with our university centre of excellence at Strathclyde has increased significantly in 2015 with collaborations on a range of live projects such as the Innovation Park @ Ravenscraig and China developments, and; working together on areas of critical importance to industry, such as deployment of low cost monitoring, application of simulation modelling procedures and jointly delivering learning and education. The BRE team has particularly welcomed the Centre's efforts to connect us with other departments and faculties across the university, and can foresee real synergy developing as a result of the positive links made. (Rufus Logan, Director, BRE Scotland, Wales and Southwest)

UNIVERSITY OF BATH

Bath University: BRE Trust Centre for Innovative Construction Materials

The BRE Centre for Innovative Construction Materials (BRE CICM) was founded in July 2006. Its primary aim is to conduct internationally leading and interdisciplinary research in the development of innovative and sustainable construction materials and technologies. Since its establishment BRE CICM has developed particular expertise in the following areas: Advanced composites in construction, Concrete materials and structures, Low carbon building materials, Structural masonry, Timber engineering.

The Centre continued to grow its research portfolio and reputation throughout 2015. Key achievements include:

– Lecturer and BRE Trust alumni Dr John Orr was awarded a 5 year EPSRC Early Career Fellowship in July 2015. His research looks at modelling of reinforced concrete structures. John's fellowship will look to reduce the global environmental impact of concrete construction through a new method for the analysis of concrete structures. This method is well suited to producing the optimised designs that have the potential to significantly reduce material consumption.

– Professor Tim Ibell served as the President of the Institute of Structural Engineering in 2015, demonstrating the high esteem in which the centre's staff are regarded by industry professionals.

– The Centre began work on a new Horizon 2020 project, ISOBIO which seeks to combine existing technologies in order to develop bio-based panels and renders with high insulating properties, low embodied energy, low embodied carbon and which are hygrothermally efficient. This compliments the existing ECO-SEE project that is developing the use of eco-materials and photocatalytic coatings to improve the indoor air quality of modern carbon buildings.

– The Centre's associated MSc course in Innovative Structural Materials started its second year with a third intake of around 30 students planned for 2016.

Flood resilience: Reducing building drying time and indirect costs of flooding, Fiona Gleed

This project will investigate a number of aspects with the ultimate goal of reducing the indirect costs for flooded buildings by limiting the moisture uptake in the building fabric and reducing the drying time of the building after a flood event.

This will be done through the investigation of different materials, surface treatments and drying conditions and the effect that they have on moisture within typical UK masonry wall structures. Treatments to be studied will include sol-gel, silicate and chemical treatments (both commercially available and developed in the laboratory). Materials will include earth, stone and brick structures.

"The relationship with Bath has become particularly strong with considerable cross working between the teams at Bath and BRE. This provides BRE with access to academic networks and joint research opportunities that we could not achieve alone. Through the years we have been delighted to see some of the brightest and most innovative thinkers in alternative construction materials seek out the Centre to further investigate their ideas and push the accepted boundaries of construction materials." Dr Julie Bregulla, Director of Building Technology and Fire Services.

In 2016 the centre will move to a new building for the School of Architecture and Civil Engineering, which accommodates new £3 million research laboratories, which will enable the centre to expand its research capabilities and expertise, accommodating more staff and PhD candidates.

THE UNIVERSITY of EDINBURGH

University of Edinburgh – BRE Trust Centre for Fire Safety Engineering

The BRE Centre for Fire Safety Engineering conduct research the areas of fundamental fire science and engineering to develop knowledge and analysis tools in support of: innovative building design, including innovative and tall buildings; to mitigate the impacts of climate change / natural disasters, for example in the form of wildfires and their impact on the built environment; and to support increased resilience of buildings and fire prevention and mitigation. Much of the work is underpinned and validated with experimental testing at multiple scales, using a variety of novel techniques including fire testing in the BRE Burn Hall.

The Centre's outreach continues to grow as a leading internationally recognised centre of research excellence in the field. In addition to the work with the BRE Trust, the Centre is increasingly carrying out research on behalf of a range of UK and international funders. Building on research carried out by BRE for the UK Department for Communities and Local Government (DCLG), one key project carried out in 2015 was:

Strategies for fire-fighting in basements

The Fire Service Research and Training Trust funded the BRE Centre for Fire Safety Engineering to carry out two series of fire tests in laboratory scale 'basement' compartments. As these experiments were small-scale, it was possible to carry out a parametric type study to better understand the various phenomena occurring in under-ventilated burning situations, and also to define the critical conditions which may cause a sudden change in burning behaviour if the ventilation is changed. The results were compared with those from large-scale experiments carried out by BRE for DCLG. The outcomes of the project have direct practical application in terms of fire fighter safety, by interacting directly with the policy makers in the UK fire services to ensure that current operational guidance is in line with current understanding of the fire behaviour. The results are already being implemented into fire brigade practice through consultation with London Fire Brigade and the Scottish Fire and Rescue Service.

Additionally, this work should form the basis of future studies to consider the best approaches to design for ventilating basements in the event of a fire, including consideration of the validity of the use of pavement lights.

New PhD Project – Ignition of solid fuels under transient heating, Simon Santamaria

Current ignition theory cannot predict ignition under conditions of transient heating. Such conditions arise during the growth phase of a fire, as a fire spreads inside a compartment, and are also experienced by buildings adjacent to a fire. This studentship will address the fundamentals of ignition under transient heating using both experimental work and numerical simulations.

2016 and beyond…

The focus for 2016 will be to continue to expand the Centre's expertise and research capability, including exploring Wildland Urban Interface fires via new joint projects with US funding agencies. The Centre will also strengthen and grow through the addition of a new BRE Trust Lecturer and a new BRE Chair in Fire Safety Engineering.

"The relationship between the University and BRE has been fundamental in the international development of a generation of fire safety specialists who are equipped to deliver innovative and safe solutions into a rapidly changing built environment and we are delighted to have benefitted by directly recruiting 3 members of staff to strengthen our team. Additionally, we continue to work collaboratively with the University on funded projects delivering large scale experimental validation to underpin the research and using the PhD outputs to enhance our knowledge base to deliver new and relevant guidance to industry." Dr Debbie Smith, Managing Director, BRE Global

BRE Trust Centre in Sustainable Engineering – University of Cardiff

Chair: Prof Yacine Rezgui

BRE Trust Centre for Sustainable Engineering aims to pave the way for a new generation of digital buildings that have lifelong resilience and adaptability to their environment, usage and occupancy enabled by (a) smart materials and products, (b) integrated design and manufacturing systems, and (c) total lifecycle approaches.

In 2015 the BRE Centre for Sustainable Engineering pursued the potential for semantics to underpin smart systems, buildings and cities. The centre has been pioneering the potential of BIM (Building Information Modelling) and is now looking at how the data analytics and processing that have been applied to BIM can be applied at a wider city level, focusing on systems such as transport, water and energy.

Semantic processing enables datasets from different sources and in different formats to be analysed together. Semantic processing enables different systems to communicate with each other without the requirement for full systems integration. In this way it enables a system of systems approach. Having common view of different data sets allows users to see the datasets in context and understand how they interrelate to each other.

PhDs commenced in 2015:

Eco-cities – Towards energy positive districts enabled by BIM Level 3 semantics, Corentin Koster

With varied and mounting challenges facing the urban environment, many new technologies and management strategies are being developed to improve the operation of urban energy systems. Increasingly, research aims to integrate distributed energy resources through concepts such as smart grids, microgrids, district heating and cooling and polygeneration. The growing interest in these areas embodies the underlying shift in the energy landscape towards sustainability and integrates heat and electricity systems at the urban scale. This overarching aim of the proposed research is to develop the semantic referential that will underpin Digital Built Britain energy vision. This will form a key part of the currently planned BIM Level 3 standards.

Modelling and minimising thermal losses in a district configuration using a combined analytical and semantic approach, Yi Li

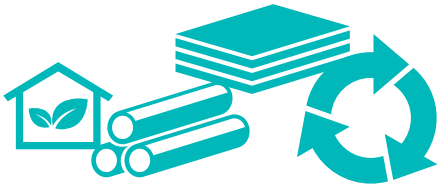
Existing district energy systems can be improved to achieve better efficiency while using primary energy resources to further reduce their environmental impact. For example, district heating systems need to be kept running at low distribution temperatures to achieve high efficiency. Large temperature differences between supply and return temperatures need to be maintained to reduce both energy and exergy losses, which consequently will help increase the overall system efficiency. But achieving this can be a complex task, as it requires real-time control and configuration. This research aims to improve district energy resilience by informed energy systems design and operation taking into account the dynamics of heat losses across the energy system network as well as (near) real-time supply / demand, clean energy generation prediction, energy costs (factoring in variable tariffs), and environmental factors.

Smart algorithms, models, interfaces for virtual and self-learning semantic building management systems, Jonathan Reynolds

The aim is to deliver a smart energy management capability on the cloud that interfaces seamlessly with Building Energy Management (BMS) systems of a block of buildings within a district configuration with a view to reduce the gap between predicted and actual energy consumption in buildings. The research involves knowledge in energy modelling, building physics, automation systems, artificial intelligence and software development.

Response of MICP-stabilised geotechnical structures to deterioration and possibility for self-healing, Stefani Botusharova

With increasing global population, there is an increasing demand for new infrastructure, which necessitates stable ground conditions. The emergence of the field of biogeotechnics allows for the development of new more sustainable and economic ways to stabilise soils. The aim of this research is to advance MICP (microbially induced calcite precipitation) as a self-monitoring and self-repairing mechanism in soils. Laboratory work with microorganisms and sand will evaluate the possibility for such self-healing geotechnical structures. Results from experiments in aqueous solution with the common soil bacteria *Sporosarcina ureae* show that calcite encapsulated, sporulating microorganisms can survive adverse environmental conditions and prolonged periods of starvation. Once a damage leading to the breakdown of the calcite matrix exposed the spores to more favourable conditions, they germinated into vegetative bacteria and formed calcium carbonate cementation again. The findings from the laboratory work in solution will be used as a foundation to examine the short and long-term response of microbially stabilised soils to chemical (acidic deterioration) or physical (crack) damage and possibility for self-healing.



The centre continues to attract funding from other sources and in 2015 a new Horizon 2020 project "BIM4VET" commenced. The objective of the BIM4VET project is the articulation between "BIM maturity assessment" and "BIM training offer in UE" based on a "dedicated digital device". Based on the IFC (Industry Foundation Classes) and other recent formats developed by BuildingSmart International, BIM open standards are now technologically robust and the keyword is now gaining interest in the whole construction and Facility Management industries. At this stage, the UK model is the most complete as it proposes a scheme of person's certification for project information manager, task information manager, and project delivery manager. However, there needs to be harmonisation across Europe for effective deployment and approach.

In 2016 the centre is developing a generic semantic platform that can be adapted to the systems of any district or city. This enables users to model and visualise specific scenarios. The centre is also refurbishing a Connected House that will enable researchers to test virtual models in a physical environment. The Connected House will demonstrate how to manage and optimise a smart low-carbon house where users become active agents.

"The relationship between Cardiff University and BRE Wales is one of key strategic importance , the collaborative working brings together key academic research and industry context, providing exemplary working and guidance to not only the Welsh Government but industry clients as well. There is a close history of joint project delivery, which is both cutting edge in terms of BIM and District heating, and Innovative with the creation of the EMC 2 Energy controller". Colin King, Director of BRE Wales

University of Brasilia: BRE Trust Centre for Integrated and Sustainable Communities

With core funding from the BRE Trust, the Centre conducts research and development of tools and services that enable the creation, delivery and maintenance of a more innovative and sustainable built environment. The centre plays an important role in facilitating knowledge transfer between the UK and Brazil and wider Latin American countries, raising awareness of many of the BRE Trust research and tools that support improvements such as sustainability, resilience and process efficiency.

In addition to the BRE Trust Chair, the Centre now incorporates 6 under-graduate students, 2 masters students and 2 PhDs. Furthermore, the impact of the Centre goes beyond this and 15 under-graduate students are using BREEAM and other BRE tools to underpin their main graduation research work.

Key projects for 2015 include:

Resilience

The Centre is developing a tool that will identify actions and instruments needed to evaluate the resilience of cities. In developing the research, it was identified the need to develop an IT tool which will not only broaden and accelerate data collection, but communication and actions and strategic information for urban resilience. The tool will provide the data that will allow users to analyse civic responsibilities and the inter-relationships between different city systems. The tool will inform reconstruction projects after major external events such as natural disasters or epidemics. The tool will also allow for the more effective use of infrastructure on a day-to-day basis.

The project is part of a theoretical framework on urban resilience and creates a methodology and replicable tools to assess urban resilience. It tests them first in the Brazilian context and later in others. This project is closely linked with both the BRE Trust Resilient built environment Thematic Programme and will be further developed in 2016.

PISAC – Parque de Inovação e Sustentabilidade do Ambiente Construído

PISAC the Innovation Park in Brazil has brought together the entire Brazilian supply chain including public, private and academia to explore the potential for built environment innovation in Brazil. The Centre has specifically been looking at how BRE's sustainability and innovation tools can be adapted and applied on this project and across the wider Brazilian industry, include applying BREEAM, responsible sourcing and LCA methodologies, improvement of health and safety and efficiency processes tools to be used in the building site as well as post construction evaluation tools.

A site has been selected for the park that offers opportunities to explore how the built environment can be sympathetically integrated into unique ecosystems such as the Murundu ecosystem in Brasilia. It will provide an exemplar of how sustainable buildings and communities can be successfully applied in Brazil.

Work is anticipated to start on site in late 2016.

Secondments – Transferring and embedding knowledge

A key remit of the centre is to facilitate knowledge exchange between the UK and Brazil. In 2015 one PhD student carried out a 6 month placement with the BRE Sustainable Products team, looking at Life Cycle Assessment methodologies and how these could be applied in the Brazilian context.

"2015's hard work and collaboration have created the foundation for a long term programme of knowledge exchange between BRE and the University of Brasilia. Projects such as PISAC provide an excellent platform for transnational cooperation to deliver sustainable outcomes for the built environment in Brazil and wider Latin America." Orivaldo Barros, Director of BRE Latin America and Emerging Economies.

Loughborough University

Loughborough University

In 2015 the BRE Trust commenced a programme of applied research with the School of Civil and Building Engineering at Loughborough University. The programme builds on many years of working together and focusses on three core themes:

- High performing buildings: including building information modelling and design, energy demand reduction, ventilation, thermal and daylight simulation, monitoring and post-occupancy evaluation.
- Sustainable construction: including sustainability management, life-cycle assessment and informatics, responsible and ethical sourcing of materials, sustainable procurement and supply chains, waste minimisation and resource efficiency.
- Resilient buildings and communities: including disaster risk reduction, structural design and construction methods, community resilience, flooding research, condition monitoring and assessment of buildings and civil infrastructure.

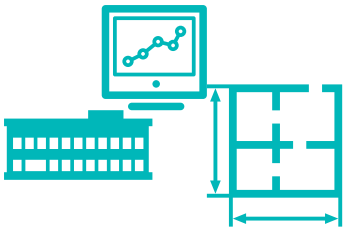
In April 2015 applications were invited for five PhDs looking at complex challenges facing the built environment. The PhDs are jointly funded by the BRE Trust and Loughborough University, in its capacity as a Royal Academy of Engineering Centre of Excellence in Sustainable Building Design. Both parties helped to shape the research focus for the cross-disciplinary challenges that include 10 academic supervisors from a range of disciplines. After a highly competitive selection process five high quality candidates commenced their projects in October 2015:

- Katherine Adams, Embedding the idea of the circular economy into buildings.
- Steven Zhang, Bringing big data into building energy modelling.
- Konstantinos Murkos, Repeatability in building modelling and design.
- Madeleine Edgworth, Measuring the resilience of communities.
- Asselya Katenbayeve, Traceability in the construction supply chain.

The project on Traceability in the construction supply chain is being supervised by Dr Shamir Ghumra who leads BRE's activities on responsible sourcing, including APRES (the Action Programme for Responsible and Ethical Sourcing) founded by Loughborough University is a key partner. Access to this network enables the researcher to access industry to inform and disseminate the research findings. The project looks specifically at what traceability means in construction and what can be learnt from other sectors that are more advanced in this field. The research outcomes will be incorporated into BES6001 (BRE's Framework Standard for Responsible Sourcing) and other potential standards and tools to drive better performance in this area.

"All of the five students are exceptional and their respective areas of research will develop and make genuine contributions to knowledge. Not only will BRE stand to benefit from this learning and research but we have a fantastic opportunity to grow five individuals" Dr Shamir Ghumra, Head of Responsible Sourcing, BRE.

University of Hertfordshire UH



University of Hertfordshire School of Engineering and Technology

The working relationship between University of Hertfordshire and BRE can be traced back to the 1990s, where there was a programme of research and teaching knowledge exchange in the areas of materials and geotechnics. The relationship has developed to focus on smart buildings and cities, including building technology development and energy management. The work is aligned with School of Engineering's long-term research interests in Smart Systems, Intelligent Control and Energy.

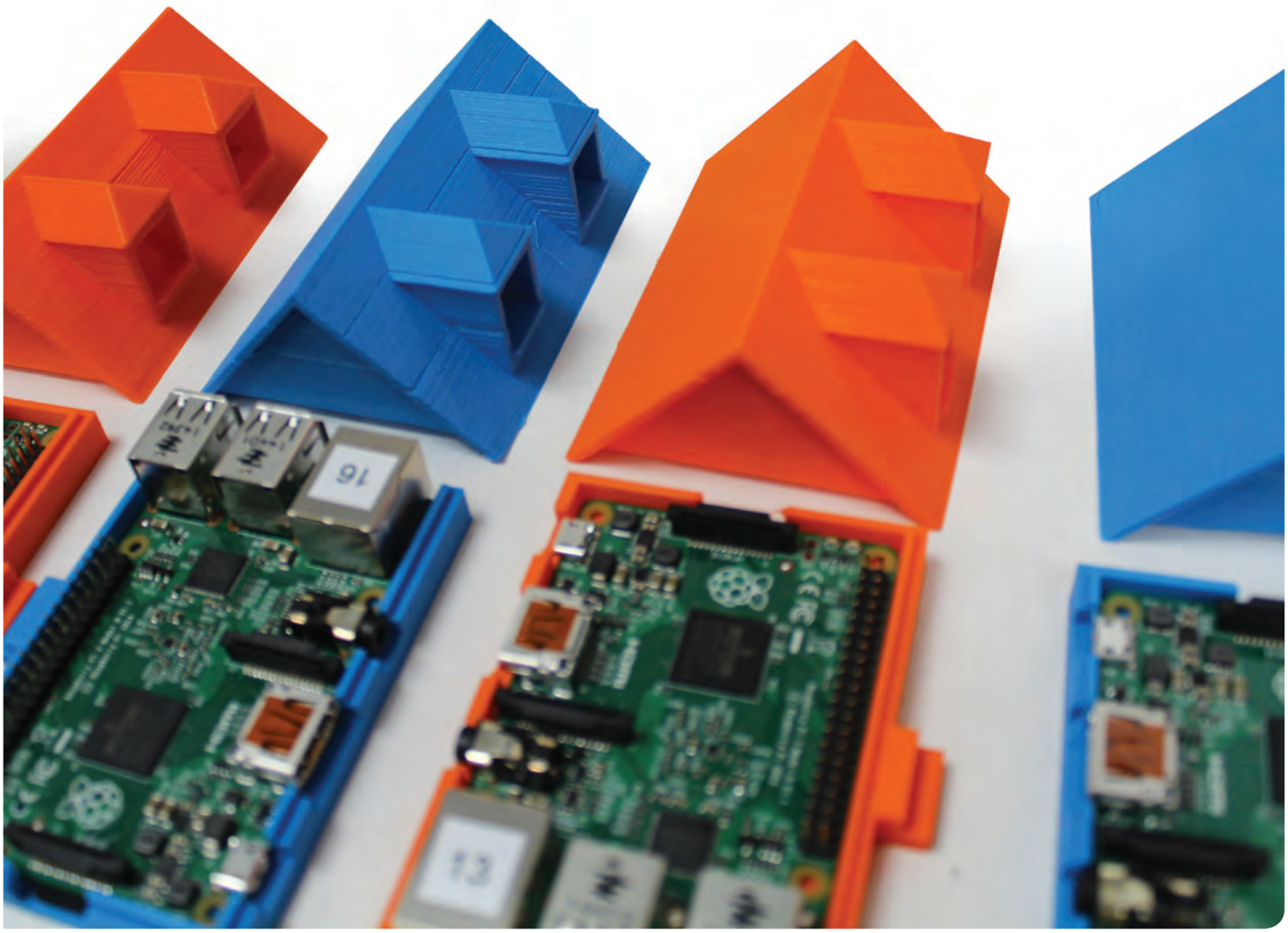
The University has been closely involved in the development of the BRE Innovation Park, in particular the Innovate UK funded Service Aggregation for Smart Homes (SASH) and Smart Meters into Smart Homes, where the Park was used as a research test bed. These projects developed into joint work on Smart and Future Cities with BRE Trust funding an EngD and PhD in 2013.

Making use of the University's Knowledge for Business Programme, BRE and the University of Hertfordshire have also carried out joint projects on Smart Power Management within Building 16 (the flagship environmental building on the BRE Campus) and Smart Electrical Networks in 2014. Funding from the BRE Trust has subsequently supported four PhD projects:

- Smart Cities and Socially Adaptive Environments, Andrew Williams.
- Smart Electrical Networks – Building Positioning System, Emillio Mistretta.
- Smart Electrical Networks – Energy Intelligence, Al-Azhar Lalani.
- Smart Grids – A Real-Time Design Tool for the Control and Optimisation of Local Electricity Networks with Distributed Demand, Microgeneration and Storage, Anthimos Ioannidis.

In 2016 the BRE Trust plans to expand upon this research to include connected built environment, energy systems and city systems.

"BRE has been working with the University of Hertfordshire for over 5 years and we really value their expertise in systems integration gained in other sectors and then apply it to the built environment. We are delighted that our research partnership is now also extending to developing new education courses together,"
Dr Deborah Pullen, BRE Group Research Director.



University College London

A number of new projects have been launched with University College London in 2015 which are now contributing towards a more strategic partnership in the future with the Bartlett Institute of Environmental Design and Engineering, directed by Professor Mike Davies. Two PhDs are currently underway:

BREEAM Communities: evaluating a new sustainability standard for master planning, Lewis Sullivan

MRes and EngD studentship to work in collaboration with BRE on research evaluating the revised BREEAM Communities standard in relation to neighbourhood-scale developments in the UK. Five case studies of urban developments are to be compiled, with an aim to highlight the ways the sustainability standard frames, coordinates, and otherwise influences development events and actors. These findings will subsequently be compared, verified, and disseminated at UK and international workshops.

Use of evidence about the built environment and health by policy and decision-makers, Helen Pineo

There is wide recognition that the environment's impact on health is a complex system. Despite some uncertainty about the relationships between the built environment and health, there are calls for policy and decision-makers to incorporate health in all scales of urban development. While public health professionals use research evidence to design new policies and programmes, how do built environment practitioners use evidence to inform the development of health promoting environments? The research involves a two-part systematic review to: 1) identify all indicator systems regarding urban environment impacts on health and wellbeing and 2) analyse previous studies which explore the use of these systems. This is followed by qualitative investigation of several case study indicator systems to inform the development of a system dynamics model of the use of evidence.

Sustainability

Defining system boundaries in BREEAM infrastructure project assessments – J Elms

Why was the research needed – The work of the BRE Trust covers the entire built environment, including infrastructure. The development of an application of BREEAM to infrastructure is a key element to enhance the sustainability of infrastructure projects.

Infrastructure differs from buildings in that the individual assets don't exist in isolation; instead they are usually part of a wider system. For example in the case of a new water treatment works within an existing network the boundary could be set around the new asset so that only the new works are assessed. However the new asset will work as part of a wider network and an alternative could be to set the boundaries wider and assess the impacts of the whole system of which the new asset is a part. This project aimed to define a process for identifying and setting appropriate system boundaries for an infrastructure project or project type in the assessment of infrastructure projects in BREEAM.

Objectives

- To identify local, regional, national and international reach for each of the proposed issues within BREEAM for each of the infrastructure sectors.
- To identify a number of commonly used systems, methods and approaches currently used by project teams, as well as exploring whether a standard process for identifying impacts, dependencies and subsequent arbitrary boundaries for different project types can be defined.
- Testing the approach on case study scenarios.

Outcomes – The project created a framework for the setting of boundaries that will be essential to the effective assessment of the environmental impact and sustainability of infrastructure projects. Simplifying the boundaries of an assessment is appropriate to ensure it remains proportional to the scale of the project and its impacts. Boundaries and the robustness of the boundary definition vary by individual issue and the overall aims and objectives of the scheme – this is the fundamental principle when deciding on the system boundaries.

Next steps – The project outputs are now being incorporated into the BREEAM infrastructure scheme. A statement has been develop in the BREEAM scheme documentation for infrastructure on how assessors should consider the system boundaries in formulating and defining their assessments.

Revision of the BREEAM weightings – A consensus based approach – C Ward

Why the research was needed – BREEAM (The Building Research Establishment Environmental Assessment Methodology) provides the assessment framework that drives sustainability decisions in built environment projects. As such it is a key mechanism for the BRE Trust to achieve widespread impact and drive a better built environment. Transparency about the decisions that sit behind BREEAM are essential to retain trust and confidence in the methodologies that sit behind BREEAM.

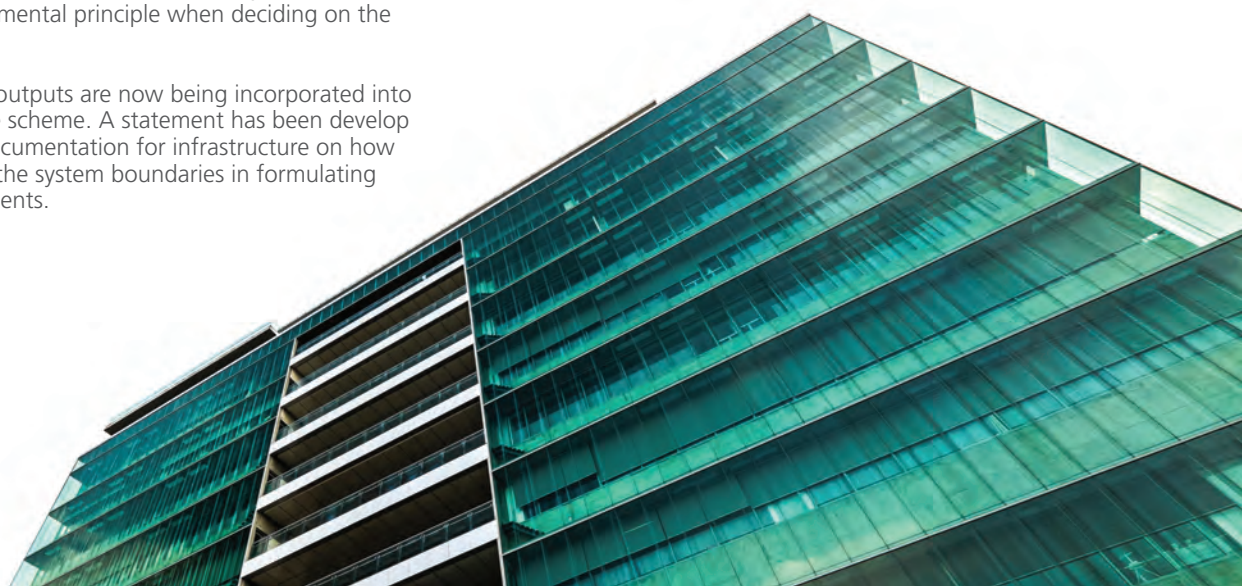
This research was required to develop and apply an appropriate methodology to revise the BREEAM weightings and to provide assurance that the weightings process is transparent and based on a robust and rigorous methodology.

Objectives

- To develop a standardised, transparent and credible methodology for assigning relative importance to the different sustainability impacts covered by BREEAM.
- To develop a new set of 'core' BREEAM weightings for the UK and a process to apply these to all BREEAM sectors and schemes.
- To provide an easily replicable process that allows for more frequent weightings revisions.
- To undertake a consensus based weightings assessment exercise to inform the setting of the 'core' BREEAM weightings.

Outcomes – The project has developed a new, independently peer reviewed BREEAM weightings methodology that can be applied to all BREEAM schemes covering different sectors (e.g. buildings, infrastructure and communities) and different life cycle stages (e.g. New Construction, In-Use, Refurbishment).

Next steps – This methodology will be applied through the BREEAM UK schemes for buildings (New Construction, In-Use and Refurbishment building life cycle stages) and infrastructure as these are updated and new schemes are developed.



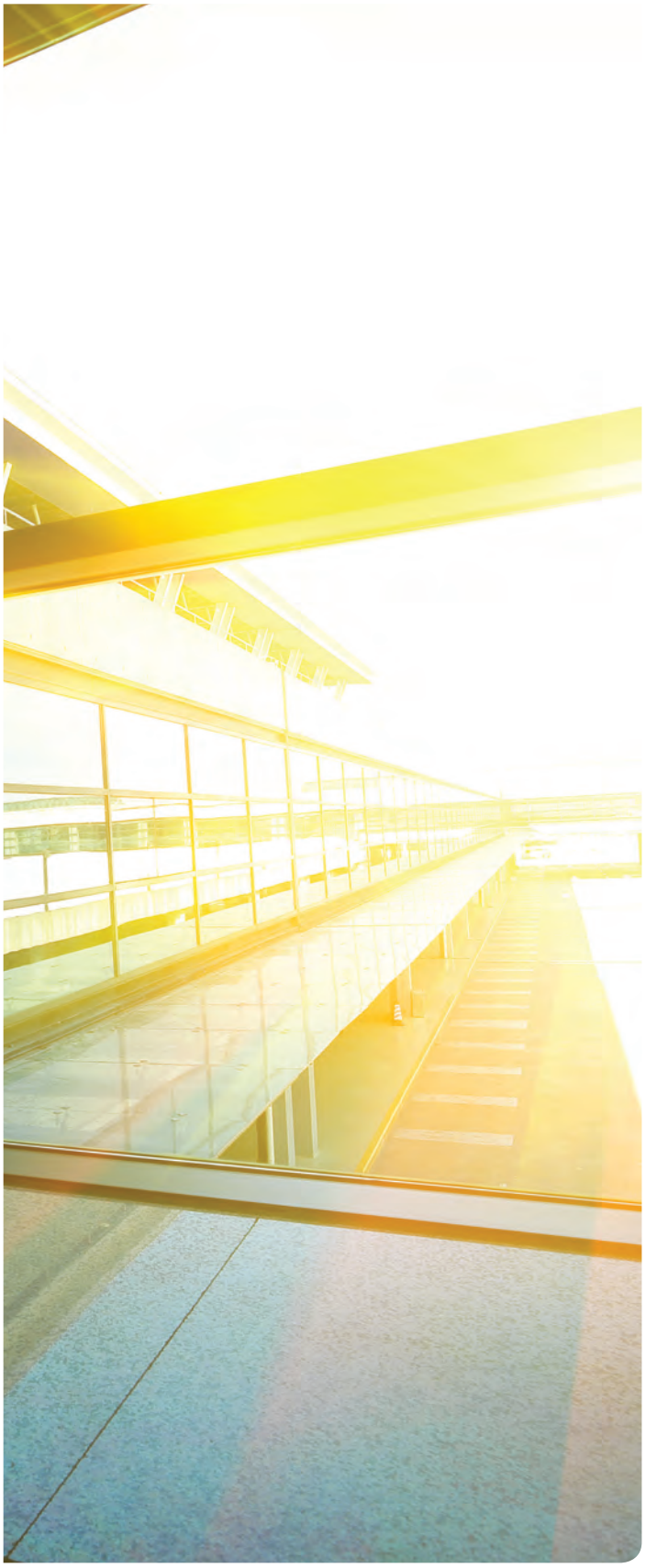
Assessing new metrics for daylighting – P Littlefair

Why the research was needed – Daylighting is a key element of sustainable building design. Traditional methods of daylight design rely on the daylight factor, which is easy to calculate. However it does not take account of the variations of daylight under sunny skies and does not vary with orientation. Climate based daylight modelling gives a much more sophisticated, and potentially more accurate, method to predict daylight provision and lighting use. There have been a number of new proposals for benchmarks for daylight provision. Work was required to check these benchmarks and determine how realistic they are and whether they meet the health and visual needs of occupants. The LENI (Light Energy Numeric Indicator) is a method for predicting lighting energy use. It relies on equations given in EN15193 Energy Performance of Buildings to predict daylight factors and the resulting lighting use for different control strategies. Despite its widespread use, the equations in it have never been evaluated in a peer reviewed paper. A thorough test of these algorithms was urgently required.

Objectives – The aims were to review and develop daylight metrics based on lighting energy modelling and climate based modelling approaches.

Outcomes – The review of daylight metrics has been fully completed, and significant contributions to the development of improved metrics have been made. The analysis revealed various issues with the calculations in EN15193. The report is due to be published as a CIBSE SLL Technical Memorandum or Technical Report. Following interest by the Education Funding Agency, two workshops were held in which EFA and their consultants gave practical feedback on the calculation and use of advanced daylight metrics in school design. The work carried out is expected to result in improved daylight metrics that are achievable and avoid overglazing, improving conditions for building occupants and reducing costs for building developers and owners. Architects and engineers will benefit from more reliable methods to calculate daylight in interiors. The work is relevant to a wide range of daylit buildings, especially offices, schools, hospitals and multi-residential buildings.

Next steps – This research will feed into forthcoming British and European standards and CIBSE SLL publications that give daylighting recommendations or methods for daylighting computation. These include the SLL Lighting Code and Handbook, SLL Lighting Guide LG10 Daylighting and CIBSE Guide A Environmental design. CIBSE co-funding will ensure access to these dissemination routes. Comments based on the results of the work have been sent to the committee rewriting EN15193, and will contribute to the final version of this standard. The EFA's involvement will mean that results from the work will benefit future revisions of their daylight design requirements and guidance. The work will also feed into future revisions of BREEAM.



Publications

Delivering sustainable low energy housing with softwood timber frame (IP3/15) – M Waghorn, E Suttie and A Sutton

Abstract: Timber frame is one of the most sustainable methods of delivering new housing. If correctly managed, timber is a renewable resource and has the potential to provide much lower embodied energy than masonry or concrete. This Information Paper describes the most common approaches to timber framing in the UK and how these are evolving to meet the increasing demand for high performance, low energy housing. The paper looks at the origins of modern timber-frame housing and the requirements for low energy housing. It reviews the currently accepted methods of delivering timber frame, including stick, open panel, closed panel, twin wall, Structural Insulated Panels, Cross-laminated timber and Dowellan. The paper considers how today's methods can be adapted for low energy standards including internal and external insulation, minimising thermal bridging, achieving airtightness and maintaining stable temperatures. Case studies illustrate three different approaches to low energy timber-frame residential construction. The paper also looks at issues relating to sourcing and processing of timber including species selection.

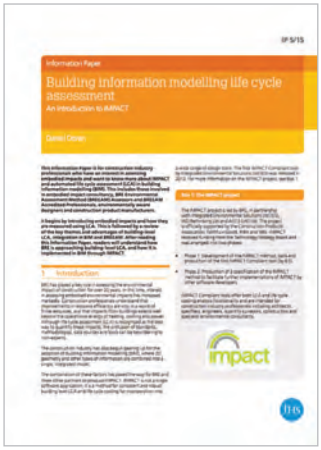
Given the complex array of factors that the designer needs to consider when developing the design, the only reasonable approach is to carefully weigh the balance of considerations that will be specific to each scheme. Design and specification decisions will then need to be tested at each stage of design development. By introducing the key issues and showing how they interrelate, it is hoped that this Information Paper will help designers to identify the appropriate route for further research, depending on the particular requirements of each project.

Reducing the embodied impacts of shopfitting equipment (IP 4/15) – J Mussett and A Robinson

Abstract: Major retailers have for some time been reporting, managing and reducing their operational environmental impacts. However, little is known about the embodied environmental impacts of the shopfitting equipment which furnishes retail stores.

In 2011 BRE, in partnership with Marks & Spencer, DisplayPlan and FITCH launched the online tool LIST which models the life-cycle impact of actual or proposed shop fitting equipment designs, also taking into account the embodied impacts of packaging and transport. Information was published on this in BRE Information Paper 1/11. BRE has since completed further research in collaboration with the National Association of Shopfitters (NAS) to model a range of real case studies and store layouts to benchmark embodied impacts of relevant shopfitting equipment and assess how this can be reduced by equipment and materials substitution. This Information Paper summarises the results of this study and sets out some key considerations for cost-effective impact reduction. It provides guidance for designers and manufacturers on producing greener shopfitting display equipment and for retailers seeking to improve their environmental profile.

This Information Paper gives the results of this latest collaborative study and sets out some key considerations for cost-effective impact reduction. It provides guidance for designers and manufacturers on producing greener shopfitting display equipment and for retailers seeking to improve their environmental profile.



Building information modelling life cycle assessment (IP 5/15) – D Doran

Abstract: Although life cycle assessment (LCA) is recognised as the best way to quantify embodied environmental impacts, the profusion of standards, methodologies, data sources and tools can be bewildering to non-experts. The construction industry has also begun gearing up for the adoption of building information modelling (BIM), where 3D geometry and other types of information are combined into a single, integrated model. The combination of these factors has paved the way for BRE and three other partners to produce IMPACT. IMPACT is a method for consistent and robust building level LCA and life cycle costing for incorporation into a wide range of design tools. This Information Paper begins by introducing embodied impacts and how they are measured using LCA. This is followed by a review of the key themes and advantages of building-level LCA, integration in BIM and BREEAM.

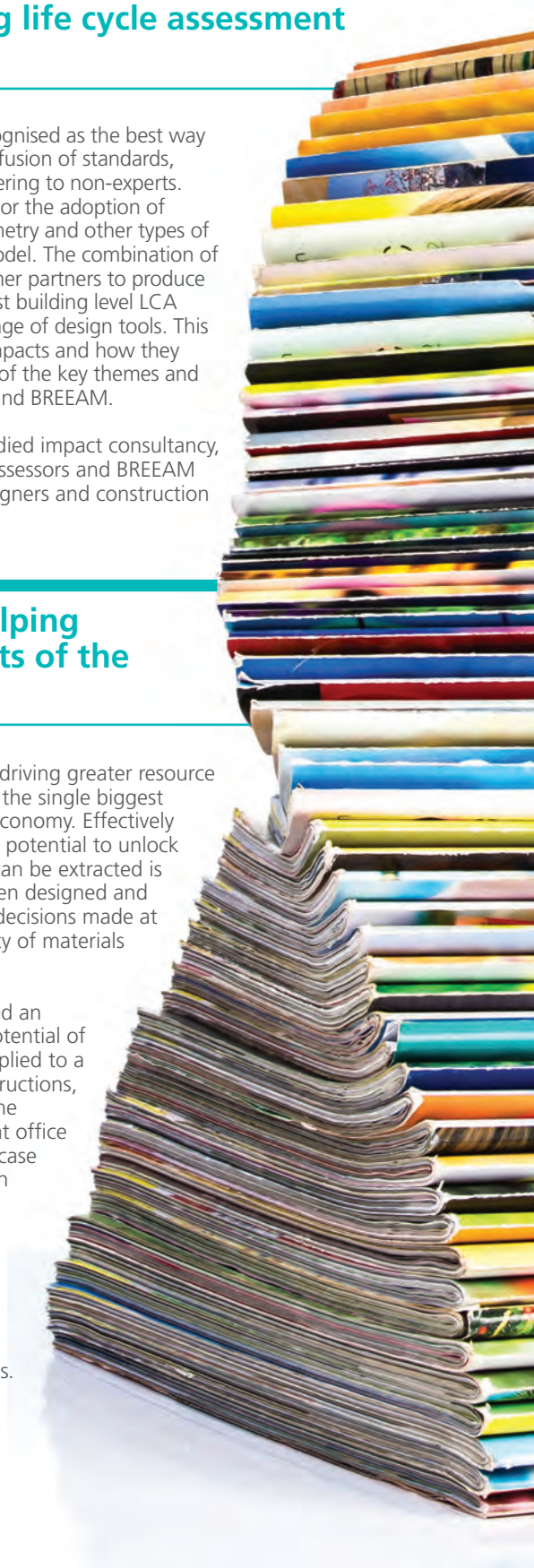
This Information Paper is for those involved in embodied impact consultancy, BRE Environmental Assessment Method (BREEAM) Assessors and BREEAM Accredited Professionals, environmentally aware designers and construction product manufacturers.

Design for deconstruction – helping construction unlock the benefits of the circular economy – K Adams

The emerging principles of the circular economy are driving greater resource efficiency. Construction and the built environment is the single biggest user of materials and generator of waste in the UK economy. Effectively dealing with buildings at the end of their life has the potential to unlock significant economic value. However the value that can be extracted is very much dependent on how the buildings have been designed and built. Design for Deconstruction (DfD) looks at how decisions made at the design stage can increase the quality and quantity of materials that can be re-used at the end of a building's life.

BRE, with support from the BRE Trust, have developed an outline methodology to assess the deconstruction potential of new build residential. The methodology has been applied to a number of case studies including two modular constructions, as well as a more traditional brick and block; while the projects themselves were of varying scopes starting at office buildings and ending at ski slope constructions. The case studies describe the methodology, the deconstruction potential and recommendations for achieving an improved deconstruction capability.

This collection of case studies, published via BRE Buzz, aim to raise awareness amongst architects, designers and contractors of the potential of deconstruction to create more sustainable buildings and some of the actions that can lead to better deconstruction outcomes.



Fire and Security

Impact of home based health and social care on fire safety strategies – N Firkins and J Fraser-Mitchell

Why the research was needed – It is estimated that by 2027 the UK population will reach 70 million people, of whom 19 million will be aged over 60, and 7.5 million aged over 75. The increasing focus on supporting people to stay within their home environment is giving rise to new fire risks within the home. In response to the increasing number of reported fire incidents involving this risk group and increases in the fire service incident response times in some areas, there have been a range of uncoordinated reactive activities undertaken by local fire and rescue services, housing authorities and product manufacturers. As a result, there is a need to evaluate this range of activities in order to understand the most effective response.

Objectives

- To identify the solutions being offered to provide fire protection in the home for the elderly and vulnerable.
- To assess the appropriateness of these potential solutions in terms of cost effectiveness and reliability.
- To develop a framework methodology to assess the level of fire risk associated with a person in their home and the level of risk mitigation offered by different solutions.

Outcomes – The first stage of the project examined the available UK fire statistics in order to see if there were clear indicators for the risks associated with vulnerable persons in their home. It was concluded that such indicators were not easily apparent, partly because the necessary information was not collected as part of the Fire and Rescue Services (FRS) data collection tools, and partly because the data was sparse in any case. The cost-benefit analysis (CBA) tool has therefore been developed based on a number of assumptions. This project has shown that a software application which provides a systematic assessment of fire risks and benefits could help organisations manage risks more effectively whilst maximising the benefits of each pound spent.

Next steps – While stakeholders appear to be keen to support the further development of the tool, research is necessary to understand fully the needs of organisations and their willingness to invest in this kind of approach. Activities such as seminars, attended by a range of risk managers from Housing Associations, will provide an opportunity to present this work and gain feedback. It is critical that the products and solutions that are offered to the market are fully assessed and approved. At this time BRE has two schemes which are seeing direct benefit of this work LPS1283 and LPS1655. Given the increased uptake of products such as watermist suppression, this project provides a route to assess the CBA of these types of products.

A security certification scheme for buildings and infrastructure – G Jones

Why the research was needed – Security is often seen as a grudge purchase, however, there are benefits for governance, legal compliance and business continuity of implementing security risk management. Nonetheless, the inability of security managers and design teams to objectively measure and compare their performance in an independent manner makes it difficult to build a business case for investment in security. This, along with significant evidence that security controls are often selected on the basis of technology push from manufacturers rather than a focus on security outcomes, represents an opportunity for a performance based certification scheme.

Objectives

- Establish the state of the security products and services market with the aim of creating a framework for delivery of appropriate, balanced security.
- Develop a standardised process for integrating security into the planning, design, construction and handover of buildings and infrastructure, and identifying metrics that can be used to measure design quality, recognising and rewarding best practice. Provide, for the first time, a holistic structure for integrating project cyber, physical and electronic security considerations.
- Create a Core Technical Standard that will form the foundation for a series of security certification schemes.

Outcomes – The Core Technical Standard produced (a standard for whole life facility security) is an internationally applicable overarching set of strategic principles and requirements that allows end-users, developers and interested parties to measure, evaluate and reflect upon the performance of both their new and existing facilities. It provides a framework for independent verification of security proposals (3rd party certification). It assists in identifying the most appropriate and proportionate action to reduce facility security risks and identifies priorities for investment and continual improvement of performance. Security performance can be compared with best practice in an independent and robust manner. Data captured can be used to support the application of intelligence, allowing changes in threat to be communicated to the most vulnerable facilities. It is intended that facility owners/operators will use their certification as a differentiator or to provide assurance to third parties.

Next steps – Further work is needed to identify gaps in product level standards where new or improved Loss Prevention Standards (LPS) will be required to support the standard. Further tasks include the creation of SABRE (Security Assessment by BRE) certification scheme documents and the development of training courses and examinations for SABRE Assessor Certification.

Investigating the real causes of false fire alarms: Part 2 – R Chagger

Why the research was needed – Fire detection and fire alarm systems (FDFAS) are used to provide early warning of fire in order to alert Fire and Rescue Services (FRSs). FRS attendance at fires save lives, prevent injury and reduce the costs associated with property damage. It is estimated that the losses attributed to false alarms are around £1 billion a year with the majority of that falling on businesses due to disruption and loss of productivity. False alarms also reduce the confidence of the general public to fire alarms and can divert fire and rescue resources away from real fires. Following a multi-agency briefing session to the Scottish Fire and Rescue Service Board it was agreed to support this particular challenge by proposing a more thorough investigation of false fire alarm causes, leading to this research work carried out in conjunction with the Scottish Fire and Rescue Service with the support of a number of stakeholders.

Objectives

- To gather sufficient statistical data to identify the key causes of false fire alarms.
- To improve the reliability of fire detection and fire alarm systems and to reduce the number of false alarms generated in commercial and domestic premises of the UK.
- To influence and drive changes to the existing product test standards and / or codes of practice to ensure more reliable fire detection systems.

Outcomes – Eight reports and 65 completed UFAS forms were reviewed during this project and used to provide recommendations in nine key areas. As well as reducing false alarms, these will also aid greater integrity and reliability of fire detection systems and management processes. The output has exceeded the original objectives as specific recommendations have been made for a much broader group of stakeholders so that the false alarm causes are tackled on multiple levels.

Next steps – This work has supported the BRE Trust multi-sensor research project, which will explore methods for performing common false alarm tests. This will provide underpinning knowledge to potentially lead to the development of false alarm tests that may go on to support an LPS for false alarm immunity. At the Fire Industry Association AGM, Raman Chagger received the Chairman's Award for recognition of this research. It was acknowledged that the work had real impact with UK businesses potentially saving millions of pounds per year if the recommendations are implemented.

External fire spread and building separation distances – S-H Koo

Why the research was needed – Some of the earliest fire safety legislation was put in place to reduce the possibility of fire spread between buildings leading to a major urban fire. Controls were placed on the width of streets, the materials that could be used on the external surfaces of buildings and on the activities that could be carried out in the buildings. The failure of such legislation (resulting in major urban fires) around the world has been due to poor enforcement or the introduction of new building methods or materials that were not considered by the legislators. There are indications that the current methods may provide separation distances that are too small for very highly insulated buildings (increasing the likelihood of fire spread) but provide excessive separation distances for very large enclosures with a low fire load (being unduly onerous on the designer). The purpose of this project is to increase the understanding of compartment fires so that the impact of changing parameters such as thermal insulation and ventilation conditions on building separation distances can be determined.

Objectives – To provide a comprehensive and technically robust methodology for determining building separation distances that can be applied to traditional and modern buildings. This will specifically consider:

- Fire development in very large spaces.
- Thermal insulation in buildings.
- Performance of glazing with relation to fire spread between buildings.
- A time dependant approach to demonstrating safe building separation.
- A probabilistic approach to demonstrating safe building separation.

Outcomes – The final report reviews existing fire compartment temperature calculation methods and presents methodologies for assessing the sensitivity of the parametric approach to variations in fire load, window size and insulation of the compartment boundaries. Analyses have been undertaken on how these changes affect the building separation distances. In addition to the current "steady state" assumption, probabilistic and time-based approaches were also considered. The project has increased the understanding of compartment fires, building on the existing BRE report, BR187, so that the impact of changing parameters such as thermal insulation and ventilation conditions on building separation distances can be determined. The report is intended to provide guidance to engineers who wish to take alternative fire engineering approaches to calculation of building separation distance and to assist them to make judgements on which elements of design they need to focus on. The selection of the fire compartment temperature calculation method is a key element and approximation in any such approach which would need to be validated and justified by the fire engineer for the specific design under consideration.

Next steps – The knowledge obtained from this project has been submitted to an international conference (Interflam 2016) and will be published as a BRE Trust Information Paper, providing guidance to fire engineers and design professionals.

Publications

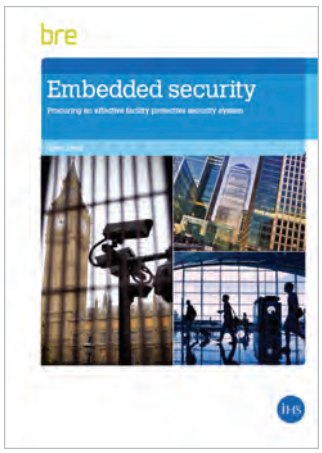
Visual alarm devices – their effectiveness in warning of fire – R Chagger

This Briefing Paper presents the outcomes from a recent research project to compare the responses of a group of participants to flashing Xenon and LED devices of varying pulse durations.

Visual alarm devices (VADs) are used to warn deaf and hard of hearing people in the event of a fire. They emit pulses of flashing light to alert those that cannot hear the sounder of the fire alarm system. As Xenon and LED devices are currently used for this purpose, this study investigated their effectiveness in warning people of a fire. The aim was to compare the responses of a group of participants to flashing Xenon and LED devices of varying pulse durations.

The flashing signals were presented individually to 96 participants who were seated in front of a screen and occupied in a written task. The devices were flashed one at a time, and from a distance of 19m were gradually brought closer to the screen until the subjects responded.

The study found that it is quite likely that a cool white LED with a pulse duration of 5ms would out-perform the Xenon in low and perhaps even in the high ambient light level condition.



Embedded security (FB77) – G Jones

Protective security is important because buildings protect what is important to us. People spend the majority of their lives in buildings, businesses operate from buildings and buildings are used to store our valuable assets. Given that there will always be those among us who seek to cause harm to others, gain financially through criminal acts or promote their ideology and beliefs through destruction and fear, there is a need to deploy appropriate and proportionate protective security controls to protect ourselves and our assets from losses. Threat may come from an individual, group, a criminal organisation or even a nation state. Each may have different motivations for their act and each is likely to have different levels of capability. There can be a broad spectrum of security threats that could be a risk to a facility and need to be addressed by the protective security system.

The aim of this guide is to provide those commissioning new facilities, and the project team members involved in the development process, with a better understanding of the role and responsibilities of security specialists, the tasks they will complete on a project and the associated information exchanges.

The information in this guide highlights the importance of establishing SMART security objectives at the outset of a project which are specific, measurable achievable, realistic and time-framed. It also seeks to encourage security specialists to adopt an integrated, multi-disciplinary approach when designing protective security systems, where collaboration with project team members is used to obtain better outcomes.

Live investigations of false fire alarms – R Chagger

This report summarises the key findings from a recent research project aimed at identifying the fundamental causes of false fire alarms, focusing on the greater Glasgow area. The research used a combination of anecdotal accounts and detailed analysis of data generated from 65 live false alarms over the course of a 6 month period.

This data was captured using an online questionnaire which enabled the fire alarm investigator to record all details of the false alarms attended. This form of 'live' investigation of false alarms has not previously been carried out. Analysis of the data indicated that the main causes of false alarm reported in this study were: Unknown, Fault, Dust, Cooking, Weekly testing, Accidental activations, Steam, Aerosol and Water ingress. The report provides a total of 35 different recommendations. An event was held in February to promote the findings and recruit industrial partners to take forward the research findings and recommendations.

Energy

Creating a national housing database – J Riley

Why the research was needed – The Government will soon be expecting to use readily available and accessible data on housing stock and its energy performance, provided from existing sources and 'big data'. BRE is a respected provider of modelled data to local authorities on the performance of the housing stock in their areas. The BRE National Housing Data Centre will collate, maintain and disseminate housing and energy data and knowledge from a variety of sources, the first port of call for the built environment.

Objectives

– Research, create and populate a framework to facilitate key housing and domestic energy data compilation, providing a 'live' and updateable picture of the current UK housing stock with existing real and modelled data from sources such as national house condition surveys, BREEAM and the Code for Sustainable Homes, home monitor/smart-meter data. It will also include data on household types, composition and attitudes from the census, national housing surveys and other sources.

– Research and develop appropriate dwelling age and type variables.

– Research other housing and energy data, which will add value to the existing dataset. This might include 'big data' trawled from the internet or provided by other organisations.

– Create an environment in which authorities and individual households will submit data.

Outcomes – The basic framework for the National Housing database is now in place, which has now been populated with experimental dwelling age and type variables which were developed as part of the project. A web interface for the database has been developed.

Next steps – This work concludes the initial phase of the National Housing database development and prepares the ground for its further development and extension.

Publications

Changing energy behaviour in the workplace – M Hadi

Abstract: This guide is aimed at small and large organisations and corporate occupants who are interested in engaging their staff in saving energy in the workplace. Engaging staff about saving energy is not only about cutting costs but can also form part of a company's Corporate Social Responsibility strategy.

Energy use in both domestic and non domestic buildings is influenced by a variety of factors: physical factors, such as the building itself, its services and control systems, and also social factors that govern energy use behaviour, such as lifestyle, individual differences and group composition. Although physical improvements to the building and new low energy technologies can make a considerable impact, these efforts will always be limited by the presence and actions of its occupants.

Studies have been carried out on the impact of the end-user on energy consumption. However, more information is needed in order to fully understand these effects and the role of behaviour, attitudes and motivation in energy use. Most studies tend to concentrate on the domestic sector rather than the workplace, where it is much more difficult to engage occupants, even though organisations are increasingly interested in changing staff attitudes and encouraging eco-friendly behaviour at work to produce energy savings.

The guide examines the literature on the psychological theory underpinning behaviour change and how it relates to energy use. It reviews the role of feedback as a change mechanism and the use of interfaces such as eco-visualisation to motivate and maintain change, using examples from BRE research. It also discusses the pros and cons of introducing fully automated systems that remove the need for user input altogether and whether there is potential for integrating both approaches.

Bridging the performance gap: Understanding predicted and actual energy use of buildings (IP 1/15) – A Lewry

Abstract: Operators of commercial and public (ie non-domestic) buildings need clear and realistic guidance on targeting energy running costs for their properties and on the potential savings available. To truly understand how a building uses energy, it is necessary to know how the building has been designed and how it is used; this requires both an asset rating (EPC) and an operational rating (DEC). The difference between these ratings – or between the predicted and actual performance of buildings – is the 'performance gap'. This Information Paper looks at a way to bridge this gap using the Green Deal assessment tool for non-domestic buildings, which allows the input of non-standard operating conditions, hours of operation and occupancy patterns. By defining these aspects of the building 'in use', the predicted energy performance of the asset can be brought closer to the in-use reality.

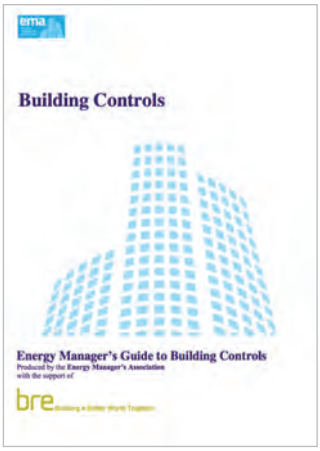
Producing the business case for investment in energy efficiency – A Lewry

Abstract: One of the biggest obstacles to the uptake of low-carbon measures is the production of a poor business case. Rarely do the benefits of energy savings alone justify investment, but this is starting to change with recent 10% year-on-year increases in energy prices. However, reduced maintenance and increased productivity need to be factored in if the business case is to stack up. This Information Paper provides guidance to energy and facilities managers, energy consultants and advisers on how to prepare a successful business case and then how to present this in a compelling way. It illustrates the importance of the 'do-nothing' scenario, highlighting the risk to the business and putting potential benefits into context as well as describe how technical staff can speak the same language as their financial counterparts.

Changing patterns in domestic energy use (FB 76), H Garrett, J Piddington – S Burris and J Hulme

Abstract: The way we consume energy for lighting, appliances, cooking and heating have changed over time. For example, there is evidence to suggest that despite the rise in energy efficient lighting and fall in total energy consumption from lighting, there are counter pressures for increased consumption as lighting has become more integral to people's lifestyle. Similarly, our patterns of space and water heating are influenced by the changing characteristics of the housing stock. This has changed with the increase in centrally heated homes, together with improvements that have been made in energy efficiency through, for example, improved levels of loft and cavity wall insulation.

This report examines changes in English domestic energy use over time and, where possible, considers what trajectory we can expect for future energy consumption for the topics covered. In doing so it is hoped that changes in energy consumption can be better understood and taken into account in energy modelling and policy. This report is aimed at construction professionals and policy makers, particularly those involved in energy.



A buyers guide to building controls – by A Lewry, published by the Energy Managers Association

The control of energy in buildings is generally poor, despite the availability of a range of tried and tested systems incorporating both mature and innovative technologies. The main reasons for this is the perceived overly technical nature of the solutions and hence the resulting complexity issues when operating them.

This Energy Managers Association (EMA) buyer's guide is designed to give Energy Managers some basic information and guidance on understanding how to approach the procurement of building controls.

This guide provides practical information in an easy to use format to support the greater uptake and better management of building control systems.

Health

Monitoring of Mechanical Ventilation Heat Recovery and Indoor Air Quality at Joseph Rowntree Foundation's Derwenthorpe Housing Development

Why the research was needed – This project provided an opportunity to build on existing BRE research on the effectiveness of Mechanical Ventilation with Heat Recovery (MVHR), which has informed the ventilation and house-building industries as well as the work of the Zero Carbon Hub Indoor Air Quality (IAQ) Task Group. The Joseph Rowntree Foundation (JRF) and Joseph Rowntree Housing Trust (JRHT) are engaged in the on-going development of an innovative mixed tenure housing scheme at Derwenthorpe, York. In order to achieve an acceptable indoor climate while satisfying demands of Code for Sustainable Homes levels 3/4/5 with respect to energy use, MVHR has been used in the 64 homes built and now occupied on Phase 1 of the development.

Objectives – The aims of the research project focussed on an assessment of the performance of the MVHR systems in these occupied homes with particular emphasis on the performance versus design intent and specifications, power consumption and thermal efficiency.

In parallel, there was an assessment of indoor air quality (IAQ) and thermal comfort within the homes. With reference to occupant perceptions, feedback, behaviour and interventions elicited from current research being undertaken on behalf of Joseph Rowntree Foundation by York University and from BRE interactions with Joseph Rowntree Housing Trust, the occupants and the site developers.

Outcomes – The huge amount of data from the MVHR monitoring is now being collated and interpreted, and along with the occupant perception findings and the IAQ measurements these will be reported in a pair of JRF research publications in 2016.

In order to comprehensively report on the MVHR systems and their installation, use and performance in these homes, BRE is currently in discussions with Joseph Rowntree and the site developer (David Wilson Homes) in order to gain access to design, specification and commissioning information regarding the MVHR units, duct work and other components of the ventilation systems.

Next steps – BRE is currently analysing the MVHR systems in other houses on Phase 1 of the Derwenthorpe development, and will incorporate these findings in the overall JRF research report. This will increase the size of the sample of houses in which some monitoring has been undertaken to at least eleven.

Overheating in dwellings: Guidance for assessment of occupant exposure to excess heat – A Dengel and M Swainson

Why the research was needed – There is evidence to show that temperatures in some dwellings are harmful to occupant health and wellbeing, and that some designs passing planning and building control could also lead to overheating. Improved guidance is needed on both the characteristics of a dwelling and/or occupant behaviour which may lead to overheating, as well as research into the factors which may make occupiers more susceptible to the effects of excess heat. Guidance is vital for housing providers, health practitioners and Environmental Health Practitioners to assist with the assessment of dwellings and the determination of appropriate preventative actions (for new build and retrofit). This project looked at developing a protocol and guidance to assist in the assessment of dwelling suitability and to inform decisions on preventative measures, both on adaptation of the dwelling and precautionary behaviour.

Objectives – The proposed protocol and guidance was designed to:

- Assist in the assessment of situations where susceptible individuals could be at risk of exposure to excess high temperatures in dwellings, and to inform decisions, both locally and nationally, on preventative measures, both on adaptation of the dwelling and precautionary behaviour.
- Be internationally transferable to countries that are exposed to the risk of overheating.
- Train assessors using BRE test houses, and in a number of real dwellings during routine Housing Health and Safety Rating System inspections.
- Disseminate the project findings and to share the improved guidance and protocol.

Outcomes – Guidance on the characteristics of a dwelling and/or occupant behaviour that may increase the likelihood of overheating and exposure to excess high indoor temperatures has been produced. This includes advice on actions to mitigate risks from exposure to these temperatures. An accompanying protocol has also been produced that recommends the practical steps involved in surveying and assessing dwellings prone to overheating. The guidance and protocol were trialled in various parts of England by experienced surveyors. The consensus was that they found the documents useful and informative. Use of these documents can contribute to a decrease in the risk of mortality and morbidity from overheating.

Next steps – The documents will inform housing providers, health practitioners, environmental health practitioners and others, and will supplement national and local heat wave plans and be adapted internationally.

Updating and expanding the BRE Trust 'Cost of poor housing' models – M Roys

Why the research was needed – The original BRE Trust sponsored work on quantifying the cost of poor housing has reached a large audience and is being widely quoted by a range of organisations. With the setting up of Public Health England, it is being used to demonstrate the relationship between housing and health and the value to the NHS of investing in good quality housing. However, the original research was based on data from 2009 and feedback suggests that more costs should be included rather than the limited NHS 1 year treatment costs covered in the first report.

Objectives

- To update the current cost-benefit models, which still use 2006 English Housing Survey and NHS data.
- To translate the models into quality adjusted life years (QALYs) to enable them to be used by the NHS, National Institute for Clinical Excellence (NICE) and Public Health England.
- To widen the models to include costs beyond the current annual treatment costs to the NHS.
- To expand the models to cover all housing and not just the worst housing.

Outcomes – As a best estimate (using revised NHS information) leaving vulnerable people living in the poorest 15% of England's housing is costing the NHS some £1.4 billion per annum in first year treatment costs. This figure can be compared with the burden to the NHS of other health hazards, such as smoking and alcohol consumption, which each account for around £2.3 - £3.3 billion per annum in first year treatment costs. Using these values the total cost to society for all the hazards measured is estimated to be £18.6 Billion. The NHS costs using the revised figures were just over £1.4 Billion, equating to 8% of the total cost to society. Using the established methodology developed for assessing the real cost of poor housing it has been possible to estimate the size of the cost for all below average housing. The majority of the cost (around 70%) is still associated with Category 1 hazards, but for a number of hazards the contribution from Category 2 (defined as housing with below average hazards) hazards is sizable. Estimates for the overall cost of sub-standard housing are between £1.2 billion and £2 billion depending upon the representative cost values used in the calculation.

Next steps – The output was jointly funded by Department Communities and Local Government who intend to include the updates in future English Housing Survey reports. There has also been significant input from Public Health England and NICE, which is now influencing public health spending and justifying new payment schemes like that being rolled out in 10 local authorities around Manchester.

Publications

The cost of poor housing to the NHS – Simon Nicol

In 2010 the BRE Trust published the results of a research project which sought to quantify the cost of people living in poor housing in England to the National Health Service. This was possible because of the availability of information from the English Housing Survey on the risk of a home incident occurring and its likely impact on health, measured through the Housing Health and Safety Rating System (HHSRS), combined with information from the NHS on treatment costs.

This Briefing Paper updates the BRE models and calculations using 2011 English Housing Survey and 2011 indicative NHS treatment costs. It also widens the definition from 'poor housing' to include all 'sub-standard' housing.

Lighting and health (FB 74) – Cosmin Ticleanu, Stephanie King, Paul Littlefair and Gareth Howlett, BRE, Feride Şener Yilmaz, Istanbul Technical University, and Marielle Aarts and Jüliette van Duijnhoven, Eindhoven University of Technology

Abstract: Adequate lighting and lighting controls, including the provision of emergency lighting, are essential to enable people to work and move around a building or external site safely. Poor lighting, particularly lighting that causes glare, can give visual discomfort which may result in sore eyes, headaches, and aches and pains associated with poor body posture. These issues can be avoided by careful lighting design that meets the recommendations of codes and standards. This publication reviews existing research on the health effects of lighting (including daylighting) typically found in buildings. It explains medical and psychological research in a clear and accessible way using questions such as: Can LEDs keep you awake at night and damage your brain? Can special lighting help people with dementia?

This report offers BRE expert guidance for lighting designers, and building occupiers and their managers, to maximise the health benefits of lighting and minimise the health risks.

Designing to reduce the chemical, biological and radiological vulnerability of new buildings (IP 7/15) – Vina Kukadia and Alan Abela

Abstract: Buildings are currently not designed specifically to offer protection against chemical, biological and radiological (CBR) releases. However, should a CBR event occur, it has the potential for a high adverse impact on buildings, their occupants' health and wellbeing, and also on business operations and services. Since buildings have a long lifespan, consideration of protection measures is particularly important at the early stages of design. Once built, retrofitting to mitigate CBR impact will be time-consuming, disruptive and expensive. It is therefore important to consider and incorporate means of reducing the impact of CBR releases as an integral part of the initial building design, planning and construction process.

This Information Paper is intended for use by building professionals, building owners and regulatory authorities and provides an overview of some existing design standards, methods and practices that may be further reviewed and implemented at the design stage without adding significantly to costs.

Radon: Guidance on protective measures for new buildings (BR211) – Chris Scivyer

Radon is a natural, colourless, odourless, radioactive gas. It is formed by the radioactive decay of the small amounts of uranium that occur naturally in all rocks and soils. The gas can move through cracks and fissures in the subsoil and eventually to the atmosphere. Most of the radon will disperse into the air outside, but some will pass from the ground and collect in spaces under or within buildings. For the average UK resident, radon accounts for half of the annual radiation dose received which could increase the risk of developing lung cancer.

Radon-protective measures installed in new build properties are expected to reduce radon levels significantly. It is difficult to quantify the effective reduction within individual households. Comparison of radon levels in properties (built in areas of close proximity), with and without protective measures, shows a trend towards lower radon levels in protected properties. However, some newly built homes still have elevated radon levels measuring above the 'action level'. Enhanced guidance included in this new edition of the report aims to improve the installation of radon-protective measures and therefore further reduce radon levels.

This report provides technical guidance on the range of protective measures for new buildings, extensions, conversions and refurbishment projects, whether they be for domestic or non-domestic use.

Radon Good Building Guides, C Scivyer

– Radon Protection for new domestic extensions and conservatories with solid concrete ground floors (GG73 revised), Chris Scivyer.

– Radon protection for new dwellings (GG74 revised), Chris Scivyer.

– Radon protection for new large buildings (GG75 revised), Chris Scivyer.

The overall aim of these three Good Building Guides is to give practical advice and guidance on the successful installation of radon-protective measures in new large buildings, new dwellings and extensions with solid concrete floors. These should be read in conjunction with BRE Report 211, Radon: guidance on protective measures for new buildings. This Good Building Guide replaces previously published titles in 2008 and 2009.

Homes and ageing briefing note in collaboration with Public Health England – Helen Garrett

This paper uses English Housing Survey (EHS) data and the research methodology detailed in the BRE Trust briefing paper on 'The costs of poor housing to the NHS'. It provides an overview of the housing conditions of older people, and information on how to estimate the cost of the poor housing occupied by the older population to the NHS in England.

This paper will be of interest to various professionals and academia working in the field of housing and / or health, including:

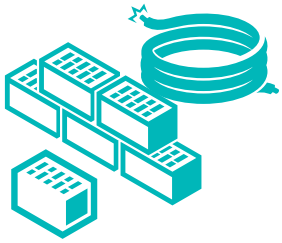
– Health and Wellbeing Boards, local housing, public health, NHS and social care commissioners, to help inform integrated commissioning and service delivery.

– Local and national providers of housing, health and care intended to improve the health and wellbeing of people as they age, such as Age Concern, Care and Repair England.

– National policy makers involved in the development of housing, health and social care strategies, particularly those at the Department of Communities and Local Government and the Department of Health.

The paper was produced in collaboration with Public Health England and was launched at the Healthy Places for People event in December 2015.

Construction materials and products



Getting the numbers right – Creation of a generic UK LCA dataset compliant with EN 15804 (CEN TC350)

Why the research was needed – The UK has challenging targets to reduce CO_2 by 80% by 2050. Recent research shows that operational and embodied impacts are approaching parity. Therefore, tackling embodied emissions from construction products will play a vital role in achieving this target. As such, it is in the public interest that good quality data and tools are available for embodied impact assessment.

Since 2012, the landscape for construction LCA (Life Cycle Assessment) has changed due to a suite of harmonising CEN/TC 350 standards that are gaining universal traction. In response, BRE has developed the new EN 15804 Environmental Product Declaration (EPD) Product Category Rules (PCR) and verification scheme. The challenge now is that the ~300 existing UK generic construction product data that make up the Green Guide to Specification are incompatible with EN 15804. This research was intended to provide a robust solution by reassessing the existing data to allow the creation of a BRE EN 15804 generic LCA dataset. This would then be available to update tools such as the Green Guide to Specification that is widely used by specifiers across the industry.

Objectives – The overall objective of this project was to create a new generic construction material dataset compliant with EN 15804 consisting of ~300 materials. This new data would allow the further development of tools like the Green Guide and IMPACT that are vital to material assessment in BREEAM.

Outcomes – The existing data sets were created using BRE's 2008 methodology, and modelled from Trade Association/representative manufacturer's primary data and Ecoinvent data. The resulting database was then used in various sustainability assessment and decision making tools. To comply with the new European standards, the existing datasets have now been updated by modelling the data using a new set of product category rules (PCR) that have been developed in compliance with the new European standard for product level environmental assessment, EN 15804. The project output is a dataset of materials' environmental performance, reported using parameters describing environmental impacts, resource use, waste categories, and output flows, as required by the European standards.

Next steps – The Product Category Rules form the basis of the generation of BRE European environmental product declarations (EPD) for construction products and will inform the development of tools, authoritative analysis and guidance to the industry.

Assessing environmental impact – low carbon concrete solutions – A Dunster

Why the research was needed – There is a strong need to adopt emerging alternative, low carbon concrete solutions due to the increasing need to reduce CO_2 arising from cement production. However there is a lack of consensus on routes and approaches towards developing performance-based standards creating barriers to exploitation. This project aimed to explore these issues, scope suitable frameworks, support engagement with industry and develop insights into the best approaches to accreditation and certification solutions. The project included partners such as Network Rail and HS2. It also aimed to support the development of future frameworks for environmental product declarations (EPDs) and to assess the true carbon impacts of low CO_2 concrete solutions.

Objectives – The specific objectives of the project were as follows:

- To assist in meeting the unfulfilled market demand for concrete products with the range of evolving low CO_2 concrete solutions, through consensus building and creation of roadmaps to standardisation.
- Develop a statement of priority low CO_2 concrete solutions (types of concrete products) for potential development of standards and certification schemes and assess demand for these.

Outcomes – The solutions of greatest mainstream commercial interest currently are geopolymers (alkali activated binders) and calcium sulfoaluminates. There is also interest in some countries in limestone/calcined clay cements. There is no consensus however on the best route to standardisation and certification of these low carbon concrete solutions but there is a need for long term durability and performance data to support these activities. A broad approach to standardisation of low carbon binders has been developed by BRE with the support of this project and there have been talks with several manufacturers about applying this framework commercially to their products. BRE is now well placed to independently conduct the necessary durability and performance studies, develop standards and product certifications for the new binders. BRE will also have a role in training provision.

Next steps – BRE will now independently conduct the necessary durability and performance studies, develop standards and product certifications for the new binders.

Publications

Building damp-free cavity walls – B Reeves and C Scivyer

Abstract: Cavity walls should be built so that the inner leaf stays dry. Many building details are designed with this express purpose and are long-established. However, dampness is still a common problem in modern buildings, due to the faulty design or construction of damp-proofing measures or the wrong choice of material. This Good Building Guide gives guidance on how to ensure that new cavity walls do not suffer from dampness problems. It is aimed at architects, designers, engineers, site managers, house builders and masonry contractors, and replaces the guidance published in 1999.

Diagnosing the causes of dampness – J Houston

Abstract: Dampness of one sort or another is the most common problem in housing. It results in visible wetting of surfaces, blistering paint, bulging plaster, sulfate attack on brickwork and mould on surfaces and fabrics. It can also lead to less obvious problems, eg the effectiveness of thermal insulation is reduced or brickwork forms cracks due to corrosion of embedded metal components. This Good Repair Guide provides advice on how to identify the potential cause of dampness in homes. It is aimed at housing professionals, home owners and occupiers, and replaces the guidance published in 1997. The other guides in the series, Good Repair Guides 6 - 8, cover specific remedial treatment for the principal causes of dampness.

Domestic floors: Part 1: Construction, insulation and damp proofing (GG28/1 revised 2015) – R Pool and C Scivyer

Abstract: This Good Building Guide (Parts 1 - 5) considers the construction of new and replacement domestic floors and their repair.

Part 1 describes ground floor construction in new buildings and in refurbishment work where floors are being replaced. It is concerned mainly with domestic buildings, but some recommendations apply equally to other types of building. Parts 2 - 5 explain how to assess different types of floor construction for replacement or repair, and how to repair them. This guide is of interest to designers, building surveyors and builders. This update to Part 1 replaces the guidance published in 1997.

Publications

Tiled floors with underfloor heating: A guide to minimising and repairing cracking (IP 6/15) – R Pool and T Yates

Abstract: A common cause of problems in rigid tiled flooring is cracking, associated with underfloor heating. Over the years, BRE has investigated numerous cases where stone or ceramic tiles have been laid onto a screed only for cracks to appear in the tiles and along grouted joints within a few weeks of operation of the heating system. The tile cracks and open joints are almost always caused by movement of the screed at a pre-existing crack or, in some instances, a 'day' joint in the screed. This movement, although only a fraction of a millimetre, is sufficient to crack even thick granite slabs. The cracks in the screed are normally the result of a poorly designed floor screed (ie badly coordinated movement joints) or failure to properly commission the heating system before the tiles are laid.

This Information Paper sets out BRE's experience of screeds that contain warm-water underfloor heating systems and describes how the risk of cracking can be minimised and how repairs can be undertaken. Electric 'undertile' heating and proprietary 'thin-screed' underfloor heating systems are not dealt with in this publication. This Information Paper is aimed at architects and specifiers.

Determining wind actions using Eurocode 1: Part 3: Worked example – calculation of forces on a tower using the full dynamic method (DG 436-3) – P Blackmore and G Breeze

Abstract: The wind-induced dynamic response of a building can be broken down into a number of components, including the alongwind response, crosswind response and torsional response. These responses can be analysed independently and the findings combined to determine the overall response of the building. This Digest provides guidance on how to calculate the effect of wind on buildings and design options to minimise it. It includes a demonstration of the calculation procedure for determining wind loads using the full dynamic method from Annex B of BS EN 1991- 1-4. The Digest also includes an example calculation for determining the dynamic response of a 128m tall building.

This Digest is for engineers, architects and other professionals who need to understand the effect of wind on buildings.

Building on fill: Geotechnical aspects 3rd edition 2015 (FB 75) – K Watts and A Charles

Abstract: A high proportion of commercial, industrial and housing developments are now built on fills, that is ground that has been deposited by human activity rather than natural geological processes, and the political and commercial impetus to build on 'brownfield' land continues to grow. An adequate understanding of the behaviour of fills and the ways in which they can economically be rendered suitable for building purposes is a critical element in ensuring the safe development of such sites.

This third edition encompasses BRE's unique experience over a period of more than 40 years. There have been some noteworthy technical innovations in ground treatment since the previous edition was published including the opportunity to study the behaviour of a wider range of fills and in one case history to extend direct observations of behaviour to over 24 years. As a consequence, this third edition contains additional chapters on ground treatment which recognise the importance of this subject and the fundamental difference in approaches adopted and methods applied.

This updated publication offers BRE expert guidance and advice for construction professionals, including developers, planners, designers, construction managers and operatives, particularly those who are involved in housing development.

Sound insulation in dwellings Part 2: New-build (GG 83-2) – G Timmins and I West

Abstract: Unwelcome noise in homes, specifically sound transmission between homes, is a major problem in the UK that requires serious consideration from both architects and builders. Noise nuisance can be a serious cause of stress and, if not remedied, can affect our health and wellbeing as well as influencing our enjoyment of buildings. People have different attitudes to noise; building occupants may be unaware that the noise they are making can be heard by their neighbours and regarded as a nuisance. When considering sound insulation, it is the construction of the walls and floors that separate dwellings (separating walls and separating floors) and their junctions with surrounding elements that is most important. Consideration of the sound insulation of internal partitions was discussed in Part 1 of this guide. The second part of this Good Building Guide considers the principal types of construction used in dwellings and divides construction into two types – heavyweight and lightweight. Heavyweight construction covers traditional materials and systems whereas lightweight construction typically uses framed construction of timber or metal.

This Good Building Guide offers BRE expert guidance on providing the correct level of sound insulation for new dwellings subject to routine pre-completion testing in England, Wales and Northern Ireland where the requirements are harmonised. This guide is aimed at construction professionals, including developers, planners, designers, construction managers and operatives.

Sound insulation in dwellings: Part 3 (GG 83-3) – G Timmins and I West

This three-part Good Building Guide provides practical guidance for designers, construction managers, construction operatives and property developers on understanding the requirements of national building regulations concerning the provision of sound insulation in dwellings. The aim of Part 3 is to give practical advice and guidance that will provide a reasonable level of sound insulation between dwellings formed by a material change of use (conversions). Where new dwellings are formed in a building as a result of a material change of use, they are subject to routine pre-completion testing to ensure that they comply with the minimum performance targets in the appropriate national building regulations and any site-specific requirements.

The regulatory requirements and more general information are provided in Part 1 of this Good Building Guide. Part 2 explains how to provide a reasonable level of sound insulation between new dwellings.

Thematic Programme – Future Cities

The Future Cities thematic programme was launched in June 2012 to provide a significant funding budget over three years to support targeted and accelerated research in a strategically important area to BRE's future business ambitions. There were 20 work streams spanning three main themes of energy, infrastructure and wellbeing. The research underpinned development of the following products: Estates Energy Information Modelling, district energy visualisation, Security systems accreditation scheme, ICT interoperability standard, resource management tool at city scale; Healthy City Index; and an indoor environment assessment tool.

Projects Completed in 2015

Healthy cities index – Air quality adaptability, Phase 3 – A Dengel

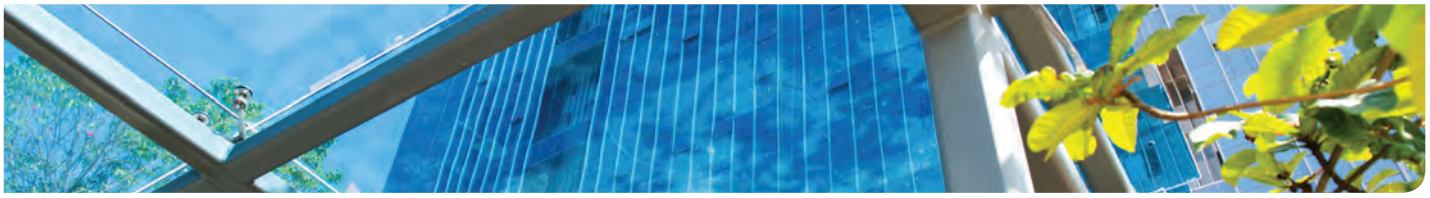
Why the research was needed – The challenge for future cities is to gain all the benefits that urbanisation can offer, while reducing and managing the potential problems that go with it. The impact of the city environment on health and wellbeing is influenced by a wide and varying range of factors, including air quality. Phase 3 of the project concentrated on buildings that include work settings. The final report details the monitoring undertaken to assess the quality of the internal environment i.e. air quality, temperature, lighting and noise in selected office areas at the University of Strathclyde in Glasgow, before and after a relocation of staff.

Objectives

- Development and application of assessment protocols for buildings including factors such as air quality, ventilation, thermal comfort, noise, lighting and non-physical aspects (tried and tested for environmental monitoring in Phase 1 of the programme).
- Evaluation of the quality of internal environments for health and wellbeing of occupants, by carrying out physical monitoring and qualitative assessments. Inform the development of the Healthy City Index.

Outcomes – The field studies and physical monitoring carried out at the eight locations (covering hospitals, care home, social housing and primary/secondary schools) in the course of this project have investigated areas of importance to the health and wellbeing of building occupants, including ventilation, air quality, thermal comfort, noise, lighting and layout/décor. Though the majority of locations exhibited satisfactory air quality some problems were found with acoustics, lighting provision and spatial planning. Walk-rounds, meetings with staff, patients and residents and questionnaire responses captured the good features of the indoor environments, but also highlighted opportunities to improve the wellbeing of building occupants.

Next steps – The outputs are now being incorporated into a BRE Trust publication and will be used to inform further research in this important area.



Imaging tool for future heat networks – R Wiltshire

Why the research was needed – The UK Government's Heat Strategy put the spotlight firmly on provision of heat for our communities, and the need to achieve that in a more efficient way. DECC (Department for Energy & Climate Change) estimates that up to 20% of domestic demand could be met by heat networks by 2030. Communities of the future are likely to be served by a new generation of heat networks, working with lower temperatures and using locally available sources of residual and renewable heat. However, awareness of district heating is still low among many planners and others within local authorities and Registered Social Landlords (RSLs) who may want to consider the option. An imaging tool was proposed by this project to help planners and others who are involved in initiating heat network projects to visualise the technology. The tool would include analysis of exergy (energy quality) because it is here that there is currently such a disparity between the quality of energy required (the demand) and the quality of energy supplied. This would demonstrate a concept that is particularly difficult to visualise and currently not often heeded.

Objectives

- To assist with visualising and assessing the benefit of heat network solutions for the Smart City of the future in collaboration with University College London (UCL).
- To jointly develop an Imaging Tool between BRE and UCL to demonstrate the concept of heat networks.

Outcomes – The Imaging Tool developed provides a visual medium to model distribution of heat to communities through District Heating (DH) networks. The tool comes as a desktop java application allowing the simulation of DH and it also provides a visual representation of the result. For planning phases or initial feasibility of a DH project the model enables an examination of likely performance of DH against a base case scenario of single building level heat provision. It provides key performance indicators to assess the application of DH for a cluster of buildings and it evaluates possible alternatives of design with respect to sources, layout and strategies. Visualisation of results is presented on a dashboard.

Next steps – The imaging tool will assist the understanding of heat network solutions for stakeholders so that they better understand the potential benefits and limitations of this technology. Further work is required to extend the tool to include comprehensive exergy evaluation.

Healthy cities index – Crime – M Roys

Why the research was needed – Research has demonstrated that the built environment is a significant contributory factor to crime and disorder. Situational crime prevention aims to reduce the opportunities for crime to occur by managing, designing or manipulating the built environment to make crime more difficult and less rewarding. It is not only concerned with reducing physical opportunities to commit a crime, but also about influencing people's perceptions about an area and reassuring them that the area is safe. This project aimed to build on the existing research, to see if crime hotspots are linked to features in the built environment; and, if so, whether the hotspot data itself could be a useful comparative measure between cities. This work was part of the Healthy Cities project.

Objectives

- To validate the findings from the Phase One case study, with further case studies.
- To develop a rating/scoring system that can be integrated into the Healthy Cities Index.
- To examine the reliability and validity of police crime map data in the UK and look at alternative methods used around the world.

Outcomes – The research has produced a solid knowledge base on which the indicators of crime and fear of crime are based. The work found that there are clear links between alcohol and crime and alcohol and health in urban environments. Alcohol-related violence is linked to a high density of drinking places, particularly if these drinking places are youth-oriented. The built environment can also affect levels of violent incidents where people under the influence of alcohol are jostled together, leading to aggression and violence. The research has revealed the strengths and weaknesses of the police crime hotspot maps. Inconsistencies were found between the hotspot crime figures and those on the police databases and local police experience did not always correspond. Fear of crime can also affect health; it is known that regular exercise improves the health, but fear of crime can deter people from using public spaces, such as parks and green places. Fear may be exacerbated by poor environmental cues such as graffiti and litter.

Next steps – The literature review, the four case studies and meetings with crime-reduction experts provided a sound basis for the evaluation criteria that have been developed as a result. The next step will be to arrange a peer review exercise with external crime experts to provide different perspectives, and to ensure the reliability and validity of the suggested assessment criteria.

Publications

Cities as systems: BRE solutions for urban environments – H Pineo

A briefing paper was launched in March 2015 to summarise the key outputs from the BRE Trust Future Cities research programme. The Future Cities research programme has produced a wealth of knowledge which at the very least underpins existing commercial activities, and in many cases completely changes the way we think about the role of the built environment in meeting future city challenges. We will build upon the success of this programme through continued collaborative research and new products and services based on the outputs of the programme. The report was launched in March 2015 to an international audience at MIPM and has led to significant awareness of the BRE Trust Future Cities Programme.

Reducing crime hotspots in city centres – S Monahan and A Gemmell

This paper summarises the findings of research carried out as part of the Future Cities thematic programme which investigated the important role that built environment play in crime and disorder. The findings will be used to inform the crime indicators for the Healthy Cities Index.

The focus of the research was the design of the built environment in town and city centres, specifically, the position, orientation, design and appearance of buildings parks and green spaces, pedestrian underpasses, alleyways, recessed doors and access routes. Certain crimes, such as violent offences, anti-social behaviour and criminal damage, were found to be more relevant than others when examining the built environment in town and city centres.

The paper aims to help planners, designers, developers and town centre managers understand the aspects of the built environment that contribute to crime and the fear of crime and best practice examples of solutions to the problems.

Open and big data in construction – D Skidmore

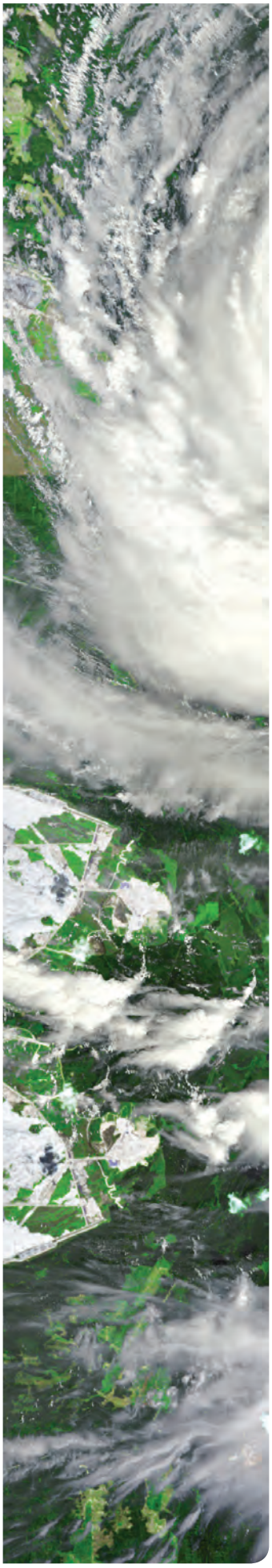
Open and big data offers many opportunities for the built environment, however it can appear overwhelming for those working in the sector. BRE in collaboration with Constructing Excellence group Generation for Change have been investigating the potential for data in the built environment. The study looked to demonstrate the potential benefits that collecting, managing, analysing and even releasing data can have on a range of organisations within the construction sector.

BRE published three multi-media articles on its new online Knowledge Hub BRE Buzz:

Understanding the language – From the outset it became clear that one of the major hurdles preventing representatives from the construction industry participating in discussions surrounding data was the often complicated concepts and language surrounding it. This article aims to provide clear and concise definitions for some of the regularly used terms in this area.

Utilising data – The UK is now becoming a much more digitised community, and data is being collected in a range of different ways. However, it is now important that organisations truly understand how to successfully analyse this data in order for improvements to be made. This article discusses how data can be used to inform decisions, and how opening datasets has the potential to drive economic, social and environmental benefit.

How can open data help to develop the construction industry? – The study was eager to better understand how data could help to aid the planning process, and simultaneously reduce any perceived risk seen by investors. Currently the process used for planning is very time consuming. Furthermore, with continuing budget cuts within planning authorities, planners are under a huge amount of pressure to carefully assess applications within a reasonable time scale. Subsequently there is a need to try and simplify this process as much as we can.



Thematic Programme – Resilient Built Environment

In April 2015 the BRE Trust launched a resilient built environment themed research programme, with a focus on climate resilience. Earlier research and consultations have highlighted three major climatic impacts with associated gaps in existing knowledge – flooding, wind and overheating – which are the priority areas for this programme.

There is growing realisation in both Government and the private sector that the built environment is struggling to cope with a world that is changing rapidly with social, technological, environmental, economic and political challenges. As a consequence there is an urgent need to address current governmental and market failings and implement policies, systems and solutions to create a resilient built environment for the future by:

1. **Strengthening the built environment to better resist stress from both short term shock and long term change.**
2. **Improving the built environment's capacity to bounce back rapidly from impacts.**

The consequences of climate change are recognised world-wide and have been highlighted in the UK by recent extreme weather and flooding events, putting it high on the political agenda. However, there are many other facets to resilience such as population growth, urbanisation, energy security, resource depletion, crime and security, all with complex interdependencies, so the market need and opportunity is very broad.

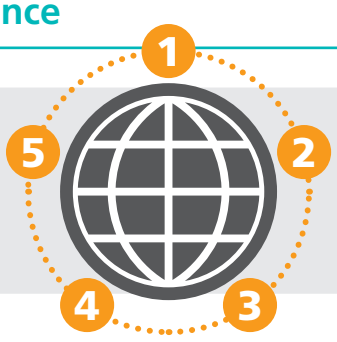
The market opportunity presented by the resilience agenda in the built environment is being driven by four key factors:

1. **A market failure – occurring on many levels within government and the private sector.**
2. **The huge cost to the economy of the detrimental effects of climate change related issues – which is predicted to rise inexorably if no action is taken.**
3. **A large latent economic opportunity – presented by the needed adaptation of the built environment.**
4. **A knowledge and skills gap – which is fuelling the market failure and holding back progress on adaptation, but which represents a significant need and hence opportunity.**

The research is closely aligned with the work of the BRE Centre for Resilience, created in 2014 to address adverse weather effects, as well as social, security and disaster issues. The Strategic Research Partnerships are an integral part of the Centre and are fully integrated into the programme.

Projects launched in 2015

5 projects were launched in 2015 with a focus on climate resilience



BRE CENTRE FOR RESILIENCE

Flood resilient homes – Repair standards – S Garvin

Flooding has long been recognised as the greatest natural threat the UK faces. Large scale structure flood prevention can only go so far and there is a changing emphasis to "living with water" putting greater focus on measures such as property level protection, including flood resilient repair for existing properties that are at flood risk. Significant market failures underpinned by the lack of appropriate standards, poor guidance and information and a lack of skills have held back the uptake of innovative solutions. The objective of the project is to enable the greater uptake of flood resilient repair approaches by homeowners, assisted by appropriate standards and contractors with the skills to deliver cost-effective measures. The outputs from the project will be a range of performance measures that will form a flood resilient repair standard for existing homes with associated technical guidance. There will be extensive dissemination to a range of stakeholders through various media including digital publications, workshops and demonstration of flood resilient repairs on the BRE Innovation Park.

Actions on structures: Extreme events and resilience of assets

The objective of this project is to reduce the wind damage to buildings by addressing the current serious performance gap where over 90% of damage occurs at wind speeds below the basic design wind pressure. The work proposed under this project links to on-going work on methods for determining/ assessing/ quantifying residual service life estimation in changed climatic conditions and exposures. This is particularly challenging in existing assets where degradation has occurred and is on-going. The output will be to provide methods and data for the construction industry and design community to better understand the changing nature of wind events in the UK and further afield and develop a better strategy for wind proofing buildings.

Resilience – Tackling overheating in urban dwellings

Overheating already manifests itself in UK dwellings due to a range of factors and climate change will almost certainly exacerbate the risks of overheating with the knock-on impact on occupants' health. New methods of energy efficient construction or refurbishment may even be making the situation worse. The objective of this project is help key stakeholders across the built environment community to reduce the future risk of overheating, by providing vital guidance and information based on hard scientific data. The key output will be a detailed review of the design and assessment of the potential risk of flats to overheat. This will be supported by monitored and test data to allow a comparison to be made with a review of the design performance and to provide the start of a dataset that can be used to develop evidence based design guidance. The outputs of this work will provide business benefit to BRE through increased consultancy and testing income associated with our leading position in this area, both reactively for existing problem buildings and also in relation to new build and retrofit. There will also be sales of products such as guidance and training, and critically it will feed into improving our own standards such as BREEAM and the new Home Quality Mark.

Building resilience to natural disasters: Developing knowledge and filling the gap

This project builds on the successful BRE Trust and IFRC funded work to develop the QSAND Tool for post disaster reconstruction/ redevelopment projects. By applying QSAND in selected post disaster reconstruction projects the project has the objective of both identifying positive practical solutions in the field and from the experience gained, improving and refining the tool. This will support the exploitation and adoption of QSAND and will also feed into the future development of resilience criteria in BREEAM's various standards internationally. The beneficial impact could be huge by contributing to the process of improving the quality of life of disaster affected communities and reducing the impact of the disaster, where feasible, on the natural and built environment. It will also better equip humanitarian organisations such as IFRC and others with the tools and the knowledge to respond more effectively to disasters. BRE will benefit directly from the uptake of QSAND which will require significant training of those working in disaster relief and which also has the potential for being turned into formal certification. The development and enhancement of future international BREEAM standards provides the single largest opportunity for future income for BRE.

Community resilience: A methodology for mapping and evaluating resilience using the Brazilian context

This project is a precursor to a wider project which is in preparation to develop a tool for assessing and managing resilience at a community level. This was a key feedback from stakeholder engagement. This project will investigate the context of resilience of the built environment in the Brazilian situation at a Federal, State and City level, understanding the resilience challenges, the relevant legislation, and the agents and instruments of implementation. The output from the project will feed into the main project which is being proposed for the middle of the year which has the potential to create a valuable new product which can be applied to other international markets.

An additional four projects are due to start in 2016

Setting standards for built environment resilience at different scales – S Garvin

The ability to understand and measure resilience in a consistent manner is fundamental to creating resilient buildings and cities, having standards to support resilience are essential. The aim of the research will be to develop a coherent knowledge and evidence base for the setting of standards of built environment resilience tools at different scales. The research will lead to the setting of standards for building components, buildings and cities. The standards will address issues such as changing population size and demography, as well as issues such as climate change.

Energy resilience in the built environment

The issues affecting energy resilience are complex. This project will identify and map key drivers in terms of projects and research and use the outcomes to explore opportunities for an energy resilience assessment method for communities and the wider built environment.

Cyber security for smart homes

Smart homes and buildings will see an exponential growth in the range of electronic products and systems used for sensing, control, automation and communication. The potential cyber hacking of systems and the unintended consequences of sharing and aggregating large data sets including personal information presents considerable risks to safety, security and privacy. The project will identify the level and types of common failures for smart homes energy and security solutions. It will develop appropriate standards and methodologies for the testing and certification of homes and solutions and identify risks and mitigation methods for handling issues around the integration across multiple vendors and platforms.

Implementing climate and flood resilience

In the past ten years substantial research and development has been undertaken into flood and climate resilience of buildings and the built environment. The task remains of how to drive up adoption of property flood and climate resilience measures by building owners to reduce their residual risk.

This project will:

- Carry out a thorough review related to implementing climate and flood resilience.
- Create a plan for learning and action alliances at national and local level.
- To research funding and financing mechanisms that have synergy with business and householder needs and can be realised by lenders and insurers.
- To seek opportunities for 'win-win' scenarios, for example improving energy efficiency and simultaneously improving resilience.

BRE ACADEMY®

The BRE Academy was set up in 2013 to deliver leading edge training and development services to improve the performance and competence levels of individuals in the workplace. The BRE Academy works across the BRE Group to explore the most effective way to disseminate BRE Trust outputs and programmes to ensure the maximum take up and the best execution methodology is deployed, such, as classroom based, online, or blended to educate and train professionals on best practices for the built environment. The Academy now ensures that the research programmes developed by the BRE Trust see part of the full output developed via a training programme.

In 2015 the BRE Academy trained nearly 2000 people. The Academy also strengthened its strategic partnership with key professional institutes such as RIBA, CIOB, IStructE, IEMA and CIAT in order to deliver Continuous Professional Development to a wide range of built environment professionals.

BIM AP International

BRE Trust funded the development of a Building Information Modelling (BIM) International training course, with the intention of transferring the industry knowledge and best practice from the UK to international markets. This was launched in May 2015 with two sets of courses having been delivered in Dubai in partnership with Alpin Limited, a leading technical advisory firm for the built environment in the United Arab Emirates (UAE). Running at near full capacity, both courses have attracted senior delegates from across the construction industry in UAE. In addition four courses have been delivered in New Zealand and the material has been licensed to partner BRANZ for local delivery, with potential to extend this to Australia. The Academy is currently developing partnerships to deliver the BIM International programme in Malaysia and India.

Site Sustainability Manager

The Trust also funded the development of the original Sustainable Site Manager (SSM) training course. This helps construction site managers ensure buildings achieve their design targets and to make site activities more sustainable – it also links to a specific BREEAM credit. The course underwent a major revamp following feedback from delegates and the first day of the 2-day course is now delivered and tested on-line.

Outlook for 2016

The BRE Academy works closely with the industry to develop the most relevant and effective ways to deliver lifelong learning. In 2016 the Academy will be launching a new digital platform which will enable more efficient, tailored and user friendly delivery of online and blended learning services. The new functionality will provide more interaction for digital learning and enriched learning experiences.

The Academy also plans to launch new courses on BREEAM Infrastructure and on-line BIM training which build on the research outputs from BRE Trust projects. In addition, the Academy will offer a new course, BREEAM Associate, to ensure delivery teams and clients can be effective and proactive, giving knowledge and confidence when going in to the BREEAM process so as to get the best result in the most efficient way. The scheme was developed in collaboration with industry, and the training will be delivered completely on-line via www.bre.ac.

About BRE Trust

Background

BRE Trust is a charitable company whose objectives are, through research and education, to advance knowledge, innovation and communication in all matters concerning the built environment for public benefit.

Building Research Establishment Limited, along with BRE Global Limited and FBE Management Limited, are wholly owned subsidiary companies of the Trust. This ownership structure enables BRE to be held as a national asset on behalf of the construction industry and its clients, independent of specific commercial interests and protects BRE's impartiality and objectivity in research and advice.

Profits made by the subsidiary companies are gift-aided to the Trust and used by it to promote its charitable objectives.

The Trustees meet in Council four times a year to provide strategic direction and to oversee and guide developments of the charity and its subsidiary companies. The Trustees ensure that the charity pursues its objectives of 'for public benefit' research and education and that the assets owned by the Trust, namely its subsidiary companies, are used in a way that will contribute to the Trust achieving its objectives.

The Trust is the largest UK charity dedicated specifically to research and education in the built environment.

Constitution

BRE Trust is a company limited by guarantee Company number 3282856 and is registered as a charity in England and Wales (no 1092193) and in Scotland (no SCO39320). It is governed by its memorandum and articles of association.

Its registered office is Bucknalls Lane, Garston, Watford, Herts, WD25 9XX.

Trustees and officers serving in 2015

The Trustees have delegated the day to day management of the Charity to the Chief Executive of the BRE Group Limited, Peter Bonfield and the Company Director, Russell Heusch and management of its subsidiary activities to the Board of BRE Group Limited.

Chairman James Wates CBE

Michael Ankers OBE (stepped down July 2015)

Francesca Berriman MBE HonDTech (joined June 2015)

John Carter

Michael Dickson CBE

Hugh Ferguson

Dr Liz Goodwin OBE

Professor Nick Jennings CBE (joined August 2015)

Sir Ken Knight CBE

Quentin Leiper CBE

Peter Lobban OBE

Ashley Pocock (joined June 2015)

Ashley Wheaton (joined June 2015)

Martin Wyatt

Russell Heusch Secretary

BRE Trust Research Committee

Dr Liz Goodwin OBE (Chair)

Michael Dickson CBE

Quentin Leiper CBE

Ashley Pocock

BRE Trust Publications Committee

Hugh Ferguson (stepped down as Chair end 2015)

Francesca Berriman MBE HonDTech (Chair)

Michael Ankers (stepped down July 2015)

John Carter (stepped down August 2015)

Ashley Wheaton

Martin Wyatt

Governance

Tustees are invited to become a Trustee because of the merit of their skills, and because their general expertise would be of benefit to the Trust and represent wider interests of the built environment.

During 2015, the Council had three committees reporting to it:

BRE Group Trust Audit Committee

Research Committee

Publications Committee

Management

The role of the Trustees is to manage the activities of the Trust, its assets and investments. These are explicitly defined as:

- To manage and administer the activities of the BRE Trust, its assets and investments in accordance with the relevant Acts and guidance issued by the Charities Commission.
- To give strategic direction to the work of the BRE Trust and group companies.
- To make input into the strategic business plans of the group companies.
- To extend the scope of BRE Trust's charitable activities for the public good and seek funding.
- To develop research and education objectives for the charity and to prioritise expenditure against such objectives.
- To act as ambassadors for the work and objectives of the Trust and its group companies.
- To periodically benchmark the activities and achievements of the BRE Trust and its group companies.
- To ensure the excellence of scientific standards within the BRE group of companies.

All day-to-day decisions have been delegated to the boards of directors of the subsidiary companies.

Subsidiary companies

The Council of Trustees meets quarterly. The directors of subsidiary companies and senior staff are invited to the meetings to report on operational and business performance.

The activities of the trading subsidiaries are:

- Building Research Establishment Limited provides independent advice and information on building performance, construction and sustainability in the United Kingdom.
- BRE Global Limited carries out research, testing and certification of materials and products, and certification of personnel, buildings, processes, systems and supply chains.
- FBE Management Limited manages research work and carries out consultancy and research for the European Commission and provides technical support for the Construction Product Directive.

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BRE Trust
The BRE Trust uses profits made by BRE Group to fund new research and education programmes, that will help it meet its goal of 'building a better world together'.

The BRE Trust is a registered charity in England & Wales: No. 1092193, and Scotland: No. SC039320.