Improving learning to enhance sustainability management

Engagement with sustainability by construction organisations is typically evidenced by the presence of certified product and management system standards. Such standards, which include the widely implemented ISO 9001 for quality management and ISO 14001 for environmental management systems, as well as the construction-specific BES 6001 for responsible sourcing, are implemented to demonstrate performance of the organisation or their products against specific areas. Certification to these standards is relatively easily achieved within larger organisations where, often, dedicated sustainability staff and finances to address sustainability are readily available. However, for small and medium-sized enterprises (SMEs) this is seldom the case, and there may be limited time and finances available to implement such standards.

In the face of customer demand for evidence of certification addressing sustainability, SMEs are often pressurised in this regard. This becomes a bigger issue when demands are placed on them to implement multiple standards, causing an even greater drain on resources. To address the struggles that SMEs typically experience, research at the Centre for Innovative and Collaborative Construction Engineering at Loughborough University has focused upon the development of a sustainability framework which looks to make certification for the SME a more cost-effective process.

This research has elucidated the link between sustainability proactivity and high levels of learning, which itself is based upon the ‘absorptive capacity’ of an organisation. Essentially, the framework aims to reduce consultant time by streamlining the initial stages of the consultancy process, and hence reduces fees for clients, by assessing what an organisation has in place around core sustainability issues and by identifying any additional work the organisation needs to do to comply with the requirements of a given standard. These actions are underpinned by learning activities such that requirements of standards are embedded within the organisation to deliver added value, rather than simply being implemented in a way that does little except to fulfil a ‘box-ticking’ culture.

The proposed framework is designed in three parts, with the third part focusing on delivering the learning to underpin sustainability implementation. The first phase adopts a risk-based approach and it is envisaged that it will ask broad questions around the nature of operations and supply chain performance. The second phase will then analyse those answers to assess which aspects are ‘significant’ to environmental and social impacts based upon the organisation’s context. Those that are identified here are then addressed in the final phase, where more detailed questions are asked to determine what the organisation has in place and where action is required. Actions will typically focus upon developing policies and processes as required by many of the management system and product standards but will be supported by learning material, perhaps in the form of short e-learning material that is relevant to a particular issue. The idea is therefore that, if an organisation is unsure of how to complete an action when prompted, it can consult the e-learning material relevant to that action to determine how it should go about addressing it.

Increasing the learning and knowledge is key to delivering innovations and it is hoped that this ‘learning framework’ can provide the foundations for a more sophisticated sustainability tool in the future, perhaps to be developed via a web-based platform.

For further information please contact James Upstill-Goddard, Sustainability Consultant at Responsible Solutions Ltd (01509 320100; E-mail: J.D.Upstill-Goddard@lboro.ac.uk).

James Upstill-Goddard speaking at East Midlands Chamber Sustainability Summit.

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Social aspects of fire engineering – fire safety in informal settlements

A novel research partnership at the University of Edinburgh is seeking funding to tackle an age-old but neglected fire safety problem of global importance – fire safety in informal settlements. The research partnership has been initiated by the Ove Arup Foundation and the Royal Academy of Engineering (RAEng). It involves Senior Research Fellow Dr Graham Spinardi from the Ove Arup Foundation/RAEng, Arup Chair of Fire and Structures Professor Luke Bisby, and Rushbrook Lecturer in Fire Investigation Dr Rory Hadden.

Deaths and injuries due to fire have reduced dramatically in the UK and other developed countries over the last few decades. Fire safety engineers can of course take some (but not all) of the credit for this. Although the exact reasons are hard to definitively pinpoint, other important factors for reducing fires and their impacts include the work of fire brigades and others in promoting the use of smoke alarms, the development and regulation of less flammable household products, and even the rise of the oven chip (meaning fewer chip pan fires!). With better-engineered buildings and continual advancements in fire safety engineering profession as the built environment continually innovates and evolves, annual fire deaths have dropped in the developed world – past examples include the Great Fire of London in 1666, the Baltimore Fire in 1904 and the San Francisco Earthquake Fire in 1906. However, large fires still occur regularly in informal settlements. For example 2,000 large fires occur monthly in shanty towns in South Africa, thousands of people have been left homeless after fires in Sao Paulo favelas in recent years, and 10,000 were left homeless after a fire in a Manila shanty town in March 2015. The resilience of these communities against fire (and other hazards such as earthquakes, tsunamis, floods, and landslides) remains very low, with the potential for dramatic loss of life and property high. The impacts of fires and other hazards also leads to damage to social structures and local economies, hindering long-term economic development and helping to perpetuate a cycle of poverty and global inequality.

This problem seems intractable because informal settlements are, by their very nature, lacking in many of the key features that have reduced fire casualties and damage in the developed world. Organised fire fighting services, reliable water mains, and enforced building regulations could greatly reduce the impact of fires on informal settlements – as they demonstrably have over centuries in the developed world – but exhortations to take such measures amount largely to empty gestures when there seems little realistic prospect of their implementation.

Instead, perhaps it is necessary to address the problem in ways that do not rely entirely on the traditional tools of civic governance. For example, does the apparent success of widespread use of smoke alarms in the UK and elsewhere indicate one potential approach to the problem – the development and dissemination of some device or technology that will reduce the incidence or impact of fires in informal settlements? Such technical fixes have the appeal that cheap, mass-produced devices could provide a blanket solution to the problem of fire in informal settlements. Whilst workable solutions clearly cannot be purely technological, one such promising invention proposed in South Africa is the wirelessly networked Lumkani heat detector, which offers an inexpensive fire alarm suitable for habitations where sooty fires for cooking and heating are commonplace. Or, in some cases, might there be a greater role for insurance providers, even in these informal settlements, to give incentives for better fire safety practices (a key driver for fire safety improvements in much of Europe and North America prior to the 20th century)?

Such proposals face multiple challenges because they must work (i.e. be feasible and efficacious) both technically and socially. A central technical challenge is that the close spacing of buildings in informal settlements and the widespread use of flammable construction and cladding materials, and the resultant high risk of fire spread and conflagration, means that solutions adopted by individual households may have limited collective benefits. The core challenge socially is that informal settlements differ greatly from place to place, with some having higher social cohesion and/or greater levels of employment and incomes than others. Building practices, the level of...
government intervention, regulation and enforcement, and lifestyle also vary greatly. All of this means that any approach to address fire risks in informal settlements based solely on the dissemination of a ‘technical fix’ may be misguided because it ignores the importance of social context (e.g. in the case of a heat detector an important consideration is whether occupants would accept and maintain such devices or regularly heed their warnings). The various informal settlements around the world have many similarities, but also many important differences. This matters not just because social context is likely to affect the way that technical solutions are adopted and used, but also because many aspects of fire safety are fundamentally social in their nature.

For this reason, Spinardi, Bisby, and Hadden are now proposing a more radical approach to investigating the potential for technical innovation through a demand-side orientated analysis, focused on the social and material particularities of informal settlements. To identify potential socio-technical solutions, the proposed methodology uses historical analogy in which the fire problem in different modern informal settlements is understood in relation to how earlier settlements developed ways of improving fire safety. Spinardi, Bisby, and Hadden are interested in two fundamental questions:

Question 1: How was the fire problem solved as the developed world developed?

While many improvements in fire safety can be traced to fire disasters (such as the Great Fire of London) that resulted in government action to impose building regulations, such centralised governance was only one factor in improving fire safety as cities developed. Private initiatives were also important. Indeed, many early fire-fighting services were established by insurance companies, with municipal fire brigades only emerging during the 19th century. And insurance companies not only sought to extinguish fires in properties covered by their insurance, but also to effect loss mitigation by requiring customers to follow rules as regarding the construction and use of property. Increasing wealth too was an important factor in reducing conflagrations in 19th century cities, as people could afford to build with less flammable materials, and importantly, to have larger lot sizes with greater spacing between properties.

However, it is still necessary to understand better how earlier settlements evolved and addressed fire risks. The research team at the University of Edinburgh plan to carry out detailed historical case studies, chosen to provide comparative insights whilst covering a wide range of relevant variables. Many fire safety solutions are now seen as universal and context-independent, but such a framing fails to capture their historically specific origins and differing implementations. These case studies will provide rich accounts of how technical and social innovations have improved fire safety, thereby suggesting potential solutions for current informal settlements.

Question 2: What are the fire risks in current informal settlements, and what socio-technical innovations are compatible with their material and social circumstances?

Detailed studies of informal settlements are planned in South Africa, India, and Brazil, where significant differences are expected to enable comparative analysis. Spinardi, Bisby, and Hadden hypothesise that the feasibility of fire safety solutions will be affected by variations in social relations, modes of governance, community engagement, and material circumstances. It is hoped that developing an in-depth understanding of the social contexts specific to each informal settlement, along with findings from historical case studies of how fire safety developed in earlier settlements, will enable assessment of a range of potential solutions, such as heat detectors, safer cooking stoves, or more integrated solutions such as vegetable fire-walls or sprinkler fire-breaks.

With these two lines of inquiry we hope to be able to provide a range of useful suggestions as to how the problem of fire in informal settlements can be tackled. However, as with most fire deaths in the developed world, it is clear that improving socio-economic circumstances is probably the best solution, for this, as well as for other reasons.

For further information please contact Dr Graham Spinardi, Ove Arup Foundation/Royal Academy of Engineering Senior Research Fellow in Integrating Technical and Social Aspects of Fire Safety (E-mail: G.Spinardi@ed.ac.uk).
Condition indices, condition evaluation and data-driven decision making for highway filter drains

Highway filter drains (HFDs) are aggregate filled trenches fitted with a porous carrier pipe laid at the base, used in the United Kingdom to drain significant lengths of the highway network acting as a combined drainage system. The highly porous granular backfill used, which is typically exposed at the surface of the trench, gradually deteriorates as foreign particles penetrate the trench and minimise the available void space in the drain. HFDs therefore require maintenance so they are fit for purpose. Following the paradigm shift of infrastructure management, and aiming to establish the context for a proactive HFD management approach, a set of condition assessment metrics is being developed along with the tools and methods to facilitate the requirement for reliable and accurate condition information to be collected. The aim of these developments is to improve decision making with regards to managing the maintenance of HFDs.

Under current business models, planned HFD maintenance often tends to be passive or reactive, based on empirical evidence in a given network with little formal long-term planning of investments or life-cycle cost assessment. This is largely due to the lack of a structured framework to enable road operators to collect and process condition data for this particular asset and the fact that dealing with drainage systems in the highways sector has not in the past been integrated in holistic Asset Management (AM) plans.

There is a consensus within the sector that any AM system is developed by aligning high level organisational goals to daily activities that prescribe what individuals are doing – how, when and where. This approach is defined by and revolves around asset data and knowledge generation. Condition data, a key input in any management system, enables the evaluation of the current physical state of an asset, allows the generation of performance indicators (from metrics to levels of service), enables the identification of current maintenance backlogs, and can be used to project deterioration and establish asset maintenance and rehabilitation (MR&R) strategies.

This research conducted by the Centre for Innovative and Collaborative Construction Engineering at Loughborough University, in collaboration with Connect Roads and Pavement Testing Services (PTS), focuses on the aforementioned drainage system and proposes the adoption of condition metrics that have been developed to represent deteriorated HFD performance, based on the extent of fouling or blocking of the drainage media.

The existing fuzzy projections of HFD service life (anticipated to be limited to 10 years according to design standards) are placed under evaluation and the proposed quantitative condition assessment approach addresses the gap between evaluating which drains are in a particular physical condition and how long-term investment plans can be generated for a given network.

To establish a quantitative level of anticipated performance, fouling metrics are mapped to drainage capacity trials. Relevant experimental work is being carried out to measure – as a proxy for degradation – the permittivity properties of HFD granular backfill material (Non-Destructive Evaluation using the ground penetrating radar (GPR) - see Figure 1) in various fouled states, and moisture contents to represent in-service deteriorated sections. The permittivity dispersion study exhibits how the GPR can be applied in practice to extract and quantify the deterioration characteristics of the HFD aggregate backfill.

The proposed metrics, coupled to the GPR tool can provide the fundamental building blocks required to develop and adopt a Condition Assessment System (CAS) tailored to the specific service conditions of HFD. Evaluation techniques also using higher frequency antennae and the analysis from available void space of the material are being developed in collaboration with PTS. An example of such work is presented in Figure 2: two air-coupled antennae are used to extract condition data from in-service HFD sections (this is similar to the approach used to evaluate railway trackbed). The data collection and analysis is carried out to define the framework required to conduct network-level non-destructive condition surveys of the physical condition of HFDs in the UK highways network.

For further information please contact Theodoros Stylianides (E-mail: Theodoros.stylianides@connectroads.com or T.stylianides@lboro.ac.uk).

Figure 1: Laboratory evaluation of HFD aggregate backfill; variation of dielectric permittivity as a function of Free Voids Ratio

Figure 2: Non-Destructive evaluation of in-service HFD section using air-coupled GPR antennae; analysis from void space and extraction of dielectric values
The Civil Engineering Triennial Summit – resilience and growth for future cities

Three global engineering institutions – the Institution of Civil Engineers, American Society of Civil Engineers and the Canadian Society for Civil Engineering – are coming together, leveraging the combined expertise of 300,000 members to deliver a summit on resilience and growth for the world’s future cities. The summit will connect decision makers and the investment community from around the world with engineers, technology experts and built environment professionals together to address the challenges of civic resilience and major issues facing future cities.

The Civil Engineering Triennial Summit 2015 will be taking place on 9-10 December in Westminster, London at the Institution Civil Engineers (ICE) headquarters. This is the first time in a decade that the two-day summit returns to the ICE in Westminster. Built by engineers, the programme features more than 40 speakers from across the globe who already make the world’s cities more resilient.

The Summit provides a chance to learn from and shape thinking on the funding, development and build of the globe’s future cities. The Summit will acknowledge the complex problems facing cities including the new reality of extreme weather events, population surges and resource scarcity. Research suggests that the earlier cities begin to future proof, the better the end results will be, so the focus of this year’s Summit is on future planning and resilience. Physical structures and the political, economic and societal mechanisms that support resilience must be up to task. Otherwise cities and their societies risk exponential poverty, social inequality and economic decline, and vulnerability to terrorism and conflict.

By joining together built environment professionals from around the world, the Civil Engineering Triennial Summit 2015 will connect people at the forefront of civic resilience to:

- Highlight best practice case studies of resilience from a range of future city projects around the world: which measures are adaptable to your city, community or asset?
- Share the latest climate change and demographic models resulting in better informed, sustainable future risk management decisions.
- Pinpoint the regions and cities at the highest risk/recovery profile. Which cities can we best help with the finite resources available?
- Address issues of financially resilient infrastructure – outlining an holistic-benefits approach to international funding and demonstrating return on investment.
- Identify any gaps in skills or diversity amongst the engineering workforce that would limit our ability to future proof cities. What steps can we take to close them?
- Troubleshoot barriers to development of resilience projects, collaborative working, new technology roll out and scaling up smart city test beds.
- Disseminate findings from leading academic projects at the forefront of future city and resilience research.
- Outline the way forward: how do we ‘build in’ resilience to infrastructure, societal consciousness and political decision making?

With the focus of the Summit on resilience and future proofing cities, inevitably innovation is a theme entwined within the content of much of the Summit. Some aspects of the agenda that particularly harness innovation as a theme includes:

- The digital revolution and intelligent data management as a step towards a resilient and vibrant future for cities. Intelligent data management systems can provide a backbone enabling better visibility, better decisions, a clearer view of networks and services, such as transport, energy and eGovernment, which cut across society.
- Integrating and collaborating a wide range of stakeholders to enable the progression of future cities. It is important to acknowledge how people can be the most powerful blockers to the progress of future cities with difficulties in getting everyone working together.
- The need for innovation and a focus on decarbonised infrastructure and a low carbon economy.

For further information and to register for a place at the Summit please visit www.ice-triennial.com.
Continuing to transform UK construction – ‘Construction 2025’

On 8-9 September the Construction Industry Summit, the flagship conference and event attended by individuals from across the construction industry, was held in London. The key note speaker at the Summit was Dr Peter Hansford, Chief Construction Adviser to the UK Government. Dr Hansford’s address focused on progress with ‘Construction 2025’, the sector strategy for transforming construction, supported by Government. This strategy sets out a vision for the construction industry in the UK to become world-class by the year 2025, so the world looks to the UK for excellence in construction projects.

What is ‘Construction 2025’?

In his opening remarks about ‘Construction 2025’, Dr Hansford stressed that ‘Construction 25’ represented a continuum of the journey that the construction industry has been going through for the last 20 years, rather than existing in a ‘vacuum’. However he did state that it was a new and different strategy, produced by industry and Government working together.

‘Construction 2025’ was launched in 2013 and is a joint industry and Government strategy to transform construction in the UK. The strategy sets out a vision of where industry and Government jointly wish construction to be in this country by 2025, and how this will be achieved by working together. It’s a vision of a world where buildings and infrastructure are conceived and built much faster, with greater whole-life value and better carbon and energy performance. It’s also a vision where construction is driving growth across the whole economy, and where UK companies are working in partnership in markets at home and overseas.

At the heart of the strategy are four bold ambitions:

• a 33% reduction in both the initial cost of construction and the whole-life cost of assets;
• a 50% reduction in the overall time from inception to completion for new build and refurbished assets;
• a 50% reduction in greenhouse gas emissions in the built environment, in line with the Low Carbon Routemap to 2050 – for example, innovation in LED lighting has led to much greater flexibility in design and is enabling bespoke design at much lower costs;
• a 50% reduction in the trade gap between total exports and total imports for construction products and materials – with more products sourced and manufactured in Britain.

Themes of ‘Construction 2025’

Dr Hansford talked through the five broad themes of ‘Construction 2025’:

1) People

This theme covers image, skills, working conditions, diversity and attracting and retaining the people needed for driving a world-class construction industry. Dr Hansford commented on some of the achievements that had already been reached with regards to this theme:

• A ‘young persons on site’ statement has been published, covering how young people can be protected on sites.
• Progress has been made on developing a Common Gateway for potential entrants to the industry.
• Work is underway on health issues in the industry; and creating a more diverse workforce.
• The housebuilders have embarked on a new image campaign, together with initiatives to recruit new housebuilding talent.
• TrustMark was relaunched, demonstrating Government’s support to this consumer protection scheme.

2) Smart

This theme covers Building Information Modelling (BIM), off-site construction, better use of technology, innovation and a more co-ordinated approach to research and development.

Progress already made highlighted by Dr Hansford included:

• Priorities for innovation have been agreed by the Leadership Council – industrialisation, smart infrastructure and buildings, new industry business models, and retrofit solutions. Work on these strands has already begun.
• BIM has progressed well towards Level 2; and Level 3 BIM is being developed.
• Progress has been made in developing and promoting off-site construction solutions.

3) Sustainable

This theme covers green and low carbon construction, and also addresses how to create a sustainable industry for the future. Dr Hansford mentioned some achievements reached under this theme:

• The Infrastructure Carbon Review was published, with its core message of “reducing carbon reduces cost”.
• A ‘Switch the Lights’ campaign was launched in the retail sector, encouraging a switch to LED lighting (note – an article on this campaign featured in the 102nd edition of
4) Growth

This theme includes building a strong and resilient supply chain; supporting the many SMEs in the industry; as well as promoting overseas trade and investing in UK manufacturing capacity so as to substitute for imports. Dr Hansford commented on some of the achievements that had already been reached with regards to this theme:

- The Construction Supply Chain Payment Charter was published, promoting fairer payment across the industry.
- Work is under way in simplifying the prequalification process.
- Work has continued on infrastructure and construction pipelines, together with work on supply chain and skills capacity.
- UK Export Finance resources have been increased to provide further support to the industry.

5) Leadership

This theme looks at taking forward the strategy between industry and Government. This is the role of the Construction Leadership Council, formed in June 2013, and which has met 6 times since then.

The Construction Leadership Council

The Construction Leadership Council was set up at the time of the development of Construction 2025. This started as a Council of 31 members. Talking about the Council, Dr Hansford remarked that, originally being so large, the aim was to get all the key parties into one tent. However, he added that being such as large group does not make for the most effective action. Consequently the Council has been streamlined and now consists of 12 members.

Constructing Britain Productively

In concluding his address at the Summit, Dr Hansford drew attention to the fact that the role of Chief Construction Adviser would not be continued beyond the end of his contract, the end of November 2015. Dr Hansford stated that he was proud to have taken over from Paul Morrell back in 2012 and that Paul had achieved a great deal – in establishing the role, developing the Government Construction Strategy in 2011, and setting the industry off on a new route to a low-carbon built environment by 2050. He said that he had been pleased to carry the baton for the next leg of the relay race – particularly with developing, promoting and implementing Construction 2025; with focusing on the image of construction; giving profile to schools initiatives, such as ‘Adopt a School’; and raising the importance of innovation in achieving our long-term ambitions. However, he stated that it is not quite over yet – for example at the beginning of November he will be publishing a report on Solid Wall Insulation, as a vehicle for reducing carbon emissions in our domestic properties.

It had been viewed that the role of Chief Construction Adviser was no longer required, mainly due to the significant strengthening engagement mechanisms for ongoing dialogue between industry and Government. Dr Hansford stressed that he is working with Government and industry to ensure that any gaps created by the loss of the role are plugged in effective ways. He finished his address saying:

‘Now is not the time for the baton to be dropped. It is incumbent on us all to ensure that that does not happen. One of the key issues for this new Government is increasing productivity across UK industry and the UK workforce. This totally accords with the ambitions and direction of Construction 2025. The task for all of us in construction is to find ways to construct our built environment by more-productive means. It is clear to me that the big prize for our industry is to construct Britain productively. That important journey continues.’

For further information please contact Jane Chelliah-Manning at the Department for Business, Innovation & Skills (0207 215 1630; E-mail: Jane.Chelliah- Manning@bis.gsi.gov.uk).
Construction efficiency: A tale of two developed countries

The measurement of construction performance is a vexed problem. Despite much research effort, there remains little agreement over what to measure and how to measure it. The problem is made even more complicated by the desire to benchmark national industry performance against that of other countries. A research paper written by Professor Craig Langston from Bond University in Australia, which was the ‘Highly Commended Winner’ in the Research Paper category of the CIOB Innovation & Research Awards, introduces a new method for comparing international construction efficiency. The method has been tested on a dataset of 337 modern high-rise buildings in Australia and the USA.

Construction efficiency is defined as cost over time (i.e. $/month). This research adopts a purchasing power approach for cost adjustment within and across countries using a unique basket of construction-specific materials, labour and plant. This basket is called a citiBLOC. Cost, therefore, is measured as the number of citiBLOCs necessary to construct a project, where the standard basket is priced in each city in local currency, removing the need to apply currency exchange rates that otherwise introduce volatility and erroneous outcomes. Construction efficiency is used to comment on the relative performance of the procurement process in different locations.

This research draws on what is understood to be one of the largest samples of construction project data ever assembled in a single study. Data comprised 337 high-rise projects of 20 storeys or more, completed between 2003 and 2012, throughout the five largest cities in Australia and the USA and representing two-thirds of the known population of such buildings in these locations. The ensuing analysis not only demonstrated the practical application of the model, but provided new insight into the efficiency track-record of the construction industry in Australia and the USA over time. The growth in baseline cost/m² suggested a corresponding rise in project complexity. Despite a similar trend in efficiency improvement, there was evidence that base costs in Australia had outstripped the US, meaning that ‘real’ construction efficiency in Australia was relatively less. It is determined that the US has outperformed Australia in terms of construction efficiency by 1.10% pa over a 10-year period.


For further information on this topic please contact Professor Craig Langston (E-mail: clangsto@bond.edu.au) at Bond University, Australia. For further information on the CIOB International Innovation & Research Awards please contact Dr Chung-Chin Kao (E-mail: ckaoc@ciob.org.uk), or visit http://iandrawards.ciob.org.uk/.

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