dti

The Construction Research Programme - Project Showcase

FEBRUARY 2007

Contents

Foreword

This report celebrates the achievements of the Construction Research Programme and looks forward to the challenges and opportunities opening up for the sector through the newly established *National Platform for the Built Environment.*

In doing so, we have 14 case studies highlighting the work undertaken within the programme. The projects selected here are seen as having made, or having the potential to make, a positive impact on the sector - but this does not mean that those not selected from the list will not. The projects selected show the breadth and range of the portfolio, from technologies, materials and building service engineering to process - with the emphasis very much on the way the programme tried to address the reforms highlighted by Sir John Egan's Construction Task Force in its seminal report *"Rethinking Construction".*

Although we have now said goodbye to the dedicated construction research programme this does not mean that the job is done. Far from it.

The sector has historically under-invested in its own research by comparison with both other UK sectors and, crucially, with its overseas competitors. DTI is committed to working with the National Platform to develop the case for more, and more strategic, research investment and additionally to encourage the sector to take advantage of the significant research funds available through both the European Commission and from UK research funders.

The Platform needs to translate these opportunities into projects which excite and engage UK companies.

The Platform's *Strategic Research Agenda* launched in June 2006 is a step in the right direction. The SRA is a key document for the sector giving the industry a voice to speak to Government, to articulate long-term research needs and inform future research funding – including the funds available through the Government's Technology Programme.

Equally important, the time has come to try to better connect the sector's real business problems with the centres of excellence that exist in the UK. To this end, the DTI has approved the funding of a major *Knowledge Transfer Network for the Modern Built Environment* to try to unlock this knowledge and make the key connections between business and research expertise.

I would like to express my thanks to all those who participated in the programme; companies, Institutions, Universities and research organisations and those who made the Construction Research programme such a success.

I would also like to acknowledge the industry assessors and the teams at Atkins and Davis Langdon Management Consultancy for their effective management of the research portfolio on our behalf.

Rt Hon Margaret Hodge MBE MP
Minister of State:
Industry and the Regions

CHAPTER 1

THE CONSTRUCTION RESEARCH PROGRAMME

History and Operation

The Change Agenda

The 1998 report 'Rethinking Construction' by the Construction Task Force, chaired by Sir John Egan, identified radical steps needed to improve the efficiency and quality of delivery in UK Construction. The priorities identified by Sir John in turn led to the development and re-structuring of the then DETR's research programme to be able to better deliver the Task Force's recommendations.

Post 2000, all research projects entering the programme had to show a clear contribution to the overall aims of *"Rethinking Construction"* (and its follow-up report *"Accelerating Change"*) and *"Building a Better Quality of Life",* the Government's strategy for sustainable construction published in 2000.

Both reports aimed to bring about a radical change and continuous improvement in the way the industry goes about each aspect of its business. Both were concerned with achieving a more profitable and competitive industry which provides better value to customers; an industry which respects and treats its stakeholders fairly and one which minimises its impact on the environment.

In keeping with sustainable development, research proposals had to show potential impact on at least one of the following areas:

Economic Benefit – Creating a profitable and competitive industry – at home and abroad – which provides customer satisfaction and value. An industry which focuses on the needs and expectations of customers and other stakeholders, improves profit margins, measures and compares performance, learns from others and shares experience, develops and respects people and undertakes its work in an ethical and sustainable manner

Social Benefit – Creating an industry which respects and treats its stakeholders fairly and provides a safe and healthy built environment. An industry which meets people's needs and aspirations in ways that are acceptable to society.

Environmental Benefit – Creating an industry which protects and enhances the environment and minimises the impact on consumption of energy and natural resources.

Rethinking Construction and *Building a Better Quality of Life* remain key documents driving the competitiveness and client value agenda for construction.

The Department has recently undertaken a key review of *Building a Better Quality of Life* – setting out the current challenges and issues. The document can be found on the Dept's website at: http://www.dti.gov.uk/sectors/construction/sustainability/strategy/page13543.html

Scope of the Programme

The Programme encompassed contracts awarded under Partners in Innovation, and the preceding Partners in Technology programme, the 5-year BRE Framework Programme, established following privatisation of the BRE in 1997 and 'LINK' projects co-funded by the Department and EPSRC as part of the MCNS ('Meeting clients' needs through standardisation') and IDAC ('Integration in design and construction') programmes.

Partners in Innovation (PII) was the Programme's flagship collaborative research scheme which provided up to half the costs of research and innovation (R&I) projects. It was open to all UK companies, industry bodies, institutions, research and technology organisations and

universities. Run as an annual competition, new money available for the scheme each year was circa £7m with around £21 million of research projects in the portfolio at any one time.

The PII programme was refined annually, and in its final year of operation comprised:

'PII Focus' – contracts for specific projects that addressed priority areas specified by the Department following consultation with industry. The topic areas were based on both industry drivers as identified by the former Construction Research and Innovation Strategy Panel and tested by open consultation.

'PII Open' – contracts awarded on proposals on any important topic of relevance to the Government's key policy objectives for construction.

'PII Programmes' – A directed call, seeking applications for integrated major programmes of work that bring together the major R&I competencies and industrial concerns. PII Programmes attracted significant levels of public and matching private funding. Introduced in response to the Fairclough review, these were designed to support a critical mass of integrated R&I activity within selected key areas and encourage collaboration between the key players which will ultimately lead to the development of self-supporting centres and networks of excellence in those areas. (the BUILDOFFSITE and AVANTI programmes are 'showcased' in Chapter 3).

The Construction Research programme also ran a trial in a smaller scale 'fast-track' scheme – an opportunity for a rapid response to time-limited opportunities to capture learning from experience.

Project Selection and Management

Industry engagement with the project selection process was always considered crucial to the success of Construction Research programme. The PII programme in particular was developed by the Department on an annual basis in close consultation with industry. The process evolved over time but essentially involved:

- Construction Research and Innovation Strategy Panel (and latterly *n*CRISP) identifying high-level strategic directions / objectives
- Feedback from / discussions with industry bodies
- A workshop to help identify priority areas, with representatives from major players in the industry and the research and technology organisations (RTOs).

The outcome from this process was an annual 'prospectus' that reflected both the policy objectives of the Department and the needs of industry. It outlined the policy context and key features of the programme and called for proposals in well-defined categories recognisable to the sector. Project selection also engaged independent expert panels drawn from industry, Government and our research managers.

Management of the research portfolio was undertaken by Research Management contractors reporting to theme managers within the Department. The input of the research managers, primarily from Atkins and Davis Langdon Management Consultancy, supported by FBE Management, Fulcrum Consulting and Alan Baxter and Associates, amongst others, proved invaluable in bringing real industry expertise to the management activity.

Evaluation

An end of project evaluation system was devised to ensure the research projects were being addressed and managed in a way appropriate for public funding. This type of evaluation does not however show the impact of the programme.

Two portfolio evaluation exercises were undertaken in 2000. An evaluation of the impact of projects in the technology and performance portfolio by Taylor Woodrow; and a project looking to improve understanding on how to identify more successful project proposals based on the construction process portfolio, undertaken by Consensus Research and Davis Langdon Consultancy. A 2003 study by Databuild sampled the project portfolio, project partners and wider industry to compile an indicative impact assessment.

The conclusion from these projects was that, where it has been possible to determine a benefit in cost terms, return is high in relation to the level of Government funding. Although the portfolio contained both high impact, and indeed some very low impact research proposals, both Taywood and Databuild identified projects where the resultant potential savings to the industry over just one or two years were sufficient to cover the cost of the whole Construction Research Programme portfolio funding.

"Everyone in the country stands to benefit from a modern, efficient, high quality and good value construction industry. Innovation, driven by well founded R&D, is the best way forward."

Sir John Fairclough

The Fairclough Review

The former Government Chief Scientific Adviser, Sir John Fairclough was commissioned to give an independent view of the role government should play in supporting construction research.

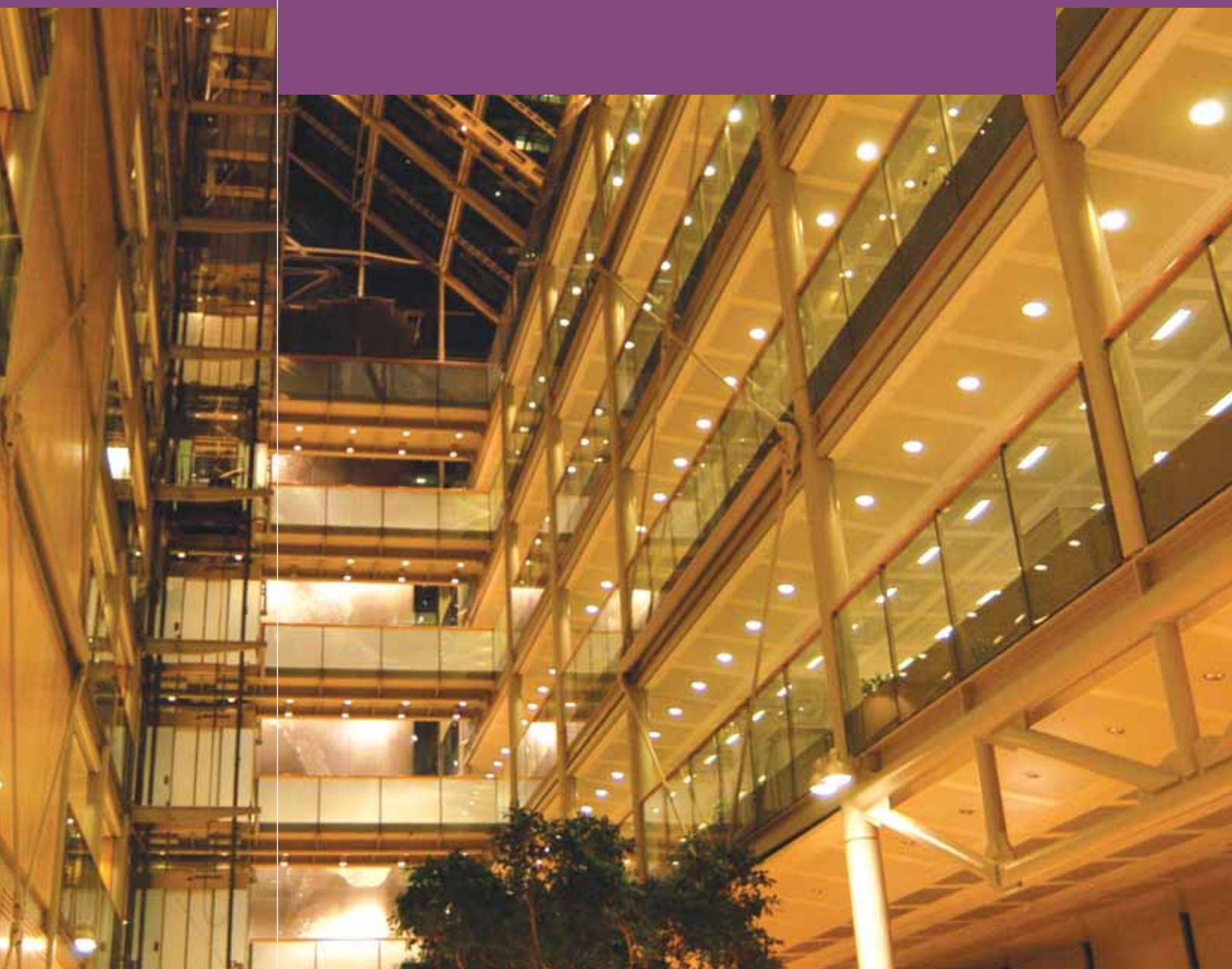
Published in February 2002, *"Rethinking Construction Innovation and Research"* made several key recommendations including the safeguarding of investment in construction R&D, encouraging industry to develop and own a vision for construction's contribution to the quality of life agenda, for Government R&D priorities to be based on a strategic analysis of issues and for Government to commission longer-term programmes of R&D encouraging collaboration and networks to ensure relevance. Outside of these areas Government should progressively withdraw funding support, leaving shorter-term knowledge transfer and research on incremental improvements to be funded by industry.

The Construction Research Programme moved to the DTI in 2001 and was reviewed additionally as part of the Government's wider Innovation review – discussed in Chapter 2. Many of Sir John's findings matched the Innovation Review conclusions and have remained influential in shaping the sector's innovation agenda.

Sir John Fairclough felt CRISP (the Construction Research and Innovation Strategy Panel), could form the nucleus for a new organisation, owned by industry, and linked to the vision of the Strategic Forum. CRISP has since evolved, through nCRISP, into the National Platform for the Built Environment. Further details of the Platform, and the opportunities it gives the sector, are discussed in Chapter 2 below.

CHAPTER 2

THE FUTURE



The Innovation Report

The DTI's Innovation Report, 'Competing in the global economy: the innovation challenge', published in December 2003 concluded that a business-led **Technology Strategy Board** (TSB) should be appointed to select the technology areas where public funds would be used to support collaborative research and knowledge networks.

Underpinning this, the Business Support Review concluded that sector specific support schemes, including PII, should be rationalised into streamlined support products and Collaborative Research should be supported through a single Technology Programme.

The Technology Programme

The Technology Programme is the combination of business support products and information that the Government is offering business in response to the Technology Strategy. The TSB, comprising mainly experienced business leaders, identifies the new and emerging technologies critical to the growth of the UK economy into which government funding and activities can be directed.

In the Spring and Autumn each year, businesses, including construction businesses now have the opportunity to compete for funding using the DTI business support product: Collaborative Research and Development. The calls for each round are developed and approved by the Technology Strategy Board after consultation with interest groups such as sector based Innovation and Growth Teams, Research Councils and other priority setting Institutions. One of the key future advisory bodies will be the **National Platform for the Built Environment**.

The first 3 research competitions yielded over £19 million of funding for research projects either from the sector or directly impacting on Built Environment Technology issues.

CHAPTER 2
THE FUTURE

Looking forward, in April 2006 the Technology Strategy Board published key medium term strategies for technology in a TSB publication, Developing UK Capability. The strategies are intended to provide a technology focus and create a dialogue for taking forward activity in areas where UK business can succeed. The strategies build on the Call to Action document published in November 2005 which identified the following key areas:

- Advanced Materials
- Bioscience and Healthcare
- Design Engineering and Advanced Manufacturing
- Electronics and Photonics
- Information and Communication Technologies
- Sustainable Production and Consumption

Construction and operation of the Modern Built Environment depends on technology development in 5 of these 6 key areas.

National Platform for the Built Environment

The National Platform (NP), built on the former nCRISP organisation, sets the strategic vision and technology priorities for the sector, and acts as a key influencer, including representing the industry in the European Technology Platform structure. It promotes collaborative research, among other mechanisms, as a vital catalyst for long-term industry improvement.

Crucially, the National Platform is owned and led by industry while engaging the wider construction research community. Not only does this ensure that research programmes reflect the real needs of industry and clients but it also creates a single powerful voice for the built environment industry. To be effective in securing research funding and influencing our regulatory environment, the sector has to be focused and work collaboratively.

The Platform consists of two groups, a High Level Group, chaired by Keith Clarke, Chief Executive of Atkins, which meets regularly to provide strategic guidance, and a Support Group, chaired by Bob White of Constructing Excellence, Chairman of Mace. The Support Group develops the detailed programme within the Strategic Research Agenda and related activities.

Strategic Research Agenda (SRA)

The Platform's SRA Framework was published in June 2006, and builds on the European Construction Technology Platform's 2030 Vision and SRA. It sets out three key areas which will shape research in the UK built environment sector over the next 10-15 years. The areas identified are:

- Reducing resource consumption
- Creating a new client and user focused, knowledge-based construction process
- ICT and automation

The three research themes were decided following consultation with stakeholders from across the industry as the UK's priorities from among those identified by the European Strategic Research Agenda (see below). Reducing resource consumption was clearly seen by all stakeholders as the top priority to be addressed for sustainable success of the industry.

Once complete, the Strategy will be a key document, articulating the sector's research and innovation needs and influencing R&D strategy and spend in industry, and Government support for innovation (including the UK Technology Programme, Research Council and European Framework Programme funds). This document should also help influence innovation in procurement - a key driver for built environment innovation.

CHAPTER 2
THE FUTURE

The European Construction Technology Platform

The European Construction Technology Platform (ECTP) was launched at Maastricht in 2004. The ECTP aims to analyse the sector's challenges in terms of society, sustainability and technological development. Research and innovation strategies will be developed to meet these challenges in order to meet the needs of society. The ECTP is seen as a key grouping to inform future European research calls through Framework Programme 7 and beyond. The ECTP is supported by over 30 national organisations including the UK National Platform.

Framework Programme 7 (2007-2013)

The Framework Programme for Research, Technological Development and Demonstration (FP) is the European Community's primary funding mechanism for collaborative research and development projects and a range of other initiatives to assist science, technology and engineering. €50 billion will be made available over 7 years in FP7, including €9bn for ICT research, €3.5bn for nanotechnology, materials and processes, €1.8bn for environmental issues and €4.1bn for transport research.

The Knowledge Transfer Network for the Modern Built Environment

Following an open competition in 2006, the DTI approved a £3 million in grant support to establish a 3-year Knowledge Transfer Network aiming to increase the breadth, depth and speed of knowledge transfer of technology into UK construction businesses.

The selected KTN delivery consortium, led by the Building Research Establishment, is focusing on construction issues in three key market sectors – Healthcare (BRE), Infrastructure (CIRIA) and Office (BSRIA). The network activity is underpinned by a Knowledge Management process devised by ARUP. The University Research Group for the Built Environment – URG(B)E will provide a gateway to research in the academic knowledge base. Sector Boards from the three communities of interest help steer the direction and targets of the knowledge transfer activity.

Sustainable Construction Strategy

Last year, DTI carried out a review of the Government's Strategy for Sustainable Construction, published in 2000, in consultation with sector stakeholders. The review examined the current main strands of Government policy and initiatives related to sustainable construction; the current good practice within the industry, and took a forward look on how industry sees sustainable construction developing and the future priorities.

The review is seen as a first step. The Department is now working with policy leads and stakeholders from across Government and industry to produce a range of targets and measures which will inform a new Sustainable Construction Strategy. The Strategy will take a longer-term view on how the UK construction industry can be more sustainable and support the UK's overall sustainability goals.

"The construction industry must embrace more sustainable forms of building. This means buildings that meet the needs of society and stimulate the economy, but with higher environmental performance, particularly in terms of energy and water efficiency and waste management."

Sir John Harman and Victor Benjamin

SUSTAINABLE BUILDINGS TASK GROUP

CHAPTER 3

THE CASE STUDIES

The 14 case studies featured in the following pages are a small selection from the full portfolio of projects supported by the Construction Research Programme between 1998 and 2006.

The selection is intended to show the breadth of the portfolio, from materials and product technology development, building service engineering to process - with the emphasis very much on how the programme supported the essential reforms highlighted by Sir John Egan's Construction Task Force in its seminal report *"Rethinking Construction"*.

The full project portfolio comprised projects developed and funded under three main project streams:

Partners in Innovation
DTI's (formerly DETR's) cost-shared annual competition for research funding

The BRE Framework Programme
A 5-year programme of activity established following privatisation of the BRE in 1997.

LINK
A collaborative research programme jointly funded by DTI with the Engineering and Physical Sciences Research Council (EPSRC).

Details of the full project portfolio of over 1400 projects – including a search engine and links to sources of further information can be found at: www.constructionresearch.info/dti/projects.asp

BUILDING DOWN BARRIERS

The Tavistock Institute

This project, led by the Tavistock Institute in partnership with Defence Estates (DE), CIRIA, Laing, Amec and others was a milestone in the reform of attitudes and processes in the procurement of major projects. In particular it embedded the concept of supply chain management in the awareness of both the construction industry and its client government departments, together with the concepts of integrated teams and collaborative working. It comprised 'action research', working out the principles of integration and collaboration on two live projects, namely multi-facility sports complexes at Aldershot and Wattisham for Army Land Command. In particular it implemented the vision of two Directors of Defence Estates to import supply chain management into construction from best practice in manufacturing industry.

The project generated a 'Handbook of supply chain management', associated management 'tools' and a community of practice of those who had had live experience of their application.

The outcome of DE's search for improvement in its construction procurement is
that it has adopted a new procurement system refined from the BDB initiative. The essence of this procurement method, referred to as "prime contracting", is that a single entity, the prime contractor, is responsible to the DE for the design, construction and maintenance of any project procured using this method. It is intended to draw on the best available tools, techniques and practices, including assessment of WLC, SCM, value engineering, value management and risk management to achieve through-life value for money for the client and increased profitability for supply chain members.
The approach was espoused and carried forward by the Design Build Foundation and subsequently by 'Be' and

Constructing Excellence. Building Down Barriers has influenced not only the industry but also the Office of Government Commerce - feeding directly into the development of procurement strategy in Defence Estates and is quoted as best practice by other public sector procurement agencies. Similar progression was evident in a subsequent series of projects on supply chain management that informed and supported the thinking and activity of the Strategic Forum for Construction.

For Further Information :
www.ciria.org.uk
Or contact: Dr. Richard Holti,
Open University Business School
r.holti@open.ac.uk

The ISC PROJECT

Advancing the Integration of the Supply Chain in Construction

The Open University

The ISC project was carried out jointly by the Open University (OU) Business School and Constructing Excellence for the Built Environment (CE). It was part funded by the DTI and the Engineering and Physical Sciences Research Council.

The project set out to develop guidance tools and processes for achieving greater integration between the members of the supply chains responsible for designing and delivering the built environment.

Over the three years of the project, the project team established action research teams with seven CE member companies or groups of companies. These lead participants were the Pearce Group, Taylor Woodrow Construction, Laing O'Rourke, Bovis Lend Lease, Irvine Whitlock, Wates and the Building Design Partnership. Each action research team comprised researchers and staff from the focal company.

The action research teams established an agenda for integrated supply chain innovation, hypotheses about an area of ISC development, and implemented the necessary changes. A further eight companies signed up to work with OU Business School research team on a less intensive basis, forming action learning sets within an Action Learning Club, feeding off the concepts developed in the action research.

These action research activities combined to produce findings in the following areas:

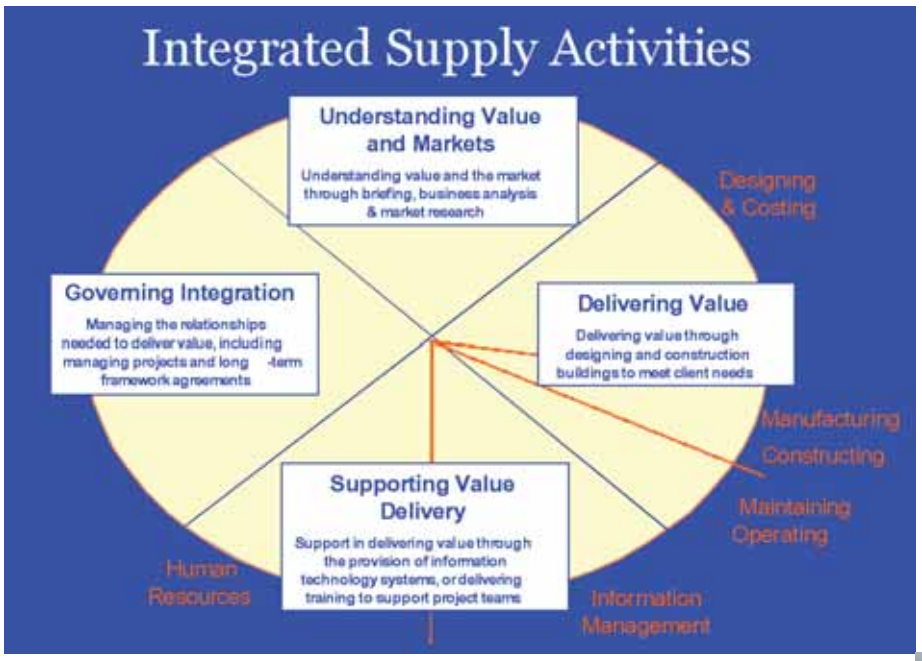
- An analysis of the issues faced by firms in the construction sector in crafting a strategic rationale for investing in collaborative supply chain relations

- A conceptualization of the process of developing progressively more integrated ways of working with chosen supply partners over a sequence of built environment projects, including the challenges and potential pitfalls that need to be overcome;

- An evaluation methodology and measurement system that supply chain integrators and their key supply partners can use to measure their joint performance and improve it over time to demonstrate delivery of improved value to clients.

These are set out in a Final Evaluation Report which will be published by Constructing Excellence in 2007.

The project also produced guidance material drawing on these research findings. The research team developed a workshop-based methodology for initiating and developing integrated ways of working within built environment supply chains. This methodology is also about to be published by Constructing Excellence. It permits an aspiring supply chain integrator to clarify their strategic rationale and identify relevant strategic supply partners, and then to move on by establishing where the more integrated ways of working need to be developed through the supply chain. This methodology makes use of a four-fold categorization of areas in which integrated working may need to be developed. The diagram summarises these four areas:



For further information see www.constructingexcellence.org.uk
Or contact: Dr. Richard Holti, Open University Business School
r.holti@open.ac.u

AVANTI

**ICT enabled collaborative working -
sharing what we know and making it work**

CWC AVANTI
PEOPLE + PROCESS + TOOLS

The AVANTI programme was one of the two 'programmes' of activity selected for funding by DTI in 2002. The introduction of larger areas of development – aiming to become self-funding, ongoing networks – was a response to the recommendations made by Sir John Fairclough in Rethinking Construction Research and Innovation (see Chapter 1).

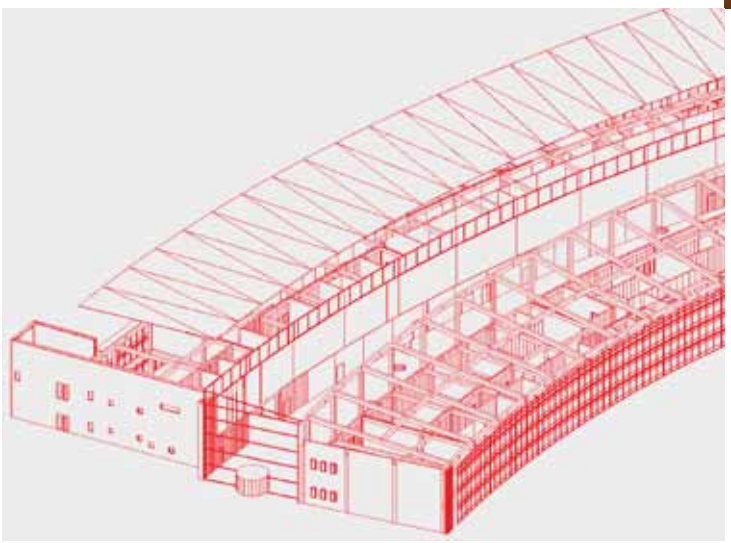
The Avanti initiative was led by Collaborating for the Built Environment (Be) in partnership with Teamwork and IAI. The group identified a need to reduce the risks involved in adoption of new methods of working, bringing together areas of current best-practice (such as CPIC protocols) that had previously gained too little market penetration to have significant impact on the sector.

The objective was to deliver improved project and business performance through the use of ICT to support collaborative working, applying the AVANTI approach by getting people to work together; providing processes to enable collaboration; and applying tools to support collaborative working.

The Avanti approach increases the quality of information, the predictability of outcomes and by reducing risk and waste. Avanti is not an IT system or tool. As a method or approach, Avanti can be applied to projects using 2D CAD as well as those using 3D intelligent modelling or building information models. It is supported by handbooks, toolkits and on-site mentoring.

The core of the Avanti method is an approach where all CAD information is generated with the same origin, orientation and scale, and organised in layers that can be shared. All layers and CAD model files are named consistently within a specific Avanti convention to allow others to find the relevant CAD data.

Avanti achieves its core objective in three ways; through providing consultants, each an expert in the Avanti approach; Information standards and procedures; and cross-project assessment and measurement.



Evaluation of the impacts of the Avanti have shown:

- Early commitment offering up to 80% saving on implementation cost on medium size project
- 50-85% saving on effort spent receiving information and formatting for reuse
- 60-80% saving on effort spent finding information and documents
- 75–80% saving in effort to achieve design co-ordination
- 50% saving on time spent to assess tenders and award sub-contracts
- 50% saving on effort in sub-contractor design approval

Constructing Excellence, who merged with Be, have taken over as custodians of Avanti and are developing a self-sustaining business to support roll out of the Avanti methodology to the UK construction industry. They will also draw on the results of other DTI-supported collaborative research such as Building Down Barriers.

For Further Information:
http://www.constructingexcellence.org.uk/resources/az/view.jsp?id=841

OFFSITE MANUFACTURE

buildoffsite

'Buildoffsite' is an industry-wide campaigning organisation promoting greater uptake of offsite technique by UK construction. Buildoffsite (then known as Prospa) was one of two major "programmes" of activity funded under Partners in Innovation in reaction to the call by Sir John Fairclough to establish major on-going networks of expertise.

Currently approximately 50 organisations are in membership with an additional 10 industry trade and research organisations designated as associate members. The membership includes international and national clients, designers, main contractors, specialist contractors, manufacturers, consultants, universities and Government and public bodies.

Buildoffsite's development is managed by an Executive Group which includes senior industry representatives acting as sector champions for key market sectors and Buildoffsite's programme of activities is managed by a Direction Group comprising Members and Associates.

Principle activities within Buildoffsite have included:

- Development of a web-site and regular newsletters to promote offsite the details of Buildoffsite activities and outputs.
- Publishing the first illustrated Glossary of Off-site construction terminology and case studies detailing the measured business benefits arising from the use of off-site construction methods.
- Initiating the development of an assessment/certification scheme providing global recognition of compliant off-site solutions.
- Supporting the development of the IMMPREST project management "tool" to support decision making relating to the potential value and cost effectiveness of off-site solutions in new construction projects

- Facilitating the establishment of collaborations to establish virtual supply chains – leading to real world innovative project solutions
- Hosting numerous events such as "Meet the Client" Briefings involving leading client Members such as GlaxoSmithkline and B&Q ; major Debates on off-site solutions in collaboration with key clients and leading industry and trade associations; Sector Groups meetings in key markets including ultra large steel frame structures and composite structures: regional Workshops; and a Chatham House Rule Debate for major industry figures to review the impact of off-site methods on wider construction processes.
- Launching the Discovering Off-site programme of technical tours to off-site manufacturers and construction projects incorporating off-site methods.
- Delivering awareness raising events key sectors such as an event for the Health Sector in collaboration with the Department of Health.
- Participated at national and international industry exhibitions and conferences.
- Delivered numerous Networking and Business to Business Events for the Membership and Guests

Buildoffsite is now well positioned and resourced to sustain its rapidly developing work programme going forward. Buildoffsite is fulfilling a unique role within the UK construction industry providing the focal point and authoritative vehicle for both developing and driving active and informed promotion of off-site construction.

Further details:
www.buildoffsite.com

IMMPREST

Measuring the cost and value of off-site construction

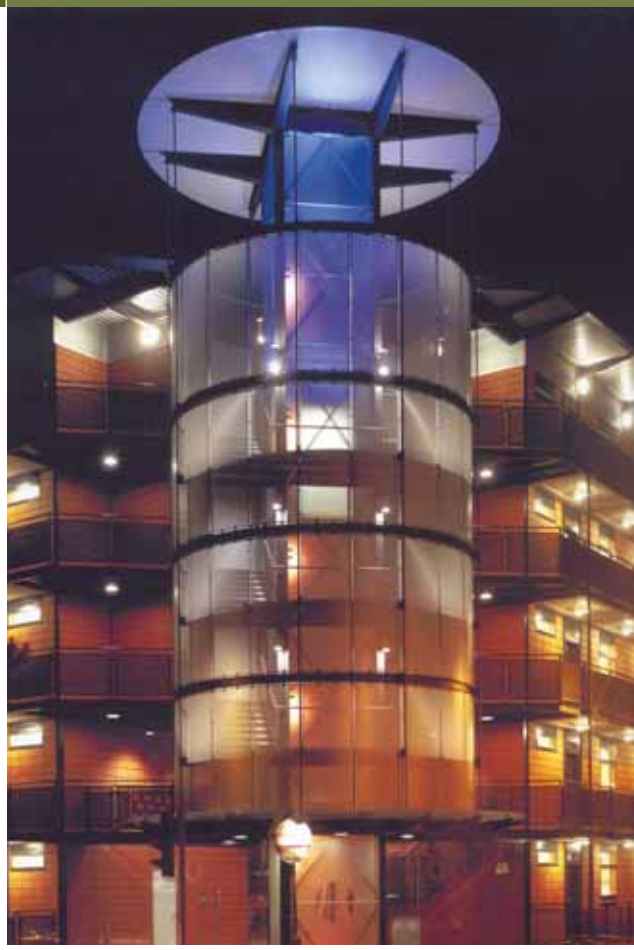
IMMPREST (Interactive Method for Measuring PRE-assembly and STandardisation benefit in construction) originated from a 3 year research project part funded by DTI and EPSRC, measuring the benefits of pre-assembling building elements off-site. The project was led by Loughborough University in collaboration with 11 industrial partners and their supply-chains.

IMMPREST is a cost and value comparison tool for offsite construction. In the simplest terms, it is a comprehensive check-list of considerations, set within an interactive spreadsheet, enabling detailed evaluation and analysis.

The widely-known benefits of 'offsite' are commonly cited when justifying an offsite approach, yet methodical assessments of the benefit of these solutions have been lacking. Common methods of evaluation simply use material, labour and transportation costs when comparing various options, disregarding other cost-related items such as site facilities, crane use and rectification of works. Often these cost factors are buried within the imprecise preliminaries figure, with little reference to the associated building approach. Other sources of value, which do not always lend themselves to evaluation in monetary terms, such as health and safety, effects on management and process benefits, are either implicit or disregarded within these comparison exercises.

IMMPREST was developed to address this significant deficit within the construction industry, by ensuring that decisions regarding different building approaches are based on structured, value-based assessments.

Since the completion of the IMMPREST project in 2003, there has been a significant increase in interest in off-site construction and the tool has been adopted as the *Buildoffsite* recommended methodology for comparing the costs and value of traditional construction with offsite solutions.



IMMPREST has been applied to a series of case study comparisons with the objective of providing authoritative cost and value data for use by the construction industry and its Clients. These case studies have included projects undertaken by N G Bailey (pictured), BAA and Crown House Technologies, and there are proposals to include projects from, amongst others, Corus Hi-Point and Yorkon.

Over 20 software licenses for the original have been sold and the research team is now pursuing the development of the toolkit into a fully commercial version. This work, led Loughborough, includes functions to better support the estimating process and the storage and use of data collected over a number of projects. An interim version of the toolkit, including these new improvements, is being prepared for release soon.

Further details:
www.immprest.com

TECHNICAL DESIGN QUALITY CONTROL

This project exemplifies a series of guides produced by BSRIA with significant potential - at a very practical level - to improve the way the industry worked in its particular sector.

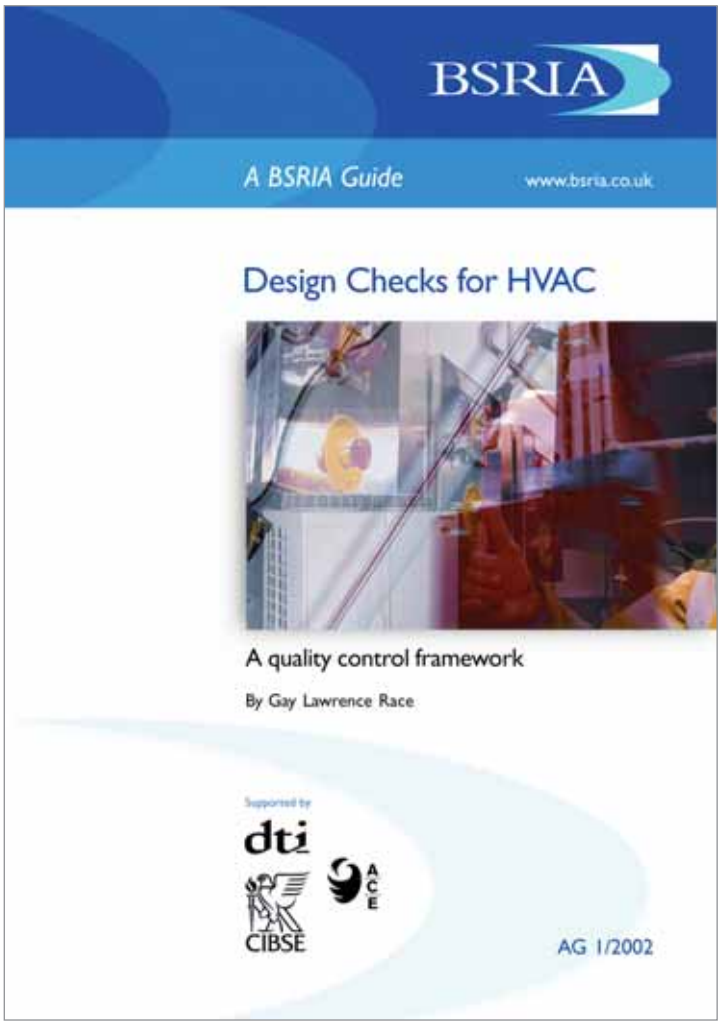
Led by BSRIA, along with a over 17 industrial sponsors and many more contributors including CIBSE, The Technical design quality control (TDQC) project was targeted on building engineering services, developing systematic quality control guidance for HVAC designers.

In the mid 1990's, BSRIA undertook a study into the use of engineering design margins for CIBSE. The work concluded that design margins could be seen as part of the wider problem of over-engineering, coupled with design deficiencies and a lack of feedback to design. There was no systematic guidance available to the building services designer on the appropriate use of design margins and showed that the use of unnecessary margins frequently led to over-sizing of systems.

Much of the detailed technical aspects of design were based on personal learning and experience; there was little evidence of standardisation. The margins study concluded that there needed to be effective quality control of the actual technical design process and procedures to include checks on input data, on staged calculation outputs and comparisons with benchmarking data where available.

The TDQC team undertook a comprehensive review of current building services design practice and procedures was carried out in consultation with the industry, based on the knowledge gained from the Margins work, to identify best practice and current problems, and explore relevant design tools.

The result was a good practice guidance entitled "Design checks for HVAC" published in April 2002 and included a "map" of the HVAC building services design process; design Guidance sheets giving information and guidance on design inputs, outputs and practical watchpoints for 60 key design topics, to aid the design



process and reduce errors; and design Check sheets that can be included in project QA procedures.

This guidance provides a formal framework to record and review design inputs and encourage designers to consider the requirements for installation, commissioning, operation and control and subsequent maintenance of their selected systems at the design stage. It contributes to greater consistency in HVAC design and to an overall raising of design standards by identifying, recording and presenting best practice.

The publication subsequently became one of BSRIA's best sellers. Significantly its recommendations were adopted by a number of major M&E design practices, integrating them into their quality procedures.

Other work in the guide series funded through the Construction Research Programme included the Illustrated guide to electrical building services and Practical guide to building services calculations which was considered to be of great value, particularly to graduate and junior engineers.

For Further Information:
www.bsria.co.uk

LEARNING FROM THE ECBP

The European
Concrete Building
Project

A number of projects were funded extending the use of the knowledge that came from the European Concrete Building Project at Cardington.

The European Concrete Building Project, an initiative created by the British Cement Association (BCA), BRE, CONSTRUCT and the Reinforced Concrete Council (RCC), used a full-scale multi storey test building to carry out process research and some performance research on concrete frame buildings. The building demonstrated many significant improvements in the construction process which became the focus of a series of research projects funded by DTI which included support for the development and publication of 8 best practice guides derived from lessons learnt from the Cardington experience.

The BRE led project- Achieving best practice in concrete frame construction – developed case studies which illustrated the practicalities of implementing innovations on small to medium sized concrete frame construction projects and concentrated on reaction to the selected innovations in the context of normal commercial projects.

Commercial subsidy of any innovation was limited to the participating company's willingness to explore the practicality of the innovation proposed. Many unforeseen and previously undocumented complicating issues were uncovered. The published discussion of these issues was expected to better inform the industry and research community as many of the practicalities and realities of working on smaller concrete frame construction sites.

The findings were published in the BRE Report *'Best practice in concrete frame construction: Case Studies'*. An additional best practice guide on the use of ultra high strength concretes was prepared and distributed to industry.

The project's objective was further achieved by the study of general industry attitudes to the innovations trialled in the Cardington process research.

This included noting barriers to adoption, views of industry and uptake rates determined from industry feedback. This knowledge has been used to highlight two specific areas where minimal extra effort might realistically produce a large increase in impact. These findings were reported to industry in the BRE report *'Innovation in concrete frame construction 1995-2015'*, which also included a review of past and present innovation in concrete frame construction. A wide consultation process was undertaken as part of the project and the findings are expected to help industry take stock of the developments made over the past 10 years and to focus future industry innovation effort on areas likely to be important to clients and society generally.

Other projects building on knowledge from the ECBP included the development of the National Structural Concrete Frame Specification by a research team led by CONSTRUCT, which is aimed at standardising specifications across the industry and reducing ambiguities; and a further project led by BRE, with a major developer, into the application of practical lessons learnt from Cardington being incorporated into high- rise residential structures.

For Further Information:
www.bre.co.uk
www.construct.org.uk
www.concretecentre.com

COMIT

Construction Opportunities for Mobile IT

COMIT (Construction Opportunities for Mobile IT), began as a two-year research and development project initially led by ARUP, in partnership with BSRIA and Loughborough University. The project brought together representatives from construction, technology, research and dissemination organisations to form the COMIT Community.

COMIT's early aim was to establish a project community to facilitate the realisation of business benefits from the adoption of mobile information and communication technologies. In other words to, *"learn from experience to deliver measurable business benefits"*. Following its success, COMIT aims now extend to becoming a *"Centre of Excellence"* for the implementation of Mobile IT in the Construction Industry.

COMIT's objectives and deliverables achieved during the first two years included eight case studies, four demonstration projects (and associated reports), press articles, newsletters, videos and the COMIT Website that has become the key 'information hub' for the organisation.

All of the case studies were chosen by the COMIT community and all eight have now been completed. They involved a number of COMIT member companies, addressed various processes and looked at a number of technologies such as Tablet PC's, Wireless LAN's, PDA's, Digital Pens and Paper and RFID tags. It was found that all the case studies achieved both generic and specific benefits. Costs varied from £7,400 to £135,000 and the ROI payback period was attained in a year.

Similarly, the demonstration projects were chosen by the COMIT community. Thirty possible projects were looked at from past work. These were voted down to ten and then to four by the membership. The four demonstration projects looked at the key process areas of Maintenance Inspections, Monitoring Progress, Site Design and Problem Resolution, as well as Monitoring Health and Safety.

The companies involved included; Stent Foundations, Pearce Construction, Orange, Taylor Woodrow, Sysnet, Knowledge Online and Mobile Computing Systems.

The COMIT project has been a resounding success, so much so that at the request of its members COMIT began as a self funded organisation in September 2005. A steering group has been elected and there are now 40 paying members.

The COMIT community in its new industry-owned form is looking to build upon the work done in the first two years and continue reporting on projects and case studies. Some of the new projects being worked upon now include: RFID in Construction and 'Intelligent Tools', Rapid Site Set-up, Location and Mapping of Buried Underground Services, On-site accounting of personnel and continued projects involving quality inspections at Heathrow Terminal 5.

COMIT also continues to share its experiences and knowledge with the wider world through conferences, exhibitions, press events, university lectures and through its very popular website. The website includes information on all its work including a very valuable 'lessons learned' area highlighting good practice in the implementation of mobile technology.

For further information:
www.comitproject.org.uk

RFID TAGGING TECHNOLOGY

This project, led by BRE, set out to examine the technical issues and business benefits of using tagging & wireless technology in the manufacturing, installation and maintenance of high valued construction products.

Radio Frequency Identification Device technology, commonly referred to as RFID tagging or e-tagging, already has a proven track record in many applications, for example in the tracking of livestock, maintenance of infra structure and improving the logistics in retail and other industries, but has yet to be employed widely in construction.

An RFID system consists of two main components, the tag and the reader, which work together to provide the user with a non-contact solution to uniquely identify items and their locations, unlike barcodes, RFID tags do not require a line of sight for identification.

This project built on previous work by Bovis Lendlease (on iTAG) and previous DTI funded tagging project led by BRE, by using these technologies for maintaining/ planning replacement of boilers in homes and doors.

The system developed used tagging and handheld devices to automate asset tracking and the scheduling of maintenance tasks. The system provides wirelessly collected data that can be presented through the web browser for remote access and interface to the existing asset management system. The tagging system comprised of three components; a centralised database with reporting through the web browser; a wireless hand-held device; RFID read/write passive tags embedded into boilers and doors.

This technology should offer construction new opportunities to improve the maintenance of assets and manufactures to develop smart products and new services.

The potential savings (money and efficiency) that these pilots have shown include improvements in productivity, data capture, Job tracking, quality control, stock control as well as an

improvement in customer information. RFID can also lead to a reduction in paper work, eliminating the cost of sending wrong products to site and enabling web based customer information system. RFID allows manufacturers to offer new value added maintenance services for their products

For further information:
www.bre.co.uk

STRATRISK

Rethinking decision making on strategic risks & opportunities for the construction industry

strategicrisk

The STRATrisk research project was a collaborative venture between The Institute of Civil Engineers, The Actuarial Profession, the Universities of Bath and Bristol and industry, aimed at firstly gaining an understanding of how strategic risk is identified and managed in UK construction companies and secondly in providing a toolkit for company boards to better understand and manage those strategic risks and opportunities which could materially impact on the survival of the enterprise.

The resulting report and guidelines, aimed at directors of companies and public sector bodies, set out, for the first time, the various steps which companies should take in order to manage strategic risks effectively. It stresses the need for 'risk leadership' within an organisation to establish the right culture and internal communications system.

Strategic risks include loss of reputation, fraud, staffing, customer dissatisfaction, over-complexity and financial mismanagement. Some strategic risks are foreseeable but others are less so, but they can still be managed and this guidance produced by the project aims to show how.

Seven main recommendations emerged from the study:

- Recognise that strategic risks are different and manage them differently.
- Strategic risks differ in character as well as in magnitude to other risk and are generally more dynamic, uncertain and interconnected.
- Establish a systematic, holistic approach. Organisations need to manage strategic, operational and projects risks in a holistic way and assign responsibilities for managing each area of risk.
- Ensure strong Board commitment and leadership
- Create appropriate culture
- Improve communications
- Build flexibility into operations, systems and response mechanisms
- Use Suitable tools

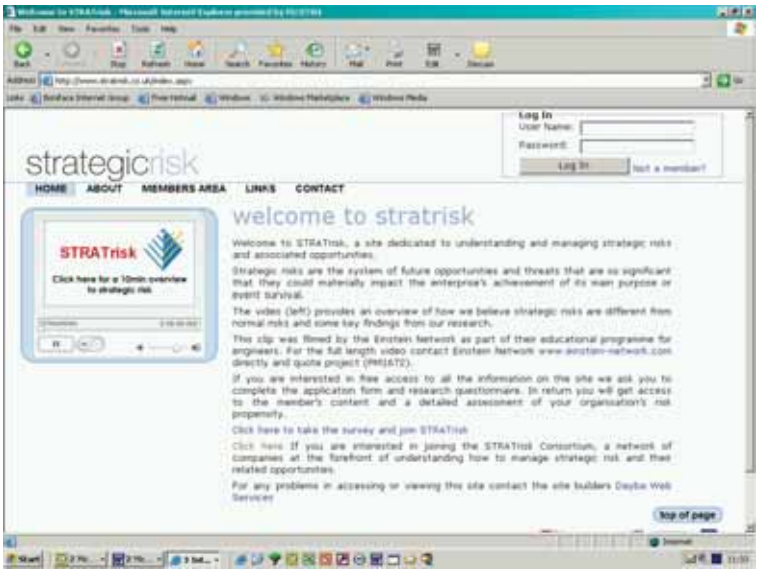
The project also identified a number of interlinked tools that could be used to help manage strategic risk:

- Concept mapping: helping to establish links between objectives and risks, issues and activities
- Horizon scanning: helping to Identify potentially important issues
- Pattern recognition: Providing an understanding of underlying patterns of risk
- Risk Grouping: Gathering risks in broad categories for reports to the Board

Over 80 opinion formers attended the launch event and subsequently the Institution of Civil Engineers held a special Presidential Forum, bringing senior industry figures together to explore the project findings, identify the lessons for their company and identify areas for future development.

The findings of the project were captured in Strategic Risk a Guide for Directors published by Thomas Telford Ltd in May 2006.

For Further Information:
www.stratrisk.co.uk



VALiD

Value in Design

"Value delivery is the key goal of all projects" - This construction industry mantra is familiar but do all stakeholders in today's complex project relationships share a common vision and understanding of "value"? This is a difficult but often unanswered question, despite the many value related capabilities offered today.

VALiD (Value in Design) comprises the main findings of a three-year joint industry and academic research project "Managing Value Delivery in Design". Part funded by the DTI and EPSRC, the project sought to increase customer satisfaction through a better, shared understanding of appropriate value systems (for the project process, the product and its performance) and standardised mechanisms that map and measure the flow and delivery of value within the design solution.

The project was led by Sheppard Robson and Loughborough University, and engaged a number of key organisations including Collaborating for the Built Environment (Be), The Commission for Architecture in the Built Environment (CABE), Royal Institute of Chartered Surveyors (RICS), the Royal Institute of British Architects (RIBA) and others.

The objectives of the research project were to develop a common value culture and language for clients, users and designers; to provide standard mechanisms that capture and communicate an evolving set of project values; to relate design tasks to project values, justifying their outcomes and monitoring overall project effectiveness regarding value delivery and hence user satisfaction upon occupation; and to recommend implementation strategies to encourage uptake and provide appropriate training.

The resulting VALiD (Value in Design) approach to value delivery integrates stakeholder value judgements into the project process. Outputs include a suite of simple, practical methods that can be customised to engage stakeholders throughout the delivery process. It takes people's judgements and uses them to understand stakeholder value and to demonstrate project performance.

VALiD offers a series of activities that align with relevant stages of a project. An appropriate set is selected for a particular project and linked to its delivery process. The nature of VALiD activities changes as the project progresses to reflect its shifting focus.

This new approach to understanding and delivering value is based on six principles:

- value delivery is the goal of all projects
- value is subjective and based upon stakeholders' underlying values
- successful projects deliver value for all stakeholders
- project teams have provider and customer stakeholders, each with their own understanding of value and expectation for its delivery
- value is judged by each stakeholder from their own perspective and aggregated to provide a project view
- effective project value delivery requires an ongoing dialogue between all stakeholders to negotiate appropriate compromises and balance stakeholder views

For further information see:
www.valueindesign.com

TIMBER SPECIFICATION

Balancing specification and design lives for durable timber construction

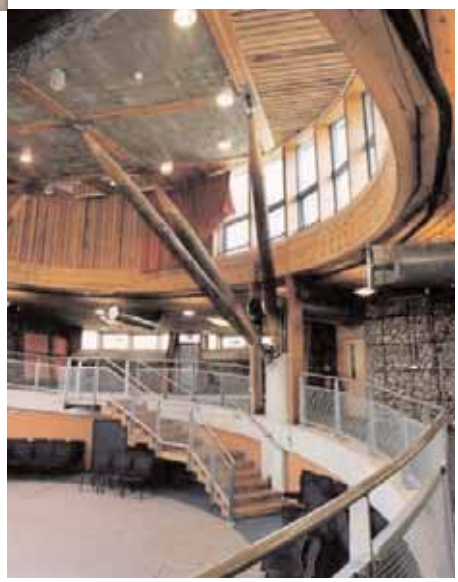
If used correctly timber is one of the most environmental friendly building materials and can play a major role in contributing to a building's sustainability. But as a natural, bio-degradable material, wood as part of a structural design must address the issue of durability as an integrated aspect of the design alongside verification of potential stresses and deformations in service.

To address durability concerns, timber structures are often over-specified, which can lead to the use of oversized members and add unnecessary costs - financial and environmental. Wood is also often treated with synthetic chemicals whereas with the use of correct passive durability design this may be unnecessary. Equally there is also widespread use of unnecessary non-benign surface treatments and finishes causing potential future disposal problems. The small firms and practices that largely comprise the timber supply chain are extremely conscious of this, but need assistance in changing towards the benign use of organic building materials.

The use of passive durability design alleviates many of timber's end-of-life cycle problems through:

- The greater use of European larch, British-grown oak and Douglas fir (all sustainably produced national timbers) that are able to withstand our climatic conditions without synthetic treatments;
- The specification and use of protective timber building design features, ("weatherings", local "roofs", overhangs, flashings, raised post bases) which have older versions known for centuries, that tend to have been forgotten.

This objective of the project, led by TRADA Technology (Timber Research and Development Association) with industry partners, aimed to draw together the key items of currently fragmented information resource and repackage it in an IT Toolbox format, constructed to act as an easily navigable information resource geared towards assisting in specification of



timber for appropriate durability in the context of a structural timber design. The team studied early design decisions and related processes influencing degradation of timber structures and components, as well as conducting selective interviews with mainstream professionals; clients' advisors and client representatives.

The project website contains details of the project and the beta version of the software developed as the principal output is now accessible online.

For Further Information:
http://research.ttlchiltern.co.uk/pif306/index.htm

COMPOSITES IN CONSTRUCTION

network group for composites in construction
ngcc

NGCC represents the composites in construction industry in the UK and unites its members in one body. Its membership covers all sectors of the industry and it provides a vital link for NCN (National Composites Network – a DTI knowledge transfer network) to the construction sector. Activities of NGCC include dissemination of information and news, forums for collaboration and networking, and providing a central focus for those needing support within the industry. The group has been operational since its launch in November 2000. Initial DTI funding kick-started the group, but the main activities have been self-funded since March 2003. Additional DTI funding was provided in 2003 to help set up regional groups for the network. These regional groups were designed to better engage the local community and industry. Active groups were established in Scotland, Wales, North West and Central England. BRE lead the DTI projects to establish and coordinate NGCC.

Composites (fibre reinforced polymers) continue to find effective use in a wide variety of construction applications ranging from new build structures to refurbishment and restoration projects.

Their use is set to increase further over the coming decade as major opportunities arise including the 2012 Olympics, the current housing crisis and an ever aging infrastructure. Key properties such as light weight, excellent long-term durability, flexibility in design, prefabrication and fast construction process on-site will enable innovative cost-efficient structures to be developed using composite materials in both a pure form and also working synergistically with other materials to give improved performance.

In order to meet these new challenges, NGCC (Network Group for Composites in Construction) has realigned the way in which it operates. NGCC aims to bridge the interface between the composites industry and the construction community, providing guidance, technical support and advice where needed. In order to achieve this, core activities such as networking, CPD seminars, conferences and site visits will continue; but to improve technology and information transfer, a new interactive website has been launched as well as a redesigned newsletter targeted at the wider construction community. NGCC has also been working closely with the National Composites Network (NCN) to produce a 'road map' for the composites in construction industry in order to facilitate the step changes required to meet the new opportunities.

NGCC has changed its coordinating organisation in March 2006; the head-office is now at NetComposites Ltd, Chesterfield under the direction of Dr Sue Halliwell.

For Further Information:
www.ngcc.org.uk
e-mail: ngcc@netcomposites.com

DYNAMIC COMPACTION

A key policy objective of Government has been to achieve 60% of new housing on brownfield land, along with the desire to encourage regeneration of former industrial areas. This objective required a range of measures to ensure such land is safe and economically viable for redevelopment. The increasing use of brownfield sites for building developments often means that some form of ground treatment is needed before development.

The repeated dropping of a heavy weight onto the ground surface is one of the simplest and most basic methods of ground improvement and is a widely used means of treating brownfield sites. The major use of the method in the UK has been to compact loose, partially saturated soil or fill by dynamic compaction - repeated impacts of a large mass commonly dropped from a large crane etc or by rapid impact compaction.

It is important that those specifying dynamic compaction ground treatment understand the nature of the particular treatment process employed and its potential benefits for the ground conditions being considered. There was, however, very little guidance on this method available to industry and a comprehensive specification for dynamic compaction was recognised as long overdue in the UK.

An authoritative specification was produced by BRE, withy industrial partners. The document was produced using informed advice on technical best practice through a Steering Group comprising the leading UK specialist ground improvement contractors who also providing sponsorship for the work. Information on industry requirements were also be sought from the whole supply chain. It provides a technically prescriptive specification for the process, including design issues, which is based on accepted best practice.

The Specification and Notes for Guidance represents an authoritative and unifying statement of best practice. The new guidance aimed to raise

technical standards within a framework of fair competition for specialist contractors, by providing common benchmarks for all parties to a dynamic compaction contract - and provide value for money for clients. Its use will save considerable time at tender stage, avoid misunderstandings between those specifying the works and the specialist contractors, particularly in the use of standard terminology, and provide common benchmarks for all parties to a dynamic compaction contract.

For Further Information:
www.brebookshop.com

ANNEX A

FURTHER INFORMATION

Developing UK Capability
www.dti.gov.uk/files/file27950.pdf

Technology Programme
www.dti.gov.uk/innovation/tech-priorities-uk/about_the_programme/CR&D/page11705.html

National Platform for the Modern Built Environment – Strategic Research Agenda
www.ncrisp.org.uk/Publications/UKSRA_6page_Final%20Brochure.pdf

Knowledge Transfer Network for the Modern Built Environment
www.mbetktn.co.uk

European Construction Technology Platform
www.ectp.org/

Framework Programme 7
http://cordis.europa.eu/fp7/

Strategy for Sustainable Construction
www.dti.gov.uk/sectors/construction/sustainability/strategy/page13543.html

Construction Research and Innovation Compendium
www.constructionresearch.info/dti/projects.asp

Innovation and Research Focus
www.innovationandresearchfocus.org.uk/

ANNEX B

WIDER LINKS

Department For Trade And Industry
www.dti.gov.uk

Department For Communities And Local Government
www.communities.gov.uk

Constructing Excellence In The Built Environment (Ce)
www.constructingexcellence.org.uk

Building Research Establishment (Bre)
www.bre.co.uk

Steel Construction Institute (Sci)
www.steel-sci.org

Construction Industry Research And Information Association (Ciria)
www.ciria.org.uk

Timber Research And Development Association (Trada)
www.trada.co.uk

The Concrete Society
www.concrete.org.uk

Innovative Manufacturing Research Centres
www.epsrc.ac.uk/researchfunding/programmes/innovativemanufacturing/innovativemanufacturingresearchcentres/

Sustainable Urban Environment Research Centres
http://www.epsrc.ac.uk/researchfunding/programmes/infrastructureandenvironment/initiatives/sue/default.htm

Small Business Service
www.sbs.gov.uk

ACKNOWLEDGEMENTS

IMAGES

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Page 11	**Gateshead Millennium Bridge - Michele Turriani**
Page 13	**Birmingham Bullring Centre**
Page 15	**Maurer Court, Greenwich Millennium Village - CABE**
Page 19	**Aldershot Sports Hall, courtesy of MOD**
Page 23	**Advanced Dental Surgery - A & M Photography Ltd**
Page 27	**Murray Grove - Cartwright Pickard**
Page 41	**Ecology & Art Pavilions & Children Play Centre - CABE /David Whyte**

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