ARCOM construction management abstracts : cumulative abstracts and indexes of journals in construction management, 1999 update

Book

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Introduction

The purpose of this document is to provide a single source of reference for every paper published in the journals directly related to research in Construction Management. This volume brings together articles published during 1999.

It is indexed by author and keyword and contains the titles, authors, abstracts and keywords of every article from the following journals:

- Building Research and Information (BRI)
- Construction Management and Economics (CME)
- Engineering, Construction and Architectural Management (ECAM)
- Journal of Construction Procurement (JCP)
- RICS Research Papers (RICS)

The index entries give short forms of the bibliographical citations, rather than page numbers, to enable rapid reference to articles. A cumulative volume is available from the editor.

Included in this volume is an appendix listing a wide range of journals associated with construction management research, giving details of frequency, editorial addresses and web sites, as well as whether each journal is international and/or refereed.

Contents

BRI: Volume 27, 1999

1999, **27**(1), 4–19

Productivity in buildings: the 'killer' variables

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Losses or gains of up to 15% of turnover in a typical office organization might be attributable to the design, management and use of the indoor environment. There is growing evidence to show that associations between perceived productivity and clusters of factors such as comfort, health and satisfaction of staff. Some of the management, design and use characteristics which contribute towards better energy efficiency also help productivity, thereby helping to close the loop on a potential 'virtuous' circle. Unfortunately, the vast majority of occupied buildings do not have these self-reinforcing qualities and many are unmanageably complex. This paper examines which factors within the control of building designers and managers best contribute to human productivity, the 'killer' variables of the title.
Keywords: comfort, complexity, energy efficiency, productivity, workplace.

1999, **27**(1), 20–34

Application of information technologies in building design decisions

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Research and development of a new sophisticated software environment to support building design decisions are presented. This new software, the Building Design Advisor (BDA), is intended as a research tool, teaching aid and, eventually, as a practical professional tool to facilitate both strategic and detailed decision-making throughout the design process from the early schematic phases of building design through to the detailed specification of building componentsand systems. BDA supports the integrated, concurrent use of multiple simulation tools and databases, while allowing output to support multi-criterion judgement. BDA's ultimate aims are to address the data needs of whole building life-cycle analysis: design, construction, commissioning, operation, performance and demolition.
Keywords: building performance, data model, design process, information management, IT, life-cycle analysis.

1999, **27**(1), 35–55

Developing a new military shelter system: a case study in innovation

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A lightweight, rapid-erect shelter system using a new combination of composite materials and fabric diaphragms in a truss support system has been developed in response to changes in military requirements. This paper outlines the background to the project and the reasons for its inception; it follows the development of the design from initial conceptual idea to eventual solution. Decisions influencing the overall design, structure, materials, prototyping and manufacturing techniques are discussed in relation to performance criteria and client capabilities. The focus is on the problems encountered in the development programme and the innovation process, highlight how these problems were overcome and detail the benefits that were created. In particular, the resulting tent incorporates lightweight sprung glass reinforced composite beams, post-tensioned by a fabric diaphragm. The new shelter uses a minimum number of these lightweight, rigid components and consequently achieves a reduction in weight, erect and strike times and packed bulk through its innovations.
Keywords: advanced material, case study, design management, innovation, prototype, shelter, tent.

1999, **27**(2), 64–83

Developing a new military shelter system: a technical study in advanced materials and structures

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The development of a new lightweight military shelter system is based on an unusual composite structural system utilizing the innovative use of pultrusion production techniques for plastic. The authors report on the combined

development of both the structural system and the components, which are made from linear pultruded sections of reinforced plastic, and an anticlastic stressed membrane. The shelter comprises a 'kit' of purpose-designed components, which are used to fulfill the multiple requirements of the shelter brief. This has resulted in a smaller number of component parts, less weight and enhanced ease of fabrication and assembly. Some of the techniques used in the design of components and parts indicate an alternative approach to the use of plastics in building construction.
Keywords: material, composite material, lightweight structure, reinforced plastic, shelter, tent, thermosetting plastic.

1999, **27**(2), 84–95

The significance of financial risks in BOT procurement

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The significance of the financial risk characteristics of Build-Operate-Transfer (BOT) projects is explored. The objective was to identify and discuss the significance of the types of financial risk variables in conjunction with the different phases of procurement. A survey was therefore conducted to investigate the nature of the relationships between the financial risk variables and the different phases of BOT projects. 'Interest rate fluctuation' was the most significant financial risk variable in the pre-investment phase. For the implementation phase, both the variables 'design deficiency' and 'time overrun' were found to be highly statistically significant. The variable 'time overrun' was found to be the most statistically significant in the construction phase. The majority of the risk variables were considered to be moderately significant in the operations phase; these included 'competition', 'currency exchange restrictions' and 'defective products or facilities'. A mathematical model employing discriminant analysis was established to demonstrate the classification of financial risk variables in relation to the five BOT project phases.
Keywords: build-operate-transfer, financial risk, Hong Kong, private finance, procurement, risk analysis.

1999, **27**(2), 96–108

Visualization of photovoltaic clad buildings

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The need to be able to visualize buildings is not new, and tools to aid architectural visualization have developed over the years, up to the current trends in computer-aided design. The emergence of complex building materials and an increase in the number of participants involved in the design process is placing more demands on visualization tools. The technology of photovoltaics, the conversion of solar energy to electricity, has resulted in the emergence of photovoltaics as a building material. Designs for photovoltaic clad buildings, new-build or refurbished, need to be viewed by client, architect, engineer, photovoltaic specialist and the public. Architects are concerned with aesthetics, engineers with structural and environmental performance. Clients are concerned with aesthetics, performance and cost. The contribution of computer-aided design technology to the visual assessment of photovoltaic clad buildings is investigated. Issues of computer representation and communication between interested parties in the design process are examined. Widely used, low cost, commercially available software can contribute to the visualization of photovoltaic clad buildings, but issues are raised relating to the credibility and appropriateness of the end results of computer visualizations to meet the needs of interested parties.
Keywords: computer-aided design, design, software evaluation, photovoltaics, visualization.

1999, **27**(2), 109–119

Factors in formwork selection: a comparative investigation

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Results of an investigation concerning preferred methods of construction formwork by contractors' planning engineers in France, Germany and the UK are presented. Findings confirm differences amongst preferred solutions in these international locations. French and German contractors tend to employ similar proprietary formwork methods, whilst the UK 'standalone' in preferring traditional timber solutions. It is found that company size has no significant impact on the formwork system selected. Nine formwork selection factors are identified, and ranked in terms of importance for each international group of contractors. Statistically, the rankings are shown to have significant correlation for each pair of countries. 'Relative costs', 'Specification (quality) of concrete' and 'Degree of repetition', are found to be the principal formwork selection criteria. Correlation analysis reveals association between many of these selection factors.
Keywords: concrete, contractor, Europe, formwork, planning.

1999, **27**(2), 120–123

Quasi-static testing of composite masonry construction

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Research is introduced that investigates the effects of earthquakes on composite masonry and concrete buildings in China. The quasi-static test is used on a nine-storey composite masonry quarter-scale model. The structure is analysed under loads to assess structural ductility, power absorption ratio, damping, etc. Testing indicates important conclusions for architects and policy makers. Bending effects induced by earthquakes can be minimized and controlled by the design of the building's depth to width ratio. Composite masonry construction can be an appropriate technology for buildings of less than nine storeys in China's earthquake regions.
Keywords: China, composite masonry, earthquake resistance, quasi-static testing.

1999, **27**(3), 127–139

Using portable datafiles in the construction supply chain

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Portable datafile technologies such as high density bar coding and electronic tagging now permit very high information storage capacities. Aside from anecdotal evidence, there are few examples of these technologies being used within construction. The potential advantages of using portable datafiles are explored for storing and transmitting information relating to construction materials and components. A structured methodology aids the definition of information that could be encoded within labels or tags and the stages within the supply chain where such a device would most fruitfully be employed. A case study demonstrates both the operational and financial feasibility of using portable datafiles within the scenario of a live project. Recommendations are made for the development of a construction industry standard for portable datafiles as part of a framework to promote more widespread deployment of the technologies.
Keywords: auto-ID, bar coding, electronic tagging, information management.

1999, **27**(3), 140–148

Developers, regeneration and sustainability issues in the re-use of vacant industrial buildings

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The outcomes from a survey of developer and related organizations active in a local industrial property market in mid-1998 are reported in respect of the use and re-use of industrial buildings. The discussion focuses on both refurbishment and re-use and new-build sectors, and draws out some evidence on sustainability issues. Despite a relatively limited understanding of sustainability as a concept, developers are found to have a positive attitude to re-use when conditions allow it. Indeed, those more actively involved in re-use have sometimes engaged in a variety of practical, sustainable solutions to refurbishment needs. Most are open to influence on questions of good practice and sustainability. This all suggests that legislation designed to turn the development and construction industry towards brown-fleld opportunities and the sustainable re-use of existing infrastructure is likely to induce a favourable response.
Keywords: building stock, developer, industrial building, refurbishment, re-use, sustainable development, vacant property.

1999, **27**(3), 149–164

Is solar air conditioning feasible?

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The feasibility of desiccant cooling in UK climates is examined, using gas -solar hybrid technology for regeneration. Desiccant cooling is a heat driven system. It has potential to reduce energy costs and environmental pollution, when compared with conventional vapour compression systems. The regeneration of the desiccant can be provided by any low temperature warm air or water source including waste heat, CHP, gas or solar. Heat recovery is also available. Gaia Research worked with Napier University to develop computer codes for the simulation of solar energy collection and hot water delivery to drive the desiccant cooling system, based on real meteorological data. A solar desiccant computer model was developed with the University of Leeds, which analysed the energy consumption and costs associated with desiccant cooling using meteorological data for an inner London site in 1994. The study demonstrates that coupling the

desiccant system to solar collectors produces significant savings in both running cost and CO_2 emissions. The existing models of solar contribution and desiccant cooling will be refined. This will enable an assessment to be made of the UK opportunities for energy conservation and CO_2 emission reduction in relation to latitude, internal design conditions, and real loads.

Keywords: air conditioning, alternative technology, desiccant, efficiency, energy, passive design, solar.

1999, **27**(3), 165–182

Semi-prefabrication concrete techniques in developing countries

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Providing housing to the general population at an affordable cost is a colossal task facing governments in developing countries. Through the adoption of semi-prefabrication techniques, concrete construction is re-appraised for enhanced quality, economy and speed. This study involved identification of areas of optimization, design and analysis of model buildings. Outcomes indicate that semi-prefabrication concrete techniques are appropriate for achieving quality, economy and speed of construction.

Keywords: appropriate technology, concrete, housing, developing country, semi-prefabrication, Tanzania.

1999, **27**(4), 206–220

The built environment and the ecosphere: a global perspective

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The human population is rapidly urbanizing, leading many observers to conclude that humans are leaving nature and the countryside behind. This is a perceptual error consistent with the technological optimism inherent in the prevailing expansionist cultural worldview. By contrast, ecological analysis reveals that modern cities are actually increasingly dependent on the goods and services of nature. This fact is merely obscured by technology and urbanization itself. Typical high-income cities appropriate the productive and assimilative capacity of a vast and increasingly global hinterland, resulting in an 'ecological footprint' several hundred times larger than the areas they physically occupy. In the next 27 years, the urban population alone is expected to grow by the equivalent of the total human population in the 1930s. This will double the 1970s urban presence on the Earth. Unfortunately, the conventional development path is biophysically unsustainable, calling for a radical transformation of our thinking about urban form and function. Buildings account for 40% of the materials and about a third of the energy consumed by the world economy. Combined with ecocity design principles, green building technologies therefore have the potential to make an enormous contribution to a required 50% reduction in the energy and material intensity of consumption globally. The needed dematerialization increases to 90% in the high-income countries. Such enormous gains in material productivity are unlikely in the absence of significant ecological fiscal (tax) reform. Ironically, then, the most effective path to green buildings and ecocities may be intensive lobbying for higher taxes on primary energy and materials.

Keywords: city, ecological footprint, green building, regulation, sustainable development, urban design.

1999, **27**(4), 221–229

GBC '98 and GBTool: background

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Green Building Challenge '98 (GBC '98) was a 2-year development process involving international teams from 14 countries. The overall goal of Green Building Challenge '98 (GBC '98) was to develop, test and demonstrate an improved method for measuring building performance across a range of environmental and energy issues and then to inform the international community of scientists, designers, builders and clients about the results. 34 case study buildings from 14 countries were used to test and demonstrate this new method. As a second-generation method for assessing building performance, the GBC '98 assessment framework builds on the first generation systems developed in a number of countries. Unique to GBC '98 is the provision of an international framework capable of being adapted to national or regional circumstances. A description of the design goals and design features of the GBC '98 assessment method and GBTool is provided. Both the process and the product have served to stimulate critical debate about the scope and role of building environmental performance assessment and the actual design of green buildings.

Keywords: building performance, environmental assessment method, green building.

1999, **27**(4), 230–246

Building environmental assessment methods: clarifying intentions

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The intentions for, and the thinking behind, the Green Building Challenge (GBC) assessment framework and its development are made explicit. Three separate roles for environmental assessment of buildings are disentagled (stimulating owners to improve a building's performance, informing decision-makers during the design stages and delivering objective measurements of a building's impact on natural systems). Some significant lessons from the development exercise are identified and further implications and directions for developing environmental assessment methods for buildings are discussed. A distinction is made between 'green' and 'sustainable' agendas and their implications for the future development of building environmental assessment methods. This is essential in order to clarify the many roles and applications demanded of these tools. The considerable practical overlap between the 'green' and 'sustainable' agendas suggests that they can be reconciled within a single tool. 'Green' performance is most usefully described in relative terms in comparison to similar buildings in the region, while absolute energy and mass flows are a prerequisite for assessing progress towards sustainability. A fewer number of carefully elected performance measures are required to provide a measure of a building's role in ecological sustainability than to describe its green performance. The GBC process has clarified the roles and applications demanded of different tools and these lessons will be integrated into the restructuring and application of GBTool, and add significantly to the wider debate on environmental assessment.
Keywords: design tools, environmental assessment method, feedback, labelling, sustainable development.

1999, **27**(4), 247–256

Regional and cultural issues in environmental performance assessment for buildings

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The Green Building Challenge '98 (GBC '98) developed and tested an international assessment system for buildings. An underlying premise of GBC '98 was to allow for regional differences by providing flexibility and weighting of building assessment criteria within an international framework. This was considered crucial for the acceptability of the assessment system as well as for its ability to accurately reflect best local practice. Regional adaptation is complex, however, and raises many considerations that may be in conflict. This paper analyses the importance of integrating regional aspects into assessment tools on the one hand and the benefit of setting up an international assessment system on the other. An approach for achieving a balance between the regional and international levels of a universal assessment system is discussed. Issues and proposed solutions for further consideration are raised along with suggested topics for further research.
Keywords: assessment method, cultural issues, environmental assessment, regional issues.

1999, **27**(4), 257–276

Customizing and using GBTool: two case-study projects

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This paper highlights the differences in the customization and use of GBTool during the GBC '98 process by contrasting the assessments of two multiunit residential case-study projects: the Ekoporten project (renovation project), Norrkoping, Sweden and Co-housing project (new build), Cambridge, Massachusetts, USA. The application of GBTool in the two projects suggests that the differences between assessing new and refurbishments is much more significant than initially envisaged. The customizing of the default Performance scales was extensive. The wide range of interpretations that different National Teams placed on the various criteria reinforced the importance of regionally specific assessment methods. The Non-applicability designation was often applied due to technical difficulties in performing an evaluation rather than whether or not the performance issue was pertinent to the case-study project. The Criticality-Non-criticality designation was ineffectively used during this first testing of the assessment process, primarily due to the absence of meaningful guidance. Although an option existed for National Teams to propose the addition of a limited number subcriteria unique to the region or building type it was not used. The GBC process clearly showed that users need time to become familiar with an assessment procedure and it is evident that a much clearer and consistent set of directives must be provided to assist in any customization process than currently evident within the GBC process.
Keywords: case study, environmental assessment, green building, Sweden, USA.

1999, **27**(5), 286–293

The Green Building Challenge in the UK

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The background to and feedback from the UK team on the Green Building Challenge process in the UK is provided along with a commentary on the future development of the environmental assessment of buildings. Unique amongst the GBC national teams, the UK team chose buildings that had undergone post-occupancy evaluation. As a consequence, buildings were evaluated on their design, construction and operation phases. This additional information on actual rather than predicted performance provides a number of important lessons for the environmental assessment of buildings. Future expectations for the development of GBC from the UK perspective include providing proper credit for design features such as low-energy passive cooling and daylighting, modifying the assessment weighting system to provide more reliable comparison or benchmarking between design solutions, providing a practical international assessment method for comparison or benchmarking, incorporating post-occupancy evaluation to validate assessment methods and tools. Ease of use is important and GBC could usefully be simplified to consider the point of application in design, post-design certification and post-occupancy. Environmental assessment of buildings in the future must evolve within a wider context of local Agenda 21 sustainable development criteria.
Keywords: BREEAM, environmental assessment, feedback, green building, post-occupancy evaluation, UK.

1999, **27**(5), 294–299

Japanese expectations for green building assessments

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The background and feedback on the Green Building Challenge ’98 process in Japan is provided by a representative from one of two Japanese teams (representing the Building Constructors’ Society). The positive process of validating and adapting the international criteria to particular national circumstances and then customizing these criteria is explained. Three significant benefits to the Japanese building industry are discussed: existing technologies and methodologies were validated, it was discovered that these have potential for world-wide application, the life expectancy of Japanese buildings needs to be lengthened. Future expectations from Japan include: the ongoing refinement of the international framework for the environmental assessment of buildings; the customization of criteria requires further structure and limits, a critical review of the customization process; an expansion embracing both developed and developing nations’ new and existing buildings. The prototype green building assessment from GBC ’98 has the potential to be refined and adopted as a worldwide methodology and is endorsed as the fastest way to achieve world-wide consensus.
Keywords: environmental assessment, feedback, green building, Japan, longevity.

1999, **27**(5), 300–308

Building environmental assessment methods: applications and development trends

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The construction and property sector has seen the development of a number of methods for evaluating the ‘greenness’ of buildings in the 1990s -both for new designs and existing buildings. These range from very detailed life-cycle assessment methods, which account for all the embodied and operational environmental impacts of building materials, to higher level environmental impact assessment methods, which evaluate the broader implications of the building’s impact on the environment. In between these two are environmental assessment methods such as BREEAM, BEPAC, LEED, and GBA. In this paper, we discuss the potential market applications of these systems and compare and contrast several of the major environmental assessment methods.
Keywords: building performance, environmental assessment, green building, life-cycle assessment.

1999, **27**(5), 309–320

The relevance of Green Building Challenge: an observer's perspective

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The objectives and achievements of the international Green Building Challenge project are analysed. GBC is situated within the context of other international environmental methods. The differences between assessment tools, design tools, environmental management and audit tools and the large data problems entailed by these are discussed. Possible development scenarios for extending GBC into Life-cycle Assessment methodology, into other life-cycle phases (maintenance and refurbishment) and adapting GBC for use with the existing building stocks are proposed. The notion of 'green' buildings is replaced by a larger concept of sustainable development. New aggregation principles and scaleable design methods are proposed. Finally, the question of how relevant the proposed targets of GBC are in relation to the long-term sustainable development of buildings, building stock and urban environments is addressed.
Keywords: design tools, environmental assessment method, green building, life-cycle assessment, sustainable development.

1999, **27**(5), 321–331

Which focus for building assessment methods: environmental performance or sustainability?

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A personal response to the Green Building Challenge '98 conference, held in Vancouver in September 1998, is presented. This is an attempt to link together conceptually - and then comment on critically - the two main challenges thrown down at the conference. These were offered at the start and end by Rees and Kohler and were, respectively: (1) that developed countries reduce the environmental impact of their built environment tenfold by 2040 (Rees, 1999: 216), and (2) that they stop constructing additional new buildings, limiting themselves instead to improving their existing stock (Kohler, 1999: 317). Although not mentioned by Rees or Kohler, both of these challenges could be tackled, for example, through adopting a Service Economy approach to improving the built environment in industrialized countries. This could allow room - in terms of both resources input and pollution output - for the rapid urbanization predicted (and already occurring) in developing countries over the next 30 or 40 years. This paper seeks to locate their challenges in the context of broader initiatives to 'dematerialize' industrial economies. This is done in order to question whether the development of methods for assessing building performance should continue to address the relatively narrow resource-efficiency agenda that has predominated over the past ten years or whether it should now be extended to begin to tackle a wider remit - the sustainability of the built environment.
Keywords: environmental assessment, green building, service economy, sustainable development.

1999, **27**(5), 332–341

Development of a building performance rating and labelling system in Canada

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The recent GBC '98 conference presented the results of a two-year process of developing and testing a new approach to the performance assessment of buildings. The international process is continuing, but in many jurisdictions, including Canada, there is a desire to test the implementation of a system, one that includes ratings and labelling as well as performance assessments. This paper attempts to outline some of the factors that are seen by Natural Resources Canada (NRCan) as relevant to the need, market potential and barriers to such a system. The roles of various actors are considered including industry and government organizations, investors, utilities, building information centres, standards organizations, performance assessors, building owners and operators, tenants.
Keywords: Canada, environmental assessment, labelling system, market change mechanisms, performance rating, public policy, trends, voluntary system.

1999, **27**(6), 348–354

CIB Agenda 21 for sustainable construction: why, how and what?

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CIB's efforts to create an Agenda 21 for the construction sector are introduced here. CIB's unique position within the international construction community allowed it to initiate a specific sectorial response to the international agendas raised by Brundtland, Habitat II, Rio and Kyoto. CIB's recognition of the problems in establishing both a framework for sustainable development; how change within industry occurs, along with CIB's past, current and proposed activities meant that CIB was perfectly suited to respond to sustainable development. This CIB-led project resulted in global collaboration and co-ordination to specifically address sustainable development for the construction community. Situated between the broad international agendas and more local and sub-sectorial agendas, CIB's Agenda 21 is a conceptual framework that serves as an intermediary and provides for comparison and co-ordination. The three principal objectives are: to create a global framework and terminology that will add value to national, regional and sub-sectorial agendas; to create an agenda for CIB activities and for co-ordinating CIB with specialist partner organizations, and to provide a source document for definition of R&D activities.

Keywords: building design, CIB, construction process, public policy, R&D, research policy, sustainability.

1999, **27**(6), 355–367

Sustainable development and the future of construction: a comparison of visions from various countries

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This international CIB W82 Project aimed to answer the following question: 'What will be the consequences of sustainable development on the construction industry by the year 2010?' This future study investigated the relationship and defined links between the principles of sustainable development and the construction sector. Drawing on information from 14 countries, the study identified main issues, constraints and current policies, predicted changes and adaptations for the construction sectors in each country, analysed the consequences for the phases of the construction process, provided recommendations to the main actors, illustrated the need for further best practice case studies, design methods, buildings or building products.

Keywords: building design, construction industry, future study, public policy, R&D, research policy, sustainability, technical change, trends.

1999, **27**(6), 368–378

Sustainability and the performance concept: encouraging innovative environmental technology in construction

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Encouragement of innovation is a major reason for using the performance concept in construction regulations and specifications, mostly in the context of design-build contracts. Performance criteria aiming at sustainability emphasize long-term behaviour of built facilities, which complicates the measurement of compliance. Strategies for identifying areas with strong promises of innovative technologies should be developed, so as to concentrate the efforts in developing performance requirements. The development of standardized consensus methods and procedures should be accelerated. Finally, it is suggested that good examples of how performance requirements can be expressed and monitored should be made globally avail-able.

Keywords: innovation, life-cycle assessment, performance specification, sustainability.

1999, **27**(6), 319–390

Sustainable development demands dialogue between developed and developing worlds

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The international construction community's understanding of sustainable development is compromised by a systemic communication gap between the developed and developing worlds as well as a failure to address the implications of social requirements. The inclusion of the developing world within the sustainable development debate is argued as essential and the obstacles to achieving this are considered. Initiating a real dialogue in an equal partnership between the developed and developing worlds is a key challenge to define the process, guidelines and achieve protocols for sustainable development. Although CIB has recently commenced engaging with the developing world, much more needs to be done.
Keywords: CIB, ethics, decision making, developing world, quality of life, social sustainability, sustainable development, system.

1999, **27**(6), 391–397

Sustainability in management and organization: the key issues?

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An introduction is provided to some of the key issues relating to the context of sustainability. A more holistic approach to sustainability is called for, built around a consensus of an agreed definition and a philosophical framework to allow a meaningful discussion to take place, leading to improved decision making. At this emerging stage of the topic, it is recognized that even these matters are research issues and that in parallel with this debate it is important that progress at the sub-problem level must continue. These issues provide a context for many of the papers in these proceedings.
Keywords: evaluation method, framework, management, research, sustainability.

1999, **27**(6), 398–405

Integrated delivery systems for sustainable construction

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This study, based on a Delphi exercise and further analysis, provides a consensus view on sustainable development in relation to the construction industry, together with a broad improvement-oriented model. A pressure-state-response model has been infused with carefully identified priorities to give an iterative agenda for action.
Keywords: feedback, model, sustainable development, UK.

1999, **27**(6), 406–409

Materials and technology for sustainable construction

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Research undertaken in the development of basic approaches for and dissemination of information on the design, maintenance, re-use or renewal and assessment of materials and technologies for sustainable construction were the focus of Symposium A at the 1998 CIB Gäyle Conference. Contributions have been prepared within four areas including: (i) performance, durability and service life, (ii) information technologies, (iii) life-cycle analysis and maintenance management, and (iv) environmental technologies and processes. A summary of the more significant contributions within these specific areas is provided.
Keywords: sustainability, performance, durability, life-cycle analysis, environmental technology, maintenance.

1999, **27**(6), 410–412

Legal and procurement practices for sustainable development

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The current relationships between post-construction liability, insurance, procurement and the concept of sustainable development were the focus of Symposium C at the 1998 CIB Gävle World Building Congress. A number of issues were identified as impacting on procurement: ethical and human rights, higher environmental standards, ecodesign

principles, life-cycle implications and performance specification, understanding clients' cultural values. Alternative procurement strategies will be required to incorporate sustainability issues. The impact of environmental and sustainability issues on liability presents increased risks and this results in new forms of insurance coverage for all environmental risks.
Keywords: culture, liability, mediation, procurement, risk, sustainability.

1999, **27**(6), 413–419

The fifth EU framework programme and its consequences for the construction industry

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The EU's 5th Framework Programme provides significant opportunities for the construction industry to en-gage in innovation and change in many areas: preserving the ecosystem, promoting competitive and sustain-able growth, economic and energy efficiency, integrated approaches for sustainable development of cities, rational management of resources; protection, conservation and enhancement of cultural heritage, assessing strategies for sustainable urban transport. EU R&D activities (in concert with other actors) are a potent contributor to facilitate fundamental transformation not only of the construction industry's processes, products and environmental and social impacts but of the construction industry itself.
Keywords: European Union, innovation, public policy, R&D, research policy, sustainability, trends.

1999, **27**(6), 420–424

The UK's approach to sustainable development in construction

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This paper, updated from a speech delivered to the CIB World Congress on 12 June 1998 at Gävle, Sweden, outlines recent and proposed developments by the UK government on its approach to sustainable development in construction. A wide definition of sustainability includes social progress, environmental protection, prudent use of natural resources and economic growth/stable levels of employment. A wide array of measures have been or will be implemented: an integrated national transport policy, a national programme of CO 2 reductions from new (and possibly existing) buildings, a Social Exclusion Unit, a Welfare to Work programme, demonstration projects of sustainable construction, a new sustainable development strategy, dialogue with the construction industry, waste reduction schemes, landfill and aggregate taxes, improved management of water resources, an emphasis on whole life costs rather than initial capital costs of buildings, the development of sustainability indicators.
Keywords: public policy, sustainability, UK.

1999, **27**(6), 425–431

Sustainable development for industry and society

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A holistic view is presented on the issues and challenges facing business which in its the move towards sustainable development. There is a strong shift from a few years ago when the environment and sustainable development were viewed by business as risk factors. The situation today (and even more in the future) is that these are seen as responsibilities and opportunities, sources of competitive advantage. The progressive companies have already understood this and they are grabbing the opportunity.
Keywords: business, competitive advantage, corporate responsibility, environmental performance, sustainability, trends.

1999, **27**(6), 432–436

Industry's contribution to sustainable development

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Swedish industry supports sustainable development and recognizes this as a business opportunity. The market economy approach along with flexible, efficient economic instruments are key factors to enable industry to positively respond to sustainable development in terms of resource efficiencies and environmental protection. Swedish industry, by virtue of its being a world leader in reducing environmental problems, can act as a catalyst and example to others for moving towards sustainable development at local, national and international levels.
Keywords: environment, industrial development, market forces, public policy, sustainability, Sweden.

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1999, **17**(1), 5–7

A needs based methodology for classifying construction clients and selecting contractors: comment

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This note is a comment on Chinyio, E A, Olomolaiye, P O., Kometa, S T and Harris, F.C (1998) *A needs based methodology for classifying construction clients and selecting contractors,* Construction Management and Economics, **16**(1), 91-98, which describes research aimed at classifying clients by their needs rather than by the traditional public/private/developer approach. The paper also proposes a new method of selecting contractors by matching clients' needs to contractors' ability to satisfy them. The note offers constructive criticism of some aspects of the analysis.
Keywords: classification, client, contractor, scaling briefing, tender evaluation.

1999, **17**(1), 9–19

A grounded theory of construction crisis management

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Construction crisis management research is in an exploratory state where contemplated questions are of more value than hasty answers. For this reason, this paper is more concerned with theory formulation than theory testing. More specifically, it derives a grounded theory of construction crisis management which forms a useful basis for future research. It does so from an investigation of the complex patterns of communication and behaviour which emerge in response to construction crises. The conclusion is that construction crisis management is about the effective control of social and behavioural instability and the conflict which arises out of it. However, effective crisis management is made difficult by the in-built defence mechanisms which construction crises appear to have. The grounded theory also is contrasted with current crisis management theory and thereby, the uniqueness of crisis management in a construction context is identified.
Keywords: behaviour, conflict, crisis management, grounded theory, power, uncertainty.

1999, **17**(1), 21–27

Quasi-rational behaviour in the property and construction market

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The notion of quasi-rationality is discussed and some new empirical evidence of actual (as revealed in experiments) rather than theorized behaviour is presented. Results from a series of experiments show evidence of money illusion in perception of salary levels and frame dependent risk aversion in agreeing contracts for property development. The implications for the property and construction markets and for research in property and construction economics are discussed.
Keywords: human behaviour, money illusion, quasi-rationality.

1999, **17**(1), 29–43

Skills, knowledge and competencies for managing construction refurbishment works

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An appropriate body of management skills and knowledge for construction refurbishment is established: a skills and knowledge inventory. Of the 75 types of management skill and knowledge, the six most important are leadership, communication (oral/written), motivation of others, health and safety, decision-making, and forecasting and planning. Refurbishment managers' jobs as defined by their application of skills/ knowledge are, on the whole, homogeneous, with some overlap across levels of management and types of organization, and this dispels the view that management tasks are totally different across management strata. A comparison of the relative importance of management skills/knowledge

for refurbishment and management skills for general construction shows that the skills/knowledge associated with forecasting and planning, managing conflict and crisis, tenant welfare, team building, and decision making are higher than in general construction management; reflecting the uncertain nature and the relatively higher levels of risks associated with refurbishment works.
Keywords: competency, education, knowledge, refurbishment, skill, training.

1999, **17**(1), 45–52

Productivity rates and construction methods for high rise concrete construction: a comparative evaluation of UK, German and French contractors

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Recent investigations concerning the productivity of the UK construction industry and its performance compared with other European and worldwide nations have reported conflicting endings. These investigations have utilized various methodologies in attempting to measure and compare productivity levels. The present investigation uses a customized method to gauge the productivity at site level of three European national construction industries, namely Germany, France and the UK. Analysis of variance is employed to compare the productivity rates used by contractors' planning engineers for a specific concreting operation. The performance of UK contractors is found to be more disparate than those of contractors in either France or Germany. Although leading UK contractors can compete with the best on the continent, there are a number of companies whose performance is far worse than any in France and Germany, due mainly to the construction methods used by UK contractors. It is concluded, therefore, that a best practice recommendation for UK contractors would be for them to avoid using traditional timber formwork methods to beams, and instead adopt more productive approaches afforded using either proprietary or prefabricated systems.
Keywords: analysis of variance, construction method, European comparison, formwork, productivity.

1999, **17**(1), 53–62

Construction work and education: occupational health and safety reviewed

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An overview is given of occupational safety and health and of training in the construction sector, summarizing the findings of different researchers. The studies discussed emphasize safety instruction and on the job training at sites, especially the teaching of first aid skill s and accident prevention. Construction workers regard occupational training as important in maintaining work ability. Present developments of vocational training with new flexible pathways are described. Rehabilitation needs are found to be a further important target of work ability promotion. The study provides support for comprehensive occupational health and safety measures. New feedback safety measures (LIIKKUVA, TR-safety audit), which are based on goal setting and a follow up in collaboration, seem to improve considerably both the safety and the development of construction work.
Keywords: construction occupation, occupational safety and health, on the job training, vocational education, safety instruction.

1999, **17**(1), 63–76

Modelling client business processes as an aid to strategic briefing

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The briefing process can be divided into two stages. The first is referred to as strategic briefing and is concerned with understanding the client's business processes. The second stage comprises the conceptualization of built solutions and issues of performance specification. It is the first of these two stages that often is the most problematic. Several authors have established a relationship between strategic briefing and business process re-engineering (BPR), but doubts remain regarding both the originality of BPR and the extent of its theoretical justification. A social constructivist interpretation of BPR is presented and the connection is made with soft systems methodology (SSM). It is argued that SSM offers a rigorous framework for modelling client business processes that subsumes the principles of BPR. A participative research seminar is described which evaluates the potential use of SSM using case study material. Feedback from the seminar participants provides strong support for the contention that SSM could indeed provide the basis for a significant enhancement of current briefing practice. However, there is a danger that practitioners may adopt the techniques of SSM without necessarily buying in at the methodology level. The terminology of SSM also is likely to present a barrier to those construction professionals who are unwilling to make the necessary intellectual investment.

Keywords: briefing, business process re-engineering, client, social constructivism, soft systems methodology.

1999, **17**(1), 77–90

A world-wide survey of current practices in the management of risk within electrical supply projects

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A survey is described which examines the current risk handling practices in evaluating capital development projects (transmission, generation and distribution) within the electricity supply industry worldwide. As risk perception is an important aspect of risk management, the attitudes towards and the barriers created by management to risk management plus the benefits perceived are examined and compared with the results of previous surveys. The survey will assist also in determining the need and feasibility of applying a risk management process to capital budgets in investments such as transmission construction works and other appropriate applications. The survey has demonstrated that a formal risk management process is more likely to apply to large, complex projects with potential of cost overrun. However, the criteria for application are likely to depend more on overcoming managers concerns about time involvement, human/organizational resistance and understanding of quantitative techniques, such as assessing probability distributions, deter-mining and interpreting expected values, variances, and risk management output results, so as to appreciate the benefits and enable effective decisions to be made. The worldwide survey confirms that there is a drive towards a more thorough assessment of risks than previously recorded, with a formal risk management process that will meet the expectations of business growth and project sponsors and ensure that all risks are actively managed throughout the life-cycle of a project.

Keywords: electricity supply industry, power generation, power distribution, practice, risk management, world-wide survey.

1999, **17**(1), 91–98

Inducing rules for selecting retaining wall systems

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Rule induction is a paradigm of machine learning that governs how knowledge is acquired from experience. This paradigm not only classifies existing data into logical sets, but also expresses them by `if ± then' rules. Rule induction can be applied to the experience-oriented construction industry. A typical example would be to select an appropriate retaining wall system at the project planning stage, in which engineers normally employ certain empirical laws or select from the types for which they have relevant expertise in making appropriate selections. This work presents a novel rule induction approach, capable of inducing from 254 retaining wall cases in engineering design reports into 181 rules, thereby allowing for an appropriate retaining wall system to be selected. A system referred to herein as RULES is also constructed with an illustrative example provided as well. Test results of the system demonstrate that the rule induction approach can effectively resolve retaining wall selection problems at the project planning stage. The approach proposed herein is highly promising for resolving experience-oriented problems in the construction industry.

Keywords: artificial intelligence, knowledge discovery, retaining wall selection, rule induction.

1999, **17**(1), 99–106

The likelihood and impact of changes of key project personnel on the design process

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Both the construction and the risk analysis and management literature have overlooked the highly disruptive influence of the loss of key project personnel. It is clear from other industries involved in managing projects, such as information technology, that the likelihood of this adverse event is openly recognized. The construction literature looks at a series of issues which all relate to communication and information transfer but fails to isolate one of the key issues which, when it materializes, seriously undermines the essence of design: the complete integration of the creative contribution of all the participating design disciplines. The risk analysis and management literature recognizes the significance of risk identification but pays scant attention to discontinuity, and the borrowed identification techniques are reliant solely on subjective judgements. Propositions for examination are tested against a documentary analysis of twenty-two projects to establish the existence of this threat to a project' s objectives. Of the sample of projects examined, changes to personnel are commonplace, and clearly lead to project overruns.
Keywords: design management, key project personnel, risk.

1999, **17**(1), 107–119

ISO 9000 standards: perceptions and experiences in the UK construction industry

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With the adoption by construction firms of BS EN ISO 9000 there has been much debate concerning its effectiveness and value as a quality management system. In spite of the reported benefits of ISO 9000 certification, however, concerns regarding its overall benefit to construction firms due to unnecessary bureaucracy and paperwork, increased costs, stilling of innovation, etc. still persist in the industry. This paper reports on the results of a research carried out on the implementation of BS EN ISO 9000 as a continuation of BS5750 in the UK construction industry from the viewpoint of the experiences and perceptions of quality assurance managers of selected construction firms.
Keywords: quality assurance, quality management system, ISO 9000 standard, certification, construction firm.

1999, **17**(2), 129–132

Construction cost and building height

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A simple neo-classical production function model is used to determine the incremental cost of each floor as building height increases. This analytic method provides an alternative to earlier studies using computer simulation and more cumbersome attempts at measuring the cost variation directly. By modelling construction costs analytically, it is possible to identify and assess the impacts of particular variables more explicitly. There are two main findings. First, cost variation with building height is not only affected by technology; building design, demand and institutional factors also play important roles. Secondly, the model may be used to estimate construction cost variation with building height from readily avail able data. In this sense it is an improvement over previous methods using simulated or direct cost measurement.
Keywords: building height, construction cost, productivity.

1999, **17**(2), 133–137

The missing arguments of lean construction

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The emerging concept of lean construction is concerned with the application of lean thinking to the construction industry. The ideas of lean thinking seem set to dominate the UK construction industry' s quest to improve quality and efficiency. However, the current debate is based on a highly selective interpretation of the available literature. The extent to which the Japanese model of lean production is applicable in Western contexts remains hotly debated. An extensive body of critical opinion equates the Japanese model of lean production with technocratic totalitarianism. Whilst the claims of productivity achievements in Japanese manufacturing transplants are impressive, the rhetoric of flexibility, quality and teamwork too often translates in practice to control, exploitation and surveillance. Furthermore, it cannot be taken for granted that any increases in productivity necessarily serve the interests of the end customer. The

current agenda for the implementation of lean thinking in the UK construction industry notably ignores the extensive critical literature on lean production. In the absence of a more balanced research agenda, there is a danger that dogma rather than a balanced appraisal of the available evidence will drive construction policy.

Keywords: critical theory, customer responsiveness, human resource management, lean construction, technocratic totalitarianism, total quality management.

1999, **17**(2), 139–153

Ethics in tendering: a survey of Australian opinion and practice

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The main issues in the philosophical foundations of ethics and tendering ethics are outlined, and an introduction is provided to the Australian codes of tendering practice. A questionnaire survey is then described which sought to ascertain the extent to which ethical behaviour in tendering is supported and practiced in Australia. The results of the survey indicate that most companies support the use of codes of tendering; defend the right of withdrawal of tenders; disapprove of bid shopping, cover pricing and union involvement in the tendering process, and support the principals' right to know what is included in a tender as well as the self-regulation of the tendering codes. It is also shown that most companies have developed, and follow, idiosyncratic ethical guidelines that are independent of, and often contrary to, the nationally prescribed codes. The conclusions recommend a need for the development of a theoretical frame of reference that can be tested through a more detailed empirical approach to the development of future ethical prescriptions in the field.

Keywords: ethics, restrictive practice, tendering.

1999, **17**(2), 155–167

Modelling information flow during the conceptual and schematic stages of building design

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The aim of this research was to study, model and simulate the information flow at the conceptual and schematic stages of building design. The development of a generic model of the conceptual and schematic design process for buildings is described. This model comprising design tasks and their information requirements was produced using data flow diagrams. Examples from several levels of the model are provided. Details are then given as to how the model may be used to assist the management of the design process both directly and by providing primary data for other tools and techniques. Industry feedback on the data modelling and these tools and techniques is then discussed. It is concluded that it is only by a better understanding of the flow of information among project participants that the management of design may be improved, and that although the generic data flow model provides immediate benefits to design managers these can be enhanced greatly by the use of the model as a primary data source for other tools and techniques including the design structure matrix and simulation.

Keywords: conceptual design, schematic design , data flow diagram, design structure matrix, information flow, simulation.

1999, **17**(2), 169–176

Combining rule-based expert systems and artificial neural networks for mark-up estimation

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Rule-based expert systems and artificial neural networks are two major systems for developing intelligent decision support systems. The integration of the two systems can generate a new system which shares the strengths of both rule-based and artificial neural network systems. This research presents a computer based mark-up decision support system called InMES (integrated mark-up estimation system) that integrates a rule-based expert system and an artificial neural network (ANN) based expert system. The computer system represents an innovative approach for estimating a contractor' s mark-up percentage for a construction project. A rule extraction method is developed to generate rules from a trained ANN. By using the explanation facility embedded in the rule-based expert system, InMES provides users with a clear explanation to justify the rationality of the estimated mark-up output. Cost data derived from a contractor' s successful bids were used to train an ANN and, in conjunction with a rule-based expert system, select the expected mark-up for a project. The combination of both ANN- and rule-based expert systems for estimating mark-up allows significant benefits to be made from each individual system, such as understanding why and how the estimated mark-up was derived and also the effects of imposing rules and constraints on a company's mark-up estimation. The mark-up

decision support system presented can assist contractors in preparing a rational mark-up percentage for a project. Moreover, InMES as proposed will assist contractors in their tender decision making, that is, whether or not to submit a bid for a project considering the estimated mark-up.

Keywords: explanation facility, hyCMEd system, mark-up decision, rule extraction.

1999, **17**(2), 177–188

Bargaining tactics in construction disputes

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Bargaining is the initial and informal means by which parties attempt to resolve their differences during a construction dispute. However, knowledge of the bargaining process in construction projects is scant, with most attention being given to developing more formal, costly and reactive means of dispute resolution. This approach is questioned, in favour of a more ef® cient one based upon a better understanding of bargaining behaviour and improved bargaining skills. To this end, the behavioural complexities of the bargaining process during construction disputes are investigated. It is concluded that the majority of construction disputes are unintentional and escalate as a result of misunderstandings and tactical miscalculations during the bargaining process. A series of recommendations is set out to reduce the potential for unintentional escalation during a construction dispute.

Keywords: bargaining, behaviour, claim, conflict, dispute, negotiation.

1999, **17**(2), 189–196

Modelling building durations in Hong Kong

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The duration of Australian construction has been modelled by a time and cost formula expressed in the form of T = KC B , where T is the actual construction time in working days, C is the final cost of contract in millions, K is a constant characteristic of building time performance, and B is a constant indicative of the sensitivity of time performance to cost level. This paper applies the relationship to building projects in Hong Kong using time and cost data from 110 projects. Regression analysis was used to compute the values of K and B and check how well the model actually is, and the best predictor of average construction time of building projects in Hong Kong is found to be T = 152C 0.29. It is also found that the Hong Kong private sector takes a shorter time (120 days) to complete a hypothesized project with a contract sum of HK$1 million (at December 1994 price) than its government counterpart (166 days). The time and cost relationship serves as a convenient tool for both project managers and clients for predicting the actual optimum time required for delivery of a building project.

Keywords: building project, Hong Kong, regression model, time cost relationship.

1999, **17**(2), 197–204

The quality of accident and health data in the construction industry: interviews with senior managers

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Despite recent changes in legislation and advances towards an integrated project-wide approach, health and safety management in the construction industry is still a major problem, involving a substantial cost to business, society and individuals. A prerequisite to improving the situation and developing an effective management strategy is monitoring, providing a detailed understanding of the effectiveness of different approaches to intervention. This paper describes a feasibility study using in-depth interviews with senior managers to explore the quality of accident and health data of nine large, high profile companies from the engineering construction sector. The interview dialogue comprised a series of questions and issues to be explored on the organization' s accident reporting systems (e.g. what is reported, analysis performed, computerization), unsafe act and near miss auditing (e.g. definition, validity), failure type indicators (e.g. auditing, quantification) and safety culture indicators (e.g. commitment, health). Although safety was a priority for companies, health (i.e. medicals and monitoring systems) had not been given the same consideration, especially with regard to sub-contracted labour. This study shows that the validity of accident statistics as a measure of safety remains a limitation and that there is a requirement for a consistent and integrated approach to the measurement of health and safety performance.

Keywords: accident data, health, interviews, safety.

1999, **17**(2), 205–213

Risk response techniques employed currently for major projects

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Risk management is fundamental to the success of a major project. However, the variations in using risk management practices are considerable and are dependent on numerous factors such as the industry sector, the size of the project, and the stage in the project life-cycle. One of the major constituents of successful risk control is the use of risk response. This paper concentrates on the choice and use of the most successful risk response techniques within the oil and gas industry and compares them with the use of those chosen by the construction industry. Results were ascertained through a survey of over one hundred companies within these two sectors by use of an extensive questionnaire. The main conclusions are that risk reduction as a response to assessed risks is most commonly used by both sectors; and that the construction industry concentrates almost exclusively on reduction of financial risk. It is proposed that the construction industry can benefit greatly from the more experienced oil and gas industry in managing technical risk which, with the advent of private funding, is likely to become a more predominant part of construction procurement.
Keywords: risk management, risk response.

1999, **17**(2), 221–230

European construction contractors: a productivity appraisal of in situ concrete operations

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Site productivity levels for high-rise, in situ concrete operations are compared among three groups of European construction contractors. Results confirm significant differences between the contractor' s productivity rates for each of the three countries investigated (Germany, France and the UK). German firms are the most efficient at reinforcement and concrete placing operations, whereas French firms are most productive at formwork. UK firms are the l east productive for two operations, namely form work and concrete. French firms are least productive at fixing reinforcement. Based on a specific model project, it is determined that French and German firms require significantly fewer man-hours to carry out the said concrete operations than do UK firms. UK contractors achieve the lowest levels of labour productivity for the operations involved. The UK also exhibited greater productivity variation, i.e. providing evidence of extreme (most and least efficient) levels of labour output for several concrete operations. Leading on from these analyses, a construction (labour) cost comparison indicates that French contractors are the least expensive. Furthermore, the ideal solution for clients would be to have French firms build their projects in the UK, since this combination provides the most economic solution to the model building overall.
Keywords: analysis of variance, Europe, in situ concrete, labour cost, productivity.

1999, **17**(2), 231–241

An evaluation of the accuracy of the multiple regression approach in forecasting sectoral construction demand in Singapore

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In the current state of research in construction demand modelling and forecasting there is a predominant use of the multiple regression approach, particularly the linear technique. Because of the popularity, it may be useful at this stage to gain an insight into the accuracy of the approach by comparing the forecasting performance of different forms of regression analysis. It is only through such formal means that the relative accuracy of different regression techniques can be assessed. In a case study of modelling Singapore' s residential, industrial and commercial construction demand, both linear and non-linear regression techniques are applied. The techniques used include multiple linear regression (MLR), multiple log-linear regression (MLGR) and auto regressive non-linear regression (ANLR). Quarterly time-series data over the period 1975-1994 are used. The objective is to evaluate the reliability of these techniques in modelling sectoral demand based on ex-post forecasting accuracy. Relative measures of forecasting accuracy dealing with percentage errors are used. It is found that the MLGR outperforms the other two methods in two of the three sectors examined by achieving the lowest mean absolute percentage error. The general conclusion is that non-linear techniques are more accurate in representing the complex relationship between demand for construction and its various associated indicators. In addition to improved accuracy, the use of non-linear forms also expands the scope of regression analysis.
Keywords: construction demand, forecasting accuracy, non-linear, model evaluation, regression technique.

1999, **17**(3), 251–267

Studies on the impact of functional analysis concept design on reduction in change orders

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Functional analysis concept design (FACD) is a method by which owners and designers can `partner' during the design phase of projects. Much has been written and reported about partnering on construction projects, but little is avail able on the applications and results of FACD. While FACD has been mentioned in the literature to be a valuable tool, evidence on its effectiveness has been missing. Consequently, FACD has not hitherto emerged as a common management system used during design. Management processes on its implementation also had not been developed fully until the United States Navy carried out research, much involving tedious trials and revisions. This paper describes processes that have been found suitable. The economic benefits of FACD have never been directly evaluated, but by examining and testing the quantum of change orders on projects, this study finds that FACD is a viable method that can reduce construction costs overall. Whereas value engineering and constructability review are other common tools, FACD is distinct from them both. FACD is allied to functional analysis system technique (FAST); regulations, and specifications have been developed to implement FACD to ensure its success.
Keywords: ANOVA, change order, cost, design, FAST, functional analysis.

1999, **17**(3), 269–283

Construction costs in The Netherlands in an international context

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OECD purchasing power parities (PPPs) are used regularly in strategic governmental policy papers to compare the performance of construction industries among countries. These PPPs suggest that the relative competitiveness of the Dutch construction sector is fairly weak compared with surrounding countries. This contradicts the general view that the Dutch construction industry is very productive and efficient, especially in house building. For the member countries of the European Union the OECD uses data from Eurostat, the statistical office of the European Union. In this paper the methodology followed by OECD/Eurostat in their calculation of PPPs for construction is reviewed. The data for five European countries (Netherlands, Belgium, UK, France and Germany) are analysed. Next, the Eurostat results are placed alongside the results of other international building cost comparisons. The differences are observed and the conclusion is that the Eurostat PPPs do not reflect the real construction price or cost differentials among the five EU countries. It appears that the basic construction price data used by Eurostat are not very accurate, that the comparison methodology applied by Eurostat itself is insufficient to express and explain building cost differences among countries, and that the Eurostat figures for construction are the result of a complex statistical weighting and processing procedure in which corrections are not applied for extreme deviations. The conclusion is that the Eurostat data cannot be used for comparison purposes. Proposals for improvement of the comparison methodology are reviewed.
Keywords: cost, international comparison, statistics, purchasing power parity.

1999, **17**(3), 285–296

Tendering theory revisited

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The content, origin and development of tendering theory are considered in terms of a theory of price determination. Tendering theory determines prices and differs from game and decision theories. In the tendering process, with non-cooperative, simultaneous, single sealed bids with individual private valuations, extensive public information, a large number of bidders and a long sequence of tendering occasions, there develops a competitive equilibrium. The development of a competitive equilibrium means that the concept of the tender as the sum of a valuation and a strategy, which is at the core of tendering theory, cannot be supported, and that there are serious empirical, theoretical and methodological inconsistencies in the theory.
Keywords: bidding, price determination, tendering, tendering theory.

1999, **17**(3), 297–303

The Italian residential construction sector: an input-output historical analysis

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Two sets of input-output tables are employed in this paper to analyse the role of the Italian residential construction sector in the national economy. The analysis focuses on changes in construction technology over a period of some 30 years, ending in 1985, the last year for which such data are available. A set of eight-sector input-output tables is used to show the weakening of the residential construction sector' s effect on the economy as a whole. This trend is caused by the progressive saturation of the residential construction market and the transformation of the overall Italian economy. As expected, the achieved maturity of the Italian economy is accompanied by the growing importance of maintenance and repair construction because of the ageing building infrastructure. Another set of 24-sector input-output tables is used to analyse the input and output profiles of the residential and non-residential construction sectors, by selecting key supply industries. Significant differences are reported in the technology of the residential sector, with a shift towards services and away from manufacturing inputs.

Keywords: backward and forward linkage, construction technology, input-output analysis, residential construction.

1999, **17**(3), 305–314

Prediction of hoisting time for tower cranes for public housing construction in Hong Kong

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Material transportation for high-rise building construction relies heavily on tower cranes. Hence the proper use of tower cranes is of paramount importance for high-rise residential building construction. In planning and monitoring crane usage in Hong Kong, a schedule is usually prepared to co-ordinate hoisting operations. Apart from that, little research in optimizing crane usage has been carried out previously, except on operation cycle times, e.g. concreting using a crane and skip and form work erection. Allocation of time for the hoisting schedule is based on the planners' and operators' experience. The accuracy of the hoisting schedule for crane dominated construction works has significant effects on the materials supply and on concreting operations. Imbalance in the allocation of crane usage for sub-contractors may lead to conflicts between trades and idling of workers due to a shortage of materials. Although planners understand that the load hoisting time is proportional to hoisting height and other factors, floor construction cycles usually, for simplicity, are assigned to be constant six day, eight day or ten day cycles without making the necessary compensation for the longer hoisting times for upper floors. The prediction of hoisting times is of great importance to planners to ensure the accuracy of the construction schedule for crane-dominated construction. This paper describes the derivation of a mathematical model to predict the hoisting times for a tower crane for public housing construction. Work measurement is used to collect hoisting times data for analysis. Twelve factors considered to influence hoisting time are identified for the model. Multiple regression models are built for predicting supply hoisting times and return hoisting times. The effects of the variables on hoisting time are reviewed. Estimated hoisting times calculated from the models are compared with actual hoisting times, and a worked example illustrating the application of the models is presented.

Keywords: hoisting time, multiple regression analysis, public housing, tower crane.

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A model for sub-contractor selection in refurbishment projects

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A model is presented for analysing the sub-contractor' s risk elements in construction refurbishment projects. The system is based on the use of fuzzy set theory with the fuzzy set representing the overall weighted average rating of refurbishment contractors' criterion for the selection of sub-contractors. A prototype knowledge based expert system is described, which provides a systematic and objective approach to the selection of sub-contractors. Knowledge elicitation methodology using the `repertory grid' technique is detailed. The implementation of a sub-contractor selection and appointment Model for refurbishment contractors (SSARC) in linguistic terms allows the user to interact with the system in a very friendly manner using natural language expression.

Keywords: knowledge based system, fuzzy logic, refurbishment, repertory grid, sub-contractor.

1999, **17**(3), 329–340

A participative research strategy for propagating soft methodologies in value management practice

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The emerging methodologies of `soft operational research' have been developed for the purposes of structuring multi-perspective problems characterized by uncertainty, ambiguity and conflict. A participative research project is reported that sought to propagate the three most established `soft' methodologies within UK value management practice. The adopted research strategy consisted of four key stages. Following an initial literature review, an insight into existing value management was gained by twelve semi-structured interviews with leading practitioners. This was followed by a series of six participative research seminars, which used simulated case studies to evaluate the potential application of the three methodologies within the context of value management. A final series of interviews then determined the extent to which the three methodologies subsequently had been adopted in practice. The results are encouraging in that already the research has had an influence on UK value management practice. However, doubts remain as to whether the practitioners have assimilated the methodologies fully, or simply have adopted individual techniques in the absence of any theoretical understanding.

Keywords: briefing, group decision support, participative research, risk management, soft operational research, value management.

1999, **17**(3), 341–350

Assessment of construction processes and innovations through simulation

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The objectives of this research are to represent construction activities accurately, and to provide a means for assessing the impacts from using innovations. The research approach is the detailed characterization of construction processes, and the development of system and material specific dynamic process simulation models. The ongoing research program is developing a set of specific models, based on extensive empirical data, to enable the accurate modelling of all of the construction processes for a complete facility construction project. A specific process model, glass/metal curtain wall erection, demonstrates the approach, with an analysis of the impacts from a related innovation.

Keywords: construction innovation, construction process improvement, dynamic process simulation, cost estimating, simulation model, safety.

1999, **17**(3), 351–362

Modelling and predicting construction durations in Hong Kong public housing

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Construction time performance is provoking worldwide concern and discussion within the industry. This paper reports the results of a survey in the fourth stage of an investigation seeking to identify a set of significant variables influencing construction durations of projects in Hong Kong, the stage addressing the formulation of standard norms for overall construction durations of public housing projects by modelling the primary work packages in the building process, namely piling, pile caps/raft, superstructure, E and M services, finishes and their respective sequential start-start lag times, on the basis of the identified groups of critical factors. Data were collected from a sample of 56 standard `Harmony' type domestic blocks of the Hong Kong Housing Authority; (the `Harmony' series of block design having become popular for average quality public housing blocks in the 1990s, ranging from 30 to 40 storeys and containing about 16 residential units on each floor). These data were analysed through a series of multiple linear regression exercises that helped to establish the time prediction model. This model was then tested and validated using information from a further nine projects from the Housing Authority. Both the usefulness and shortcomings of the model are briefly presented and discussed. It is concluded that the model is applicable to the public housing industry in Hong Kong, and that the methodology used may be applied to develop similarly useful models in other subsectors, and in other countries.

Keywords: construction duration, Hong Kong, public housing, modelling, multiple linear regression, predicting.

1999, **17**(3), 363–374

Energy impact analysis of building construction as applied to South Africa

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Basic embodied-energy intensities of building construction materials/systems by various units and building types are shown to produce conflicting results and are not directly applicable at a national policy-intervention level. Using building construction and the allied sectors in South Africa, this paper demonstrates the extension of basic energy intensities derived through an improved input-output (I-O) method into a sectoral energy conservation framework. The framework is based on sectoral total-embodiment energy impact coefficients derived through the multiplication of the total-embodiment energy intensity coefficients with the use-intensity coefficients. A ranking of building construction and the al lied sectors in South Africa according to their energy impact coefficients is used to formulate a priority listing of critical sectors for energy conservation measures. The framework is used also to identify generic conservation measures for further investigation and evaluation.
Keywords: building construction, embodied energy, input-output, South Africa, use-intensity.

1999, **17**(3), 375–382

A survey of the site records kept by construction supervisors

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A number of writers have cited poor records as limiting the ability of supervisors, and indeed of contractors, to carry out some of their most important functions. The study reported in this paper aimed to identify the problems in detail. This was achieved by conducting a mail-shot survey of construction supervisors working for firms of civil engineering consultants. The results indicate that there is considerable room for improvement in the records kept on most sites, where guidelines are said to be inadequate and the problems of enforcing these inadequate guidelines were also recognized. The main source data for progress records was identified as the site diaries kept by individual members of the supervisor' s team, and these were found to be particularly difficult to access for a number of reasons. Since the site diaries are such an important source of information, it is argued that most benefit may be gained by taking steps to improve these daily logs, which, in turn, will allow better overviews of progress to be produced.
Keywords: claim, documentation, progress records, site operation, role, supervisor.

1999, **17**(3), 383–391

Strategies for insuring sub-contracted works

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In the UK construction industry there are different strategies used in practice for the insurance of sub-contracted work of which two predominate: one is for sub-contracted work to be insured by both main contractor and sub-contractor (model A) and the other is for only the main contractor to insure the sub-contracted work (model B). The extent of use of these approaches is discussed and the rationales for them are presented in the context of research undertaken by questionnaire surveys and structured interviews. A background is provided to the requirements for sub-contractor insurance found in commonly used forms of contract, including FIDIC. Four possible model s of sub-contractor insurance are identified and their relationship to the contract provisions in model forms is outlined. Two of the models have little practical relevance to sub-contractor insurance and the reasons for this are given. About 75% of the main contractors in the research sample were found to adopt model A for all disciplines, although the reasons given were not entirely consistent. About 15% of the sample adopt model B for all disciplines and the remainder use different models for different disciplines. Again, the rationales for these choices were not found to be robust. The main conclusions are first that the choice of strategy for sub-contractor insurance is highly independent of both the discipline and the selected form of sub-contract, and second that some commercial decisions in this area may be sub-optimal. There is an unreconciled argument over the immediate commercial advantages claimed by many for model A and the potential for longer term reduction in insurance costs which might arise from the widespread adoption of model B.
Keywords: discipline, form of contract, insurance, sub-contractor, works.

1999, **17**(3), 393–401

Cash farming in building and construction: a stochastic analysis

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Cash flow management is a significant issue in the management of a building or construction firm. This paper steps back from the well researched area of poor cash management and its relationship with failure, to focus on the funds which are generated through operations, and the positive benefits which can follow in a well managed organization. A stochastic model is developed which illustrates how an average of 16% of turnover can be available for reinvestment. This is sufficient to allow investment in non-liquid assets, provided that this is managed carefully and precautions are taken against a severe reduction in turnover. This level of funds is sufficient to encourage firms to enter the industry with the motivation of generating funds, rather than a desire to build. This has implications for large clients and for government when dealing with the industry.
Keywords: cash farming, liquidity, Monte Carlo, net cash flow, stochastic modelling.

1999, **17**(4), 441–447

Allocation of contingency in activity duration networks

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This paper describes a method for apportioning contingency in a probabilistic network. It distinguishes between two requirements for contingency: for high variance crucial activities, and for high ¯ oat non-critical activities. This enables a logical two-step apportionment, the first based upon the idea of `cruciality', which has become established as an important indicator of an activity' s importance in risk terms, and the second based upon standard ideas about ¯ oat. A numerical example is given based on data used by previous work, so that a comparison of the methods can be made.
Keywords: construction planning, contingency, CPM, network analysis, stochastic networks.

1999, **17**(4), 449–461

ISO 14000: its relevance to the construction industry of Singapore and its potential as the next industry milestone

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ISO 14000 is a series of standards defining a formal and structured approach to environmental management. It demonstrates, with assurance, that an organization complying with current policy and legislation actively addresses environmental issues. Construction activities have a myriad of environmental implications. Hence, construction entities must manage their environmental performance. ISO 14000 represents a possible solution. This study considers the relevance of environmental management to construction organizations. After an overview of the environmental impacts of construction, ISO 14000 and its principles are explored. A field study is reported that was set up to assess the level of commitment of construction enterprises in Singapore to environmental management. Contractors in Singapore are aware of the merits of environmental management, but are not instituting systems towards achieving it. A framework for the development and implementation of an environmental management system (EMS) is proposed.
Keywords: construction industry, environmental management, implementation, ISO 14000, Singapore.

1999, **17**(4), 463–471

A neural network-based system for predicting earthmoving production

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An artificial neural network based system (NN_earth) is developed for construction practitioners as a simple tool for predicting earthmoving operations, which are model led by back propagation neural networks with four expected parameters and seven affecting factors. These networks are then trained using the data patterns obtained from simulation because there are insufficient data available from industrial sources. The trained network is then incorporated as the computation engine of NN_earth. To engender confidence in the results of neural computation, a validation function is implemented in NN_earth to allow the user to apply the engine to historic cases prior to applying it to a new project. An equipment database is also implemented in NN_earth to provide default information, such as internal cost rate, fuel cost, and operator' s cost. User interfaces are developed to facilitate inputting project information and manipulating the

system. The major functions and use of NN_earth are illustrated in a sample application. In practice, NN_earth can assist the user either in selecting a crew to minimize the unit cost of a project or in predicting the performance of a given crew.

Keywords: artificial neural networks, back propagation, earthmoving, prediction, simulation, site operation.

1999, **17**(4), 473–482

On the issue of plan shape complexity: plan shape indices revisited

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Plan shape indices are based on the geometry of the plan shape rather than on empirical data, and are problematic as they embrace implicit assumptions that are not tested empirically nor justified theoretically. Empirical research using data in Hong Kong confirms that these plan shape indices are much poorer predictors of unit construction costs than the variables used to construct the indices. This study also develops a method for constructing a plan shape index that is free from the unjustified assumptions implicit in existing plan shape indices; it involves an empirical cost model. Different functional specifications of the cost models are tested. The result rejects the linear model and other special case models such as semi-log and log-linear models. However, the reciprocal model is not rejected. This result suggests that a linear plan shape index can predict the amount of floor area that can be constructed with a fixed sum of money better than the construction cost per floor area.

Keywords: building cost model, Box-Cox transformation, construction cost, design, plan shape.

1999, **17**(4), 483–492

Examination of relationships between building form and function, and the cost of mechanical and electrical services

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This paper describes analysis work undertaken to examine relationships between building function, building form and mechanical and electrical services cost, including the collection of raw data, and the transformation work undertaken to enable analysis. Relationships are identified between building form parameters, e.g. perimeter of external walls, gross floor area, storey heights, percentage of glazing, and the mechanical and electrical services costs for buildings of different functions (commercial, industrial and residential). There are relationships between the costs of the mechanical and electrical services installations and some building form descriptors, but the particular descriptors and the strength of the relationships vary according to the function of the building.

Keywords: building form, building function, cost planning, mechanical and electrical services, tender cost.

1999, **17**(4), 493–503

Age-dependent business failures in the US construction industry

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Age-dependent failure in the construction industry is explored over two 11-year periods (1973-1983 and 1984-1994) by analysing the age distribution of failed construction companies in each year and computing age-specific failure probabilities over a 10 year period (1985-1994). The conflicting perspectives of organizational theory are reconciled by taking advantage of the complementary nature of the adaptationist and organizational ecology theories while the effects of the characteristics of the construction industry are also considered. The research findings reveal an age-dependent business failure pattern in the US construction industry where the risk of failure increases initially with increasing age, reaches a peak point and decreases thereafter as companies grow older. Newness of a construction company, which implies lack of organizational l earning and lack of legitimacy, appears to be the main factor explaining this pattern.

Keywords: adaptation, business failure, construction company, inertia, learning, legitimacy.

1999, **17**(4), 505–517

Determining the causal structure of rework influences in construction

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One of the most perplexing issues facing organizations in the construction industry is their inability to become quality focused. As a result sub-standard products and services often emanate, which inadvertently result in rework. Typically,

rework is caused by errors made during the design process. These errors appear downstream in the procurement process and therefore have a negative impact on a project' s performance. The lack of attention to quality, especially during the design process, has meant that rework has become an inevitable feature of the procurement process, and the costs have been found to be as high as 12.4% of total project costs. Such costs could be even higher because they do not represent schedule delays, litigation costs and other intangible costs of poor quality. To reduce the cost and effect of rework, an understanding of its causal structure is needed so that effective prevention strategies can be identified and the effects of rework reduced or eliminated. A case study approach based upon deductive and inductive reasoning is used to identify the major factors that influence rework in projects. From the findings and with reference to recent literature, the concept of system dynamics is used to develop a series of influence diagrams, which are then integrated to develop a conceptual causal loop model that is used to determine the overall causal structure of rework. Once an understanding of the causal structure of rework events has been acquired, effective strategies for rework prevention can be designed and implemented in order to improve project performance. This paper contributes to study of quality in construction by capturing the complexity and dynamism of those factors that influence rework and project performance in a holistic manner.
Keywords: causal loop diagramming, quality management, rework, system dynamics.

1999, **17**(4), 519–527

Selection of mobile cranes for building construction projects

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The complicated process of selecting cranes for construction projects can be divided roughly into two main phases: (1) a general decision on the type of crane, mobile or tower; and (2) selection of the particular model according to the required size and technical specification. Several determinants of this second phase of the selection process in a typical mobile crane culture were investigated through on-site interviews with representatives of major construction companies. Factors affecting mobile crane selection were identified, classified, and rated according to their degree of influence. The involvement in equipment planning and crane selection was characterized with regard to project stages and planning parties. The findings were analysed with a view to the changing participation level of each party throughout project life. The conclusions of the study portray a picture that is different from the common assumptions about mobile crane selection, with respect to both influencing factors and the process itself. The study underlines the weight of non-project-specific factors, and shows that equipment planning is not merely a one-time technical exercise executed by a planner, but rather a process carried out throughout project life by a joint effort of several parties.
Keywords: building construction, crane selection, equipment planning, mobile crane, planning party.

1999, **17**(4), 529–536

Gate-keepers or judges: peer reviews in construction management

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Peer review has a momentous influence upon the lives of those who seek to publish, upon the credibility of an academic discipline and upon the way it develops. It is used widely within the academic community on the assumption that it encourages high standards of scholarly writing by providing an informed, fair, reasonable and professional opinion about the merits of research work. This paper reports an experiment which tested the extent to which peer review in construction management serves this function. The results indicate that the outcome of the peer review process is not significantly different from random, and that there is little consistency in the reasons advanced for rejection or revision.
Keywords: peer review, publication, research.

1999, **17**(5), 589–602

Modelling financial decisions in construction firms

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Some contractors predict their corporate cash flow on the basis of individual contracts without considering the relationships between the overall before-tax profit, risks, other crucial qualitative factors, or the allocation of resources within the company. Moreover, some contractors, in predicting their cash flow, focus only on the early-start progress in the project and their predictions of progress are too pessimistic, or result in the overuse of resource in order to make up for delays. In the present research a decision model is established for a contracting firm. It provides a methodical system for construction financial decision-making, and a way of solving a financial decision problem under qualitative and fuzzy circumstances. The model can be applied to the management of corporate cash flow, thereby facilitating the minimal use of resources. The information provided by the model allows the planner to eliminate excess use or idleness

of resources during the scheduling of a project. Financial forecasting may also suggest the best time to invest in a new project. Four projects for a medium size construction firm in Hong Kong were employed as case studies in order to evaluate the mathematical model. The cases involve two objectives: maximize profit margin and minimize construction risk (consider in a qualitative factor). The model leads to a compromize optimal schedule that provides the contracting firm with the optimal schedule for achieving optimal profit and construction risk by making optimal use of the contractor' s resources.

Keywords: cash flow, fuzzy, multiple-objectives, optimization, qualitative.

1999, **17**(5), 603–612

Effects of high pre-qualification requirements

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When designing a set of pre-qualification requirements, the first objective is to select the basic factors that are deemed appropriate to scrutinize, and the second objective is to establish the threshold for each of these factors to evaluate the capability and capacity of the bidders on a given project; together, these factors and the limits imposed on each constitute the basis for qualifying or disqualifying each of the bidders. To obtain the desired pre-qualification results and the consequent quality delivery of a project, both selecting the factors and determining the limits for each factor are crucial and must be given careful attention with due consideration of the prevailing environment (including market conditions, deadlines, need for technology transfer, etc.). In this study it was found that an improper design of pre-qualification requirements seriously affected the progress and cost of projects, provided opportunities for collusion, and encouraged the obtaining of contracts through improper practices. Based on an analysis of data from 30 Taipei Mass Rapid Transit projects, together with information gleaned from numerous interviews with contractors, consultants, and clients, it is shown that a risk-taking attitude by the Government and the establishment of relatively low pre-qualification requirements would be more conducive to achieving a desirable balance among (a) satisfying the schedule and sequence of contracting, (b) obtaining lower prices by an increase in competition, (c) procuring the timely del ivery of a quality project, and (d) fostering the growth of local contractors.

Keywords: economic development, government policy, pre-qualification, Taipei Mass Rapid Transit.

1999, **17**(5), 613–623

Private sector participation in infrastructure projects: a methodology to analyse viability of BOT

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Many developing countries are now attempting to finance new infrastructure projects through private sector participation. This paper outlines a methodology based on financial and risk analyses that a government or a government utility can use to analyse the viability of private sector participation in new infrastructure projects. The water supply projects in Sri Lanka are used for the case study to outline the methodology. Financial analyses of a bulk water supply project and a water distribution project are carried out to estimate subsidy percentages that are required to make the projects viable, using a model developed for the investment analysis of all types of infrastructure project. This analysis looks at four pricing options for the bulk supply project, and sixteen procurement options for the distribution project, from the view point of the utility, for three cases of non-revenue water (35% as base case, 50% and 25% as extreme cases). The risk analysis takes into account the risk and uncertainty in non-revenue water, cost and demand estimates, rate of debt and forecasts of escalation. These analyses show that the best option for the util ity is to obtain both bulk supply and distribution projects through private sector participation using BOT arrangements.

Keywords: BOT, developing country, financial analysis, infrastructure, investment, risk analysis, utility, water supply.

1999, **17**(5), 625–633

Matching housing supply and demand: an empirical study of Hong Kong' s market

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This paper has the objective of improving on the issue of forecasting new housing construction, and highlights differences between space demand and investment demand in housing markets. Further, it indicates how these differences will affect construction decisions. The first step is to identify the factors associated with estimating

residential property prices in Hong Kong, based on a demand-supply adjustment process. Specifically, this study examines the role of population growth, transaction volume, inflation and interest rate in determining house prices. Second, based on these estimations, a methodology is developed to estimate the investment demand schedule and new construction of residential property.
Keywords: housing demand, house price, Hong Kong, transaction volume.

1999, **17**(5), 635–646

Comparative analysis of pre-bid forecasting of building prices based on Singapore data

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An analysis is described of a sample of pre-bid forecasts for 181 Singapore building contracts awarded between 1980 and 1991 in comparison with previous research results in this topic. Despite the apparent contradictions that occur between findings, it is shown that such differences could be illusionary due to a general lack of reported significance levels together with, in some cases, small sample sizes. As a result it is suggested that a general commonality in outcomes may exist in the form of a single underlying variable.
Keywords: accuracy, building, estimating, pre-bid estimate, statistical analysis.

1999, **17**(5), 647–655

Important causes of delay in public utility projects in Saudi Arabia

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This study was conducted to determine the most important causes of delay in public utility projects, based on the frequency and severity of the causes. A survey of randomly selected samples of contractors, consultants, and owners was carried out to assess the frequency of occurrence and the severity of impact of sixty potential delay causes. A frequency index and a severity index were determined for each cause. An importance index for each cause was then computed as the product of the frequency and severity indices. The results showed that the three parties surveyed generally agree on the importance ranking of delay causes. The causes were grouped also into six major categories of delay. The analysis showed lack of agreement among the parties on the ranking of the major categories of delay.
Keywords: claim, delay, Saudi Arabia, time, utility project.

1999, **17**(5), 657–668

The application of JIT philosophy to construction: a case study in site layout

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The just-in-time (JIT) philosophy has been used in the manufacturing industry for some forty to fifty years. This system increased not only the productivity of the industry but also the quality of its products. Explorative studies have been completed in recent years to see how JIT can be applied into the construction industry to reap the benefits of the system. Most of these studies have concluded that it is possible to apply the techniques of JIT in the construction industry with some modifications. Taking into consideration that one of the key components of site management is concerned with waste management (i.e. bringing wastage down to the minimum), this study focuses on applying JIT for site layout to improve productivity and quality. By eliminating waste on site, controlling the movement of inventory coming into the site and within the site, and controlling the usage of mechanized plant and equipment, smooth work flow can be achieved.
Keywords: just-in-time, productivity, quality, site layout.

1999, **17**(5), 669–677

The practical application of delivery methods to project portfolios

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The rebirth of design-build, design-build-operate, and build-operate-transfer as viable alternatives for the delivery of major capital projects is symptomatic of dynamic changes in the relationship between producers and clients throughout the construction industry. In the private sector, these delivery methods offer clients the chance to shift emphasis towards core functions and away from real estate development and operations. In the public sector, where capital budgets are

constrained, delivery alternatives offer clients the chance to combine construction skills and technology to meet infrastructure needs in innovative ways. However, for those clients with numerous facilities and a steady flow of projects over long periods of time, a critical problem is emerging: how to effectively match each project in the portfolio to a preferred delivery method. This paper presents a tool called CHOICES, which permits convenient comparisons of alternative delivery scenarios for a portfolio of capital projects and services. CHOICES is designed to help formulate a portfolio infrastructure strategy, test that strategy, and adjust it to meet strategic goals within capital constraints.
Keywords: portfolio management, procurement method, project delivery.

1999, **17**(5), 679–687

Sustainability and the impact of Chinese policy initiatives upon construction

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The environment has been perceived as an international issue, and ways of attaining sustainability are becoming important for countries seeking sustainable development. The international community has been active in developing policy frameworks towards achieving the sustainability, such as an ecological modernization approach and environment assessment. Developing countries deserve special attention in the effort to make sustainability an operative criterion in their development activities. Given the difficulties that developing countries are facing, their perceptions of the concept and principles of sustainability differ in various contexts from those of developed countries, and the attainment of sustainability is much more difficult. Therefore, the establishment of a global partnership is important for the vision of sustainability to be realized and operationalized in the world. The current stage of economic development in China provides an opportunity to incorporate environmental provisions into the national development strategies from a relatively early stage, rather than attempt retrofit to strategies. However, at present China' s pol icy initiatives expressed in its Agenda 21 remains only a visionary concept. A comprehensive policy framework and realistic implementation measures are needed. The environmental impacts of the construction industry are extensive, particularly in developing countries. However, as in many developing countries, China' s sustainable construction is still at its primary stage and current practice is unsatisfactory.
Keywords: China, policy, sustainable development.

1999, **17**(6), 699–709

Responsibility, power and construction conflict

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Responsibilities in construction projects are not entirely predetermined by construction contracts. Many emerge arbitrarily from the resolution of power struggles between opposing interest groups who are trying to minimize their exposure to an unexpected resourcing demand. These struggles contain the seeds of conflict because those with relatively little power tend to emerge with relatively high levels of responsibility. For the weak, this inequality causes financial strain, anxiety, resentment, frustration and malevolence.
Keywords: authority, behaviour, conflict, contract, power, responsibility, risk.

1999, **17**(6), 711–720

Impact of employee, management, and process issues on constructability implementation

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This paper reports the findings of a study that examined five projects in which implementation of constructability concepts was viewed as a schedule reduction tool. The study attempted to determine the benefits, success factors, and implementation barriers across the case studies. The data suggested that adopting constructability concepts has the potential for significantly reducing the project delivery time compared with the historical performance of the participating companies. Success factors, implementation barriers, and lessons learned were viewed as management, employee, and process-related issues. These issues were ranked further according to their apparent significance in the cases studied. When such a ranking is verified by additional studies, the efforts of present and future implementations will focus on the issues that yield the highest payoffs.
Keywords: constructability, project delivery time, schedule compression, schedule reduction, time to market, value engineering.

1999, **17**(6), 721–730

The impact of change orders on mechanical construction labour efficiency

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Change orders impact many areas of a construction project. However, the impacts that change orders have on labour efficiency are much harder to quantify than other impacts and therefore are a significant risk to contractors. Little research has been completed in the past quantifying these impacts, so disputes are common between owners and contractors regarding the actual cost of change. This study used data from 43 projects to develop a linear regression model that predicts the impact of change orders on labour efficiency. The input factors needed for the model are (1) total actual project hours, (2) total estimated change hours, (3) impact classification, and (4) timing of change. The model calculates the labour loss in efficiency for a particular project so that owners and contractors will better understand the true impact of change on labour efficiency. The research is limited to the mechanical trade, but does include specific work in plumbing, HVAC, process piping, and fire protection.
Keywords: change order, labour efficiency, mechanical contractor, productivity.

1999, **17**(6), 731–743

To instruct or not? The engineer's dilemma

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A recent research project explored the sources of relatively higher value and/or more frequent construction claims in civil engineering projects in Hong Kong. Fourteen common sources of claims were cited to seek views from the industry as to the perceived frequencies, magnitudes and avoidabilities of claims from such sources. One of the significant sources was identified as `instructions not being issued', with reference to the provision in most standard civil engineering contracts that `the engineer' shall issue necessary instructions for the purposes of completion of the Works. The study reported here focuses on the possible responses of `the engineer' when the contractor requests instructions/information. Also the study examines the possible generation of construction claims therefrom. Eleven practitioners who were familiar with such matters were issued a questionnaire which described ten typical construction problem scenarios (cases) where contractors may request instructions. The responses are summarized and the basis for reaching each of these decisions is analysed. An example of the eleven detailed responses to one of the cases is presented to demonstrate the divergence of perceptions on each issue and the consequent different recommendations. Strategies to minimize the claims and disputes arising from such scenarios are developed, based on resolving the evident conflicts between the reasons for such divergences.
Keywords: claim, Hong Kong, instruction, engineer.

1999, **17**(6), 745–755

Applying fuzzy techniques to cash flow analysis

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Construction managers are interested in the direction of movement of cash flow at valuation periods rather than its forecast value, and fuzzy set theory applied to decision making might help in this process. Fuzzy models are particularly suited to making decisions involving new technologies where uncertainties inherent in the situation are complex. The problem of healthy cash flow at valuation periods relates to the proper estimation of cash in and out flows and project progress. The paper presents an alternative approach to cash flow analysis for construction projects. This project is based on the assumption that cash flow at particular valuation stages of a project is ambiguous. The paper discusses the weaknesses of existing methods for cash flow and establishes the need for an alternative approach. Using an example of 30 cash flow curves, the advantage of fuzzy cash flow analysis is demonstrated. Results of the analysis are presented and discussed. The model can be used to analyse the cash flow curve of projects at any progress period to make sure it is reasonable.
Keywords: cash flow, fuzzy technique, progress, valuation.

1999, **17**(6), 757–765

Survey of construction lawyers' attitudes and practicein the use of ADR in contractors' disputes

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Continuing a survey of contractors' perceptions about alternative dispute resolution (ADR) this paper seeks to report an investigation of the level of involvement of legal advisors to the construction industry in the dispute resolution process and the perceptions that legal professionals have about the use of ADR in construction disputes. The research findings are that contractors are likely to involve lawyers in the dispute resolution procedure, particularly when disputes concern a legal issue, when the parties to the dispute are entrenched in their argument, or when the other party insists on using legal professional assistance. In these defined circumstances, legal advisors will be influential in determining the potential use of ADR. The paper concludes that lawyers are unlikely to recommend ADR for most disputes between contractors, particularly if the dispute resolution process is perceived to involve the use of delay by main contractors, if the parties are fixed in their arguments or if they are exhibiting adversarial behaviour in their approach to the dispute. In these circumstances lawyers and their clients prefer the force of the formal systems over conciliatory ADR procedures.
Keywords: alternative dispute resolution (ADR), contractor, dispute resolution, lawyer.

1999, **17**(6), 767–776

A genetic-algorithm-based resource-constrained construction scheduling system

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Resources for construction activities are limited in the real construction world. To avoid waste and shortage of resources on a construction job site, scheduling must include resource allocation. A new resource-constrained construction scheduling system is proposed in this paper. A GA-based searching technique is adopted in the system. In this paper, new GA crossover and mutation operators, UX3 and UM3, are presented. These new operators overcome the drawback of traditional GA operators for sequencing problems. The system effectively can provide the optimal combination of construction duration, resource quantities and minimum project duration under the constraint of limited resources.
Keywords: genetic algorithm, multiple-objective programming, resource allocation, resource constraint, scheduling.

1999, **17**(6), 777–787

Development of a customer focused strategy in speculative house building

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The UK housing industry has been slow to adopt new working practices which have brought improvements in product quality and customer focused operations to many sectors of manufacturing industry. Instead, the dominant business driver has been land and house price inflation, with the market characterized by pronounced boom-and-bust cycles. Reports on the sector often have highlighted the need for research and action aimed at bringing about fundamental changes in its operations, both to satisfy social needs and benefit the companies in the industry. This paper examines the drivers needed for implementing new customer focused business processes in the sector. Of particular importance is the development of a product strategy based on an understanding and analysis of the market. Results are presented from a large market survey that was carried out, and their implications for the industry are discussed.
Keywords: house building, market research, mass customization, product development, strategy.

1999, **17**(6), 789–798

A non-results-based effectiveness index for construction site managers

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A method is presented for non-results-based effectiveness indexing of construction site managers (CSMs). The 52 competence element index is based on previous research on construction-specific competency elements and stakeholder assessment systems. The method was qualitatively assessed through industry focus groups and quantitatively validated through an empirical study. The performance of 61 Australian CSMs was evaluated by 329 peers, superiors and subordinates. The measurement tool successfully measured each individual' s level of ability on each competence element and produced an individual effectiveness score for each CSM. The application of the method resulted in the identification of three levels of effectiveness: a distinct and homogeneous `elite' group of very effective CSMs; a very

low performing control group of former CSMs; and a group of CSMs that are adequately effective. The development and validation of the method are provided, plus some insights into the characteristics of each of the groups identified.
Keywords: competence, effectiveness, index, site manager, stakeholder.

1999, **17**(6), 799–809

Quality practices in design organizations

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Design organizations play a major role in the construction industry: they are the media that transfer the requirements of the client to the contractor and ensure that they are met. Thus they need to provide a high quality of service to ensure that their client's project achieves the best possible standards of cost, time and quality. Seventy quality practices (QP) were identified as having a bearing on the quality of service provided by the local design organizations. These quality practices were grouped into fifteen sections termed quality sections (QS). The prevalence of these practices among the local design organizations was surveyed and determined. The results indicate a significant need for improvement in the quality sections 'working relationship' , 'employee training and education' , and 'performance quality audit'. The study reveals the need for the establishment of a design code, and evaluation standards for local design organizations.
Keywords: design organization, Saudi Arabia, quality practice

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1999, **6**(1), 6–3

The eLSEwise initiative

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Recognition of the importance of Large Scale Engineering (LSE) construction in the economics of Europe has resulted in the European Commission supporting the proposal for the eLSEwise project (Esprit 20876). eLSEwise is the European LSE Wide Integration Support Effort, which commenced in 1996 as part of the family of the 'User Reference Group' projects established by the European Commission to define the needs of the business users of ICT within several industrial areas. This paper describes the eLSEwise initiative and the approach adopted in identifying the LSE construction needs and the business processes that come together to allow an LSE project to evolve through the various phases of a project life cycle.
Keywords: information and communication technology (ICT), Large Scale Engineering (LSE), future vision.

1999, **6**(1), 7–20

Trends in world markets and the LSE industry

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The Large Scale Engineering (LSE) industry operates in a global market place and during recent years it has been the scene of major political and economic changes resulting in increasing market pressures. The paper outlines findings from Workpackage 1 of the European Union funded Esprit eLSEwise project. The eLSEwise project has an objective of contributing to improving the competitiveness of the European LSE industry. The paper focuses principally on trends in the LSE global industry market place and the challenges facing European LSE contractors in adapting to these changes. The paper outlines the research methodology; world market trends and LSE industry structure; critical success factors and enablers for LSE projects; the forces shaping the LSE industry and the necessary contractors' core competencies and competitive advantages for continued success.
Keywords: core competency, competitive advantage, globalization, international construction, Large Scale Engineering (LSE).

1999, **6**(1), 21–29

Emerging clients' needs for Large Scale Engineering projects

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In recent years the Large Scale Engineering (LSE) construction sector in Europe has seen profound change. This is mainly due to increasing competitive pressures from the United States and the Asian-Pacific countries which has led in turn to increased pressures to improve competitiveness, productivity and client satisfaction. Lack of understanding of client's requirements hinders achieving such goals especially with the increasing trends of executing LSE projects in a 'virtual enterprise' environment. Different parties within the construction process need to understand and fulfil client's business and information requirements. Information and Communications Technologies (ICT) vendors and developers also need to understand clients requirements of systems and to align their products to them. This paper reports on findings from a study within the eLSEwise project to identify the emerging clients' business and ICT needs within the LSE construction industry and to identify the changes in clients' relationships with the supply chain and the gaps in ICT provision.
Keywords: business processe, client requirements, eLSEwise, ICT, information exchange, large scale engineering.

1999, **6**(1), 30–37

ICT tools for improving the competitiveness of the LSE industry

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This paper describes an analysis of Product Data and Information Technologies (PDIT) which are available to support processes in Large Scale Engineering (LSE), particularly those which are construction related. Three main areas are addressed: supporting environment; systems and technologies; and application software. On-going and future developments in these areas are considered. The findings from each of the PDIT areas examined are presented, together with their potential opportunities for exploitation within LSE in construction. The perceived barriers to the adoption of such technologies are also addressed. Considerations are given to the most significant emerging technologies within the IT industry and the potential impact these may have on the business needs within LSE. The work was undertaken within the User Reference Project ESPRIT 20876-eLSEwise-European Large Scale Engineering Wide Integration Support Effort.

Keywords: information technology, Large Scale Engineering (LSE), product data technology, strategy.

1999, **6**(1), 38–50

Large Scale Engineering project process and user requirements

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This paper presents results from an analysis of Large Scale Engineering (LSE) project process conducted within the ESPRIT 20876 project 'eLSEwise'. The paper describes the LSE project processes, interfaces with business processes, the effects of the changing market place, and current process barriers. In searching how these barriers can be reduced or eliminated, the LSE industry information requirements and Information and Communications Technologies (ICT) requirements were explored.

Keywords: business process, project process, user information, information management, large scale engineering.

1999, **6**(1), 51–62

The eLSEwise vision, development routes and recommendations1

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eLSEwise is the acronym of ESPRIT project 20876 which investigated the Information and Communication Technology (ICT) needs of Large Scale Engineering (LSE) construction over the next 10 years. eLSEwise investigated the business needs related to market and client demands for change in the future delivery processes of LSE construction projects and how the constructors perceive their roles changing in response. It also undertook a state-of-the-art review of the existing and emergent technologies. From these investigations eLSEwise then postulated a vision how LSE construction projects may be delivered in the future, fully utilizing the benefits of emergent technology to satisfy the business needs. The project also considered how companies may progress from their present condition towards this future view, leading to basic development strategy. This paper presents the eLSEwise views of such a future. These findings are presented in three parts: the eLSEwise vision, development routes and recommendations.

Keywords: future vision, information technology, Large Scale Engineering (LSE).

1999, **6**(1), 63–70

Impact of Large Scale Engineering products and processes on society–the eLSEwise view

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The universal impact of Large Scale Engineering (LSE) projects is in evidence in diverse aspects of the personal and working lives of citizens around the globe. This does not only include the direct impact of the LSE product or facility but also encompasses the effects on society resulting from new ways of working. These new ways of working have been visualized by the eLSEwise (European Large Scale Engineering Wide Integration Support Effort) project as part of its postulated vision of how LSE construction projects may be delivered in the future, fully utilizing the benefits of emergent information and communication technologies to satisfy the business needs. This paper describes different effects on society resulting from LSE construction products and processes based on the eLSEwise vision and provides recommendations for ensuring that the benefits to society can be achieved.
Keywords: effects on society, eLSEwise, Large Scale Engineering (LSE), ORDIT.

1999, **6**(1), 71–77

An approach to infrastructure client projects

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eLSEwise is a User Reference Project under the EU ESPRIT programme. The objective of eLSEwise is to analyse the Large Scale Engineering (LSE) sector in terms of IT usage and business perspectives. Based on an analysis of the LSE sector today, the trends in the LSE world-wide market, the trends in the IT industry and a future LSE vision are defined. A 'road map' guiding the European LSE industry from where it is today to where the vision sets the goal 10-15 years ahead has been developed. This paper is about the approach adopted by the Danish National Railway Agency (DNRA) in dealing with infrastructure projects. DNRA represents one of the target business areas of eLSEwise: transportation. DNRA is the owner and manager of the Danish national railway infrastructure. Like most European railway companies DNRA is facing major changes, moving from monopoly into a profitable, self-sustained business. At the same time major infrastructure projects are planned and executed, aiming at the creation of a trans-European high speed network, and at the general revitalization of the European railway sector. After a presentation of DNRA's business and technical context and major current projects, the paper discusses the eLSEwise perspective of life-cycle oriented infrastructure management and the integrational aspects related to execution of a major infrastructure project and subsequent facility management. Finally, the paper identifies the major gaps between the current situation and the eLSEwise vision of life-cycle oriented total management of large scale engineering facilities like railway sections.
Keywords: Denmark, eLSEwise, infrastructure, integration, interoperability, Large Scale Engineering (LSE), life-cycle, management, railway.

1999, **6**(1), 78–87

Public sector client–private sector project: transferring the state construction administration into private hands

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Due to the decreasing public budget, the Bremen state construction and building administration is undergoing serious changes. Efforts made, for more than 10 years to tighten design and construction processes by implementation of information technology have not shown the intended results. It had to be admitted that the construction authorities had not yet structured all data necessary for the whole life cycle of buildings in a way which was suitable for IT use. The IT systems do not fulfil the requirements of continuous data documentation during the life cycle of buildings and construction. Finally, it was realized that the bureaucratic organization of the building authorities will not satisfactorily support efficiency. Those findings were the motives not only for joining the eLSEwise project (Garas and Hunter (1999) Engineering, Construction and Architectural Management) but, even more importantly, for the intended privatization of the construction administration in Bremen and other German States.
Keywords: geographical information system, ISYBAU, Germany, privatization, public construction administration.

1999, **6**(2), 91–104

Client briefing processes and procurement method selection: a South African study

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An effective client briefing process and the selection of an appropriate building procurement system both contribute to the attainment of client objectives with respect to time, cost and quality for construction projects. The present paper documents the results of an empirical study into the nature and effectiveness of the project briefing process, and the selection and effectiveness of procurement methods in the attainment of client objectives. A national questionnaire survey was administered to clients, architects, quantity surveyors, engineers, project managers and general contractors in South Africa. The results show that room for improvement exists in the manner in which project briefing is conducted and the manner in which procurement methods are selected.

Keywords: ECAMefing process, construction project, procurement method, South Africa.

1999, **6**(2), 105–111

A research model of project complexity and goal commitment effects on project outcome

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Essentially, performance evaluation is a human behavioural phenomenon involving a cognitive perceptual process. Project performance has two attributes, at least: (1) the individual's expected performance (manifested as assigned goals); and (2) the individual's perceived actual performance. Evaluation comprises the comparison of these two attributes. The present paper develops a research model for project outcome evaluation designed to examine the effects of the two moderators, goal commitment and project complexity, on the perceived project performance of project participants. It is postulated that: (1) there is a positive monotonic relationship between goal difficulty and performance, but that this is moderated by project complexity; (2) difficult goals lead to higher performance, but that this will happen only when the project participant is committed to the goal; and (3) the transferability of critical success factors to enhance/improve the performance of subsequent projects has to be examined and applied in the light of the effects of these two moderators on project performance.

Keywords: goal commitment, project complexity, outcome.

1999, **6**(2), 112–120

Management errors in construction

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Errors occur everywhere and research into inaccuracy has become an important area of study. Managers make errors, and the effects include poor safety, reduced quality, increased cost and decreased profit. Despite this, management errors have received almost no study. The present paper contains a review of the definition and causes of human errors, and discusses the applicability of these factors to managers and the effect of time pressure on decision making. The concept of management errors is proposed and a network-based project model is developed. This approach is used to simulate the occurrence of activity-based errors, and to determine the influence of pressure on management and the effects of inaccuracies on the project duration.

Keywords: construction duration, error, management, simulation, time pressure.

1999, **6**(2), 121–132

Using genetic algorithms to solve optimization problems in construction

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Genetic algorithm (GA) is a model of machine learning. The algorithm can be used to find sub-optimum, if not optimum, solution(s) to a particular problem. It explores the solution space in an intelligent manner to evolve better

solutions. The algorithm does not need any specific programming efforts but requires encoding the solution as strings of parameters. The field of application of genetic algorithms has increased dramatically in the last few years. A large variety of possible GA application tools now exist for non-computer specialists. Complicated problems in a specific optimization domain can be tackled effectively with a very modest knowledge of the theory behind genetic algorithms. This paper reviews the technique briefly and applies it to solve some of the optimization problems addressed in construction management literature. The lessons learned from the application of GA to these problems are discussed. The result of this review is an indication of how the GA can contribute in solving construction-related optimization problems. A summary of general guidelines to develop solutions using this optimization technique concludes the paper.
Keywords: genetic algorithm, optimization.

1999, **6**(2), 133–144

Application of artificial neural network to forecast construction duration of buildings at the pre-design stage

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The application of an artificial neural network (ANN) to forecast the construction duration of buildings at the predesign stage is described in this paper. A three-layered back-propagation (BP) network consisting of 11 input nodes has been constructed. Ten binary input nodes represent basic information on building features (i.e. building function, structural system, foundation, height, exterior finishing, quality of interior decorating, and accessibility to the site), and one real-value input represents functional area. The input nodes are fully connected to one output node through hidden nodes. The network was implemented on a Pentium-150 based microcomputer using a neurocomputer program written in C++. The Generalized Delta Rule (GDR) was used as learning algorithm. One hundred and thirty-six buildings built during the period 1987-95 in the Greater Bangkok area were used for training and testing the network. The determination of the optimum number of hidden nodes, learning rate, and momentum were based on trial-and-error. The best network was found to consist of six hidden nodes, with a learning rate of 0.6, and null momentum. It was trained for 44 700 epochs within 943 s such that the mean squared error (judgement) of training and test samples were reduced to 1.17×10□7 and 3.10×10□6, respectively. The network can forecast construction duration at the predesign stage with an average error of 13.6%.
Keywords: artificial neural network (ANN), back-propagation, duration estimation, Generalized Delta Rule (GDR), predesign stage, supervised training and testing.

1999, **6**(2), 145–154

Breakwater construction: an effective method for industrial waste utilization

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The Environmental Protection Bureau of Taiwan established the South Star Project in Kaohsiung, Taiwan, as a solution to two problems facing the city-the urgent need to dispose of industrial wastes and the need to increase land for the city. To embank land from the sea, breakwaters were constructed. The material used to construct breakwaters was a mixture of furnace slag (waste from the steel industry) and fly ash (waste from power plants). After constructing the breakwaters, the 'reclaimed land' was used as a landfill for construction and public waste. In the future, these reclaimed lands will be used for the development of a deepwater port or sea airport. Construction of breakwaters is a very repetitive process, and any improvements made would help contractors reduce the duration of the operation, improve efficiency in the process and thereby reduce costs. This paper discusses the process of breakwater construction and the utilization of industrial wastes for the concrete work on the project. Data collected from the first stage of the South Star Project is used in the modelling, simulation and analysis of the process, in order to examine the interaction between different resources.
Keywords: breakwater, industrial waste, productivity, reuse of waste material, resource, simulation.

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Decision-makers' perceptions in the formulation of pre-qualification criteria

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Contractor pre-qualification involves the establishment of a standard for measuring and assessing the capabilities of potential tenderers. The required standard is based on a set of pre-qualification criteria (PQC) that is intended to reflect the objectives of the client and the requirements of the project. However, many pre-qualifiers compile a set of PQC according to their own idiosyncratic perceptions of the importance of individual PQC. As a result, sets of PQC, and hence pre-qualification standards, vary between pre-qualifiers. This paper reports on an investigation of the nature of the divergencies of the perceived importance of individual PQC by different groups of pre-qualifiers via a large-scale empirical survey conducted in the UK. The results support the conclusion that there are significant systematic differences between groups of pre-qualifiers, with the individual PQC that contribute most to the differences being the method of procurement, size of project, standard of quality, financial stability, project complexity, claim and contractual dispute and length of time in business.

Keywords: contractor pre-qualification, decision criteria, discriminant analysis.

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The relationship between construction project management theory and transaction cost economics

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The process of managing the design and construction of a project on behalf of a client may be analysed using project management theory based on a contingency approach. The analysis provided by this approach, whilst useful for understanding the interaction of the parts of the system, the functions of project management and the effectiveness of the organization structure, may be limited by not incorporating an economic explanation of how a project organization structure is chosen. The transaction cost approach to the study of economic organization may provide a theoretical basis for such an explanation. This approach holds that an understanding of transaction cost economizing is central to the study of organizations as it determines whether functions are provided by the market or by hierarchy. This paper seeks to explore the relationship between these two powerful approaches in explaining the structuring and management of project organizations on behalf of clients and to explain the benefits of combining these approaches in furthering construction project management theory.

Keywords: client, consultant, contractor, project management theory, system approach, transaction cost.

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Differing site conditions risks: a FIDIC/engineering and construction contract comparison

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A new edition of the FIDIC Red Book is under discussion. It is an issue whether this edition should be based on the current edition or there should be a complete break with tradition in favour of a contract based on a new philosophy such as that of the NEC, which is reported to be used in many countries in circumstances in which the Red Book would otherwise have been used. This article compares the two contracts on the way they deal with site conditions issues. The comparison is on equity and clarity in risk allocation, adequacy of contractual procedures for dealing with unforeseeable conditions encountered, effectiveness of contractual machinery for dispute resolution, and compliance with reported new developments in successful contractual practices in underground construction. Studies highlighting the recurring frequency of claims for unforeseen ground conditions suggest a need for such particular attention to this aspect of construction. Although a desire for some equity in risk sharing is discernible in both contracts, there is room for improvement in the clarity of both contracts. Each contract has commendable features which are not present in the other. However, a better approach involves a combination of these features with full compliance of the reported modern developments in successful contracting practices.

Keywords: contract, site conditions, dispute, FIDIC, NEC.

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Architectural management: an evolving field

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The term architectural management has been in use since the 1960s and forms an essential part of this journal's title. However, the evolution of the architectural management field has not been a smooth affair, coming into, out of, and then back into fashion; and concise definitions continue to be illusive. Architectural management is a powerful tool that can be applied to the benefit of the professional service firm and the total building process, yet it continues to receive scant attention in the professional journals, seen as little more than a specialist interest. This paper charts the development of the architectural management field and takes a critical look at the field in relation to current research and its applicability to those who stand to gain the most from architectural management, the professional service firms. The paper concludes that architectural management is a cultural issue.
Keywords: architectural management, culture, definition, professional service firm.

1999, **6**(2), 197–212

Integrated models for construction planning: object flow and relationship

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Sharing and exchanging information between project participants are basic requirements for developing construction plans. An isolated construction planning knowledge-based system is no more useful and beneficial than any another 'island of automation' unless the integration with other construction applications are addressed. This paper proposes conceptual data and process models for a construction planning system, CONPLAN (Intelligent CONstruction PLANning), which works within a fully Integrated Construction Environment (ICE). An object oriented methodology (James Martin) has been used to establish generic construction models within which other construction applications can be integrated. This paper also introduces briefly the modularized approach that has been adopted to integrate the various construction applications over the project life cycle.
Keywords: building life cycle, conceptual model, construction planning, data and process model, integrated construction environment.

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Modelling cost-flow forecasting for water pipeline projects using neural networks

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This paper furthers work that already exists in the use of artificial intelligence techniques to forecast cost flow for construction projects. The paper explains the need for cost-flow forecasting and investigates the methods currently used to perform such a task. It introduces neural networks as an alternative approach to the existing methods. The relationship between the number of nodes used and the accuracy of the neural network in modelling the cost flow is closely examined. From this research an optimal solution is proposed for the case and a prototype system is developed. The results of the investigation of the number of nodes used and testing of the prototype neural network for sample cases are presented and discussed.
Keywords:

1999, **6**(3), 225–234

Risk management trends in the Hong Kong construction industry: a comparison of contractors and owners perceptions

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This paper reports a study carried out to compare the attitudes and perceptions of Hong Kong construction contractors and owners on the importance of various construction risks and also how the risks should be allocated between the parties to the contract. Data were collected by a questionnaire survey on industry professionals representing contractors and owners. Both the owners and the contractors have attached high importance to risk factors such as safety, quality and financial failures. Results also indicate a readiness on the part of the contractors to allocate a greater portion of risks to themselves.
Keywords: allocation, Hong Kong, importance, risk managementd.

1999, **6**(3), 235–255

The need for life-cycle integration of project processes

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The focus of this paper is on life-cycle objective-based project management systems in general, and SPMIS in particular. SPMIS (short for Smart Project Management Information System), has been designed: (a) to facilitate the employment of life-cycle objective-based project management approaches; and (b) to support concurrent engineering and construction, thus promoting greater integration of the processes under which projects are proposed and implemented. In order to validate the functions designed for SPMIS the authors undertook a detailed case study of a large capital project. The actual project management functions employed by the project team on the case project were researched and charted using the best current PM practices as the guide. While this field research shed light on the actual needs and requirements, the design of the SPMIS functions was approached from first principles in order to incorporate the basic shift from the traditional objectives of cost, time, and quality to life-cycle objective functions, such as return on investment, facility operability, and life-cycle integration. This paper describes the fundamental philosophy and framework for the development of life-cycle objective function-based project management systems in general, and contrasts these with the existing PM methods.
Keywords: capital project, consurrent construction, life cycle cost, project management, smart project management system.

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The development of a benchmark model that uses historical data for monitoring the progress of current construction projects

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Conventional methods of project duration control primarily rely on comparing contracts programs with actual progress. Detailed barcharts are often produced and progress is measured and recorded for monitoring by site based practitioners. Head office managers that are responsible for a group or groups of contracts running simultaneously depend on the reports generated on site for their control mechanism. There are many drawbacks in relying solely on site based reports, including concerns about accuracy, misrepresentation of facts, competence of site based staff, time taken to interpret these reports, etc. This paper develops and proposes the use of a new system that can be used as an additional tool whereby significant discrepancies in projects' progress performance can be highlighted. The system is based on stochastic models developed to simulate the cost commitment curves of traditional construction projects. The paper describes how the system is developed and how it can be used. The system has been developed as part of a pilot study to validate its usefulness in principle. Hence the factors used to distinguish projects characteristics were only based on broad terms. It is hoped that an improved model would be developed when more variables are considered and incorporated.
Keywords: benchmarking, cost flow, duration control, expenditure, stochastic model.

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Pre-bid building price forecasting accuracy: price intensity theory

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A theory of pre-bid building price forecasting accuracy is proposed, based on the heuristic bias framework and with reference to the common practice of basing building price forecasts on the price per square metre of floor area, termed here as Price Intensity (PI). The main prediction of the theory, that high PI contracts will be underestimated and low PI contracts will be overestimated, is tested by a re-analysis of a set of Singapore data and in comparison with previous work.
Keywords: accuracy, judgement bias, price forecast, price intensity theory.

1999, **6**(3), 276–286

The implications of environmental issues on UK construction management

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The paper identifies the broad environmental issues and legislation affecting the construction industry in the UK and goes on to place the environment firmly on the construction agenda, highlighting the major issues for concern. This paper summarizes work undertaken in five pilot studies. The work reveals that the consideration of environmental issues within a framework related to the construction process facilitates the allocation of management responsibility within the construction team. The illustrative representation of this framework forms a prototype decision-making strategy for use in construction procurement and methods for incorporating environmental issues into every day construction management are proposed.
Keywords: contractor, designer, project manager, quantity surveyor.

1999, **6**(3), 287–298

Evaluation of factors affecting time and cost performance in Hong Kong building projects

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Time and cost are usually critical to construction clients. Given the many contributory factors, improved quantitative models of time and cost may help clients to predict project outcomes at the outset, and also at different stages of the project life span. These can also help to compare deviations in significant contributory factors, and to suggest corrective actions. Multiple linear regression (MLR) and artificial neural networks (ANN) were applied in developing such quantitative models in a research project based in Hong Kong. A comparative study indicated that ANN had better prediction capabilities than MLR by itself. Significant factors identified through quantitative models developed, indicated that time over-run levels were mainly governed by non-procurement related factors (e.g. project characteristics and client/client representative characteristics), while cost over-run levels were significantly influenced by both procurement and non-procurement related factors (e.g. project characteristics, client/client representative characteristics and contractual payment modalities). A parallel approach yielded interesting comparisons of the variations of mean time and cost over-runs, when comparing groups of projects using different procurement sub-systems, from the Hong Kong sample.
Keywords: artificial neural network, multiple linear regression, non-procurement factor, performance, procurement.

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Design/construction integration: issues and illustrative prototype

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The architecture, engineering and construction (AEC) industry is epitomized by a wide range of project business lines, different project scopes, unique client requirements, and a rapidly changing automation technology. This current scenario requires a constant transfer of project data among the various professionals representing different specializations, project phases and interests. The implementation of improved computer techniques such as object-oriented programming and CAD reduces fragmentation and enhances the efficiency of integrating project data through all stages of generation, sharing, maintaining, and updating. This reduced fragmentation will assist in bridging the gaps

between and within the project phases, thereby increasing the competitiveness of the AEC industry. This paper presents different issues related to the existing fragmentation in the AEC industry and the challenges and approaches to achieve a meaningful and smooth integration. The paper describes the development of ODCSI-an object-oriented design/construction system for integrating CAD and construction software applications. The system architecture captures design data in an object-oriented project model and acts as an intelligent CAD interface. In the hierarchy of object-oriented classes and subclasses, the design data are inherited; hence all functional, geometrical, structural, construction management, and construction engineering functions are shared across class boundaries. These design data are used as the input to various computer-based construction software applications, hence providing seamless project integration.
Keywords: CAD, design aggregation, object oriented programming, project management.

1999, **6**(3), 315–328

Neural network model for contractors' pre-qualification for local authority projects

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The way in which clients or their consultants undertake to select firms to tender for a given project is a highly complex process and can be very problematic. This is also true for public authorities as, for them, 'compulsory competitive tendering' is a relatively new concept. Despite its importance, contractors' pre-qualification is often based on heuristic techniques combining experience, judgement and intuition of the decision-makers. This, primarily, stems from the fact that pre-qualification is not an exact science. For any project, the right choice of the contractor is one of the most important decisions that the client has to make. Therefore, it is envisaged that the development of an effective decision-support model for contractor pre-qualification can yield significant benefits to the client. By implication, such a model can also be of considerable use to contractors: a model of this nature is an effective marketing tool for contractors to enhance their chances of success to obtain new work. To this end, this work offers a decision-support model that predicts whether or not a contractor should be selected for tendering projects. The focus is on local authorities because, in the absence of a viable universal selection system, there are significant variations in the way they conduct pre-qualification. The model is based on the use of artificial neural networks (ANN) and uses data relating to 42 local authorities (clients). With the aid of a questionnaire and a scaling system, the pre-qualification attributes that are considered to be important by clients are identified. The survey indicates significant variations in the level of importance given to different attributes. Statistical methods are adopted to generate additional data representing disqualified instances. Following a pre-processing exercise, the data form the basis of the input and output layers for training the neural-net model. An independent set of data is subjected to a similar pre-processing for testing the model. Tests reveal that the model has a highly satisfactory predictive accuracy and that the ANN technique is a viable tool for the prediction of success or failure of the contractor to qualify to tender for local authority projects.
Keywords: artificial neural network, decision-support system, local authority, marketing, modeling, pre-qualification, tendering.

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Private Finance Initiative (PFI): UK construction industry response

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Few initiatives within United Kingdom (UK) construction have received as much publicity as the Private Finance Initiative (PFI) since it was launched in 1992. The Government, while keen to highlight the amount of project work that has resulted from PFI, has also had to admit that there have been many administrative problems in the implementation. The Construction Industry, while initially interested because of the potential workload, has continued to express doubts about the likely success. This paper examines the history of PFI, and the reasons for the problems. Risk bearing is identified as a major factor and proposals are put forward which may alleviate some of the concerns of the industry.
Keywords: partnership, PFI, private finance initiative, procurement, risk, tendering.

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How innovative is the common law of tendering?

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Traditional design-by-owner remains an important procurement option despite the advances made by design-build in recent years. Contractor-led innovation is important and desirable in both procurement options, yet traditional design-by-owner procurement processes prevent, restrict or even discourage such innovation. Developments in common law are revealed which result in contractual obligations for the procurer which might further inhibit innovation, as the procurer becomes obliged to treat all tenderers equally and fairly.
The theory of the tendering contract is introduce and the problems for the procurer discussed when presented with a non-conforming alternative tender that offers a significant cost-saving against conforming tenders. However, if accepted, puts the procurer in breach of contract to at least one aggrieved tenderer. The conclusion is reached that in order to properly consider alternative tenders without failing in its obligation to treat all conforming tenderers equally and fairly, the owner must make specific provisions within tender conditions which create the power to consider alternative proposals. The owner must also define the permitted scope of such alternatives, and set evaluation criteria and any relevant weighting of criteria which will be applied in a contract evaluation and award process. The owner needs to strike a balance between, on the one hand, restricting or inhibiting innovation, and on the other, permitting such a wide scope of innovative proposals that the solution adopted bears no relationship to the original project for which tenders were invited.
It therefore becomes important for the procurer to design the tender process rules so as to encourage contractor-led innovation, yet at the same time place some limit on the scope for such innovation. The limits must be such that the project delivered is still the project for which tenders were invited. A contract awarded to one tenderer for a product quite different from that which was tendered for probably results in the procurer's breach of the tendering contract' and consequent liability to pay damages to the other injured tenderer(s).
Keywords: competition, design innovation, obligation, procurement, tendering.

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Strategies to remove or alleviate constraints affecting the processes of construction procurement in Malaysia

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This paper is focused upon the development, appraisal and validation of strategies to remove or alleviate the constraints identified in resources and functions within the processes of construction procurement in Malaysia. This is achieved by the development of methodologies for this purpose, which could be repeated in time or adopted in other countries. Respondents in the study were Malaysian organizations involved in the processes of construction procurement in Malaysia. A range of strategies was identified which could be implemented to remove or to alleviate the constraints identified in construction procurement processes. In supporting the proposed strategies, respondents emphasize the important role of government in implementing the strategies to ensure that sufficient importance is given to the strategies and that adequate pace is achieved in their implementation.
Keywords: procurement, Malaysia, strategy.

1999, **5**(1), 58–75

Conflict management and construction project effectiveness: a review of the literature and development of a theoretical framework

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A theoretical model is developed for the investigation of the relationship between construction project effectiveness and the style that project managers adopt when handling conflict. The research method uses 35 case studies in Saudi Arabia, all of them are sponsored by one client: the General Directorate Military of Works/ Ministry of Defence and Aviation (GDMW/MODA) in the Kingdom of Saudi Arabia (KSA). The research seeks to test the relationship of project performance measured by time, costs, quality, conflict intensity, conflict resolution method, and intensity of construction effort. This performance is then linked to the project managers' conflict handling styles. Project managers are employed by (GDMW/MODA) and their contractors. It is hypothesized that project managers who exhibit a conflict management style that seeks to integrate the parties to the contract will run more effective projects.
Keywords: conflict management, project manager, project performance, Saudi Arabia.

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Risk and risk management in construction projects: concepts, terms and risk categories re-defined

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Understanding of risk and risk management in the construction industry is erratic. An attempt is made to redress this situation by reviewing the concepts of risk and uncertainty and by re-defining the terminology. The preferred definition of risk is that it is the probability that an adverse event occurs during a stated period if time. The main context for construction risk management is found to lie in the decision-making aspects of building procurement. A source-based approach to categorizing construction and project risks is proposed, with natural and human systems as the two primary source, categories. Human risks comprise events or actions originating in humanly devised systems are further categorized as social, political, economic, financial, legal, health, managerial, technical, or cultural sources of risk.
Keywords: procurement, project management, risk, risk analysis, risk management, uncertainty.

1999, **5**(2), 88–98

Factors facilitating faster construction

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Parallel investigations sought critical contributors to faster construction in Hong Kong, within three different building sub-sectors viz. public housing, public non-residential buildings and private sector buildings. Previously identified contributors as noted both from the international literature and from Hong Kong construction projects in general, were supplemented by preliminary interviews of industry experts. The foregoing helped to decide on the different target groups and questionnaire structures for each category. The responses are consolidated within each category using 'Relative Importance Indices'. The more important factors and 'factor categories' are identified, e.g. the 'fast information flow' factor in public non-residential buildings and the 'organization and co-ordination between project teams' factor category in 'public housing' construction. Different factors and factor categories are found to be more important within the three building sub-sectors. Comparisons are also made with the factors that emerge as significant (e.g. 'information flows', 'informal communications' and 'speed of decision making) from a model to predict public housing construction durations that was developed in another parallel study. Strategies for faster construction must focus on such factors that are found to be more significant in particular construction scenarios.
Keywords: duration, Hong Kong, speed, time.

1999, **5**(2), 99–117

Application of analytic hierarchy process to the evaluation of logistics factors and their contribution to improvements in construction materials supply

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As the most important element among logistics elements is customer service, all logistics activities should ensure the highest level of customer service at any given total cost of materials supply. Achieving efficiency and cost-effectiveness in materials supplies at any preferred level of customer service involves trade-off decision-making among various logistics elements. Thus, managing construction materials efficiently requires an understanding of elements that contribute most to customer service. An evaluation of the importance UK contractors attach to the contribution of various logistics factors to improved customer service in the supply of construction materials has been presented. The analytic hierarchy process was used to quantify the subjective assessment made by contractors on the contribution of various logistics factors to overall improved customer service. The general view of surveyed buyers was that improving contractor-supplier relationships would contribute more to improved customer service in the supply of construction materials by ensuring better reliability, cost -effective sources of supply, increased flexibility, improved lead times and greater value-added service. Traditional elements (such as capability of suppliers (viewed in terms of financial strength, technical ability, and experience), administrative and management ability, quality management systems, quoted prices and locations in relation to projects) were also considered important. The interviewed buyers considered information and communication technologies to have less influence in improving customer service, as were health and safety, and environmental records of suppliers.

Keywords: analytic hierarchy process, material, customer service, logistics.

1999, **5**(2), 118–128

Restructuring the building industry for improved performance

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A fundamental restructuring of the building industry is needed. This is due, firstly, to the observed problems in the present practice. Secondly, it seems that the future business environment will present such challenges that the prevailing organization will not be able to rise to them. This paper suggests some changes to the industry's organization and operational modes, and argues why they need to be made. The suggested changes are based not only on the problems of present practice but also on different general development trends and phenomena of the market and society in general. The main motivation for the change is to accelerate development in the building industry.
The solution was arrived at by the gathering, analysis and synthesis of various actual ongoing development programmes in the building industry worldwide. It offers the best potential for improving the quality, productivity and innovativeness of construction.

Keywords: building process, development, future, innovation, organizing, project.

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Quality issues in building project price forecasting: factors affecting model selection

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Clients considering the procurement of sustainable building projects as solutions to their accommodation problems are involved in making value-for-money business decisions. One dimension of such decisions is the need to take account of good quality early stage building project price advice. Quality in terms of the provision of early stage building project price forecasts for clients is explored in this paper, and a broader, more multi-stranded approach is advanced that will help to put current research efforts on the development of more accurate price forecasting models into context. In particular, the paper addresses one of these identified research themes, namely the selection of appropriate building project price forecasting model(s) for use. The extent to which practitioners fail to understand price-forecasting models is assessed in terms of the extent to which this creates a barrier to model selection. This is done by reference to the results of a large-scale quantitatively based study that was carried out with over two thousand three hundred practitioner organizations in England. Other, more positive criteria are identified that are suspected as affecting model selection. It concludes by developing a rudimentary framework within which the more influential of these selection criteria can be identified. It is anticipated that the eventual development of a tool to aid model selection by practitioners will contribute towards the provision of better quality building project price advice for clients.

Keywords: forecasting, price advice, modelling, quality, research theme.

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Updating techniques for cumulative cost forecasting on construction projects

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The use of standard cost/value flow curves (S-curves) in cash flow forecasting has been questioned by many construction management researchers. This is mainly due to the limited accuracy of these curves. This issue is addressed by analysing the cumulative cost flow curves of 128 construction projects. Cost flow profiles vary significantly even when projects are classified using effective criteria. Consequently, two new techniques that are capable of using cost/value flow data of current project are proposed to forecast (update the forecasts of) the remaining, future monthly values of these projects. The two techniques are tested for accuracy using eight recently completed projects. It is concluded that one of the techniques performed accurately and that it should be adopted by the construction industry.

Keywords: correlation model, cash flow, cost-flow curve, expenditure pattern, forecasting.

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Partnering performance in Australia

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The concept of partnering was introduced into the Australian construction industry as one of the key elements of the reform strategy formulated and driven by the Australian Government. This paper assesses the performance of partnering based on three recent Australian research studies. The results of these studies are presented in both quantitative and qualitative terms. They provide a useful overview of partnering performance in the Australian construction industry. The findings suggest that partnering has significantly improved the performance of projects by lowering the frequency of disputes and by reducing project cost growth.

Keywords: Australia, cost, dispute, partnering.

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Partnering: the propaganda of corporatism?

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A critical perspective on partnering is developed with reference to current concerns regarding the increasingly corporatist nature of global capitalism. Many leading clients advocate partnering as a means of improving customer responsiveness and ensuring continuous improvement. The seductive rhetoric of partnering too often serves only to disguise the crude exercise of buying power. In the UK, the four largest supermarket chains are all leading advocates of partnering. Ironically, the grocery sector has attracted sustained public criticism regarding its exploitative supply chain management practices. Evidence suggests that the resultant savings are not automatically passed on to customers. Despite these concerns, the large supermarkets continue to preach 'customer responsiveness' to a seemingly gullible construction industry. It is argued that the doctrine of customer responsiveness ultimately owes more to corporatist propaganda than to progressive management policies. The buying power of the industry's major clients continually discourages dissent to the partnering ideal. Construction companies that are not similarly committed risk being denied access to a substantial proportion of the UK market. The increasing influence of industry on the construction research agenda also discourages academics from challenging the legitimacy of partnering discourse. There is an urgent need for research which is independent of commercial vested interests.

Keywords: continuous improvement, corporatism, critical theory, customer responsiveness, partnering, technocratic totalitarianism.

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Procurement lessons from Solomon's temple project

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The search for new ideas capable of improving the procurement of facilities is continuing. New systems and methods are being developed within the industry and others are being adapted from other industries. There is general agreement that adversarial relationships are not beneficial and, as such, they should be avoided. Consequently, design and build and other partnering systems are in vogue. In this paper, it is argued that the industry can learn lessons from history. The Jerusalem temple built by King Solomon is a classic example of a project executed to the satisfaction of all the

parties involved. The project was executed in an atmosphere of trust, good organization, recognition of expertise and good communication, thus providing valuable lessons that may help in improving harmony on today's projects.
Keywords: culture, communication, expertise, relationship, trust.

1999, **5**(2), 197–210

Future challenges in construction management: creating a symbiotic learning environment

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The next wave of industrial development will necessarily incorporate the adoption and utilization of innovative technological processes and developments, and see the emergence of highly focussed organizations capable of exploiting transient and niche markets. This environment demands a responsive and dynamic construction industry with the diversity to cope with and initiate change, which is capable of employing a range of approaches to the procurement and delivery of construction projects. A research study was initiated in late 1996, the aim of which was to test the hypothesis that the level of innovation is higher on projects where the client actively imparts knowledge gained from the global arena to the contracted parties involved in the construction procurement process. The study examined the role of the client and the main contractor and the nature of the relationship between these two parties. Overall the study indicates that the level of innovation and the ultimate success of a project is highly dependent on four key factors: the client's recognition of the need for innovation; contractual incentives to encourage innovation; creation of symbiotic learning environment; · open communication at all levels. Rather than one party being passive in the process, the studies suggested that the two parties assumed a symbiotic relationship, where each gained from the knowledge and experience of the other. Moreover, in these instances, rather than driving innovation the principal role of the client was to create an environment conducive to innovation and learning. Given this scope and the freedom to innovate, the main contractor would capitalize on these opportunities, once again to the benefit of both parties.
Keywords: culture, innovation, learning.

1999, **5**(2), 211–220

Procurement as a learning process

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The way in which people learn from experience and conduct experiments in self-improvement has been analysed by many writers. In particular, Kolb's learning cycle and the single and double loop learning postulated by Argyris and Schon has been used to explain how learning takes place in organizations. Creating the 'learning organization' is a current preoccupation of management theory and practice. With few exceptions little of this accumulated knowledge about learning in organizations has been applied within the project context and even less within the construction project situation. This paper will argue that different procurement paths encourage or discourage different types of learning. For example, the traditional design-tender-build method based on competitive tendering does not allow original design concepts to be challenged by the builder and therefore prohibits double loop learning. Equally, learning from experience can only occur where there is opportunity to reflect on those experiences and compare them with mental models, which is then followed by experimentation; design and build methods may allow this to occur, as may some of the management methods of procurement. Partnering is clearly a vehicle for experiential learning. The link between learning and project performance is also discussed and the need for a new role of Learning Facilitator is argued. It is vital that we understand the link between learning and procurement if we are ever to improve the efficiency and effectiveness of construction projects.
Keywords: learning, organizational learning, procurement, project.

RICS: Volume 3

1998, **3**(1), 1–22

Meeting the requirements of the Granada Convention: a review of policy for the protection of the architectural heritage in the Republic of Ireland

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This study examines the situation regarding the protection of the architectural heritage of the Republic of Ireland against the framework of the Convention for the Protection of the Architectural Heritage of Europe (1985) (the Granada Convention). The Granada Convention sets out a basis to achieve greater unity between member states of the Council of Europe for protecting and preserving their common heritage. The architectural heritage is recognised as an irreplaceable expression of the quality and diversity of Europe's cultural heritage. Three conditions are required to be met by the Convention which are signified by the date of signature, the date of ratification and finally the date upon which the terms of the convention are brought into force. The Republic of Ireland signed the convention in 1985 but it was not until January 1997 that the terms of the convention were ratified. Little progress has been made towards developing an effective administrative and legal basis to protect the architectural heritage until a recent policy review. Despite this, action has been slow. Work has commenced on the development of a national inventory of architecture, but the formulation of new legislation and measures to provide financial support are still under debate. This paper examines the machinery for the protection of the architectural heritage in Ireland, making a critical review of the situation in practice in Dublin and according to national and local policy issues. It considers the operation of listed building control and preservation policy for buildings of 'artistic, architectural or historical interest' including ancillary measures such as financial support and the operation of conservation policy against the backdrop of negative legislative powers. In the light of increasing condemnation of weak conservation policy, recommendations to place the system for protecting the architectural heritage on a stronger statutory footing are considered for the purpose of bringing into force the terms of the Granada Convention. In summary, statements concerning the current situation and actions required to fulfil the terms of the convention are presented.
Keywords: Granada Convention, heritage, preservation, Republic of Ireland.

1999, **3**(2), 1–24

A critical examination of the designer's role under the ICE design and construct conditions of contract and the Highway Agency's design and build conditions of contract

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The remarkable growth of design and build within the building industry since the introduction of JCT 81 has only now led to a similar trend within civil engineering in the 1990s. The recent introduction of both the ICE Design and Construct Conditions of Contract and the Highways Agency's (HA) Design and Build Conditions of Contract has served to address the previous deficiency. The results of the research indicated that the HA designers had far more responsibility than their ICE counterparts because of the supervisory and certifying role that is demanded by the Agency, whereas the ICE designers need not be site-based at all. These differences had a significant effect on the way in which contracts were operated, in particular with respect to the number of design representatives required to be permanently site-based. For each of the five HA contracts investigated, a permanent site presence was provided by the designer and the number of site representatives was equivalent to that of the Resident Engineer's staff on a traditional contract. In contrast, a permanent site presence was only considered necessary on the larger two of the three ICE contracts investigated and even then only a single representative was provided.
Keywords: civil engineering, contract, design, design and build, responsibility, role, UK.

1999, **3**(3), 1–34

Adjusting comparable capitalization rate evidence: guidance for practitioners

David Parker
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The process used by property practitioners to adjust evidence, derived from the analysis of comparable sales, for use in the assessment of the capitalization rate for valuation purposes is contended to be subjective, informal and heuristic, contributing to a sub-optimal level of variability in capitalization rate determination which, it is further contended, may be reduced through the use of a deterministic approach. The determinants of the capitalization rate are identified through a literature review and an explanatory algebraic equation is proposed. Through a survey of an expert panel of property practitioners, the requisite data is collected for a sample of office properties in the Sydney Central Business District (CBD) and analysed, using cross-sectional multiple regression analysis, to produce an econometric model. When tested on a further, independent, sample of Sydney CBD office properties, the econometric model is found to produce a lower level of variability in capitalization rate assessment than that found from the expert panel using the currently advocated process. It is, therefore, contended that when seeking to adjust capitalization rate evidence for office investment property, the practitioner should have greatest regard to the relatives of the quality of the location, building attributes, occupancy level and occupant credit quality characteristics with the adoption of a deterministic approach advocated to contribute positively to the efficiency of the property investment market, valuation accuracy and the incidence of professional negligence claims.

Keywords: capitalization rate, property investment, valuation.

1999, **3**(4), 1–22

Construction demand modelling: a systematic approach to using economic indicators

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The published literature abounds with evidence of a close relationship between the construction industry and the national economy. This study reinforces the strength of this relationship by advocating the use of economic indicators to model demand for construction. A systematic approach is proposed to identify and select economic indicators that relate to construction demand. It involves four distinct stages and they are: (1) theoretical identification; (2) data collection and pre-processing; (3) statistical selection; and (4) usage. This stage-by-stage process is illustrated on residential, industrial and commercial-type construction in Singapore. To validate the approach, regression models are built for residential-type construction to generate ex-post forecasts. The findings confirm that, firstly, demand In the construction industry is significantly related to a wide range of economic measures and, secondly, the models are able to produce accurate forecasts that satisfy the acceptable limit of 10% mean absolute percentage error. Implications for future work in demand modelling are highlighted and discussed.

Keywords: demand, modelling, Singapore.

1999, **3**(5), 1–94

Computerized maintenance management systems: a survey of performance requirements

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The role that computers play in the management of property maintenance has increased, both with the development of the technology and as a result of changes in the way that property is managed. Yet their impact has fallen short of the industry's expectations and of their true potential. This report provides information on what current users believe to be essential or desirable attributes of such systems, and indicates the current state of art or industry benchmark for current systems in terms of both performance and functionality. The benchmarks are based on an evaluation matrix methodology, which was used in conjunction with a substantive questionnaire survey of maintenance managers, to identify and evaluate the importance and performance of key computerized maintenance functions. This method may also be used to identify system attributes or functions when commissioning new computer systems from software developers. The performance of computerized maintenance management systems was evaluated and areas of weakness were identified. The report concludes that, while certain aspects of computerized maintenance management systems appear to be performing well, others need significant improvement if the full benefits are to be realized. The report also outlines a practical methodology that may be used by maintenance managers to evaluate current and potential computerized maintenance management systems.

Keywords: information technology, maintenance management, survey.

2000, **3**(6), 1–28

Can building form and function be used to predict the costs of mechanical and electrical services?

L Swaffield, C Pasquire and A Tyler
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This paper discusses existing methods of pre-design cost estimating for the mechanical and electrical (M and E) services elements of building projects. The research examined the parties involved in the early cost advice process, the information used and generated, and the relationships between building form, function, and M and E services costs. The authors found serious deficiencies in the availability, format and detail of cost information for M and E services, which prohibited further advances to research in this area. It concludes that there are relationships between building form and function and M and E service costs, but qualifies this by saying that the influence of M and E services quality could not be examined, due to lack of suitable qualitative data.
Keywords: cost, services, pre-design, estimating, mechanical and electrical services.

2000, **3**(7), 1–40

Urban renewal in Hong Kong: the record of the Urban Development Corporation

D Adams and B Hastings

The authors evaluate the record of the Land Development Corporation, established by the Hong Kong Government in 1988 to undertake, encourage, promote and facilitate urban renewal. Following a brief historical review of urban development and renewal in Hong Kong, the paper summarizes the reasons for the establishment of the Corporation. From detailed examination of the Corporation's first two phases of projects launched in 1988 and 1992, the paper identifies three crucial institutional weaknesses which have undermined the LDC's capacity to promote urban renewal. These are official powers and procedures, the contradiction created by seeking to assemble redevelopment sites in multiple ownership principally through negotiation, and the problem of relocating existing occupiers of redevelopment areas. The paper argues that the British administration's review of urban policy in the mid-1990's insufficiently addressed these weaknesses. It suggests, in conclusion, that if the pressing need for comprehensive restructuring and renewal of older Hong Kong is to be taken seriously by the Government of the new Special Administrative Region, then it will be necessary both to ensure proper organizational arrangements for urban renewal and to accord social and environmental considerations equal importance to financial demands in urban policy.
Keywords: Hong Kong, urban design, urban regeneration.

2000, **3**(8), 1–10

Surveying flood damage to domestic dwellings: the present state of knowledge

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The authors present a critical review of existing knowledge in respect of surveying flood damage to domestic properties and subsequent specification of required repair works. The aim of the investigation is to highlight the need for greater standardization in respect of these issues. The authors confirm that definitive benchmarks, against which repair work could be objectively gauged, do not exist. At present, surveyors rely predominantly on experiential judgement and, while providing direction, the available literature tends to over-generalize. Key findings are: there is considerable emphasis on surveyors' individual subjective opinions towards what construction repair work is required for any given flood damage scenario; 'standard' and 'scientific' guidelines for necessary flood damage repair specification do not exist; previous research into the surveying and repairing of flood damaged properties has largely ignored significant influencing factors including the duration of a flood, the possibility of floodwater contaminants, the velocity of floodwater through or on, a building; contradiction in the literature regarding recommendations for the drying of flood damaged buildings. In view of these observations, the authors highlight a need for further research in this area. Procedures need to be developed to assist the insurance industry, the construction refurbishment sector and the surveying profession to manage the repair of flood damaged properties in a more standardized manner.
Keywords: damage, flood, housing, surveying,

List of relevant journals

–A–

AIA Journal of the Academy of Architecture for Health

Editor(s): James G Easter Jr
Editor(s)'s Affiliation: American Institute of Architects
Editorial Board: National (USA)
Peer Reviewed: ?
Coverage: Subjects of interest to AIA-AAH members and to others involved in the fields of healthcare architecture, planning, design and construction.
Frequency: annual
Publisher: AIA
Web site address: http://www.e-architect.com/pia/acadjour/general.asp/
Source: web site
Last updated: 13 April 2000.

American Professional Constructor

(1971–)
Editor(s): David W Goodloe
Editor(s)'s Affiliation: ?
Editorial Board: National (USA); plus one chapter in Ontario, CA, and one in Hong Kong in process.
Peer Reviewed: Yes
Coverage: Articles on technical and management issues for the professional contractor.
Frequency: ?
Publisher: American Institute of Constructors
Web site address: http://www.aicnet.org/Publications/journal.htm/
Source: web site and Ulrich's.
Last updated: 13 April 2000.

Architecture Australia

(The official magazine of the Royal Australian Institute of Architects)
Publishing assistant: Ian Close; publisher@archmedia.com.au
Editor(s): ?
Editor(s)'s Affiliation: ?
Editorial Board: None
Peer reviewed: No
Coverage: Reviews of recent commercial and public buildings and new houses in Australia or designed by Australian architects for construction overseas. Features commentary on urban design and architectural theory by the profession's leading opinion-makers. Supplies latest information on architectural competitions, designs for major projects, books, exhibitions and conferences.
Publisher: Archmedia
Frequency: bi-monthly
Web site address: http://www.archmedia.com.ac
Last updated: 13 April 2000.

Architectural Record

(1891-)
Editor(s): Robert Ivy; rivy@mcgraw-hill.com
Editor(s)'s Affiliation: American Institute of Architects
Editorial Board: ?
Peer Reviewed: No
Coverage: The leading professional magazine edited for architects, project owners and their consultants. It is the worldwide leader among Architectural Publications for over 100 Years. It is also read by

corporate and government owners, builders, as well as college, faculty and students. Architectural Record presents designs from the World's outstanding architects. Staffed by professional editors, most of who have architectural backgrounds. Architectural Record is the leading source for architectural design, technology with business and products information.
Publisher: A division of the McGraw-Hill Companies
Web site address: http://www.archrecord.com
Source: web site.
Last updated: 11 April 2000.

Architectural Review

Editor: Peter Davey; peterd@construct.emap.co.uk
Editor's affiliation: ?
Editorial Board: National (UK)
Peer Reviewed: No
Coverage: World-wide coverage of the very best in contemporary architecture
Frequency: monthly
Publisher: ABC business press/ EMAP Construction
Web site address: http://www/arplus.com
Source: web site.
Last updated: 11 April 2000.

Asian Pacific Building and Construction Management Journal

Editor: Mrs Linda C N Fan
Editor's affiliation: Hong Kong Polytechnic University
Editorial Board: National, Hong Kong
Peer Reviewed: Yes
Coverage: Forum for researchers and practitioners to present and discuss worthwhile innovations in building and construction project management in the Asian-Pacific region. The heavy involvement of the international construction industry in this region also leads it to expect significant international participation.
Publisher: A joint publication of the Asian Construction Management Association, The Chartered Institute of Building and The Building Division, Hong Kong Institute of Engineers.
Frequency: biannual
Source: Issue 1 Inaugural Issue 1995
Last updated: 12 June 1999.

Australian Journal of Construction Economics and Building

(formerly Australian Institute of Building Papers and Australian Institute of Quantity Surveyors Refereed Journal)
Editor: Different editor allocated to each issue; contact@aiqs.com.au
Editorial Board: Different editorial board for each issue
Peer reviewed: Yes
Coverage: While the journal is titled "The Australian Journal of Construction Economics and Building" it will be international in scope and standard but with particular reference to the Australasian & Pacific region.
Frequency: Bi-annual
Publisher: AIQS
Source: AIQS general mailing
Web site address: www.aiqs.com.au then follow links to publications, then Instructions/Guidelines for contributors.
Last updated: 5 December 2000

Automation in Construction

(1992–)
Editors: Y E Kalay and M J Skibnieswski
Editors' Affiliation: College of Environmental Design, Department of Architecture, University of California at Berkeley and School of Civil Engineering, Purdue University, IN, USA
Editorial Board: International
Peer Reviewed: Yes

Coverage: It includes: use of Information Technologies in Architecture, Engineering, Construction Technologies and Maintenance and Management of Constructed Facilities. Also, Robotics and Automated Machines.
Frequency: bi-monthly
Publisher: Elsevier
Web site address: http://www.elsevier.nl/inca/publications/store/5/2/3/1/1/2/
Source(s): web site
Last updated: 12 May 2000.

–B–

Building Design and Construction Magazine (Formerly Building Construction until 1958)

Editor(s): C.C. Sullivan; csullivan@cahners.com
Editor(s)'s Affiliation: ?
Editorial Board: National (USA)
Peer Reviewed: ?
Coverage: Published for the building team –architects, engineers, contractors, building owners and facilities managers involved in design and construction of non-residential buildings.
Frequency: monthly
Publisher: Cahners Publishing Company
Web site address: www.bdcmag.com
Source: Ulrich's, web site.
Last updated: 14 April 2000.

Building Economist

(Incorporated Quantity Surveyor)
(1962–)
Editor: Ian Blyth
Editorial Affiliation: AIQS
Editorial Board: ?
Peer Reviewed: No
Publisher: AIQS
Coverage: It contains data on Current Construction Costs in Australia, as well as technical articles relevant to construction economics and related subjects, contains data on current construction costs in Australia.
Frequency: quarterly
Source: March 1998, Ulrich's and website
Web site address: http://www.aiqs.com.au
Last updated: 14 April 2000.

Building and Environment

(The International Journal of Building Science and its Application)
(1965–)
Editor: E. Mathews
Editor's affiliation: Universiteit van Pretoria, South Africa
Editorial board: International
Peer reviewed: Yes
Coverage: Building research and its applications, the social, cultural and technological contexts of building research and architectural science.
Frequency: 8 issues a year
Publisher: Pergamon
Web site address: http://www.elsevier.nl/inca/publications/store/2/9/6/index.htt
Source: web site
Last updated: 14 April 2000.

Building Research and Information

(1970–)

Editor: Richard Lorch
Editorial Board: International
Peer Reviewed: Yes
Coverage: It includes environmental issues in construction; practical application of research; non-destructive testing; problems regarding healthy buildings; construction law; rise in the use of expert systems. It also includes technical papers and reviews.
Frequency: bi-monthly
Publisher: Spon
Web-site address: http://www.tandf.co.uk/journals/routledge/09613218.html
Source: web site
Last updated: 12 May 2000.

–C–

Chartered Surveyor Monthly

(Official journal of the Royal Institute of Chartered Surveyors)
CSM
Editor(s): Imogen Mcevedy; imcevedy@rics.org.uk
Editor(s)'s Affiliation: RICS
Editorial Board: ?
Peer Reviewed: No
Coverage: ?
Publisher:
Web site address: http://www.rics.org.uk/csm/
Source: web
Last updated: 14 April 2000.

Civil Engineering and Environmental Systems

Editor(s): C.B. Brown and P.W. Jowitt
Editor(s)'s affiliation: Department of Civil Engineering, Oregon State University, USA and Department of Civil and Offshore Engineering, Heriot-Watt University
Editorial Board: ?
Peer Reviewed: ?
Coverage: Civil Engineering and Environmental Systems is the only Journal devoted to the discussion, dissemination and development of systems techniques and their underlying assumptions through the spectrum of civil engineering activity and environmental decision-making and management. The Journal provides a comprehensive approach to the practical application and development of ``hard'' and ``soft'' systems methodologies. covering engineering optimization, risk assessment and decision making, system identification, numerical simulation and qualitative modelling of complex systems, safety, methods of modelling uncertainty. Attention is paid to conceptual issues as well as quantitative techniques. The Journal also deals with emerging information technology techniques such as knowledge-based systems, genetic algorithms and neural networks.
Publisher: The Gordon and Breach Publishing Group.
Web site address: http://www.gbhap.com/journals/723/723-top.htm
Source: Web site.
Last updated: 1 June 2000.

Computers and Structures

(1971–)
Editor(s): K J Bathe and B H V Topping
Editor(s)'s affiliation(s): Department of Mechanical Engineering, Massachussetts Institute of Technology, USA and Department of Mechanics and Chemical Engineering, Heriot-Watt University, UK
Editorial Board: International
Peer Reviewed: Yes
Coverage: The objective of this journal is to communicate recent advances in the development and use of computer methods for the solution of scientific and engineering problems related to hydrospace, aerospace and terrestrial structures. The word 'structures' is interpreted in the broadest sense. The journal is intended to be of interest and use to researchers and practitioners in academic, governmental and industrial communities.

Frequency: 30 issues in 2000.
Publisher: Pergamon
Web site address: http://www.elsevier.nl/inca/publications/store/3/5/9/index.htt
Source: web site
Last updated: 17 April 2000.

Computer Methods in Applied Mechanics and Engineering

(1970–)
Editors: J.H. Argyris (Princ Editor), T.J.R. Hughes and J.T. Oden
Editors' affiliation: Universitä Stuttgart, Germany; Stanford University, USA and The University of Texas at Austin, USA.
Editorial Board: International
Peer reviewed: Yes
Coverage: The journal publishes papers concerned with applications of digital or hybrid computers to problems of applied mechanics and engineering.
Frequency: 52 issues a year
Publisher: North Holland
Source(s): web site
Web site address: http://www.elsevier.nl/inca/publications/store/5/0/5/6/4/5/
Last updated: 17 April 2000.

Construction Information Quarterly

Editor(s): ?
Editor's(s') affiliation: ?
Editorial board: ?
Peer reviewed: ?
Coverage: This new publication contains the latest technical information on the best practice in construction. With 3-4 technical papers and one digest in each issue, the new Construction Information Quarterly ensures subscribers are kept abreast of all the latest developments in construction.
Frequency: 4 times a year – no fixed dates.
Publisher: Englemere Ltd, CIOB.
Source(s): Englemere.
Web site address: ?
Last updated: 9 May 2000.

Construction Innovation: Information, Process, Management

(formerly International Journal of Construction Information Technology)
(1993–)
Editors: Mustafa Al-Shawi and Martin Skitmore; m.alshawi@surveying.salford.ac.uk, r.m.skitmore@qut.edu.au
Editors' Affiliation: Department of Surveying, University of Salford and Faculty of Built Environment and Engineering, Queensland University of Technology
Editorial Board: International
Peer Reviewed: Yes
Coverage: First launched in 1993 to inform the construction industry and research community of the latest advances in construction IT, the *International Journal of Construction Information Technology* provided high quality technical papers on current developments in the rapidly changing IT environment of the global construction industry. ***Construction Innovation*** will continue to cover the fundamentals of technical issues and reflect the most recent developments in construction IT with the added benefit of greater coverage of management issues such as process modelling, bench marking, integration of design and construction, supply chain management, data exchange and e-commerce, to provide a complete picture of all aspects of construction IT. Integrating the entire field of information, process, technology and management, ***Construction Innovation*** will disseminate research results, communicate new practical ideas, applications and developments and provide case studies related to design and construction. ***Construction Innovation*** is essential for academics and researchers in building, construction, construction and property management and managers within the construction industry.
Frequency: Quarterly

Publisher: Arnold
Web site address: http://www.arnoldpublishers.co.uk/journals/Journpages/14714175.htm
Last updated: 5 December 2000

Construction Law Journal

(1984–)
Editor: Andrew Burr
Editor's affiliation: Barrister
Editorial board: National (UK)
Peer reviewed: No
Coverage: A journal tailored for lawyers, architects, engineers, surveyors and company officers who require a forum to which they and members of other professions may turn for guidance, comment and informed debate. It reports developments in case law and legislation, important changes in both law and procedure occur rapidly. Contents: Case reports –cases of interest from the UK Courts as well as from other common law jurisdictions. General information section –a short informative section covering matters of interest to the construction industry. Articles –by leading lawyers in the field of construction law, and by senior academics specializing in this area of the law. Books review.
Frequency: 6 issues a year.
Publisher: Sweet and Maxwell
Source(s): 12(5) 1996
Web site address: http://www.smlawpub.co.uk/index_catalog.cfm
Last updated: 12 May 2000.

Construction Manager

(formerly Chartered Builder, formerly Building Technology and Management))
Editor: Connal Vickers
Editor's Affiliation: CIOB
Editorial Board: ?
Peer Reviewed: No
Coverage: contains articles on technical and management aspects of building, together with reports on conferences and seminars.
Frequency: 10 times per year
Publisher: Englemere CIOB
Web site address: http://www.ciob.org.uk/
Source(s): June 1999 5(5), web site, Ulrich's and Englemere.
Last updated: 9 May 2000.

Construction Papers

Absorbed by CME
(1980-1983)
Editor: Kenneth J. Lane
Editor's affiliation: CIOB
Editorial Board: National (UK)
Peer reviewed: Yes
Coverage: Scientific and technical papers covering the full range of the various sciences applied to problems in construction. This was a high-quality, but short-lived journal with only five issues appearing in print over the four years of its existence.
Publisher: CIOB
Source: Archived issues.
Last updated: 13 June 2000

Construction Management and Economics

(1983–)
Editors: Ranko Bon and Will Hughes
Editors' Affiliation: Department of Construction Management & Engineering, University of Reading
Editorial Board: International
Peer Reviewed: Yes
Coverage: General building, housing, civil engineering, repairs and maintenance as well as the construction of other major capital products; organization and management of projects, construction

companies and professional practices engaged in the construction process as well as the management of existing buildings; design economics, cost planning, estimating and cost control, the economic functioning of firms within the construction sector and the relationship of the sector to national and international economies.
Frequency: Eight times per year.
Publisher: Spon
Web site address: http://www.tandf.co.uk/journals/routledge/01446193.html
Source(s): CM&E, 18(1).
Last updated: 9 May 2000.

Cost Engineering Magazine

Editor: Kathy Deweese
Editor's affiliation:
Editorial Board: ?
Peer Reviewed: Yes
Coverage: subjects that directly relate to the Total Cost Management profession
Frequency: monthly
Publisher: AACE International (WV)
Web site address: http://www.aacei.org/newdesign/technical/welcome.shtml
Source(s): 36(12) Dec 1996
Last updated: 12 July 1999.
Notes: Indexed in Engineering index, Cambridge Scientific Abstracts and ABI/Inform Database

Cost Engineer, The

(1962–)
Editor(s): Lesley Carter (assistant); a.coste@btinternet.com
Editor's(s) affiliation: The Association of Cost Engineers
Editorial Board: ?
Peer reviewed: ?
Coverage: technology, international, project performance, estimating, training & education, quantity surveying (topic per issue all year through).
Frequency: 6 issues per year and a year book.
Web site address: http://www.btinternet.com/~A.CostE/
Source(s): web site
Last updated: 17 April 2000.

–D–

Design-Build

Editor(s): ?
Editor(s)'s Affiliation: ?
Editorial Board: ?
Peer Reviewed: ?
Coverage: Design-Build serves design builders and owners in the world-wide non-residential construction. It is the only publication dedicated to this design-build project delivery method. It is the indispensable authority, reporting on successful design-build projects, companies and cutting-edge professionals.
Frequency: quarterly
Publisher: ?
Web site address: http://www.accessglobal.com/jas/db/index.htm
Source: Web site
Last updated: 13 February 2000.

Design Studies

(1979–)
Editor(s): N Cross; n.g.cross@open.ac.uk
Editor(s)'s Affiliation: Department of Design and Innovation, Faculty of Technology, The Open University, Milton Keynes, UK

Editorial Board: International
Peer Reviewed: Yes
Coverage: Includes design management, design methods, participation in planning and design, design education, AI and computer aids in design, design and engineering, theoretical aspects of design, design in architecture, design and manufacturing, innovation in industry and design and society.
Frequency: 6 issues a year
Publisher: Elsevier Sciences Ltd and the Design Research Society
Web site address: www.elsevier.nl/inca/publications/store/3/0/4/0/9/index.htt
Source: Ulrich's and web site
Last updated: 17 April 2000.

–E–

Engineering, Construction and Architectural Management

(1994–)
Editor: Ronald McCaffer; r.mccaffer@lboro.ac.uk
Editor's Affiliation: Department of Civil and Building Engineering, Loughborough University
Editorial Board; International
Peer Reviewed: Yes
Coverage: The Journal publishes papers on innovative developments in the management and practice of construction and original research work in all aspects of construction management.
The Journal interprets the scope of construction broadly, encompassing all capital projects including building, civil engineering and major infrastructure, as well as repair and maintenance.
The management of construction includes: the management of projects encompassing both the design and construction processes and their interrelationship; the management of construction companies, and design and architectural practices; and the management and development of the construction industry from a national and international perspective.
Frequency: quarterly
Publisher: Blackwell Science Ltd
Web site address: http://www.lboro.ac.uk/ecam/, or http://www.blackwell-science.com/products/journals/ecam.htm
Source(s): 5(4), Dec1998, web site and Ulrich's
Last updated: 9 May 2000.

Environments by Design

Editor(s): Timothy Eccles; t.eccles@kingston.ac.uk
Editor(s)'s Affiliation: School of Surveying, Kingston-upon-Thames, UK
Editorial Board: International
Peer Reviewed: Yes
Coverage: publishes research reports, criticisms and speculations about the formation, use and evaluation of the designed environment.
Frequency: 2-3 times a year
Publisher: university of Kingston
Web site address: http://www.kingston.ac.uk/~ac_s033/ebdpages/title_p.htm
Source: web site
Last updated: 17 April 2000.

–F–

Facilities

Editor(s): Dr Edward Finch; e.f.finch@reading.ac.uk
Editor(s)'s Affiliation: Department of Construction Management and Engineering,
University of Reading
Editorial Board: International
Peer Reviewed: Yes
Coverage: All areas relating to briefing, design and use of facilities; the emerging technologies that support organizational skills in the workplace; innovations in theory, tools, legislation and analysis techniques; applications of new ideas in the facilities management. Plus: space planning, relocation,

maintenance, renovation, energy consumption, cost reductions; ergonomics, quality initiatives, intelligent buildings, the effects of corporate change on property, health and safety issues, and IT issues.
Frequency: 14 times/year
Publisher: MCB University Press
Web site address: http://www.mcb.co.uk/cgi-bin/journal1/f
Source: Property and 16(12/13), Dec 1998 and web site
Last updated: 17 April 2000.

–G–

Geotechnique

(1948–)
Editor(s): Dr G C Sills
Editor(s)'s Affiliation: University of Oxford, UK
Editorial Board: National (UK)
Peer Reviewed: Yes
Coverage: It contains rigorously refereed papers and technical notes in English or French in the fields of soil and rock mechanics, engineering geology and environmental geotechnics. Topics include experimental or theoretical research, novel design or construction methods, detailed geotechnical case histories, and observations and measurements during and after construction. Written by internationally renowned authors from industry and academia, papers are of outstanding quality.
Frequency: 6 issues a year
Publisher: T Telford
Web site address: http://www.t-telford.co.uk/JOL/index.html
Source: web site
Last updated: 17 April 2000.

–I–

International Journal of Architectural Management Practice & Research

Editor(s): M P Nicholson
Editor's Affiliation: University of Nottingham
Editorial Board:
Peer Reviewed?
Coverage:
Frequency:
Publisher:
Web site address: http://www.archman.com/ampr14.html
Source: web site.
Last updated: 1 June 2000.

International Journal of Computer Integrated Design and Construction

Editor(s): Dr Chimay Anumba
Editor's Affiliation: Loughborough University, UK.
Editorial Board: International
Peer Reviewed: Yes.
Coverage: The International Journal of Computer-Integrated Design and Construction (CIDAC) is intended to provide a forum for the dissemination of information related to the use of computers and associated technologies in the integration of the design and construction processes. The journal publishes both original research papers as well as practical papers on aspects of computer-integrated design and construction. Papers on theoretical, industrial and computing developments which have a bearing on computer-integrated design and construction will also be published. The scope of the journal is wide and includes the following and related topics: computer-aided design, computer-integrated construction, concurrent engineering in construction, computer-integration of design activities, computer-aided cost planning and control, computer-aided construction process planning and scheduling; information management in integrated design and construction, organizational/human issues in integrated design and construction, intelligent systems in integrated

design and construction, life-cycle design of facilities, computer-integrated facilities management, computer-aided construction site layout design, computer-aided construction safety management, communication issues in integrated design and construction, and product and process modelling.
Frequency: Four issues this year.
Publisher: SETO London, UK.
Web site address: http://www.lboro.ac.uk/cidac/
Source: web site.
Last updated: 1 June 2000.

International Journal for Construction Marketing

Editor: Hedley Smyth; hjsmyth@brookes.ac.uk
Editor's Affiliation: Oxford Brookes University
Editorial Board: International
Peer Reviewed: Yes
Coverage: It is dedicated to publishing high quality research papers on marketing in: Construction; Contracting and Subcontracting; Consulting and Consultancy; Project Management; The Design Team and Engineering Building Materials and Supply Industries, in the areas of construction, construction management, building, civil engineering and the corporate management of organizations operating in these sectors. The policy of the journal is to publish papers of that develop the theoretical understanding of construction marketing and of new case material and empirical evidence.
Frequency: twice a year, January and September
Publisher: Oxford Brookes University
Web-site address: www.brookes.ac.uk/other/conmark/IJCM/
Source: web site
Last updated: 5 December 2000

International Journal of Facilities Management

(1997-)
Editor(s): Keith Alexander; alexander@sgbs.strath.ac.uk
Editor(s)'s Affiliation: Centre for Facilities Management, University of Strathclyde
Editorial Board: International
Peer Reviewed: Yes
Coverage: A high quality, academic forum in order to advance facilities management as a discipline. An appropriate vehicle for development and discussion of theory; research and practice in facilities management. A means of recording and circulating information concerning research work and related activities in facilities management; extensive peer-reviewed articles so you can be sure that all papers are of the highest standard
Frequency: quarterly
Publisher: Spon
Web site address: http://journals.routledge.com/fm.html
Source: Web site
Last updated: 17 April 2000.

International Journal of Project Management

(1981-)
Editor(s): Rodney Turner
Editor(s)'s Affiliation: Faculty of Economic Science, Erasmus University, Rotterdam, The Netherlands
Editorial Board: International
Peer Reviewed: Yes
Coverage: A bi-monthly international journal that offers wide ranging and comprehensive coverage of all facets of project management. It provides a focus for worldwide expertise in the required techniques, practices and areas of research; presents a forum for its readers to share common experiences across the full range of industries and technologies in which project management is used; covers all areas of project management from systems to human aspects; links theory with practice by publishing case studies and covering the latest important issues. Application areas include: information systems, strategic planning, research and development, system design and implementation, engineering and construction projects, finance, leisure projects, communications, defence, agricultural projects, major

re-structuring and new product development. Papers originate from all over the world and are fully peer-reviewed, on the 'double-blind' system. In addition, the journal carries conference reports, and book reviews.
Frequency: Bi-monthly.
Publisher: Pergamon.
Web site address: http://www.elsevier.nl/inca/publications/store/3/0/4/3/5/, and http://www.apmgroup.co.uk/journal.htm
Source: Copac and Ulrich's, web site.
Last updated: 8 March 2001.
Note: The journal is published in collaboration with The Association of Project Management (APM) and is its official journal.

–J–

Journal of Architectural Engineering

Editor(s): Bijan Mohraz; bijan@seas.smu.edu
Editor(s)'s Affiliation: Southern Methodist University and National Institute of Standards and Technology
Editorial Board: National (USA).
Peer Reviewed: Yes
Coverage: practice-based information on the engineering and technical issues concerned with all aspects of building design. Topics related to building such as planning and financing, analysis and design, construction and maintenance, codes applications and interpretations, conversion and renovations, and preservations.
Frequency: quarterly
Publisher: ASCE
Web site address: http://www.pubs.asce.org/journals/ae.html
Source: web site
Last updated: 17 April 2000

Journal of Architecture

Editor(s): Allen Cunningham
Editor(s)'s Affiliation: University of Westminster
Editorial Board: International.
Peer Reviewed: Yes
Coverage: Topics to be covered include the interplay between cities, building, history and economic forces; problems of gender and ethnicity in architectual. Also, production and understanding; the powers, weakness and pre-suppositions of criticism; rewriting the historical canon of architecture, problems of interpreting cities. More over, eurocentrism and the rise of nationalism; the language and rhetoric of the construction industry; the sociology and pathology of professionalism; power games and patronage. As well as, the legal and political relationships between infrastructures and superstructure, and the conservation of 20th century architecture. Finally, it covers the rise of tourism; the uses and effects of the media; issues of greening and ecosystem, and the impact of computerization.
Frequency: 4 issues per year
Publisher: Spon and RIBA
Web site address: http://www.tandf.co.uk/journals/routledge/13602365.html
Source: web site
Last updated: 17 April 2000.

Journal of Computing in Civil Engineering

Editor(s): William J Rasdorf and Sivand Lakmazaheri; rasdorf@eos.ncsu.edu, lakmazaheri@cua.edu
Editor(s)'s Affiliation: North Carolina State University and The Catholic University of America
Editorial Board: National (USA).
Peer Reviewed: Yes
Coverage: Serves as a comprehensive resource for innovative ideas in civil engineering computing. Publishes technical papers, technical notes as well as brief discussions that review software, hardware, and strategic issues involved in contemporary civil engineering computing.
Frequency: quarterly

Publisher: ASCE
Web site address: http://www.pubs.asce.org/journals/cp.html and http://www.wmich.edu/jcce/jcce.htm
Source: Web site
Last updated: 17 April 2000.

Journal of Construction Management

Editor: Gary Berman
Editor's Affiliation: Greyhawk (North America, LLC), a medium-size CM firm.
Editorial Board: International
Peer Reviewed: Yes
Coverage: Every aspect of the management of construction – scheduling, estimating, cost engineering, planning, procurement, bidding, claims, dispute resolution, research, productivity, equipment, bonds, liens, contracts, organization and much more.
Publisher: Construction Management Association of America (CMAA)
Web site address: http://www.cmaanet.org
Source: email circular <gberman@greyhawkna.com>
Notes: First issue out in March 2000
Last updated: 14 February 2000.

Journal of Construction Engineering and Management (Construction)

(1956–)
Editor: James E. Rowings
Editor's Affiliation: Iowa State University
Editorial Board: National (USA).
Peer Reviewed: Yes
Coverage: It aims to advance the science of construction engineering to harmonise construction practices with design theories, and to further education and research in construction engineering and management.
Frequency: bi-monthly
Publisher: ASCE
Web site address: http://www.pubs.asce.org/journals/co.html
Source(s): web site
Last updated: 18 April 2000.
Notes: Abstracted in Transactions of the ASCE, CE Database online

Journal of Construction Procurement

(1995–)
Editors: Peter Hibberd, David Jaggar, Roy Morledge
Editor's(s) Affiliation: Joint Contracts Tribunal, UK; Liverpool John Moores University, UK; and The Nottingham Trent University, UK.
Editorial Board: International
Peer Reviewed: Yes
Coverage: International procurement, strategic procurement management; risk analysis; risk management; facilities management; decision making processes; selection of procurement methods and contractual arrangements; performance of procurement systems; psychological sociological environmental influences and behavioural issues, philosophical and ethical influences, customer satisfaction.
Frequency: (current) semi-annual
Publisher: International Research Group Ltd
Web site address: http://www.fbe.unsw.edu.ac/JOPC/default.htm
Source: 4(2) November 1998, Copac and web site.
Last updated: 18 April 2000.

Journal of Construction Research

(2000–)
Editors: Raymond Y.C. Tse and Heng Li
Editors' Affiliation: Department of Building and Real Estate, Hong Kong Polytechnic University
Editorial Board: International
Peer Reviewed: Yes

Coverage: Provision of an international forum for the interchange of information and ideas relating to operations management and production management in the construction industry. Market and policy papers introducing and analysing the operational and institutional setting, the supply side of real estate, policy issues and related laws and regulations of construction markets are also welcomed. The aim of this Journal is to explore the interface between academic research findings alongside articles related to everyday professional practice. Papers are published in two sections, Academic Papers and Practice Papers.
Frequency: Bi-annual (March and September).
Publisher: Hong Kong Institute of Building (HKIOB)
Web site address: http://www.hkir.com/hkiob/jcr.html
Source: web site
Last updated: 18 April 2000.

Journal of Digital Information

Editor(s): Cliff McKnight; c.mcknight@lboro.ac.uk
Editor(s)'s Affiliation: Loughborough University, UK
Editorial Board: International
Peer Reviewed: Yes
Coverage: electronic journal with no paper equivalent form, digital libraries hypermedia systems intelligent agents information management interfaces to digital information social consequences of digital information digital information design Web applications.
Publisher: JoDI is supported by the British Computer Society and Oxford University Press.
Frequency: various issues per year
Web site address: http://jodi.ecs.soton.ac.uk/about.html
Source: web site.
Last updated: 18 April 2000.

Journal of Financial Management of Property and Construction

(1996–)
Editor(s): Akintola Akintoye and Jim Birnie; akin@gcal.ac.uk, jw.birnie@ulst.ac.uk
Editor(s)'s Affiliation: Glasgow Caledonian University, UK, and University of Ulster at Jordanstown, UK.
Editorial Board: International
Peer Reviewed: Yes
Coverage: JFMPC will publish original quality manuscripts (theoretical and empirical) on issues dealing with: Project and corporate finance, risk management, property market analysis, modelling and forecasting; capital structure decisions and management; building/construction economics; investment theory and practice, pricing and valuation; cost forecasting, prediction and modelling; design and construction process, financial implications of IT systems; financial aspect of statutory regulations, energy and environment; cost evaluation of alternative procurement methods. The Journal combines the disciplines of financial and managerial economics, risk management, econometrics, and accounting in property and construction contexts.
Frequency: 3 issues a year.
Publisher: Glasgow Caledonian University, UK.
Web site address: http://jfmpc.gcal.ac.uk/
Source: editor
Last updated: 2 May 2000.

Journal of Management in Engineering

(1993–)
Editor(s): Jeffrey S Russel
Editor(s)'s Affiliation: University of Wisconsin, Madison, USA.
Editorial Board: National (USA).
Peer Reviewed: ? Some peer-reviewed papers
Coverage: All the latest concepts and current practices of management in the engineering marketplace. The Journal's scope now encompasses a blend of informative feature articles, peer-reviewed papers, practical case studies, and user-oriented information to provide a comprehensive review on topics ranging from project management to budgeting and strategic planning.
Frequency: Bi-monthly

Publisher: ASCE
Web site address: http://www.pubs.asce.org/journals/me.html
Source: Web site and Copac
Last updated: 18 April 2000.

Journal of Professional Issues in Engineering Education and Practice

(1991–)
Editor(s): Mark Evans
Editor(s)'s Affiliation: US Military Academy
Editorial Board: National (USA).
Peer Reviewed: ?
Coverage: Examines topics of broad professional interest, diverse views of engineering management, professional activities, and technical problems. The journal investigates the relationships between civil engineering and other disciplines, while emphasizing the engineers' obligations and responsibilities. Social, economic, and ecological implications of technological achievements are highlighted in papers authored by both engineers and professionals from relevant disciplines. Other subjects featured include applications of artificial intelligence in civil engineering and recent developments in civil engineering education
Frequency: Quarterly.
Publisher: ASCE
Web site address: http://www.pubs.asce.org/journals/ei.html
Source: web site
Last updated: 18 April 2000.

Journal of Property Investment and Finance

(formerly Journal of Property Valuation and Investment incorporating Journal of Property Finance)
(1999–)
Joint Editors: Nick French and Gerald Brown
Editors' Affiliation: University of Reading and National University of Singapore
Editorial Board: International
Peer Reviewed: Yes
Coverage: access to international leading edge information pertaining to the property valuation and investment field. Fully refereed papers on practice and methodology in the UK, France, Germany, USA and other countries, in the following areas: academic papers on the latest research, thinking and developments, computer briefings covering the latest information technology, law reports assessing new legislation, market data for a comprehensive review of current research, practice papers - a forum for the exchange of ideas and experiences. Plus, macro and micro economics issues, appraisal methodology, legal issues relating to valuation and property finance. Portfolio theory, forecasting, rental and capital determinants. Funding and borrowing; property taxation and databases.
Publisher: MCB University Press.
Web site address: www.mcb.co.uk/jpif.htm
Source(s): Property and 16(12/13), Dec 1998 and web page
Last updated: 18 April 2000.

Journal of Property Research

Editor(s): Bryan D MacGregor; b.d.macgregor@abdn.ac.uk
Editor(s)'s Affiliation: Department of Land Economy, University of Aberdeen, Scotland
Editorial Board: International
Peer Reviewed: Yes
Coverage: expansion of research into property investment and development. The Journal will also publish regular editorials, book reviews and market review material. It provides a forum for research in the field and assists researchers, private investors and developers and public authorities to keep abreast of new developments.
Frequency: 4 issues a year
Publisher: Spon
Web site address: http://www.tandf.co.uk/journals/routledge/09599916.html
Source(s): web site
Last updated: 18 April 2000.

Journal of Property Valuation and Investment

(formerly Journal of Property Investment and Finance)
(1990–)
Editors: Nick French and Gerald R. Brown
Editorial Board: International
Peer Reviewed: Yes
Coverage: covers the full range of professional activities relating to property appraisal, investment and finance. This includes micro and macro-economic issues; appraisal methods; capital markets; and portfolio theory; property financing issues and all matters which directly or indirectly affect the attractiveness of property as an investment.
Frequency: 6 issues/year
Publisher: MCB University Press
Web site address: http://www.mcb.co.uk/jpvi.htm
Source(s): 16(1), web site, Copac
Last updated: 18 April 2000.

Journal of Real Estate Literature

Editor(s): James B. Kau and C.F. Sirmans.
Editor(s)'s Affiliation: University of Georgia, USA and University of Connecticut, USA.
Editorial Board: International (mostly from the USA).
Peer Reviewed?
Coverage: The Journal of Real Estate Literature is a publication of the American Real Estate Society in conjunction with Kluwer Academic publishers. The purpose of this Journal is to provide a source of information to encourage academic research and teaching in the field of real estate. Our scope includes, but goes beyond, that of the traditional literature journal listing published research, dissertations, and work in progress. We intend to include other information on tools, such as software and data bases, helpful to those pursuing research. Finally, we plan to support the classroom instructor of real estate by providing case studies or other teaching aids.
Frequency:
Publisher: Kluwer Academic Publishers, USA.
Web site address: http://www.aresnet.org/ARES/pubs/jrel/JREL.html, or http://www.wkap.nl/journalhome.htm/0927-7544
Source(s): web sites.
Last updated: 1 June 2000.

Journal of Real Estate Portfolio Management

Editor(s): Willard McIntosh
Editor(s)'s Affiliation: Prudential Real Estate Investors.
Editorial Board: International (majority USA)
Peer Reviewed: Yes
Coverage: all aspects of real estate investment and portfolio management
Frequency: ?
Publisher: American Real Estate Society
Web site address: http://www.aresnet.org/ARES/pubs/jrepm/EdsJREPM.html
Source: web site
Last updated: 1 June 2000.

Journal of Risk Research

(1998-)
Editor(s): Ragnar Löfstedt; r.lofstedt@surrey.ac.uk
Editor(s)'s Affiliation: Centre for Environmental Strategy, University of Guilford, UK.
Editorial Board: International
Peer Reviewed: Yes
Coverage: publishes peer reviewed theoretical and empirical research articles within the risk field from the areas of engineering, physical, health and social sciences, as well as articles related to decision making, regulation and policy issues in all disciplines. It also addresses issues outside the current focus of the North American literature, providing the reader with a variety of interesting research results.
Frequency: quarterly

Publisher: Spon
Web site address: http://www.tandf.co.uk/journals/routledge/13669877.html
Source: web site
Last updated: 18 April 2000.

Journal of Structural Engineering

(1956–)
Editor(s): David Darwin; daved@ukans.edu
Editor(s)'s Affiliation: University of Kansas, USA
Editorial Board: National (USA).
Peer Reviewed: Yes
Coverage: Engineers, consultants, and professors detail the physical properties of engineering materials (such as steel, concrete, and wood), develop methods of analysis, and examine the relative merits of various types of structures and methods of fabrication. Subjects include the design, erection, and safety of structures ranging from bridges to transmission towers and tall buildings; technical information on outstanding, innovative, and unique projects; and the impact of natural disasters and recommendations for damage mitigation.
Frequency: monthly
Publisher: ASCE
Web site address: http://www.ascepub.infor.com/journals/st.html
Source: web site
Last updated: 18 April 2000.

Journal of Urban Planning and Development

(1983–)
Editor(s): Ian Kingham; kingham@gmc1.bc.ca
Editor(s)'s Affiliation: GMK Transportation Planning and Engineering Ltd, CA, USA
Editorial Board: International (UP&D Publications Committee representing both Canada and the USA).
Peer Reviewed: No
Coverage: It covers the application of civil engineering to urban planning aspects such as area-wide transportation, the co-ordination of planning and programming of public works and utilities, and the development and redevelopment of urban areas
Frequency: quarterly
Publisher: ASCE
Web site address: http://www.pubs.asce.org/journals/up.html
Source: Web site
Last updated: 18 April 2000.

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NICAR Journal of Construction Management

Editor(s): Prof. Kanwal N. Vaid
Editor(s)'s affiliation: Institution and University
Editorial board: International
Peer reviewed: ? Done
Coverage: management of civil works, energy, safety, habitat, buildings, irrigation, environment, infrastructure, transportation, social services, communications and rural development.
Frequency: Quarterly
Publisher: National Institute of Construction Management and Research, Walchand Centre, Tardeo, Mumbai 400 034.
Web site address: http://www.nicmar.org/pub.htm
Source(s): E-enquiry to the Editor and web site.
Last updated: 30 May 2000.

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Proceedings of Institution of Civil Engineers-Civil Engineering

(1837–)

Editor: ?
Editorial board: Overseas corresponding members
Peer reviewed: Yes
Coverage: The Proceedings of the Institution of Civil Engineers is the oldest series of civil engineering journals in the world. Divided into six parts, Proceedings offers both engineering professionals and academics the chance to read in depth refereed papers and forms a valuable reference guide to projects and debates past, present and futures. Topics covered: Civil Engineering, Geotechnical Engineering, Municipal Engineering, Structures and Buildings, Transport, Water Maritime and Energy.
Frequency: 4 issues/year plus 2 special issues
Publisher: Thomas Telford Ltd
Web site address: http://www.t-telford.co.uk/JOL/index.html
Source(s): Feb 1999
Last updated: 18 April 2000.

Project

(Magazine of the Association for Project Management)
Editor: Jo Simpson
Editorial board: None
Peer reviewed: No
Coverage: Regular features in "Project" include: project management scene news, letters, feature articles, body of knowledge –a series of articles on various aspects of Project Management, APM Network-news of the Association, contacts, forthcoming events, and international events.
Frequency: monthly (except September and January)
Publisher: APM, Financial Business Pubs
Web site address: http://www.apm.org.uk/
Source: March 1999, 11(9)
Last updated: 18 April 2000.

Property Management

(1992–)
Editor(s): Frances Plimmer.
Editor(s)'s Affiliation: School of the Built Environment, University of Glamorgan, UK.
Editorial Board: International
Peer Reviewed: Yes
coverage: property management covers the full scope of topics in its field including: changing technology - environmental regulations - quality issues - the marketplace - legal issues - use and occupation - ethical concerns - business, commercial, industrial and residential property management - land use and development - marketing - leasing - Financial issues
Frequency: quarterly
Publisher: MCB University Press
Web site address: http://www.mcb.co.uk/cgi-bin/journal1/pm
Source(s): Property and 16(12/13), Dec 1998 and web site
Last updated: 1 June 2000.

–R–

RICS Research Papers

(1996–)
Editor(s): Les Ruddock; l.ruddock@surveying.salford.ac.uk
Editor(s)'s affiliation: Department of Surveying, University of Salford, UK.
Editorial board: International
Peer reviewed: Yes
Coverage: research and development in any area relevant to the surveying profession. Papers will range from fundamental research work to innovative practical applications of new and interesting ideas.
Publisher: Royal Institute of Chartered Surveyors
Web site address: http://www.rics.org.uk/research/submitapaper.html
Source: Web site and ARCOM Construction Management Abstracts
Last updated: 18 April 2000.

–S–

Structural Engineer

(1922–)
Editor(s): A Lorans; istructe.lon@mail.bogo.co.uk
Editor(s)'s affiliation: Structural Engineers Trading Organization
Editorial board: ?
Peer reviewed: Yes
Coverage: Theory and practice of building design and construction
Publisher: Structural Engineers Trading Organization Ltd
Web site address: no web site
Source: Ulrich's
Last updated: 5 December 2000

Structural Survey

(1982–)
Editors: Mike Hoxley
Editors' affiliation: Department of Built Environment, Anglia Polytechnic University, UK.
Editorial Board: National (UK), and one member from Hong Kong.
Peer reviewed: Yes
Coverage: surveys of commercial & residential property, case studies of refurbishment projects, building conservation, building regulation and codes, mechanical and electrical services survey, materials and components, building and material defects, practice abroad, law and practice of dilapidation
Frequency: 4 issues a year
Publisher: MCB University Press
Web site: http://www.mcb.co.uk/cgi-bin/journal1/ss
Source(s): web site
Last updated: 18 April 2000.

Swedish Building Research

(1995–)
Editor(s): Kerstin Franklin; kerstin.franklin@bfr.se
Editor(s)'s affiliation: ?
Editorial board: ?
Peer reviewed: No
Coverage 'Swedish Building Research is the journal that will keep you, the non-Swedish-speaking reader, up to date with the development in the field.'
Frequency: 4 issues a year
Publisher: Swedish Council for Building Research
Web site address: http://www.bfr.se/default.asp
Source: Web site and Ulrich's
Last updated: 14 February 2000.

–U–

Urban Design International

(1996–)
Editor(s): Richard Hayward and Sue McGlynn
Editor(s)'s affiliation: Joint Centre for Urban Design, Oxford Brookes University, UK
Editorial board: International
Peer reviewed: Yes
Coverage: Urban Design International aims to build the first international network for all of those involved in the multi-disciplinary tasks of urban design and management. In providing a forum for the exchange of information and a vehicle for the debate which constantly redefines the scope of urban design, the journal places a primary emphasis on bringing together practice and research. It addresses current issues and aims to make a range of material accessible to all: from in-depth papers and reviews of projects, to book reviews, comments on previous contributions and a diary of international events. Some issues are themed by topic or geographic region.

Frequency: 4 issues a year
Publisher: Routledge, Taylor & Francis Group
Web site address: http://www.tandf.co.uk/journals/routledge/13575317.html
Source: web site and COPAC
Last updated: 18 April 2000.

Urban Management

(1969–)
Editor(s): Jaci Leitel
Editor(s)'s affiliation: ?
Editorial board: ?
Peer reviewed: No
Coverage: Engineering Journal covering all disciplines in the urban management sector
Frequency: monthly
Publisher: John Pattrick
Web site address: No web address
Source: Ulrich's
Last updated: 8 Dec 1999

Urban Studies

(1964–)
Editor(s): W.F. Lever, Ronan Paddison
Editor(s)'s affiliation: ?
Editorial board: International
Peer reviewed: Yes
Coverage: Contents include original articles, notes and comments, and a comprehensive book review section. Regular contributions are drawn from the fields of economics, planning, political science, statistics, geography, sociology, population studies and public administration. It also publishes the occasional 'state of the art' article, consisting of an analytical review of the major strands of contemporary thinking in a given topic area, supported by an extended bibliography of the topic. This journal deals with every kind of urban and regional problem that is susceptible to social science or other relevant analysis. These range from such problems as urban housing, employment, race, politics and crime, to problems of regional investment and transport. Although most articles published deal with problems located in the advanced industrial societies of Europe and the Americas, important articles dealing with these problems in Asia, the Third World and in Eastern Europe are also published regularly.
Frequency: 9 issues per year and an annual volume.
Publisher: University of Glasgow
Web site address: ?
Source: Vol. 33, Number 10, Dec 1996.
Last updated: 30 March 2000

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