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Special issue: Green management in construction

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Due to the worldwide energy shortage and the need for sustainability of construction, green management in construction has become a conceptual and empirical issue in strategic management. Green management in construction refers to green practices and procedures used in the whole construction processes, by integrating green ideas (i.e., environmental protection, energy saving, carbon emission and pollution reduction) to meet the sustainable development requirements. In the process of construction, the popularization and application of green technology and the extensive development of green construction can improve the energy efficiency and achieve green management.

The existing literature in green construction has mainly examined how construction companies can reduce energy consumption and carbon emissions to decrease the impact on natural environment and increase their competitiveness. These green practices in the construction industry have prompted the development of green management. Meanwhile, the environmental regulation has been the key motivation for the contractors to conduct green management in construction projects. However, there are still some gaps considering the complexity of green construction.

The rationale of this cross-disciplinary approach is twofold. First, this special issue on *Frontiers of Engineering Management* aims to bring the voices of neighboring disciplines into green management in construction research and shed a light into advancing green management theories. Second, it will provide researchers a chance to solve respective real-world issues in business practice.

Wang et al. systematically reviewed and summarized the definitions of built environments from different perspectives and levels, so as to address the major challenges faced by built environments, such as the use of science and technology to solve key national and global issues. In this article, they addressed the key items of built environment, including climate change and energy consumption, urbanization and infrastructure construction, growth, and innovation. In response to identified challenges of built environments, they put forward the corresponding management issues and proposed future development strategies.

By proposing a model for measuring the impacts of high-speed rail (HSR) operation on HSR stations and the

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surrounding areas, which are called HSR-based nodal zone (HNZ), Liu and Ye involved in the academic debate about high-speed rail's contribution to urban development. This model consisted of two variables (i.e., transportation situation and transportation vitality) and three subsystems – economic, societal, and environmental system. Through questionnaire survey, they found that, the effects of HSR operation on HNZ are multidimensional; transportation vitality functions as an intermediate in the effects; the effects on the physical environment are negative. They proposed that urban development policies should be built on the mechanism of HSR in driving HNZ to grow.

With the aim of further understanding of the relationship between work and the psychological well-being of workers, Lee et al. proposed 12 dimensions of work, which were indicated to be significant in the establishment of such relationship. These dimensions also had a great impact on the psychological state of workers and were translated specifically into actionable items in the workplace. In order to relate these dimensions to one another, to workers, and to organizations, they developed a hypothetical system model. Furthermore, they also utilized these 12 dimensions to further develop work design and evaluation tools.

Zhao et al. explored the impacts of the sustainable roof area, photovoltaic (PV) array layout, and shading effect on high city density on the urban environment of rooftop PV's economic performance. A case study was taken in the urban area of Melbourne, and 90 photovoltaic designs were carried out under three shading conditions to generate 270 scenarios. Through a lifecycle cost-benefit analysis, they comprehensively grasped the economic performance of rooftop PV designs covering most of the urban areas of Melbourne, determined the optimal PV design scenarios for the urban environment, and provided useful information on value-for-money PV design. Moreover, they identified design scenarios with greatest ability to sustain the shading effect, and their founding also helped policymakers develop and deploy rooftop photovoltaic systems in urban planning.

Lespier et al. developed a tool that could quantify and rank preferred environmental impact indicators within a maritime transportation systems (MTS) and be used for decision making in complex environments, achieving the goal of improving environmental sustainability. Meantime, the model also provided an analytical tool for environmental policymakers in the shipping industry to conduct evaluation and developed alternatives that were less detrimental to the environment.

Based on the concepts of lean construction and green construction, Lu et al. introduced greenhouse gas emission as a cost factor in construction planning, equipment selection, and cost estimating, and formalized a comprehensive framework for equipment cost analysis. This framework could guide the selection of suitable construction equipment while taking into account the exhaust emission and productivity performance, and assess the impact of greenhouse gas emissions on estimating hourly rates for equipment and comparing greenness and sustainability for alternative equipment options.

Tam et al. proposed a solution in the deformation control for recycled concrete by adding supplementary cementitious materials – fly ash and blast furnace slag. Results indicated that the 50% fly ash replacement in Portland cement increased the rupture modulus of the recycled concrete. Conversely, a mixture of cement with over 50% replacement of either fly ash or slag or a combination of both exhibited detrimental effect on the compressive strength, rupture modulus, and drying shrinkage. The combined analysis of environmental impacts and mechanical properties of recycled concrete demonstrated the possibility of optimizing the selection of recycled concrete because the best scenario in this study was obtained with a concrete mixture of M8 (50% of fly ash with 100% recycled coarse aggregate).

Through research on two interior latex products with different raw material ratios and one non-woven wallpaper product, Zhang et al. evaluated the environmental and human health profiles of interior latex and wallpaper, respectively. The results indicated that the integrated impact of interior latex was lower than that of non-woven wallpaper, and the interior latex with low quality caused low life cycle integrated impact. The most impacted categories were global warming, respiratory effects, and water consumption. Hotspots of product manufacturing were recognized to promote green product design.

With the aim of helping decision makers choose low-carbon programs from previous experience according to the impact features of carbon emission and specific city context, Huang et al. proposed a case-based reasoning methodology as a reference for low-carbon city development, selecting the best practices for specific cities. This

methodology consisted of case representation, case retrieval, and case adaption and retention and was applied in the selection of the best practices for low-carbon development of Chengdu City in Sichuan Province, China.

Hubbard and Hubbard suggested that sustainability was also important in airport and roadway infrastructure projects, which were much less well known for sustainability than vertical construction. They provided an overview and discussions of sustainability rating systems for airport and roadway infrastructure from the perspectives of construction and operation, and introduced some specific projects highlighting both proven and innovative sustainable practices to demonstrate the applications of such concepts. They also discussed the relationship between sustainable transportation infrastructure and resilient transportation infrastructure.

Finally, we are extremely grateful to all the authors for their deep insights into the green management in construction and great contributions to this special issue. We also express sincere gratitude to all the editors-in-chief and reviewers for their supports and valuable suggestions in the process of reviewing and improving the articles.

Guest Editors-in-Chief

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Wen LING is an academician at the Chinese Academy of Engineering and an expert on systems and energy engineering. He is currently vice governor of People's Government of Shandong Province, chairman of Hydrogen Industrial Technology Innovation Alliance of China (HITIAC), and vice chairman of China Energy Society. He was former CEO, Director and Deputy Secretary of Party Leadership Group of China Energy, and former Chairman of Shenhua Energy Company. He was also vice chairman of the 9th Committee of Systems Engineering Society of China. Dr. Ling received his bachelor degree from Shanghai Jiao Tong University in 1984 and his doctoral degree in management engineering from Harbin Institute of Technology in 1991.

Experienced in systems engineering practice, Dr. Ling has long been endeavoring to apply systems engineering theory to large projects management and has made significant contributions to systems engineering theory and practice, and to the coordinated development of the industry. He is a National Outstanding Post-doctorate and a recipient of the State Council special allowance. He has been awarded 3 second prizes of National Prize for Progress in Science and Technology, 5 first prizes of Provincial Prize for Progress in Science and Technology and 10 international and domestic patents of invention.



Anlin SHAO is an academician at the Chinese Academy of Engineering and an expert on mining and metallurgical engineering. He is the vice general manager of ANSTEEL Group, the chairman of ANSTEEL Mining Group, the honorary president of China Metallurgical and Mining Enterprises Association, and the director of the Technical Committee of National Iron Ore Standardization. He has been long-termly engaged in lean iron ore technology development and project management. Shao presided over key techniques to overcome the bottlenecks of lean iron ore development and provided technical support for vitalizing iron ore resources in China. He applied system engineering theory to the practice of lean iron ore development project, created the "coordination of five stages" mining and metallurgy systems engineering mode, and introduced a systematic and innovative road for the green and efficient development of iron ore. He takes the lead in compiling the first medium and long-term developmental

plan for iron ore industry in China and chairs the establishment of multiple national and industrial criteria, which promoted the technological progress and sustainable development of metallurgical and mining. He has been awarded 3 second prizes of National Prize for Progress in Science and Technology, 1 top grade and 10 first prizes of science and technology at provincial level.



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Professor Zeng has undertaken over 20 research grants. He focused his research on management of infrastructural megaprojects in recent years. He currently directs two key research projects supported by the National Natural Science Foundation of China (NSFC), including innovation and green management in infrastructural megaprojects. He has published over 80 refereed journal papers. Professor Zeng has been awarded numerous honors and awards, including the National Distinguished Youth Researcher Award from NSFC in 2010.