Preface

RETHINKING SUSTAINABILITY: SUSTAINABLE URBAN AND INFRASTRUCTURE DEVELOPMENT

Introduction

In the foreword the Sustainable Urban and Regional Infrastructure Development: Technologies, Applications and Management, Kevin O’Connor points out that, in the 21st Century, ‘urban and infrastructure sustainability’ has become a very prominent element in the day-to-day debate on urban policy and the expression of that policy in urban planning and development decisions. While the origins of the sustainability discussion date back to the work of the Club of Rome, the Bruntland Report and the Rio declaration, in recent years, its critical importance has been highlighted by the adverse impacts of human activities such as a rapidly changing climate and the severe effects of greenhouse gas emissions.

In an atmosphere where civilisation is progressing and becoming more aware of the consequences of careless development decisions, rethinking sustainable development—particularly sustainable urban and infrastructure development—has become an inevitable necessity. As Glen Searle highlights in the afterword of the same text, the provision of infrastructure that is sustainable is still a central challenge for contemporary urban governance. Hence, answers to the sustainability problems should not be sought by just relying on technology solution availability only. A comprehensive approach to the rethinking of sustainable urban and infrastructure development is a must and forms the raison d’être of this book.

This book, which is a companion volume to Sustainable Urban and Regional Infrastructure Development: Technologies, Applications and Management, (2010, Information Science Reference) aims to bridge the gap in the current literature by addressing the overall problems present in the theory and practice of urban and infrastructure development. It presents a comprehensive coverage and understanding of sustainable urban and infrastructure development that provides insights into overcoming the consequences of unsustainable development. This comprehensive approach broadly covers the planning, design, engineering and management aspects of sustainable urban and infrastructure development.

Content

The foreword and afterword of the book are written by senior eminent academic researchers from Queensland University of Technology, Australia. The foreword by Stephen Kajewski focuses on establishing sustainable urban, and the afterword by futures John Bell focuses on sustainable urban and infrastructure development. The body of the book is organised into four main sections, each clustering...
a number of chapters dealing with specific aspects of sustainable urban and infrastructure development: (1) Planning sustainable urban and infrastructure development; (2) Designing sustainable urban and infrastructure development; (3) Engineering sustainable urban and infrastructure development; and (4) Managing sustainable urban and infrastructure development.

Section 1: Planning Sustainable Development: Sustainability of Urban Infrastructure

The seven chapters in Section One consider the role of urban, regional and infrastructure planning in achieving sustainable urban and infrastructure development.

In the opening chapter of the book, Suharto Teriman, Tan Yigitcanlar and Severine Mayere argue that achieving long term sustainability requires an integrated planning and development process. Their chapter, therefore, focuses on an investigation that develops a new planning and development approach that provides sustainable outcomes, and introduces a new sustainability framework for urban planning and development. This framework integrates urban planning and development processes by considering ecosystems and sustainability assessment mechanisms.

In the second chapter of this section, Didem Dizdaroglu, Tan Yigitcanlar and Les Dawes highlight the urgent need to develop urban planning and development policies with a more intensive sustainability focus for improving the quality of urban ecosystems in response to environmental problems. They argue that ecological planning is a functional requirement in the establishment of sustainable built environment. The chapter underlines the importance of ecological planning principles for sustainable urban development, and presents a conceptual framework for developing sustainable urban ecosystems through an ecological planning approach.

The third chapter in Section One focuses on sustainable stormwater management, which, in the era of climate change, is crucial for almost every settlement. This chapter (by Shinyi Lee and Tan Yigitcanlar) investigates the role of water sensitive urban design as one of the key factors in better managing urban stormwater runoff. The chapter explores the fundamental issues, barriers and drivers in water sensitive urban design projects that affect sustainability outcomes of urban stormwater management and improve sustainable urban stormwater management efforts.

In the fourth chapter, Benson Au-Yeung, Tan Yigitcanlar and Severine Mayere argue that achieving triple-bottom-line sustainability without compromising quality of life is an increasingly important issue as cities face a number of challenge and problems. This chapter introduces a new urban infrastructure management model that better deals with the ill effects of 21st Century urbanisation: The ‘Brisbane Urban Growth Model’. This model provides a dynamic platform for timely and coordinated delivery of urban infrastructure and supports efforts that pursue sustainable and effective urban infrastructure management.

In the fifth chapter of this section, Fatih Dur, Tan Yigitcanlar and Jonathan Bunker examine the triple bottom line approach and the applicability of this approach to sustainable urban and transport development. The chapter introduces the ‘Integrated Land Use and Transportation Indexing Model’ that incorporates triple bottom line considerations with environmental impact assessment tools to help decision-makers and planners. This chapter indicates the usefulness of the model in picturing the holistic state of urban settlements with respect to their current and future sustainability levels.

The next chapter in this section (by Tan Yigitcanlar) points out the catalyst role of information and communication technologies in sustainable urban development. It investigates the potential contributions of information and communication technologies to the sustainability of cities. It examines several web-based best practice project examples which offer comprehensive analysis tools to capture public
opinion and to enable planning for sustainable urban futures. The significant points made here relate to the raison d’être of this section: the need for suitable planning support technologies, models and processes to ensure the long term sustainability of urban and infrastructure development.

In the final chapter of the first section, Paul Donehue evaluates the impact of commodification of residential land and housing on the sustainability of the built environment. The chapter utilises research conducted into intentional communities, many of which have chosen to de-commodify their housing and land in order to pursue goals of greater sustainability. This chapter identifies the tendency of social and legal structures to protect the operation of the free market, and emphasises that the types of resources required by a community as a consequence of commodification may be a threat to the maintenance of long-term sustainability.

Section 2: Designing Sustainable Development: Sustainable Urban Transportation Infrastructure

The five chapters in Section Two provide insight into planning and designing sustainable urban transportation infrastructure—a key element in establishing sustainable urban futures.

The first chapter of the section (by Kushari Rashid, Tan Yigitcanlar and Jonathan Bunker) focuses on the transport disadvantage problem which could be eased by moving towards sustainable transport development. Its authors see transportation disadvantage as a multi-dimensional problem with socio-economic, transportation and spatial dimensions. The chapter particularly investigates the spatial dimension of the transportation disadvantage problem (which has not previously been thoroughly covered) by comparing the travel capabilities and accessibility levels of residents with land use characteristics.

The second chapter in this section focuses on transit oriented developments as a new form of development that contributes to the sustainability of urban environments. In this chapter, Deepti Muley, Jonathan Bunker and Luis Ferreira present the findings of travel surveys undertaken in a case study of the Kelvin Grove Urban Village, Brisbane, Australia. The study provides insights into sustainable transport development by confirming that residents, visitors and employees of transit oriented developments (such as the Kelvin Grove Urban Village) make more use of sustainable modes of transport compared to the rest of the population.

The subsequent chapter in Section Two focuses on a very important aspect of sustainable transport development: route choice behaviours of public transit users. The authors – Yulin Liu, Jonathan Bunker and Luis Ferreira – undertake a historical review of such behaviours from the 1960s to the present. They also provide an insight into future directions for modelling transit users’ route choice behaviours. They draw on both road transport and modelling practice research to further explore these behavioural complexities.

Parvez Mahbub, Godwin Ayoko, Prasanna Egodawatta, Tan Yigitcanlar and Ashantha Goonetilleke’s chapter on the impacts of transportation and climate change on stormwater quality presents a methodology for policy makers to assist in forming policy and plans to deal with unsustainable urban and transport development. The methodology and the case study introduced in this chapter provide invaluable insights into the collection and testing of heavy metals and total petroleum hydrocarbons from urban road surfaces in order to see the potential impacts of transportation related pollution and climate change.

Linked closely with the previous chapter, the final chapter of this section (by Janaka Gunawardena, Ashantha Goonetilleke, Prasanna Egodawatta, Godwin Ayoko and Jason Kerr) examines the impacts of urban traffic characteristics on urban stormwater quality. Its authors report on their new methodology
which was developed to determine the urban, traffic-generated key pollutants in receiving waters. The methodology is tested in a number of study sites selected from the Gold Coast, Australia.

Section 3: Engineering Sustainable Development: Safety and Integrity of Urban Infrastructure

In five chapters, Section Three of the book focuses on engineering issues including the safety and integrity of urban infrastructure. These issues are reported in the literature as being among the key sustainability considerations.

The first chapter of Section Three (by Hoi Wai Shih, David Thambiratnam and Tommy Chan) introduces dynamic computer simulation techniques to assess potential damage to urban infrastructure which affects its sustainability. With a particular focus on bridges, the methodology introduced in this chapter utilises numerically simulated modal data to assess the structural health state of urban infrastructure. The chapter discusses the strength and competence of the modal strain energy method and its applicability to multi-girder composite bridges.

The second chapter in this section (by Praveen Moragaspitiya, David Thambiratnam, Nimal Perera and Tommy Chan) also focuses on infrastructure sustainability with a particular focus on the differential axial shortening of high rise buildings’ concrete structures. The authors investigate the adverse effects of time dependent behaviour that results in volume change known as shrinkage, creep and elastic deformation. The chapter introduces an accurate numerical procedure to quantify the differential axial shortening of structural elements, along with new practical concepts relating to the variation of vibration characteristic of high rise concrete buildings.

The chapter by Herath Thilakarathna, David Thambiratnam, Manicka Dhanasekar and Nimal Perera investigates infrastructure sustainability by focusing on vulnerability of axially loaded columns that are subjected to transverse impact load. The chapter reports the findings of research undertaken to investigate the impact capacity of columns of low to medium rise buildings designed according to the Australian construction standards. The chapter provides useful information on how to assess the vulnerability of columns to a new generation of vehicles in urban areas.

The fourth chapter in Section Three examines and identifies some important structural health monitoring issues. Authors Liang Wang, Tommy Chan, David Thambiratnam and Andy Tan discuss and review the recent developments in damage detection and condition assessment techniques based on vibration-based damage detection and statistical methods. The chapter considers vibration-based damage detection methods based on changes in natural frequencies, curvature or strain modes, modal strain energy, dynamic flexibility, artificial neural networks before and after damage, and other signal processing methods.

The final chapter of this section (by Manindra Kaphle and Andy Tan) explores structural health monitoring, particularly focusing on source location of acoustic emission waves of bridges. Kaphle and Tan provide a background of acoustic emission technique and the process of source localisation. The chapter presents the results from laboratory experiments conducted to explore several aspects of source localisation processes. It summarises the findings of a study that enhances the knowledge of the acoustic emission process and the development of effective bridge structure diagnostics systems.
Section 4: Managing Sustainable Development: Project Management of Urban Infrastructure

In five chapters, the final section of the book investigates the management issues of urban infrastructure, particularly focusing on decision support mechanisms, trust, satisfaction levels, capacity management and knowledge transfer issues.

The first chapter of this section discusses the roles of contemporary decision support tools in sustainable infrastructure project planning. Chapter authors–Omar Mohd Faizal, Bambang Trigunarsyah and Johnny Wong–indicate that decision support systems are complicated and do not adequately support the decision making of project team members. The chapter illustrates a framework for a more desirable decision support system environment. This chapter also describes some of the key issues related to decision support system implementation in sustainable infrastructure project planning.

The prime focus of the second chapter in Section Four is to explore ways in which to overcome the lack of trust and social networking in small and medium size project teams. Authors Liang Chen, Anna Wiewiora and Bambang Trigunarsyah present their approach to these problems. This approach identifies the optimum structure of relationship networks and knowledge networks within small and medium size projects. The chapter also outlines the findings of an extensive literature review in the areas of social capital, knowledge management and project management and presents the conceptual model of the authors’ research approach.

The subsequent chapter in Section Four (by Asrul Nasid Masrom and Martin Skitmore) focuses on the sustainability performance of the construction and satisfaction levels in construction projects. The chapter summarises a review of the advantages of satisfaction measurement in the construction industry, examines the methods commonly practised in current measurements of satisfaction levels, and discusses the advantages of promoting these methods. The authors then provide recommendations for the most appropriate methods to be used in identifying the performance of project outcomes.

The fourth chapter of the final section concerns sustainable infrastructure assets and capability for infrastructure capacity management. In this chapter, Eric Too, Martin Betts and Arun Kumar scrutinise the concept of capability and identify the core capability needed in infrastructure capacity management. Through a case study of the Port of Brisbane, Australia, they show that infrastructure organisations must develop their intelligence gathering capability so as to effectively manage the capacity of their infrastructure assets, particularly when sustainable outcomes are targeted.

The final chapter of the book (by Anna Wiewiora, Bambang Trigunarsyah and Glen Murphy) argues the need for a unique approach to knowledge transfer in project based organisations. The chapter provides a comprehensive review of the literature on the areas of project management, knowledge management, and organisational structure. The study is further supported by empirical evidence from interviews with project management practitioners. This chapter reveals the key elements that play an important role in across project knowledge transfer, including the need for social communication, a lessons learned database, and a project management office.
Contributors

All chapter authors of this book are affiliated or associated with the Infrastructure Research Theme of The Queensland University of Technology, Brisbane, Australia. The Infrastructure Research Theme is a research organisation of The Queensland University of Technology’s Faculty of Built Environment and Engineering. The Infrastructure Research Theme aims to establish both a national and international reputation for infrastructure related research in key areas by creating and disseminating fundamental and applied knowledge of importance to industry and the community. The primary goal of the Theme is to undertake strategic and applied research and thereby contribute to improving the planning, design, operation and management of vital infrastructure critical for human wellbeing.

Researchers affiliated with the Theme aim to significantly contribute to the theory and practice of sustainable urban development through research in urban, regional, environmental and transport planning, developmental infrastructure provision, sustainable urban growth management, knowledge-based urban development, and land and water resources management. They work towards improving the delivery of physical infrastructures and enhancing effectiveness and efficiency during the operational phase by undertaking research into the procurement of infrastructure, project financing, sustainable construction, integrated project management, project leadership and knowledge management.

Research is also undertaken in the areas of transport asset management, intelligent transport systems, congestion management, infrastructure (existing and new) adaptation to climate change, land transport modelling, freight logistics, integrated transport, public transport, toll road and pricing, road and pavement design, and construction materials.

Researchers in the Theme also seek to make a significant contribution to ensuring the safety and integrity of infrastructure including road, rail, airports, seaports, housing, water and sanitation through groundbreaking research in structural health monitoring, infrastructure asset management, reliability modelling, infrastructure sustainability and smart and sustainable infrastructure.

Tan Yigitcanlar
Queensland University of Technology, Australia

ENDNOTE
