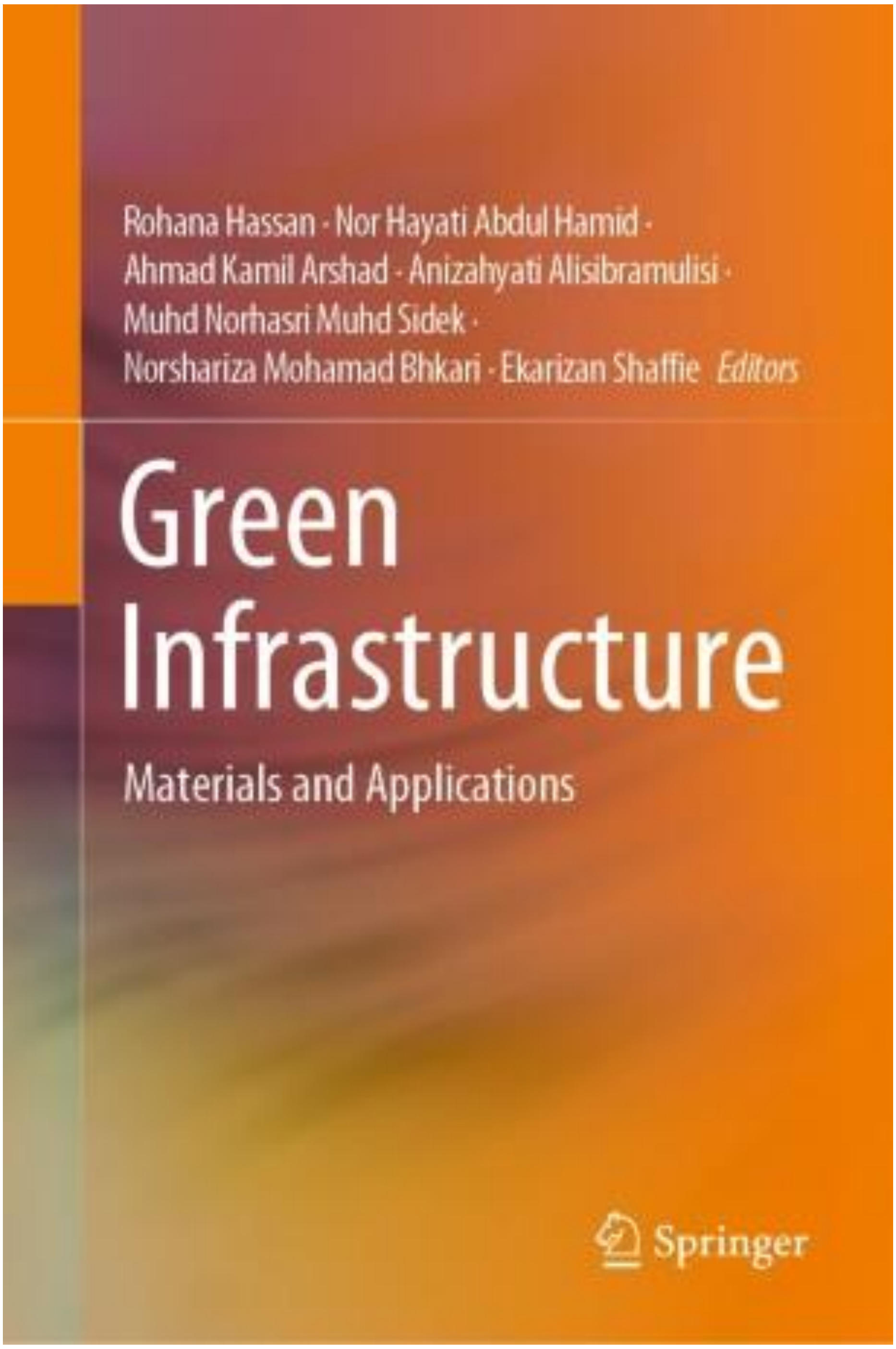

Green Infrastructure

Materials and Applications

Editors: Rohana Hassan, Nor Hayati Abdul Hamid, Ahmad Kamil Arshad, Anizahyati Alisibramulisi, Muhd Norhasri Muhd Sidek, Norshariza Mohamad Bhkari, Ekarizan Shaffie

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ISBN 978-981-16-6382-6 ISBN 978-981-16-6383-3 (eBook)
https://doi.org/10.1007/978-981-16-6383-3

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd.
The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

Preface

This book highlights green infrastructure materials and their applications along with their limitations in contributing towards green industries. It starts by discussing modifications in concrete design by adding recycled polyethylene terephthalate bottles as partial replacement of aggregates, mortar, ordinary Portland cement, alternative binder for paving blocks and others. This mixed concrete can be used as sustainable wall panels and concrete blocks. These types of sustainable wall panels can be used to construct green buildings and to save the environment through reduction of waste plastic bottles at landfills.

The initial chapters discuss the repair and retrofitting of concrete structure by using palm oil fly ash (POFA) which is the byproduct of palm oil industries as alkaline and physical activated POFA cement paste. A review of concrete performance on tin slag polymer concrete as green structural material for sustainable future and its study on the effect of waste paper sludge ash (WPSA) in addition to fresh and hardened ultra-high-performance concrete are explained and elaborated.

Chapters "Flexural Performance of Strengthened Glued Laminated (GLULAM) Timber Beam Using Glass Fibre-Reinforced Polymer (GFRP)"–"Analysis of the Flexural Strength of Reinforced Beam with Bamboo by Empirical Modeling Using Statistical Model" present the physical and mechanical properties of timber as one of the green material that contributes to green infrastructure construction and sustainability. The experimental results on flexural performance of strengthened glued laminated (glulam) timber beam using glass fibre reinforced polymer (GFRP); overview on bending and rolling shear properties of cross laminated timber (CLT), together with delamination test for Mengkulang timber species using method A and C are presented. Further analysis on flexural strength of reinforced beam with bamboo by empirical modelling using statistical model is also presented in the book.

The two following chapters in this book discuss road pavement materials and their testing and evaluation. It includes innovative new and waste materials which can be recycled to prolong the life span of road pavements. In order for the pavement to withstand the ever-increasing loadings from vehicles in terms of intensity and axle applications, pavement materials must have adequate strength to withstand these loads and must also be durable to withstand the effects of environment, namely moisture and temperature. Chapter "Application of Pavement Evaluation for Road Maintenance and Rehabilitation" describes the process of pavement evaluation and the application of its results for use in the maintenance and rehabilitation of roads. Meanwhile, chapter "Performance Evaluation of Stone Mastic Asphalt Containing Steel Fibre as Additive" presents the findings of a study on addition of steel fibre in stone mastic asphalt (SMA) application. SMA is a gap-graded asphalt mixture that consists of a large proportion of coarse aggregate, a high percentage of asphalt binder and a substantial amount of filler which provides a durable surface course.

Chapters "Post-construction Complexity Factors Impacting Infrastructure Project Performance in Malaysia"–"Governance Practices in Poverty Alleviation Projects: Case Study from Stewardship-Driven Perspective and Sustainability Context" present the post-construction complexity factors that impact the infrastructure project performance in Malaysia, followed by the SWOT analysis of green technology application for the development of low carbon cities and a sharing of a case study from stewardship-driven perspective and sustainability context through governance practices in poverty alleviation projects.

Discussion on interception loss of tree canopy as green infrastructure and an evaluation of parameters for sustainability assessment of green infrastructure in the urban water system are presented in chapters "Interception Loss of Tree Canopy as Green Infrastructure" and "Evaluation of Parameters for Sustainability Assessment of Green Infrastructure in the Urban Water System", respectively. This contemporary book also covers a green community-based social enterprise (CBSE) for B40 in Sabah, through a sharing of freshwater lobster production-green Aquaponics Perennial System (flp-gaps) in chapter "Freshwater Lobster Production-Green Aquaponics Perennial System (FLP-GAPS): A Green Community-Based Social Enterprise (CBSE) for B40 in Sabah". Last but not least, chapter "An Edible Cutleries Using Green Materials: Sorghum Flour" presents the use of sorghum flour as one of the green materials in a form of edible cutleries performance.

This comprehensive book entitled "Green Infrastructure Materials and Applications" is suitable for engineering students to develop competency in theory, practical and communication skills. It presents a framework for engineers to add on different materials into practice. The chapters in the book also present the link between materials and the application processes. The various engineering materials presented in this book will inspire and stimulate discussions in academia and industry to develop and promote green infrastructure materials and their applications for the future.

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Contents

A Review on Tin Slag Polymer Concrete as Green Structural Material for Sustainable Future

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Chapter | First Online: 06 December 2021

Abstract

Ordinary Portland cement concrete (OPC) is widely utilized in construction industry as structural material, but it has environmental issue due to natural resources consumption and Carbon emission. Therefore, polymer concrete (PC) with tin slag (TS) waste are introduced to replace aggregate and cement in OPC. Previous research on potential to apply TSPC as structural material has provided compressive strength data which shows that it can compete with OPC. PC using polyester and 100% TS aggregate with resin-aggregate ratio 30:70 consist of fine (<1 mm) uniformly graded aggregate has achieved compressive strength 58.21 MPa. After that, in another study, gap graded performance of TSPC using raw (4 mm) and coarse (2 mm) TS aggregate introduced and result in compressive strength 37.71 MPa, highest compared to other variation. By applying external FRP strengthening with two layers of CFRP increase strength to 125.07 MPa and finally uniformly graded TSPC with three layers of CFRP wrapping increased strength to 156.88 MPa. This discovery has contributed to the beginning of active study in TSPC as green structural material for sustainable future.

Keywords

Green · Structural Material · Polymer Concrete · Tin Slag · Compressive Strength · FRP Confinement · TSPC · Sustainable

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Acknowledgements

This review is to explore gap and research potential in TSPC study in the aspect of external strengthening to be applied as structural material. The funding of this research comes from a collaborative research grant from University Technology Malaysia (CRG UTM—Tin Slag) under Vot. CRG: RDU192311 and also from Postgrad Research Scheme 2021(PGRS), UMP under Vot. Project PGRS210339.

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