

Lecture Notes in Civil Engineering

Ashok Kumar Gupta
Sanjay Kumar Shukla
Hazi Azamathulla *Editors*

Advances in Construction Materials and Sustainable Environment

Select Proceedings of ICCME 2020

 Springer

Ashok Kumar Gupta · Sanjay Kumar Shukla ·
Hazi Azamathulla
Editors

Advances in Construction Materials and Sustainable Environment

Select Proceedings of ICCME 2020

 Springer



Jaypee University of Information Technology, Learning Resource Center
Acc. No. : D03879
Date : 06/06/2022
Call No. :

Editors

Ashok Kumar Gupta
Department of Civil Engineering
Jaypee University of Information
Technology
Solani, India

Sanjay Kumar Shukla
School of Engineering
Edith Cowan University
Joondalup, WA, Australia

Hazi Azamathulla
Department of Civil and Environmental
Engineering
University of the West Indies
St. Augustine, Trinidad and Tobago

ISSN 2366-2557

ISSN 2366-2565 (electronic)

Lecture Notes in Civil Engineering

ISBN 978-981-16-6556-1

ISBN 978-981-16-6557-8 (eBook)

<https://doi.org/10.1007/978-981-16-6557-8>

© Springer Nature Singapore Pte Ltd. 2022

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

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

Contents

Use of Biochar for Sustainable Environmental Remediation	1
Krishna R. Reddy and Jyoti K. Chetri	
Macro and microscale Engineering Response of Rigid-Soft Gravel-Rubber Inclusions: Insights from Detailed Laboratory and DEM Numerical Investigations	11
Gabriele Chiaro, Ali Tasalloti, Kevin Chew, Jayan S. Vinod, and Krishna Allulakshmi	
Structural Health Monitoring of Heritage Structures Using Geotechnical Instruments	29
Abhinav Maloo and Parth Thaker	
Zinc-Based Anodes for Cathodic Protection of Reinforced Concrete Structures	45
Arpit Goyal	
An Overview: Supplementary Cementitious Materials	53
Pooja Jha, A. K. Sachan, and R. P. Singh	
Degradation and Decoloration of RB5 Dye via UV Radiation Using Fe-TiO₂ Composite Photocatalyst in Fixed-Mode	65
Lavneet Kumar, Ina Thakur, Anoop Verma, B. S. Bhatia, and Charanjit Kaur Mangat	
Study on Concrete Developed with Recycled Fine Aggregate	77
Nancy Soni and Dharmendra Kumar Shukla	
Examination of Platooning Variables on Two-Lane Highways Having Mixed Traffic Situation	95
Amardeep Boora, Indrajit Ghosh, Satish Chandra, and Kavita Rani	
Walkability Analysis of an Urban Area: Gender-Based and Combined Model Approach	111
Kavita Rani, Amardeep Boora, and Manoranjan Parida	

State of Art: Review for Sustainable Application of Waste Material in Rigid Pavement	127
Amardeep Boora and Ankit Dharma	
Study on Cost Modeling and Economical Design of Superstructure	143
Peerzada Danish, Kamil Ashraf Bhat, S. Ganesh, and J. Anita Jessie	
Structural Assessment of an Overhead Storage Reservoir Using NDT: A Case Study	151
Ram Prakash and Sunita Bansal	
Fracture and Impact Studies on Steel Fibre and Wire Mesh Embedded Concrete	163
S. Kanchidurai, P. Jaishankar, R. Vidya, and Prakhsh Neelamegam	
Physico-Mechanical and Thermal Properties of Lightweight Structural Concrete with Light Expanded Clay Aggregate for Energy-Efficient Buildings	175
Rajesh Kumar, Rajni Lakhani, and Ashok Kumar	
Agro-Industrial Wastes Incorporated Cement Stabilized Mud Composites for Roof and Wall Assembly in Energy Efficient Building Envelope	187
Rajesh Kumar, Rajni Lakhani, Bibhakar Kumar Singh, Mahesh Sharma, and S. K. Negi	
Seismic Response of Reinforced Concrete Frames with Masonry Infills	197
Vinayak Sharma and Sushil Kumar Madan	
Analysis of Seismic Behavior of Buildings With and Without Shear Walls in Various Seismic Zones and Soil Types	207
Diptanshu Lal, Biplav Regmi, Haris Farooq Bhat, and S. Anbu Kumar	
Review on the Durability Parameters of Self-compacting Concrete	219
Reshul Raj, Mayur Bhat, Achal Agrawal, and Narayan Chandak	
An Approach Towards Zero-Waste Building Construction	239
Anil Soharu, Naveen BP, and Arjun Sil	
Improvement of Hard Water Characteristics and Scale Formation Under the Effect of Pulsating Electromagnetic Field	259
Amrit Anand Dosar and Vivek Srivastava	
Critical Overview of Reinforcing Sand Using Geocell for Shallow Foundation	271
K. Anusha Raj, Pragya Sinha, Sanjeev Kumar, and Davinder Singh	

Road Bridges Across Cooum and Adyar Rivers in Chennai City—Need for Structural Health Monitoring	281
A. Rose Enid Teresa, S. Stella, M. Goutham Priya, P. Gajalakshmi, and J. Revathy	
Evaluating Factors Affecting Red Mud Interfacial Strength Using Binder Cement Kiln Dust and Polypropylene Fiber	295
Pankaj Sharma, Saurabh Rawat, and Ashok Kumar Gupta	
Review on Thermal Energy Efficiency Using Gypsum Integrated Phase Change Materials in Buildings	305
Kavita Vaishnav, Gift Pon Lazarus, Sunita Bansal, and Yaman Hooda	
Coastline Protection Using a Rubble Mound Seawall: A Case Study	321
Prakhar Joshi, Prashant, Pritesh Goyal, and Pradeep K. Goyal	
Prediction of Compressive Strength of Rubberized Concrete Using Ordinary Least Squares Regression Model	331
Prabhat Kala, Shivam Upadhyay, Pradhyumna Asthana, and Pradeep K. Goyal	
Effect of Soil Fill on the Load Distribution Characteristics of RC Skew Box Culverts for Road Under Bridge Design	341
Shimol Philip, R. Rakendu, and Rajesh Lal	
Chloride Ion Penetration of GGBS-Based Geopolymer Concrete with Different Molarities of NaOH	355
N. Sailaja, M. Naveen, S. K. Amir Basha, B. Sarath Chandra Kumar, C. Ravi Kumar Reddy, Y. Himath Kumar, and J. D. Chaitanya Kumar	
Application of RSM in the Optimization of GGBS and Metakaoline Based Geopolymer Concrete	365
Ch. Pavan Kalyan, D. Anil Kumar, K. Saloman Raju, B. Sarath Chandra Kumar, C. Ravi Kumar Reddy, Y. Himath Kumar, and J. D. Chaitanya Kumar	
Evaluation of Use of Plastic and Rubber in Road Construction	375
Neeraj Kumar, Nikhil, Ashutosh Kumar, and A. R. Kongan	
Evaluation of Cloth Bag and Gunny Bag as Potential Reinforcing Materials for Pond Ash	385
Sujit Kumar Pradhan, Anwesha Rath, and Goutam Kumar Pothal	
The Effect of Sisal Fiber on Mechanical Strength of Concrete M20 Grade	395
Celso Januário Baúque, Ankit Thakur, and Bhartesh	

Waste Plastic Management via Pyrolysis as Sustainable Route	409
Sahil Chauhan, Subhankar Basu, Sk Aakash Hossain, and Arasavilli Srija	
Seismic Fragility of Buildings Subjected to Pounding Effects with Soil–Structure Interaction	425
Rajan L. Wankhade, Ajinkya Sawarkar, Ayush Chandwani, Shahaji Chavan, Pratik Malkar, and Gaurav Sawarkar	
Sustainable Bituminous Pavement: A Study on Low-Density Polymer Modified Bituminous Binder	435
Vishnu Vijayan, Jeevan Mathew Tharayil, R. Rakhil Krishna, Jiji Saji, Divya S. Shaji, and G. Lakshmi	
Identification of Parking Sites in the Kukatpally Region Using GIS and AHP	447
Ramu Penki, T. Srinivasa Rao, G. Vinod Naik, and Rapaka Aparna	
Minimization of Risks in Highway Projects Using Buffer	457
Rahul Garg and Saurabh Rawat	
Trend Modeling for Air Quality—An Approach	467
M. Goutham Priya and S. Jayalakshmi	
Traffic Analysis on Intersection Using PTV Vissim	481
Pranjal Sharma, Ashok Kumar Gupta, and Akash Bhardwaj	
Parametric Strength of Sustainable Concrete Using Fly Ash, GGBS and Recycled Aggregates as Per Taguchi's Approach	491
Yaman Hooda, Sunita Bansal, and Anjali Gupta	
Numerical Analysis on Voided Slab with Different Reinforcement on ANSYS 2020R1	505
Nikita Jain and Asif Hussain	
Laboratory-Based Study of Flexible Facing in Soil Nailed Slope	517
Mohammad Farhad Ayazi, Samrity Jalota, and Amanpreet Tangri	
Summer Vs Winter Air Pollutants Variation for Year 2019 and Lockdown Effect for CRRI Mathura Road Station Delhi	531
Shahbaz Ahsan, Shashi Tiwari, S. M. Huzaifa Abbadullah, Deepak Nader, and Gaurav Kumar	
Use of Fly Ash—A Resourceful Byproduct in Road Embankment: A Review	539
Deepak Kumar Sahay and Sunita Bansal	
Application of Industrial Wastes for Soil Strength Improvement	551
S. Muthu Lakshmi, S. Geetha, M. Selvakumar, S. Revathy, and K. M. Shri Varshini	

Physical and Mechanical Characteristics of Cement Mortar with Coal Bottom Ash as Fine Aggregate Under Elevated Temperature	561
Abhishek Srivastava, S. K. Singh, and Rajesh Kumar	
Prediction of Air Pollution Due to Mobile Sources Using Line Source Models	573
M. Selvakumar, S. Geetha, and S. Muthu Lakshmi	
Estimation of Methane Generation from Municipal Solid Waste of Mohali Landfill Site	585
Rishi Rana, Abhinav Choudhary, Karma Yangzom, and Kaushal Kumar	
Evaluation of Water Quality Index to Assess the Impact of River Pollution on Vembanad Lake—A Ramsar Site	597
Rohan Nair, K. V. Hariprasad, S. Ashwin Sheno, M. P. Amrutesh, Kiran V. Gireesh, Gevargis Muramthookil Thomas, and S. N. Jyothi	
A Scientometric Analysis on Bio-Bitumen	607
Ramu Penki, Banna Madhavi, K. Akhilesh Patnaik, and A Sri Divya	
A Scientometric Analysis on Aggregate Blending	621
Kota Komal Kumar and Ramu Penki	
Contextual Analysis on Antenatal and Postnatal Effects of 2018 Flood in Ernakulam, Kerala	635
Athira B. Menon, Devi priya, Krishna Rajeev, Geena Prasad, and Gevargis Muramthookil Thomas	
Mechanical Properties of Concrete Containing Plastic Fiber	647
Shubham Sharma and Amardeep Boora	
Structural Health Monitoring Through the Application of Piezoelectric Sensors – State of the Art Review	657
Aishwarya Thakur and Saurav	
The Inhibitive Effect of Vitamin-C on the Corrosive Performance of Mild Steel in Ground Granulated Blast Furnace Slag-Based Concrete	675
Imran Qasim and Khushpreet Singh	
Hydrodynamic Modeling for Identifying Flood Vulnerability Zones in Mahi Lower Sub-basin	687
R. Rathod Krina and Sudhanshu Dixit	
Influence of Distinctive Parameters on Fundamental Time Period of the Building	699
Shubam Sharma and Aditya Kumar Tiwary	

Experimental Study of Fiber-Reinforced Concrete Prepared with Recycled Coarse Aggregate Bagasse Ash and Polypropylene Fiber	711
Harish Kumar and Aditya Kumar Tiwary	
Effect of Shear Walls on Tall Buildings with Different Corner Configuration Subjected to Wind Loads	723
Saransh Mahajan, Vikramaditya Yadav, Rahul Raj, and Ritu Raj	
Analytical Investigation of Moment Resisting Frame Structure—A Case Study on Performance-Based Capacity Spectrum Method	735
Ajay Singh Thakur and Tanmay Gupta	
Study of Slope Stability Using Flexible Facing	747
Amanpreet Tangri and Saurabh Rawat	
Use of Waste Polymers in a Plastic Bricks as Sustainable Building and Construction Materials	757
Prajwal Madghe, Himanshu Berad, Abhijeet Roy, Nishant Vaidya, Nivesh Sakharwade, and Rajan L. Wankhade	
Determination of the Probability of Collapse for Existing Building Using Rapid Visual Screening as Tool	767
Salil Jha and Shilpa Pal	
Prioritizing Buildings for Seismic Retrofit on the Basis of RVS Score	779
Salil Jha and Shilpa Pal	
Utilization of Rice Straw Ash as a Replacement of Cement and Fine Aggregate in Mortar Mixes	793
Mohammad Ihtesham Hadizai and Aditya Kumar Tiwary	
Analytical Behavior of Concrete-Filled Single-Skin and Double-Skin Tube Columns Subjected to Axial Loading	809
Sakshi Bhatia and Aditya Kumar Tiwary	
Corrosion Monitoring in Reinforced Concrete Structures by Impressed Current Technique	823
Meenakshi Dixit and Ashok Kumar Gupta	
Evaluation of Model 3D Printer and Design Mix for 3D Concrete Printing	837
Ashutosh Dwivedi, Ankit Pal, Shiv Singh Patel, Ajay Chourasia, and A. K. Jain	
Axial Compression Behavior of Single-Skin and Double-Skin Concrete-Filled Steel Tube Columns: A Review	849
Sakshi Bhatia and Aditya Kumar Tiwary	

Comparative Seismic Analysis of Multi-storied Building with and Without Floating Columns	863
Arvind Thakur and Amreen Khatun	
Axial Loading Behaviour of Concrete Filled Steel Tube (CFST) Columns: A Parametric Study	873
Aditya Kumar Tiwary and Ashok Kumar Gupta	
Comparative Investigation on Mode Shapes and Natural Frequency of Low-Rise RC Frame Building	885
Pushkar Sharma and Tanmay Gupta	
Study of Behavior of the Masonry Infill Structures Subjected to Lateral Loads	899
Shilpa Pal, Sahil Yadav, Omkarnath Thakur, and Rohit Kashyap	
Quantification of Municipal Solid Waste and Effect of Open Dumping on Soil in Smart City Dharamshala, Himachal Pradesh	913
Anchal Sharma, Love Sharma, and Rajiv Ganguly	
Strength Characteristics of Clayey Soil Stabilized with Brick Kiln Dust and Sisal Fiber	927
Mandeep Singh, Kanwarpreet Singh, and Abhishek Sharma	
Numerical Investigation of Wind Load on Side Ratio of High-Rise Buildings	937
Rahul Kumar Meena, Ritu Raj, and S. Anbukumar	
Effective Remediation Techniques for Twin Shallow Lakes in Panchkula, Haryana	953
Prachi Vasistha and Rajiv Ganguly	
Influence of Pond Ash on Compaction and Strength of Clayey Soil Mixed with Terrazyme	973
Nitish Kumar, Abhishek Sharma, and Kanwarpreet Singh	
Seismic Analysis of Vertically Regular and Irregular Buildings with Shear Walls and RCC X-Bracing System	981
Mohd Zahid, Md Miraz, Mohd Faizan Saifi Warsi, and Shilpa Pal	
Crumb Rubber Concrete Formation by Partial Replacement of Fine Aggregates	995
Pradeep K. Goyal and Akhilesh Chauhan	
Influence of Mineral Admixture on Acceleration Carbonation Curing of Concrete: A Review	1005
Ishfaq Ahmad Bhat, Khushpreet Singh, and Nittin Sharma	
Pre-Engineered Buildings—A Cost Saving Approach	1019
Abhijeet Roy, Rohit Motwani, Aditya Jaiswal, Aishwarya Raipurkar, and Kshitija Kadam	

Effect of Curing on Compressive and Shear Strength Parameters of Liming Waste Ash Stabilized Expansive Soil	1035
Niraj Singh Parihar and Ashok Kumar Gupta	
Analysis of Critical Factors Affecting Labor Productivity of Construction Projects in Himachal Pradesh	1047
Kaushal Kumar and Rishi Rana	
Effect of Adding Fly Ash and Metakaolin on Mechanical Properties of Concrete	1059
S. K. Singh, Maninder Singh, and Rajesh Goyal	

About the Editors



Dr. Ashok Kumar Gupta is currently a Professor of Civil Engineering and Dean (Academics and Research), Jaypee University of Information Technology, Wahnaghat, Solan, Himachal Pradesh, India. He obtained his B.E. (Civil) with honours and M.E. (Geotechnical Engineering) from University of Roorkee which is now Indian Institute of Technology, Roorkee. He completed his Ph.D. from Indian Institute of Technology, Delhi. His major areas of research include testing and modeling of geotechnical materials, finite element method and its applications to geotechnical engineering, continuum damage mechanics and its application to rockfill materials modeling, and environmental geotechnique. He has published 57 papers in international journals of repute and co-authored 2 books and seven book chapters. He is also a reviewer for the Journal of Geotechnical and Geoenvironmental Engineering, ASCE and International Journal of Geomechanics, ASCE for which he has been awarded the Best Reviewer Award for three consecutive years. Professor Gupta is also the Founder Chairman, Indian Geotechnical Society (IGS) Shimla Chapter. He is a lifetime member of Indian Geotechnical Society, Indian Society of Rock Mechanics and Tunneling Technology (ISRMTT) and Indian Society of Technical Education (ISTE).



Dr. Sanjay Kumar Shukla is Founding Editor-in-Chief of the International Journal of Geosynthetics and Ground Engineering, Springer Nature, Switzerland. He is Founding Research Group Leader (Geotechnical and Geoenvironmental Engineering) at the School of Engineering, Edith Cowan University, Joondalup, Perth, Australia. He holds the Distinguished Professorship in Civil Engineering at Delhi Technological University, Delhi, VIT University, Vellore, Chitkara University, Solan, Himachal Pradesh, VR Siddhartha Engineering College, Vijayawada, Amity University, Noida, and Amrita University, Coimbatore, India. He has over 25 years of experience in teaching, research and consultancy in the field of Civil (Geotechnical) Engineering. He collaborates with several world-class universities, research institutions, industries and individuals on academic and field projects. As a consulting geotechnical engineer, he has successfully provided solutions to the challenging field problems faced by many engineering organisations. He has authored more than 280 research papers and technical articles, including over 175 refereed journal publications. He is also author/editor of 23 books, including 7 textbooks and 22 book chapters. In 2020/2021, his ICE textbooks, namely *Core Principles of Soil Mechanics* and *Core Concepts of Geotechnical Engineering*, have been ranked #1 by Amazon. His research and academic works have been cited well. Shukla's generalized expressions for seismic active thrust (2015) and seismic passive resistance (2013) are routinely used by practising engineers worldwide for designing the retaining structures. Shukla's wraparound reinforcement technique, developed during 2007–2008, is a well-established ground improvement technique. He has been honoured with several awards, including 2021 ECU Aspire Award from the Business Events Perth, Australia, and the most prestigious IGS Award 2018 from the International Geosynthetics Society (IGS), USA, in recognition of his outstanding contribution to the development and use of geosynthetics. He serves on the editorial boards of several international journals. He is a fellow of American Society of Civil Engineers and Engineers Australia, a life fellow of the Institution of Engineers (India) and Indian Geotechnical Society, and a member of several other professional bodies.



Dr. Hazi Azamathulla is currently a Professor of Civil and Environmental Engineering at the University of the West Indies at St. Augustine, Trinidad. He obtained his B.Tech. (Civil Engineering) from G. Pulla Reddy Engineering College, Kurnool, Sri Krishna Devaraya University (SKDU), Anantapur, India. He did his M.E. (Water Resources Engineering) from SGSITS, Devi Ahilya Vishwa Vidyalaya (DAVV), Indore, India and Ph.D. in Hydraulic Engineering from Indian Institute of Technology Bombay. His major research areas include water resources engineering hydraulics, physical hydraulic model studies, hydro informatics and climate change. He has authored/co-authored more than 120 research papers in reputed refereed journals. He is/has been a member of the editorial board of several high-ranked journals: *Water Science and Technology*, *Water Science and Technology: Water Supply*, *Journal of Pipeline Systems Engineering—ASCE* (2009–2013), *Dam Engineering Journal*. He is also a Life Member of Indian Society for Hydraulics (ISH) and Associate Member in Institution of Engineers (India). He is a fellow member of International Flood Network (IFNet), Japan and International Association of Hydrological Sciences (IAHS), UK. He is the Associate Editor of *Journal of Hydrology*.

Lecture Notes in Civil Engineering

Ashok Kumar Gupta · Sanjay Kumar Shukla · Hazi Azamathulla *Editors*

Advances in Construction Materials and Sustainable Environment

Select Proceedings of ICCME 2020

This book comprises select papers presented at the International Conference on Construction Materials and Environment (ICCME 2020). The topics discussed revolve around the identification and utilization of novel construction materials primarily in the areas of structural engineering, geotechnical engineering, transportation engineering, and environmental engineering. The volume presents a compilation of thoroughly studied and utilized sustainable construction materials in different areas of civil engineering. Newly developed testing methodologies, physical modelling methods, numerical studies, and other latest techniques discussed in this book can prove to be useful for researchers and practitioners across the globe.

ISBN 978-981-16-6556-1



9 789811 665561

► [springer.com](https://www.springer.com)