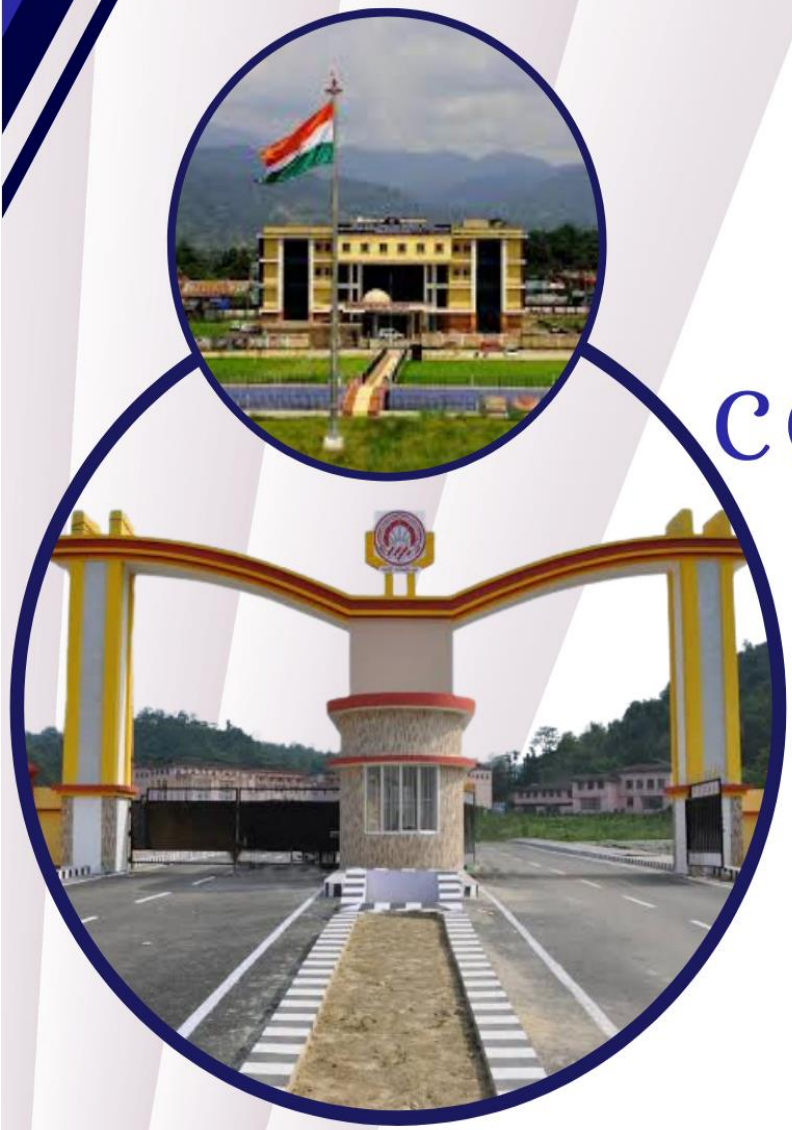
CAMSSC 2024

International Conference on

Computer-Aided Modeling for the Sustainable Development of Smart Cities



ABSTRACT COMPENDIUM

NOV. 27-30,2024

ITANAGAR

ORGANIZED BY

DEPARTMENT OF CIVIL ENGINEERING

NORTH EASTERN REGIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY

NIRJULI- 791109, ARUNACHAL PRADESH, INDIA

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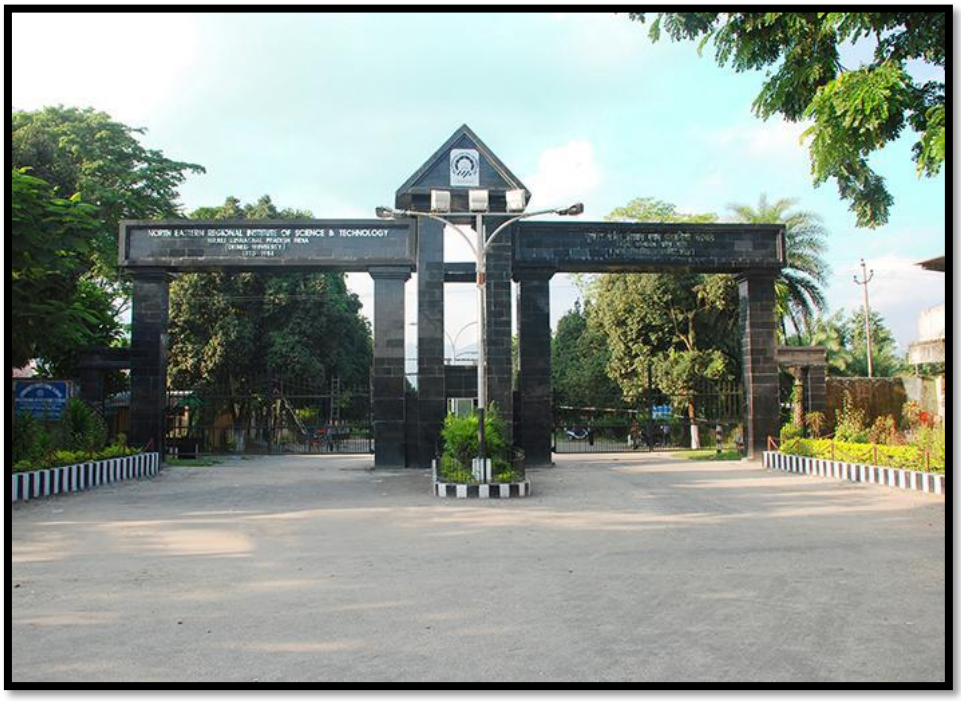
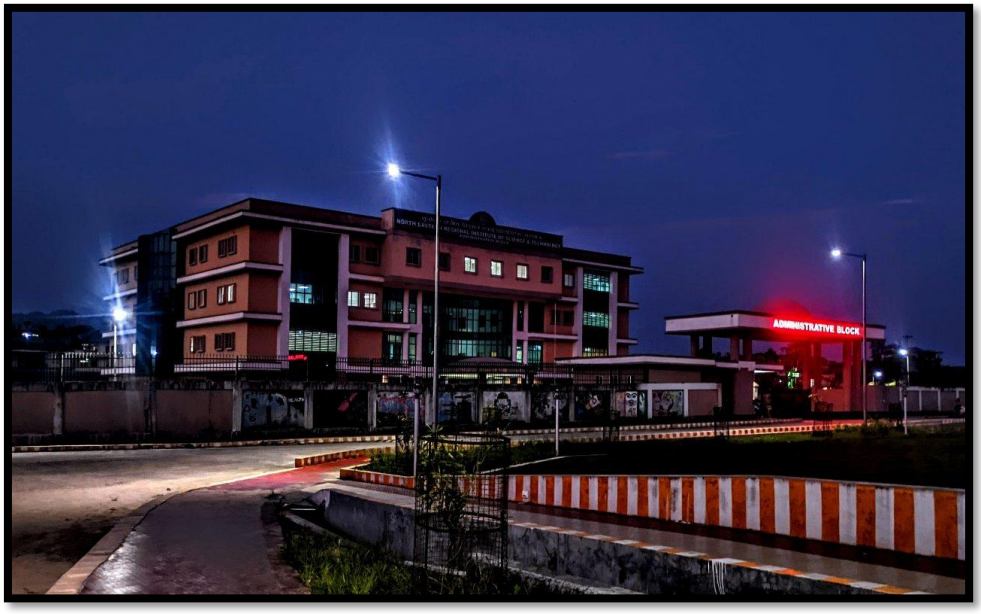


NERIST MAIN GATE



NIGHT VIEW OF ADMINISTRATIVE BLOCK

International Conference on

Computer-Aided Modeling for the Sustainable Development of Smart Cities

CAMSSC 2024

NOV. 27-30, 2024

ITANAGAR, INDIA

ABSTRACT COMPENDIUM

Organized by

Department of Civil Engineering

North Eastern Regional Institute of Science and Technology

Nirjuli-791109, Arunachal Pradesh, India

Contents

MESSAGE

It is a great honor and privilege to share my thoughts in the abstract booklet of the International Conference on "Computer-Aided Modelling for the Sustainable Development of Smart Cities" (CAMSSC 2024), organized by the Department of Civil Engineering, North Eastern Regional Institute of Science and Technology (NERIST), Itanagar, Arunachal Pradesh, India.

The theme of CAMSSC2024 is both timely and crucial. As urbanization continues to shape the fabric of our society, sustainable development of smart cities has emerged as a pressing need. The role of computer-aided modelling in this endeavor cannot be overstated—it empowers researchers, policymakers, and urban planners to design, simulate, and implement solutions that are both efficient and sustainable.

I am delighted to see NERIST taking the lead in bringing together experts, researchers, and practitioners to discuss and deliberate on this vital subject. Such collaborative efforts are essential for addressing the multifaceted challenges of urbanization while ensuring environmental sustainability and quality of life for citizens.

May CAMSSC2024 be a resounding success, fostering innovation, collaboration, and actionable solutions for a sustainable urban future.

I wish the conference all success.

Prof. Dilip Kumar Baidya,

Director, NIT Silchar

पूर्वोत्तर क्षेत्रीय विज्ञान एवम् प्रौद्योगिकी संस्थान
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(Deemed to be University u/s 3 of the UGC Act, 1956)
Under the Ministry of Education, Govt. of India
निर्जुली - ७९१ १०९ (ईटानगर)
अरुणाचल प्रदेश, भारत
Nirjuli - 791 109 (Itanagar)
Arunachal Pradesh, India

MESSAGE

It gives me immense pleasure to welcome you all to the "International Conference on Computer-Aided Modelling for the Sustainable Development of Smart Cities" (**CAMSSC2024**), organized by the Department of Civil Engineering, NERIST. This conference represents a significant milestone in our efforts to promote cutting-edge research and innovation in addressing the challenges of sustainable urban development.

The theme of CAMSSC2024 is highly relevant in today's rapidly urbanizing world. Smart cities hold the promise of creating sustainable, efficient, and resilient urban environments, and computer-aided modelling plays a crucial role in achieving this vision. By simulating and analyzing complex urban systems, these models help researchers, planners, and policymakers devise innovative and practical solutions for sustainable development.

NERIST takes immense pride in hosting this platform that brings together distinguished academicians, researchers, industry experts, and students from diverse disciplines. The collaborative exchange of ideas and knowledge at this conference will undoubtedly pave the way for impactful research, transformative technologies, and actionable strategies for smart city development.

I extend my heartfelt appreciation to the organizing committee for their dedication and meticulous efforts in making CAMSSC2024 a reality. I also thank the esteemed speakers, participants, and sponsors for their invaluable contributions. Your presence and insights will enrich this event and inspire progress in this critical domain.

I wish CAMSSC2024 great success and hope it sparks meaningful discussions, fosters fruitful collaborations, and contributes significantly to the sustainable development of smart cities.

Prof. Narendranath S.

Director, NERIST

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Nirjuli - 791 109 (Itanagar)
Arunachal Pradesh, India

MESSAGE

I am pleased to welcome all delegates and resource persons to the International Conference on "Computer-Aided Modelling for the Sustainable Development of Smart Cities" (**CAMSSC2024**), organized by the Department of Civil Engineering, NERIST.

This conference underscores the essential role of advanced computational models in developing sustainable, efficient, and resilient smart cities. The need for research in this area is more pressing than ever, as the challenges of urbanization, environmental sustainability, and technological integration require innovative academic solutions. CAMSSC2024 provides a valuable platform for academics and researchers to share insights and foster collaborations that will contribute to the growth of knowledge in this critical field.

Such conferences are vital for driving academic progress, as they enable the exchange of ideas and the exploration of new research avenues that will influence the future of urban development. I extend my best wishes to all participants and presenters, whose contributions will play a key role in advancing the field of smart cities.

I trust this event will inspire fresh perspectives and foster collaborations that will advance both research and practical solutions for smarter, more sustainable cities. I also commend the organizing committee for their hard work in making this event possible, providing a valuable platform for sharing knowledge.

25/11/24

Prof. Sarsing Gao
Dean (Academic)
NERIST

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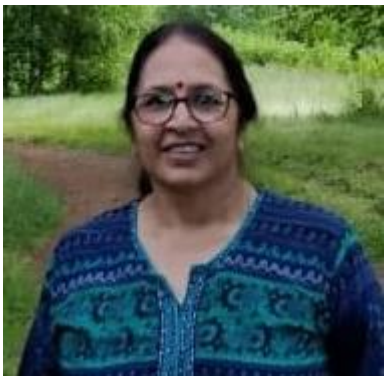

MESSAGE

I am glad that our Civil Engineering Department is organising an International Conference on "Computer-Aided Modelling for the Sustainable Development of Smart Cities" (**CAMSSC2024**) at North Eastern Regional Institute of Science and Technology, Nirjuli, Arunachal Pradesh

The theme of this conference highlights a critical aspect of modern urbanization - developing sustainable smart cities through advanced computational tools and interdisciplinary research. Such platforms are vital for exchanging ideas, exploring innovations, and fostering collaborations to address global challenges in urban development and sustainability.

I encourage everyone to participate actively, whether by attending sessions, engaging in discussions, or presenting your own work. I extend my best wishes to the organisers, distinguished speakers, participants and sponsors to make this conference a grand success. I am confident that CAMSSC2024 will inspire impactful research and solutions for the smart cities of the future.

Wishing you all a fruitful and enriching experience.

Warm regards

Prof. Madhu Bala Sharma
Dean (R & D), NERIST

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Nirjuli - 791 109 (Itanagar)
Arunachal Pradesh, India

MESSAGE

It is with great pride and enthusiasm that I extend my warmest greetings to all delegates and resource persons of the "International Conference on Computer-Aided Modelling for the Sustainable Development of Smart Cities" (**CAMSSC2024)**, organized by the Department of Civil Engineering, NERIST.

This conference is a testament to the commitment of NERIST towards advancing knowledge and fostering innovation in areas critical to societal growth. The theme of CAMSSC2024 addresses one of the most significant challenges of our time: developing sustainable smart cities that are efficient, resilient, and inclusive. Through the integration of computer-aided modelling and interdisciplinary research, this event promises to explore cutting-edge solutions for urban development and planning.

The Department of Civil Engineering, NERIST has always been at the forefront of academic and research excellence. CAMSSC2024 reflects this dedication by bringing together renowned experts, researchers, and professionals to share insights, present innovative research, and discuss practical applications in the field of smart city development.

I commend the organizing committee for their tireless efforts in orchestrating this remarkable conference and express my gratitude to all the distinguished speakers, participants, and sponsors for their invaluable contributions. I am confident that CAMSSC2024 will serve as a catalyst for meaningful dialogue, fruitful collaborations, and impactful advancements in this critical field.

Wishing all delegates and resource persons a productive and intellectually enriching experience.

25/11/2024

Dr. M. K. Camder
Registrar,
NERIST

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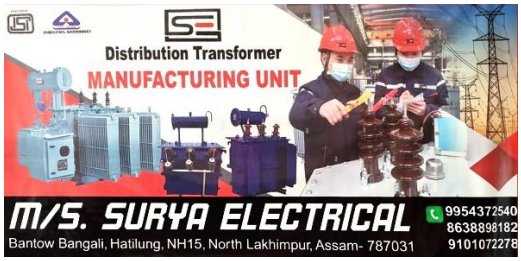
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Overview of Session Schedule

TIME	DAY-I (November 27, 2024)				
14:00-15:30	Registration (Venue: Seminar Hall, Department of Civil Engineering, NERIST)				
16:00-17:00	Inauguration (Venue: Seminar Hall, Department of Civil Engineering, NERIST)				
17:00-17.30	High Tea (Venue: Seminar Hall, Department of Civil Engineering, NERIST)				
	Invited Speech-1				
17:30-18:05	Chair:	**Prof. Narendranath S.**		***Prof. D. K. Baidya***	NIT Silchar
18:05-18:40				***Prof. K. V. R. Ravi Shankar***	NIT Warangal

TIME	DAY-II (November 28, 2024)				
8:45-10:00	**Technical session-I (Track-3)**				
	(Smart Mobility and Traffic Management)				
	Chairs:	**Prof. K. V. R. Ravi Shankar**	**Prof. Brind Kumar**	Paper Ids:	35, 37, 19, 27, 13
10:00-10:45	**Invited Speech-2**				
	Chairs:	**Prof. Mallikarjuna C.**	**Prof. S. Baishya**	***Prof. Yiska Goldfeld***	Technion - Israel Institute of Technology, Israel
10:45-11:15				***Prof. Rajesh Gupta***	VNIT Nagpur
11:15-11:30	**Tea Break**				
11:30-12:30	**Invited Speech-3**				
	Chairs:	***Prof. Rajesh Gupta***	**Prof. R. K. Prasad**	***Prof. Mallikarjuna C.***	IIT Guwahati
				Prof. Brind Kumar	IIT (BHU) Varanasi
12:30-13:15	**Technical session-II (Track-5-1)**				
	(Sustainable management of water, environment and climate change)				
	Chairs:	***Prof. Rajesh Gupta***	**Prof. R. K. Prasad**	Paper Ids:	38, 42, 54
13:15-14:15	**Lunch break**				
14:15-	**Technical session-III (Track-2-1)**				

15:00	(Materials for Sustainable Development)				
	Chairs:	**Dr. Biplab Das**	**Dr. Sparsh Johari**	Paper Ids:	9, 34, 50
15:00-15:45	**Technical session-IV (Track-4-1)**				
		(Soil improvement for sustainable development)			
	Chairs:	**Dr. Dibyendu Pal**	**Dr. Shivangi Saxena**	Paper Ids:	5, 8, 24
15:45-16:45	**Invited Speech-4**				
	Chairs:	**Prof. Aditi Bhadra**	**Prof. Ajay Bharti**	***Dr. Sparsh Johari***	IIT Guwahati
				Prof. Hemanta Doloi	The University of Melbourne, Victoria, Australia
16:45-17:00	**Tea Break**				
17:00-18:15	**Invited Speech-5**				
	Chairs:	**Prof. Arnab Bandyopadhyay**	**Prof. S. Samanta**	***Dr. Biplab Das***	NIT Silchar
				Dr. Anuj Kishor Budhkar	IIEST Shibpur
TIME	**DAY-IV (November 30, 2024)**				
9:00-10:30	**Invited Speech-6**				
	Chairs:	**Prof. Aditi Bhadra**	**Prof. Ajay Bharti**	***Prof. L. B. Roy***	NIT Patna
				Prof. Pijush Samui	NIT Patna
				Dr. Rubi Chakraborty	NIT Meghalaya
10:30-10:45	**Tea Break**				
10:45-11:30	**Technical session-V (Track-1)**				
	(Application of AI in Smart Cities)				
	Chairs:	**Dr. Santosh Kumar Tamang**	**Shri Aswini Kumar Patra**	Paper Ids:	33, 44, 51
11:30-12:15	**Technical session-VI (Track-6)**				
		(Modeling sustainable structure and disaster management)			
	Chairs:	**Shri S. K. Sahu**	**Dr. Yamem Tamut**	Paper Ids:	6, 46, 49, 52
12:15-	**Technical session-VII (Track-5-2)**				

13:15		(Sustainable management of water, environment and climate change)			
	Chairs:	**Dr. N. G. Sorum**	**Dr. M. Puming**	Paper Ids:	2, 10, 12, 45
13:15-14:15	**Lunch break**				
	Technical session-VII (Track-5-3)				
14:15-15:45	(Sustainable management of water, environment and climate change)				
	Chairs:	**Prof. Pijush Samui**	**Dr. Nabam Teyi**	Paper Ids:	3, 4, 11, 14, 20, 29
15:45-16:15	**Technical session-IX (Track-4-2)**				
	(Soil improvement for sustainable development)				
	Chairs:	**Dr. Dipika Devi**	**Dr. Rubi Chakraborty**	Paper Ids:	32, 36
16:15-16:45	**Technical session-X (Track-2-2)**				
	(Materials for Sustainable Development)				
	Chairs:	**Dr. Amar Taggu**	**Dr. Yadaiah Nirsanametla**	Paper Ids:	17, 48, 53, 55
17:00-17:45	**Valedictory and certificate distribution**				

Inauguration Programme

Day 1 27 November 2024 (Wednesday)	
TIME	**Event**
14:00-15:30	**Registration (Venue: Seminar Hall, Department of Civil Engineering, NERIST)**
Inauguration (Venue: Silver Jubilee Hall, South Campuss, NERIST)	
16:00-17:00	**Felicitation of the Guests**
	Lighting of Lamp
	Welcome Address By Dr. Dipika Devi, Head, Civil Engineering Department
	About the Programme By Dr. D. Pal, Conference Chair, CAMSSC 2024
	Address by the Chief Patron, CAMSSC 2024
	Address by the Special Invitees
	Release of ABSTRACT compendium
	Address by the Chief Guest, Prof. Dilip Kumar Baidya, Director, NIT Silchar
	Vote of Tanks by Dr. N. G. Sorum, Secretary, CAMSSC 2024
17:00-17.30	High Tea (Venue: Lobby, Silver Jubilee Hall, South Campuss, NERIST)

Detailed Session Schedule

Day 1	27 November 2024 (Wednesday)
TIME	**Event**
Invited Speech-1 ***Chair: Prof. Narendranath S.***	
17:30-18:05	**Challenges in Geotechnical Engineering and Solutions** ***Prof. D. K. Baidya, NIT Silchar***
18:05-18:40	**Machine Learning Applications for Mobility and safety of Road Traffic System.** ***Prof. K. V. R. Ravi Shankar, NIT Warangal***
19:30 - 21.00	***Conference Dinner***

Day 2 28 November 2024 (Thursday)	
TIME	**EVENT**
Technical session I: Smart Mobility and Traffic Management (Track 3)	
Session Chairs: Prof. K. V. R. Ravi Shankar, Prof. Brind Kumar	
Paper IDs: 13, 19,27, 35,37	
8:45-10:00	**Developing an Intelligent Traffic Control System for Urban Roads.** Shabbir Poswal, Ayan Mondal, Somnath Dey, Gourab Sil.
	Can Segregating Powered Two-Wheelers From Other Vehicle Types Improve Safety in Urban Mixed and No-Lane-Disciplined Traffic?: A Proactive Approach. ShivasaiSamalla and Mallikarjuna Chunchu
	Noise Emission Curves for Train in Arrival, In-front and Departure Mode. Brind Kumar, Amarjeet kumar Himanshu, Ashish Kumar Chouksey, Amar Deep Pandey
	Analysis of Roadside Advertising Impact on Driving Behavior. HarinadhGogada, Lakshmi Kiranmai V, and Ravi Shankar K.V.R.
	Determinants of walking as a mode of transportation: A case study of Howrah. Sharif Hossain, Anuj Kishor Budhkar, Protik Saha Palash and Rahul Kumar Bharti

Invited Speech-2	
Chairs : Prof. Mallikarjuna C., Prof. S. Baishya	
10:00-11:15	Smart and Sustainable Concrete Structures: Advancements and Challenges with TRC Technology **Prof. Yiska Goldfeld, Technion - Israel Institute of Technology, Israel**
	Prof. Rajesh Gupta, VNIT Nagpur
11:15-11:30	**Tea Break**

Invited Speech-3	
Chairs: Prof. Hemanta Doloi, Prof. R. K. Prasad	
11:30-12:30	Sustainable Transportation for achieving the Sustainable Development Goals **Prof. Mallikarjuna C., IIT Guwahati**
	Prof. Brind Kumar, IIT (BHU) Varanasi

Technical session II : Sustainable management of water, environment and climate change (Track 5-1)	
Session Chairs: Prof. Hemanta Doloi, Prof. R. K. Prasad	
Paper IDs: 38, 42, 54	
12:30-13:15	**Economic Design of Combined Gravity and Pumped Water Transmission Main.** Madhulika Sargaonkar, Laxmi Gangwani, Satyam Tiwari, Nikita Palod and Rajesh Gupta.
	A Framework of Minimizing Life Cycle Impact Towards Sustainable Asset Management of Water Supply System in Smart Cities. Amitava Sengupta and Mainak Majumder.
	Mitigating River Pollution During Indian Festivals: The Efficacy of Artificial Idol Immersion Ponds as a Sustainable Solution.

	Suraj Tiwari and Avijit Paul
13:15-14:15	**Lunch break**

Technical session III: Materials for Sustainable Development (Track 2-1)	
Session Chairs: Dr. Biplab Das, Dr. Sparsh Johari	
Paper IDs: 9, 34, 50	
14:15-15:00	**Enhancing the Mechanical and Hydraulic Properties of Pervious Concrete using Treated Reclaimed Asphalt Pavement: Impact of Different Treatment Durations.**GyanenTakhelmayum and Konsam Rambha Devi
	Study of Wettability on Solid Surfaces via Molecular Dynamics Simulation. Mukesh Kumar, S.K. Tamang, and M. Dabi
	Surface Treatment Methods of Waste Rubber Tyre Aggregates to be Used as Aggregates in Concrete Mix-A Review. Jumnya Basar, S.Mishra, and Y.Tamut

Technical session IV: Soil improvement for sustainable development (Track 4-1)	
Session Chairs: Prof. Rajesh Gupta, Dr. Shivangi Saxena	
Paper IDs: 5, 8, 24	
15:00-15:45	**Geospatial Evaluation of Soil Degradation in Western Himalayan Basins: A Case Study for Alaknanda Basin.** Nyigam Bole, Kedovito Chasie, Munuvelu Vese, Arnab Bandyopadhyay, and Aditi Bhadra
	A Sustainable Solution for Vertically and Horizontally Reinforced Stone Columns. Shivangi Saxena, L. B. Roy, and Pawan Kumar
	Utilizing Vetiver and Bamboo Fibers to Enhance Soil Stabilization in Arunachal Pradesh. Radha Palpi Boruah and Aditya Kumar Anshu

Invited Speech-4	
Chairs: Prof. Arnab Bandyopadhyay, Prof. S. Samanta	
15:45-16:45	**Dr. Sparsh Johari, IIT Guwahati**
	Smart Data Platform for Sustainable Rural Development-A contrasting view to the creation of Smart Cities ***Prof. Hemanta Doloi, The University of Melbourne, Victoria, Australia***
16:45-17:00	**Tea Break**

Invited Speech-5	
Chairs: Prof. Arnab Bandyopadhyay, Prof. S. Samanta	
17:00-18:15	**Dr. Biplab Das, NIT Silchar**
	Revolutionizing Traffic Data Collection: methods and Challenges for Mixed Traffic Systems ***Dr. Anuj Kishor Budhkar, IIEST Shibpur***

Day 3	29 November 2024 (Saturday)
	Technical Visit
Day 4	**30 November 2024 (Saturday)**
TIME	**EVENT**
Invited Speech-6	
Chairs: Prof. Aditi Bhadra, Prof. Ajay Bharti	
9:00-10:30	**Comparative Study of the Spacing of Subsurface Drains in the Eastern Gandak Project using Different Criteria** ***Prof. L. B. Roy, NIT Patna***
	Future Perspective of AI in Smart City ***Prof. Pijush Samui, NIT Patna***
	Data-Driven Probabilistic Slope Stability Assessment for Smart Cities ***Dr. Rubi Chakraborty NIT Meghalaya***
10:30-10:45	**Tea Break**

Technical session V: Application of AI in Smart Cities (Track 1)	
Session Chairs: Dr. Santosh Kumar Tamang, Shri Aswini Kumar Patra	
Paper IDs: 33, 44, 51	
10:45-11:30	**Enhancing Urban Sustainability: An Automatic Rooftop Cooling Mechanism for Smart City.** Yash Raj, Pirma Jamatia, Aayan Jabidur Rahman, Amar Taggu and Nabam Teyi
	Prediction of Compression Index of Soil- A Perspective Review. Bishwajoty Paul, Dipika Devi, Santosh Kumar Tamang
	Effect of Influential Factors to Injury Severity of Two-Vehicle and Multi-Vehicle Accidents: A Review. Nyato Lendo, Neero Gumsar Sorum, Sownak Saha, Joydip Kakoti

Technical session VI: Modeling sustainable structure and disaster management (Track 6)	
Session Chairs: Shri S. K. Sahu, Dr.Yamem Tamut,	
Paper IDs: 6, 46, 49, 52	
11:30-12:15	**Various external strengthening techniques on Reinforced Concrete Deep Beam with openings- A Review.** Rakesh Shivaji Mawal and Govardhan Bhatt
	Parametric Study of Lateral Earth Pressure on Rigid Retaining Walls Using ABAQUS. Taku Muni, Dipika Devi, and Sukumar Baishya
	Exploring the Potential of Cement-Stabilized Fiber-Reinforced Soil in Slope Stability. Raja Sarkar , Dipika Devi and Santosh Kumar Tamang
	Analysis of Pile-Raft Foundation in Cohesionless Soil Strata. Natasha Kakati and Abhijit Deka

Technical session VII: Sustainable management of water, environment and climate change (Track 5-2)	
Session Chairs: Dr. N. G. Sorum, Dr. M. Puming	
Paper IDs: 2, 10, 12, 45	
12:15-13:15	**Assessment of Variability in Glacier and Snow Melt Runoff for Alaknanda River Basin using Spatially Distributed Snow and Glacier Melt Runoff Model** (SDSGRM) R. Murtem, N. Shiu, A. Bhadra, A. Bandyopadhaya
	A Review Study on Modular Buildings Construction. Aparna Bhatt and Govardhan Bhatt
	Integrating Groundwater Modelling System Software and QGIS for Spring Water Delineation and Management: A comprehensive review. Mudang Tamer, R K Prasad, and Yamem Tamut
	Mitigating River Pollution During Indian Festivals: The Efficacy of Artificial Idol Immersion Ponds as a Sustainable Solution. John Yigam and Ajay Bharti
13:15-14:15	**Lunch Break**

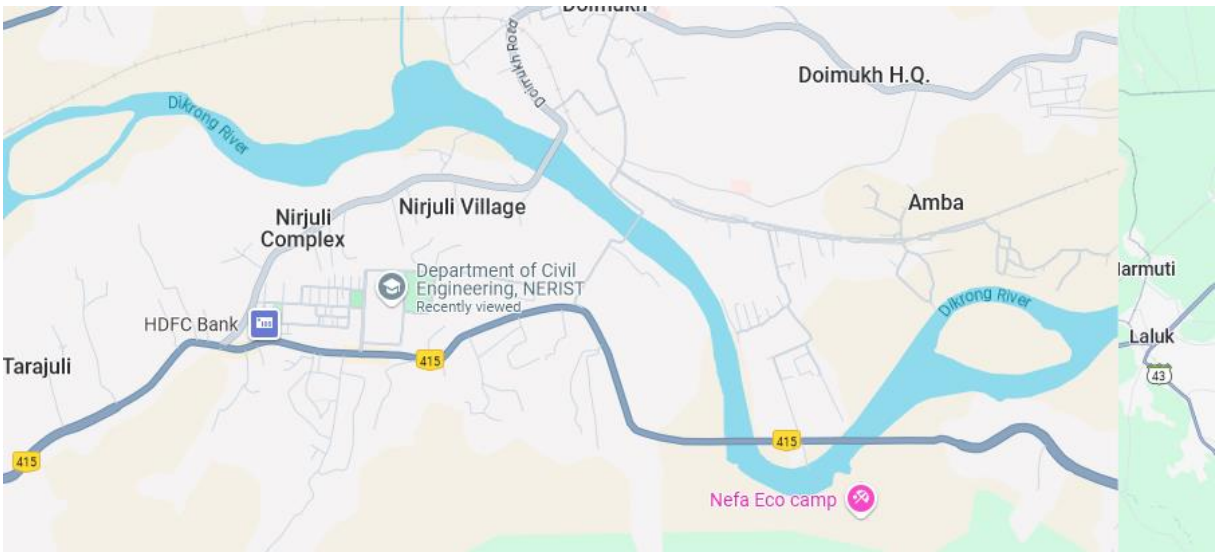
Technical session VIII: Sustainable management of water, environment and climate change (Track 5-3)	
Session Chairs: Prof. Pijush Samui, Dr. Nabam Teyi	
Paper IDs: 3, 4, 11, 14, 20, 29	
14:15-15:45	**Flood risk mapping for Tlawng river basin of Mizoram.** Sagar Debbarma, Vithono Tase, Bhaskarjyoti Buragohain, SanayanbiHodam, and Arnab Bandyopadhyay
	Gauge-to-Gauge Flood Prediction Using Advanced Data-Driven Techniques in Tlawng River Basin of Mizoram, India. Akhilesh Kumar, Kikhumcha Y, Sagar Debbarma, Aditi Bhadra, Arnab Bandyopadhyay
	Sustainable Urban Infrastructure Development: Integrating Smart Technologies for Resilient and Green Cities. Taba Nyokum and Yamem Tamut
	Life Cycle Assessment of potential Municipal Solid Waste Management practices for Itanagar city, India. Naka Chukhu and Ajay Bharti
	Assessing equity and demand satisfaction of an intermittent water supply using a non-iterative implementation of EPANET 2.2: A Case Study of Itanagar Water Distribution Network. Ram Kailash Prasad and Bini Kiron.
	Sustainable Management of Mesua Ferrea Leaf Litter in Avenue Plantation. NirigiLinggi, Ajay Bharti, and Sorokhaibam Sureshkumar Singh

Technical session IX: Soil improvement for sustainable development (Track 4-2)	
Session Chairs: Dr. Dipika Devi, Dr. Rubi Chakraborty	
Paper IDs: 32, 36,53	
15:45-16:15	**Examination of the Effect of Chemical Additives on Subgrade Soil Stabilization: A Review.** SangkarYangfo and NeeroGumsar Sorum.
	A Comparative Study of Bio-Cementation Effects on Geotechnical Properties of Clayey Soil. Radha Palpi Boruah and NeeroGumsar Sorum
	A review on the prediction of California Bearing Ratio of Soil Using Machine Learning algorithm. Nababam Tado, Salam Medhajit, Dibyendu Pal

Technical session X: Materials for Sustainable Development (Track 2-2)	
Session Chairs: Dr. Amar Taggu, Dr. Yadaiah Nirsanametla	
Paper IDs: 17, 48, 53, 55	
16:15-16:45	**Computation of modulus of subgrade reaction from laboratory CBR test.** BinandaKhungur Narzary, Roselina Daimari, and Mompi Basumatary
	Analysis of Bamboo Reinforced Unpaved Road Using ABAQUS. Aowati Jamir and Dipika Devi
	A Review on the Prediction of California Bearing Ratio of Soil using Machine Learning Algorithm NababamTado, Salam Medhajit, Dibyendu Pal
	Sustainable Paving Solutions: Laboratory Analysis of Geopolymer Paver Blocks with Reclaimed Asphalt Pavement Aggregates. Yeswanth Paluri, S R R Teja Prathipati, Vijay Kunamineni, V Bhavitha Chowdary and Tottaramudi Pavan Kumar

17:00-17:45	**Valedictory and certificate distribution**

Conference Venue



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ABSTRACT COMPENDIUM

CAMSSC2024_ID_2

Assessment of Variability in Glacier and Snow Melt Runoff for Alaknanda River Basin using Spatially Distributed Snow and Glacier Melt Runoff Model (SDSGRM)

R. Murtem[a], N. Shiu[b], A. Bhadra[c], A. Bandyopadhaya[d]

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Assessing snow melt (SM), glacier melt (GM), and rainfall-induced runoff streamflow is essential for understanding the hydrological regimes in glaciated basins. However, this task is challenging due to the remoteness and lack of instrumentation in these basins. A robust hydrological model is crucial for accurately evaluating the runoff components in such data-scarce basins. The Spatially Distributed Snow and Glacier Melt Runoff Model (SDSGRM) in the Alaknanda River Basin assessed the streamflow runoff. This model requires daily inputs including temperature, precipitation, snow cover, albedo, relative humidity, wind speed, sunshine hours, and the initial glacier surface area to generate glacial area data. Calibration (2006–2010) and validation (2012–2014) were performed using various melt depth indices viz: temperature index method, radiation temperature index method, advection driven index method and energy balance method. During calibration, modeling efficiency (ME) ranged from 0.51 to 0.77, with R^2 values exceeding 0.6 and, the coefficient of residual mass (CRM) varying from -0.01 to 0.2. Validation showed similar performance, with ME and R^2 above 0.5 and 0.6, respectively, and CRM values varying from -0.08 to 0.18. The energy balance method generally outperformed the others. Average runoff contributions were 93.19% from rainfall water yield (RWY), 6.58% from snow water yield (SWY), and 0.17% from glacier water yield (GWY). Given its acceptable performance, SDSGRM proves to be an effective tool for analyzing the runoff contributions in glaciated, data-scarce basins and for assessing the influence of climate change.

Keywords: *SDSGRM; Rainfall; Snowmelt; Glacier-melt; Runoff*

CAMSSC2024_ID_3

FLOOD RISK MAPPING FOR TLAWNG RIVER BASIN OF MIZORAM

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The study aims to assign weights to hazards and vulnerability factors using the AHP method, and to create a flood risk map for the Tlawng river basin by combining these hazard and vulnerability indices. Hazards indicators include slope, drainage density, elevation, rainfall, distance to river, NDVI, MNDWI, TWI, Lithology. Vulnerability indicators include total population, population density, LULC, distance to road, distance to hospital. Further, spatial layers for each indicator have been prepared followed by weightage calculation for each indicator by employing pair-wise matrix and employing AHP. The hazard and vulnerability maps have been crossed to create the final flood risk map. According to the risk map, 41.6% of the study area, or 1445.7 square kilometres, is at high and very high risk of floods. We can suggest a number of actions to lower the danger of flooding in the Tlawng river basin by creating the risk map.

Keywords: *AHP, flood risk, hazard, vulnerability, Tlawng river basin*

CAMSSC2024_ID_4

Gauge-to-Gauge Flood Prediction Using Advanced Data-Driven Techniques in Tlawng River Basin of Mizoram, India

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Reliable flood forecasting is essential for managing risks and providing timely alerts, especially in flood-vulnerable areas. This study investigated application of four data-driven techniques, including support vector regression (SVR), simple recurrent neural network (SRNN), long short-term memory (LSTM), and gated recurrent unit (GRU), to predict water levels at downstream gauges within Tlawng river basin. The models were evaluated under sequential and random data splitting scenarios to assess their performance and robustness. The results indicated that LSTM model consistently outperformed other techniques, achieving Nash-Sutcliffe Efficiency (NSE) values of 0.79 during training and 0.75 during testing in sequential scenario, as well as 0.79 during training and 0.78 during testing in randomized scenario. Additionally, LSTM model exhibited the lowest root mean square error (RMSE) and mean absolute error (MAE) among all models, with RMSE as low as 1.11 and 0.98, and MAE of 0.86 and 0.75 in sequential and randomized scenarios. The GRU model closely followed, demonstrating comparable performance, while the SRNN and SVR models showed lower accuracy, with SVR being the least effective of four. Further analysis using two additional datasets assessed robustness of the models. While sequential scenario yielded less favourable results, the randomized scenario produced similar NSE, RMSE, and MAE values, confirming effectiveness of the models on new data. Interestingly, a comparison between datasets with a common downstream gauge revealed that using Reiek-kai as upstream gauge led to better predictive accuracy, particularly for LSTM model. This highlights the crucial importance of gauge selection in enhancing accuracy of water level prediction models.

Keywords: *Flood forecasting;Tlawng river basin; support vector regression (SVR); simple recurrent neural network (SRNN); long short-term memory (LSTM); gated recurrent unit (GRU)*

CAMSSC2024_ID_5

Geospatial Evaluation of Soil degradation in Western Himalayan basins; a case study for Alaknanda basin

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To implement effective conservation plans, it is crucial for policymakers to first evaluate the extent of soil deterioration within the designated region to develop more targeted and impactful measures. The soil erosion model (RUSLE) incorporated with geospatial techniques was used to examine soil loss in high altitude Alaknanda River basin, situated in the Uttarakhand, Chamoli district at the Western Himalayas for a fifteen-year period (2004–2018). The estimated soil depletion was categorized into six distinct levels of erosion vulnerability, spanning from minimal to extremely high risk classes. The study highlights the significant vulnerability of the Alaknanda River basin to eartherosion, having an anticipated average loss of 28.45 t ha^{-1} yr^{-1}surpassing the permissible limitof 25 t ha^{-1} yr^{-1} in young mountain environments. The majority of the eroded portion is categorized within the slight erosion class at 43.67% and the minority of the eroded region falls under the medium erosion class at 3.78%. The overall temporal variation in mean soil loss showed a rising pattern from 2004 to 2010, followed by a decrease from 2010 to 2018, following a pattern like that of the R-factor temporal trend, which also increased from 2004 to 2010 and decreased thereafter, underscoring the significant influence of rainfall on earth erosion in Alaknanda. This geospatial evaluation of soil degradation in the Alaknanda basin offers valuable perspectives on the underlying factors resulting to erosion and pinpoints key areas that warrant priority interventions.

Keywords: *Soil degradation; Alaknanda; RUSLE; GIS;*

CAMSSC2024_ID_6

A review paper on various external strengthening techniques for Reinforced Concrete Deep Beam with openings

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In structural design, deep beams are essential for carrying large loads and preserving overall stability. These days, it's common to find reinforced concrete deep beams constructed with openings to pass electrical cables, plumbing pipes and air conditioning ducts. The stiffness and strength of the beam may be diminished as a result of these openings and also increasing deflection and breaking. The openings geometric discontinuities cause the nonlinear distribution of stress across the beam's depth to be disturbed. Numerous research have looked at how these openings dimensions and shapes affect the way deep beams perform structurally and how effectively different strengthening methods work to replace lost capacity. This review's objective is to evaluate the impact of various external strengthening methods on the deep beams made of reinforced concrete with openings. Furthermore, recommendations for future research are proposed to fill the gaps observed in the current body of knowledge.

Keywords: *Deep beam with openings, Strengthening, Shear, Carbon fiber reinforced polymer, Galvanized steel sheet.*

CAMSSC2024_ID_8

A Sustainable Solution for Vertically and Horizontally Reinforced Stone Columns

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Stone columns are a widely used technique for soil reinforcement. If installed in extremely soft ground, there is possibility of stones squeezing into the surrounding soil which will hinder the performance of stone columns. In such restrictive situations individual stone columns within a geosynthetic enclosure would help preserve the stone column's function. This article comes up with an opportunity and demonstrates the necessity of using various recycled aggregates in lieu of natural aggregates as a solution to the exploitation of natural aggregates and disposal of construction waste. The feat of geotextiles as smart material in the construction of Geotextile Encased Stone Column has been evaluated through laboratory modeling on the California Bearing Ratio (CBR) mould. The proposed methodology employs unit cell approach of stone column to analyze the load bearing characteristics of different aggregates when encased with vertical geotextile encasement and horizontal geotextile reinforcement. The results highlighted the benefits of encasing stone columns with smart geosynthetic material- Non woven geotextile (GSM 120) and replacing the natural aggregates with spent railway track ballast and recycled concrete debris along with sand. The unsoaked CBR test results of Vertically Encased Stone Columns (VESCs) and Horizontally Reinforced Stone Columns (HRSCs) made up of recycled aggregates and sand showed improved efficiency in terms of load settlement response and strength properties. The efficiency of HESC and VESC made up of 50% spent railway ballast and 50% sand was found to be 94% and 92% respectively with respect to natural aggregates; whereas, the least efficiency was observed for concrete debris and sand mixture (71% for HESC and 67% for VESC) among all the combinations of aggregates. It was concluded that sand can be used as partial replacement to the aggregates and recycled aggregates are the economical and sustainable alternative to natural aggregates in the construction of stone columns.

***Keywords*:** Ground Improvement, Sustainable approach, California Bearing Ratio test, recycled aggregates, Horizontally Reinforced Stone Columns, Vertically Encased Stone Columns

CAMSSC2024_ID_9

Enhancing the Mechanical and Hydraulic Properties of Pervious Concrete using Treated Reclaimed Asphalt Pavement: Impact of Different Treatment Durations

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This investigation explores the impact of the reclaimed asphalt pavement (RAP) materials treatment duration pertaining to the structural and hydraulic performance characteristics of pervious concrete (PC) mixes, accompanied through results based on a 28-day curing period. RAP replacement levels ranging from 0% to 100%, increasing by 25% and treatment durations of 0, 12, and 24 months were evaluated. The results indicated a 6% to 7% reduction in density and a 20% to 28% rise in porosity. The permeability rose significantly, increasing by up to 55% with a higher RAP content. The compressive strength dropped by 40% to 45% at 100% RAP, with similar decreases in flexural strength, although both properties improved by up to 10% with longer treatment durations. While a higher RAP content enhances permeability, it reduces the strength and density. However, the extended treatment of RAP mitigates these effects, making treated RAP a sustainable and effective option for pervious concrete (PC) applications that require both hydraulic performance and structural integrity.

Keywords: *Pervious Concrete; Recycled Asphalt Pavement; Hydraulic Permeability; Compressive strength; Flexural strength*

CAMSSC2024_ID_10

A REVIEW STUDY ON MODULAR BUILDINGS CONSTRUCTION

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Prefabricated modular steel construction offers a rapid and cost-effective solution for addressing the demand for low-cost housing, gaining popularity in multi-to-high rise buildings due to its mechanical strength, eco-friendliness, and construction efficiency. While it significantly reduces on-site construction time, multi-story modular steel buildings (MSBs) can be vulnerable to failure during large earthquakes due to the intricate detailing and assembly required for these systems. This study addresses modular steel construction 's environmental advantages, cost efficiency, and obstacles, such as seismic performance, connection details, and logistical complications, using a complete analysis of current research. Furthermore, the research emphasizes modular construction's potential to transform the construction industry by lowering waste, increasing on-site efficiency, and providing flexibility for future adjustments. However, technical skills and competent management have been highlighted as crucial to overcome structural variability and assembly accuracy constraints. This assessment serves as a platform for future research on modular steel construction system optimization, with an emphasis on enhancing resilience, scalability, and overall performance in a variety of building applications.

Keywords: *Modular steel construction, Prefabricated modular construction, Modular steel connections*

CAMSSC2024_ID_11

Sustainable Urban Infrastructure Development: Integrating Smart Technologies for Resilient and Green Cities

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The rapid urbanization trend necessitates innovative approaches to develop sustainable and resilient urban infrastructure. This study explores the integration of smart technologies, such as the Internet of Things (IoT), artificial intelligence (AI), and advanced materials, to foster resilient and green cities. Utilizing a comprehensive literature review, case studies of leading smart cities (Barcelona, Singapore, Copenhagen, Amsterdam, and New York City), and stakeholder engagement, key technologies and their impacts on urban sustainability are identified. The primary focus areas include smart water management systems, energy-efficient building designs, sustainable transportation networks, innovative waste management solutions, and green space integration.

The findings indicate significant improvements in resource efficiency, public services, and urban quality of life through smart technologies. However, addressing challenges such as data privacy, interoperability, funding, and public engagement is crucial. This paper proposes a framework for integrating smart technologies into urban development, emphasizing stakeholder engagement, technology selection, data management, and continuous evaluation. Practical insights and recommendations are provided for policymakers, urban developers, and researchers to incorporate smart technologies into urban planning effectively. Leveraging these technologies enhances resource management, reduces environmental impacts, and promotes sustainable and resilient urban environments.

Keywords: *Smart cities; Sustainable urban development; IoT (Internet of Things); Urban resilience; Green infrastructure.*

CAMSSC2024_ID_12

Integrating Groundwater Modelling System Software and QGIS for Spring Water Delineation and Management: A comprehensive review

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In order to protect the ecosystem and ensure that there is always access to the required amount of fresh water, it is crucial to arrange the management of spring water in a proper manner. Regarding the characteristics of the spring water sources, it must be emphasized that specialized equipment and techniques must be applied. The next document describes the specifics of the software GMS's integration with QGIS to enhance spring water management and division. The groundwater modelling capabilities of GMS and the spatial analysis and spring water resource display capabilities of QGIS would be complementary in the suggested framework. The paper illustrates the methodology, the positive aspects along with drawbacks of the integration process, and provides examples of its use in work.

Keywords: *Groundwater modelling system (GMS); QGIS; spring; water resource; integration*

CAMSSC2024_ID_13

Developing an Intelligent Traffic Control System for Urban Roads

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As urban populations and vehicle numbers continue to rise, traffic congestion has become a growing challenge, especially in large metropolitan areas. This congestion not only delays and stresses drivers but also increases fuel consumption and air pollution. To tackle this persistent issue, we urgently need real-time traffic monitoring to optimize signal control and improve traffic management. Efficient traffic control plays a crucial role in maintaining smooth vehicle flow and must adapt to meet rising demand. Our proposed system uses live camera feeds from intersections to assess traffic density through advanced image processing and artificial intelligence techniques. By analyzing vehicle volume in real time, the system dynamically adjusts traffic signal timings to match current traffic conditions. This approach aims to reduce congestion, facilitate faster vehicle movement, and lower pollution levels, ultimately delivering a more efficient and eco-friendly traffic management solution.

Keywords: *Signal Design, YOLO, YOLOv8, Traffic Light Control, Object Detection, Traffic Management, Webster Method, Machine Learning*

CAMSSC2024_ID_14

Life Cycle Assessment of potential Municipal Solid Waste Management practices for Itanagar city, India

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This study evaluates the environmental impacts of various Municipal Solid Waste Management scenarios for Itanagar City, governed by the Itanagar Municipal Corporation, using Life Cycle Assessment (LCA) as an analytical tool. Four waste management scenarios were analyzed: Scenario S1 serves as the baseline, indicating the existing waste management practices; Scenario S2 involves a sanitary landfill without landfill gas capture; Scenario S3 features a sanitary landfill with a 50% landfill gas collection efficiency; and Scenario S4 proposes an Integrated Waste Management approach, incorporating recycling, composting, and inert landfilling. One tonne of Municipal Solid Waste was designated as the functional unit for the assessment. Primary data were obtained through sampling, surveys, and literature review. The scenarios were compared using the Recipe Midpoint H method across five impact categories: Global Warming Potential (GWP100), Human Toxicity Potential (HTP), Particulate Matter Formation Potential (PMFP), Photochemical Oxidant Formation Potential (POFP), and Terrestrial Ecotoxicity Potential (TETP). This analysis was conducted with the help of openLCA software in conjunction with Eco-Invent databases. Results demonstrate that Scenario S1 (baseline) performed worst across most impact categories, while Scenario S2 exhibited the highest Global Warming Potential (2.334×10^{3} kg CO2-Eq) and Photochemical Oxidant Formation Potential (9.499×10^{-1} kg NMVOC-Eq). In contrast, Scenario S4, which implements an Integrated Waste Management strategy, emerged as the least environmentally damaging across all evaluated categories.

Keywords: *Life Cycle Assessment, Municipal Solid Waste Management, Itanagar Municipal Corporation, openLCA, Integrated Waste Management*

CAMSSC2024_ID_17

COMPUTATION OF MODULUS OF SUBGRADE REACTION FROM LABORATORY CBR TEST

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The plate bearing test is conducted in the field to determine the modulus of the subgrade reaction (*K*-value) of subgrade soil through the standard deformation equation for rigid plate loading. Alternatively, the test may be carried out in the laboratory on a small-scale basis using the California bearing ratio (CBR) test given the similarity in loading, provided that the deformation equation is developed for the boundary conditions of the test. Therefore, the present study focused on creating a deformation equation to estimate the deformation of soil subjected to axial circular pressure from the CBR test. The study was initiated with testing of the geotechnical properties of the soil sample, followed by the development of a finite element model (FEM) of the CBR sample. Using the Mohr-Coulomb (MC) soil constitutive model, the FEM computed the load corresponding to the prescribed deformation for the given geotechnical properties of soil. The result was finally compared with the laboratory CBR test to validate the model. Later, the FEM was modified with the linear-elastic soil model, and then the load was computed again for various arbitrary deformation levels. The computation results were utilized to develop the deformation equation of the CBR sample using the regression technique. Using the deformation equation, the modulus of subgrade reaction of soil is determined from the equations modulus of subgrade reaction of the CBR sample.

Keywords: *K-value; Elastic; FEM; CBR, Deformation; Regression*

CAMSSC2024_ID_19

Can Segregating Powered Two-Wheelers From Other Vehicle Types Improve Safety in Urban Mixed and No-Lane-Disciplined Traffic?: A Proactive Approach

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Powered Two-Wheelers (PTWs) constitute a significant portion of traffic in developing countries, particularly in India, where they account for 41% of all road crashes. This high crash rate underscores the need for effective safety measures. In countries like Malaysia, Indonesia, and Taiwan, dedicated PTW lanes have led to significant reductions in crash rates and severity. However, limited research exists on whether such strategies can be supported in urban areas with weak-lane-disciplined mixed traffic, like those found in India. This study uses a proactive approach to analyze crash risks and severity during PTW interactions with both other PTWs and larger vehicles. Anticipated Collision Time (ACT) and Generalized Extreme Value (GEV) models are employed to assess crash risks, while Delta-V is used to estimate crash severity. The findings reveal that PTWs are more vulnerable to side-swipe crashes than rear-end, with side-swipe crash risks being consistently higher regardless of whether PTWs are interacting with PTWs or any other vehicles. PTWs face increased crash risk when interacting with larger vehicles. In terms of crash severity, PTWs are exposed to more severe crashes when interacting with other larger vehicles than with other PTWs, with side-swipe conflicts posing greater severity than the rear-end. These results underscore the vulnerability of PTWs when navigating through urban environments, particularly in interactions with larger vehicles. The findings of this study suggest that segregated lanes for PTWs could be a viable safety strategy for reducing crash risks and severity, supporting their potential implementation in Indian cities to improve road safety.

Keywords: *Powered Two-Wheelers; Dedicated Lanes; Surrogate Safety Measures; Extreme Value Theory, mixed traffic*

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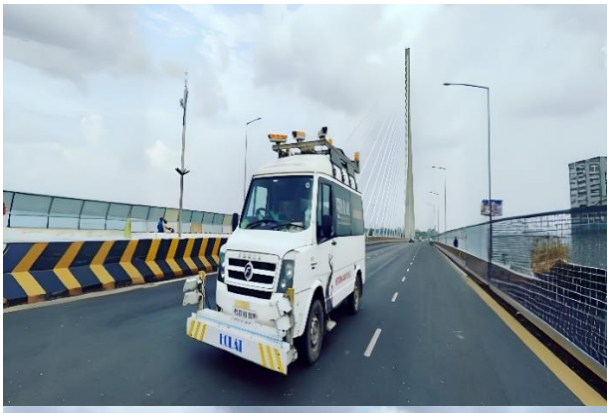
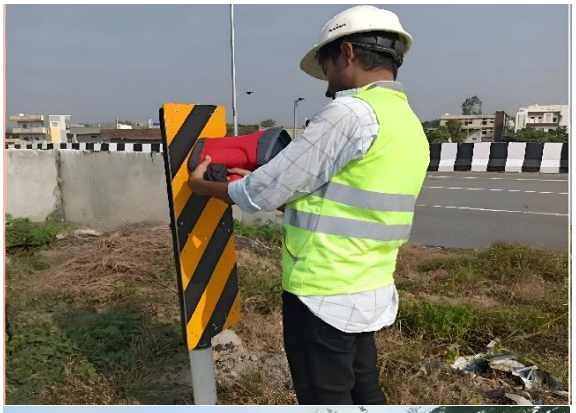
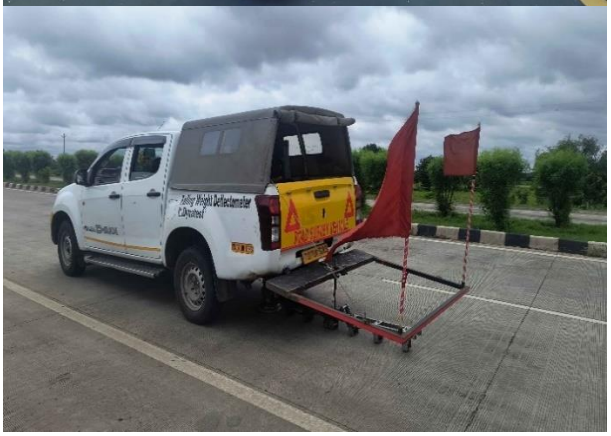


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CAMSSC2024_ID_20

Assessing equity and demand satisfaction of an intermittent water supply using a non-iterative implementation of EPANET 2.2: A Case Study of Itanagar Water Distribution Network

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Intermittent water supply (IWS) is a water supply system in a developing country where water is supplied intermittently for a limited duration. Factors responsible for IWS are water resource scarcity, inadequate facilities, unaccountable water losses, etc. The IWS systems, however, frequently result in variable pressure levels, water quality issues, and potential customer dissatisfaction. Furthermore, a crucial feature of the water distribution network (WDN) is to provide adequate water to the consumers to meet the required demand with satisfactory performance. Thus, in this study, consumer satisfaction is assessed through demand satisfaction and the level of equity for the Water Distribution Network of Itanagar (Arunachal Pradesh). This study is unique of its kind for Itanagar WDN, as no study of this kind has been undertaken of this network. This study also compares different equity formulae available in the literature. Moreover, EPANET version 2.2 was used to simulate the Itanagar WDN. The results highlight that the water supply depends on the availability of water at the source of the Itanagar WDN. Furthermore, it is also found that the pressure varies significantly at nodes. The consumer dissatisfaction is high due to insufficient access to drinking water in Itanagar town under IWS. A huge discrepancy in supply-demand ratio was observed in the Itanagar WDN, where more than half of the demand nodes are facing a shortage of supply against their demand. As such, some consumers are getting more than their required share of water, and others are not getting the required demand or no supply to sustain their livelihood. Consequently, the equity value is found to be approximately 0.5 under full supply condition, as against its ideal value of 1. This signifies that there is insufficient access to drinking water in Itanagar for a supply duration of 4 hours.

Keywords: *Intermittent water supply; Equity; Water distribution networks; Demand Satisfaction; EPANET software.*

CAMSSC2024_ID_24

Utilizing Vetiver and Bamboo Fibers to Enhance Soil Stabilization in Arunachal Pradesh

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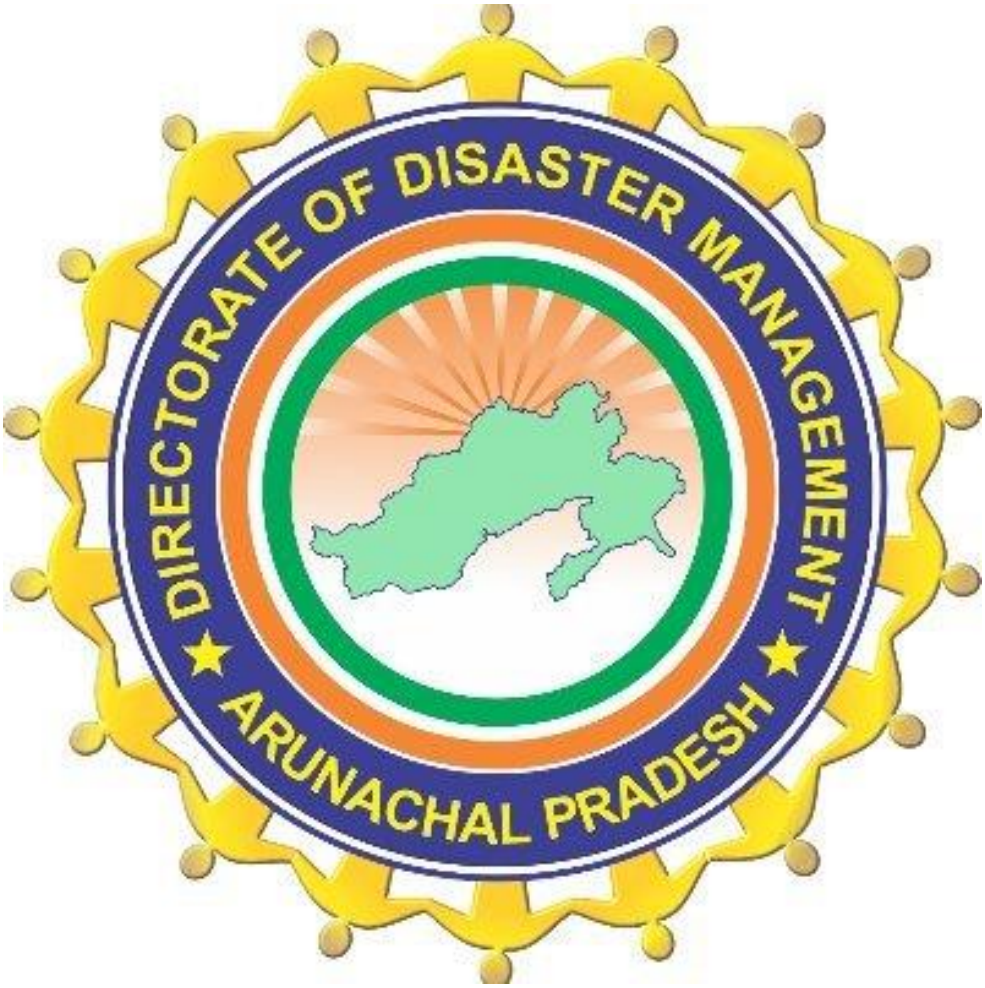
An innovative method of soil enhancement is biologically oriented in which chemical and biological processes are utilized for better soil improvements. The current research put forward a viable option through improvement of sandy silt soil mechanical performance by vetiver and bamboo fibers along with gaur gum (GG) powder. In the experimental treatments, poorly-graded sandy soil was mixed with fibers and GG powder and shear strength parameters were determined through direct shear tests. To measure the permeability of the soil, a falling head permeability test was performed for different reaction periods. The results indicated that both vetiver and bamboo fibers cemented with GG significantly increased the shear strength of the sandy soil and reduced the permeability, with bamboo fiber demonstrating a greater improvement than vetiver. The introduction of these fibers facilitated additional interlocking, enhancing the cohesion among soil particles.

Keywords: *soil stabilization; vetiver fiber; bamboo fiber; unconfined compressive strength; permeability; gaur gum*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CAMSSC2024_ID_27

NOISE EMISSION CURVES FOR TRAIN IN ARRIVAL, IN-FRONT AND DEPARTURE MODE

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Rail transport has long been a cornerstone of societal development, contributing significantly to economic growth by facilitating the movement of goods and people. However, it also presents environmental challenges, one of the most prominent being noise pollution, which can affect both urban and rural populations. This paper addresses the critical issue of railway noise emissions by identifying and analysing the various sources of noise produced during train operations. In this study, noise emission curves were developed for trains in three distinct operational modes - arrival, in-front, departure. Analysis was done on a dataset of 180 noise measurements for trains traveling at different speeds using Class 1 sound level meter, kept at a height of 1.2m from the ground to simulate the location of human ears, at safe distance from the centre of the track. The overall LAeq of trains passing a point, encompassing the arrival, in-front, and departure phases, ranged from 53.3 to 104.0 dB(A), with average of 87.05 dB(A). The analysis indicated that a logarithmic curve best fits the noise data across all modes of operation, supported by coefficient of determination (R^2) greater than 0.85 during both training and testing stages. This suggests that the logarithmic model effectively represents the measured noise levels. The high R^2 values indicate that the developed equations are reliable for predicting train noise emissions under identified modes of operation. Notably, the mean actual error and root mean square error for the arrival stage were both under 1 dB(A), which is lower as compared to in-front and departure stages. These predictive models can play an important role in noise mitigation efforts, offering a tool for railway planners and engineers to forecast noise levels and implement appropriate control measures.

Key words: Rail noise, Environment, Rolling noise, Cruising noise

CAMSSC2024_ID_29

Sustainable Management of *MesuaFerrea* Leaf Litter in Avenue Plantation

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Avenue plantations are commonly implemented in institutional and urban areas to improve aesthetics and reduce air and noise pollution. *Mesuaferrea* (M.F.) is a preferred avenue tree due to its attractive canopy, but it generates leaf litter (biomass) all year round. Unlike the other leaf litter, M.F. leaf litter is resistant to natural decomposition which often leads to illicit burning, contributing to environmental pollution. Therefore, to address this issue, a study was conducted to quantify the M.F. leaf litter produced in the avenue plantations at the NERIST campus over two years (May 2017 – April 2019). The study involved designing a leaf litter collection system and measuring the monthly variation in litter fall, as well as the annual production per tree and the total output for the 171 M.F. trees on the campus. Results showed that the highest leaf litter was produced in March during both years, with a gradual annual increase in litter production per tree, rising from 13.231 kg to 15.779 kg per tree. The total M.F. leaf litter production for the campus was estimated at approximately 2.918 tons/year. Given the significant amount of leaf litter produced, sustainable and eco-friendly management solutions are necessary to prevent environmental pollution and reduce the labour-intensive process of managing the biomass. Simultaneously, further study on the conversion of M.F. leaf litter into compost or vermicompost may be carried out to fulfil the increasing demand for biofertilizers.

Keywords: *Avenue plantation; Leaf litter; Mesuaferrea; Sustainable;*

CAMSSC2024_ID_32

EXAMINATION OF THE EFFECT OF CHEMICAL ADDITIVES ON SUBGRADE SOIL STABILIZATION: A REVIEW

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Chemical soil stabilization involves adding chemical stabilizers to weak soil to enhance its geotechnical properties. These additives are highly effective across different types of soil in various climatic conditions, thereby significantly enhancing the soil properties. This paper presents a comprehensive literature review on the effects of traditional and non-traditional chemical additives on the properties of expansive, organic, silty-clay, laterite, and sandy soil. Out of 358 articles, after screening, a total of 112 articles published between 2001 and 2024 were included in this review. The review concluded that the inclusion of chemical additives to the soils significantly improved the relevant engineering characteristics of various types of soil. These maximum improvements were dependent on the optimum additive percentages, types of soil, and their nature. In this review, it was also found that non-traditional chemical additives were more effective and cost-effective than traditional chemical additives. Based on these reviewed studies, some future focuses in this research area are presented. Practically, this review will help geotechnical researchers better comprehend the effect of various chemical additives on the geotechnical properties of different soil types.

Keywords: *Subgrade soil stabilization; Chemical additives; Nanomaterials; Permeability*

CAMSSC2024_ID_33

Enhancing Urban Sustainability: An Automatic Rooftop Cooling Mechanism for Smart City

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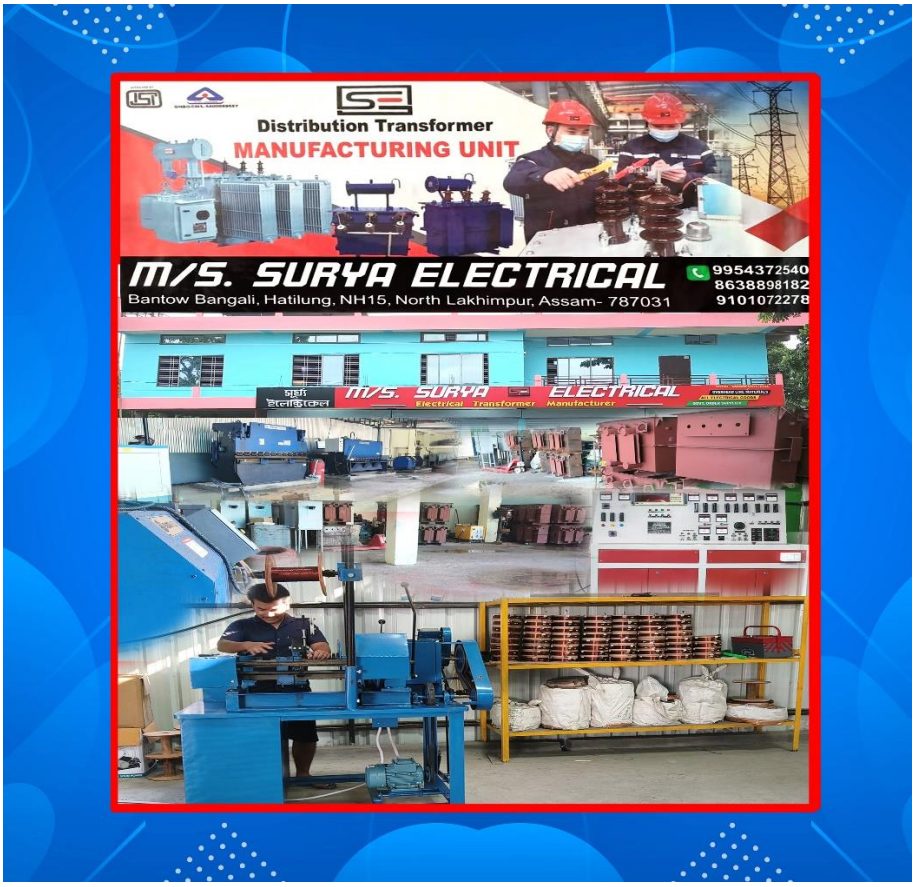
In the context of increasing urbanization and rising temperatures, the demand for innovative cooling solutions in urban environments has become critical. This study presents the development and evaluation of an automatic rooftop cooling mechanism designed to enhance energy efficiency and sustainability in smart city applications. Utilizing a DHT11 sensor for real-time temperature monitoring, an Arduino microcontroller for automated control, and a Peltier module for water cooling, the system effectively reduces rooftop surface temperatures. Environmental tests indicated a temperature decrease of approximately 1°C every 1.5 minutes, demonstrating the system's potential to alleviate heat buildup in urban settings. The methodology encompasses calculations of heat conduction rates, water flow efficiency, and performance assessments under varying ambient conditions. The findings underscore the importance of integrating advanced cooling systems into smart city frameworks, providing a viable solution to mitigate the urban heat island effect and promote energy conservation.

Keywords: *Automatic rooftop cooling; Urban sustainability; Urban cities; Water spray evaporation; Temperature monitoring; Energy efficiency*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CAMSSC2024_ID_34

Study of Wettability on Solid Surfaces via Molecular Dynamics Simulation

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Wettability, the ability of a liquid to spread across a solid surface, plays a pivotal role in numerous industrial and scientific applications. Traditional experimental techniques often lack the resolution needed to probe wettability at the molecular level. Molecular dynamics (MD) simulation presents a potent approach to delve into the intricate dynamics governing wetting phenomena. This research employs MD simulation to investigate the wettability of solid surfaces by liquid molecules. We meticulously set up MD simulations, incorporating appropriate force fields and simulation parameters to accurately model the interactions between solid and liquid phases. By employing advanced boundary conditions, we track the dynamics of contact angle evolution. Our results unveil a notable reduction in contact angle, indicative of enhanced wettability at the solid-liquid interface. Through rigorous analysis of molecular trajectories and interfacial energies, we elucidate the underlying mechanisms dictating the observed changes in wettability. Our findings extend to diverse fields including surface engineering, materials science, and nanotechnology. Understanding molecular-level interactions facilitates the design of surfaces with tailored wettability for applications such as self-cleaning coatings and microfluidic devices.

Keywords: *Wettability, Molecular simulations, Contact angle evolution, enhanced surface properties, Surface engineering applications*

CAMSSC2024_ID_35

Analysis of Roadside Advertising Impact on DrivingBehavior

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Now-a-days, advertising boards on the roadside are increasing day by day at a very fast rate. The effects of advertisement boards on different occasions are discussed here. These advertising boards are distracting the drivers from their tasks and in fact possess a threat of accidents. Not paying attention on the road i.e., inattention or distraction is an important aspect which is responsible for accidents. Analysis of the impact of roadside advertising on road safety has not been given utmost importance as there many other types of distractions on the road. There has been no enough study to say that the advertising boards distract the drivers to an extent they might lose their attention which puts them in a dangerous position. The risk possessed by advertising boards on every individual is not the same as different people react to different situations in different ways. So, it cannot be clearly stated that advertising boards are serious threat to the road users. Here, public perception of the factors influencing the distraction of drivers towards advertising boards has been studied. Here, in this study, the potential factors that are responsible for distraction of driver's attention have been identified and a public survey on their opinion to what extent these advertisements are harmful has been conducted. The survey is conducted on different kinds of people with difference in gender, age-group, driving experience etc. The responses represent all kinds of people's behavior with respect to their attention and distraction during driving. Then, analysis on the collected data has been done by overlapping the factors and consolidated the extent of the effect of each variable on another variable. Factors that are highly intimidating the driver's behavior because of the road side advertisements should be considered while installing these advertisements. As this distraction cannot be measured with any kind of tool and as there can be no evidence that advertisements are responsible for change in behavior of the driver that may lead to accidents, precautionary measurements should be taken while installing the advertisements.

Keywords: *Distraction; Advertising boards; Driver behavior; Driving environment; Human factors; Billboards.*

CAMSSC2024_ID_36

A Comparative Study of Bacillus subtilis and Staphylococcus saprophyticus for Bio-Cementation of Clayey Soil

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To improve the mechanical properties of clayey soil, a method to induce biocementation in the form of bioslurry to strengthen the mechanical properties is presented in this study. The bioslurry was prepared by mixing cultured bacteria and a cementation solution at 100, 300, and 600 mmol/L concentrations. The two strains of bacteria used were Bacillus subtilis and Staphylococcus saprophyticus. This study used a cost-effective solution to enhance the mechanical properties of clayey soil by incorporating a bioslurry. The unconfined compressive strength test was performed for both the slurries and their results were compared. The findings of this study showed a loss in plasticity and an enhancement in unconfined compressive shear strength of the clayey soil with the most significant improvements observed at the 600 mmol/L concentration of cementation solution. Moreover, the bioslurry consisting of Staphylococcus saprophyticus showed more promising results as compared to Bacillus subtilis. This study indicates that the bioslurry produced from the bacterial-cementation solution can effectively enhance the properties of soils for ground improvement applications.

Keywords: *Biocementation; Microbially induced calcite precipitation; Bioslurry; Plasticity; Unconfined compressive strength; Bacillus Subtilis*

CAMSSC2024_ID_37

Determinants of walking as a mode of transportation: A case study of Howrah

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This study examines factors influencing the choice to walk for work trips in the densely populated city of Howrah, where narrow streets and by-lanes dominate the urban landscape. A sample of 250 residents from 25 wards was interviewed to gather data on socio-demographic and trip-specific variables such as age, education, house rent, and trip length. The study addressed two key questions: whether residents prefer walking for work trips and why they make this choice, with options like budget, health, short distance, or no preference for walking. Logistic regression analysis revealed that age, education, house rent, and trip length significantly impact walking preferences, with more affluent individuals less likely to walk due to a lack of safe pedestrian infrastructure. It was also found that older people are more likely to walk due to health and budget reasons, suggesting that planners should focus on improving pedestrian infrastructure for this group, The findings highlight the need for better pedestrian infrastructure, including well-maintained footpaths, pedestrian-only streets, and improved accessibility for older residents.

Keywords: *Walking behavior; Urban mobility; Socio-economic factors; Logistic regression analysis; Transportation mode choice; Pedestrian choices;*

CAMSSC2024_ID_38

Economic Design of Combined Gravity and Pumped Water Transmission Main

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A water transmission system is designed to supply treated water from the Water Treatment Plant (WTP) to the storage reservoirs located in the different zones of the city in urban area, or in different villages in a grouped water supply scheme. In case of a grouped water supply scheme, the cost of transmission network is quite large as the villages are generally located far from each other. Such transmission system are planned as a direct pumping or a combined gravity and pumped type system. Recently, in the CPHEEO Manual, a methodology for economic design of such systems is suggested that involves minimizing the cost of pipes, cost of pumps, Master Balancing Reservoir (MBR) cost (if required), and capitalized energy cost. A Linear Programming (LP) based model is suggested to design the network. The LP model provides two pipe sizes for some of the links which is sometimes not liked by field engineers. Herein, a methodology based on single pipe size for each link, called as Modified Marginal Cost Increase Head Gain Ratio (MMCH) method, is suggested to use. The present work focuses on developing a software using a Python code. Initially, it is tested with a single-source single-destination pumping main, which is used to pump water from sump of a WTP to MBR. Later, an economic analysis of a combined gravity and pumped transmission network is considered. The example network from the Manual is considered, it is observed that the overall difference in cost is 1.04 %, when each link is consisted of single size in the transmission network.

Keywords: *Transmission System, Pumping Main, MMCH method*

CAMSSC2024_ID_42

A Framework of Minimizing Life Cycle Impact Towards Sustainable Asset Management of Water Supply System in Smart Cities

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Systematic Asset management is an important and essential attribute to ensure sustainable water supply for the well-being of smart cities. There is a need for technological innovation and implementation of an affordable asset management system taking due consideration of the life cycle impact (LCI) of all integrated components for achieving a robust water supply system in smart cities. Health risk due to possible intrusion through leakages, associated loss of energy, monetary involvement, and consequent loss of water, use of pumps has made assets management a vital aspect in contemporary research as well as in the practical world. Therefore, a decision-framing system is required to be developed through a life cycle assessment of the various integrated water supply components under smart cities. Studies suggested that water treatment and water abstraction were found to be the main consequences for most of the categories considering their huge electricity consumption. The detailed inventory list, data requirement and LCI parameters are assessed based on literature which is extremely essential for holistic assessment of water supply assets. In this paper an attempt has been made to provide a brief review of available literature and provide an impetus for preparing a conceptual framework for a proper trade-off concerning asset management systems, highlighting possible advantages and drawbacks considering its real-world application in the water supply system. A brief detail of the life cycle analysis system and its applications in water supply systems based on available literature are captured in this paper so that a simple, easy to operate, cost-effective, user-friendly and efficient method can be adopted for efficient asset management of water supply components under smart cities. Impacts are conventionally assessed for environmental, economic, and social consequences for analyzing the sustainability of the system. Advancement in the arena of life cycle assessment is discussed and the requirement of decision framing to detect possible detrimental effects on the assets and how it can be pro-actively assessed/ avoided are also emphasized. The role of life cycle analysis in water supply asset management is evaluated through literature-based case studies. An overview of the work carried out through Life cycle tools/ approach is examined to give motivation for future research work. Critical parameters are carefully reviewed considering their importance in benchmarking asset management systems. A conceptual framework has been proposed based on which water supply assets under smart cities can be efficiently managed for achieving a sustainable water supply system. The issues and challenges associated with Asset management along with a brief outline of future research scope are also highlighted.

Keywords: *Asset Management; Sustainability; Water supply; Life Cycle; Loss Management; Decision Making*

CAMSSC2024_ID_44

Prediction of Compression Index of Soil- A Perspective Review

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The settlement analysis of structures built over soil masses is integral to design, ensuring both stability and long-term performance. A critical parameter influencing settlement behavior is the soil's compression index (C_c), which provides insights into soil compressibility and potential risk factors essential for informed structural design. Traditionally, the estimation of C_c relies on standardized laboratory procedures (e.g., Bureau of Indian Standards), which, while accurate, are often costly, labor-intensive, and time-consuming. To address these limitations, researchers have explored correlations between C_c and easily measurable index properties of soil, such as Atterberg limits and others. Through exploring these index properties, predictive models based on Linear Regression and Computer aided Learning algorithms have emerged as efficient alternatives for C_c estimation. This review provides a comprehensive perspective on current methodologies for C_c prediction, highlighting that liquid limit, in-situ void ratio (e_o), and natural moisture content exhibit a significant correlation with C_c estimates across both linear and machine learning models. The findings from this study underscore the potential for data-driven approaches to streamline soil compressibility assessments, offering reliable and time-efficient predictions essential for geotechnical design practices.

Keywords: *Compression Index; Computer aided Learning; Linear Regression; Index properties; Machine Learning*

CAMSSC2024_ID_45

Mitigating River Pollution During Indian Festivals: The Efficacy of Artificial Idol Immersion Ponds as a Sustainable Solution

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India, with its rich cultural and religious heritage, sees idol immersion in water bodies as a widespread practice. The current study aims to assess the efficacy of artificial idol immersion ponds as a sustainable remedy to mitigate the adverse environmental impact of idol immersion in rivers during Indian festivals in the Itanagar Capital Complex Region of Arunachal Pradesh, India. Water samples were taken from direct idol immersion in river at Dikrong river at Doimukh town during the Vishwakarma Puja and artificial Idol immersion Pond at Jullang town during Durga Puja. The samples were collected in three distinct phases: before the immersion, during the immersion, and after the immersion the key parameters such as temperature, pH, BOD (Biochemical Oxygen Demand), COD (Chemical Oxygen Demand), TDS (Total Dissolved Solids), hardness, DO (dissolved oxygen), turbidity, and some heavy metals like lead, mercury, iron, cadmium, arsenic were analyzed. The findings revealed that Idol immersion in the river significantly impacts the water quality of the Dikrong River, especially through elevated levels of turbidity, BOD, COD, and heavy metals (lead and mercury), all of which exceeded permissible limits. The study also revealed that the artificial immersion ponds for the Durga Puja festival celebration had less impact on the Dikrong River than the direct immersion of the idol in the Dikrong River during the Vishwakarma Puja celebration by containing pollutants in controlled environments, allowing for easier waste management and minimizing ecological disruptions.

Keywords: Artificial Idol immersion ponds, Indian festivals, River pollution, Sustainable solution.

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Parametric Study of Lateral Earth Pressure on Rigid Retaining Walls Using ABAQUS

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A comprehensive parametric investigation is carried out to explore the effect of associative and non-associative flow rules on the behaviour of a rigid retaining wall, particularly concerning the lateral earth pressure exerted on the wall. This analysis is conducted utilizing Finite Element Analysis (FEA) software ABAQUS, which provides a robust platform for studying the interactions and responses within the soil-wall system. The active and passive lateral earth pressure distributions on the wall are obtained for different angles of internal friction (ϕ) with varying dilation angles (ψ). From the analysis it is found that there is an increasing trend of stability in the results of the distribution of active earth pressure (*Pa*) with increase in value of dilation angle in soil for same value of ϕ. The passive earth pressure (*Pp*) distribution results show that the difference in the behaviour of earth pressure due to associative and non-associative flow rule can be observed only in the lower part of the wall height, while associative flow rule in soil with higher value of ϕ may give overestimated passive earth pressure. The earth pressure distribution for non-associative flow rule with $\psi=0$ shows more fluctuation and unstable results, whereas with $\psi=0.5\phi$ shows more uniform and stable pressure distributions for both passive and active cases. Thus, the study reveals that dilation angle significantly impacts the behaviour of rigid retaining walls and hence non-associative flow rule with appropriate value of dilation angle should be considered in their analysis and design.

Keywords: *Earth pressure, Dilation angle, Flow rule, ABAQUS*

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Analysis of Bamboo Reinforced Unpaved Road Using ABAQUS

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In this paper, the response of an unpaved road reinforced with bamboo grids is investigated. An aggregate base layer over a typical soft subgrade is analyzed using ABAQUS software under both static and dynamic loading conditions. Six cases are considered: four for static loading and two for dynamic loading. For the static case, analysis is performed on two unreinforced base layers with thicknesses of 150mm and 300mm, as well as two bamboo-grid reinforced base layers, each 150mm thick. The reinforced cases consider two different reinforcement placements: at the bottom of the base and at a height of one-third of the base layer from the bottom. For the dynamic case, the model is analyzed for a 300mm unreinforced base and a 150mm bamboo-grid reinforced base with reinforcement placed at the bottom.

The results reveal that bamboo-grid reinforcement reduces settlement by 20-27% under static loading and 19% under dynamic loading, depending on its placement. The inclusion of bamboo grids also enables a reduction in base thickness, saving up to 50% of aggregate material, thereby improving economic and material efficiency. Furthermore, the reinforcement placement significantly affects deformation, with the lowest deformation observed when the bamboo grid is positioned at the base-subgrade interface compared to its placement at one-third the base height. Thus the study highlights the potential of bamboo-grid reinforcement to enhance the performance of unpaved roads, offering a sustainable, low-cost alternative to conventional reinforcements like geogrids.

Keywords: *Bamboo-grids, unpaved road, subgrade, dynamic load, Abaqus*

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Exploring the Potential of Cement-Stabilized Fiber-Reinforced Soil in Slope Stability

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Landslides pose a significant challenge in the northeastern states of India, particularly in Arunachal Pradesh, due to the region's steep topography and heavy monsoon rainfall. This study explores the stabilization of soils of a slope at BageTinali, Itanagar of Arunachal Pradesh using cement as additive and **Polypropylene fiber** as reinforcement to enhance the strength and stability. The research emphasizes replacing traditional sand and coarse aggregates with locally available silty soil of a slope to enhance its strength, which proves to be an innovative and cost-effective solution for stabilising natural soils of a slope.

Comprehensive laboratory tests were conducted to evaluate critical parameters, including unconfined compressive strength (UCS), maximum dry density (MDD), optimum moisture content (OMC), and water absorption of the stabilised soil. The results show that incorporating 20% cement and 1.25% polypropylene fiber increases UCS by approximately 1829.48% compared to untreated soil. Additionally, the proposed mixture exhibited notable improvements in MDD and OMC, confirming its effectiveness for slope stabilization in hilly terrains.

Economic analysis highlights the cost-efficiency of this method compared to conventional shotcrete techniques. This study offers a sustainable and economical solution for mitigating landslides, contributing to the resilience of critical infrastructure in the region.

Keywords: *Slope stability, Reinforced soil, Cement, Fiber*

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Surface Treatment Methods of Waste Rubber Tyre Aggregates to be Used as Aggregates in Concrete Mix-A Review.

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Waste rubber tyre disposal has become a major problem nowadays as there has been a drastic increment in the usage of rubber tyres, leading to the generation of an enormous amount of waste tyres for disposal. Concrete is composed of cement, sand, coarse aggregate, water, and admixtures. It is largely used worldwide in the construction field for the construction of structures like road pavements, dams, high-raised buildings, bridges etc. As concrete is used in such a large volume the demand for raw materials for its production also increases, since aggregates are the naturally available raw material for concrete, they are drastically used leading to the scarcity of sustainability of the natural aggregate, so incorporation of waste rubber tyres with some percentage replacement for natural aggregate in concrete subjected for extensive research and investigation in recent times. The capacity of waste rubber tyres to enhance certain concrete properties is a sustainable disposal method and has drawn the attention of research in this field. This paper contains work to study the surface treatment techniques adopted to increase the bond with the waste rubber tyre and concrete mix. This paper will review the waste rubber tyre surface treatment methods and their effectiveness in the concrete mix.

Keywords: *waste rubber tyre aggregate; surface treatment; waste disposal; sustainable material.*

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Effect of Influential Factors to Injury Severity of Two-Vehicle and Multi-Vehicle Accidents: A Review

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This review study examines several factors influencing injury severity in two-car and multi-car accidents by examining the data collected from accident reports, medical records, and traffic datasets. It investigates the effects of driver demographics on injury outcomes: age, gender, physical condition, and driver experience; vehicle characteristics: type, age, and mechanical condition; and factors of environment like weather, lighting conditions, and time of day; Roadway elements: surface condition, road class, and presence of intersection. The findings disclosed that senior drivers, especially those 65 years and above, were at greater threat of severe injury, as were occupants in heavier vehicles or those older than a decade. The wet surface road conditions and rural roads greatly aggravated the severity of injuries,whereas the possibility of severe or fatal injuries was significantly raised due to speeding and alcohol use. Accident-specific characteristics also indicated that head-on and angle accidents resulted in more serious injuries than rear-end accidents. These findings motivate traffic safety interventions and policies for reducing consumer injury severity and suggest that these and similar risk factors could inform injury prevention efforts ranging from roadway design to driver behaviour modification programs to improve traffic safety and resource allocation during emergency management.

Keywords: *two-vehicle accidents, multi-vehicle accidents, injury severity*

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Analysis of Pile-Raft Foundation in Cohesionless Soil Strata

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Soil that alter with the variation in environmental situations when used for constructional activities are usually present. Since ages, construction on such ground is a pronounced challenge in the arena of geotechnical engineering, as it results in the delay of work due to instability of the ground and cost over-run in accomplishment of the project. The major geotechnical issues associated with such type of soils includes slope instability, excessive settlement, bearing capacity failure etc. Such soil shows common challenges for the sustainable and serviceable design and further construction of structural foundations. Thus, study of pile-raft foundation is of utmost importance in order to make use of such soils. Hence, the current paper contains study made on pile- raft foundation on cohesionless soil using PLAXIS 3D. The PLAXIS 3D program is a three dimensional finite element method/programme which is used for deformation and stability analysis of various types of geotechnical applications. The analysis involves effect of angle of internal friction in settlement study of cohesionless soil. The current study also noted that dilatancy angle can also bring impact in load settlement of cohesionless soil. It was observed from the current effort that with the increase of angle of internal friction angle the settlement was noted to gradually decrease. Thus, to understand the affect of other vital parameters the study of cohesionless soil should be made in depth.

Keywords: *Cohesionless soil ; PLAXIS 3D ; Settlement ; Modelling*

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A REVIEW ON THE PREDICTION OF CALIFORNIA BEARING RATIO OF SOIL USING MACHINE LEARNING ALGORITHM

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This literature review discusses different research works related to predicting CBR of soils under the application of machine learning techniques. Traditionally, an important parameter of pavement design has been presented by conducting laboratory testing, which consumes a lot of time. As a result, current research has analyzed the use of machine learning algorithms to determine the CBR value very efficiently. With these objectives in mind, various works with different algorithms, such as Random Forest, ANN, SVM, and hybrid models, have been utilized. The training of such models mainly takes on data relating to soil properties, including particle size distribution, Atterberg limits, and compaction parameters. Machine Learning: the art of creating accurate and cost-effective CBR prediction review consists of prediction improvement in order to streamline the pavement design process and to improve the basis for decision making within geotechnical engineering. Several key findings emerge from the reviewed studies. First, machine learning models consistently demonstrate high accuracy in predicting CBR values, often outperforming traditional statistical methods. Second, the choice of algorithm can influence prediction accuracy, with some studies suggesting that Random Forest and ANN models tend to perform better than others. Third, the quality and quantity of available training data are fundamental to the performance of models, highlighting the importance of richer better-labeled datasets. Finally, several areas of further work are identified, which include more robust models that can tolerate more complex soil conditions, as well as the development of new algorithms for machine learning in making the predictions. The literature generally indicates that machine learning might provide an excellent point of leverage for efficiency improvements with respect to enhanced accuracy in geotechnical CBR estimation.

Keywords: *machine learning; CBR; CBR prediction; Random Forest; ANN*

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ANALYSING TEMPERATURE ANOMALIES IN INDIA: PROJECTIONS AND TRENDS USING CMIP6 MODELS OUTPUTS

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India, characterized by its diverse climatic and geographic conditions, lacks a comprehensive analysis of temperature anomalies across its regions. Research on localised temperature dynamics and its consequences for certain regions and socioeconomic groups is needed. This study offers an in-depth analysis of historical and future temperature variations in India from 1965 to 2064, based on climate projections from the Coupled Model Intercomparison Project Phase 6 (CMIP6). This study identifies significant warming trends projected under four Shared Socioeconomic Pathways (SSP) scenarios: a low-emission scenario (1-2.6), a medium pathway (2-4.5), a high-emission pathway (3-7.0), and an extreme scenario (5-8.5). According to spatial study, the regions of northern India, especially those close to the Himalayas, likely to have large temperature anomalies, with maximum temperatures expected to exceed 4°C and mean temperatures exceeding 3.5°C under extreme scenario (5-8.5) in the future. The central and southern regions will also experience noticeable, though smaller, temperature increases. The long-term estimates indicate that by 2064, the mean temperature anomalies will be increases roughly by 1.5°C under low-emission scenario (1-2.6), 2.0°C under medium pathway (2-4.5), 2.5°C under high-emission pathway (3-7.0), and over 3.0°C under extreme scenario (5-8.5) in this study. Under low-emission scenario (1-2.6), maximum temperature anomalies are expected to rise by about 1.7°C, by 2.2°C under medium pathway (2-4.5), by 2.6°C under high-emission pathway (3-7.0), and nearly 3.0°C under extreme scenario (5-8.5). Minimum temperature anomalies are projected to increase by 1.5°C under low-emission scenario (1-2.6), by 2.0°C under medium pathway (2-4.5), by 2.5°C under SSP 3-7.0, and almost 3.5°C under extreme scenario (5-8.5).

Keywords: *Climate Projections, Temperature Anomalies, Shared Socioeconomic Pathways (SSP), General Circulation Models (GCMs), India Climate Change*

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Sustainable Paving Solutions: Laboratory Analysis of Geopolymer Paver Blocks with Reclaimed Asphalt Pavement Aggregates

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India's urban infrastructure faces a critical gap in pedestrian and non-motorized means of transport facilities. While concrete paver blocks (CPB) are commonly employed for this purpose, their production contributes to significant environmental impacts. This research explores geopolymer concrete as a sustainable alternative for paver blocks. Geopolymer paver blocks (GPB) are produced using fly ash, ground granulated blast furnace slag (GGBS), and an alkaline activator. To further enhance sustainability, reclaimed asphalt pavement (RAP) aggregates were incorporated as a substitution for conventional aggregates. The study evaluated the mechanical, durability, and abrasion properties of the developed GPB, comparing them to traditional CPB. The use of RAP aggregates lead to reduction in the workability of fresh concrete; however, all evaluated mixtures satisfied the standards for paver blocks (PBs) for medium to light traffic applications. The experimental findings revealed that use of RAP aggregates lead to a decline in the strength properties of the GPBs; however, they still adhered to the necessary standards. Notably, the GPBs exhibited enhanced durability attributes relative to traditional concrete. Moreover, the research disclosed that the abrasion resistance of GPBs surpassed that of CPBs; however, an increase in RAP content correlated with heightened abrasion loss. The insights gained from this study reinforce the potential of applying RAP in GPB as a significant leap towards sustainable infrastructure development, thereby diminishing the carbon footprint tied to standard cement-based materials.

Keywords: *Reclaimed Asphalt Pavement; Geopolymer Concrete; GeopolymerPaver Blocks; Sustainable Concrete*