INDIA CHAPTER

INTERNATIONAL ROAD FEDERATION
INDIA CHAPTER

National Conference-cum-exhibition on
"REVOLUTIONIZING ROAD INFRA WITH MODERN EQUIPMENT, TECHNOLOGIES, SUSTAINABLE MATERIAL AND POLICY GUIDELINES"

February 29th – March 01st, 2024

Manekshaw Centre, Parade Road, Delhi Cantt. New Delhi - 110 010

SOUVENIR

CONTENTS

Dr. P K Sikdar
Secretary
Conference Technical Committee

MESSAGE

I am happy to inform that the International Road Federation's India Chapter is organizing a National Conference-cum-Exhibition on "Revolutionizing Road Infra with Modern Equipment, Technologies, Sustainable Materials and Policy Guidelines" from 29th February – 1st March 2024 at Manekshaw Centre, Parade Road, Delhi Cantt. 110 010.

As you very well know, the Researchers and practicing professionals across the world are aiming for infrastructures using the concept of Sustainability in all phases of developments considering economy & durability. Therefore, it becomes imperative to use construction materials & technologies that promote sustainability in all stages of development like functional design, detailed engineering, selection of materials, construction methodology, construction management and management of assets, etc. Recyclability, use of waste materials, flexibility in choice of materials ensuring durability with lower lifecycle cost is important to achieve true sustainability in infrastructure developments and maintenance management. Therefore, sustainability should concentrate beyond references to only embodied energy or decarbonization of materials, etc., and should focus on a comprehensive strategy aided by technology innovation.

The two-day conference is a serious effort to bring out the possible directions for the future identifying the available options in terms of new and innovative materials as well as alternatives. The Conference will have key-note presentations from the Experts in this domain, invited papers. Various technical sessions will be discussing about various facets of sustainable construction materials and technologies besides focus on road safety.

The Conference will have Six Technical sessions focusing on sustainable technology in infrastructure development; cost-effective construction materials & technologies; innovative technologies in road safety; bridges and tunnels; technologies of project planning, DPR, Survey, etc. Besides, the Six technical sessions, there will be a Session for Start-ups as well as Platform for Posters from research scholars. An exhibition, will run concurrently to the Conference activities to display the technologies relevant to the Conference theme.

Prof. P.K. Sikdar

Hon'ble Minister
Shri. Nitin Jairam Gadkari
Minister of Road Transport & Highways
Government of India

नितिन गडकरी
NITIN GADKARI

सत्यमेव जयते
आज़ादी का अमृत महोत्सव

मंत्री
सड़क परिवहन एवं राजमार्ग
भारत सरकार
Minister
Road Transport and Highways
Government of India

MESSAGE

I am happy to learn that International Road Federation – India Chapter (IRF–IC) is hosting a 2–day National Conference-cum-Exhibition on *"Revolutionizing Road Infrastructure with Modern Equipment, Technologies, Sustainable Materials and Policy Guidelines"* scheduled to be held from February 29th to March 1st, 2024.

The theme of the conference underscores the urgent need to embrace innovation, sustainability and effective policy frameworks as we strive to address the evolving challenges and opportunities in our infrastructure sector. I am confident, participants from diverse backgrounds and sectors will converge to engage in dynamic iscussions, share insights and explore innovative solutions that promise to revolutionize our approach to road infrastructure. From the adoption of cutting-edge technologies to the promotion of sustainable materials and the development of robust policy guidelines, I am pleased to note that every aspect of the conference is designed to catalyze positive change and drive progress in our infrastructure development agenda.

I extend my heartfelt appreciation to the IRF-IC and all the Partners and Sponsors for their unwavering commitment and dedication in bringing this event to fruition. The tireless efforts from the entire group have laid the foundation for what promises to be a truly enlightening and impactful conference.

(Nitin Gadkari)

Date: 23 February, 2024
Place: New Delhi

Room No. 501, Transport Bhawan, 1, Sansad Marg, New Delhi – 110 001, Tel.: 011-23710121, 23711252 (O), 23719023 (F)
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Mr. K. K. Kapila

President (Emeritus),
International Road Federation Geneva &
Founder President, International Road Federation - India Chapter

INTERNATIONAL ROAD FEDERATION
FEDERATION ROUTIERE INTERNATIONALE

www.irfnet.ch

K. K. Kapila
President (Emeritus), International Road Federation Geneva &
Founder President, IRF India Chapter

MESSAGE

It is with great pleasure and pride, we are organizing a 2-day National Conference-cum-Exhibition on "Revolutionizing Road Infrastructure with Modern Equipment, Technologies, Sustainable Materials, and Policy Guidelines," which is to be held on 29th Feb- 1st March, 2024 at New Delhi.

As the founder president of the International Road Federation's India Chapter (IRF-IC), I am delighted to witness the continued dedication and commitment of our esteemed colleagues in advancing the discourse on road infrastructure in India. It is imperative that we harness the transformative power of technology and innovation to drive progress and address the evolving challenges faced in the infrastructure sector.

In today's rapidly evolving landscape, technology and innovation play a pivotal role in shaping the future of road infrastructure. From the advent of autonomous vehicles to the development of smart transportation systems and the integration of renewable energy solutions, the possibilities are limitless. This conference provides a unique platform for stakeholders to explore the latest advancements, share best practices, and collaborate on innovative solutions that have the potential to revolutionize the way we design, build, and manage our roads.

As we embark on this journey of revolutionizing road infrastructure, let us embrace the transformative power of technology and innovation to create safer, more efficient, and sustainable road networks for generations to come.

(K.K Kapila)

Date: 26th February 2024
Place: New Delhi

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Lt. Gen. Harpal Singh, PVSM, AVSM, VSM (Retd.)
President, International Road Federation - India Chapter

International Road Federation
Fédération Routière Internationale
Federación Internacional de Caminos
अन्तरराष्ट्रीय सड़क संघ
INDIA CHAPTER

Lt. Gen. Harpal Singh, PVSM, AVSM, VSM (Retd.)
President, IRF India Chapter

MESSAGE

As President of the International Road Federation's India Chapter (IRF-IC), it is my pleasure and privilege to present to you the 2-day National Conference-cum-Exhibition on "Revolutionizing Road Infrastructure with Modern Equipment, Technologies, Sustainable Materials and Policy Guidelines". This event will be held on 29th Feb. & 1st March, 2024 at New Delhi.

As we stand to launch a new era in road infrastructure development, it is imperative that we embrace the latest advancements in technology and innovation to drive progress and address the evolving challenges in our sector. From the integration of smart technologies and intelligent transportation systems to the use of sustainable materials and the development of effective policy guidelines, the possibilities are endless. By harnessing the power of technology and innovation, we can create safer, more efficient, and sustainable road networks which meet the needs of our rapidly growing population.

Furthermore, while our focus is on revolutionizing road infrastructure, we must not lose sight of the critical importance of road safety. Every day, countless lives are affected by accidents on our roads, underscoring the urgent need for comprehensive road safety measures.

I look forward to welcoming you all to this groundbreaking event and witnessing the transformative discussions and collaborations which will unfold.

(Lt. Gen. Harpal Singh, PVSM, AVSM, VSM (Retd.))

Date: 26th February 2024
Place: New Delhi

INTERNATIONAL ROAD FEDERATION-INDIA CHAPTER
A-9A, 3rd Floor, Green Park Main, New Delhi-110 016 India
Tel. : 91-11-40041435, Email : india@irf.org.in, Website : www.indiairf.com

PREFACE

The National Conference & Exhibition of IRF India Chapter is on a highly contextual theme of recent time like 'Revolutionizing Road Infrastructure', a foray into the realm of Modern Equipment, Technologies, Sustainable Materials and Policy Guidelines. In the age of 'Digital India', modernization of India's road network is progressing in leaps and bounds.

The roads we travel on are the lifelines of the present day civilization connecting us to places, people and opportunity. The evolution of road infrastructure has always been closely linked to the advancement of the society, shaping the way we live, work and interact with the world around us. The development of modern equipment, technologies, sustainable materials and policy guidelines has revolutionized road infrastructure, paving the way for safer, more efficient and environmentally conscious transportation networks.

In this souvenir dedicated to the theme of Revolutionizing Road Infra with Modern Equipment, Technologies, Sustainable Materials and Policy Guidelines, we embark on a journey to explore the transformative impact of modern innovations on road infrastructure. From cutting-edge equipment to state-of-the-art technologies, from sustainable materials to forward-thinking policy guidelines, each element is going to play a pivotal role now in redefining the way we design, build, and maintain the roads.

Through a wide range of Abstracts dedicated to varied aspects of the central theme, we delve into the profound changes taking place in the road infrastructure landscape. We thank the highly experienced professionals, start-ups and budding researchers for their innovative expressions through the Abstracts. These innovations and ideas we believe would ultimately drive the country toward a future of unprecedented transformation towards sustainability, resilience and connectivity.

Let this souvenir serve as a testament to the remarkable progress we have made, and the boundless potential that lies ahead as we continue to embrace the power of modern equipment, technologies, sustainable materials and policy guidelines in shaping the roads of tomorrow.

Prof. P. K. Sikdar

Akhilesh Srivastava

CONFERENCE ORGANISATION

Organising Committee

- Maj. Gen. Ashok Kumar - Director General, Military Engineer Services
  - Chairman
- Mr. Akhilesh Srivastava, Executive Vice President, IRF India Chapter
  - Co-Chair
- Dr. Abhishek Mittal - HoD, Principal Scientist, CSIR-Central Road Research Institute
  - Secretary
- Mr. S.K. Nirmal - Secretary General, Indian Roads Congress
  - Secretary, IRF India Chapter
- Prof. Pradeep Kumar Ramancharla – Director, CSIR-Central Building Research Institute
- Dr. N. Anandavalli – Director, CSIR-Structural Engineering Research Centre
- Mr. Sanjeev Kumar – Director, Indian Academy of Highway Engineers
- Mr. V.K. Rajawat – Member (Projects), National Highways Authority of India
- Mr. P.N. Ojha – Joing Director & Head, National Council for Cement & Building Materials

Technical Committee

- Prof. Manoranjan Parida – Director, CSIR-Central Road Research Institute
  - Chairman, Technical Advisory Committee
- Mr. V. Suresh - President, Good Governance India Foundation, Chairman, Policy, Advocacy and Govt. Relations, Indian Green Building council, Chairman, National Building Code of India, Former CMD, HUDCO, Former President, Indian Building Congress
  - Co-Chairman, Technical Advisory Committee
- Mr. Shailendra Sharma - Former DG, CPWD
- Prof. P.K. Sikdar – Advisor, IRF India Chapter
- Mr. R.K. Pandey - Former CGM, NHAI
- Mr. D. Sarangi - ADG (East-II), Ministry of Road Transport & Highways
- Mr. Manoj Kumar - Member (Projects), National Highways Authority of India
- Prof. Mahendrakumar Madhavan - Professor, Civil Engineering, Indian Institute of Technology Hyderabad
- Mr. Alok Bhowmick - Consulting Engineers Association of India
- Mr. S.K. Puri - Executive Director, Intercontinental Consultants & Technocrats Pvt. Ltd.
- Dr. S.K. Singh - Chief Scientist, Structural Engg. Group & Professor AcSIR, CSIR-Central Building Research Institute
- Mr. P.N. Ojha - Joing Director & Head, National Council for Cement & Building Materials
- Prof. Prem Krishna

- Prof. N. Raghavan - Department of Civil Engineering, Indian Institute of Technology Madras
- Prof. A. Veeraragavan - Retired Professor, Indian Institute of Technology Madras
- Prof. K. S. Reddy - Professor, Civil Engineering, Indian Institute of Technology Kharagpur
- Prof. J. Murali Krishnan - Department of Civil Engineering, Indian Institute of Technology Madras
- Dr. I.K. Pateriya - Director (P-III), National Rural Infrastructure Development Agency
- Dr. Vasant Havanagi - Chief Scientist & Professor, Geotechnical Engineering Division, CSIR-Central Road Research Institute
- Dr. J.K. Goyal - HoD, Chief Scientist, Bridges & Structures Division, CSIR-Central Road Research Institute
- Dr. Rakesh Kumar - HoD, Chief Scientist, CSIR-Central Road Research Institute
- Prof. Dharamveer Singh - Associate Professor, Department of Civil Engineering, Indian Institute of Technology Bombay
- Prof. Aravind Swamy – Professor, Department of Civil Engineering, Indian Institute of Technology Delhi
- Ms. Atasi Das - Assistant Vice President, G.R. Infraprojects Ltd.
- Dr. Swapan Bagui - HoD & Vice President, ICT Pvt. Ltd.
- Ms. Minimol Korulla - Head – Strategic Initiatives & Projects – ISEAP, Maccaferri Environmental Solutions Pvt. Ltd
- Prof. G.D. Ransingchung R.L. - Professor, Transportation Engineering, Indian Institute of Technology Roorkee.
- Mr. Sanjay Pant - Scientist-F & DDG (Standardization-II), Bureau of Indian Standards
- Mr. S. Arun Kumar - Director & Head (Civil Engineering), Bureau of Indian Standards
- Mr. Pradip Kumar Mishra - Director General, Institute for Steel Development & Growth (INSDAG)
- Prof Mahesh Tandon - Managing Director, Tandon Consultants Pvt Ltd., International Professional Engineer (India), Guest Professor, IIT Gandhinagar
- Mr. Alok Bhowmick - Managing Director, B&S Engineering Consultants Pvt. Ltd.
- Dr. Harshavardhan Subbarao - Chairman & Managing Director, Construma Consultancy Pvt. Ltd.

ABOUT INTERNATIONAL ROAD FEDERATION - INDIA CHAPTER

In year 2011, the International Road Federation (IRF), Geneva, Switzerland set up an India Chapter known as IRF-IC as a membership-based organisation, representing leading corporates, Government entities and institutional players drawn from the road and mobility sectors. IRF-IC's mission is to promote safe and sustainable development of roads and road networks that enable access and sustainable mobility for all. Its approach is centred on the 5Es of Road Safety, namely, Engineering of Roads, Engineering of Vehicles and Policy Intervention, Education & Mass Awareness, Enforcement & Traffic Management and Emergency Care.

Mr. Kiran K. Kapila, President of IRF Geneva for 9 years and presently its President (Emeritus), has made immense contribution in shaping IRF India and its activities in the road safety domain. His passion for road safety is driving IRF India to relentlessly and consistently carry out various road safety programmes.

A dynamic and decorated officer of Indian Armed Forces, Lt. Gen. Harpal Singh (Retd.), former E-in-C, Indian Armed Forces, is the President of the India Chapter of International Road Federation. Lt. Gen. Harpal Singh is a former E-in-C, MES and DG of Border Roads Organisation. MES is one of the largest construction and maintenance agencies in India responsible for creating the strategic and the operational infrastructure as also the administrative habitat for all three Services and the associated organisations of the Ministry of Defence. Lt. Gen. Harpal Singh is credited with the resurgence of BRO. His notable contribution has been the completion of Atal Tunnel.

About IRF

The International Road Federation, Geneva Programme Centre is a non-governmental, not-for-profit organization with the mission to encourage and promote development and maintenance of better, safer and sustainable road and road networks. The IRF enjoys a Special Consultative Status at the United Nations Economic and Social Council. It is an institutional partner with the UN, WHO, World Bank, EU and many other international organisations.

About IRF-IC

IRF India Chapter, which has been active in India since 2005, was formally set up on 5th February 2009 and registered under the Societies Registration Act 1860 of India. With aims and objectives in consonance with its parent body, its present membership includes 90 organizations. The Ministry of Road Transport & Highways, National Highways Authority of India, National Highways & Infrastructure Development Corporation, Central Public Works Department, Delhi Development Authority, PWD Delhi, number of State Governments are Life Members of IRF-IC. The membership comprise of Government Organizations, Highway Authorities, Research Organizations, Professional Associations, Contractors, Concessionaires, Consultants, Automobile Manufacturers, Manufacturers and Suppliers of Road Safety Devices, NGOs, etc.

Our Mission

Better & Safer Roads; Safer Transport & Safer INDIA

Our Initiatives

- Conferences / Seminars on Road Safety themes

- Intertraffic Exhibition, world's largest exhibition on Traffic Technology
- Road Safety curriculum in all subjects from class VI to X for high school level incorporating Road Safety topics. To download the books, click on the link below: https://indiairf.com/project/starting-them-young-irf-initiative-for-integrating-road-safety-in-school-curriculum/
- Conspicuity for Bicyclists & Tractor/Trolleys – Introduced use of retro-reflective tapes on parts of bicycles. Promote use of
- Retro-reflective tapes on Tractor / Trolleys / Commercial Vehicles.
- Road Accident Data Recording (RADaR) system of scientific and comprehensive accident data collection
- CHANGER, a Green House Gas (GHG) Calculator for assessing the GHG emissions from the raw materials used in road construction projects
- Enhanced First Aid (eFD) programme for Commercial Drivers and Bystanders
- Blackspot Improvement Programme
- Annual participation in Road Safety Week/Month of MoRT&H
- Road Safety Anthem in various languages covering all Indian States, nay the world at large
- Short films on Road Safety
- Participants in National & International Trade Fairs
- Newsletter & Yearbook

FULL MEMBERSHIP:

Through the diversity of its members, the International Road Federation (IRF) is a network of public and private sector entities all with a common interest in the development of modern, economically and ecologically efficient and safe roads. IRF enjoys Special Consultative Status in the UN's ECOSOC and is represented in its Committees working on safer and sustainable mobility.

IRF set up its India Chapter, IRF-IC in 2011. Since its inception, IRF-IC has been active in pursuing Safe Roads and Safe Mobility in the country. With 9 major regional conferences, a number of road shows, notable efforts with Government, a World Road Meeting in 2017, IRF-IC has undertaken relentless activities in India. It continues to forge ahead with its 5E Programme in the 7 top ranking States with regard to road traffic accidents in the first phase. Details about this programme is available in our website www.indiairf.com.

Our membership includes:

- Consulting engineers, planning and management services
- Construction companies
- Construction equipment machinery manufacturers
- Distributors of construction equipment
- Road construction materials manufacturers
- Road infrastructure operators and concessions
- Ministries of Transport, Road Directorates and other Government services / agencies / authorities / departments associated with Road Transportation
- Automobile Manufacturers
- UN Institutions covering safer and sustainable transportation development as well as those concerned with the development of Safer Vehicles (IRF Leads the Safer Transportation Development group and is an active member in the other).
- Road associations
- Trade and sectorial associations and organisations
- Educational institutions and universities
- Research institutions
- Highway Systems Technology
- ITS and traffic management
- Safety devices

Membership Benefits:

The catalyst for new BUSINESS opportunities

By uniting the entire supply chain of road players, the IRF is an ideal platform for developing business partnerships and joint ventures. IRF helps people meet the right contacts in a neutral and trusted atmosphere, thereby fostering investment in the sector, improving product development and accelerating sales cycles.

ADVOCATE for the Road and Road Mobility Sectors

IRF works to mobilise political will with sound evidence, and to create a favourable climate for the road and road transportation sectors. IRF has a strong voice and significant influence when it comes to defending the members' interests. IRF reinforces members' dialogues with their own stakeholders, supporting individual advocacy efforts.

IRF India's 5E Programme of Road Safety, namely Engineering of Roads, Engineering of Vehicles and Policy Interventions, Education, Enforcement and Emergency Care, lay focus on each of the aspects in depth. Under 2nd E on Vehicular Engineering, IRF-IC is working closely with the Ministry of Road Transport and Highways* and Ministry of Heavy Industry, besides various State Governments. This is an excellent platform for advocacy/opinion making and policy interventions.

The promoter of INNOVATIONS and forward-looking solutions

IRF is a forward-looking Federation, striving to anticipate the needs, identify and promote future solutions for the road and road mobility sector.

Projection of your organization as a Good Corporate Citizen through involvement in various Pan India projects based on 5Es – Road Safety Audits (E1), Vehicular Engineering and Policy Interventions (E2), Road Safety Education Programs (E3), Training of Police Personnel to strengthen Enforcement (E4) and Emergency Care (E5).

The 5Es form major component of the global concept of a Safe System. This concept envisions a System where the Roads become forgiving so that even when an accident takes place there is no fatality. This is ably supported by the other Es to ensure safer and better Vehicles, well aware, informed and sensitised communities, trained police personnel, adept at controlling and handling any mishaps and bystanders trained as skilled good Samaritans to provide pre-hospital care, reasonably well-equipped hospital care facilities by upgrading the existing facilities, thereby giving a chance to the victims to survive.

IRF-IC's Coalition Programme

IRF-IC has recently launched a Coalition Programme. This coalition will bring into its fold like-minded Corporates, think tanks, academia, research organizations etc. to consistently undertake programs on road safety. This coalition will aim to undertake programs on education and mass awareness and emergency care to begin with.

The coalition therefore provides a platform to all its existing as well as prospective members to join the mission of Road safety and help in the achievement of UN's Decade of Action envisaging 50% reduction in road safety accidents and fatalities by the year 2030.

IRF-IC's School Zone Safety Programme

Recently, IRF (IC) has launched a School Zone Safety Programme, which follows the guidelines outlined in the IRC: SP: 32 for fostering a culture of safety and undertaking safety capacity-building audits near schools. IRF-IC has also developed a School Zone Safety Portal that will bring visibility about the School Zone Road Safety status in the public domain so that parents/citizens can see how safe the schools are and exert pressure on the school and civil administration. Each school will receive a unique login ID, so they can have all the information related to the school's road safety zone.

The Corporates can play an active role in this effort by adopting a number of schools near their area of operations / establishments / manufacturing units and fulfill their role as Good Corporate Citizens working for the betterment of the society.

The global centre of KNOWLEDGE and know-how

IRF acts as the point of reference and a centre of best practices and benchmarking for the road industry. IRF acts as a knowledge hub on past and current developments and future

trends. As such, IRF is the worldwide expert on global transport and related issues. It continues to undertake research on areas of innovative developments.

We have just made a breakthrough in comfortable and safe movement of vehicles during fog. This is being provided on the Bundelkhand Expressway in U.P. We are working on plants which emit light during night with Pant Agriculture University as a research Project. Similar effort is also on going in MIT Boston as well as in Netherlands.

The Provider of TRAINING and EDUCATION

IRF provides members worldwide with a wide range highly educational and professional development opportunities and resources.

In house Training Programmes of IRF-IC such as Road Safety Audits, Drivers' Training, Police Personnel training on Traffic Management, Pre-hospital Trauma Care Training and Road Safety Education for School Children are some of our key programmes. We are in the process of enhancing our training curriculum and competence using external resources as well.

Some of our notable works include preparation of Road Safety Curriculum for school children integrated with the existing contents of Hindi, English, Mathematics, Science and Social Science of classes VI to X. For creating extensive awareness, we have also prepared short road safety films in association with Maruti Suzuki.

Recently, we prepared a Road Safety Anthem of 1 min. in 23 Indian languages and a few widely spoken foreign languages. Our vision is to make this Anthem universal with road safety in the country and heard in every nook and corner, every school and gatherings. An Anthem in all the Indian languages is enclosed herewith with a humble request to play it in your establishments, before the start of every shift.

Advertising Opportunities

IRF provides ample opportunities to participate in its road shows, activities and unique publication called World Road Statistics (WRS). WRS is one of its kind data publication providing data on Roads and Road Mobility sectors of the world.

Giving STATUTORY Rights

Being a member of the IRF gives special and specific statutory rights which include opportunities to be a part of the Governing Council and Governing Body, both in India and the world body.

Organizational Committees

IRF-IC has in place 7 committees namely, Engineering & Infrastructure Committee, Transportation & Logistics Committee, Automotive & Vehicle Safety Committee, Education & Awareness Committee, Enforcement & Legislation Committee (Advocacy Committee), Emergency Response & Medical Committee and Research & Innovation Committee to work to expedite the mutual objectives of members and the Federation. A member can be a part of any one or two committees and take an active part in the Federation.

World Road Statistics

A unique publication of datasets of over 200 countries pertaining to Road Networks, Road Traffic Volumes, Multimodal Transport, Vehicle Fleets, Country Profile, Road Traffic Accidents, etc. will be shared with our members to serve as a rich source of data.

International AWARDS and RECOGNITION

The IRF Awards Programs are set up to gather and disseminate information on the exemplary people and projects around the world that place this industry at the forefront of social and economic development.

International Road Federation
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Federación Internacional de Caminos
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INDIA CHAPTER

IRF (INDIA CHAPTER) FULL MEMBERSHIP FORM
ANNUAL SUBSCRIPTION FOR THE YEAR 2024

We hereby apply for membership in the International Road Federation (India Chapter) and, upon acceptance, agree to comply with the Statutes and By-Laws of the organisation, as well as such rules and regulations as may be adopted for its governance & operation.

Institution/Company Information

Organization	
Street address and number	
City	Pin:
Country	
Email	
GST No.	

Contact Information Please give the following details for two contact people within the organisation:

	First Contact Person	**Second Contact Person**
Title (Mr/Ms/Dr. etc.)		
First name		
Last name		
Designation		
Telephone/Fax		
E-mail		

Membership Category (please indicate:☑)

		IRF annual fees (for Indian Members) (INR)
☐ Educational and research (research institutes, universities, educational)		25,000
☐ Government	a) Local Bodies (Life Membership – 35,000*10)	35,000 3,50,000
	b) Central / State (Life Membership – 60,000*10)	60,000 6,00,000
☐ Start-up		25,000
☐ **Companies**		
☐	turnover upto Rs. 25 Crore	65,000
☐	turnover Rs. 25-200 Crore	1,10,000
☐	turnover Rs. 200-350 Crore	2,10,000
☐	turnover Rs. 350-650 Crore	3,20,000
☐	turnover Rs. 650 -1300Crore	4,60,000
☐	turnover Rs. 1300 -2000Crore	7,00,000
☐	turnover above Rs. 2000 Crore	8,00,000
	+ GST @ 18% or as applicable (on applicable membership fee amount)	
	Net Payment	

Payment (please indicate:☑) ☐ Please invoice me ☐ I will pay:

Payment can be made of appropriate amount through Demand Draft/Cheque /NEFT/RTGS in favour of **International Road Federation (India Chapter)** payable at CA 921010038943439, IFSC Code UTIB0000015, AXIS Bank Ltd., Green Park, New Delhi.

GSTIN: 07AAAAI4265N1ZE **PAN No.: AAAAI4265N**

Signature _____ Date: _____

INTERNATIONAL ROAD FEDERATION-INDIA CHAPTER
A-9A, 3rd Floor, Green Park Main, New Delhi-110 016 India
Tel. : 91-11-40041435, Email : India@irf.org.in , Website : www.indiairf.com

INDIA CHAPTER

INDIVIDUAL MEMBERSHIP PLAN

PRO **- Rs 10,000/Year + GST /1 Lakh + GST for Lifetime**
Age Eligibility: 25-40

Benefits:

- To get our Bi-Monthly Digital News Bulletin.
- Write articles in the IRF-IC Newsletters.
- One page Advertisement space free in Digital News Bulletin - once a year.
- Access to webinars, workshops, and training programs to enhance skills and knowledge.
- Networking opportunities with experienced professionals in the field of road safety.
- Mentorship programs to receive guidance from higher professionals.
- Reduced fees for events and conferences.
- A platform for voicing opinions through articles and events.
- Form & lead a young Professionals Forum.

PREMIUM **- Rs 15,000 + GST/Year / 1.40 Lakh + GST for Lifetime**
Age Eligibility: Above 40

Benefits:

- To get our Bi-Monthly Digital News Bulletin.
- Write articles in the IRF-IC Newsletters.
- One page Advertisement space free in Digital News Bulletin - once a year.
- Access to webinars, workshops, and training programs to enhance skills and knowledge.
- Reduced fees for events and conferences.
- Advisory roles on committees and projects to share expertise and insights.
- Opportunities to lead or participate in specialized committees and working groups.
- Priority consideration for speaking engagements.
- Recognition and awards for outstanding contributions to road safety.
- Leads Mentorship Program and Trainings.

STUDENTS **- Rs 5,000/3 Yrs**
Age Eligibility: 18-25

Benefits:

- Discounted or complimentary access to conferences and workshops.
- Mentoring programs with higher professionals to guide career development.
- Access to a dedicated online forum for student members to connect and share research knowledge.
- Poster Competitions.

International Road Federation
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INDIA CHAPTER

IRF (INDIA CHAPTER) MEMBERSHIP FORM FOR INDIVIDUAL MEMBERS
ANNUAL SUBSCRIPTION FOR THE YEAR 2024

I/We hereby apply for individual (associate) membership in the International Road Federation (India Chapter) and, upon acceptance, agree to comply with the Statutes and By-Laws of the organisation, as well as such rules and regulations as may be adopted for its governance & operation.

Individual Information

Name of the Individual	
Street address and number	
City	Pin:
Country	
Mobile	
Email	
GST No.	

Individual Category (please indicate:☑)		**IRF annual fees (INR)**	**Life Membership**
☐ PRO		10,000	1,00,000
☐ PREMIUM		15,000	1,40,000
☐ Student Membership (valid for 3 years)		5,000	--------
	+ GST @ 18% or as applicable (on applicable membership fee amount)		
	Net Payment		

Payment (please indicate:☑)

Please invoice me –
☐ Annual Membership
☐ Life Membership

Payment can be made of appropriate amount through Demand Draft/Cheque /NEFT/RTGS in favour of **International Road Federation (India Chapter)** payable at 921010038943439, IFSC Code UTIB0000015, AXIS Bank Ltd., Green Park, New Delhi.

GSTIN: 07AAAAI4265N1ZE **PAN No.: AAAAI4265N**

Signature _____ Date: _____

INTERNATIONAL ROAD FEDERATION-INDIA CHAPTER
A-9A, 3rd Floor, Green Park Main, New Delhi-110 016 India
Tel. : 91-11-40041435, Email : India@irf.org.in , Website : www.indiairf.com

ABOUT THE CONFERENCE

The need for efficient and sustainable road infrastructure has become more crucial than ever in present day. The demand for well-designed and well-maintained roads has increased tremendously. To meet the need of rapidly growing population & expanding urbanization, it is imperative to revolutionize road infrastructure development by incorporating modern equipment, cutting-edge technologies, sustainable materials, and comprehensive policy guidelines. Traditional methods of road construction and maintenance are often time-consuming, labour-intensive, and prone to producing low quality. By embracing advanced machinery and tools, such as automated pavers, intelligent compaction systems, and robotic surveying devices, we can significantly enhance the efficiency and accuracy of road construction processes. Furthermore, the integration of cutting-edge technologies is essential in revolutionizing delivery of road infrastructure. Technologies like Geographic Information Systems (GIS), Building Information Modelling (BIM), and AI can provide planning, implementation and management of real-time data and insights, enabling better planning, design, and maintenance of roads.

Traditional road construction materials, such as asphalt, have significant environmental impacts due to their high carbon footprint and non-renewable nature. The sustainable alternatives like recycled materials, bio-based binders, and permeable pavements, can not only contribute to a greener future but also provide cost-effective solutions in the long run. Therefore, comprehensive policy guidelines are crucial for revolutionizing road infrastructure. Governments and regulatory bodies need to establish clear and forward-thinking policies that promote the adoption of modern equipment, technologies, and sustainable materials, which should encourage innovation, with appropriate research and development, and ensure the implementation of best practices in road construction and maintenance.

IRF India Chapter National Conference-cum-Exhibition held during February 29 - March 1, 2024 will strive to bring together the experts and policy planners of above aspects through a wide range of Presentations to be made by Experts. Also, there will be a showcase for the technologies in the Exhibition, which will run concurrently.

PROGRAMME STRUCTURE

INDIA CHAPTER

Revolutionizing Road Infra with Modern Equipment, Technologies, Sustainable Materials and Policy Guidelines

DAY 1 – 29 Feb 2024 (Thursday)

0830 – 1000	**Registration & Networking**	
1000 – 1105	**Inaugural Session**	
1000 – 1015	Welcome Address Address by	**Lt. Gen. Harpal Singh (Retd)** President IRF IC **Mr. K. K. Kapila** Founder President IRF IC
1015 – 1025	Special Address	**Mr. Anouar Benazzouz** President International Road Federation Geneva
1025 – 1035	Address by Guest of Honour	**Mr. Sudhendu J Sinha** Adviser, NITI Aayog
1035 – 1050	Chief Guest Address	**Mr. Anurag Jain** Secretary, MoRTH
1050 – 1055	Vote of Thanks	**Mr. DO Tawade** Sr. Vice President
1055 – 1130	***Tea/Coffee & Networking Break***	
1130 – 1150	**Keynote I: Sustainable Technology & Innovation in Infrastructure Development** **Mr. V. Suresh, Former Chairman & Managing Director, HUDCO**	
1150 – 1315	**Technical Session 1: Innovative and Intelligent Construction Equipment**	
	Chair: Prof (Dr.) Manoranjan Parida, Director- CSIR- CRRI **Co-Chair: Mr. B K R Prasad, GM Marketing,** TATA Hitachi	
8-10 min each	**Senior Representative**, JCB India: **Innovative construction equipment *** **Mr Satin Sachdeva**, Secretary CERA, **Rental equipment for construction** **Mr. Meghdut Guha**, Managing Director, Trans Asian Techno Pvt. Ltd. SAKAI: **Intelligent compaction equipment** **Mr. Amol Sinha,** Director, TEREX: **Equipment** **Mr. Rachit Kaushal,** Key Accounts Manager, Amman India: **Equipment** ***Q&A (5 min) & summing up (5 min)***	
1315 – 1415	***Networking Lunch***	
1415 – 1545	**Technical Session 2: Innovative, Sustainable and Cost-effective Construction Materials & Technologies - I**	
	Chair: Mr. S K Nirmal, Secretary General, IRC **Co-Chair: Dr. Hari Kishan Reddy**, Chairman, CUBE Highways	
8-10 min each	**Mr. Satish Pandey**, Principal Scientist, CSIR- CRRI: **Steel Slag Road** **Dr. L. R. Manjunatha**, Vice President, JSW Cement: **Low Energy Cement** **Mr. Vikas Thakar**, MD, Pavetech Consultants, CEO, Construction Excellence Testing & Research Services**: White topping as a cost effective and sustainable technology for rehabilitation of High-volume traffic highways.**	

	Dr. A.V. Rahul, Assistant Professor, IIT Tirupati, **Concrete 3D Printing for Fast and Sustainable Construction** **Dr. Dharamveer Singh**, Professor IITB: **"Tools and Techniques for Understanding Bituminous Mixes and Pavement Performance"** **Mr. Himanshu Agrawal**, Chief Operating Officer, Zydex ***Q&A (15 min) & summing up (10 min)***	
1545 – 1600	***Tea/Coffee & Networking Break***	
1600 – 1640	Presentation by Platinum Sponsors	Presentations @10 minutes each
1640 – 1810	**Technical Session 3: Innovative, Sustainable and Cost-effective Construction Materials & Technologies - II**	
	Chair: Mr. D. Sarangi, DG(RD) & SS, MoRTH **Co-Chair: Mr. Sudhir Hoshing,** CEO, IRB	
8-10 min each	**Dr. Ambika Behl**, Sr. Principal Scientist, CSIR-CRRI: **Sustainable pavements** **Ms. Minimol Korulla**, Head (SISP) Maccaferri: **Use of Geosynthetics in Flexible Pavements** **Mr. Arpan Ghosh**, President Engineering, Cube Highway: **PG Bitumen in Highway Construction** **Ms. Atasi Das**, Assistant Vice President, GR Infra: **New Edge Tech in Pavement Application** **Mr. Shashank Shekhar**, Co-Founder & CEO, MiCoB: **3D Concrete Printing** ***Q&A (15 min) & summing up (10 min)***	
1810 – 1840	**Presentation by Start-ups**	
05 min each	Presentation of New Researches and Innovations	**Mr. Konala Varma**, CEO, INAI (Hyd) **Dr. Venkata Satyanand Mutnuri**, Technical Officer, TIHAN (Hyd) **Mr. Chaman Tulsyan**, President, Verma Industries **Dr. Ankit Gupta**, IIT BHU **Prof. Nikhil Saboo**, IIT Rorkee **Mr. Ganesh Verma**, CMD, Bhavya Srishti Udyog Pvt Ltd. **Mr. Nitin** G. R., CEO, GRAND PITSTOP **Ms. Prerna Kalra,** Co- Founder, Hanu AI
1840 – 1910	**Visit to Poster Presentations**	
1910-onwards	**Cultural Programme**	
	Networking Dinner	

DAY 2 – 01st March 2024 (Friday)

0900 – 0930	**Registration**
0930 – 0945	**Keynote-2: Road Safety in India** **Mr. K. K. Kapila, President Emeritus IRF Geneva**
0945 – 11.15	**Technical Session 4: Innovative Technologies in Road Safety**
	Chair: Mr. Mahmood Ahmed, Addl. Secretary, MoRT&H * **Co-Chair: Mr. Rahul Bharti,** Maruti Suzuki– (5 min) *
8-10 min each	**Mr. S Kumar Popli**, Advisor (Road Safety), NHAI: **NHAI initiatives on Road Safety** **Mr. Dipan Bose**, Senior Transport Specialist, World Bank: **WB initiatives to improve RS in India (Video)** **Dr. Joydeep Shome**, DDG, NIC: **eDAR/iRAD: Towards better accident reporting and management** **Mr. Teja Gudena**, Executive Vice President, Netradyne: **ADAS System for road safety** **Dr. S. Velmurugan**, HoD, Chief Scientist, Traffic Engineering and Safety Division, CSIR - CRRI, New Delhi: **Revolutionizing Road Safety using Artificial Intelligence: A Case Study** **Prof. Rajalakshmi**, Professor, TIHAN (Hyd): **Autonomous Vehicle for India** **Mr. Akhilesh Srivastava**, Executive Vice President, IRF-IC: **Next Generation Road Safety** ***Q&A (15 min) & Summing UP (05 min)***
1115 – 1130	***Tea/Coffee Break & Networking***
1130 – 1150	**Keynote 3: Sustainable Technology & Innovation in Bridges** **Prof. Mahesh Tandon, CMD, Tandon Consultants**
1150 – 1315	**Technical Session 5: Bridges and Tunnels**
	Chair: Mr. B.N. Puri, Director, AITD **Co-Chair: Mr. Alok Sahay,** Secretary General & Executive Head, Indian Steel Association
8-10 min each	**Mr. Alok Bhowmick**, Adjunct Professor, B&S Engineering Consultants: **"FRP Composites – A Wonder Material of Future for Infrastructure Application"** **Mr. J. K. Goyal**, Chief Scientist, CSIR-CRRI: **Water proofing in bridges** **Dr. Narayan Chandra Pal,** OSD-cum-Engineer in Chief (Civil) Works Department Govt of Odisha **Bridge Management System** **Col. Parikshit Mehra, BRO: Challenges in Tunnel Construction** **Mr. Yousef Eshaghpour Rahimabadi**, Team Leader of AE for NHIDCL ICT: **Green Technologies of Road & Tunnel** **Mr. Satish Navanale**, COO, Long Span Structures Pvt Ltd. **Longspan Bridge** **Dr. Harshavardhan Subbarao,** Chairman & Managing Director, Construma Consultancy Pvt Ltd* ***Q&A (15 min) & Summing Up (10 min)***
1315 - 1415	***Networking Lunch***
1415 - 1545	**Technical Session 6: Innovative Technologies of project planning, DPR, Survey, Structural Design, Mix Design, Project Monitoring using IoT, GIS, AI, Drone, BIM, 3D, Digital Twin and Road Asset Management**
	Chair: Mr. R.K. Pandey, Advisor to the Hon. Minister of Road Transport & Highways **Co-Chair: Ms. Susanna Zammataro,** DG, IRF
8-10 min each	**Mr. Tony Mathew**, Principal Transport Specialist, TRL(India): **Data & Road Asset Mgmt**

	Mr. Kasturi Srinivas, Industry Director (Transportation), Bentley Systems: **Design Software & Innovations** **Dr. Rakesh Kumar**, Chief Scientist: **Presentation of a CRRI Case Study** **Mr. Gurpreet Singh Basra,** Delivery Head, AMNEX Info-technologies: **Data Lake Concept & Use** **Mr. Amit Saxena**, Regional Sales Manager, Trimble: **GIS and AI Based Project Monitoring Tools** **Dr.-Ing. Saptarshi Sasmal, Chief Scientist,** CSIR- Structural Engineering Research Centre; **Safety Auditing, Capacity Augmentation and Service Life Enhancement of Road Bridges – Through Detailed Instrumentation, Field Tests and Simulations** ***Q&A (15 min) & Summarising (10 min)***
1545 – 1600	***Tea/Coffee Break & Networking***
1600-1645	**Valedictory Session & Award Ceremony** **Guest of Honour - General (Dr.) Vijay Kumar Singh (Retd.), PVSM, AVSM, YSM, ADC,** Hon'ble Minister of State for Road Transport, Highways and Civil Aviation* Ministry of Road Transport and Highways and Ministry of Civil Aviation
1645 - 1650	**Vote of Thanks & Closing of Conference**
Tea / Coffee	

KEYNOTES

Keynote I

Sustainable Technology & Innovation in Infrastructure Development

Mr. Vasudevan Suresh

Former Chairman & Managing Director
HUDCO

Email: vsuresh30@gmail.com

ABSTRACT:

SUSTAINABLE TECHNOLOGIES AND INNOVATIONS IN INFRASTRUCTURE DEVELOPMENT

With fast paced demographic growth and India emerging as a leading country with an expected 1.6 billion population by 2050, India is on cusp of major developmental initiatives for the additional 600 million population. Buildings and Infrastructure development with quantum jump in scale, size and space is already being witnessed. Massive investments in Financial resources is backing up the Gati Shakti programmes and major Urban transformation projects.

The critical issues that need urgent attention are related to the fast paced delivery modes for construction backed by input resources of building materials and technologies. With the hresiliuge demand, many options for use of modern, alternative and innovative materials and technologies are emerging. It is equally important that resilience and sustainability as two major parameters are taken into account while selecting the emerging options. The enabling environment for adoption of these options dictate the urgent upskilling and reskilling needs of a large construction work force and use of new equipments and machineries for giving it the speed element. The Climate Change action areas also pose many challenges in the construction options in environmentally sensitive areas and vulnerable locations visited by many natural calamities and the need for adopting resilient construction options to take care of the same. Sustainability is the key considerations to ensure long term durability and strength and continuing performance. The new construction blocks and its applications will be tested for performance enhancement. The Infrastructure sector with many players in the Government and Private sector have done phenomenally well to deal with the challenges as could be seen in the completion of many prestigious infrastructure projects in time, cost, quality and performance . The next two decades will be India's years of phenomenal economic growth and infrastructure development and the country has to be fully geared up to deal with all challenges in harnessing all the resources just in time."

BRIEF BIO-DATA:

V Suresh is a Civil Engineer from Anna University (College of Engineering, Guindy, Chennai) with experience of over 58 years, in Housing, Urban and Rural Development, Infrastructure and Real Estate Sectors and Sustainable Development.

Was former CMD HUDCO, with all-round growth in housing, innovative infrastructure development, use of appropriate technology applications for the resilient and sustainable built environment.

He was member of Expert group for EIA-Large Infra projects of Ministry of Environment and Forests and Climate Change, Member of Advisory Council for Rebuild Kerala and Member of Tamil Nadu Govt. Committee on Housing and Township Policy.

He is Immediate Past Chairman of CII Indian Green Building Council [IGBC], Chairman, Policy Advocacy and Government Relations, IGBC, President of FOCUS, Chairman of BIS Housing and Planning Committee, Chairman of National Building Code of India and Member of BIS Smart Cities Committee.

He has received 18 awards and to cap it with the CIDC Industry Doyen Award 2011, IBC Life Time Achievement Award 2014, CIA-World Life Time Achievement Award 2017 and ACCE GAURAV Award 2020.

He is President, Good Governance India Foundation for good urban governance initiatives for meeting the challenges of urbanization and making smart, green, sustainable and vibrant cities through work on MUNICIPALIKA.

Keynote-2

Road Safety in India

Mr. K. K. Kapila

President (Emeritus)
International Road Federation Geneva &
Founder President, International Road
Federation's India Chapter

A-9A, Green Park Main, New Delhi
Email: kkapila@irfnet.ch

ABSTRACT:

A PRESCRIPTION TO ROAD SAFETY – 5E PROGRAMME

Road Safety has remained amongst top 10 health hazards and a poignant issue of concern globally. Road traffic accidents resulted in 1.3 million deaths and 50 million injuries in the world in the year 2019. India's contribution to global road traffic fatalities was at 11%. The world loses 3.5 Trillion Dollars on account of road accidents.

In a developing economy like India, the road traffic accidents cause untimely deaths in the productive age group causing immense financial and emotional trauma to the families of the victims who are the sole bread earners. On an average, year after year India records over 150,000 fatalities and 500,000 injuries which is responsible for permanent disability to many. This places undue monetary pressure and colossal loss to the economy, which is approximately 3.16% of the GDP.

The issue of Road Safety which became a concern for the global leaders from over 100 countries who under the auspices of the United Nations vide a resolution adopted the decade of 2010-2020 as the Decade of Action for Road Safety. The participating countries, of which India was one, resolved to reduce road traffic accidents and resulting fatalities by 50% by the end of the Decade. The UN also gave a 5Es framework to the world to plan, adopt and implement to achieve the road safety target. However, almost the entire group of developing countries, contributing majorly to the poor road safety scenario, did not achieve the target. The situation in India was no different.

Though the decadal goal was not achieved, the importance and need to enhance road safety scenario got an impetus, thanks to the decade long activities and awareness efforts. It became evident during 2018-19 that the chances of achieving the Decadal Goal was absolutely impossible and it was prudent to extend the timeline by 10 years, and accordingly, the new timelines to achieve the road safety targets is 2030.

One of the important reasons as to why the road accidents and fatalities could not be reduced is that the efforts were not undertaken in a structured manner. Rather than working together and simultaneously on the 5Es of Road Safety, namely Engineering of Roads (E1), Engineering of Vehicles and Policy Corrections (E2), Education and Mass Awareness (E3), Enforcement and Traffic Management (E4) and Emergency Care (E5), the efforts were standalone and inconsistent.

The International Road Federation (Geneva), a not-for-profit membership-based organization, pursuing the mission of ''Safe Roads and Safe Road Mobility'' since over 7 decades across 146 countries of the world is undertaking a cohesive Road Safety Programme through its India Chapter, based on 5Es of Safe System concept. The efficacy of the 5E programme is dependent upon a National Action Plan to be adopted and implemented uniformly across the country. The efforts taken up in India by the India Chapter of IRF based on the action plan is indicated in the table below.

IRF-IC's 5E Programme in a nutshell :

Engineering of Roads	Engineering of Vehicles & Policy Intervention	Education & Mass Awareness	Enforcement	Emergency Care
1.Road Safety Audit by IRF-IC team led by an expert 2.Design correction & BOQ 3.Submission to Authorities for inviting Bids 4.Follow up to get the correction done	1. Policy Interventions (FUPD, SUPD, RUPD, Retro-reflective tapes etc.) 2. Advocacy for Mandatory Safety features in 2 wheelers/4 wheelers 3.Provision of other safety features such as Alcolock to reduce drunken driving 4.Promotion of Good Samaritan provisions as mandated in the MV Act 2019 5. Campaign for No GST on helmets, etc.	1.Mapping of Educational Institutions falling within the 2Km buffer on either side of the road stretch. 2.Enumeration of the mapped data to prepare a list of schools. 3.Training on road safety education in schools/ education institutions 4.Mass awareness to road safety issues through road safety anthem and road safety films in all Indian languages to influence the communities adjoining the road	1.Mapping of Police Posts/ Stations falling within 2 Kms buffer on either side of the road stretch. 2.Enumeration of the mapped data. 3.A 3-day Training of Police Personnel on traffic management in association with IRTE at their Campus in Faridabad 4.The Training includes half day training on road Accident data collection using RADaR Software developed by IRF 3.Knowledge of Good Samaritan Law	1.Mapping of medical facilities falling within 5 Kms buffer on either side of the road stretch. 2.Enumeration of Medical Facilities on the road stretch to find gaps in existing capacities with the help of AIIMS Trauma Care Medical team. Objective is to develop 25-30 L1/L2 trauma care centres in due course. 3.Identify able bodied bystanders/commercial vehicle drivers and train them on first aid trauma care 4.Knowledge of Good Samaritan Law

BRIEF BIO-DATA:

Mr. Kiran K. Kapila, P.E., a Chartered Civil Engineer and a Fellow in the American Society of Civil Engineers is a well accomplished person. Apart from leading a renowned infrastructure Consultancy Organization in India, employing over 1,500 professionals. He was unanimously elected as first non-European Chairman of International Road Federation (IRF) Geneva in 2010. After completion of 3 terms of 3 years each as Chairman, IRF, the IRF Geneva had bestowed on him the title of President Emeritus in 2019. He is the Founder President of the IRF's India Chapter.

Mr. Kapila believes that safety in transport network is the hallmark of a sustainable and robust economy. His focus is to fulfill the UN Decade of Action envisaging 50% reduction in road fatalities through various activities on 5Es of safe system.

Mr. Kapila has authored a number of papers published in various journals and is recipient of a number of national and international awards for infrastructure development and road safety.

Keynote 3

Sustainable Technology & Innovation in Bridges

Prof. Mahesh Tandon

Chairman, Tandon Consultants Pvt Ltd
Guest Professor, IIT Gandhinagar,
International Professional Engineer (India)

Email: mahesh.tandon@tcpl.com

ABSTRACT:

SUSTAINABILE TECHNOLOGY AND INNOVATION IN BRIDGES

In the past building was the important thing- not its impact on the surroundings. Now we must think in a different fashion while constructing bridges. We have to build without slowing or shutting anything down. Structural conception as well as the selection of materials and technologies for bridge construction must essentially be driven from the point of view of sustainability. Such bridges would be environmentally sensitive, durable and of high aesthetic quality. They would be appropriate to local conditions from the point of view of constructability as well as cultural settings.

Retention of and least disturbance to the existing ecosystems is important. Landscaping to enhance the character of the environs should be part of the overall planning. The involvement of residents, ensuring safety and reducing inconvenience during construction are the other issues of importance.

The success of the new generation of bridges are evaluated based on life-cycle analysis where cost and carbon footprint, both need to be taken into consideration.

In the urban situation, mixed traffic is invariably encountered, there should be segregation of pedestrian and cyclists from motorized vehicles. Public transportation like buses should form part of the overall planning where required. Open spaces below the bridges and flyovers is another area which requires careful planning.

Foot overbridges properly integrated into traffic interchanges can enhance the safety of pedestrians without disturbing the structural concept of the bridge.

New structural forms and technologically advanced techniques of construction are being increasingly adopted. These require careful assessment of safety and meticulous planning. Method statements of all activities need to be made and understood by all the stakeholders involved. Design and construction are inextricably intertwined and must be regarded as two sides of the same coin.

The presentation will illustrate how these ideas were implemented in real life cases.

BRIEF BIO-DATA:

Prof Mahesh Tandon, Chairman, Tandon Consultants Pvt Ltd is an international expert in the field of Structural Engineering. Many of the structures designed by Prof Tandon and Tandon Consultants have been widely acclaimed and have received recognition in India as well as internationally.

He has spearheaded the development of new codes of practice and path-breaking bridge technologies suited to Indian conditions. These include pioneering work in the field of Segmental construction, Integral construction, Accelerated Bridge Construction, Long span bridges and Structures for Metro (both viaducts and underground). His structures have been described as highly creative, futuristic, aesthetic, environmentally sensitive and innovative.

He has accreditation of International P.E. (India) and is a Fellow of the Indian National Academy of Engineering (INAE). He has been appointed as Chairman of Research Council of Central Building Research Institute.

He has received (2022) the Lifetime Achievement Award of Indian Roads Congress in Recognition of his Outstanding Contribution to the Highway Profession.

He is the Recipient (2018) of the Distinguished Alumnus Award of IIT Roorkee.

TECHNICAL SESSION - 1

INNOVATIVE AND INTELLIGENT CONSTRUCTION EQUIPMENT

Chair
Prof (Dr.) Manoranjan Parida
Director, CSIR- CRRI

Co-Chair
Mr. B K R Prasad
General Manager - Marketing, TATA Hitachi

Innovative and intelligent construction equipment is revolutionizing the way construction projects are executed, enhancing efficiency, safety, and productivity on job sites. Advanced technologies such as telematics, GPS tracking, and IoT sensors are integrated into construction machinery, providing real-time data on performance, location, and usage. These technologies also enable predictive maintenance, reducing downtime and optimizing equipment lifespan. Furthermore, automation and robotics are transforming traditional construction processes, increasing precision and speed while minimizing labour requirements and safety risks. Drones equipped with cameras and sensors offer aerial monitoring capabilities, enabling project managers to oversee large-scale projects more effectively and identify potential issues early on. Additionally, machine learning and AI algorithms analyze data from sensors and equipment to optimize workflows, predict equipment failures, and improve decision-making. As the construction industry embraces these innovative technologies, the future promises even greater advancements in intelligent construction equipment, reshaping how infrastructure is built in a more sustainable, efficient, and intelligent manner.

Mr. Satin Sachdeva
CERA - Secretary
Email: Info@equipment-planet.com

BRIEF BIO-DATA:

As a man thinketh in his heart so is he. If you can think different, so will be you. That's what describes Satin Sachdeva in one line.

The founder of CERA (Construction Equipment Rental Association) and also its current Secretary General, India's largest equipment rental association and a dynamic entrepreneur, who has set the industry ablaze with his modern ideas, dynamism, keen foresight, impeccable leadership skills, intellect and futuristic outlook, is celebrating nearly three decades of successful journey in the industry, rendering excellent services to the nation in building infrastructure and generating employment. Satin Sachdeva leads by example and believes that the ability to learn and transform is very important in the fast -changing world.

He is the pioneer of seeding the thought of organizing the equipment rental industry and the one who has realized the contribution of construction equipment rental industry towards India's infrastructure progress. With a vision of creating and sustaining a conducive environment for the growth of the industry, he has mooted the strong relationship between the construction equipment rental industry, manufacturers, financers and construction companies not within India but globally.

For an automobile engineer, it was natural to fall in love with machines that move and work. With his zeal to contribute to the nation, he chose the industry of construction equipment and earthmoving machines and worked his way up.

He is also the Managing Director & CEO of the company he founded – Equipment Planet, a premier construction equipment rental company which also buys and sells construction equipment. His group's other company E-value is a valuation & inspection, surveyor & loss assessor organization.

A fitness enthusiast, he starts his day early with a morning walk in the lap of nature and lives a mix of simple, healthy and trendy life. A perfect family person, a responsible son, a caring husband and loving father who loves spending time with his family.

- Winner of Indian Achiever's Award 2021-22 for outstanding professional achievement & contribution to nation-building through his notable work done for India's equipment rental industry and founding Construction Equipment Rental Association (CERA).
- MD & CEO, Equipment Planet Group (India's fast growing rental company & trading in used equipment)
- MD & CEO, E-value, a trusted, reputed and old valuation & Inspection Company & also surveyors and loss assessors.
- Consultant – Indian market entry, Rental business set up, Equipment buying.

➢ Founder & Secretary General, Construction Equipment Rental Association (CERA)
CERA represents India's equipment rental industry.

➢ Member & Represents Indian Rental Industry in Global Rental Alliance (GRA)

➢ Member – Infrastructure Development; Skill and Entrepreneurship Development, MSMEs, Asean South East & Oceania, Expert Committees of PHDCCI (PHD Chambers of Commerce & Industry)

➢ Member – National Executive Committee of Chamber of Startups, Industries and Entrepreneurs (India) Council [CSEC]

➢ Member – Advisory Board, INTERMAT India & Member – Advisory Board, Equipment India magazine, a leading infra sector equipment magazine

Mr. MEGHDUT GUHA

Managing Director,
Trans Asian Techno Pvt. Ltd.

Email: ttplindtechno2017@gmail.com

ABSTRACT:

INTRODUCTION OF THE INNOVATIVE PRODUCT/TECHNOLOGY

Sakai Heavy Industries Ltd, Japan had introduced Vibratory Pneumatic Tire rollers in 2004 and have a patent for the unique design of this product. Until now that is the one and only Vibratory Pneumatic Roller in the world with unmatched performance and no competition.

It is a pavement researcher's distress that good designed pavement does not always show good pavement performance. There is the construction stage between design and performance. In another words, pavement does not show good performance without good construction. Most important factor of good construction will be good compaction of asphalt mixture. By decreasing 1% air void, the performance of pavement is improved 10%.

THE NEED:

HMA (Hot Asphalt Mix), by default has got some inherent issues and often contractors do struggle to manage the HMA paving and the rolling.

The issues are mainly:

1. Thermal segregation
2. Particulate segregation
3. Shorter window for paving and rolling
4. Uniform density in all the layers
5. Number of rollers to be engaged
6. Surface finish
7. Avoiding crack formation in base layer
8. Managing tight longitudinal joints

As it is said that the need is the mother of all innovations, Sakai took up this challenge and developed a unique product, Vibratory Pneumatic Tire Roller (VPT) in the year 2004 and further kept on improving with model names: GW750- GW751-GW752-GW753 and GW754.

This compaction mode is very effective not only in compacting asphalt mixtures, but also in achieving a smooth surface on those materials. The development of the VPT roller began in the mid - 1990's at Sakai Heavy Industries, Ltd., that would successfully compact a newly designed asphalt emulsion cold mix containing Portland cement as an additive to provide a stiffer mix. Many trials were conducted to find the best way to compact the new emulsified cold mix.

Furthermore, reducing the number of rollers needed in the roller "train" behind the paver, reducing the number of rollers passes of each roller, as well as achieving the desired degree of density immediately behind the asphalt paver while the mix temperature is high is the desire of an efficient asphalt paving contractor.

In this article the outline of new developed VPT roller and the effectiveness of VPT roller for

various type of asphalt mixture or various thickness of pavement lift are described.

OUTLINE OF VPT ROLLER:

Most of the SPT rollers currently in use are in the weight range of 8,000 - 15,000 kg in an un-ballasted and ballasted condition, respectively. There are some larger SPT rollers in the weight range of 12,000 - 25,000 kg in an un-ballasted and ballasted condition, respectively.

There is an interaction that takes place between pneumatic tires and compacted materials called the “kneading effect”, which is generated by the deformation and compression of the pneumatic tires. This kneading action can be simulated in a testing laboratory by a gyratory compactor compressing a cylindrical specimen while applying both shear and vertical compression force simultaneously.

In 1995, Sakai developed the first VPT roller and then improvement of the VPT roller was continued. Finally, the fourth VPT roller called the Model GW750 was developed in 2003. This VPT roller equipped sufficient engine power to drive and vibrate both axles. It was equipped with seven tires: three tires on the front axle and four tires on the rear axle. The latest model’s name are now GW753 & GW754.

Such innovative rollers are widely used worldwide for Highways, Airport runways and specially Pavements where Superpave technology is in use.

Detail of VPT Roller:

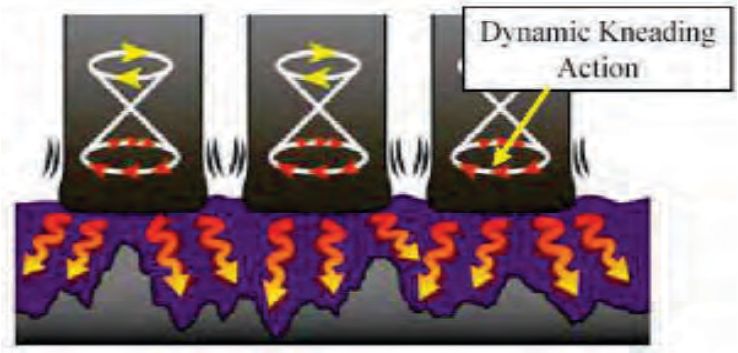
The VPT, named as GW750 is illustrated in FIGURE. The maximum mass with water capacity of 600 litters is 9,100 kg, and a wheel load per tires is 12.7 kN. Four different kinds of centrifugal forces of 10 kN, 29 kN, 44 kN, and 78 kN are available, thus the dynamic load (The sum of static and dynamic load) per wheel are 14.1 kN, 16.8 kN, 19.0 kN, and 23.8 kN. Tires with rolling width of 1950 mm in the other axle cover the gaps between adjacent tires in one axle.

The articulated frame in the front and rear support three and four tires, respectively. Both of the tires on each axle is driven and vibrated by hydraulic motors. Variable vibration system is employed in an internal cylinder fixing the tires, and four different kinds of amplitude are available such as 0.2 mm, 0.5mm, 0.7mm, and 1.3mm.

Mechanical Feature of VPT Roller:

Among the benefits derived from the use of a Vibratory Pneumatic tire roller are the dynamic, instead of static, kneading effect. Conventional rubber tire rollers achieve compaction through a combination of wheel load and inflation pressure. As the inflation pressure increases with the same wheel load, the compaction effort is also extended deeper into the pavement layer.

At the contact points between the rubber tires and the surface of an asphalt concrete mixture, a so-called kneading effect is generated due to the deformation of the rubber tires under load. This kneading action is effective in improving the density of the mix as well as increasing the tightness of the pavement surface.

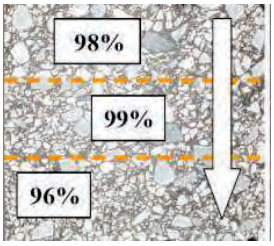


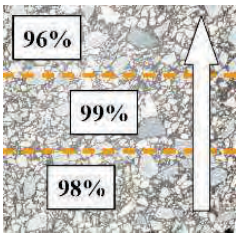
The use of a vibratory rubber tire roller appears to be the “best of both worlds”. The roller allows for the compaction of a tender asphalt concrete mix within the middle temperature zone without shoving or movement of the mix as under a vibratory roller. In addition, the use of the rubber tires decreases the permeability of the pavement surface compared to use of a vibratory roller.

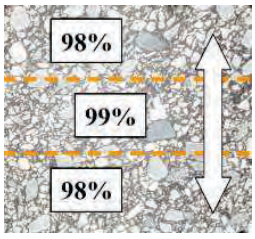
Further, the combination of the kneading action of the rubber tires and the vibratory compaction effort permits the reduction in the size of the rubber tire roller for the same relative compaction effort.

Pavement construction is becoming more difficult and complex for highway contractors. For instance, paving contractors are now required to achieve uniform density throughout the entire mat, because it increases the life cycle of pavement systems. Also, the performance bonuses and penalties are often linked to test reports from the jobsite. The vibratory pneumatic tire roller is best suited to satisfy today’s toughest requirements than any other compaction machine on the market today.

Uniform density:







1) Conventional steel drum rollers typically compact the pavement layer from the top down. The density of the top 1/3rd is higher than the bottom 1/3rd.

2) Conventional pneumatic tire rollers typically compact the pavement layer from the bottom up. The density of the bottom 1/3rd is higher than the top 1/3rd.

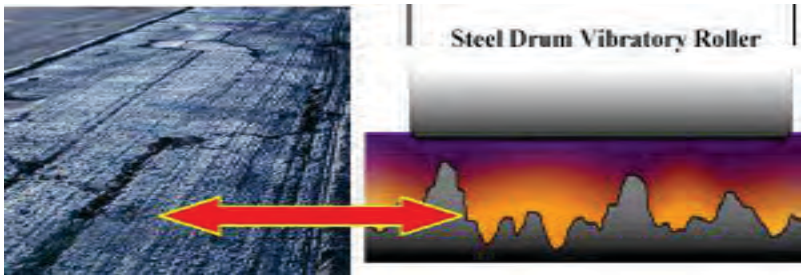
3) The VPT roller compacts the pavement layer uniformly from top to bottom.

Good bonding:

Over the last 10 years, more and more pavement surfaces have been prepared with cold milling machines that produce a very rough surface. In order to meet today’s specifications, paving contractors must ensure that the bond between old milled pavements and new HMA overlays is complete.

The “Dynamic Kneading Action” of the VPT roller eliminates the “bridging effect” that

normally occurs with steel drum rollers as they pass over the high and low spots on a rough milled subbase (FIGURE 7).



Tight longitudinal Joint:

"Dynamic Kneading Action" of the VPT roller also achieves tight longitudinal joints without crushing the aggregate, which makes unwanted changes to the gradation of the mix. This is a big plus for contractors who must meet joint density requirements.

Smoothness of finished surface:

The developed super-flat tires of the VPT roller provide uniform contact pressure. They achieve smoother finished pavement surfaces compared to conventional rounded pneumatic tires. The comparison of finished surface of the VPT roller and the conventional double drum roller is shown in FIGURE below.

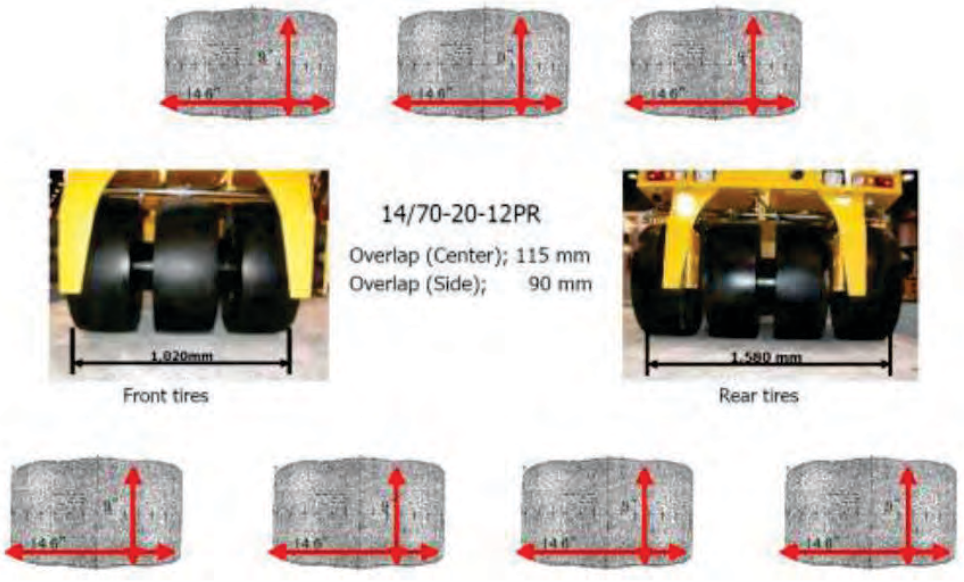


FIGURE14 Comparison of cutting core

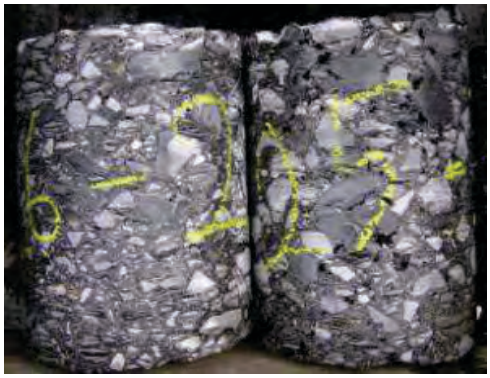
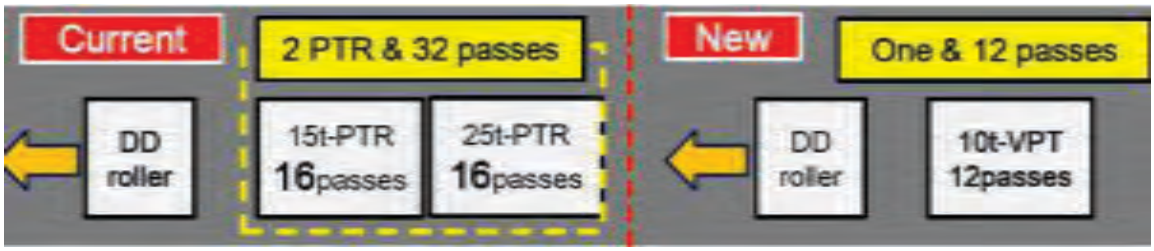


FIGURE above shows the cutting core of 2 sections. The left core was cut from the section where the VPT roller was used in the breakdown rolling. The right core was cut from the section where only the DDV roller was used. The right core seemed have more air voids and the left core was compacted uniformly in depth. From the result of density test, around 1% bigger density was obtained in the case of using the VPT roller.

Reducing the number of rollers:



The VPT roller increased the total working efficiency by reducing a number of rollers and its passes. In this case density of 96~97% achieved by the VPT roller is greater than that of 95% by two static PTRs.

Distribution of density

As mentioned above, the pavement requires high density and Section resulted in the highest density results and the most favourable visual inspection of the pavement surface. The vertical line indicated by the pen in is aligned with the longitudinal joint. The cold side is on the left, and the hot side is on the right. The longitudinal joint is seamless. The photo of the same longitudinal joint taken in the horizontal direction is shown in.

FIGURE 9. “Super-Flat” pneumatic tires for smooth finished surface

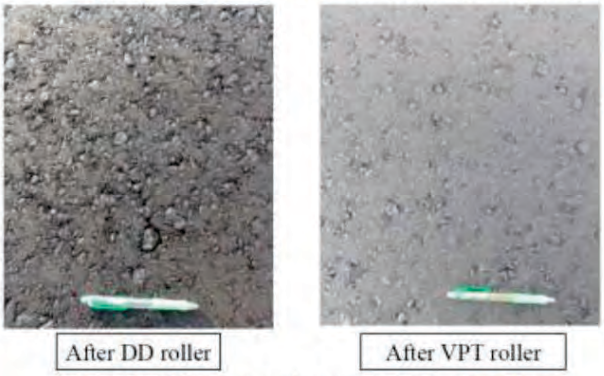


FIGURE 10 Comparison of finished surface

The mechanical features of the VPT roller is described in this paper, and based on the worldwide construction examples using the VPT roller, following conclusions can be made.

1) The VPT roller is used for not only thick lift, but also thin lift successfully. Furthermore, it is effective to compact various types of asphalt mixture like stone mastic or so.

2) The combination of vibratory roller in oscillatory mode in the breakdown and the VPT roller in the finish is the best option to achieve the required density and tighter surface. It will assure durable and long-lasting asphalt pavements.

3) A new roller train using only two rollers, a DDV roller and a VPT roller, easily achieved the required level of density of the asphalt mixture. This result means that the contractor can construct in lower operating costs using two rollers instead of three.

4) The strong point using the VPT roller is the possibility of covering various applications from middle size to large size Pneumatic Tire Roller. The VPT roller is equivalent to 10t, 14t, 18t, 23t, and 28t not using or using vibration. Another strong point is making smoother surface because of the wide-flat tires and avoiding the cracking of the aggregates.

At this moment the VPT roller (GW750) was improved to satisfy EPA Tier 4 Interim (iT4) as the new models GW751/752/753/754 with some mechanical improvement.

BRIEF BIO-DATA:

Mr. Meghdut Guha, the Founder-Director of the organisation is a Mechanical engineer, with over 34 years of experience in the field of Construction equipment in India and had served many Globally reputed organisations like Atlas Copco, Ingersoll Rand, JCB, Caterpillar and Ammann in the senior most portfolio of Aftermarket and product support departments, before introducing the organisation, Trans Asian Techno Pvt. Ltd in the year 2018.

Mr. Amol Sinha Director, Product & Training Terex India Private Limited. Email: amol.sinha@terex.com	

BRIEF BIO-DATA:

Amol Sinha is Director, Product & Training, Terex India Private Limited. In his 24+ years of experience, he has been very actively involved in application, product development and training of customers for proper operation of Crushing, Screening, Washing & Recycling which form the core of the equipment required for producing raw material for Road Infra.

He started his career with Terex in 2013 as Sales Manager for Terex Washing Systems business. In 2022, he assumed the role of Director of Product & Training for Terex offerings in India. He is also in charge of New Product Development and Marketing.

Amol graduated with a Bachelor of Technology in Mining Machinery from the IIT(ISM) Dhanbad. Before joining Terex, Amol worked in various companies such as Ambuja Cement, GMMCO – Caterpillar and Metso.

Mr. Rachit Kaushal

Key Account Manager - Sales & Marketing
Ammann India Private Limited.,
Email: rachit.kaushal@ammann.com

BRIEF BIO-DATA:

Rachit Kaushal is a seasoned sales and marketing professional with over 13 years of experience in the industry. Currently serving as the Key Accounts Manager at Ammann India Pvt Ltd, Rachit is responsible for overseeing and managing the company's major accounts in the North India region. Throughout his career, Rachit has displayed a strong aptitude for developing and implementing innovative sales strategies tailored to meet the unique needs of his clients. His keen understanding of market dynamics, coupled with his exceptional communication and negotiation skills, has enabled him to forge lasting partnerships and drive revenue growth for his organization.

TECHNICAL SESSION - 2

INNOVATIVE, SUSTAINABLE, AND COST-EFFECTIVE CONSTRUCTION MATERIALS & TECHNOLOGIES-I

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Mr. S K Nirmal
Secretary General, IRC

Co-Chair

Dr. Hari Kishan Reddy
Chairman, CUBE Highways

Innovative, sustainable and cost-effective construction materials and technologies are revolutionizing the way infrastructure is built and maintained. These advancements address the dual challenge of meeting the growing demand for construction while minimizing environmental impact and reducing costs. Materials such as recycled aggregates, engineered wood products, and bio-based composites offer sustainable alternatives to traditional construction materials, reducing resource consumption and waste generation. Additionally, advancements in prefabrication and modular construction techniques streamline the construction process, improving efficiency and reducing construction time and costs. Incorporating these innovative materials and technologies not only enhances sustainability but also ensures long-term economic viability for construction projects, making them key drivers of progress in the construction industry.

Mr. Satish Pandey
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New-Delhi, India
Associate Professor, Academy of Scientific and Industrial Research (AcSIR)
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ABSTRACT:

STEEL SLAG ROAD: A PERPETUAL PAVEMENT USING PROCESSED STEEL SLAG AGGREGATES

Steel Slag is a major solid wastes generated in steel industries. Around 150 to 200 kg. steel slag is generated as solid waste during production of 1 ton carbon steel in an integrated steel plant. Around 19 million ton of steel slag is generated every year in India from various steel plants which is slated to reach to 60 million tons by the end of 2030 with the expected increase in steel production in the country from present level of 150 million tons to 300 million tons per annum. Disposal of steel slag in safe, environment friendly manner is a challenging task to steel industries as its not only occupy large tract of land but also causes land, water and air pollution. CSIR-Central Road Research Institute to facilitate large scale steel slag utilization in road construction , has developed steel slag valorisation technology to convert different types of waste steel slag i.e BOF/LD slag, EAF Slag, and CONARC slag as good quality processed steel slag aggregates for road construction. Processed steel slag aggregates developed through different types of steel slag in India's leading steel plants comprising Arcelor Mittal Nippon Steel India (AMNS India), TATA Steel, and JSW Steel has been successfully utilized as 100 % substitute of natural aggregates in the construction of bituminous and concrete steel slag roads in different parts of the country. India's First Six lane Bituminous Steel Slag Road is built at Hazira Surat using around 1 lakh tons processed EAF steel slag aggregates in all layers of bituminous pavement along with road median and shoulders. This road is designed for 100 MSA design traffic and built with 32% reduced thickness in comparison to conventional bituminous road crust composition recommended in IRC:37 for 8 % CBR and 100 MSA design traffic. Processed BOF steel slag aggregates developed at TATA Steel, Jamshedpur plant is utilized as substitute of natural aggregates in the construction of 40 km. long six lane section of NH-33 in granular layers i.e WMM and GSB layers. Border Road organization has also utilized processed LD/BOF steel slag aggregates in the construction 1.2 km long bituminous wearing course of Bituminous concrete at Zero, Arunachal Pradesh under the technological guidance of CSIR-CRRI. Steel slag road section on NH-66 Mumbai-Goa is constructed using processed CONARC steel slag aggregates where around 0.60 lakh tons slag aggregates are utilized in all layers of bituminous and cement concrete road.

Steel slag road built using processed steel slag aggregates were evaluated for structural performance using repeated plate load test and heavy weight deflectometer along with the serviceability evaluation for surface roughness and skid resistance testing using dipstick and British Pendulum Tester. Non destruction structural evaluation of the steel slag roads shows that the steel slag road is around 3 times stronger than the conventional road built using natural aggregate with good riding quality and excellent skid resistance. High structural stiffness of bituminous steel slag road shows that it will have very high rut and fatigue resistance under vehicular traffic thus will offer significantly high durability in place of

conventional roads.

Key Words: Steel Slag Road, Steel Slag Aggregates, Steel Slag Valorisation, CSIR-CRRI, EAF, CONARC, BOF.

BRIEF BIO-DATA:

Mr. Satish Pandey is working as a Principal Scientist in Flexible Pavement Division of CSIR-Central Road Research Institute, New-Delhi India. He is also associated as an Associate Professor in Academy of Scientific and Industrial Research (An Institute of National Importance) and Border Road Organization, Govt. of India as an Officer on Board. He has 18 years long research experience in the field of Transportation and Highway engineering as a scientist in CRRI. Mr. Pandey is credited to published around 28 research Papers in National and International journals, contributed in development of four IRC specifications and.

He is the inventor of couple of cost effective road construction, recycling, and maintenance technologies such as REJUPAVE, TERASURFCING, Modified Mix Seal Surfacing, Cold Mix Technology, Macrosurfacing and Steel Slag Road Technology. Mr. Pandey is credited to develop INDIA'S First Steel Slag Road at Surat, Gujarat which is for its technological prowess inducted in INDIA's BOOK OF RECORDS and ASIA BOOK OF RECORDS. For his distinguished contribution in the Field of Steel Slag Road Technology Mr. Pandey is bestowed with coveted Global Slag Personality of the Year Award 2023, at Dusseldorf Germany. He is the first Indian Scientist who received this International award since its inception in 2007.

Mr. Pandey is also the recipient of CSIR-Technology Award 2017, from the then Hon. President of India Shri RAMNATH Kovind in Vigyaan Bhawan, SKOCTH GOLD AWARD for Environment and Sustainability 2023, Best Guide Award from Indian Concrete Institute and ACC Cement and so on.

Mr. Pandey did several R&D projects for leading steel industries in India such as TATA Steel, JSW Steel, Arcelor Mittal Nippon Steel INDIA, HARSCO, SAIL and Rastriya Ispat Nigam Limited to facilitate utilization of iron and steel Slag as road construction aggregates. He is also credited to establish state of art Center for Research on Steel Slag, first of its kind in India to facilitate research on steel slag and allied products for possible utilization in infrastructure projects.

Dr. L R Manjunatha,
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ABSTRACT:

NEED FOR DEVERLOPMENT OF LOW CARBON CEMENT MANUFACTURING IN INDIA

Concrete is the most widely used material used by mankind after water. Average consumption of 14 billion Cu.M of Concrete happens worldwide. India is the second largest cement producer in the world and by 2030, Indian cement industry is expected to reach 700 MT due to rapid of development of infrastructure. With a CAGR of 8.2% globally, China tops the cement production followed by India. Cement production contributes to 6- 7% of global CO_2 emissions. It won't be a fair choice to just focus on development by compromising the resources and needs of future generations. It is important to focus on the long term goal and expansion without causing disturbance to the environment and utilizing the finite resources conservatively. Thus, Sustainable development is a need of the hour which focusses on creating a place where people and planet both thrive and grow together harmoniously. It is pressing priority to adopt Sustainable approaches in manufacturing processes of Cement by cutting down the carbon emissions. This article is focused on various sustainability approaches and resources that can be incorporated for manufacturing of cement to achieve net zero emissions.

Keywords: Blended Cement, OPC, GGBS, Fly ash, PSC, PPC, SCM, GHG, WHRS, CCUS

BRIEF BIO-DATA:

Dr.L.R. Manjunatha is a Professional Civil Engineer and an accomplished techno-marketing, branding ,sustainability and ESG Expert with total industry experience of 30 years having worked in the Construction ,manufacturing, green building materials industry in India and has decades of experiences working in the management committees of various reputed professional bodies like Indian Concrete Institute, INSTRUCT, ISTD, ACCE(I), BMTPC, RMCMA, GCCA and Bureau of India Standards in various committees.

His core Interests are climate action, Sustainability, ESG, Climate change Actions, green building materials, RMC, Sustainable constructions ,3D Printing , Blended cements ,Special concretes ,Durability in constructions

With PhD in Management on Sustainability of Green building materials in Constructions from Bharatiyar University, Coimbatore ,MBA from Alliance University (Bangalore) BE Civil from UVCE (Bangalore), Master class training on building sustainable business Strategy by MIT Sloan School of Management, USA , Post graduate program in concrete technology from the prestigious CITY & GUILDS Landon Institute ,(UK).He has also attained the following certifications as certified management trainer from All India Management Association ,New Delhi .Certified Concrete Technologist from RMCMA and Future fit Leadership program from the prestigious Indian School of Business ,Hyderabad during the course of his professional career.

He has published 68 research papers and articles in various National and International journals and magazines and has a readership of 83000 readers on Research gate,3000 readership on Academia portals from top universities and research institutes from more than 100 countries and 81 citations for his research work with research score of 460 .

He has actively participated as Expert speaker at many national and international conferences and delivered more than 100 paper presentations and expert lectures on sustainability and construction technologies.

Currently he is part of the following national and International committees:

Member: Working Group: Bureau of Indian Standard: IS 4926, RMC and IS 383

Member: Working Group, Global Cement and Concrete Association(GCCA), UK on Green Procurements.

Awards : With his continuous decades of contributions for the Industry ,he has received the following awards,

1.Receipent of the Construction Industry development Council (CIDC)-Vishwakarma Award as the Technologist of the year 2022,Govt of India

2.Eminent Civil Engineer of the Year 2022-Bangalore, by Association of Consulting Civil Engineers (India), ACCE(I)

3.Outstanding Concrete Technologist of the year 2023 by Concrete Engineers Association, New Delhi.

4.Sustainability Leader of the year 2023 by UBS Forums during 2 nd Sustainability Summit and Awards 2023 , Bangalore.

International Speaker :

1.Panelist and Speaker at World Cement Association Annual International conference, 24-25 th Oct 2023 , Dubai, UAE.

2.He has travelled to Singapore to present his research paper at Structural Engineers World Congress-SEWC- 2015 on Invitation by ACCE(I) representing JSW Cement Limited and ACCE(I) Committee.

3.He has attended the SEWC 2019 WORLD Conference as the chairman of the Indian Delegation representing Association of Consulting Engineers (India)-ACCE(I) and JSW Cement Limited for the Structural Engineers World Congress-SEWC 2019 held at Istanbul, Turkey from 24 -26th April 2019 Chairing the Session on –Architectural and Environmental Engineering at the conference.

Mr. Vikas Thakar

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ABSTRACT:

WHITE TOPPING AS A COST EFFECTIVE AND SUSTAINABLE TECHNOLOGY FOR REHABILITATION OF HIGH-VOLUME TRAFFIC HIGHWAYS.

Thin White Topping (TWT) overlay is Cement Concrete layer laid on top of existing bituminous pavement surface which is in structurally sound condition. It is a composite pavement which takes advantage of existing flexible pavement crust as base for providing a maintenance free and durable concrete overlay. TWT is used to strengthen the existing bituminous pavement to increase the life, durability and reduce maintenance. The existing bituminous surface acts as a base layer over which the thin concrete layer is laid by seeking proper bond between bituminous surface and overlay slab. Whitetopping has been used in the United States, European countries and australis since 1970's with fair success. In India, TWT overlays have also been constructed in numerous urban road sites having low traffic volume in cities like Thane, Pune, Aurangabad, Mumbai, Nagpur, Jaipur and Bangalore in the last few years. TWT overlay technique for high volume road traffic highway with above 4000 commercial vehicles per day, was used for the first time by Public (National Highway) Maharashtra for the project of rehabilitation of two lane with paved shoulders for National Highway No 848 stretches between Nashik and Peth (Gujarat Border) in Maharashtra state. The project was funded by the Ministry of Road Transport and highways (MoRTH). Total 15 km length of TWT overlay was completed in March 2021 for the project highway between the sections in km 16/000 to km 34/000, km 39/000 to 57/000 & km 62/000 to 65/600. Additionally, some MDR category roads are constructed in the state of Maharashtra new Islampur town in 2022. The performance of these white topping projects is found to be satisfactory and encouraging even though there is lot of scope for improvement in the overall execution part. With the experience gained in the construction and also observing the performance of the white topping works, NHAI has taken up the projects of white topping for sections on the Mumbai Goa Highway (between Panvel to Indapur) has been taken up for white topping of the four-lane carriageway. The Dahisar Surat six lane highway is also underway with white topping of the main carriageway and service roads. With the experience gained in the construction of the TWT overlay for high volume traffic and the encouraging performance white topping offers a cost-effective maintenance and rehabilitation alternative for bituminous pavements even under high traffic volume such as NH/ SH. With the amount of highway infrastructure works ongoing in the country it is essential to consider and further improvise the technologies like white topping as a long-term maintenance and rehabilitation solution for Indian highways.

BRIEF BIO-DATA:

Mr. Vikas Thakar, MS is Civil Engineering from USA is currently working as a Consultant for MoRTH, NHAI, PWD, MSRDC, Smart Cities (Pune, PCMC, Nashik etc) and number of Municipal Corporations for projects of Highways and Urban Roads/ Streets. He has been active in the Highway consultancy filed for the past 18 years. He has successfully completed urban road projects of cost above Rs. 2000 Crore and Highway design projects of cost above Rs. 2500 Cr as Principal Consultant. Mr Thakar is a recipient of the Pt Jawaharlal Nehru Award from IRC for year 2015 for outstanding contributions to road and Highway Sector in India. He is currently serving on the number of IRC Codal committees for preparation of IRC Codes (H8 Urban roads committee, G6 Multimodal transport). He has been working as Expert Advisor to Chief Engineer National Highway, Maharashtra for technical audit of all MoRTH funded NH works in Nagpur and Aurangabad Region of total length 3800 Km and cost Rs. 14000 Cr. He is a leading expert in the country on concrete White topping works and has completed designs for above 400 Km white topping works in India.

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ABSTRACT:

CONCRETE 3D PRINTING FOR FAST AND SUSTAINABLE CONSTRUCTION

Concrete 3D printing is a new construction technique that has recently gained wide interest in the construction industry. In concrete 3D printing, an element or an entire civil engineering structure is fabricated from a virtual model by extruding a special concrete through the nozzle of a concrete 3D printer. Compared to traditional construction, it offers significant advantages such as reduced labour, high construction speed, and the elimination of formwork which allows the creation of complex geometries and architecturally appealing shapes. This talk will cover the basics of concrete 3D printing technology and how this technology can be used for fast and sustainable infrastructure construction. The potential application of this technology in road-related infrastructure, such as the fast construction of culverts with customized geometries and the construction of bus stops, roadside shelters, pedestrian crossings, and bridges, will be discussed.

The talk will also discuss the ongoing research at IIT Tirupati on new advancements in concrete 3D printing. One of our main research areas is developing concrete 3D printing systems with a “set-on-demand” feature. Set-on-demand involves injecting an accelerator at the printhead or nozzle of the 3D printer. The accelerator mixes with the concrete and causes a rapid setting just after the deposition of the concrete through the nozzle. Set-on-demand can be helpful for applications requiring extremely fast construction and high buildability while 3D printing. The design of the printhead for enabling the accelerator injection and how to have a uniform mixing with the concrete without causing blockages will be discussed in this talk. Another ongoing research at IIT Tirupati concerns durability issues in 3D printed elements. This talk will cover issues such as high plastic shrinkage cracking tendency in 3D printed elements due to lack of formwork protection. The precautions and mitigation strategies to prevent such issues will be discussed. Finally, this talk will also briefly mention other products developed by our research team with potential applications in infrastructure construction, such as glycerine pitch-derived low-cost brick, nano-graphene-modified concrete, and ultra-high-performance concrete for highway overlay and bridge repairs.

BRIEF BIO-DATA:

Dr. A. V. Rahul is an Assistant Professor in the Department of Civil and Environmental Engineering at IIT Tirupati. He did his PhD from IIT Madras on the mixture development of concrete mixtures for extrusion-based 3D printing. Before joining IIT Tirupati, he was a postdoctoral researcher at Magnel-Vandepitte Laboratory for Concrete Research, Gent University, Belgium. At Ghent University, he was involved in the 3D2BGreen project, which focused on the construction of breakwater units in Dubai and Belgium ports using concrete 3D printing technology. His primary research areas include concrete 3D printing, rheology of cement-based materials, cement hydration, and thermodynamics-based constitutive modelling. He has over 25 publications in reputed international journals. Dr. A. V. Rahul is also a member of the newly formed BIS committee, CED 32, which is working on formulating recommendations for construction by concrete 3D printing.

Dr. Dharamveer Singh
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Indian Institute of Technology (Bombay)
Mumbai

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ABSTRACT:

TOOLS AND TECHNIQUES FOR UNDERSTANDING BITUMINOUS MIXES AND PAVEMENT PERFORMANCE

Flexible pavement can show numerous distresses such as rutting, cracking, moisture damage, ravelling, stripping. The bituminous mix composed of aggregates and bitumen; in such a s way it results in the desirable performance in the field. Therefore, major emphasis is given on selection of good quality of aggregates and bitumen. There are multiple factors based on which a pavement is designed, such as traffic volume, loading, temperature, climate and local conditions. For example, many new additives have arrived in the market those can help to enhance performance of bitumen, such as graphene oxide, carbon nano-tube, innovative polymer. Therefore, highway agencies should be equipped enough to understand the best way to capture performance of such binders. The presentation will highlight few tools on understanding characterization of such materials using dynamic shear rheometer, double edge notch tension test (DENT). Similarly, aggregate shapes (angularity, sphericity, texture) are critical to ascertain good performance of asphalt mixes. The recently method to characterize aggregates shape in India is not adequate to differentiate between crushing techniques and processing methods. Therefore, this talk will highlight use of digital techniques-based tool, such as aggregate image measurement system (AIMS) to measure different aggregate morphology and understanding health of crushers. Though different bituminous mixes are used in India, however, considering traffic loading and temperature, they are not showing expected performance. Therefore, innovative or superior mixes are required for Indian conditions. Few mixes such as stone matrix asphalt (SMA) and open graded friction course (OGFC) have recently motivated highway engineers, however, these mixes have also shown poor performance due to many obvious reasons. Therefore, industry should understand fundamentals on these mixes, and what tools and techniques to be used to screen good versus bas mixes during mix design and production process. A mix should show a balance performance between rutting, cracking, and moisture damage; therefore, it is mandatory to make performance tests essential during mix design phase. The accelerated rutting test, fracture/fatigue test, and dynamic simulation of moisture damage are important to be absorbed by industry to have confidence on the selection of mixes and their combinations.

BRIEF BIO-DATA:

Dr. Dharamveer Singh is an Professor at Department of Civil Engineering at Indian Institute of Technology (IIT) Bombay in India. Prof. Singh has been a faculty member at IIT Bombay since 2012. He received BE from MBM Engg. College Jodhpur, M.Tech. from IIT Kharagpur, and Ph.D. from University of Oklahoma USA.

Prof. Singh's field of specialization is in Pavement Engineering, focusing on recycling, stabilization, new and innovative technology for road construction, pavement design, and maintenance and preservation of pavements, forensic investigation.

Prof. Singh is closely associated with industry and highway fraternity on various fronts including pavement design, construction, training, and implementation of new technologies.

Prof. Singh is member of various IRC committees on pavement design, low volume roads, asset management, and composite pavements. Also, Prof. Singh is associated with Bureau of Indian Standards (BIS), technical committee on Bitumen, Tar and Related Products, PCD 06.

Prof. Singh has been conferred with Pt. Jawaharlal Nehru Birth Centenary Award- 2018 by Indian Roads Congress. Prof. Singh has published over 100 papers in international journal and conferences. Prof. Singh is an Associate Editor for International Journal, Innovative Infrastructure solutions, Springer Publisher, and Editorial Board Member of International Journal of Pavement Research and Technology, and International Journal of Road Materials and Pavement Design.

TECHNICAL SESSION - 3

INNOVATIVE, SUSTAINABLE, AND COST-EFFECTIVE CONSTRUCTION MATERIALS & TECHNOLOGIES-II

Chair

Mr. D. Sarangi
DG (RD) & SS, MoRTH

Co-Chair

Mr. Sudhir Hoshing
CEO, IRB

In the realm of construction, the pursuit of innovative, sustainable, and cost-effective materials and technologies continues to drive transformative changes. From cutting-edge eco-friendly concrete formulations to innovative insulation materials derived from recycled sources, the construction industry is witnessing a shift towards greener and more efficient solutions. Advancements in 3D printing technology enable the fabrication of complex structural components with reduced material wastage and construction time. Moreover, the integration of digital tools such as Building Information Modeling (BIM) facilitates better project management and optimization throughout the construction lifecycle. By embracing these innovative approaches, construction projects can achieve the dual objectives of environmental sustainability and cost-effectiveness, paving the way for a more resilient and prosperous built environment.

Dr. Ambika Behl

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ABSTRACT:

SUSTAINABLE PAVEMENTS

Transport and communications are the two most important and essential for the development of any country. It helps in the economic growth of a country. Pavements/Roads are critical assets of transportation infrastructure of a country. In road infrastructure most of the investments are related to pavement materials. Considerable investment is also required for maintenance and rehabilitation of rods. These huge investments represent an opportunity for decision makers to identify cost-effective pavement designs, materials and construction practices. To keep the planet from warming more than 1.5°C above pre-industrial levels, most countries have goals set to reach net zero by 2050. *India* aims to reach *net zero* by 2070. Net zero, or becoming carbon neutral, implies not adding greenhouse gases to the atmosphere which is very difficult for India to achieve looking at the scale of growth & development taking place in the country specially in infrastructure sector. Can there be new methods to construct roads to be green and sustainable without hindering the graph of growth?

Road Construction is an energy-intensive processes and also is the biggest polluter in terms of carbon emissions which leads to adverse impacts on the environment. One of the key aspects of decarbonizing road construction lies in selecting sustainable materials. Traditional road construction relies heavily on energy-intensive and carbon-intensive materials, such as asphalt and concrete. However, alternatives like recycled asphalt, reclaimed concrete, waste and alternate materials and warm-mix asphalt can significantly reduce carbon emissions. These materials not only lower energy requirements during production but also decrease the need for virgin materials, thus minimizing environmental impact.

Road authorities must encourage sustainable practices to alleviate the negative environmental impacts of roads and make more economical investment decisions. Sustainable pavements are highly dependent on the selection of appropriate materials. Pavement recycling, stabilization and Utilization of waste materials are one of the sustainable strategies with regard to pavement materials. But more than the materials, we must also think about the plant and machinery used for road construction. Road construction agencies can have a huge impact on lowering emissions, particularly from energy used on road networks, building materials and fleet operations.

The sustainability of pavements can be measured in various ways by relevant methods or tools, including pavement performance assessment, life cycle cost analysis (LCCA), life cycle assessment (LCA) and sustainability rating systems.

BRIEF BIO-DATA:

Dr. Behl has done her PhD from IIT Roorkee and has work experience of more than 18 years.

Dr. Behl is a member BIS-PCD6 committee and Indian Road Congress (IRC) Committee, Assocham, Bitumen India Forum and Transportation Research group of India. She is actively involved in drafting BIS and IRC codes for highway material testing and specifications for flexible pavement construction in India. She has authored many research papers and articles on various subjects of asphalt pavements. She has delivered invited lectures at many national and international platforms. She is also a faculty for Academy of Scientific and Industrial Research (AcSIR). She has been granted a patent for the process developed for "use of PVC plastic waste in road construction", filed another patent in 2022 on recycling agent for asphalt pavements. In the year 2022 Dr. Behl became the first woman to receive IRC Pt. Jawaharlal Nehru Birth Centenary Award for her achievements in the field of Highway Engineering. She is recipient of CIDC (construction industry development council) Vishwakarma Achievement Award 2021, Bitumen India Award 2017, Skoch (Silver Category) award for Pavement Recycling project in 2019. She also received Best Research Paper Award by Dr. Harsh Vardhan at India International Science Festival 2016. She has received felicitation award by Hon'ble Minister of Road & Transport Sh. Nitin Gadkari ji for her work in the field of sustainable pavements. She received appreciation letter from many state PWD for her guidance to the department in constructing roads sustainably. She received appreciation letter from Govt. of Himachal Pradesh for guiding their engineers to construct waste plastic roads in Shimla. She has rich experience in Research and Development activities of Highway Engg Sector. She has guided many Master's and PhD dissertations and she is serving as reviewer for many national & international research journals like ASCE, ASTM, IJPRT, CBM, JPET. She believes that infrastructure development should not be at odds with sustainability and continues her work in the area of sustainable pavement construction technologies.

Ms. Minimol Korullla

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ABSTRACT:

USE OF GEOSYNTHETICS IN FLEXIBLE PAVEMENTS

Road networks play an important role in the development of any country. Similarly, quality and durability will also play a pivotal role in the construction of road networks.

Generally, the roads that we are designing are subjected to heavy loads throughout their design life, maybe more than the design capacity of the road. Hence, we should emphasize more on how we can prevent the failure of such roads.

Most of the flexible pavement is susceptible to fatigue and rutting issues, which lead to the formation of cracks in the existing roads. This issue can be addressed by incorporating a geosynthetic material, as it improves the stability and strength of the flexible pavement. It will also help in the reduction of the total cost of the construction, as by incorporating geosynthetics in the flexible pavement, the requirement of high-quality aggregate fill material for the base and subbase layer will be reduced and the performance and life of different layers can be enhanced. This will lead to a reduction in the overall cost of the project as well and it will also help in the reduction of the construction time.

It's a need of the time to move towards a sustainable solution with carbon footprint reduction compared to the conventional solutions. Incorporation of geosynthetics will reduce the maintenance requirements. Thus altogether there will be a significant reduction in the life cycle cost of the construction as it will reduce the amount of construction material, time period of the construction and maintenance requirements.

BRIEF BIO-DATA:

Ms. Minimol Korullla has M. Tech. (Geotechnical Engineering) & General Management, started her career in 1990 as a Building Engineer & Quantity Surveyor for MGOSCM. She worked with Kerala Irrigation Dept. as a Graduate Apprentice Engineer. From 1997 to 2001, she worked in series of structural consultancy firms Ketan Consultant, Mesacon of Andheri and Sha & Sha in Nariman Point Mumbai to get proficiency in structural and geotechnical engineering fields. She joined Maccaferri in 2001 and it was a turning point from conventional Civil Engineering Field to Advanced Geotechnical Engineering with new materials. She has exposure to the field of Geosynthetics, Bio Engineering, Woven steel wire mesh products like Gabions, Rope panels and different slope Drapery systems, etc. At Maccaferri her is mission was to adopt ecofriendly approach with a focus on best solution to the customers. In her 25 years of career she has held diverse positions like – Technical Manager, Regional Manager – South Region, DGM – Technical, GM - Design, Head of World Design Center, Chief Technical Officer, VP – Technical, Head – Strategic Projects.

Presently she is heading the Strategical projects, National Standards Committee participations and Institutional Collaboration of Maccaferri Group in Indian subcontinent. One of key her assignments is to lead the strategic Initiatives of the Global company in ISEAP (India, Southeast Asia Pacific) region. She had unique opportunities to get involved in challenging projects of the country in the domains of Slope stabilization, Riverbank stabilization, Ground Improvement and Disaster Mitigation projects as technical reference point.

Minimol lends her expertise is many mutable Technical Committees of IRC, ISO, BIS, MED, GC, IGS, ISSRM, etc. She has been an Editorial member in various works of IRC, IGS, ISO etc. She has had numerous opportunities as invited facility at IAHE as well as Expert Speaker at CRRI, IITs, NITs, L&T, etc. Her contribution have been recognized through honors such as.

Eminent Woman in Geotechnique – IGC India -2018, Eminent Women in Geotechnique-IGC Goa 2017, Commendation for exemplary contribution to Highway Engineering – IRC – 2013 and Exemplary contribution to Geosynthetics – IGS 2019.

Mr. Arpan Ghosh

President Engineering, Cube Highways

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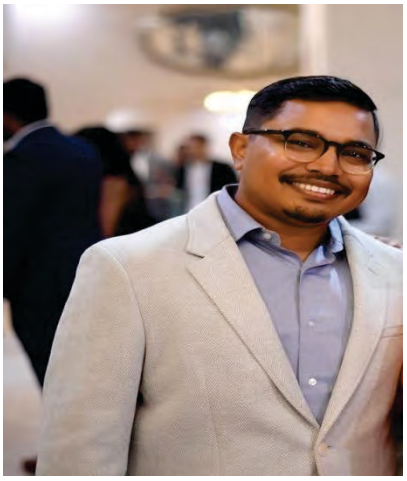

ABSTRACT:

SUSTAINABLE CONSTRUCTION MATERIALS & NEW TECHNOLOGIES : TRAJECTORY TO SUSTAINABLE GROWTH (SCM-TSG)

Introduction

The global construction industry plays a pivotal role in shaping our urban environments, but it also has a significant environmental footprint. From the extraction of raw materials to energy-intensive construction processes and construction waste, traditional construction methods have been associated with resource depletion and environmental degradation. However, there is a positive shift happening in the industry, with a growing emphasis on sustainable construction materials.

Sustainable, speedy, and safe highway construction has become extremely essential for ensuring the long-term viability and effectiveness of transportation infrastructure.

Selecting the right sustainable construction materials for road projects depends on factors like design requirements of the project, environmental and climatic factors. Sustainable road construction practices considers the entire life cycle of the materials and the roads themselves to minimize environmental and social impacts while ensuring long-term durability and cost-effectiveness.

Benefits of Sustainable Construction Materials and Technologies

The adoption of sustainable construction materials and technologies offers several advantages:

- Environmental Benefits: Reduced resource consumption, lower carbon emissions, and minimized waste generation contribute to a healthier planet.
- Economic Benefits: Sustainable materials often lead to lower operating costs and longer building lifespans. Energy-efficient buildings, for instance, have lower utility bills.
- Social Benefits: Sustainable buildings provide healthier and more comfortable living and working environments. They also contribute to local economies by promoting green jobs.
- Regulatory Compliance: Many regions are implementing stricter environmental regulations and building codes, making the use of sustainable materials a necessity for compliance.

One of the pillars of sustainable construction in roads is the use of recycled materials. Recycled Asphalt Pavement (RAP) is reclaimed asphalt from old roads that is crushed and

mixed with new asphalt to create a more sustainable road surface. It reduces the demand for new asphalt and conserves natural resources.

Adoption of low-energy construction technologies such as warm-mix asphalt, cold mix asphalt, micro surfacing will help reduce energy consumption during material production and construction. In addition, the use of energy-efficient construction equipment and practices will minimize fuel consumption and emissions.

Challenges and the Road Ahead

While the trajectory towards sustainable construction materials and technologies is promising, challenges remain. Cost can be a barrier, although the long-term benefits often outweigh the initial investment. Additionally, the availability of sustainable materials in some regions may be limited, necessitating a shift in supply chains.

Collaboration among stakeholders, including governments, consultants, developers, engineers and contractors, is crucial to accelerate the adoption of sustainable materials and technologies. This collaborative effort can drive innovation, increase affordability, and expand the market for these materials and technologies.

Conclusion

The highway construction industry's trajectory towards sustainable growth is not just a passing trend; it is a necessity driven by environmental concerns, regulatory pressures, and the desire for economic efficiency. Sustainable construction materials and technologies are at the forefront of this transformation, offering a path to reduce the industry's carbon footprint, lower operational costs, and create healthier environment. As we move forward, embracing these materials and technologies is not just a choice; it is an imperative for a sustainable and prosperous future.

BRIEF BIO-DATA:

Mr. Arpan Ghosh, President – Engineering, is currently leading the Engineering Department at Cube Highways Technologies, having a team strength of 136 members comprising of 5 sub departments namely Pavements, Technical Due Diligence & Project Management, Highway Design, Structures and Estimation & Costing. Arpan holds a Post Graduate Degree in Civil Engineering (M-Tech) with specialization in Transportation Systems Engineering from IIT Kanpur. He has over 14 years' experience of working in over 150 assignments which include Transaction Advisory, Lenders Independent Engineer, Pre-Bid and Post Bids assignments and Detailed Design. He has experience of consulting assignments in India and Kenya. His key interest areas include Pavement Design, Pavement Evaluation, Deterioration Modeling, Pavement Maintenance Management, Evaluation of Pavement Materials. He has also delivered number of training sessions at IAHE-Noida, IIT Bombay, IIT BHU and for government and private industry professionals. He led the PMC team of 50+ Engineers for the World Record of Paving 112.5 lane km in 100 hours in NH34 (Ghaziabad Aligarh Section).

Ms. Atasi Das

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ABSTRACT:

NEW EDGE TECHNOLOGIES IN PAVEMENT APPLICATION

Rapid progression of the network of highway and road infrastructure requires quantum expenditure and natural resources. Considering the constraint and availability of both, new edge pavement technologies in both flexible and rigid pavement have emerged as ecofriendly and economic solutions. The Government of India has mandated the use of new technologies to reduce the direct consumption of materials, which will eventually have positive impact on the management of the GHG emission, directly or indirectly. Such recent technologies both in flexible and rigid pavements and their features are addressed here.

When a highway is upgraded, the current culture is to scarify the existing carriageway and discard the material, especially the precious bituminous layers, which could otherwise be utilized or recycled or renewed in the construction of new bituminous pavement in the name of RAP (Reclaimed Asphalt Pavement). In foreign countries, up to 100% RAP utilization has successfully been achieved. In India, the scope of RAP is very limited as the industry is reluctant to using high dosage of RAP yet. Why? What is the reason? High dosage RAP pavement is economical, environmentally beneficial and performs like new pavements if proper measures such as grade of virgin binder, RAP gradation, rejuvenating agent and its dosage, type of Batching Plant and Mix Design, are undertaken.

The geogrid reinforced pavement is a newly introduced technology in our country. The geogrid is a two-dimensional mesh shaped mat used within the pavement layers or at the interface of the various pavement layers. The geogrid involves the basic concept of lateral confinement by virtue of improvement of the mechanical properties of the encompassed materials. The geogrid functions well in strengthening the weak foundation or strengthening the base/subbase course with ultimate economization in thickness of bituminous layers and reducing the cost of overall pavement system, besides time saving in a broader aspect.

Perpetual pavement, also termed as long-lasting pavement, has been implemented in India in a large scale for the greenfield expressways. The concept of perpetual pavement is to provide a thick bituminous pavement such that the stresses from traffic are negligible and the pavement structure can sustain for at least 50 years with minimal rehabilitation intermittently. These pavements necessarily consist of bituminous base courses, intermediate course, wearing course, granular layers, and strong foundation. They are suitable to cater for surprise or unprecedented traffic, typical of greenfield expressway corridors.

In the concrete pavement sector, Bonded Rigid Pavement, a unused technology till date, is gaining momentum. Here, the subbase of Dry Lean Concrete (DLC) is monolithically attached to the PQC and the whole combined structure acts as a single slab. The thickness of PQC in bonded rigid pavement is approximately 25% less than conventional rigid pavement. Here, the Grade of DLC is considered higher compared to conventional case.

Overall cost saving to the tune of 8% to 10% overall cost can be saved as compared to conventional rigid pavement. This type of pavement is suitable for heavily trafficked corridors.

BRIEF BIO-DATA:

Mrs. Atasi Das earned Bachelors in Civil Engg from Jadavpur University, India and Masters from University of Delaware, USA. Having 25 years of experience in India and USA, she specialises in Pavement, Materials and Geotechnical Engg. of highway infrastructure.

Pioneering in sustainable pavement design and successful implementation of advanced technologies of Perpetual Pavement, High Dosage Reclaimed Asphalt Pavement (RAP), Bonded Rigid Pavement, Composite Pavement, Warm Mixes, Stone Matrix Asphalt (SMA), Geogrid reinforced pavement, PMB, Cemented Bases & Subbases, Stabilised Embankment Foundation and Subgrades, economic and "green" pavement rehabilitation schemes, ground improvement treatments with extensive usage of geosynthetics including geocells, geogrids (uniaxial and biaxial) in various project corridors of national importance. She has done exemplary work in slope stabilization measures in the Himachal region.

Awarded with the prestigious CIDC 2022-23 Innovator award, she is of various highway committees of IRC and IGS, and co-authored multiple codal provisions. Besides, co-authored more than 50 technical papers published in Indian Highways, international journals and numerous conference proceedings, and authored numerous articles in Construction journals.

Mr. Shashank Shekhar,
Director, MiCoB

Dr. Ankita Sinha,
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ABSTRACT:

MiCoB's 3D Concrete Printing Technology:
An Innovative Solution for a Sustainable Future

The construction industry stands at the crossroads of numerous challenges, grappling with issues ranging from cost and time inefficiencies to limited flexibility and variable quality standards. These hurdles are further compounded by factors such as extreme weather conditions, limited manpower, and accessibility issues, particularly in remote area construction. Acknowledging the urgent need for transformative solutions, MiCoB has undertaken a mission to introduce a dynamic and revolutionary 3D Concrete Printing (3DCP) technology.

3DCP technology comprises of following systems, namely, motion control system, extrusion system, mixing and pumping system, slicing software. Three-dimensional (3D) CAD model of the structure is sliced into two-dimensional (2D) layers of specified height using the slicing software. A specially designed concrete mix which possess the properties of pumpability, buildability, extrudability, shape retention, shrinkage resistance and accelerated setting is mixed and pumped to the extruder system. The motion control system, which may comprise of a robotic arm or a gantry, places the material layer-by-layer as per the sliced information. This process does not require any formwork or support. Minimal manpower is required to operate the systems. Printed concrete can be strengthened using continuous or discreet fibers and rebars during the printing process as well.

MiCoB's 3DCP technology is strategically crafted to address the inherent inefficiencies associated with the conventional construction practices. Its primary objective is to eliminate the substantial waste of time, resources, and manpower that plagues traditional construction methods. This innovation extends its reach to the defense sector, offering a viable solution for construction in extreme climates where resources are minimal. Furthermore, MiCoB's 3DCP technology responds to the global imperative for rapid infrastructure construction, and improved housing for low-income populations, presenting an innovative approach that enhances both affordability and accessibility.

In alignment with the contemporary demands for smart city developments, landscaping, and infrastructural growth, MiCoB's technology places a strong emphasis on efficiency and automation. The scalability of the system, combined with its ability to significantly reduce dependence on labor, positions MiCoB as a frontrunner in increasing overall productivity within the construction sector. Notably, the technology requires the lowest capital investment compared to global competitors, making it an economically viable choice for a wide range of construction projects.

Crucially, MiCoB's 3DCP technology aligns with global initiatives to reduce carbon emissions in the construction sector by up to 35%. By minimizing construction waste and implementing sustainable practices, MiCoB contributes significantly to mitigating the environmental impact traditionally associated with construction methods.

In conclusion, MiCoB's 3D Concrete Printing Technology emerges as a transformative force that sets a new standard for efficiency, sustainability, and innovation in the construction industry. This groundbreaking solution seamlessly integrates into diverse construction projects, offering not only economic advantages but also paving the way towards a greener and more sustainable future for the construction sector. MiCoB's commitment to addressing multifaceted challenges marks a significant leap forward in redefining the construction landscape.

BRIEF BIO-DATA:

Mr. Shashank Shekhar is the Co-founder and CEO of MiCoB. MiCoB focuses on bringing man-machine integration in the construction segment, using its state-of-the-art 3D concrete printing technology. Shashank graduated in Civil Engineering from IIT Roorkee. Presently, he is also pursuing his Ph.D. in 3D concrete printing from IIT Gandhinagar.

TECHNICAL SESSION - 4

INNOVATIVE TECHNOLOGIES IN ROAD SAFETY

Chair

Mr. Mahmood Ahmed
Addl. Secretary, MoRT&H

Co-Chair

Mr. Rahul Bharti
Maruti Suzuki

Innovative technologies are revolutionizing road safety, offering solutions to mitigate risks and to enhance transportation efficiency. Advanced driver assistance systems (ADAS) equipped with features like automatic emergency braking and lane departure warning systems help prevent collisions and reduce the severity of accidents. Furthermore, vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication technologies enable real-time exchange of data, enhancing situational awareness and enabling intelligent traffic management. Additionally, the integration of smart road infrastructure, including intelligent traffic lights and road signs equipped with sensors and cameras, improves road safety by providing timely information to drivers and authorities. Emerging technologies such as autonomous vehicles hold the promise of further reducing accidents by eliminating human error. By leveraging these innovative technologies, road safety can be significantly improved, ultimately saving lives and creating safer transportation systems for all.

Mr. Sudershan K. Popli
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ABSTRACT:

NHAI ROAD SAFETY INITIATIVES ON ENHANCE SAFETY OF ROAD USERS

As per the report of MoRTH, the accidents on roads are on rise and so the fatalities. In the year 2022, the deaths due to road crashes has increased to 1.68 lakhs. Similar pattern has also been observed on NHs/Expressway/Access controlled Highways under the jurisdiction of NHAI. NHAI is very serious about the safety of road users along with development of world class road infrastructure. NHAI has established dedicated Road Safety Division to undertake and monitor safety on highways. Accordingly, NHAI has aligned various safety activates as follows:

1. Improvement of quality of DPR preparation, Technical Schedules B & C shall provide details to enhance safety such as Intersections design details, service roads provisions in builtup area, Safety Barrier estimate, lighting in habitations, road signs, pavement markings, etc. and issued Sample Technical Schedules for implementation.
2. Independent Road Safety Audit of each highway at various stages i.e DPR, Construction and O&M stage implemented under any mode i.e. BOT, HAM, EPC, TOT, etc.
3. NHAI has developed Road Safety Mobile App for conduction of onsite safety audit and geo tagging of unsafe location project photos. Regular monitoring of the safety audit compliance by PD/RO/Hq.
4. Special Financial Powers has been delegated to field officers for undertaking rectification of notified black spots (up to Rs 50 crore) and taking short-term measures (upto Rs 25 lakhs) for other accident spots.
5. Capacity development of Consultants and Contractors has been mandated by deployment of Safety Officers having qualified the road safety certification course.
6. Public Road safety Awareness is being an integral part of the NHAI and Road Safety month/week is being organized every year on highway sections under concerned PIU . A special drive for eye & health checkup of the drivers is being organized on at regular interval wherein free spectacles are also distributed.
7. Developing the IT tools (Using AI and ML) for audit of the highway using drone surveys data which are being conducted at the interval of every six month to monitor maintenance activities undertaken.
8. Road accident data is being collected by MoRTH using e-DAR portal and this data will be utilized in detailed analysis and designing of the safety remedial measures.

9. NHAI officers posted as Road Safety officer (RSO) at Regional offices, RSO are certified road safety auditors to monitors safety aspects under RO jurisdictions.

10. NHAI has launched Rajmargyatra Mobile App for the benefit of road users while on roads and report any maintenance/safety issues on the App, NHAI will rectify and report back to road users.

With the above initiatives, it is expected that the Road Engineering measures to make our roads safer, will be implemented with a much higher pace and with the use of new IT tools of monitoring the progress, the targeted reduction in accident and road related deaths will be achieved.

BRIEF BIO-DATA:

- Sudershan K. Popli, Master in Transport Planning from School of Planning & Architecture, New Delhi. He has 36 years of experience in the field of Traffic Engineering, Highway Design, Black Spot Management, Traffic Management and Safety Engineering. Awarded by FICCI Road Safety Manager (2017), NHAI Safety Appreciation Award (2018) and RITES Safety Expert Award (2019). Presently, Working as Advisor (Road Safety), NHAI and contributed towards development of Safety Audit Mobile App, DPR Safety Audit, Safe Engineering Design, etc.
- Worked as Highways Strategic Business Head, RITES Ltd and Team Leader on DPR and Safety Projects of Expressways, 6 & 4 lane highways. As International Road Safety Expert completed audit of 10,000 lane km Safety Audit in India and Abroad at various stages of highway projects.
- Life Fellow of Indian Roads Congress, Institution of Engineers, Institute of Town Planers, Institute of Urban Transport. As Member of IRC Technical Committee, H 1 -Transport Planning and Traffic Engineering and H 7 Committee-Road Safety and Design, contributed towards revision of IRC codes 8,9,32,35,39,46,62, 67,79,80,108,131 and IRC SP 30, 55, 85, 88. Published and presented 35 nos. papers on Traffic Studies, Traffic Calming, Design of Highways, Safety Audit, Asset Management, Intelligent Transport Systems, GIS and Social Impacts of Highways.

Mr. Dipan Bose
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ABSTRACT:

WORLD BANK INITIATIVES TO IMPROVE ROAD SAFETY IN INDIA

Beyond a rising health epidemic, road safety in India is a broader development priority impacting economic growth with a disproportionate effect on low-income households and welfare loss. With economic activities recovering after the pandemic, the road safety situation has unfortunately worsened further – India recorded a 6% increase in traffic fatalities compared to pre-pandemic levels. Therefore it is a challenging task for India to achieve the UN SDG goals by 2030 (50% reduction from 2020). With competing priorities in the current environment, it is essential that the road safety agenda remains a priority for our client at the highest level and the Bank's continuous demonstration of its support as it has shown in the past.

To this effect, the World Bank over the last 15 years has been actively supporting India to address road safety using multi-sectoral coordination and building the necessary institutional capacity required to manage and sustain a strategy for reducing road traffic deaths. This work has a strategic emphasis on the implementation of the Motor Vehicle Amendment Act of 2019. This has led to a fundamental shift in our road safety engagement in India which goes beyond advocacy and have adopted holistic legislation for better accountability, inter-ministerial agencies set up in recent years, and pilot initiatives yielding promising outcomes. Furthermore, this has helped create momentum in initiating critical policy, regulatory, and institutional reforms required to improve road safety in some countries. Our portfolio has accordingly adapted in supporting our client with dedicated safety components in almost each road project and more recently a stand-alone road safety investment in India.

Besides national support on road safety, the bank is also actively supporting several cities in terms of safe infrastructure for pedestrians, cyclists, motorcyclists, and mass transit system which will have a significant impact not only on road safety for vulnerable road users but also will improve accessibility to jobs especially for women. Furthermore, eight shared regional initiatives have been proposed concerning crash data management and analysis systems, a regional road safety observatory, infrastructure safety design and assessment, emergency and post-crash medical services, and injury surveillance systems. These initiatives are aligned with national road safety efforts throughout the region. If properly resourced and directed, they would make a major contribution to reducing the regional road safety burden. Additionally, grant funding for road safety is provided through the World Bank hosted- Global Road Safety Facility (GRSF), which is supported by contributions from UK Aid, CITA, Bloomberg Philanthropies, and total foundations. The World Bank also values its partnership with national NGOs like Save Life Foundation for collaboration in analytical work on *Traffic Crash Injuries and Disabilities: The Burden on Indian Society* and training programs for Road Safety.

BRIEF BIO-DATA:

Mr. Dipan Bose is a Senior Transport Specialist with the South Asia unit of the World Bank Group. He is a road safety engineer by training with research experience in the areas of vehicle safety, multi-sectoral road safety management with focus on designing road injury interventions for developing countries. In his current role, he is supporting governments of India, Bangladesh, and the broader region to develop national road safety programs, technical advisory and analytical activities including the preparation and supervision of World Bank financed projects. Previously at the Bank's Global Road Safety Facility he had managed and led the Bloomberg Initiative for Global Road Safety program from 2014 to 2020 focused on improving road safety in selected cities and countries in the developing world. Prior to joining the Bank in 2012, he was a Research Scientist at the University of Virginia Center for Applied Biomechanics focusing on the vehicle restraint systems and developing injury risk functions for pedestrians and vulnerable occupants. He holds a PhD from the University of Virginia Department of Mechanical Engineering.

Mr. Joydeep Shome

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ABSTRACT:

eDAR / iRAD: TOWARDS BETTER ACCIDENT REPORTING AND MANAGEMENT

In India, every year 5 Lakh+ road accidents take place, more than 1.5 Lakh people lose their lives and about double that figure get grievously injured and incapacitated. This is one of the most tragic and unsustainable aspects of India's growth story.

Various Government and Non-Government Agencies, Multiple Ministries and even Honourable Supreme Court are all sincerely involved to ameliorate the situation and ambitious targets have been set to drastically bring down these figures in the coming years.

One such key initiative from Ministry of Road Transport & Highways (MoRTH) is the eDAR/ iRAD (Electronic Detailed Accident Report/ Integrated Road Accident Database) project. The objective of the project is to collect detailed and reliable accident data from the spot through multiple stake-holder departments/ agencies, collate it with further data from related systems/ databases, link it with further stakeholders in the eco-system and provide a comprehensive platform for accident data collection, management, analytics – facilitating an end-to-end integrated system. Right from accident details entry by policemen on the road, till the adjudication and settlement of compensation to accident victims, and also the detailed analysis of the road engineering defects for prevention of future accidents, this platform will help tremendously in enabling a scientific understanding and technological solution to the painful deaths and disabilities.

Primarily, the system provides a mobile app and complementary web application for collecting and collating about 200 parameters of accident details at the spot level by the Police personnel, Transport Officials, Highway Authority and Health/ Hospital/ Ambulance establishments. Data from external systems like CCTNS, Vahan, Sarathi etc are integrated to enhance the richness and reliability of the data. This data is then linked with the Police investigation, FIR generation, Submissions to court, Insurance companies' interactions, Claim processing by MACT courts and so on.

This system has already taken off in a big way in the last 2 years and has the promise of blooming into a very matured, effective system in the coming years by connecting all the points in the eco-system and providing a robust platform to all stakeholders to effectively manage accidents and bring down the menace substantially.

BRIEF BIO-DATA:

Mr. Joydeep Shome is posted in NIC HQ, New Delhi as Deputy Director General and is the Head of Group for eTransport National Project and also Ministry of Road Transport & Highways. He is leading the team of NIC professionals who are engaged in the challenging task of bringing about digital transformation of transport sector of India. He has been instrumental in successful adoption of flagship applications like Vahan, Sarathi, echallan, mParivahan, iRAD etc by states across the country and also facilitating the Transport Digital Platform connecting all stakeholders in the ecosystem.

An engineering graduate in Electronics and Telecom from NIT Silchar, he started his career in NIC in 1989 as a District Informatics Officer in Assam and later shifted to NIC Delhi, where he was also involved with the Indian Customs EDI System project.

Apart from the eTransport Project, Mr. Shome is also associated with various core activities and committees of both MoRTH and NIC and is the member of the Technical Advisory Group. He is also looking after Agile Software Development Division and Mobile App Development Centres of NIC.

Mr. Teja Gudena

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ABSTRACT:

Driver Monitoring Systems (DMS) and Advanced Driver Assistance Systems (ADAS) represent significant advancements in vehicle safety technology aimed at reducing road accidents. DMS utilize sensors and cameras to monitor driver behaviour, detecting signs of fatigue, distraction, or impairment, and issuing alerts to maintain driver attentiveness. ADAS, on the other hand, employs sensors, radar, and cameras to monitor the vehicle's surroundings, providing warnings and interventions to prevent collisions.

The integration of DMS and ADAS creates a proactive and reactive approach to road safety. DMS proactively address driver-related risk factors, while ADAS serves as a safety net, intervening to mitigate hazards or lapses in driver judgment. Advancements in sensor technology and AI algorithms have enhanced the effectiveness of these systems in real-world driving scenarios.

Research demonstrates the efficacy of DMS and ADAS in reducing accident rates, injuries, and fatalities. Vehicles equipped with these technologies experience fewer collisions compared to those without them. Regulatory bodies of some of the western countries are increasingly mandating the inclusion of DMS and ADAS in new vehicle models, it's high time that India shall look at it too.

In conclusion, DMS and ADAS play a crucial role in improving road safety by addressing human factors and enhancing vehicle awareness and responsiveness. Continued research and innovation in these technologies promise to further enhance their effectiveness and contribute to the vision of zero fatalities on the roads.

BRIEF BIO-DATA:

Teja Gudena_is a founding team member and currently holds the position of Executive Vice President - Devices at Netradyne Technology, leveraging his extensive background spanning over 18 years in international roles encompassing mobile platforms R&D and product development. With a focus on parallel, complex, and multi-continental projects, Teja excels in developing new platforms and systems while harbouring a deep passion for pioneering technology trends and driving their adoption into the mainstream. Prior to Netradyne, Teja has worked on leadership positions in the R&D and Engineering divisions of large enterprises, including Microsoft, Nokia and Micromax. His diverse experience includes involvement in multiple product and platform deliveries.

Dr. S. Velmurugan

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ABSTRACT:

REVOLUTIONIZING ROAD SAFETY USING ARTIFICIAL INTELLIGENCE: A CASE STUDY

In the year 2020, due to the reporting of over 1.3 million global road fatalities, the United Nations declared the second decade of action plan for road safety from 2021 - 2030 so as to achieve target of 50 % reduction in road fatalities and serious injuries which could not be achieved in the previous decade of 2011 - 20. The one of the basic reason for non accomplishment of the above goal was due to the fact that many of the Low and Middle Income Countries (LMIC) either showed marginal increasing trends and level of saturation in the figures of road fatalities and serious injuries. Accordingly, it was proposed in the Ministerial Conference in Sweden (2020) to follow Safe System Approach encompassing infrastructure, mobility, vehicle, safe road use, transportation planning, and post-crash management in an integrated manner. Taking cue out of the above, the significance of emerging technologies like Advanced Driver Assistance Systems (ADAS) in the field of road safety should be explored.

India witnessed a significant surge in road crashes from year 2021 to 2022, with 11.9 % rise in road crashes, 9.4 % in fatalities, and 15.3 % in injuries. To address the above, a pilot study i.e., Project: iRASTE (Intelligent Solutions for RoAd Safety through Technology and Engineering) was initiated in Nagpur city, India in September 2021, aiming to reduce road crashes / fatalities by 50 %. This study integrated ADAS technology into the existing 4E's framework for road safety, focusing on; (a) Vehicle Safety, (b) Mobility Safety, (c) Infrastructure Safety, and (d) Education, Training, Awareness, and Emergency Care. In this context, Artificial Intelligence powered ADAS systems were installed in 250+ public transport fleets of Nagpur Municipal Corporation (NMC) that ply on 76+ bus routes covering the whole urban region of the city. Project iRASTE, the largest and longest running study on ADAS systems for commercial vehicles in India, yielded the various key findings:

- Under the umbrella of vehicle safety, the study reported that the ADAS-fitted buses recorded 41 % lower number of road crashes than non-ADAS buses during the Jan'23-Aug'23 period, showcasing the NMC's ADAS-fitted buses are almost twice as safe as non-ADAS buses today. Bus driver risk scores were tracked monthly, revealing a 30 % reduction since the inception of the project, indicating the usefulness of deploying ADAS can help to improve the driver skill. This exhibits that the deployment of ADAS as a mandatory tool in passenger cars and goods vehicles would help to enhance road safety scenario on Indian roads. Over 1100 drivers of NMC (including about 75 school bus drivers) underwent training on defensive driving with ADAS, and 150 safety champions were recognized.
- Under the banner of mobility safety, 33 greyspots i.e. potential blackspots were identified which also encompassed the identification of the top 5 unsafe corridors in Nagpur city road network using statistical models. Obviously these were validated with existing blackspots which yielded more than 70 % accuracy with the ground observations. In

summary, greyspot prediction using up to date ADAS alerts and road geometry features is an approach that is more accurate and scalable than one-time manual surveys.

- Infrastructure safety improvement included detailed geometric design plans for 38 blackspots. Additionally, Economic-Benefit Assessment and visualization works has been done to present the after effects of the improvement works which estimated about 60 - 66 % reduction in the overall road crashes coupled with 40% reduction in road accident fatalities can be achieved on Nagpur city road network if the countermeasures are applied at the identified BS. In this regard, improvement work has started at the 8 blackspots of the city and at present geometrical remedial interventions have been completed in 3 blackspots namely, Ajni Square, Chhatrapati Square, and Jaiprakash Nagar Square. The initial trends reveal that the road crash risk reduced by 30 % after its implementation.
- Under emergency care, Trystander cells were installed at 8 blackspots that contains various safety equipment to help road crash victims and through all these social interventions, saved lives of 31 road crash victims near the blackspots. In addition, city-wide awareness programs (named Avagatkara), good Samaritan events, First-aid training, involved 2000+ participants from various sectors of society, promoting adherence to traffic rules and creating a mechanism to help road crash victims.

In a nutshell, Project: iRASTE showcased the effectiveness of integrating ADAS technology and engineering solutions in improving road safety, setting a new trend for addressing the future safety initiatives in the country and thus help towards the target of 50 % reduction in the road fatalities and serious injuries

BRIEF BIO-DATA:

Dr. S. Velmurugan is presently working as Chief Scientist and Head, Traffic Engineering and Safety *(TES)* Division at CSIR - Central Road Research Institute *(CRRI)*, New Delhi. He has completed his Ph.D. in Transportation Systems Engineering from IIT, Bombay in 1995.

He possesses more than about 30 years of experience in traffic engineering, road safety and transportation planning and transport economics. He was instrumental in the formulation / revision of 18 IRC publications during the last 12 years. He has served in the capacity of Project Leader / Coordinator in the World Bank sponsored projects as well as National Highways Authority of India *(NHAI)* and various state Public Works Departments *(PWD)* projects for the conduct of various stages of Road Safety Audits (RSA) covering more than 18,000 Kms. He is acting as the Joint Course Coordinator for the most sought after course by the Highway and Transportation fraternity in the country being run by CSIR - CRRI since May, 2017 namely, 15-day Certification Course on "Road Safety Audit and Other Road Safety related Aspects".

He has published more than 150 technical papers in International and National journals / Conferences and presented in more than 100 research forums.

Dr. P. Rajalakshmi

Professor

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ABSTRACT:

REVOLUTIONIZING INFRASTRUCTURE AND TRANSPORT SERVICES WITHNEW TECHNOLOGIES

Department of Science and Technology (DST), under the National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS), has sanctioned the prestigious Technology Innovation Hub (TIH) in the technology vertical of Autonomous Navigation and Data Acquisition Systems (UAVs, ROVs, etc.). Technology Innovation Hub on Autonomous Navigation (TiHAN) at IITH is a multi-departmental initiative, including researchers from Electrical Engineering, Computer Science and Engineering, Mechanical and Aerospace Engineering, Civil Engineering, Mathematics, Design, Entrepreneurship at IIT Hyderabad with collaboration and support from reputed institutions and industry.

As part of the project, we are setting up a first-of-its-kind integrated testbed on Autonomous Navigations (Aerial/Terrestrial) on the IITH campus which has state of the art facilities such as Proving Grounds, Test tracks, Mechanical integration facilities like Hangers, Ground control stations, State of the art Simulation tools (SIL, MIL, HIL, VIL), Test tracks/circuits, Road Infra – Smart Poles, signalized & unsignalized Intersections, Environment Emulators like Rainfall Simulators, V2X Communications, Drone Runways & Landing area, Control Test center. TiHAN-IITH is envisaged as the destination for collaborative research for next-generation mobility solutions between academia, industry, and R&D Labs both national and international.

As a disruptive technology, an autonomous campus shuttle (ACS) electric vehicle has been developed at the TiHAN testbed. This driverless technology has been deployed within IIT Hyderabad, for the commute of campus residents and campus staff, for more than 6 months and has also been successfully tested and demonstrated in various parts of India. This technology utilizes state-of-the-art 3D map-based digital-twin technology for localization and navigation of the vehicle. It also utilizes a sensor suite for safe operations in dynamic environments. TiHAN testbed has also been utilized in the development of advanced driver assistant systems (ADAS) including, traffic light detection, traffic sign detection, and classifications, vulnerable users' detection, classification and tracking, potholes, and speedbumps detection. In the development of these technologies, for Indian scenarios, a multimodal dataset with various sensors has been curated in-house for the development of associated deep technologies for ADAS. Upon integration with planning and control algorithms, various use cases including adaptative cruise control (ACC), autonomous emergency braking (AEB), lane keep assist, and lane departure warning have been developed by following safety standards.

There has been an increased interest in various parts of the world in connected vehicle technology. As part of this, a new infrastructure has been developed wherein vehicles talk to vehicles, to infrastructure, and to vulnerable road users or in short V2X. As part of this, TiHAN has been at the forefront of its hardware and software stack development. TiHAN

along with its partners has come up with indigenous Cellular based V2X technologies for connected vehicles. Various use cases including, blind-spot navigation guidance within vehicle-to-vehicle communications, and infrastructure-to-vehicle communications for vulnerable road users' prediction, and road hazard detection and navigation, have been successfully developed at the TiHAN testbed.

BRIEF BIO-DATA:

Dr. P Rajalakshmi, is Professor in the Department of Electrical Engineering, Faculty in Department of Artificial Intelligence, CYIENT Chair Professor in Future Communications, and Project Director of Technology Innovation Hub on Autonomous Navigation Foundation (TiHAN) at IIT Hyderabad. Her research areas: Autonomous Navigation, Drone based sensing, wireless communications, Internet of Things, Cyber Physical Systems targeting applications like autonomous transportation – aerial and terrestrial, agriculture, healthcare, environmental monitoring, and smart buildings. She has been handling R&D projects funded by industry and Government of India in these areas. She is the Principal Investigator for NMICPS Technology Innovation Hub on Autonomous Navigations Foundation at IITH funded by DST. Along with fundamental theoretical research in IoT/CPS domain, she also emphasizes on translational research which involves development of minimum viable and user beneficial products. Out of her research activities, she has filed 20+ patents, published over 50+ Journals and 180+ conference peer-reviewed papers. She was awarded Young Faculty Research Fellowship under Visvesvaraya PhD Programme in January 2016 for a period of 5 years, 'Digital Trail Blazer Award 2016' by India Today, best paper and poster awards in reputed conferences.

Mr. Akhilesh Srivastava

Executive Vice President, IRF-IC

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BRIEF BIO-DATA:

Akhilesh Srivastava, a distinguished technology leader in the field of Digital Transformation, stands at the forefront of addressing critical societal issues through innovative technological solutions. He is renowned for spearheading large-scale e-governance initiatives, including implementing transformative programs like FASTag, Data Lake, and Online Citizen Services Apuni Sarkar for the UK Government. His impact resonates across the technology and governance landscape.

As a Member and Advisor to several prestigious International and National organizations, Akhilesh Srivastava has consistently demonstrated a strategic and visionary approach to problem-solving. His leadership roles as the EVP at the International Road Federation (IC) and Chairman of ITS India Forum underscore his commitment to revolutionizing the road sector through technology.

At the forefront of the Road Safety 2.0 initiative initiated by the World Economic Forum, Mr. Akhilesh envisions a paradigm shift in road safety by integrating next-generation technologies. The initiative, rooted in cutting-edge advancements, has yielded promising results, showcasing a potential reduction of over 90% in road accidents during pilots.

A recipient of numerous accolades, Akhilesh Srivastava's contributions extend beyond technology & road safety to a best-selling author, Chairperson of the CII road safety committee & Bitumen India Forum, and Mentor-Advisor to many Start-ups & NGOs

Akhilesh remains a visionary leader committed to leveraging technology for societal benefit. His multifaceted contributions have left an indelible mark on the intersection of technology and public service, setting a standard for the nation.

TECHNICAL SESSION - 5

BRIDGES AND TUNNELS

Chair

Mr. B. N. Puri
Director, AITD

Co-Chair

Mr. Alok Sahay
Secretary General & Executive Head, Indian Steel Association

Bridges and tunnels serve as vital components of transportation infrastructure, facilitating the movement of people and goods across geographical barriers. They play a crucial role in connecting communities, enhancing accessibility, and stimulating economic growth. Innovations in bridge and tunnel design, construction, and maintenance have led to safer, more durable, and sustainable structures. Advanced materials such as high-performance concrete and steel alloys improve structural integrity and longevity while reducing maintenance requirements. Additionally, innovative construction methods like segmental construction and immersed tube techniques enable the efficient and cost-effective realization of complex bridge and tunnel projects. Moreover, smart technologies such as structural health monitoring systems ensure the ongoing safety and performance of these critical infrastructure assets. As demands for transportation infrastructure continue to evolve, ongoing innovation in bridges and tunnels remains essential to meet the needs of modern society effectively.

Mr. Alok Bhowmick

Managing Director,

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ABSTRACT:

REINFORCED CONCRETE MATERIAL - A MAJOR LEVERAGE

TO REDUCE THE CO_2 SIGNATURE OF BUILDINGS AND INFRASTRUCTURES

The contribution of construction to the total global embodied Green House Gas (GHG) emissions amounts to around 20%. Three-quarters of these emissions originate from concrete and steel alone, due to their large production volumes. Hence, immediate actions must be taken to reduce these emissions. Construction industry in collaboration with the Government should take immediate steps in decarbonisation of Construction.

Decarbonisation of construction goes far beyond renewable energy transition and carbon capture technologies. The dramatic role of embodied GHGs in construction must be considered and the different players and parties of the construction sector must work closer together to drastically reduce these. Within the next 30-50 years, the global demand for housing and infrastructure poses a substantial challenge to the global community. This development will be driven especially by the Global South (i.e. Brazil, India, Indonesia and China), where the majority of new construction will occur. Immediate action is needed to implement the best knowledge and technologies we already have today. A paradigm shift in construction to adopt better practices must be implemented at global scale.

Using less and lower embodied carbon materials must be appreciated as fundamental way towards the decarbonisation of the construction sector. Yet, key obstacles today are lack of organisation in the construction sector and inadequate regulatory frameworks, codes and standards.

In order to achieve positive climate effects on global scale it is important to focus on the big numbers. Therefore, it is important that emphasis is put on cement and concrete due to the great global demand and the tremendous climate effect and leverage. Concrete is the second most used substance on earth after water, and for this reason, it has a significant environmental impact. In fact, concrete is an intrinsically low-impact material with much lower emissions of CO2 and energy per ton than other materials like iron and steel, even things like bricks. But because of the enormous volumes we use overall, it contributes to about eight percent of man-made CO2 emissions. Concrete is an essential material. We need it to house people, to build roads, bridges and dams. So we can't do without it, but we can significantly reduce its carbon footprint.

This paper will highlight key areas where attention is needed in use of concrete materials in bridges. This can be achieved by optimisation of design (reduced quantities in design), by decarbonisation of the cement manufacturing process, by clinker substitution. Paper will address the short-term, mid-term and long-term strategies needed to achieve the targets. The Low carbon solutions and processes and respective ontology will be discussed. Bottlenecks in the overall framework and ways to overcome will be discussed. Also ways and means to spark mindset change within the overall framework will be discussed.

BRIEF BIO-DATA:

Mr. Bhowmick is an eminent Bridge Engineer with exceptional records and achievements. He is a Fellow of National Academy of Engineering, which represents India's most distinguished engineers, engineer-scientists and technologists covering the entire spectrum of engineering disciplines. He is a FIDIC Certified Consulting Practitioner. He is also an International Professional Engineer of Institution of Engineers (India). He is the recipient of 24th S. B. Joshi Memorial Award for the Year 2018 for "Excellence in Bridge & Structural Engineering".

Mr Bhowmick has over 42 years of experience in the field of Bridge and Structural Engineering. He is known to actively participate in disseminating professional knowledge to the young professionals in many forums. He is currently A Governing Council member of Consulting Engineers Association of India (CEAI), Vice Chairman of Indian National Group of the International Association for Bridge and Structural Engineering (ING-IABSE). He is also presently the Co-Chairman of editorial board of the quarterly journal of ING-IABSE. He is the Past President of the Indian Association of Structural Engineers (IAStructE) and currently holding the post of Chairman, Publication Committee and Professional Issues Committee of IAStructE.

He is an active member of several National & International code committees in BIS & IRC. He has written and published more than 80 technical papers in various national and international journals.

Mr. Jitendra Kumar Goyal
Chief Scientist

Mr. G K Sahu and Mr. S S Gaharwar

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ABSTRACT:

DEVELOPMENT OF DESIGN GUIDELINES, TESTING PROTOCOLS AND EVALUATION CRITERIA TO CARRYOUT CONCRETE DECK WATER PROOFING FOR BRIDGES

The water proofing in building structures is quite common and being used extensively by different manufacturers through established design guidelines and national specifications. However, when it comes to the Bridges and other elevated structures on highways, the prevention of super-superstructure elements from ingress of water remains a big challenge in absence of sound bridge deck water proofing systems and norms. At times, the ingress of water becomes hazardous to the overall durability and functionality of the bridge structures as the bridges are often subject to the harshest weather conditions that climates have to offer. In order to maintain the durability of over its design life, special attention should be given to the protection of exposed elements and critical areas such as bridge deck itself, to prevent serious damages to the concrete and structural reinforcements. Due to constant movement, the deck waterproofing system requires to be able to accommodate dynamic traffic loads and bridge cracks whilst still maintaining a strong bond with both the substrate and asphalt road surface. Bonding failure can lead to loose or rucked road surfaces allowing water, chlorides and chemical to attack the structure, reducing the design life. At present, Indian codes and guidelines do not provide much information about the application of such materials available in the Indian market or being brought out by International agencies for their incorporation in permanent works for bridges, in particular. Internationally also, the norms are product driven rather through an established practice, hence not uniform all across. Therefore, keeping these issues in mind with a visible gap in the regularisation of such materials for Indian Bridges, there is a need to develop comprehensive design guidelines, testing protocol and application methodologies by evaluating different kinds of water proofing materials followed by a field study.

The paper presents a comprehensive study for use of bridge deck water proofing materials being used a membranes, applied by spray or sheet. An experimental evaluation of the crystalline capillary waterproofing coating, liquid water proofing materials and hybrid systems suitable for concrete has been carried out as per the protocols of available Euro /ASTM / IS Standards. The various characteristics such as tensile strength and elongation at break (%), heat ageing / thermal resistance, tear strength, resistance to water permeability, resistance to water penetration under pressure, resistance to chisel impact & aggregate indentation, rapid chloride penetration test (rcpt), crack bridging, tensile adhesion strength, shear adhesion Strength, etc., exhibits their suitability to use as bridge deck water proofing. An experimental investigation to other hybrid forms of bridge deck water proofing involving bio chemical liquid, spray applied to form gel within the concrete body is also investigated

and summarized in the paper. These materials have various ingredients and acceptable limits as per the internationally accepted norms. However, field observations suiting to the local environment under dynamic loadings would also be interesting to note. It is expected that the study would pave a way to establish a standard norms for application of appropriate technology for use of bridge deck water proofing materials in India and abroad, meeting International Standards and Codes of Practices.

Keywords: *Bridge, deck, water proofing, liquid, membrane*

BRIEF BIO-DATA:

Mr. J. K. Goyal, a Civil Engineer with Post Graduation in Structural Engineering from BITS Pilani. He has more than 33 years of professional experience in R&D and in the execution of Mega Civil Engineering Projects. He has been instrumental in implementation of National Highways Development Plans (NHDP) and Bharatmala Pariyojna.

His main area of work has been in the field of Bridge Health Monitoring Systems, Bridge Management and Rehabilitation of structures through sophisticated instrumentation and theoretical evaluations.

He has contributed to the evaluation of Railway bridges to study the effect of higher axle load. Shri Goyal has provided leadership to many projects in SERC/CRRI sponsored by Ministry of Road Transport and Highways, Indian Railways, State PWDs, Public Sector Organisations.

Shri Goyal has contributed significantly in Developing Infrastructure Information System for Maintenance of Bridges in India under Deptt. of Science and Technology and several Govt of India's Sponsored Projects.

He has been recipient of Swedish Road Authority (SIDA)'s Road Sector Management program fellowship.

As Project Director in NHAI he has handled the Golden Quadrilateral Projects in the State of Jharkhand and West Bengal. Also as Chief General Manager at National Highways Authority of India (NHAI), he was instrumental in framing several key provisions for Roads and Bridge Asset Management through scientific means in the Model Concession Agreements.

So far, Shri JK Goyal has published more than 150 Research papers, reports and contributed to IRC Publications.

Presently he is Chief Scientist and Head of Bridge Engineering Division in CSIR-CRRI.

Dr Narayan Chandra Pal
OSD-cum-Engineer-in-Chief (Civil)
PWD, Govt. of Odisha

ABSTRACT:

BRIDGE MANAGEMENT SYSTEM (BMS) - LESSONS LEARNED & WAY FORWARD

Bridge Management System (BMS) is a system designed to optimize the use of available resources for inspection, maintenance, rehabilitation, and replacement of bridges. Bridges in any highway network are valuable assets which cannot be built and just forgotten. It is a misconception that a bridge once constructed does not require any substantial maintenance for the first couple of decades. Though, pavement failures are common and visible, bridge failure when they occur often become catastrophic. Even high quality of construction without proper maintenance, will lead to early failure of the bridge. Bridge maintenance management is not merely a routine, but an art, which ensures that the bridges remain fit for their intended purpose over long period at minimum life cycle cost.

Considering the fact that number of bridges / bridge assets is increasing quite rapidly, there is a need to have scientific and rational approach based Bridge Management System. Bridges cannot be managed without the practical, experienced, and knowledgeable input of the engineer. Function of BMS is to provide bridge information and data analysis capabilities to improve the decision-making abilities of bridge managers. A fully operative BMS requires seven-steps process (i) inventorisation of bridge assets (ii) inspection & identification of distress (iii) condition rating (iv) prioritization of bridges for repair/ rehabilitation/ retrofitting/reconstruction (v) load carrying capacity evaluation of distressed/ deteriorated bridge (if bridges are to be strengthened) (vi) budgeting for the work and (vii) performance monitoring & evaluation. Bridge Management System consists of a database of bridge information and analysis tools to identify needs and prioritization for bridge maintenance, rehabilitation, and replacement. The IRC Guidelines for Inspection, Maintenance, Repair, Strengthening, Retrofitting & Rating of Bridges are available in our country for the purpose.

The most critical activity in BMS is bridge inspection for condition assessment. It is an essential element of any Bridge Management System particularly for aged and deteriorated bridges and a path way to condition rating. Bridge Maintenance includes both routine and preventive- maintenance. Maintenance is cyclic activity which is repeated over the life of the structure. It is preventative in principle and is generally straightforward, routine and repetitive. Bridge Routine Maintenance encompasses work that is performed in reaction to an event, season, or activities that are done for short-term operational need that do not have preservation value. This work requires regular reoccurring attention. Bridge Preservation is defined as actions or strategies that prevent, delay, or reduce deterioration of bridges or bridge elements; restore the function of existing bridges; keep bridges in good or fair condition; and extend their service life. Preservation actions may be cyclic or condition-driven. Bridge Maintenance and Preservation is generally done through a systematic process of Bridge Asset Management, which in turn is an integral part of any complete Highway/Road Asset Management Panning for an organization.

BRIEF BIO-DATA:

Dr Narayan Chandra Pal, is currently working as OSD-cum-Engineer-in-Chief in the Public Works Department (PWD), Govt. of Odisha. Dr Pal is a University Gold Medalist in Civil Engg. in 1985 who subsequently obtained M.Tech. and PhD in Structural Engg. from Civil & Aerospace Engg. Dept. of IIT-Kharagpur . He was a Study Fellow in University of York, United Kingdom for a course on Structural Conservation of Heritage Structures under a British Council Fellowship programme in 1995. He has over 35 years of experience in teaching, research, design, planning and consultancy management in the transportation sector and in execution of structural works including rehabilitation & retrofitting.

He has more than 40 research papers in International Journals/ International Conferences / National Journal

His areas of expertise include Computational Mechanics, Structural Design with Concrete, Steel and Laminated Composite Structures, Structural Restoration of Monuments, Road and Bridge Asset Management.

He took the lead role in developing and commissioning the web-based ORAMS (Odisha Road Asset Management System) for the state of Odisha in 2015 with funding provided by the World Bank.

Dr. Pal is an active member of various Road & Bridge Committees of the Indian Roads Congress (IRC) which is the apex body responsible for guidelines for road and bridge infrastructure in India. The first IRC guidelines on Road Asset Management ("IRC-130-2020") were prepared by the IRC H6 Committee under Dr Pal's Chairmanship.

He is also working as Member of Technical Expert Committee constituted by Govt of India (Archaeological Survey of India ASI) for two important monuments of the country (Lord Jaganath Temple at Puri and UNESCO Heritage structure of Sun Temple at Konark since 2010.

He has visited various countries during his service tenure namely Italy, United Kingdom, Canada, and to the European Country of France & Germany for exposure training on structural restoration, Asset Management & Road Sector Tolling Technology. Last year Dr Pal had visited Dhaka, Bangladesh as an International Guest Speaker on invitation from World Bank on Bridge Asset Management.

Dr. Pal was awarded with Govinda Gupta memorial award by the Institution of Engineer, Odisha State Centre in 2003 for his outstanding R&D contribution for the state of Odisha besides several other awards / gold medals by the engineering fraternity.

Colonel Parikshit Mehra

Border Roads Organization

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ABSTRACT:

CHALLENGES IN TUNNEL CONSTRUCTION IN INDIA

1. Current pace of urban development has created space constraints which has made way for a revolution in underground space. Recent strategic imperatives have led to requirement of Tunnels and underground storage across Himalayan ranges. Energy security & green energy requirements have given a new fillip to the hydro sector. These aspects have all made underground structures and tunnels extremely relevant in today's infrastructural context. The industry size has been growing exponentially and is likely to a major contributor in uplifting quality of life as also national GDP.

2. These underground structures are being built in shallow and deep underground space, in soils and in rocks, which solicit specific analysis and approaches for optimised construction. It is hence imperative to understand these sciences in detail and appreciate that the unpredictability involved need these works to be contracted with a nuanced approach. Understanding requirement of geo-mechanical modelling to predict rock mass behaviour and essentiality of using Earth Pressure Boring Machines to preclude ground settlements are imperative to safer construction.

3. Additional challenges of lack of trained engineers, lack of standardisation, improper investigation techniques, inadequate DPRs and improper risk allocation in contracts are also ailing the industry. An insight into fundamental differences in underground structures and other civil engineering structures is crucial to handle underground construction projects. Himalayas being a young range add to these woes owing to subduction & heightened tectonic activity.

4. Underground construction needs to be taken up with observational techniques to dynamically assess ground behaviour to ensure safety as also to optimise support systems. NATM approach is one such popular approach which has found great success in Indian context and was used in Tunnels like Atal Tunnel, Rohtang & Chenani Nashri Tunnels to name a few. Site systems need to be evolved to ensure scientific application of these techniques to make underground construction safer and cost effective.

5. The talk attempts to flag these issues & offer a way forward to ensure seamless progress of underground projects. The underlying idea being to bring the government and private players together in sharing risks and spearheading this much required revolution as equal partners for a better India.

BRIEF BIO-DATA:

Col. Parikshit Mehra was commissioned Corps of Engineers after passing out from Indian Military Academy. Before joining the armed forces he has acquired his B.Tech. (Civil Engineering).

He has rich combat engineering experience in both deserts and mountainous terrains and has been deployed in the formidable Siachen glacier as part of his regimental service. He is also an expert on nuclear, biological and chemical warfare.

The officer has been involved with many roads and tunnel infrastructure works. He has worked on Indo-China Border Roads in High altitude areas in Sikkim, commanded a Road Construction Company of Border Roads Organisation in Bhutan tasked to maintain and upgrade Asian highway 42 from Phuentsholing to Thimphu and a Border Raods Task Force in Arunachal.

Col Mehra is also an alumnus of IIT Delhi where he acquired M.Tech. in Rock Mechanics and Underground Structures (Tunnels) and has to his credit another Master's degree in Tunnelling with specialisation in NATM from Technical University Graz, Austria.

He has played a pivotal part in construction of Rohtang Tunnel in Himachal as part of Border roads Organisation where in recognition of his extraordinary contribution he has been awarded with Sena Medal, Distinguished by the government. As Cdr 42 BRTF, He was also Project Director for Sela and Nechiphu Tunnel projects in Arunachal Pradesh.

He has also rendered significant contribution in the rescue of 41 workers trapped in Silkyara Tunnel in Uttarkashi where his role has been appreciated by all national and international tunnel experts.

The officer is a member of H10 committee of IRC for codes for Hill Roads and Tunnels. He is nominated on the panel of experts for Tunnel related matters by Ministry of Road Transport and Highways.

Mr. Yousef Es'haghpour Rahimabadi

Team Leader of AE for NHIDCL Project

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ABSTRACT:

IMMENSE GREEN TECHNOLOGIES IN ROAD & TUNNEL PROJECTS

Brief about the green technologies

Green Technology for Highways

- Con – Aid / CBR Plus Technology (other than Road Packers)
- Clean Development Technologies (CDM Technologies)
- Lightings & energy saving technology.
- Digital Intelligent Monitoring & Maintenance Technologies.
- Usage of Carbon Based materials in strengthening the structures.
- Natural Materials Nano Paints for Road ways & Tunnels.
- Emerging day technologies in road construction at High Altitude.

Smart Roads & pavements fitted with Wi-Fi transmitters, Advance 'Micro pile or Cementitious Sub-Base (CTSB) technology' Use of Extruded Polystyrene sheet (XPS) over Subgrade Layer, Use of Flexible Concrete Interlocking Block pavements.

Green Technologies for Tunnels

- Noise control & Harmonization Technologies. (IPR Technology)
- Clean Development Technologies (CDM Technologies).
- Prefabricated construction (TBM) Technology, Lighting & Energy saving Technologies, Digital intelligent monitoring & maintenance Technology, Ventilation technology, Disaster Control Technology.

Miscellaneous

LED lights, smart thermostats for optimized energy consumption, energy-efficient insulation, and cool roofs to maintain comfortable environments while minimizing energy usage.

Self-cleaning Nano paints made from natural mineral materials offer durable and aesthetically pleasing solutions to infrastructure maintenance.

Concluding

By incorporating green technologies, we demonstrate our commitment to sustainable and resilient highway infrastructure. These innovations not only reduce environmental impact but also provide safe and reliable transportation routes for the future. The future of highway infrastructure looks brighter and greener than ever before with our more efforts to implement them in these advancements.

BRIEF BIO-DATA:

- Full Name & Surname : Yousef Es'haghpour Rahimabadi
- Education: M.E, Structure, from Karnataka University (1989)
- Field Experience:

  34 years diversified Experience in project execution & management (Mainly for Tunnels) with IMS System, cost control and technology transfer, Strategic planning As Site engineer, Project manager, Team Leader, PMO Director & Executive advisor in transferring Green technologies
- Fields of work: Tunnels & Highways
- Countries worked :

  Iran, UAE, Oman, Qatar, Iraq, Afghanistan & Republic Of Azerbaijan, India
- Work proficiency :
  - Project management as PM and Team Leader.
  - Contract management (In IMS system, Cost & time control), Strategic Planning.
  - PMO (Level 5 and excellent) Director, International affairs & contractual deals.
  - Financing Schemes (BOT, BOO, BOLT & Pure F) with relevant processes of Risk Factors control and studies.
- Worked with Esteemed International Firms:
  - Dress & Sommer, MRK consultants from Germany.
  - Halcrow Consultants from England.
  - CATIC, CITIC, NORINCO, CSCEC, SINOPEC EPC Contractors & financiers from China
  - ICT Consultants from India

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Longspan Structures Pvt. Ltd., Pune

ABSTRACT:

ULTRA HIGH-PERFORMANCE FIBER REINFORCED CONCRETE TECHNOLOGY

UHPFRC is a high-strength, high-durability cementitious material. It has the potential to be a viable solution for improving the "Sustainability" of infrastructure components. UHPFRC has grown in popularity in many countries over the last two decades for various infrastructure building applications. Among all of these applications, bridge construction are the most common for UHPFRC use.

Both the Government and Industry are increasingly paying closer attention to and pushing for greater efforts to make use of this novel and promising material for building more Durable, Sustainable, Economical infrastructure for Nation's growth.

BRIEF BIO-DATA:

Satish Navanale- Chief Operating Officer is Engineering Professional with extensive experience of 26 years in Infrastructure Projects. Worked with Construction companies such as Gammon India Ltd, L&T and Reliance Infrastructure. Played key role in Development of UHPFRC Technology and contributing in Technology Implementation in more than 52 UHPFRC bridges currently in India.

Dr. Harshavardhan Subbarao,

Chairman & Managing Director

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ABSTRACT:

An ongoing study based on developing a data base of more than 200 bridges including footbridges, short span and long span bridges of all types, Fixed links, for highways, railways and pedestrian loading have been considered in a data base study and very interesting trends have emerged regarding the carbon footprint of bridges. The paper entitled 'An Update on Carbon Footprint of Bridges' was recently presented at the IABSE Congress New Delhi, 2023

Sustainability of bridges has to address the 3 pillars of sustainability viz. economic, social and environmental whilst considering reduction in the embodied carbon.

Procedure to calculate embodied carbon and carbon calculators are available but require further development for their everyday use in bridges. Assuming a common frame work and basis and applying the same on a data base will show various trends. David Collings [1] [2] and his team at renowned Consultants, Arcadis, have developed such a data base and evolved the trends discussed in the presentation

The key findings are: 1. Reduce and minimize the size of all bridges i.e. length or area. 2. Reduce span to a minimum 3. Substructure and foundation have the maximum embodied carbon and therefore the size of substructures should be minimized and pile caps, piers, pier caps and all substructure components should be minimized. 4. Collings has proposed an approach to calculate the embodied carbon simply on the basis of span which allows benchmarking of designs relative to others by being in the lower quartile of the proposed equation based on span length, else it has to be redesigned. Thus a rating system has been arrived which is simple to use and over comes the shortages of the SCORBS which neglected in which the carbon footprint is normalized in keeping with the PAS 2080 Carbon Management in Infrastructure [3]. SCORBS system [4] does not differentiate between the loading type or span for different bridge structures. 5. For long Bridge–only links [as compared to bridge island tunnel type have lower carbon footprint due to reduced construction time and their lower overall cost.

Important lessons are presented which are derived from these trends and give guidance to bridge design engineers to intervene at the concept and design stage itself so as to reduce the carbon footprint of bridges.

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TECHNICAL SESSION - 6

INNOVATIVE TECHNOLOGIES OF PROJECT PLANNING, DPR, SURVEY, STRUCTURAL DESIGN, MIX DESIGN, PROJECT MONITORING USING IOT, GIS, AI, DRONE, BIM, 3D, DIGITAL TWIN AND ROAD ASSET MANAGEMENT

Chair

Mr. R. K. Pandey
Advisor to the Hon. Minister of Road Transport & Highways

Co-Chair

Ms. Susanna Zammataro
DG, IRF

Innovative technologies are revolutionizing every aspect of infrastructure project lifecycle from initial planning to ongoing asset management. In project planning, digital tools like Building Information Modeling (BIM) facilitates collaborative design, clash detection, and visualization, streamlining the development of detailed project plans and reducing errors. Detailed Project Reports (DPR) benefit from advanced surveying techniques such as LiDAR and drones, providing accurate terrain data and enabling precise project mapping. Structural design benefits from sophisticated software and algorithms, optimizing designs for efficiency, durability, and safety. Mix design for concrete and asphalt incorporates advanced materials and computer simulations, ensuring optimal performance and sustainability. During construction, IoT sensors and drones provide real-time data for project monitoring, while Artificial Intelligence (AI) algorithms analyze this data to identify potential issues and improve decision-making. Geographic Information Systems (GIS) integrate spatial data for enhanced project planning and monitoring, while Digital Twins provide virtual replicas of infrastructure assets for simulation and analysis. Similarly, Road Asset Management systems utilize data analytics and predictive maintenance algorithms to optimize maintenance schedules and extend the lifespan of road infrastructure, ensuring efficient and cost-effective management throughout its lifecycle.

Mr. Tony Mathew

Principal Transport Specialist

Transport Research Laboratory (TRL)

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ABSTRACT:

DIGITAL TECHNOLOGIES FOR RESILIENT AND ROAD ASSET MANAGEMENT

Road network is critical asset for the performance of a larger economy like India. India's investment in creation of road network assets runs into billions of dollars. While we invest in creation of these road assets, it is important that we invest in appropriate technologies and business processes to operate and maintain a road network which offers safer, smoother and reliable journeys to the road users.

For optimum management of the network, road agencies must use the emerging digital technologies and road asset management system which can provide useful and relevant information from various data sources and analytical capabilities to improve safety, resilience and reliability of the road network.

Tony Mathew's presentation will explore the transformative potential of TRL's Road Asset Management System iROADS in building resilient road infrastructure and optimizing asset management practices covering the following themes:

Data-driven Decision-Making	The foundation of resilient road asset management lies in data-driven decision-making processes. By harnessing data from various sources such as sensors, GIS mapping, historical maintenance records, and weather forecasts, agencies can gain comprehensive insights into asset conditions, performance trends, and potential risks. This enables proactive decision-making, prioritization of maintenance activities, and optimization of resource allocation to enhance infrastructure resilience.
Predictive Maintenance and Risk Mitigation	Digital technologies empower road asset managers with predictive maintenance capabilities, allowing them to anticipate and mitigate potential risks before they escalate into costly failures. Through the application of advanced analytics, machine learning algorithms, and predictive modelling techniques, agencies can forecast asset deterioration, identify vulnerable areas, and implement targeted interventions to extend asset lifespan and minimize disruptions to transportation networks.
Real-time Monitoring and IoT Integration	The integration of Internet of Things (IoT) and real-time monitoring systems provides unprecedented visibility into road asset conditions and performance metrics. Sensors embedded in vehicles and network can continuously collect data on factors such as pavement condition, traffic flow and environmental parameters. This wealth of real-time information enables rapid response to emerging issues, early detection of anomalies, and dynamic optimization of maintenance strategies to enhance infrastructure resilience.

Climate Resilience and Adaptation	Climate change poses significant challenges to road infrastructure, including increased frequency and intensity of extreme weather events, rising sea levels, and shifting temperature patterns. Digital technologies play a crucial role in enhancing infrastructure resilience by integrating climate data into asset management systems, facilitating climate risk assessments, and informing adaptation strategies. By understanding the specific vulnerabilities of road assets to climate-related hazards, agencies can prioritize investments, implement resilience measures, and future-proof infrastructure against evolving environmental threats.

BRIEF BIO-DATA:

Tony is a postgraduate in Road Management and Engineering from the University of Birmingham and is a practicing road safety and asset management professional. Tony has significant experience in implementation of projects involving digital technologies (safety & assets) in various countries in Europe, Africa, Middle East and India. Tony is heading the operations and delivery arm of Transport Research Laboratory (TRL) India business and is responsible for delivery of projects in Asia and Africa region.

Currently, Tony is engaged with various public sector clients to develop digital and institutional solutions for improved road safety and asset management. Tony is particularly interested in road crash and asset condition data, advocacy and promotion of road asset management systems in low- and middle-income countries and its role in developing a safe and resilient network.

Earlier, Tony was involved as an advisor to UN-ESCAP to develop road safety infrastructure guidelines to be adopted in Asian Highways by all member countries. Tony is also an established trainer and noted speaker on role of data in road safety and asset management and has presented papers in various technical forums in in Australia, Ghana, Tanzania, Bangladesh, UK, Thailand and India.

Dr. Rakesh Kumar

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ABSTRACT:

A NEW TECHNOLOGY FIRST TIME USED IN INDIA FOR IMPROVING THE RIDING QUALITY OF A NEWLY CONSTRUCTED CONCRETE EXPRESSWAY: A CASE STUDY

India is one of the largest markets for construction materials, construction equipment, innovative materials, technologies relating to SDGs and reduction to the causes of global climate change, and road user safety. Several thousand kilometers of cement concrete roads have been built in India in the past few years. They consist of a mixture of fully access-controlled modern expressway, highway and narrow national highway besides other roads including city roads and rural roads in various parts of the country under different government schemes. The Government of India encourages the use of innovative materials, new materials, new techniques and technologies etc., to ensure improved construction of the road infrastructures. The first impression of the quality of a newly constructed road emerges from the driver's experience of the riding comfort while driving the vehicle at near about the designed permitted speed on that road. The poor riding quality compounded with premature distresses of some stretches on many concrete highways (including expressways) constructed recently in our country is questionable/unacceptable for the permitted speed. For newly constructed cement concrete pavements, poor riding quality or higher RI or IRI can have a significant adverse impact on the user's comfort, user health & safety, driving economics, including increased fuel consumption & vehicle maintenance cost, pavement service life, and finally, the environment. This paper presents a case study where a new technology (first time in India) of macro-milling on the concrete surface of an expressway was adopted to improve its riding quality. It further discusses its suitability for a newly constructed highway. The paper finally sends a strong message that any new technique, technology and similar things can only be tried after a good understanding and deep study for their applicability and limits.

BRIEF BIO-DATA:

Dr. Rakesh Kumar, is a Chief Scientist and Head of Rigid Pavement Division of CSIR-Central Road Research Institute (CRRI) New Delhi. The recipient of the 11th Construction Industry Development Council (CIDC) Viswakarma Award 2019 for the Scientist, possesses professional work experience of more than 33 years in India and in the USA. Dr. Kumar, the former BWC member of IIT-Indore did his Doctoral Degree in Civil Engineering from I.I.T. Delhi after Graduating in Civil Engineering. Over 33 years of his productive research, academic and consultancy career, has produced over 90 peer reviewed journal & conference publications (citations over 1497, h-index - 14, i10-index-19), 1 Book Chapter,

and Two books. He currently serves as a reviewer on over 10 prestigious journals (ACI Materials, ACI Materials and Structures, ASCE, Cement and Concrete Research, Road Materials and Pavement Design, Construction and Building Materials, ICJ) and an editor of an International Journal, Journal of Sustainable Construction Materials and Technologies. In addition, he has participated in many international and national conferences in roles such as technical session chairman, co-chairman, conference paper reviewer, and conference technical committee member. Being a member of ISO/TC71/CED2/CED5 committees of BIS he has reviewed multiple BIS & IRC and ACI standards and codes, handbook chapters, and theses. His research interests include, distressed analysis, repair & rehabilitation of road, prevention of premature failure and enhancement of service life of highway infrastructures, Carbon dioxide (CO2) sequestration in cement-based materials, and use of advanced materials such as Micro, Macro and Nano materials, construction chemicals etc., for improvement of durability and constructability of concrete based infrastructures, Utilization of industrial and post-consumer by-product materials i.e. coal ash, cement kiln dust, foundry dust, quarry byproducts, construction and demolition waste, etc., as a partial replacement of basic ingredients of concrete for contribution towards meeting SDGs leading to sustainable development and a greener construction.

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ABSTRACT:

LEVERAGING DATA LAKES FOR INTELLIGENT ROAD INFRASTRUCTURE DEVELOPMENT

Data Lakes are revolutionizing the way we collect, store, and analyze data in the road infrastructure sector. This presentation will explore the transformative potential of Data Lakes in enhancing the efficiency, sustainability, and safety of road projects.

Data Integration: Data Lakes allow for the seamless integration of diverse data sources, including sensor data, weather information, traffic patterns, and construction updates. By consolidating this data in a centralized repository, stakeholders can gain a comprehensive view of road infrastructure projects and make informed decisions.

Predictive Analytics: The use of Data Lakes enables the application of advanced analytics and machine learning algorithms to predict maintenance needs, optimize traffic flow, and enhance road safety. By leveraging historical and real-time data, road authorities can proactively address issues and improve overall infrastructure performance.

Cost Efficiency: Data Lakes can significantly reduce data storage and processing costs by providing a scalable and flexible architecture. This allows road authorities to efficiently manage large volumes of data without the need for expensive infrastructure upgrades.

Case Studies: The presentation will also showcase real-world case studies where Data Lakes have been successfully implemented to improve road infrastructure. These examples will highlight the tangible benefits and ROI of adopting Data Lakes in road projects.

Conclusion: Embracing Data Lakes is key to unlocking the full potential of data-driven decision-making in road infrastructure development. By harnessing the power of data, we can create smarter, safer, and more sustainable road networks for the future.

Mr. Amit Saxena

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BRIEF BIO-DATA:

Currently working as Head of Sales across SAARC Region for Geospatial vertical at Trimble Inc. catering important sectors including Road, Defence, Land Records and construction. Having over 25 years of experience in Leadership position across in the Asia Pacific region managing technology business for the Engineering and Construction sector. Has worked with leading Multinational and Indian companies including Trimble, Bentley Systems etc. managing highly successful Sales, Business Development and Technical teams. Worked in sectors including Road, Rail, Defence, Water etc. and thus having rich experience of understanding the challenges faced in these sectors and with technology implementation helping various organizations mitigating some of these challenges. By profession, having Engineering and MBA degree.

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ABSTRACT:

SAFETY AUDITING, CAPACITY AUGMENTATION AND SERVICE LIFE ENHANCEMENT OF ROAD BRIDGES – THROUGH DETAILED INSTRUMENTATION, FIELD TESTS AND SIMULATIONS

In spite of extremely rigorous and stringent time-based maintenance regimes and the most advanced analysis-based design principles followed, catastrophic failures continue to take place, claiming invaluable lives and critical engineering assets such as bridges. Such failures bring to evidence a serious gap in today's science and technology capabilities. Conventional non-destructive evaluation (NDE) based maintenance can do little when flaws are induced and become critical between successive maintenance schedules. In the last decade and half, there has been an overwhelming interest throughout the civil/mechanical engineering communities, to address this issue by real-time detection of damages at an early stage of their growth, which has led to the development of the general area of Structural Health Monitoring (SHM). It is essentially achieved by combining the conventional NDE with built-in actuators and sensors, and appropriate domain models and data analytics for feature extraction from the sensor signals for detecting, localizing and characterizing the damage. This leads to a paradigm shift from the regular schedule-driven maintenance to a condition-based as-needed maintenance regime. Apart from preventing catastrophic failure, a robust SHM strategy can provide several other benefits such as significant reduction in the downtime and enhancement of structural integrity, and increase in operating life of the structures. A large number of bridges in our country are steadily aging and deteriorating, and many of them are beyond their design life. Due to shortage of resources to replace them, it is now necessary to extend their design life without compromising the underlying human risk or incurring unnecessary financial burden.

CSIR–SERC (Structural Engineering Research Centre), Chennai, Tamilnadu, India is a constituent Laboratory of CSIR (under Ministry of Science and Technology) devoted to R & D activities in the areas of Structural Engineering / Civil Engineering and related subjects. CSIR-SERC, with world-class facilities, expertise and vast experience, is uniquely contributing towards safety auditing, capacity augmentation and service life enhancement of bridges in India. CSIR-SERC extensively works on (i) full-scale load testing of the bridges, (ii) condition assessment and non-destructive testing of bridges, complete instrumentation of super- and sub-structure, (iii) response measurements of in-service bridges under vehicular traffic, performance evaluation of bridges under service load conditions as well for increased vehicular load demands, (iv) distress diagnosis and damage assessment of bridges to identify the weak zones in the bridge structures based on static and dynamic measurements, (v) capacity augmentation of bridges, (vi) life enhancement (repair, rehabilitation, retrofitting, and strengthening) of bridges, (vii) complete and long term structural health monitoring of bridges (SHM), and (viii) overall design and proof checking of all types of road bridges. This talk will present a glimpse of different challenges, various types of instrumentation, health monitoring strategies and techniques for assessment and life enhancement of existing bridges.

Keywords: *Bridges, Safety audit, Capacity augmentation; Life enhancement, Instrumentation, Numerical simulations, Multi-metric SHM*.

BRIEF BIO-DATA:

Saptarshi Sasmal is the Chief Scientist and Head of Special and Multifunctional Structures Laboratory of CSIR–Structural Engineering Research Centre, India. He is also the Professor of Academy of Scientific and Innovative Research (AcSIR) an Institution of National Importance by an Act of Parliament. He was awarded the DAAD fellowship for carrying out his PhD in Universitaet Stuttgart, Stuttgart, Germany. He received Gold medal from Jadavpur University, Kolkata for securing the topmost position in post graduate and Outstanding Grade thesis from University of Stuttgart. His research interests include smart/multifunctional composites, integrity assessment, structural health monitoring, *computation mechanics and multi-scale modelling.*

He has contributed to various mission mode and niche creating projects. He has closely worked with many industries including Ministry of Road Transport and Highways (MORTH), NHAI, NHIDCL, CPWD, state PWDs, RDSO, Indian (zonal) Railways, Visakhapatnam Port Trust, Central Water Commission, L&T, ADANI Energy, IOCL, IRCON, RVNL, etc for solving wide range of challenges related to integrity assessment, health monitoring and life enhancement of structures.

He has published more than 130 papers in SCI/peer reviewed journals and more than 100 publications in conference proceedings. He has also contributed to several book chapters. He has guided 7 doctoral thesis and 22 post graduate students till date.

Dr. Sasmal is the Associate Editor for American Society for Mechanical Engineers; Editor for Journal of Structural Engineering (Madras). He is in the Editorial Board of Structural Engineering and Mechanics, and also for, Advances in Computational Design, *An International Journal.*

Dr. Sasmal's work has been recognized nationally and internationally. He is recipient of several awards including elected Fellow of the Indian National Academy of Engineering (FNAE), Fellow of Institution of Engineers (India), Research Ambassador for Germany by DAAD, Raman Research Fellowship in 2019, Dr. M. Ramaiah Award (awarded several times annually for best paper by scientists of CSIR-SERC), Young Scientist Award - 2013 by Indian Concrete Institute (ICI), E.P.NICOLAIDES PRIZE by Institution of Engineers (India) in 2013, Jai Krishna PRIZE by Institution of Engineers (India) in 2013, Outstanding Young Concrete Engineer - 2012 by Indian Concrete Institute (ICI), Tamil Nadu Chennai Centre and UltraTech Cement, L & T Dr A Ramakrishna Young Engineer Award – 2011 by Institution of Engineers (India), AP for *outstanding contribution in Structural Engineering,* CSIR Young Scientist Award in Engineering Sciences for significant contributions to *condition assessment and strengthening of structures,* DAAD (Long Term) Fellowship for PhD studies in University of Stuttgart during 2006-2009, Germany, George Oomen Memorial prize from *Institution of Engineers* (India) for the Best paper in Civil Engineering in 2005, Washington Chapter Annual Fellowship for merit and academic activities, from N.C.E. Bengal & Jadavpur University in 1997, etc.

START-UPS

PRESENTATION OF
NEW RESEARCHES AND INNOVATIONS

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ABSTRACT:

6Es: FASTER AND MORE ACCURATE WITH PROJECT iRASTE

Govt. of India (GoI) is driving a vision of 50% reduction in road fatalities on Indian Roads by 2030. Technology can act a force multiplier in addressing the problems of road safety on India's roads. Artificial Intelligence (AI) based solutions have shown remarkable results worldwide in enabling safer Mobility and Transportation systems.

Project iRASTE (**I**ntelligent Solutions for Road Safety through **T**echnology and **E**ngineering) was conceptualized to take a holistic approach towards road safety that essentially combines measures from multiple disciplines into one integrated approach to reduce road accidents. For the first time in India, Artificial Intelligence (AI) scientists teamed up with Road Engineering experts to transform road safety engineering by leveraging the predictive power of AI.

In this project, we have fused together Computer vision algorithms, Advanced Driver Assistance Solutions (ADAS), Driver Monitoring Systems (DMS), AI based prediction models, Innovative Driver training methods, Transport engineering, Wide scale citizen awareness programs & Golden hour black spot intervention programs (Trystander Cells) in a comprehensive manner. The project integrated technology and engineering solutions into the existing 5E framework for Road Safety that led to faster implementations and accurate monitoring. The first implementation is in Nagpur, launched by Minister Shri Nitin Gadkari in September 2001, and the outcomes as on date are listed below.

- 41% lower accidents in ADAS equipped buses in '23
- New AI Model developed to predict Greyspots (Potential Black spots)
- DPRs Implemented at 4 Black spots
- 31 lives saved in past 4 months @ 8 Trystander cells

In addition to these, a new **E** (Encouragement) was also integrated into the project. This element adds incentives to the drivers for adhering to the rules at signal junctions and serves as a positive re-enforcement mechanism.

The second implementation was in Telangana and there are two key differences. On the Engineering side, some of the buses were equipped with DMS systems in addition to ADAS systems so that a more comprehensive picture of both Road facing and Driver facing situations is available. Also, the focus in Telangana was on the Highways (Hyderabad-Vijayawada & Hyderabad-Bengaluru) that contribute a lion's share of the accidents in our country. The initial results in Telangana have been very encouraging where accidents in ADAS equipped buses are NONE or ONE /month over the Jan-Sep '23 period.

Project iRASTE is now India's largest study of ADAS for commercial vehicles covering more than 500 buses in Nagpur and Telangana. Between Nagpur (Urban Roads) and Telangana (Highways), Project iRASTE covers the major types of roads in India and created a blueprint on how to fuse together Artificial Intelligence (AI) based predictive technology into with traditional engineering and awareness practices to reduce road accidents. This technology led 6E approach (with the addition of new E: Encouragement) is faster to implement and enables more accurate monitoring compared to existing approaches.

BRIEF BIO-DATA:

Varma S. Konala is a 26 year Intel veteran with the first 5 years in design, testing, & validation followed by 21 years in all facets of marketing (tech, product, planning, ecosystem enabling & business development). Majority of his business side experience has been in a start ups like environment handling multiple responsibilities taking products from conception to revenue. He is currently on deputation from Intel as the CEO of INAI, the Applied AI research center in IIITH that is a public-private collaborative effort between Intel, IIITH, PHFI and Government of Telangana.

Project iRASTE brings together Artificial Intelligence (AI) scientists and Road Engineering experts to transform road safety engineering leveraging the predictive power of AI. The project integrated technology and engineering solutions into the existing 4E framework for Road Safety that led to faster implementations and accurate monitoring.

Dr. Venkata Satyanand Mutnuri

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ABSTRACT:

The current infrastructure is undergoing a significant change, driven by a surge of cutting-edge technologies that are set to disrupt traditional methods in multiple industries. TiHAN (Technology Innovation Hub on Autonomous Navigation), IIT Hyderabad has been actively involved in development of autonomous vehicles and data acquisition systems innovations for on-road and off-road conditions.

The autonomous campus shuttle developed by TiHAN showcases a novel cutting-edge technology, offering a convenient and efficient mode of transportation within the campus premises/controlled environments. It employs AI-driven multi-sensor fusion techniques, to achieve digital-twin based environment perception, mapping, localization, and autonomous navigation.

A revolutionary 5G C-V2X communication platforms has been indigenously developed and introduced by TiHAN, to enable a seamless communication between moving vehicles and infrastructure. This technology holds potential in optimizing traffic management and mitigating road accidents in congested urban environments and in hilly terrains.

On the off-road technologies front, an automatic weight-balancing stair climber, with its patented chassis design redefines material handling in various industries, from logistics and construction to retail and hospitality. It can carry up-to 500kgs with autonomous load adjustment in difficult terrains. It promises effortless movement of heavy loads on staircases and enhances operational efficiency and workplace safety while significantly reducing manual labour costs. A smart electric power tiller has also been developed as a paradigm shift in agricultural equipment rental agencies. The innovation not only alleviates financial burdens for rental agencies but also extends affordability to low-income farmers, fostering accessibility and sustainability in land preparation, cultivation, and post-harvest operations. It offers 10x lower operational expenses for rental agency and 25% lower rental cost for low-income farmers. The design and development of an off-road Remotely Operated Vehicle (ROV) showcases a fusion of advanced communication technologies and robust mechanical designs. With the capability to operate in diverse terrains, including staircases, and even handle ammunition, these ROV redefine tactical operations for entities such as the Indian Army, Border Security Force, and law enforcement agencies.

In drone-based technologies, an aerostatic drone's technology has been developed for aerial surveillance and supply chain logistics. It leverages buoyancy and aerodynamics for extended flight endurance and enhanced drone operations safety. TiHAN has developed Standard Operating Procedures (SOPs) for autonomous ground vehicles and drone-based infrastructure assessment. For ground vehicles, it aims to establish a robust framework for the deployment of autonomous vehicles (AVs) on public roads by enhancing the efficiency of AV operations and road safety. The bridge inspection procedures encompass a comprehensive approach for practical field implementation. In the recent times, it is indeed challenging to manage urban traffic networks. TIHAN is developing drone-based solutions

for effective traffic management. These drones autonomously navigate to the congested areas, and aid in management by providing live data to the controllers to take further steps in less time. The frames captured from the camera are sent to an edge computing device for video analytics and real-time traffic parameters estimation

BRIEF BIO-DATA:

Dr. Venkata Satyanand Mutnuri is the Technical Officer of the Technology Innovation Hub on Autonomous Navigation Foundation (TiHAN) at IIT Hyderabad. His research interests include autonomous navigation of vehicles, multi-modal sensor data collection for Indian scenarios, and the design of control laws for aerial vehicles. He has contributed to theoretical research on wave propagation analyses in vehicular structures and published several articles in journals and peer-reviewed conferences.

Mr. Chaman Tulsyan

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ABSTRACT:

REJUPAVE – INNOVATION IN SUSTAINABLE ROAD DEVELOPMENT

REJUPAVE is an innovative product revolutionizing road construction and maintenance in India by effectively recycling distressed bituminous layers in a road structure. In India, where most roads are bituminous pavements, regular resurfacing every 3 to 4 years is essential to maintain quality. Traditionally, this involved overlaying distressed pavements with fresh bitumen and aggregates, significantly increasing pavement thickness. In place of this practice, distressed bituminous layers can be milled and reutilized through our indigenously developed technology "REJUPAVE" using hot recycling process. This can not only lower down the cost of maintenance but also conserve the bituminous binder. REJUPAVE employs a bio-oil-based rejuvenator that allows for the hot recycling up to 70% of Reclaimed Asphalt Pavement material (RAP) in new bituminous mix for binder and wearing course layers (current practises are limited to up to 30% RAP usage).

REJUPAVE is the first pavement recycling technology developed in India. It has been jointly developed by CSIR-CRRI and Verma Industries. It is a patented technology and has been tested by the NCAT (National Centre for Asphalt Technology), USA. REJUPAVE allows the use of high RAP content in the hot mix, significantly reducing the cost of material used and incurring huge cost savings on the project (up to 40% cost savings).

REJUPAVE is a 100% environment friendly and sustainable product, utilising plant based raw materials having zero environmental impact. REJUPAVE enables the conservation of precious natural resources by recycling the aggregates and bitumen which would have otherwise been wasted. It reduces the dependency on mining activities and on imports by reducing the demand of bitumen which is largely an imported material in India. REJUPAVE significantly reduces the energy usage, thus conserving energy required for production of Hot mix asphalt. REJUPAVE eliminates the problem of increasing road levels due to overlay of Hot mix asphalt.

REJUPAVE curtails energy consumption during the asphalt production process. Lower production and laying temperatures for recycled asphalt mixes, facilitated by the technology, lead to energy savings. This aligns with global efforts to reduce carbon emissions associated with energy-intensive operations, highlighting the innovation's eco-friendliness.

The market response to REJUPAVE technology reflects a keen interest in sustainable and cost-effective road construction solutions. Its successful application, industry recognition, and alignment with environmental goals indicate a promising future and a positive market reception. Further widespread adoption and implementation is expected as the industry recognizes the significance and benefits this innovation brings to road infrastructure development.

Rejupave is proudly made in India, positioning the nation as a hub for sustainable road construction solutions. In essence, REJUPAVE stands out for its pioneering approach in addressing the need for sustainable and cost-effective road maintenance, firmly placing it as a beacon of innovation in the construction industry.

REJUPAVE has also been awarded “Product Innovation of the year” by Construction World.

BRIEF BIO-DATA:

Mr. Chaman Tulsyan, as President of Verma Industries has experience in Road Construction Industry of 15+ years with forays into Bitumen, Bitumen Emulsion, Modified bitumen such as PMB, CRMB, etc while also delving into his passion area of Research and Development with close working association with premier bodies across India such as CSIR-CRRI and IIT. REJUPAVE, as a patented technology has been initiated under his able guidance, in collaboration with CRRI, making it a path breaking innovation in sustainable road development. Among other areas, TERASURFACING is another such technology which utilizes industrial waste material such as Steel slag fines, fly ash and marble dust in road construction. POTSEAL is another such example of technological marvel. With a thirst for innovation and sustainability, he has led Verma Industries to the pinnacle of technological intervention. He is also closely and actively involved in many Central Ministerial core groups and bodies for different policymaking.

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ABSTRACT:

PERFORMANCE INVESTIGATION OF ASPHALT BINDER PARTIALLY REPLACED NY BAMBOO BIO-OIL

As per the national policy on biofuels 2018, there is a surplus of biomass of about 120 to 160 MMT, much of which is either combusted or ends up in landfills, but it has a huge potential to be processed into biofuel and other value-added products. Bio-oil is one amongst such value-added product that has the potential to replace petroleum-based binders. The use of bio-oil in the replacement of petroleum-based binder is assessed in these three ways: as a modifier (10% replacement), as an extender (25 to 75 % replacement), and as a direct alternative (100% replacement), hence, promoting circular economy and sustainability principles.

In this regard, this study investigates the properties of asphalt binder when partially replaced by slow pyrolysis bamboo bio-oil. For this purpose, 10%, 20% and 30% of bio-oil were blended in asphalt binder (VG30) by the total weight to obtain bio-oil-based binder. Along with physical properties (penetration, softening point, kinematic viscosity, high PG temperature), rutting, fatigue and moisture susceptibility performance of bio-oil-based binders were evaluated using multiple stress creep recovery (MSCR), linear amplitude sweep (LAS), and bitumen bond strength (BBS) test respectively. Furthermore, mass loss and the high-temperature ageing index were determined to observe the loss of volatiles and the effect of ageing on the viscosity of bio-oil-based binders.

The result indicates that blending bio-oil other than 10% surged the penetration value and shrunken the softening point, kinematic viscosity and high-performance grading of control binder or petroleum-based asphalt binder. The MSCR test result revealed a significant increase in rutting resistance at 10% blend based on the J_{nr} 3.2 parameter. Based on the damage characteristic curve from the LAS test, bio-oil-based binder has lowered the rate of loss of material integrity and improved damaged intensity on blending to over 10%. The BBS test showed good resistance against moisture damage based on the bond strength ratio (BSR), which was found to be >80% for all proportions. Additionally, it effectively reduced the mixing and compaction temperature of the control binder. The bio-oil-based binder showed a more pronounced mass loss and high-temperature viscosity ageing index than the control binder.

Following the findings, it can be concluded that 10% blending induced the stiffening effect, which enhanced the high-temperature properties of the binder. In contrast, the softening effect was observed beyond this blend percentage, which enhanced the intermediate temperature property of the binder.

Keywords - Slow pyrolysis, Bamboo Bio-oil, Rutting and fatigue performances, Moisture-susceptibility properties, Mixing and compaction temperature, Mass loss.

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ABSTRACT:

USE OF SUGARCANE MOLASSES FOR PRODUCTION OF BIO-BITUMEN: PROMOTING SUSTAINABILITY IN ROAD CONSTRUCTION

The length of National highway in India has increased from 97,830 km in 2014-15 to 145,155 km by March 2023. With construction industry expanding exponentially, there is a huge demand of natural and non-renewable materials to be used. Bitumen is one such material which is derived from the fractional distillation of crude oil and is used to produce bituminous mixture for the surface of flexible pavement. More than 95% of the existing road infrastructure in the country comprises of flexible pavement. Notably, 40 % of bitumen used in road construction in India is imported. When used at a typical dosage of just 5%-7% (by weight of the mix), bitumen shares approximately 60 % of the total cost of the bituminous mixture. Thus, the search for an alternate binder that can completely/partially replace the use of bitumen will promote sustainability in building road infrastructure. This search has led to several researches in the development of bio-bitumen, which by definition is a mixture of conventional bitumen and a bio-binder (e.g. bio-oil, heavy oil, cooking oil, etc.). To reduce the cost of production and ensure large scale implementation, use of sugarcane molasses (SM) as a partial replacement of bitumen was explored in a recent study. SM is a dark brown thick liquid, obtained as a byproduct from sugar refining industry. India is the second largest producer of sugarcane (and thus SM) in the world, with an annual production of approximately 350 million tonnes. The SM yield varies from 6-10% by weight of the cane. States including Maharashtra, Uttar Pradesh, and Karnataka contributes to 60%-80% of the total production, while Tamil Nadu, Bihar, and Gujarat stand next. SM, when added in bitumen, develops a chemical bond (confirmed through Fourier Transform Infrared Spectroscopy) which is stable against the effect of temperature and moisture. 20%-30% replacement of bitumen with SM has been found to be optimum with respect to the criterion of workability, stiffness, and strength characteristics of bituminous mixture. With 25% SM, bituminous mixture can be produced and compacted at lower temperatures (10 °C-30 °C) in comparison to the conventional mix, thus promoting environmentally friendly construction. A 650m test section (first in the world) was constructed (November 2022) on the main carriageway of NH-709AD (connecting Muzaffarnagar and Shamli). The road has satisfactorily performed in comparison to the conventional bituminous mixture and has survived the extreme monsoon of 2023. Constructing more test sections and implementing performance monitoring will reinforce the confidence in standardizing the use of bio-bitumen in the country. Huge abundance of SM in the country coupled with the advantage of direct addition into bitumen makes it a suitable candidate for road construction. For a single lane road with 100 mm bituminous layer, a cost saving of Rs 5 lacs per km can be anticipated using this novel technology. For justifying the term ‘sustainability’ in its true sense, there is a need to implement such new technologies aggressively in field projects.

Keywords: Bitumen, Bio-bitumen, Sugarcane molasses, Sustainability.

BRIEF BIO-DATA:

Dr. Nikhil Saboo is as an Assistant Professor in the Department of Civil Engineering at IIT Roorkee. He served as an Assistant Professor at BITS Pilani, Rajasthan, from 2016-2017, and at IIT(BHU) Varanasi from 2017-2021. He completed his M.Tech. from IIT Kharagpur (2012), and PhD from IIT Roorkee (2016). He has more than 10 years of experience in the area of Pavement Engineering. Some of his areas of interest includes studies related to Pavement Materials, Rheology of Asphalt Binders, Use of Reclaimed Asphalt Pavement Material in Hot Mix Asphalt, Pavement Analysis and Design, and Pavement Evaluation. He has been working on several externally funded projects, funded by various organizations such as Department of Science and Technology (DST), Science and Engineering Research Board (SERB), National Rural Infrastructure Development Agency (NRIDA), Council of Science and Technology, UP (CST-UP), National Highway Authority of India (NHAI) and Ministry of Roads Transport and Highways (MoRT&H). He is also involved in various industrial projects that covers a wide scope from material testing to pavement design and evaluation. Dr. Nikhil Saboo has published more than 50 technical papers in journals (SCI/Scopus) of repute. He has delivered more than 30 invited talks on several topics in the domain of pavement materials and design. He has various professional awards to his credit. These include best paper award at Conference of Transportation Research Group of India (CTRG)-2015, Young Scientist in Civil Engineering by Venus International Foundation, Achievement Award for Academician / Scientist / Technologist / Innovator by Construction and Industry Development Council, etc. He was also selected for KCC Program for Young Leaders (Disaster Reduction course) organized by Japan International Cooperation Agency (JICA). He is a member of state level technical advisory committee for urban local bodies of Uttar Pradesh. He has also been associated with international conferences such as, Advances in Materials and Pavement Performance Prediction (AM3P) and European Asphalt Technology Association (EATA). He is in the editorial board of journals such as ICE (Institute of Civil Engineers), Transport; ICE, Construction Materials; and Advances in Civil Engineering, Hindawi. He is also a reviewer for many international journals such as International Journal of Pavement Engineering (T&F); Journal of Materials in Civil Engineering (ASCE); Construction and Building Materials (Elsevier); Road Materials and Pavement Design (T&F); International Journal of Pavement Research and Technology (Springer); Mechanics of Time Dependent Materials (Springer) etc.

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ABSTRACT:

BAMBOO CRASH BARRIER: A WORLD FIRST INITIATIVE TOWARDS SUSTAINABLE SOLUTIONFOR ROAD SAFETY

Road Safety: Road safety is an essential aspect for all road users. One way to ensure safety – particularly for high speed corridors - is to install crash barriers along the routes to prevent vehicles from veering away from their path and falling off the road. Metal beam crash barriers have been in use for decades. With the growing need for sustainable solutions, bamboo crash barriers are emerging as a promising alternative.

Bamboo's Potential: Bamboo expert and architect Shri Sunil Joshi emphasizes that bamboo is a versatile and renewable resource with the potential to provide ecological, economic, and livelihood security for communities. He stresses the need for its widespread promotion within the "Rural To Urban" framework, as it can contribute to achieving a socially and ecologically sustainable industrialeconomy, aligning with India's commitment to green living.

A human-centric Vision: To assist farmers in bamboo cultivation and its processing, ensure buy-back mechanisms, and facilitate the development of green and processing industries. This initiative aims to enhance the supply chain in bamboo-growing states, showcasing the industrial process of bamboo while doubling farmers' income and augmenting employment opportunities.

A Groundbreaking Achievement: With the visionary guidance of the Honorable Minister of Road Transport, Shri Nitin Gadkari Ji, Bhavya Srishti Udyog Pvt Ltd, Chhattisgarh, achieved a historic milestone by developing Bamboo Crash Barriers - for the first time globally. This groundbreaking initiative was conceptualized, researched, and developed in India, harnessing indigenous technology for manufacturing.

Rigorous Testing and Performance: The Bamboo Crash Barriers, christened Kooch Kavach, underwent extensive evaluation at government-run institutions i.e. National Automotive Test Tracks (NATRAX) (Indore), conforming to European standards and achieving Class 1 in the Fire Rating Test at the Central Building Research Institute (CBRI) Roorkee. These have also received accreditation from the Indian Road Congress.

The recycling value of bamboo barriers ranges from 50% to 70%, compared to that of steel barriers (30% to 50%).

Scaling Up for Impact: Recognizing the paramount importance of road safety, the Ministry of Road Transport and Highways is taking significant steps to promote this eco-friendly, innovative solution. MoRTH is poised to launch trial projects across 25 states, covering over 86 kilometers, within next 8 months. Subsequently, MoRTH plans to collect real-time data and performance reports from various Regional Offices (ROs). Based on the findings, the committee will assess the feasibility and potential benefits of scaling up Bamboo Crash Barriers, which could significantly benefit farmers and the ruraleconomy.

Besides the existing unit in Chhattisgarh, the company is setting up its first large scale

project to manufacture bamboo crash barriers in Assam.

Conclusion: This initiative represents a significant leap in sustainable and innovative road safety solutions, fostering highway safety coupled with promotion of rural development thru' increased cultivation of bamboo for industrial applications.

(Nagpur Outer Ring Road, 800 m, Date of Installation 05 January 2024)

(Nagpur-Hyderabad 4 Lane, NH 44, 500 m, Date of Installation 05 November 2023)

BRIEF BIO-DATA:

- Founder and Managing Director of Bhavya Srishti Udyog Pvt. Ltd. (Young start up company working in Innovations in bamboo technology.)
- Renowned Innovator in Bamboo sector. Has developed Engineered bamboo, Bamboo Composite Poles and its manufacturing technologies – has awarded 9 patents.

- Innovator of World's first Bamboo Crash barrier – and its technology.
- Founder of Bharat Samriddhi Udyog (A Food Processing Industry)
- RERA registered Builder and Developer.
- Corporate Member: Indian Road Congress
- More than 25 years of business experience in different sectors like agriculture, agro processing, construction and BPO.
- Disciple of Shri A. Nagraj (Propounder Madhyasth Darshan, Sahastitvaad)
- Founder member of Manav Teerth, CG. (A study Center of Philosophy - based on Madhyasth Darshan, Sahastitvaad)
- Founder of Prerana Vidyalaya, CG. (Working for Inculcating Human Values in Students)
- Founder of Samadhan College, Bemetara. (NAAC "A" Grade)

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ABSTRACT:

ROAD ATHENA SOLUTION BY HANUAI

Road Athena is Automated AI enabled solution for Road Asset Monitoring and Maintenance System.

Road Athena Solution is indigenously designed & developed in India.

System is trained for all types of Roads: Rural, ODR, MDR, Highways; Road type both flexible and rigid pavements.

The solution takes care of complete road conditions including pavement and road assets.

Solution is replacing manual intervention, and our reports are geo tagged date and time stamped.

The solution has global reach, and its humane AI impacts stake holders on ground by making their life easy.

Our Solution helps in achieving SDG 3.6 goal. (Still 30,000 deaths and 25000 accidents are due to potholes/bad roads).

ACCURACY and TRANSPARENCY:

RoadAthena's technology offers a high degree of accuracy and transparency, which can be beneficial for road authorities in their decision-making process. The system provides a clear picture of the road conditions, enabling road authorities to allocate resources such as manpower and finances in a timely and informed manner. RoadAthena's technology provides a standardized approach to the classification of road conditions, eliminating the potential for individual biases or subjective assessments. This ensures that the prioritization of projects is done in an objective and consistent manner, leading to better management of limited resources.

In addition to its accuracy and transparency, RoadAthena's technology can also help in evaluating the efficiency and quality of work done on road. This is because the system provides a detailed report of the road conditions, which can be compared with the contractor's work history, providing a clear picture of the quality of work done.

PATENTED TECHNOLOGY:

RoadAthena is an AI-enabled technology that is patented A/F in India, Canada, and Australia. This is technology of future.

REDUCED CUSTOMER JOURNEY:

The technology helps in reducing the current customer journey, which is typically between 6-12 months, to 3-4 months. This means that you can quickly and efficiently address road anomalies and ensure that the roads are safe for the public.

ADDRESSING CURRENT CHALLENGES:

Road repair and maintenance processes face challenges with slow manual processes, limited transparency, and complexity of detection of anomalies.

RoadAthena is an AI-based system that offers a solution to these challenges, improving efficiency and reducing the need for extensive manpower.

Great User Experience

The navigation of the reports is easy and impressive. Users can have the visibility of different layers on the map simply by selecting and clicking. The model is light and reports are simple to understand giving clear actionables to act.

The surveyor app addresses the common problem of the exact start and end point locations. Also the different set of access to various stake holders on ground to make the system easy and simple to use.

Predictive Analysis

The comparative analysis on time series is big tool on efficiency and effectiveness of the intervention done on the road and actual condition for monitoring purpose. All the senior officials can have access of the actual condition of the road on their seat and can access that data which is on cloud.

India has Second largest road network of world with around 64lac kilometer road network. Out of it 72% are rural roads. It is not going to be possible to monitor such huge road network without technology intervention and we are ready and committed to make roads for growth for all stakeholders.

भारत कदम बढ़ाओ

AI के साथ हर सड़क है तैयार

BRIEF BIO-DATA:

- Prerna Kalra is Cofounder HanuAI Pvt Ltd. The company which is working towards Automated AI enabled Road Assets and Monitoring system.
- Prerna has rich experience working in management roles in IT companies like Quark, Dell, IBM, Edifecs.
- She has started her career in Engineers India Limited, the leading company in Engineering Consulting
- She is one of the Successful Woman Entrepreneur of North India. She represented Road Athena solution in global forum Tie Global Summit Singapore, Women GPC. Winner of National award of ESC in startup category, finalist in Startup India Award, Winner of most innovative Idea in Tiecon and winner in Emerge 50 Deep Technology Award by NASSCOM.

POSTER PRESENTATION

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ABSTRACT:

Guidelines for Ultra-High Performance Concrete Mix Design with Varying w/b Ratio and Superplasticizer Dosage

The rapidly emerging construction industry demands concrete with exceptional fresh, mechanical, and durability properties to develop sustainable infrastructure, which has resulted in the development of Ultra-High Performance Concrete (UHPC). UHPC is a new-generation construction material that allows for lighter members and enhances the durability of reinforced concrete structures compared to traditional concrete. UHPC typically consists of cement, mineral admixtures, fine aggregates, high water-reducing admixtures, water, steel fibers, etc. This advanced construction material demonstrates remarkable capabilities to address a wide range of issues related to concrete structures, including load-bearing capacity, durability, sustainability, and environmental impacts. The high performance of UHPC is achieved by enhancing the particle packing density of concrete ingredients, reducing the w/b ratio, and increasing the dosage of superplasticizers. Consequently, the optimization of the w/b ratio and superplasticizer dosages plays a crucial role in UHPC design. The present study investigates the impact of w/b ratio and superplasticizer dosages on the workability, setting time, and compressive strength of UHPC mixes and formulates guidelines for the w/b ratio and dosages of superplasticizer based on the results obtained. For this purpose, UHPC mixes were prepared using a modified mix design approach based on the particle packing density of concrete ingredients. The w/b ratios varied from 0.14 to 0.22, and the dosage of superplasticizer varied from 1% to 4% by mass of binder. The workability and compressive strength of the UHPC mixes were examined using the mini-slump flow and compressive strength tests. Based on the obtained test results, it becomes evident that achieving the right combination of w/b ratio and superplasticizer dosages is a critical factor in the successful mix design of UHPC. At an extremely low w/b ratio, insufficient compaction, and homogenization led to a lower compressive strength development. While increasing superplasticizer dosages can address workability issues to some extent, excessive use of superplasticizers has adverse effects on both the fresh and mechanical properties of concrete such as setting time and compressive strength. In the context of UHPC, which is typically made within a very low w/b ratio range, it is noteworthy in contrast to conventional concrete, an increase in the w/b ratio can sometimes enhance both the fresh and mechanical performance of UHPC, as the use of high dosage of superplasticizer may not be always an ideal option.

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ABSTRACT:

Effect on Morphological and Rheological Properties of Bitumen Modified with Waste Engine Oil Residue (WEOR) for Varying Blending Time

The road construction industry stands as one of the major consumers of bitumen. However, with the rapid depletion and scarcity of bitumen resources, researchers are compelled to explore alternative binders for constructing asphalt pavements. The quest for these substitutes revolves around finding binders that not only meet but also exceed the physical and strength test requirements of conventional asphalt binders. One of the resources which is abundantly available in the global market is waste engine oil (WEO). The usage of motorized vehicles has increased drastically recently, leading to the mass generation of WEO. This research aims to partially replace the base binder with waste engine oil residue (WEOR), residue after refining WEO through some ecological processes. WEOR was added in a base binder with three different proportions (15, 20, and 25% by weight of base binder) and varying blending duration (30, 40, and 50 minutes). The blending between WEOR and base binder was achieved using a self-designed spindle to develop an optimum vortex to compose a homogeneous blend, as the vortex is considered one of the most prominent criteria for the homogeneous blending of the materials. The thermal storage stability of WEOR-modified binders was evaluated to check the homogeneity in the blending of the materials. A Fluorescence Microscopy (FM) test was conducted to determine the morphological properties of WEOR-modified binders. Fourier Transform Infrared Spectroscopy (FTIR) test and SARA analysis were carried out to determine the base binder's and modified binders' chemical composition. Rotational viscosity and frequency sweep tests were done on the WEOR-modified binders to evaluate rheological properties, which are crucial for comprehending the behaviour of the binder in various loading and temperature conditions. Evaluation of binder's performance in different loading and climatic conditions was simulated by the development of the master curves using the Williams-Landel-Ferry (WLF) method and sigmoidal model. An increment in WEOR reduced stiffness, which resulted in poor resistance to rutting in lower-frequency traffic (high temperature) conditions. However, through a master curve, it was observed that at higher frequency (low temperature) conditions, WEOR-modified binders blended with higher duration performed better. It was observed that higher blending duration using a self-designed spindle resulted in a more homogeneous blending of the materials and showed no significant difference in workability at higher temperatures. An increment in WEOR content and lower blending duration showed domination of lighter components present in WEOR over the base binder in blending and chemical composition, which resulted in an increment in aromatics and saturated components in the binder, which ultimately enhanced the low-temperature performance.

BRIEF BIO-DATA:

Bhavesh Bhambhani is a research scholar in the Department of Civil Engineering at the Indian Institute of Technology (IIT) – Roorkee. He pursued his graduation (B.Tech.) in the Civil Engineering stream from Pandit Deendayal Petroleum University (PDPU), Gandhinagar, in 2020. Further, he completed his post-graduation (M.Tech.) in the specialization of Transportation Engineering from Sardar Vallabhbhai National Institute of Technology (SVNIT), Surat, in 2022. During his graduation tenure, he was the President of the Institution of Civil Engineers (ICE), a student chapter for Civil Engineering Students. He was the placement coordinator of his batch in the then PDPU (now PDEU) and SVNIT. In these curricular activities, he learnt some crucial etiquette, such as leadership and teamwork. During graduation and post-graduation, he has done many technical and social internships as a curricular and extra-curricular activity. He has worked on Earthquake-resistant structures as a major project in B.Tech. Degree and on Recyclability of Plastic Roads as dissertation work in M.Tech. Degree at CSIR-Central Road Research Institute (CRRI). At IIT-Roorkee, Bhavesh works on sustainable pavement materials as an alternative to conventional petroleum binders. His keen interest in research areas is highway material characterization, asphalt mixtures and performance, and sustainable materials.

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ABSTRACT:

An Attempt to Reduce Carbon Footprint of Full Depth Reclamation Technique using Geopolymer Based Binder- A Comprehensive Study

Pavement recycling has emerged as an innovative solution for addressing challenges related to construction waste disposal and preservation of natural resources. Traditional road rehabilitation methods like structural overlay and milling & filling are effective when issues are limited to the asphalt layers. However, if the base and/or subbase layers are deteriorated, these approaches lack long-term sustainability. In such cases, distressed roads necessitate complete reclamation or reconstruction. To tackle this problem, Full Depth Reclamation (FDR) has emerged as a dependable alternative, enabling the reclamation of pavements up to a depth of 400 mm. However, a significant concern associated with this technique, particularly when using Portland Cement (FDR-PC), is its adverse environmental impact. Sociologists worldwide have expressed notable apprehension regarding the use of cement in construction endeavours. Extensive literature highlights that the production of every kilogram of cement results in the release of 0.81 to 0.87 kg of CO2 into the atmosphere. Consequently, researchers globally are dedicated to investigating alternate binding materials that align with FDR practices and are more environmentally friendly. This research aims to assess both the strength and durability characteristics of FDR incorporating geopolymers (FDR-GP) as a substitute for conventional FDR-PC. Various combinations of Fly Ash (FA) and Ground Granulated Blast Furnace Slag (GGBS) were tested as geopolymer precursors, ensuring that the additive content did not surpass 20% of the total mixture by weight. Sodium Hydroxide (NaOH) was employed for alkalinization in different molarities ranging from 0.5 to 4M, aiming to enhance the performance of the blends. The experimental setup was devised to achieve a target Unconfined Compressive Strength (UCS) of 4.95MPa after the 7 days of curing. This was successfully accomplished using a lower molarity of 2M and a binder composition of 70% FA and 30% GGBS. The results indicated that the highest UCS achieved was 9.12MPa and 12.98MPa for the 4M mixture at 7 and 28 days of respective curing. Additionally, the blends exhibited satisfactory performance in flexural testing and demonstrated excellent durability characteristics, as evidenced by wetting and drying tests. In this research, a Two-way ANOVA with a 95% confidence interval (α = 0.05) was employed to statistically assess the impacts of NaOH concentration and the proportions of FA and GGBS on the compressive and flexural strength of geopolymer-treated bases. Moreover, to gain insight into the essential alterations within the matrix that affect the mixture's performance, a thorough microstructural analysis was conducted. Consequently, this study presents a streamlined approach for FDR-GP mixture, which can be readily implemented using conventional FDR machinery at ambient temperatures without any special adjustments.

BRIEF BIO-DATA:

Abhitesh Sachdeva is pursuing his doctorate in Transportation engineering at the Indian Institute of Technology, Roorkee, on the topic “Feasibility Study of Geopolymer Treated Base using Full Depth Reclamation Technique”. His research is awarded the Prime Minister’s Research Fellowship (PMRF) through the Ministry of Education, Government of India. The outcomes of his ongoing research were acknowledged by the Transportation Research Board, USA, and were recently presented in their 103rd Annual Meeting held in Washington, D.C., USA. Mr. Sachdeva has a specific interest in exploring new alternative materials and technologies that can help in reducing the carbon footprint of the environment. His research works are published in various reputed journals and presented at various national and International Conferences.

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ABSTRACT:

Celebrating Eco-Friendly Infrastructure: Geopolymer and RAP Integration in Rigid Pavement Design for a Sustainable Future

The development of an extensive and robust road network is a crucial component of nation-building strategies, driving economic growth and progress. However, the predominant use of cement in rigid pavements raises concerns about its significant carbon footprint, contributing to approximately 6-7% of global anthropogenic CO2 emissions. To address this environmental challenge, there is a growing need to explore alternate binders for pavement construction. Additionally, the reliance on thermal power plants to meet the power demands in developing economies has led to the deposition of vast quantities of fly ash (FA). Industrial by-products present environmental concerns when not adequately recycled, often leading to landfill disposal and ecological damage. Offering a plausible solution to these concerns, Geopolymer concrete (GPC) has emerged as a promising environmentally friendly alternative to traditional cement concrete. It achieves this by employing an alkali medium to transform waste materials rich in aluminium and silica into high-quality binders, thereby promoting environmental sustainability. Moreover, the construction industry struggles with a dual challenge: the build-up of demolition waste from building and pavement removal and the extensive use of natural aggregates in traditional pavement construction, depleting these finite resources. Consequently, there's an increasing focus on Reclaimed Asphalt Pavement (RAP) aggregates, leading researchers worldwide to conduct thorough assessments of its influence on concrete performance, especially as a natural aggregate replacement. Through this research work, a humble endeavour has been made to investigate the viability of using industrial waste materials, specifically Fly Ash (FA) and Ground Granulated Blast Furnace slag (GGBS), as synthesizers for geopolymer concrete pavement. Additionally, the study explores the feasibility of incorporating Reclaimed Asphalt Pavement (RAP) aggregates as a substitute for natural coarse aggregates at varying proportions (0%, 25%, 50%, 75%, and 100%). The results show that employing 14M NaOH and substituting 50% of traditional aggregates with RAP yielded a binder with remarkable compressive and flexural strengths of 41.80 MPa and 4.72 MPa, respectively, following a 7-day period of ambient curing. This outcome confirms its suitability for the production of Pavement Quality Concrete (PQC). A comprehensive study was also conducted to analyse the long-term performance of the designed binders. The mix displayed significant resistance to surface abrasion and carbonation. Investigating its performance in aggressive environments, the mixes underwent exposure to a 2% H2SO4 concentration, indicating that higher replacement levels correlated with mass and strength loss, primarily influenced by RAP content. A microstructural study emphasized the importance of adhered asphalt in impeding crack propagation, contributing to the mix's improved mechanical properties. The Toxicity Characteristics Leaching Potential (TCLP) test was ultimately performed to verify the stability of the designed binders in effectively immobilizing heavy ions and preventing their release, thus ensuring the development of an environmentally friendly binder.

BRIEF BIO-DATA:

Ms. Ayana Ghosh is currently pursuing her PhD studies at the prestigious Indian Institute of Technology Roorkee, under the esteemed mentorship of Dr. G.D. Ransinchung R.N. She is actively involved in a project as Research Associate, sponsored by the Ministry of Road Transport and Highways. This project is specifically focused on assessing the performance of Recycled Asphalt Pavement (RAP) integrated geopolymer concrete. Ms Ghosh's research interests are centred around sustainable materials in pavement construction, reflecting her dedication to advancing environmentally friendly infrastructure solutions. Furthermore, she has demonstrated her scholarly commitment by publishing manuscripts in renowned peerreviewed journals, showcasing her contributions to the academic community.

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ABSTRACT:

Use of Waste Fillers in Asphalt Mixtures: Preliminary Experimental Results

In pavement construction, conventional fillers such as hydrated lime, stone dust and cement have been employed by the pavement construction industries. However, the depletion of natural resources resulting from their extensive utilization, coupled with escalating costs associated with conventional filler has turned the researchers to explore the substitution of waste materials as alternatives to traditional filler. At present, the worldwide production of solid waste amounts to approximately 1.3 billion metric tonnes, with projections indicating an anticipated surge to 2.2 billion metric tonnes by the year 2025.This study investigates the suitability of waste-derived filler in place of traditional filler, followed by their comprehensive characterization and analysis of rheological properties pertinent to rutting and fatigue resistance of asphalt mastics produced using suitable filler-binder ratios. Waste materials considered for the study are phosphogypsum (PG) and Kota stone dust (KSD). Stone dust (SD) was used as a traditional filler. Detailed physical (Specific gravity, Particle Size Distribution, Plasticity Index), chemical (Hydrophilic coefficient, pH, MBV, water solubility), and morphological (SEM, XRF, EDS, XRD) characterization was done for all the three fillers. Tests such as softening point, viscosity, and dynamic shear rheometer were carried out on prepared mastics at different filler-binder ratios (0.3,0.6,0.9,1.2,1.5,1.8) using a VG-30 bitumen. The utilization of waste fillers was observed to result in the preservation of 19 to 76 metric tons of conventional aggregates and stone dust each kilometer of road construction. Elevated rutting resistance was seen for the filler with finer particle size distribution, and better adhesion bonding with bitumen was observed for the filler containing calcite and dolomite.

BRIEF BIO-DATA:

Manish Kumar Yadav completed his Bachelor's degree in Civil Engineering from BBDNITM Lucknow. He completed his post-graduation (M.Tech.) in Transportation Engineering from NIT Rourkela in 2022. Currently, he is pursuing his Ph.D. in the field of Transportation Engineering at the Department of Civil Engineering, Indian Institute of Technology, Roorkee. His research interests include the utilization of industrial waste as filler in asphalt mixes.

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ABSTRACT:

New Low Carbon Cement – LC^3 for Sustainable Practices in Infrastructure Development of India

The path for India to achieve its aspiration of transitioning from a developing economy to a developed one can be illuminated through strategic investments in infrastructure development. Elevating investments in infrastructure, encompassing projects such as freight roads, bridges, tunnels, airports, and more, will catalyse construction activities across the country. At present, reinforced concrete stands as the most widely utilized construction material due to its versatility, ease of application, durability, and cost-effectiveness. Cement plays a pivotal role as the primary binding agent in reinforced concrete. However, it is imperative to acknowledge that the production of cement is a significant contributor to carbon dioxide (CO_2) emissions, accounting for approximately 8% of the annual global CO_2 emissions. The pursuit of infrastructure development will inevitably lead to the expansion of the cement industry, a development that carries with it the risk of increased CO_2 emissions.

In 2022, India's cement production reached a staggering 356 million tons, constituting 7% of the world's installed capacity. Projections indicate that this figure could surge to over 1,000 million tons by 2047, representing an approximate 300% increase from current levels. Furthermore, this growth will exert immense pressure on natural resources, particularly limestone, an additional 9,400 million tons of reserves will be needed to meet the escalating demand. This would necessitate extensive mining and exploration activities, potentially encroaching upon eco-sensitive zones and previously inaccessible areas. Therefore, while infrastructure development is a key driver of economic growth and progress, there is an urgent need to adopt sustainable and environmentally responsible practices in the construction sector.

Limestone calcined clay cement (LC^3) represents a ternary blended cement composed of 50% clinker, 30% calcined kaolinitic clay, 15% limestone, and 5% gypsum. LC^3 harnesses the synergistic effects of two readily available natural materials, namely clays and limestone, to substantially reduce the clinker factor, achieving a remarkable low factor of 0.5. This innovative cement formulation offers a promising solution to the pressing environmental concerns associated with cement production. LC^3 demonstrates the potential to reduce CO_2 emissions by 40% per tonne of cement manufactured while utilizing medium-grade kaolinitic clays (comprising 40-60% kaolin) in conjunction with non-cement grade limestone. This approach alleviates the strain on natural resources and reserves. Given the widespread availability of clays and limestone resources throughout India, LC^3 contributes to the decentralization of the cement industry. This decentralization strategy reduces dependence on the long-distance transport of currently employed supplementary cementitious materials like fly ash and slag.

In the present study, we showcase the performance of LC^3, produced with a reduced clinker factor and incorporating medium-grade clays and limestone. LC^3 demonstrates comparable strength to conventional cement and even exhibits enhanced durability properties in certain aspects. Additionally, our research underscores the optimal hydration behaviour and strength development achieved with LC^3 utilizing medium-grade clays and limestone content as low as 60%. This highlights the potential of LC^3 as a sustainable and effective alternative in the construction industry, offering both environmental benefits and excellent material properties.

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ABSTRACT:

Feasibility and Source Variability of Bio-asphalt Incorporating Sugarcane Molasses: An Experimental Investigation

India's unparalleled growth of highway industry induces overexploitation of crude oil resources. The limited fossil fuel reserves raise concerns over availability of the non-renewable derived product, known as asphalt binder (or bitumen). Asphalt binder is majorly used for the production if asphalt mixture, which is used on the surface of flexible pavement. The fluctuating crude oil prices coupled with non-renewable nature of asphalt binder seeks partial/full replacement of asphalt binder with renewable materials. One such material of interest is sugarcane molasses (Saccharum officinarum L.). Therefore, in this study, to promote the sustainability goals and the use of environmentally friendly materials, sugarcane molasses was partially substituted to obtain a cleaner and greener bio-asphalt. The objective of the research was to evaluate the feasibility and source variability of sugarcane molasses on bio-asphalt. One viscosity graded (VG 40) binder, along with three sources of sugarcane molasses, were selected. Sugarcane molasses was introduced at a replacement level of 10, 20, and 30 % by weight of asphalt binder. The blending was carried out using a high shear mixer at 120-130 °C temperature with a shearing rate of 500 rpm for 15 mins to obtain homogenous bio-asphalt. The developed bio-asphalt was subjected to physical (penetration, softening point), chemical (FTIR), and rheological (frequency sweep) tests to ascertain the effect of sugarcane molasses on asphalt binder. In addition, statistical test (ANOVA) was carried to quantify the source variability of sugarcane molasses on properties of bio-asphalt. The optimum content of sugarcane molasses was found to 30 % by the weight of asphalt binder. The conventional property test results show that the addition of 30 % sugarcane molasses increased softening point by 2 % and reduced penetration by 17 % in comparison to base binder. Through Fourier transform infrared spectroscopy (FTIR) it was confirmed that sugarcane molasses reacted with asphalt. Based on time temperature superposition principle (TTSP), complex shear modulus (G*) master curves were drawn, and modelled using Christensen, Anderson and Marasteanu (CAM) model. The replacement dosage of 30 % showed an increment of 50 % in G* values at 10 rad/sec, indicating enhanced high temperature performance. Statistical analysis (ANOVA) revealed that the variation in source of sugarcane molasses did not alter the test results.

BRIEF BIO-DATA:

Dheeraj Mehta is presently a PhD fellow in the Civil Engineering department at the Indian Institute of Technology, Roorkee. He attained his Masters in Transportation Engineering from the National Institute of Technology, Silchar in 2021, and holds a Bachelors in Civil Engineering from KL University, Vijayawada. With one year of prior work experience in the pavement industry, Dheeraj's research focus encompasses Pavement Materials, Bio-Asphalt, and Recycled materials.

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ABSTRACT:

TREATMENT OF CONSTRUCTION AND DEMOLITION WASTE AND RELATIONAL PARAMETER OPTIMIZATION FOR RECYCLED AGGREGATES

Construction sector is generating significant quantities of construction and demolition (C&D) waste due to the fast expansion of urbanization and industrialization. C&D waste consists of a number of materials, i.e. wood, glass, plastic, concrete, brick etc. Out of all these wastes, concrete waste makes up to 70% of the total C&D waste. Concrete itself is 60–80% aggregate by volume. Traditional C&D waste disposal involves piling and dumping, which severely pollutes the environment. Extracting recycled concrete aggregates (RCA) from concrete waste and using them to substitute virgin aggregates not only solves the problem related to C&D waste disposal but also solves the problem of the unavailability of natural aggregates. Despite these advantages, the utilization of RCA has some limitations. These limitations are due to the adhesion of old mortar. Due to the presence of adhered mortar, a weak interfacial transition zone (ITZ) is formed between the new cement mortar and the RCA. The presence of this vulnerable region adversely impacts the mechanical characteristics and durability of recycled aggregate concrete (RAC). To overcome these negative impacts, it is necessary to improve the properties of RCA by removing and/or strengthening the adhered mortar. This study focuses on exploring the mortar removal treatment approach through mechanical treatment. In the study, mechanical treatment of C&D waste has been performed using a Los Angeles abrasion machine by varying numbers of abrasive charges i.e. steel balls (2 balls, 4 balls, 6 balls, 8 balls, 10 balls and 12 balls) and rotation durations (10 minutes, 20 minutes and 30 minutes). A total of 18 combinations were chosen and for each combination 10 replicates were tested. After the treatment, treated aggregates were tested for properties like, specific gravity, absorption, impact, abrasion, crushing values and gradation. In order to optimize the mechanical treatment parameters (number of abrasive charge and duration), two different optimization techniques i.e., Taguchi Method and Grey Relational Analysis (GRA) were applied. Taguchi Method was used to assess the effect of processing variables on each individual response characteristic. In contrast, the GRA technique was implemented to identify the combined influence of processing parameters on all response characteristics. Based on the findings, it has been observed that the use of mechanical treatment substantially improves the characteristics of RCA. Following the implementation of mechanical treatment, it can be seen that all characteristics of RCA conform to the acceptable thresholds. The ideal combination for considerably improving the characteristics of RCA is determined to be 08 abrasive charges and 30 minutes of duration.

Keywords: construction and demolition (C&D) waste, recycled concrete aggregates (RCA), mechanical treatment, optimization

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