

NEWSLETTER

March, 2024



Student volunteers at the CoE on TLC2 stall during the Institute Open House 2024



Prof. Ashwin Mahalingam and Dr. Piyush Chaunsali with Student volunteers



Student Volunteers and participants with Dr. Nikhil Bugalia at the AR-VR lab

Institute Open House 2024

As part of its 'Anaivarukkum IITM' (IITM for All) initiatives, IIT Madras organized the Institute Open House 2024 on 2nd and 3rd March and invited people from all walks of life to visit and explore its state-of-the-art labs and Centres of Excellence (CoEs). CoE on TLC2 actively participated in the Open House; our research scholars had taken the initiative to showcase their fascinating work towards creating a sustainable construction ecosystem to the young school students, parents and industry professionals. The fun activities for school children were planned and designed to raise awareness of the endless possibilities of using 'waste materials' to create sustainable concrete. Participants explored use of sonic navigation and ranging(S) technique at AR-VR lab to estimate volume of Construction and Demolition waste.



Indian Institute of
Technology Madras



Technologies for
Low-Carbon and Lean
Construction

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- Upcoming Conference: CONSEC24 : Early Bird Registration closes on May 31, 2024



Students with Dr. Surender Singh at the TLC2 stall during Open House; 3D printed concrete specimen, waste materials and pervious concrete were displayed

Find us: <https://tlc2.iitm.ac.in/>

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COVER STORY

MPCEM LAB TOUR

Tour to Mechanical Performance of Civil Engineering Materials (MPCEM) Lab was organized for visitors. Textile and Fibre reinforced concrete specimens were displayed and testing method was explained.



TOUR TO INDIA'S FIRST 3D PRINTED HOUSE

A huge crowd gathered to explore the first 3D printed concrete house of India. The construction process and technology were explained and complete house tour was arranged for the visitors.



AR-VR LAB VISIT

Focus of the AR-VR lab tour was to show the new generation of school children how virtual reality can be used in real life in enhancing construction-related training for safety and quality.



WASTE TO WEALTH

Mix design process was demonstrated to school children using various waste materials like coconut fibre, fly ash, LC3, slag, brick dust. Lightweight concrete and pervious concrete specimens were displayed and their use were explained. School kids enthusiastically participated in making concrete themselves using waste materials.



Report on "Primary Life Cycle Inventory Data for Cement Production, with Relevance to Sustainability Assessment - Indian Cases" by Anusha Basavaraj and Ravindra Gettu, published in Data in Brief (2024)

In order to facilitate access to research results related to the sustainability assessment of the concrete industry, we have provided open access to our data on life cycle inventory and indicators from some cement plants in India. We hope more cement plants would collaborate.

Lattice Concrete: 3D printed periodic cellular structures through selective cement hydration

Adarsh K Tiwari, Phanisri P Pratapa, Manu Santhanam, Journal of Building Engineering, Volume 86, 1 June 2024

Highlights

- 3D printing lattice cellular concrete specimens using a powder bed technique.
- No use of advanced binders or chemical additives.
- Use of simple inexpensive syringe-based printhead with normal water.
- Twice the strength when exposed to atmosphere for long duration after curing.

Modelling and Control of Reflected Heat from Light Shelves in Tropical Climates

Archana P Ambadi, Benny Raphael
Advances in Science and Technology (Volume 137)
<https://doi.org/10.4028/p-t8Dllo>

While light shelves enhance daylight inside buildings in tropical climates, there is a concern that the heat reflected from them will increase the cooling load inside a building. In this study, experiments are conducted under controlled conditions to understand the heat transmission characteristics of light shelves. The total heat reflected by a prototype of a light shelf is compared to the case of a similar setup with a no light shelf. Different materials were tested to evaluate the heat and light transmission. To explain the experimental results, a simulation model was created using the heat balance equation for the light shelf. The simulation model could reasonably replicate the trends obtained in the experimental data. The simulation model helps in controlling the heat transferred by light shelves in tropical climates.

Galvanic Corrosion of Strands in Re-Grouted, Post-Tensioned Concrete Bridges

Karthikeyan Manickam, Radhakrishna G Pillai
CORROSION (2024) 80 (2): 130–141
<https://doi.org/10.5006/4461>

Grouted, post-tensioned (PTD) concrete systems are widely used to construct bridges, typically with an anticipated corrosion-free service life of 100+ y. However, the usage of inadequate grout materials and grouting practices in PTD concrete systems have caused unwanted air voids in ducts, leading to strand/grout/air interface, carbonation of exposed grout layer, and localized corrosion of strands (say, within about 10 y to 20 y). Re-grouting of voids as a tendon repair strategy has led to accelerated galvanic corrosion of the portion of strands at the interface between the carbonated base grout and repair grout with different chemistry, raising concerns and reluctance in re-grouting of voids in tendons. This work focused on understanding and quantifying the galvanic corrosion at the interface of carbonated base grout and repair grout in a re-grouted tendon.

Carbonation of calcium sulfoaluminate belite binder: mechanism and its implication on properties

Vaishnav Kumar Shenbagam, Paul Shaji, Yakkala Eswita, Rolands Cepuritis and Piyush Chaunsali;
Journal of Sustainable Cement-Based Materials, 2024
<http://dx.doi.org/10.1080/21650373.2024.2306271>

This study focuses on evaluating the microstructural and mechanical alterations due to carbonation in a CSAB binder system and understanding the underlying mechanism of development of the carbonation front. CSAB binder was found to carbonate rapidly compared to PC binder, accompanied by a reduction in compressive strength. This was attributed to the increase in the pore volume due to the carbonation of the ettringite-rich microstructure, facilitating further ingress of CO₂ into the microstructure. The rate of carbonation in CSAB binders diverged significantly from the square root of time model used for PC binders.

NEWS IN BRIEF

Prof. Koshy Varghese, Dr. Nikhil Bugalia and Mr. Kaushik Bhattacharjee recently visited few renowned universities in USA. They met Dr. Makarand Hastak and his research team in Purdue University where Prof. Koshy Varghese talked on the evolution of Industry-Academia cooperation in developing construction management profession in India. Dr. Nikhil Bugalia gave a talk on system-thinking based evaluation and development pathway for digital technologies for construction sector. His talk featured ML and Text-mining applications on safety related data collected from real construction sites and rigorous evaluation of VR-based training for construction quality management and defect identification.



Dr. Nikhil Bugalia, Mr. Kaushik Bhattacharya and Prof. Koshy Varghese at Stanford University, USA

TLC2 team met with Prof. John Gambatese and Prof. Joseph Louis from Oregon State University, Prof. Khalid Osman from Stanford University, and Prof. Vineeth Dharmapalan from California Polytechnic State University-San Luis Obispo at Stanford University. Social aspects of construction safety management, the role of digital technologies, benchmarking of safety practices, differences in the maturity level of safety culture, and other exciting research possibilities were discussed.

Mr. Kaushik Bhattacharya, a senior PhD student of Dr. Nikhil Bugalia, presented glimpse of his Ph.D. work at the American Society of Civil Engineers' CI & CRC Joint Conference 2024, Des Moines, IOWA, USA. Mr. Bhattacharya highlighted how construction projects of different sizes perceive safety-critical complexities differently and it is needed to focus on tailored solutions rather than a one-size-fits-all solution.

Earlier, Dr. Nikhil Bugalia and Mr. Kaushik Bhattacharjee met with Mr. Tariq Chauhan, founder of EFS facilities Service Group, and his team in Dubai and discussed on the potential collaboration opportunities related to resilient safety culture and sustainability in construction sector.



Dr. Nikhil Bugalia and Mr. Kaushik Bhattacharya with EFS team in Dubai

UPCOMING CONFERENCE

 **10th International Conference on CONcrete under SEvere Conditions - Environment and Loading (CONSEC24)**
September 25-27, 2024, Chennai, India

THEMES

- Advanced materials for severe conditions
- Lab/field testing and characterisation
- Repair and strengthening materials and methods
- Damage, deterioration and transport properties
- Service life, reliability, sustainability and resilience
- Special concretes and construction techniques

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Early Bird Registration closes on May 31, 2024