

BTCM @ IIT Madras

Providing academic leadership in the areas of
**Building Science, Construction Management,
and Construction Materials**



BTCM
Building Technology and
Construction Management

Department of Civil Engineering
Indian Institute of Technology Madras

BTCM @ IITM - Overview

- First in India to facilitate teaching, learning, and research in...
 - Building Physics
 - Construction Management
 - Construction Materials
- Academic Programs by the Division
 - Dual degree program in BTCM
 - M.Tech. (Building Technology & Construction Management)
 - UoP M.Tech. (Construction Technology & Management)
 - Since 1998
 - L&T sponsors 30 students (Civil, Electrical & Mechanical) each year
- Research Programs
 - MS & PhD
- Faculty Members
 - 10 (full time) + Adjunct and Visiting Faculty

Areas of specialization of faculty members

Faculty	Construction Materials	Construction Management	Building Sciences
Prof. K. Ramamurthy	▲		▲
Prof. Ravindra Gettu	▲		
Prof. Manu Santhanam	▲		
Dr. Radhakrishna G. Pillai	▲		
Dr. Piyush Chaunsali	▲		
Dr Keerthana Kirupakaran	▲		
Prof. Surendra P. Shah	▲		
Prof. Koshy Varghese		▲	
Prof. Benny Raphael		▲	▲
Prof. Ashwin Mahalingam		▲	
Dr. Sivakumar Palaniappan		▲	
Dr. Nikhil Bugalia		▲	
Dr. Aslam Kunhi Mohammed		▲	
Dr. Murali Jagannathan		▲	
Prof. N. Raghavan	▲	▲	
Prof. K. N. Satyanarayana*		▲	

* On deputation to IIT Tirupati as Director

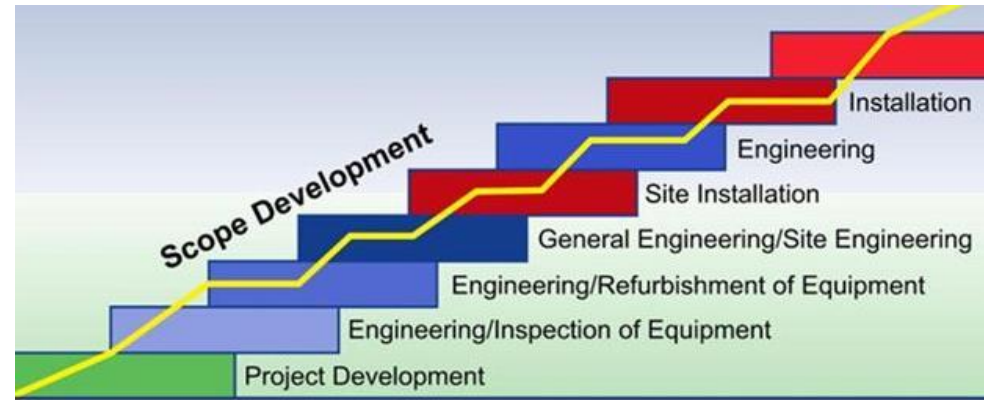
IITM
Building Technology and
Construction Management

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Studies on construction management

• Questions we answer

- How do we make construction more 'LEAN' and efficient?
- How do we increase digitalization in the industry? (e.g., BIM, AI, etc.)
- How do we create more integrated processes for project delivery?



• Impacts



**Lean Champions
Program**



**Build India
Scholarship**



AUTODESK.

Shapoorji Pallonji

Studies on infrastructure management

• Questions we answer

- How do we manage Megaprojects better?
- How do we build Sustainable and Resilient Cities?
- How do we build Infrastructure Faster, Better and Cheaper?

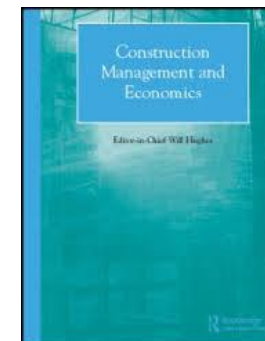
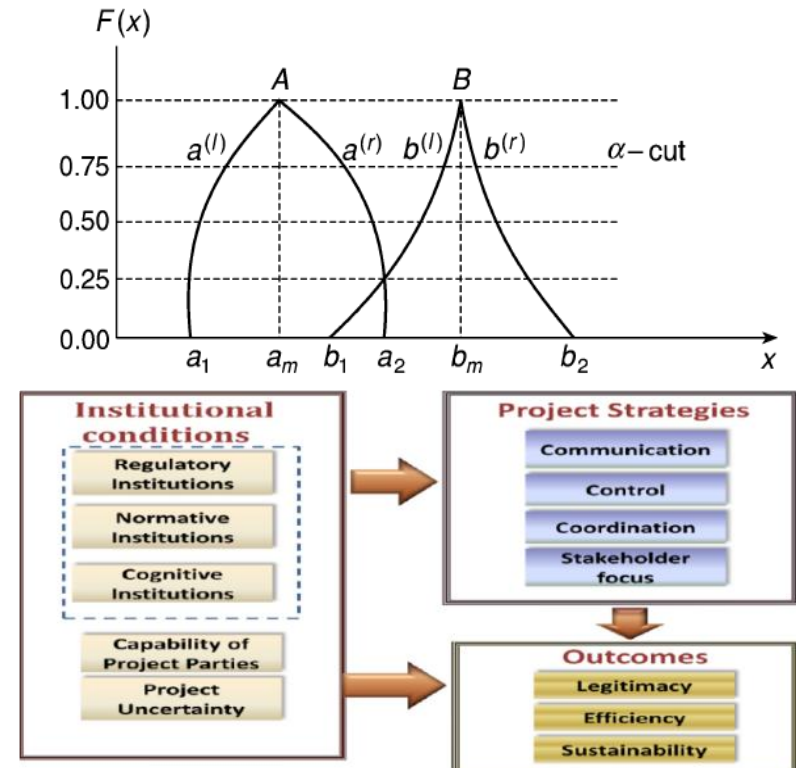
• Impacts



TN Infrastructure Development Act

MINISTRY OF FINANCE

**PPP Policy
Renegotiation Policy**



Studies on construction automation

- Questions we answer
 - How do we improve time, cost and quality of construction through automation and robotics?



- Impacts
 - New theoretical concepts, technology solutions
 - Automated construction methods
 - 3D Printing with Concrete



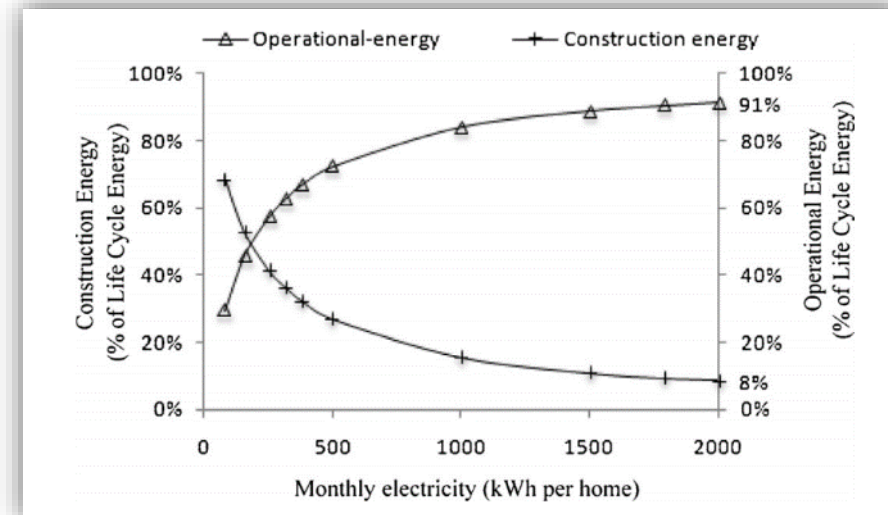
Studies on sustainable construction

• Questions we answer

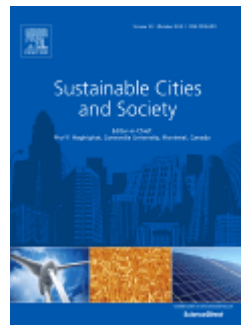
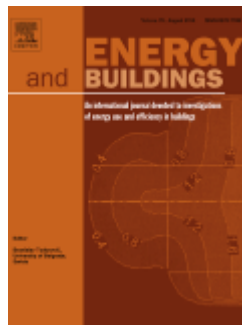
- What is the relative contribution of construction energy with respect to building life cycle energy?
- How to integrate sustainability metrics into construction planning and control practices?
- How do we improve the schedule performance of construction projects in India?

Naturally-ventilated buildings

Air-conditioned buildings



• Impacts

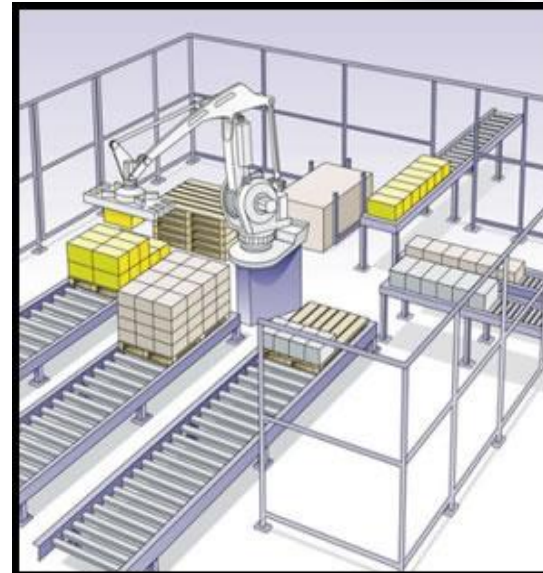
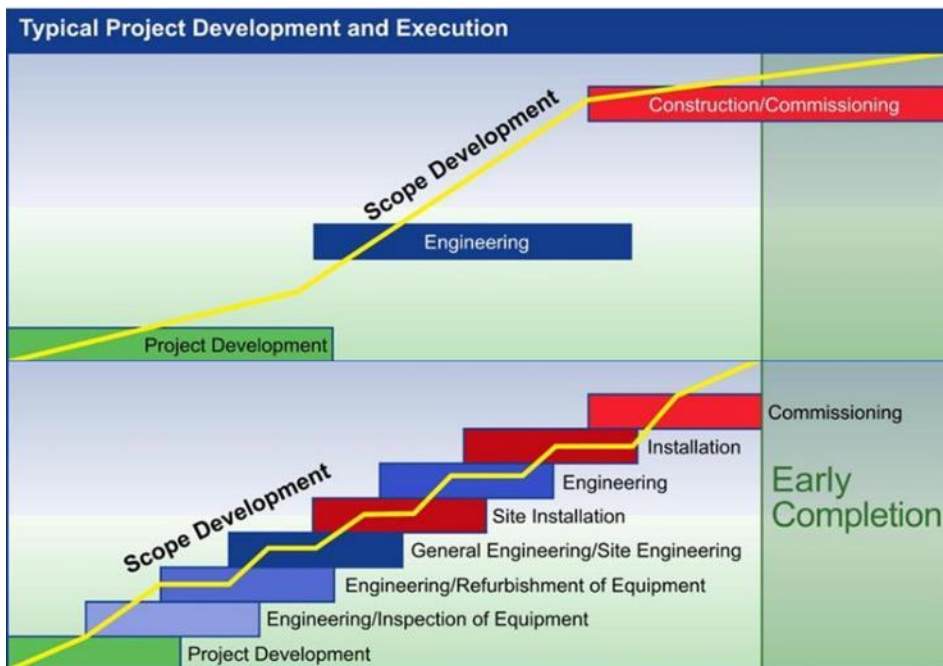




Dr. Koshy Varghese

Professor; Ph.D., University of Texas

- Automation in Construction
- Fast Track & Concurrent Engineering Projects
- Sustainable Development
- GIS in Civil Engineering Applications

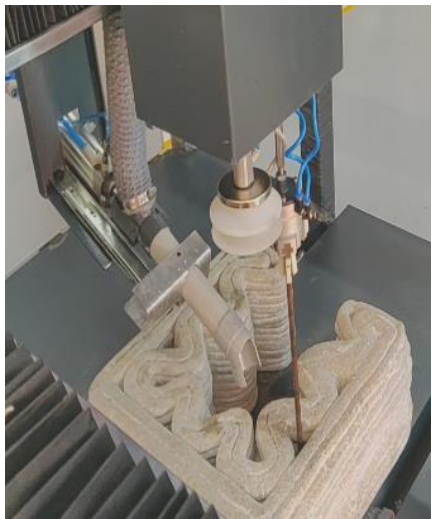
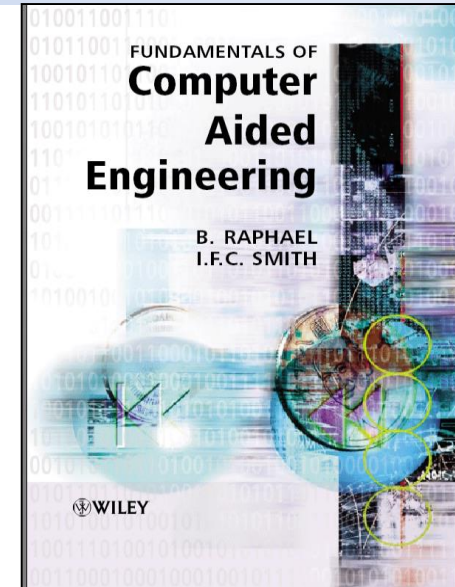




Dr. Benny Raphael

Professor; Ph.D., Univ. of Strathclyde, Glasgow

- Construction automation and robotics
- Computer Aided Engineering
 - Modeling, Optimization, Data mining
- Energy efficient buildings
 - Sustainable and smart building systems





Dr. Ashwin Mahalingam

Professor; Ph.D., Stanford University

- Megaproject Management
- Sustainable and Resilient Cities
- Building Information Modeling and Integrated Project Delivery

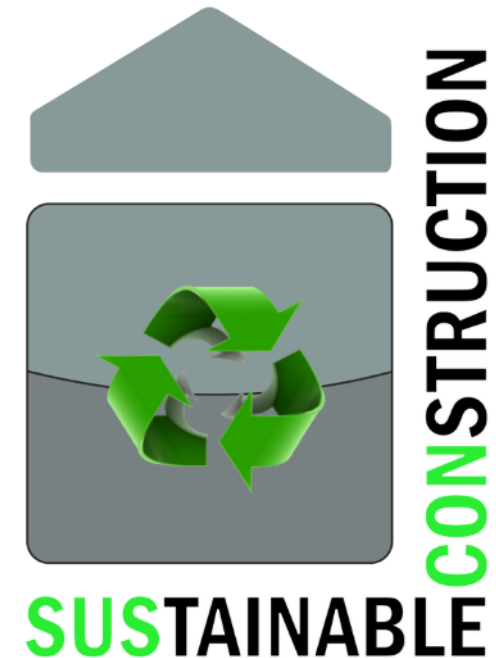
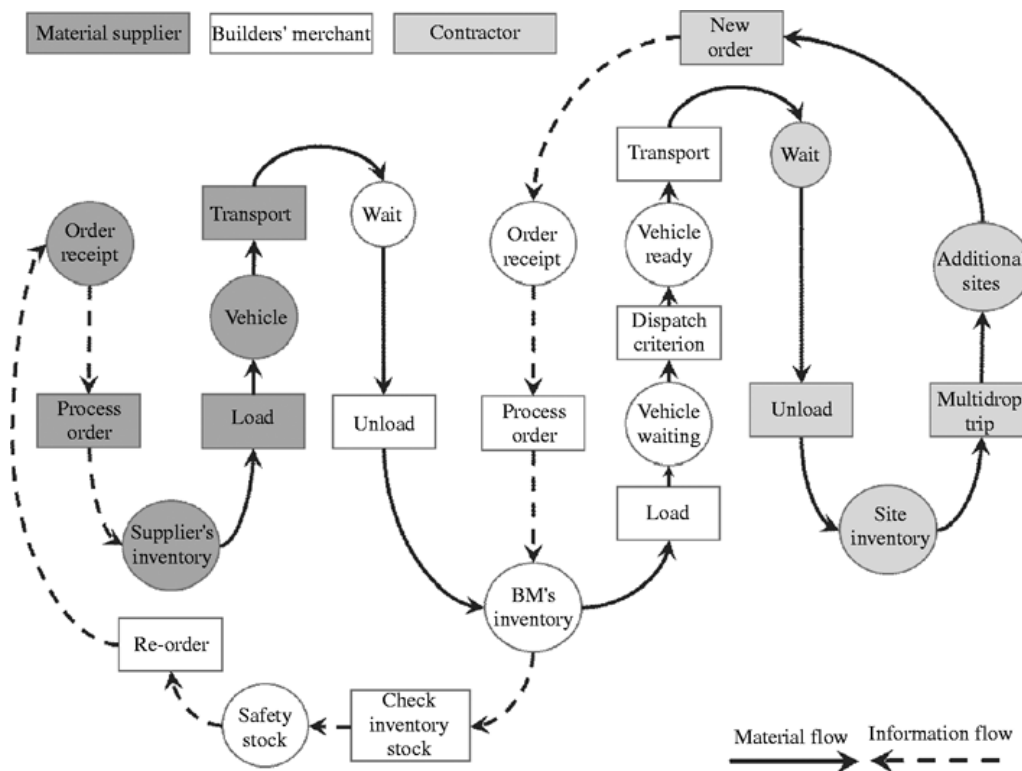




Dr. Sivakumar Palaniappan

Associate Professor; Ph.D., Arizona State University

- Modelling and Simulation of Construction Processes
- Information Technology in Construction
- Sustainable Construction

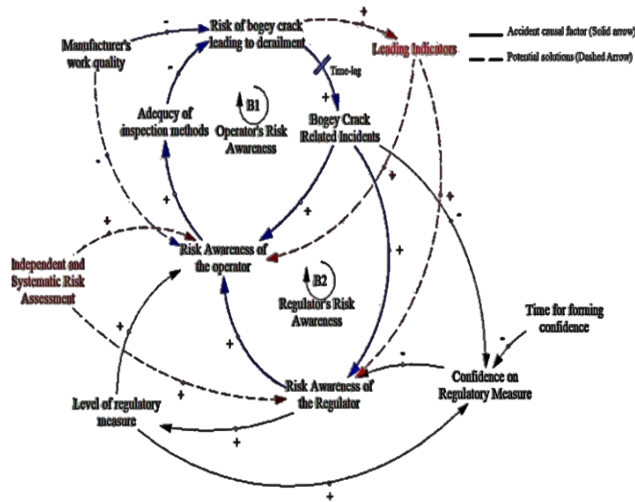




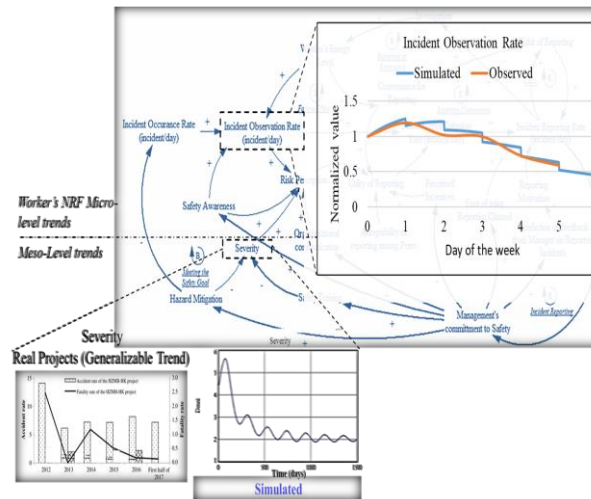
Dr. Nikhil Bugalia

Assistant Professor; PhD, The University of Tokyo, Japan

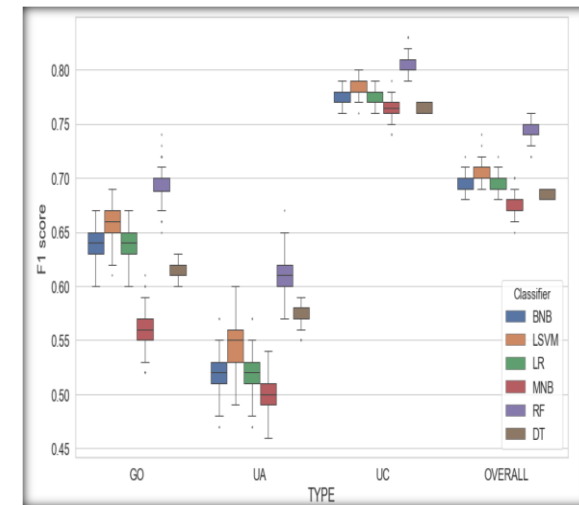
- Safety Management – Railway/Construction
- Organizational Management, Policy for safety management
- Machine-learning for Safety Management



Generalized institutional accident mechanism
in Japanese High-Speed Railway



System Dynamics based Numerical simulation for
near-miss reporting system



Machine-learning based
classification of safety reports

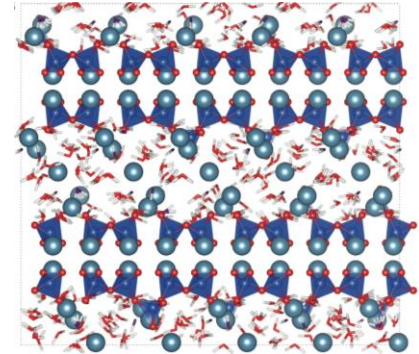
System-Thinking based process map and numerical simulations



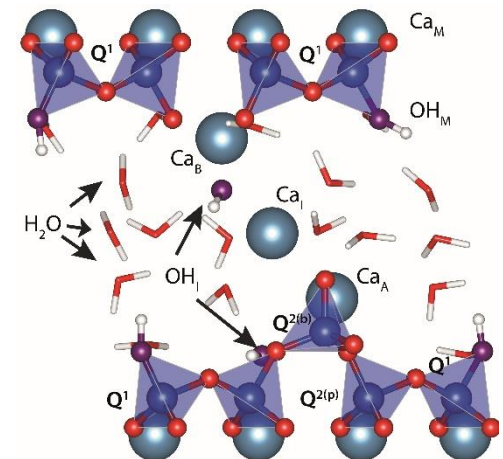
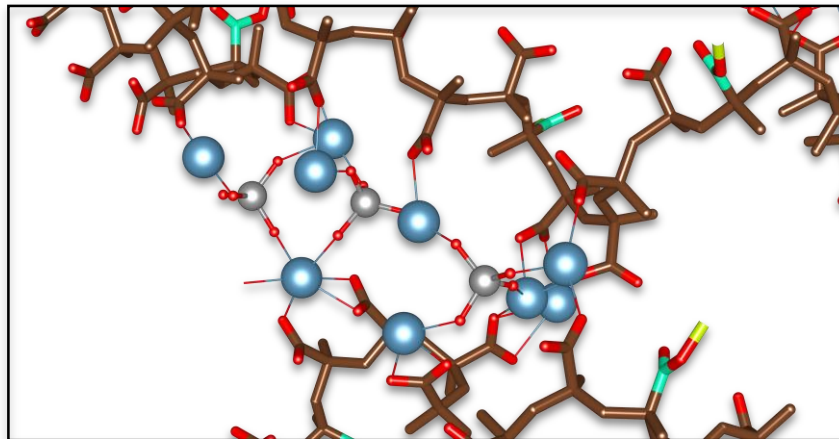
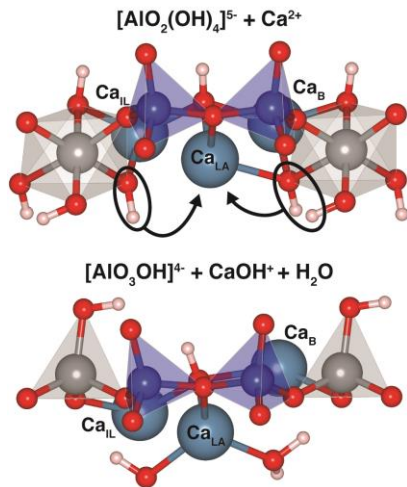
Dr. Aslam Kunhi Mohamed

Assistant Professor; Ph.D., EPFL

- Molecular modeling of cementitious materials
- Cement hydration at the atomic scale
- Low CO2 cements
- Admixtures

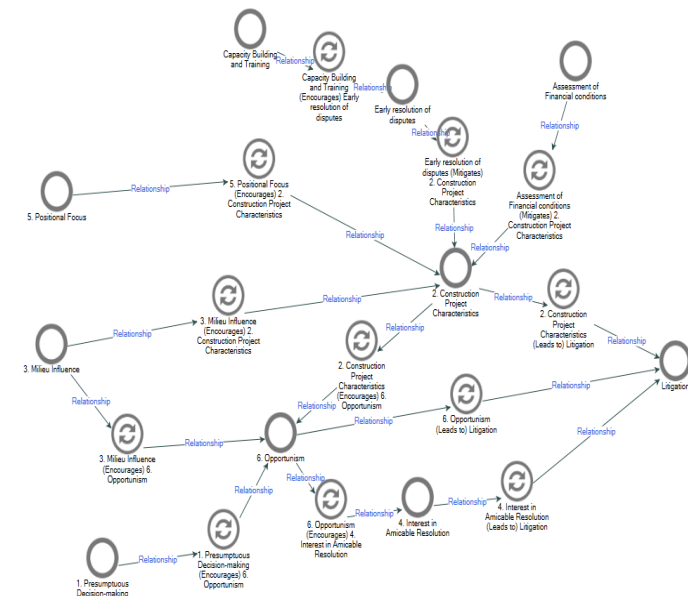


Realistic C-S-H atomic structures-
Cementitious materials and its interfaces





- The New Delhi Municipal Council (NDMC) has in this petition under Section 34 of the Arbitration and Conciliation Act 1996 dated (Act) challenged an award dated 4 October 2001 DATE, passed by the learned sole Arbitrator in the dispute arising between the Petitioner PERSON and the Respondent, National Buildings Construction Corporation Ltd. (NBCC), arising out of the award of the work of construction of the New Delhi City Centre ORG. NBCC Phase-I by the Petitioner PERSON to the NBCC ORG on 18 August 1994 DATE. The date of commencement of the project was 2 September 1994 DATE, and the scheduled date of completion was 1 September 1997 DATE. The stipulated date of completion was extended from time to time till 30 April 2001 DATE. The disputes arising between the parties were referred to an arbitrator appointed by the Chairman of the NDMC ORG on 16 June 1998 DATE. He was required to adjudicate eighteen CARONAL claims raised by the NBCC ORG. He gave an interim award on 21 September 2000 DATE. It is stated that even before the interim award was published, NBCC ORG raised ten CARONAL more claims which were also referred to arbitrator. Thereafter he passed the final award on 4 October 2001 DATE. The summary of the final award of the learned Arbitrator ORG is as under: Claim No. Particulars Amount ORG claimed Amount awarded Earth ORG filing on account of earth sliding during September 1995 DATE: Rs. 1,40,639.00 MONEY Rs ORG 1,40,639.00 Balance payment on account of shuffling in ribs: Rs. 6,44,295.00 MONEY Rs. 6,44,295.00 MONEY Extra for laying concrete in floors MONEY Rs. 1,91,081.00 MONEY Rs. 74,070.00 MONEY





Prof. N. Raghavan

Professor of Practice

- Construction Management Contracts/ Methods
- Repair & Rehabilitation
- Safety Management
- Structural Consultancy



IIT Madras
Building Technology and Construction Management

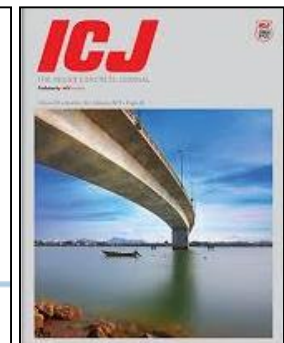
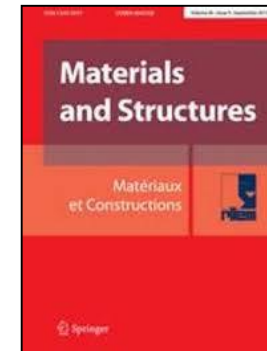
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- A circular word cloud visualization of research topics in materials science and construction. The words are arranged in a circular pattern, with size indicating frequency. Key terms include 'Corrosion', 'Materials', 'Concrete', 'Construction', 'Durability', 'Workability', 'Sustainability', 'Fly ash', 'Limestone', 'Bagasse Ash', 'Epoxy Impregnation', 'Creep', 'Potential', 'Microscope', 'Pore size distribution', 'Shrinkage', 'Flexure', 'Resilient', 'Aerating agent', 'Slump test', 'Impedance analyzer', 'Electrochemical cell', 'Thermal properties', 'Mechanical properties', 'Durability', 'Workability', 'Sustainability', 'Fly ash', 'Limestone', 'Bagasse Ash', 'Epoxy Impregnation', 'Creep', 'Potential', 'Microscope', 'Pore size distribution', 'Shrinkage', 'Flexure', 'Resilient', 'Aerating agent', 'Slump test', 'Impedance analyzer', 'Electrochemical cell', 'Thermal properties', 'Mechanical properties'.

Questions we answer?

- How to design special concretes for various specific needs?
 - SCC, FRC, TRC, LWC, etc.
- How to utilize various by products and alternative materials?
 - Fly ash, slag, limestone, calcined clay, biomass, recycled aggregates, etc.
- What are the material characteristics? How do improve the behaviour of concrete in short and long term?
 - SEM, EDAX, chemical composition, pore structure, etc.
- How to estimate and enhance the corrosion resistance and service life of concrete structures ? How can we arrest corrosion?
 - Chloride ingress, carbonation, corrosion rate, cathodic protection, etc.
- How to estimate and enhance the dimensional stability and mechanical properties of material systems?
 - Toughness, bond strength, fatigue resistance, etc.

Impacts

- Research collaborations
 - DST, Lafarge & Indian industry
 - Polimi, UCT, EPFL, MIT, Imperial, OSU
 - Other IITs, NITs & other engineering colleges
- Improved performance with existing materials, and insights into new materials
- Test methods, codes and technical guidelines
 - BIS, RILEM, ICI, & NACE
- Workshops, seminars, conferences



Studies on mechanical performance

- Test frames (5 kN to 1 MN) and prestressing bed



Fatigue, fracture, bond strength

Prestressing bed



Flexural toughness



Long-term durability performance studies

- Environmental exposure chambers



High-temperature,
carbonation, humidity
chambers

Natural carbonation
studies



Long-term shrinkage and creep studies

- Large rooms with controlled temperature and humidity environment



Studies on corrosion assessment and service life estimation/extension

- Electrochemical workstation, corrosion cells, prestressing frames



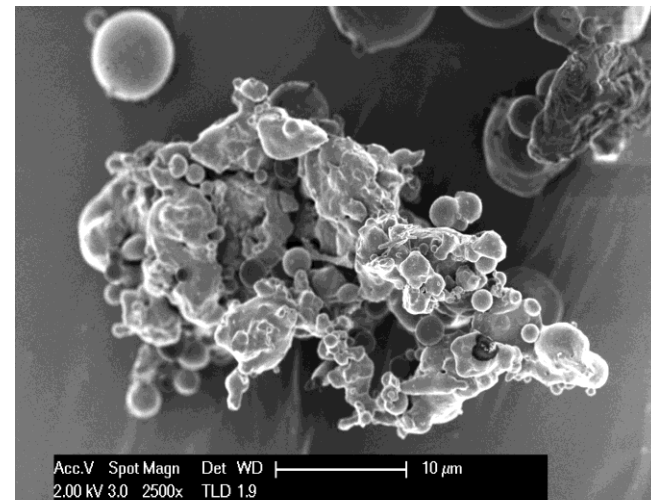
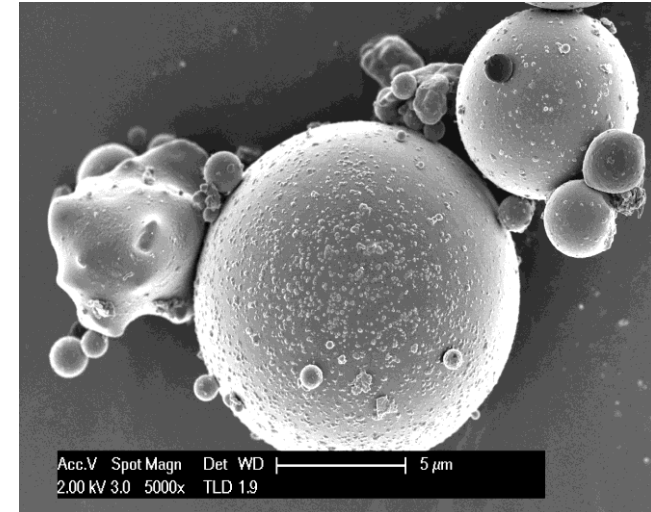
Studies on fresh properties of concrete

- Walk-in chamber, controlled environment rooms, etc.



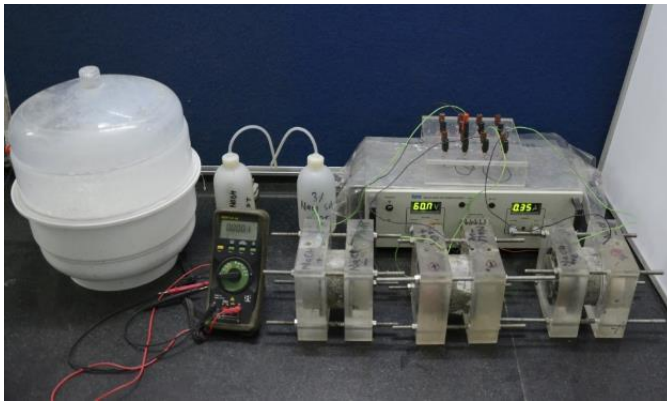
Studies on evolution of microstructure of various cementitious systems

- Optical microscopes, SEM, MIP, etc.



Studies on the transport of water, CO₂, O₂, and chlorides through concrete

- Suite of testing setups



Workshop facilities within the department for fabricating research/testing setups

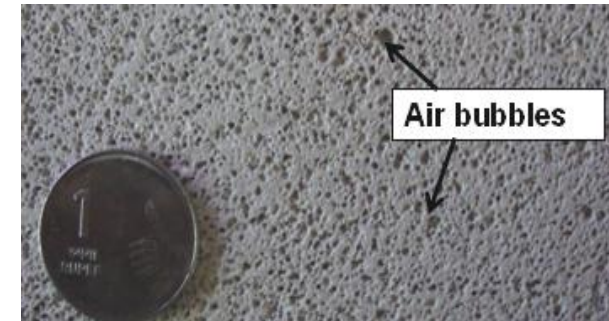




Dr. K. Ramamurthy

Institute Chair Professor; Ph.D., IIT Madras

- Light weight and fly ash aggregates
- Aerated & foam concrete blocks/bricks
- Interlocking brick masonry
- Thermal comfort & lighting of buildings

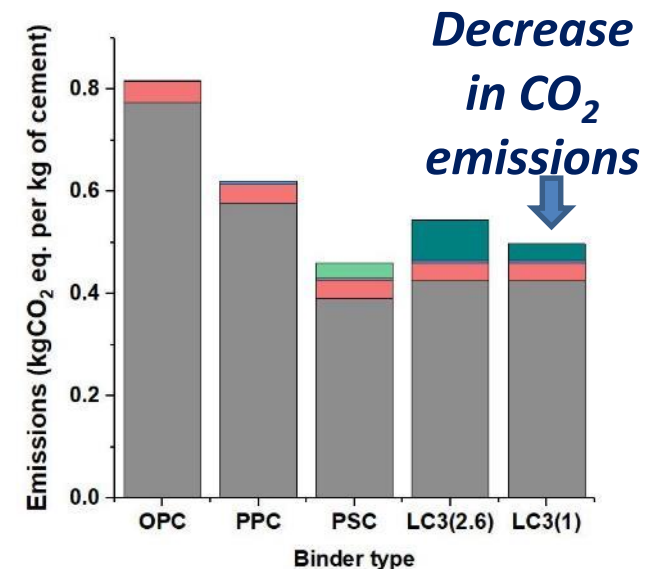
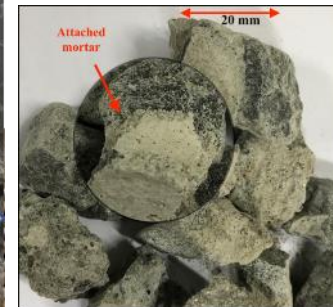




Dr. Ravindra Gettu

Prof. V S Raju Chair Professor; PhD, Northwestern Univ., USA

- High performance concrete
- Self compacting concrete
- Fibre and textile reinforced concrete
- Concrete recycling
- Sustainability assessment of concrete systems

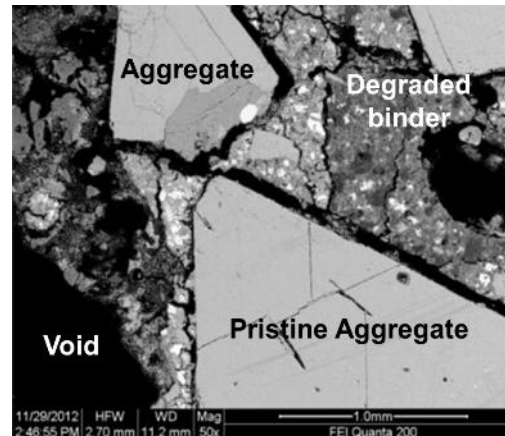
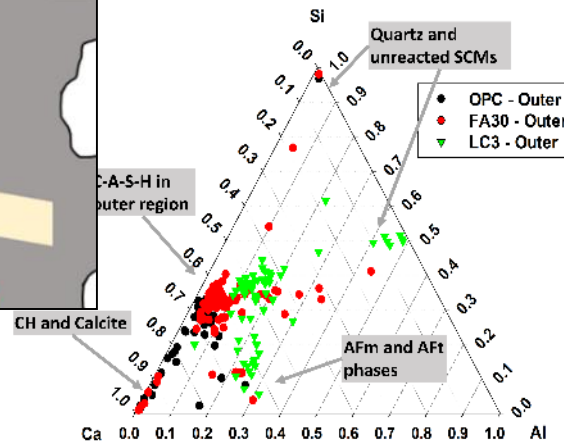
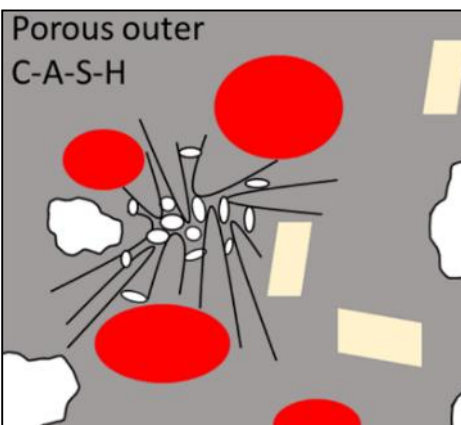
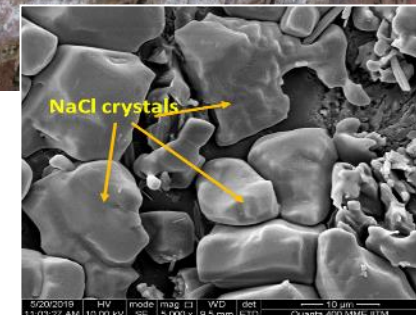




Dr. Manu Santhanam

Professor & Head of Department; Ph.D., Purdue University

- Cement chemistry & microstructure
- Characterization techniques
- Non-destructive evaluation
- Durability of concrete
- Performance specifications

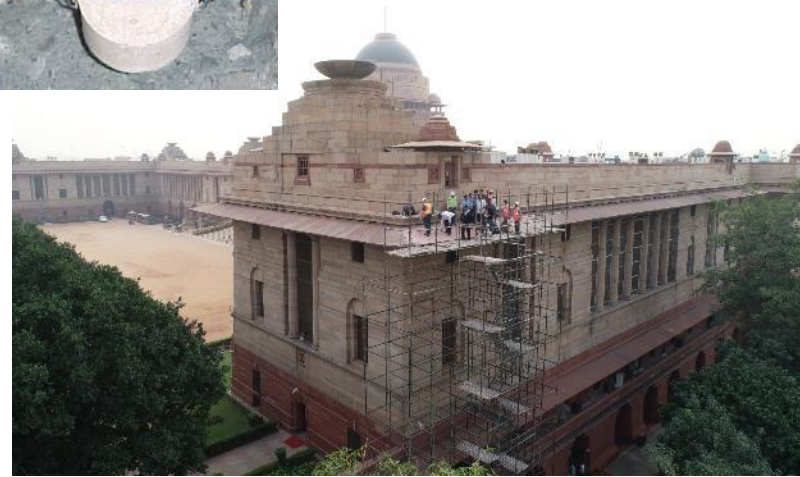
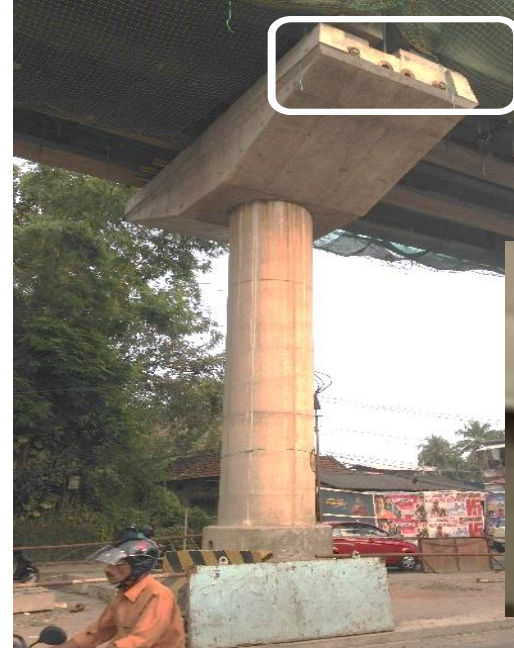




Dr. Radhakrishna G. Pillai

Associate Professor; Ph.D., Texas A&M University

- Corrosion assessment & service life estimation
- Corrosion control & service life extension
- Grout materials & practices for prestressed concrete





Dr. Piyush Chaunsali

Assistant Professor; Ph.D., Univ. of Illinois at Urbana-Champaign

- Cement chemistry and concrete durability
- Processing-microstructure-performance relationships of low CO₂ cements
- Microstructure and thermodynamic modelling of cementitious systems
- Valorization of industrial by-products

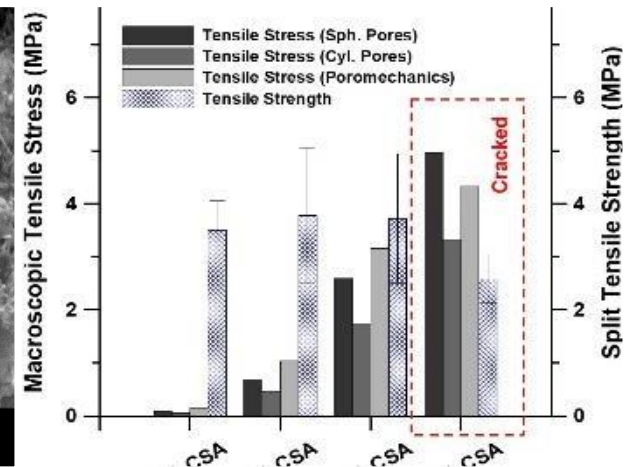
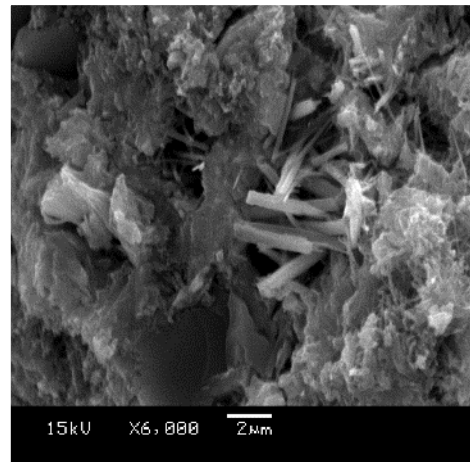
Pet Coke



Bagasse



Rice Husk

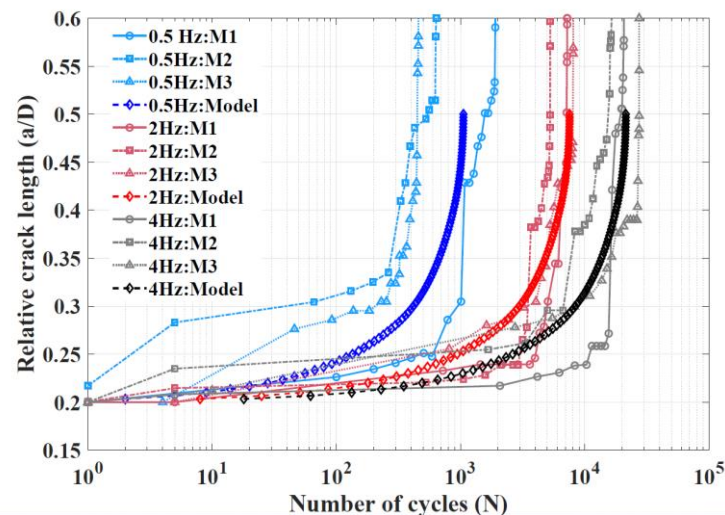
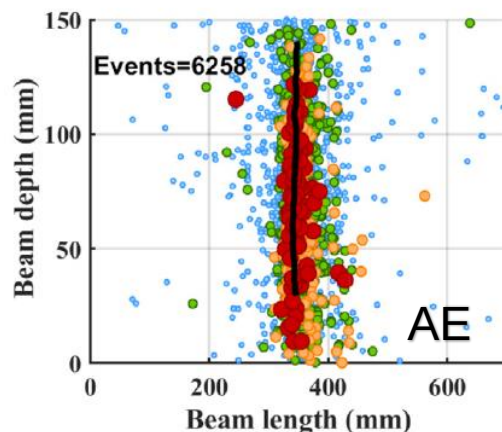
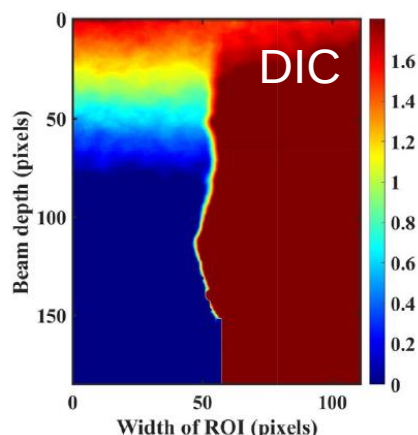
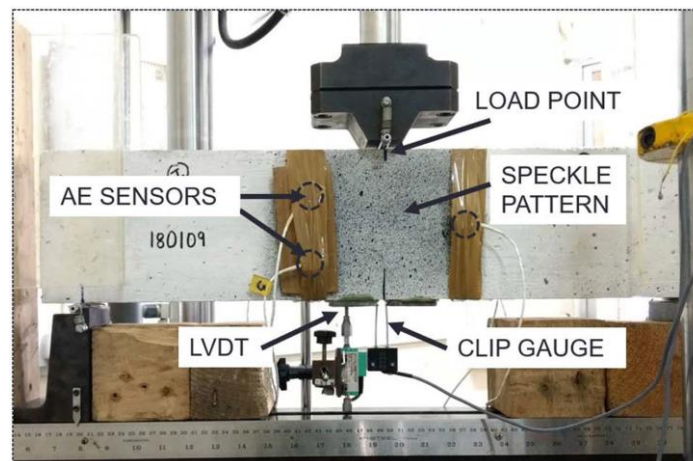


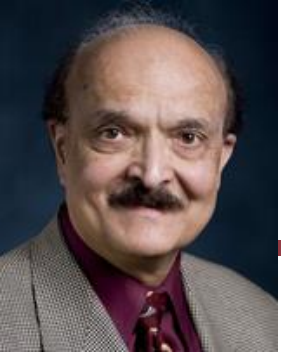


Dr. Keerthana Kirupakaran

Assistant Professor; Ph.D., IISc Bangalore

- Fracture and fatigue of concrete
- Fracture Characterization
- Fatigue life predictive models
- Fiber and Textile Reinforced Concrete

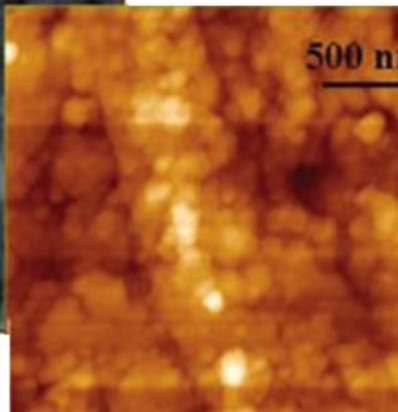
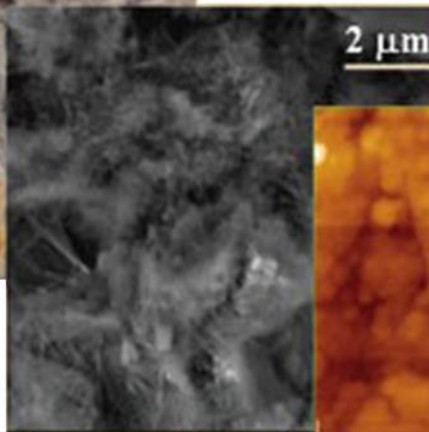
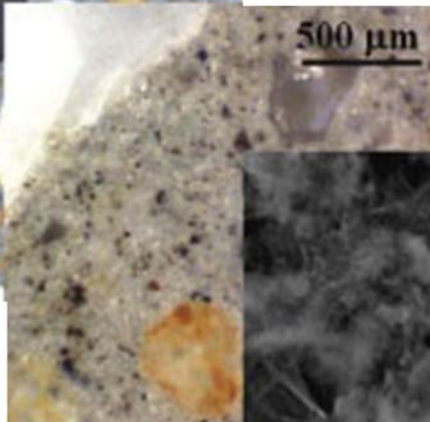
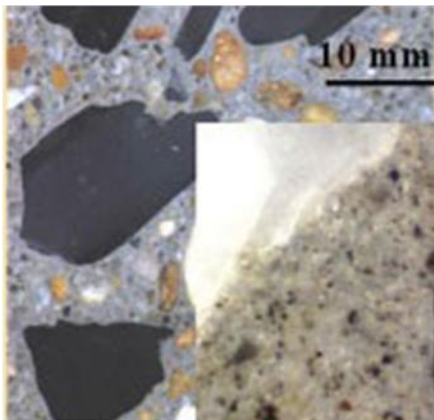
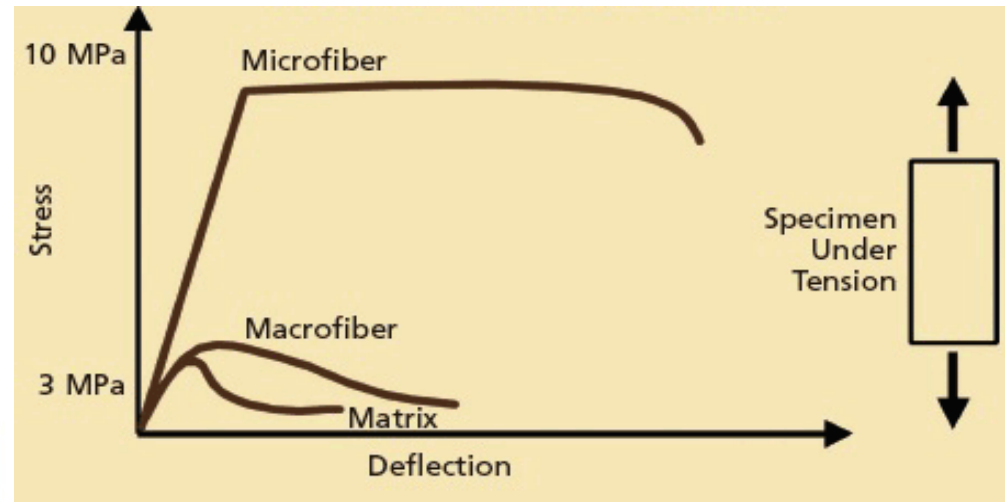




Prof. Surendra P. Shah

Distinguished Professor in Civil Engineering

- Connecting micro/nano behaviour to structural response of concrete



Interaction with the industry



BTCM graduates are now working as...

- Faculty members
 - IISc Bangalore
 - IIT Bombay, Delhi, Guwahati, Palakkad
 - NIT Trichy, Calicut, Warangal
 - Various other public/private engineering colleges
- PhD students and postdocs
 - USA, Switzerland, South Africa, Germany, Belgium, Italy
- Researchers/engineers
 - CSIR-SERC, Kuwait Inst. for Scientific Research
 - Aditya Birla, Ultratech, etc.
 - L&T Construction, SPCL etc.
 - Public sector Units
- Leaders in various other industrial units



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Department of Civil Engineering
Indian Institute of Technology Madras