BTCM @ IIT Madras

Providing academic leadership in the areas of

Building Science, Construction Materials and Construction Management

BTCM

Building Technology, Construction Materials & Management

Department of Civil Engineering

Indian Institute of Technology Madras

BTCM @ IITM - Overview

- First in India to facilitate teaching, learning, and research in…
  - Building Science
  - 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
  - M.S. & Ph.D.
- Faculty Members
  - 13 (Full time), 1 (Emeritus) and 1 (On deputation)
  - 3 Distinguished Faculty

Areas of specialization of faculty members

Faculty	Construction Materials	Construction Management	Building Science
Prof. K. Ramamurthy	▲		▲
Prof. Ravindra Gettu	▲		
Prof. Manu Santhanam	▲		
Prof. Radhakrishna G. Pillai	▲		
Dr. Piyush Chaunsali	▲		
Dr. Keerthana Kirupakaran	▲		
Dr. Aslam Kunhi Mohamed	▲		
Prof. Koshy Varghese		▲	
Prof. Benny Raphael		▲	▲
Prof. Ashwin Mahalingam		▲	
Dr. Sivakumar Palaniappan		▲	
Dr. Nikhil Bugalia		▲	
Dr. Murali Jagannathan		▲	
Dr. Aritra Pal		▲	
Prof. K. N. Satyanarayana*		▲	

* On deputation to IIT Tirupati as Director

Distinguished Faculty Members

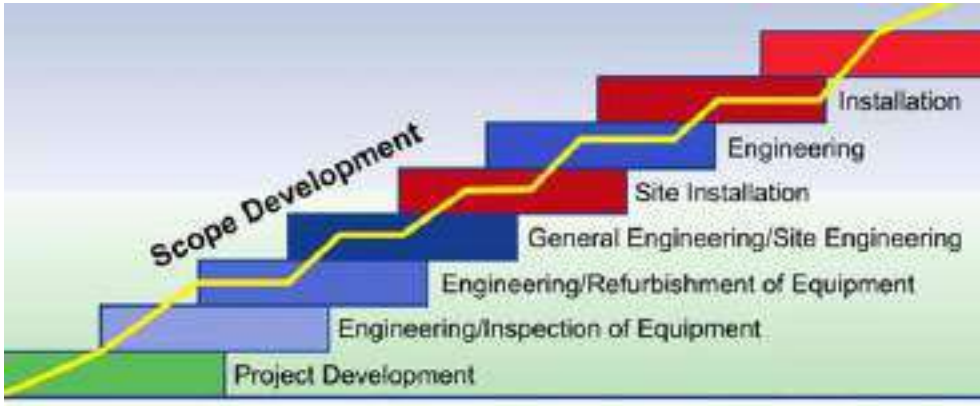
- Prof. Mark Alexander, University of Cape Town, South Africa
- Prof. Mirosław J. Skibniewski, University of Maryland, USA
- Prof. Surendra P. Shah, Northwestern University, USA

A glimpse on the activities by
Construction Management group

- Construction management
- Infrastructure management
- Construction automation

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?



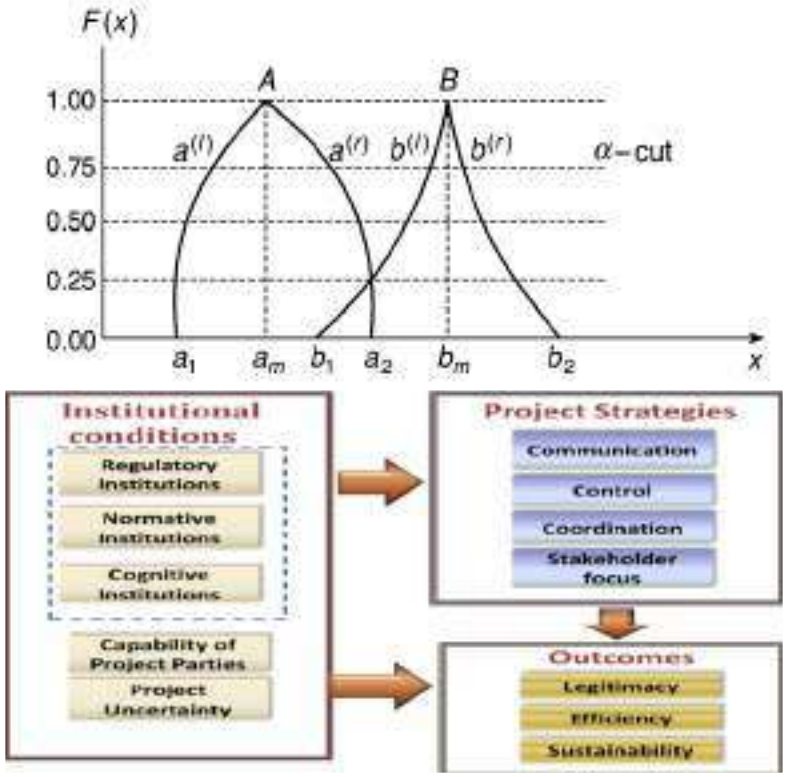
- Impacts

Lean Champions Program

Build India Scholarship

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

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

I.A.A.R.C.

SAINT-GOBAIN

Indian Green Building Council

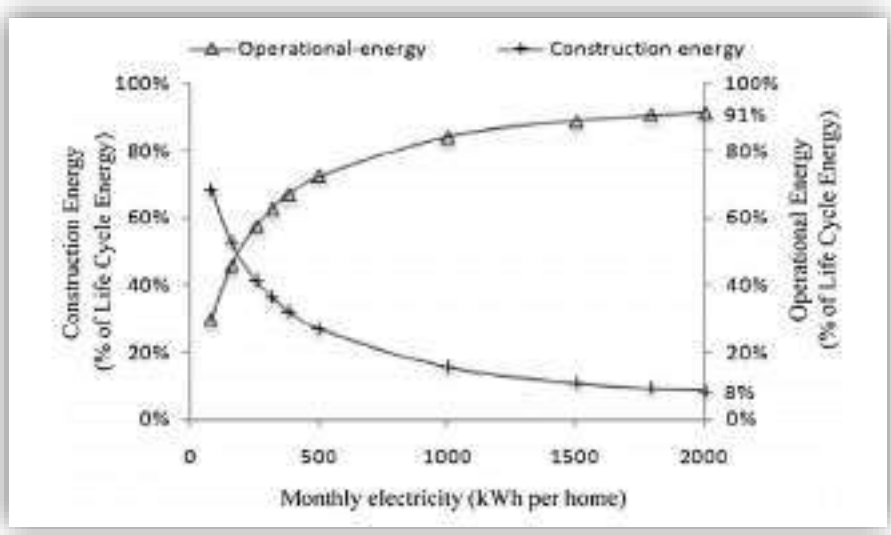
ASCE Journal of Computing in Civil Engineering

Studies on sustainable construction

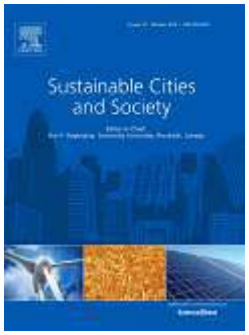
- Questions we answer
  - What is the relative contribution of construction energy with respect to building life cycle energy?
  - How to integrate sustainability metrics into construction planning and control practices?
  - How do we improve the schedule performance of construction projects in India?

Naturally-ventilated buildings

Air-conditioned buildings



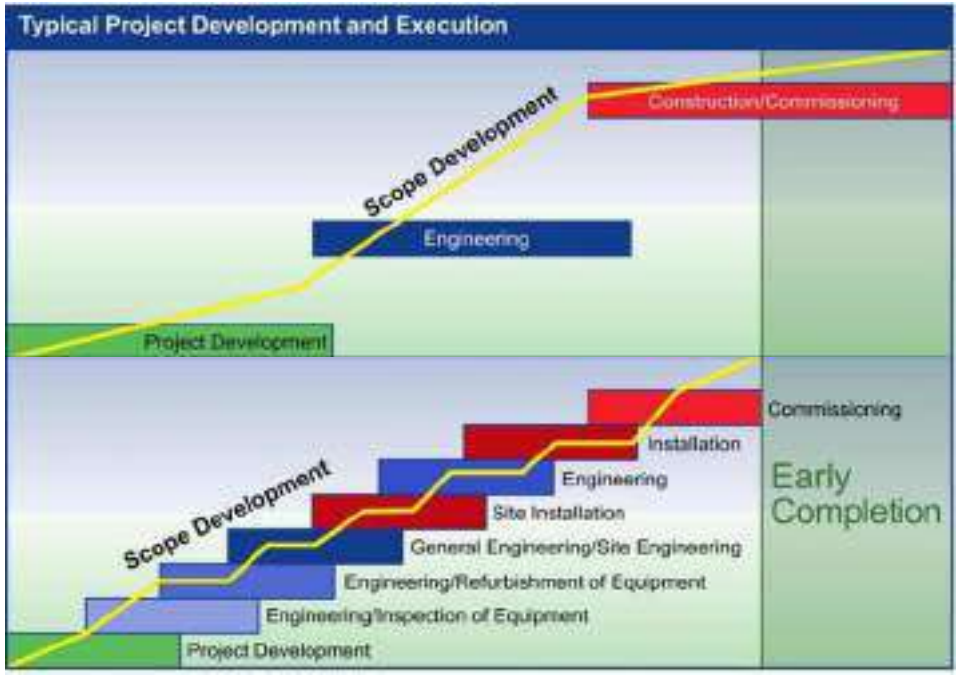
- Impacts

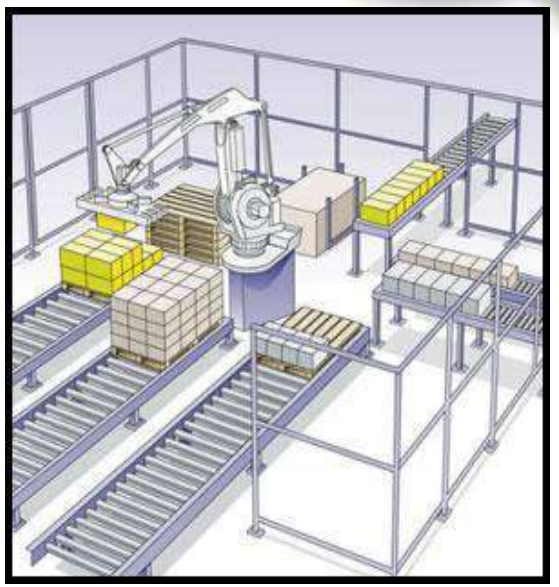


Dr. Koshy Varghese

Professor; Ph.D., University of Texas

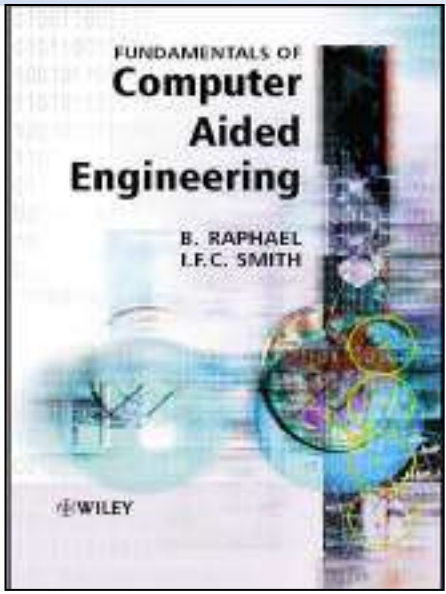
- Automation in Construction
- Fast Track & Concurrent Engineering Projects
- Sustainable Development
- GIS in Civil Engineering Applications





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

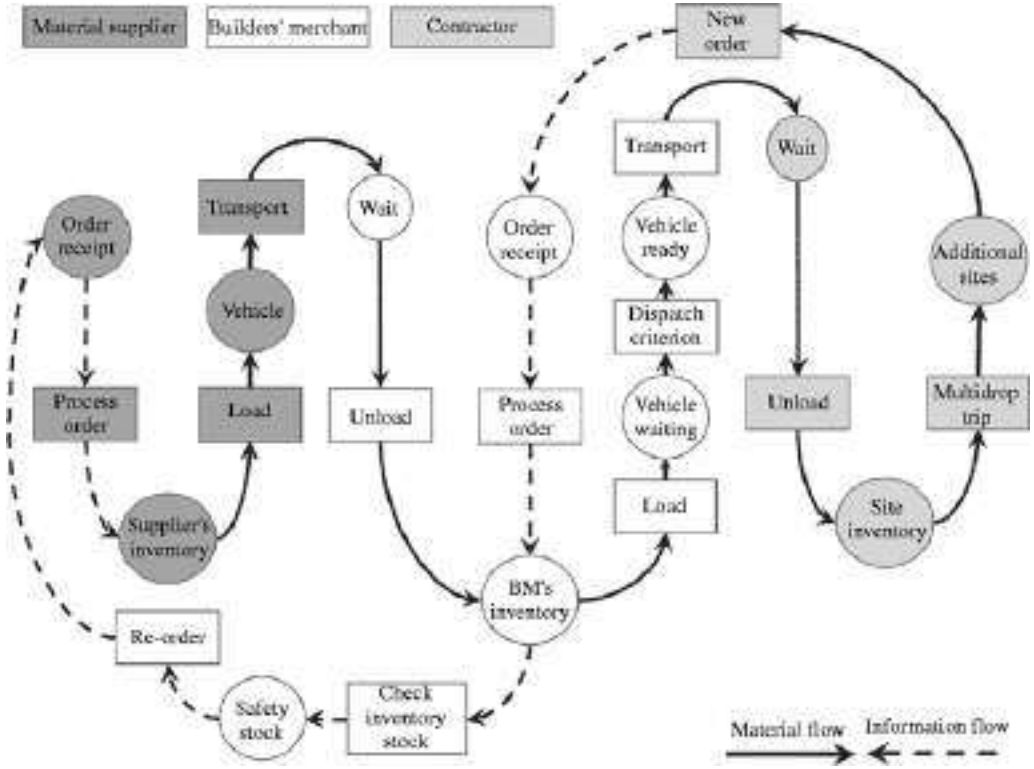
Professor; Ph.D., Stanford University

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

Dr. Sivakumar Palaniappan

Associate Professor; Ph.D., Arizona State University

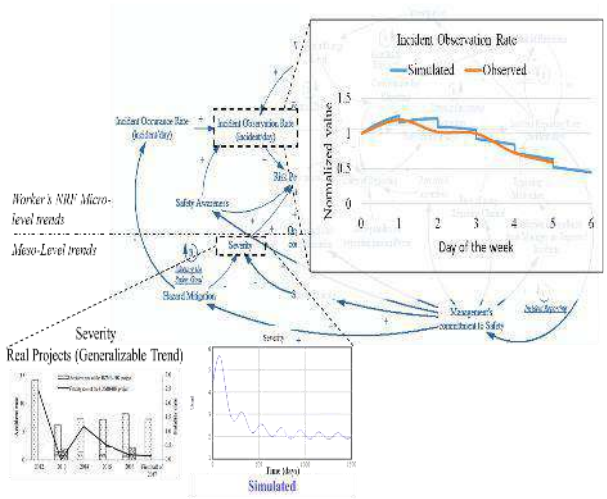
- Modelling and Simulation of Construction Processes
- Information Technology in Construction
- Sustainable Construction



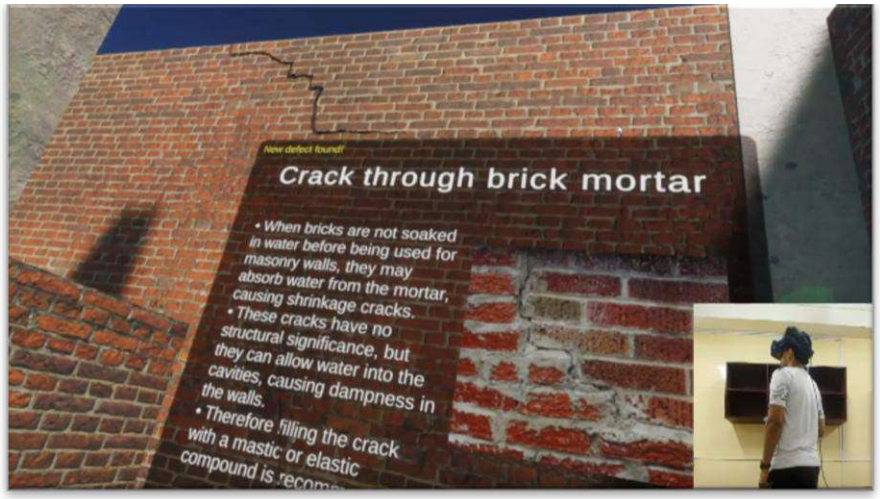
Dr. Nikhil Bugalia

Assistant Professor; Ph.D., University of Tokyo

- Safety Management – Construction
- Machine-learning for Safety Management
- Skill Development using AR-VR



System Dynamics based Numerical simulation for near-miss reporting system



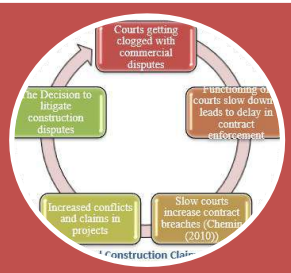
VR-based training in Construction

Dr. Murali Jagannathan

Assistant Professor; Ph.D., IIT Bombay

- Construction Contracts and Claims Management
- Lean Construction Management
- Application of Natural Language Processing (NLP) in contract management

Extracting learnings from court cases and developing training modules



Developing contract clauses to support lean implementation

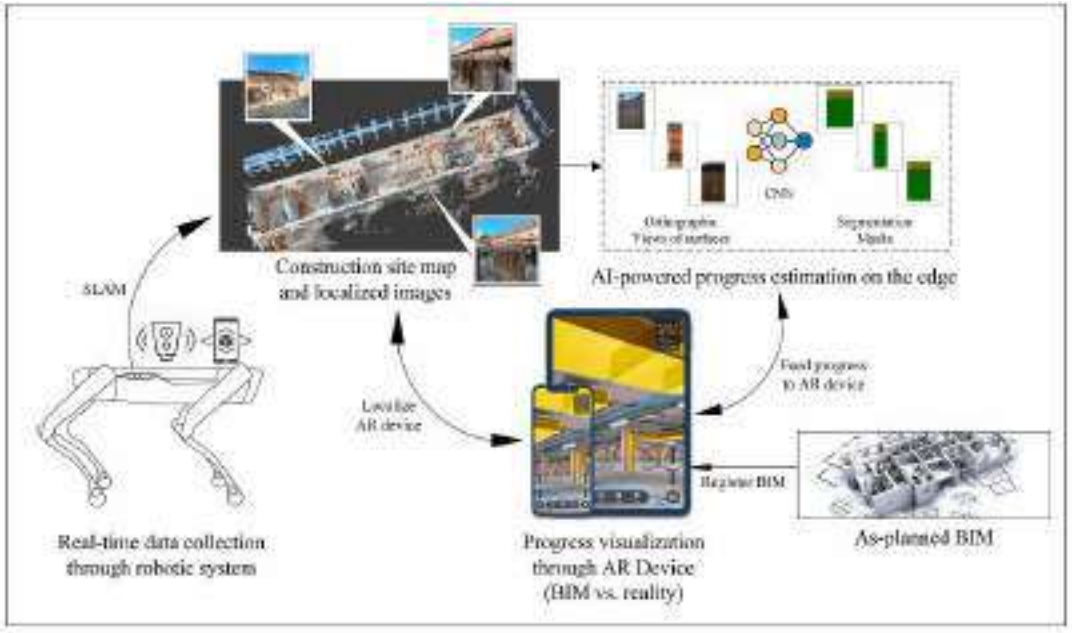
Use of technology to assess contract risks

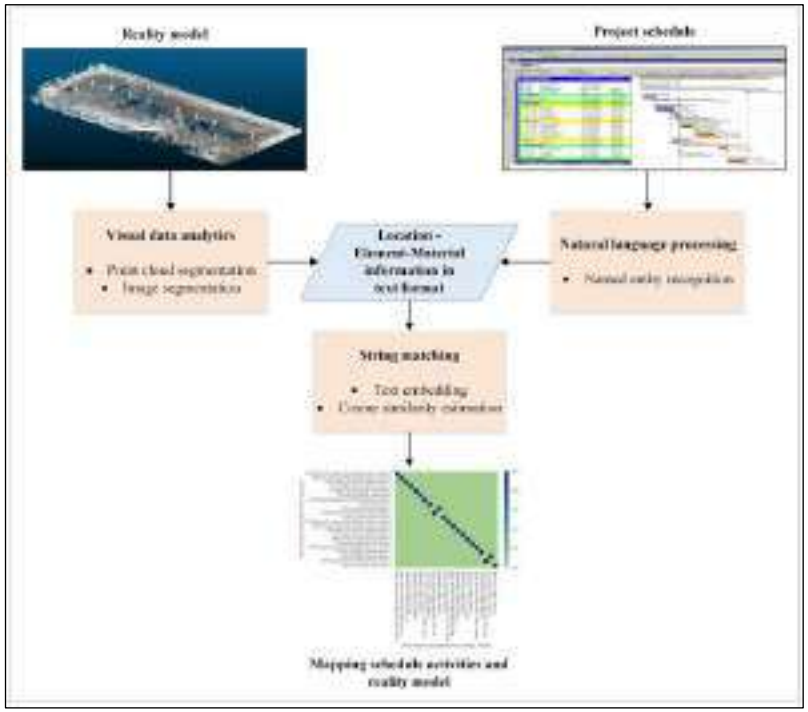
BROAD DESCRIPTION OF THE BANDWIDTH/AREA OF RESEARCH

Dr. Aritra Pal

Assistant Professor; Ph.D., National Taiwan University

- Building Information Management/ Digital Twin Construction
- AI/ML Applications in Construction Management
- Computer Vision (CV) and Natural Language Processing (NLP)
- Construction Automation and Robotics





Prof. N. Raghavan

Former Professor of Practice

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

A glimpse on the activities by
Construction Materials group

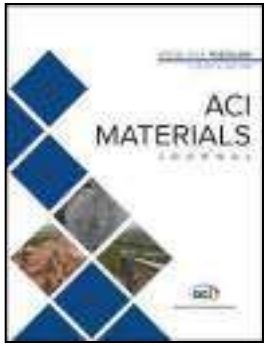
- Cement chemistry and concrete microstructure
- Mechanical properties, dimensional stability, corrosion and durability
- Service life estimation & extension
- Sustainability & life cycle assessment

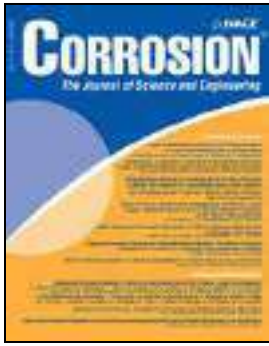
Questions we answer?

- 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





Bureau of Indian Standards

Indian Concrete Institute

NACE INTERNATIONAL

Studies on mechanical performance

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

Fatigue, fracture, bond strength

Flexural toughness

Prestressing bed

Long-term durability performance studies

- Environmental exposure chambers

High-temperature, carbonation, humidity chambers

Natural carbonation studies

Long-term shrinkage and creep studies

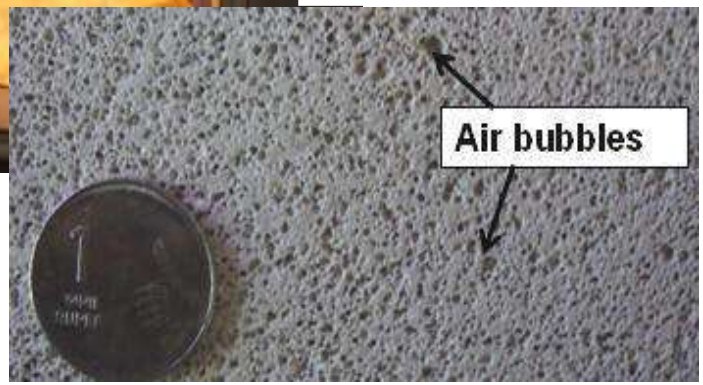
- Large rooms with controlled temperature and humidity environment

Studies on corrosion assessment and service life estimation/extension

- Electrochemical workstation, corrosion cells, prestressing frames

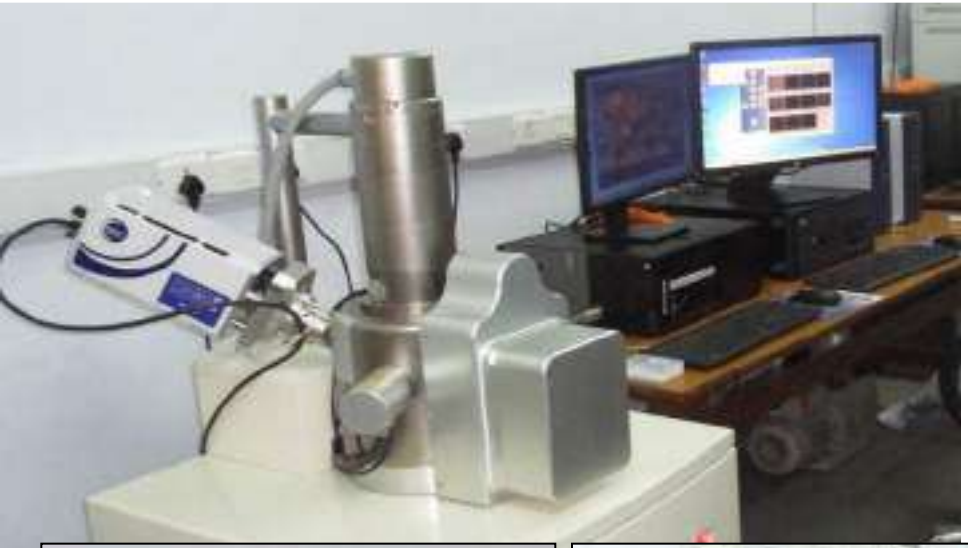
Studies on fresh properties of concrete

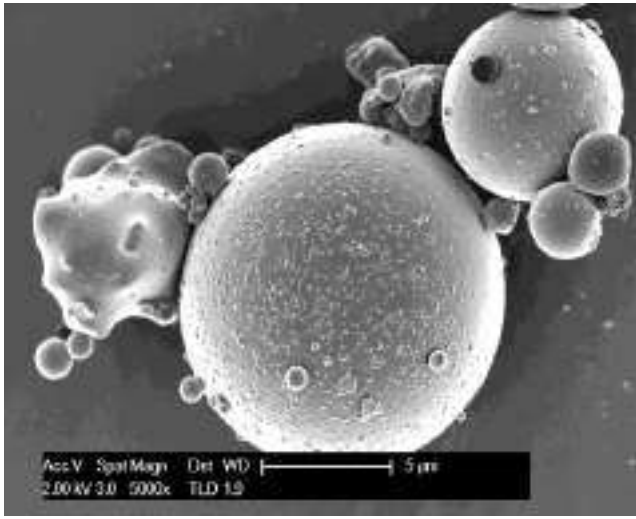
- Walk-in chamber, controlled environment rooms, etc.

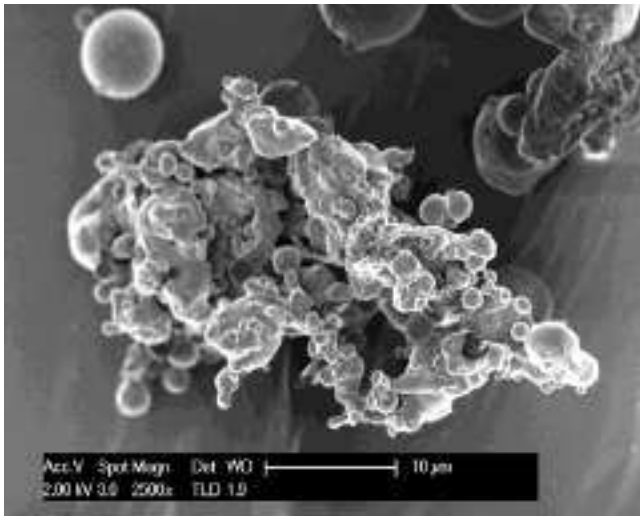


Studies on evolution of microstructure of various cementitious systems

- Optical microscopes, SEM, MIP, etc.

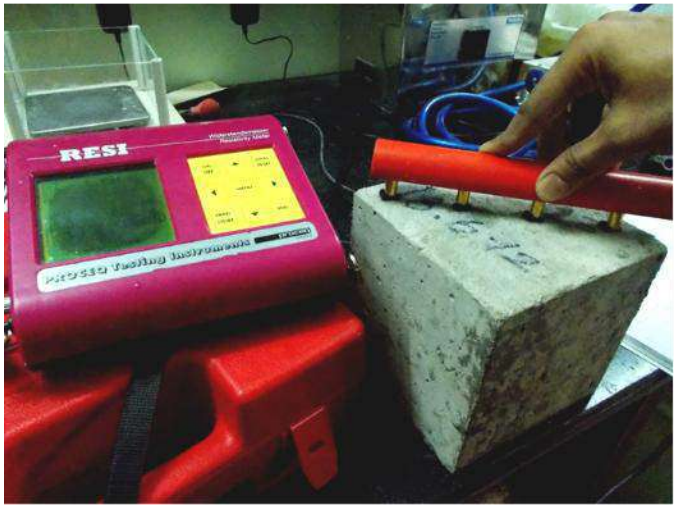






Studies on the transport of water, CO_2, O_2, and chlorides through concrete

- Suite of testing setups

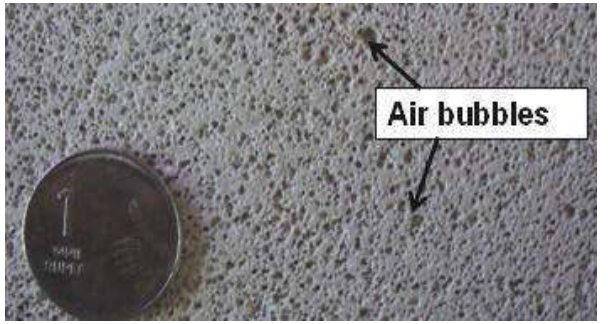


Workshop facilities within the department for fabricating research/testing setups

Dr. K. Ramamurthy

Emeritus Professor; Ph.D., IIT Madras

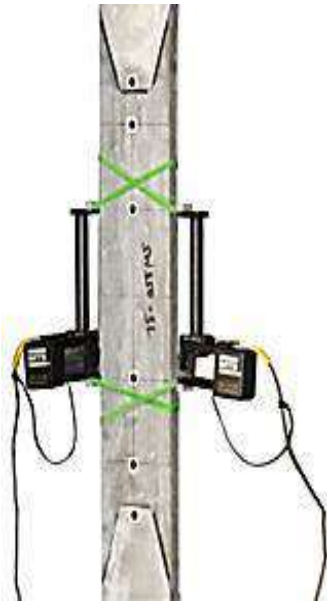
- Light weight and fly ash aggregates
- Aerated & foam concrete blocks/bricks
- Interlocking brick masonry
- Thermal comfort & lighting of buildings

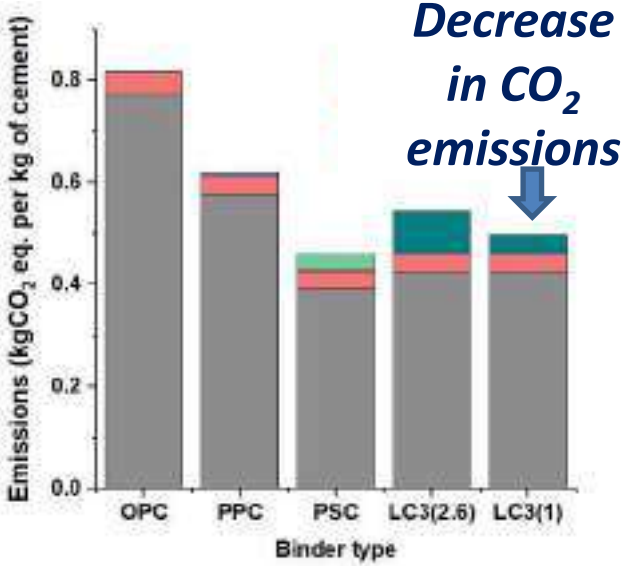


Dr. Ravindra Gettu

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





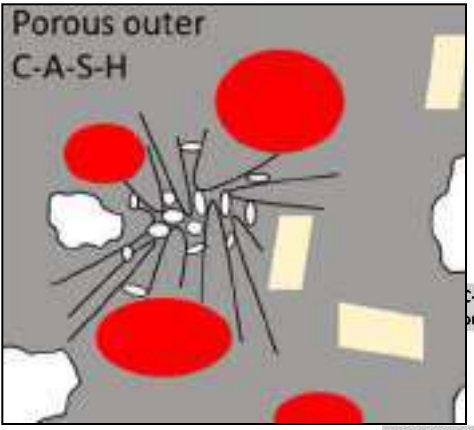
Decrease in CO_2 emissions

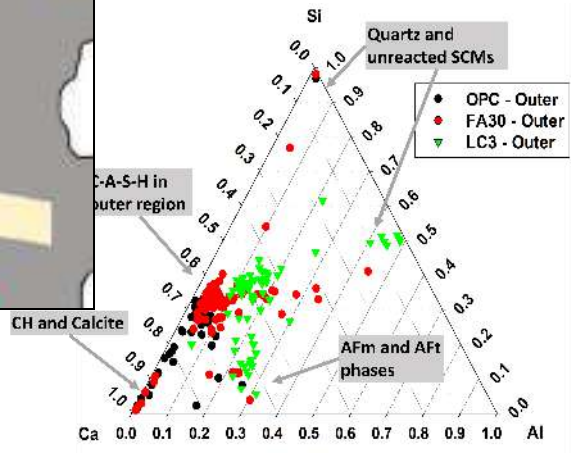
Dr. Manu Santhanam

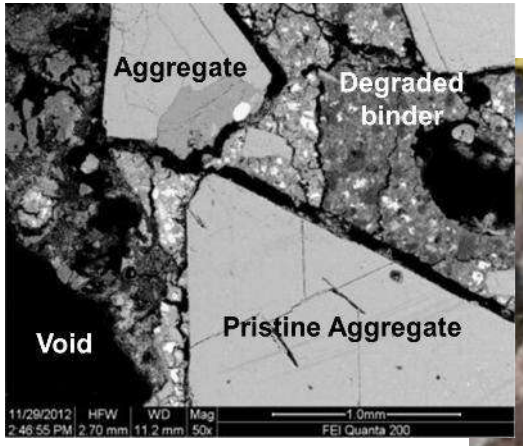
Surendra P Shah Chair Professor; Ph.D., Purdue University

BICM

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







Dr. Radhakrishna G. Pillai

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

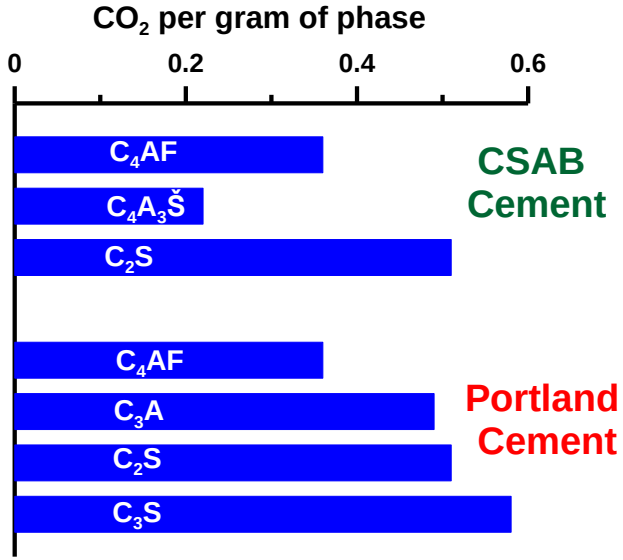
- Corrosion assessment & service life estimation
- Corrosion control & service life extension
- Grout materials & practices for prestressed concrete

Dr. Piyush Chaunsali

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

Major Areas of Research

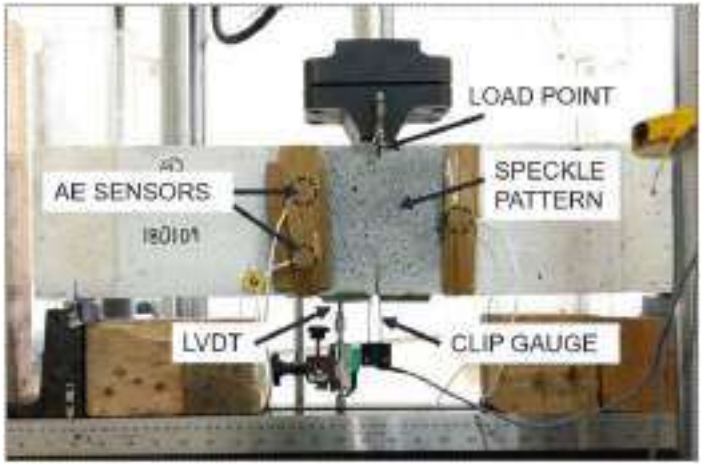
- Cement chemistry and concrete durability
- Processing-microstructure-performance relationships of low CO_2 cements
- CO_2 mineralization in cement-based composites

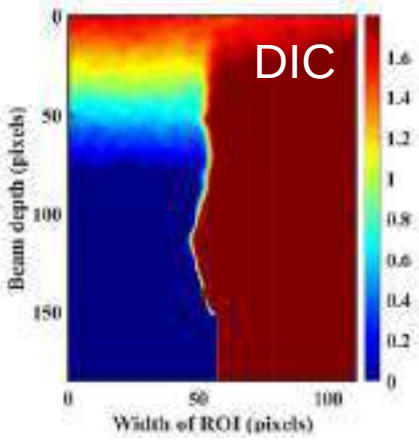


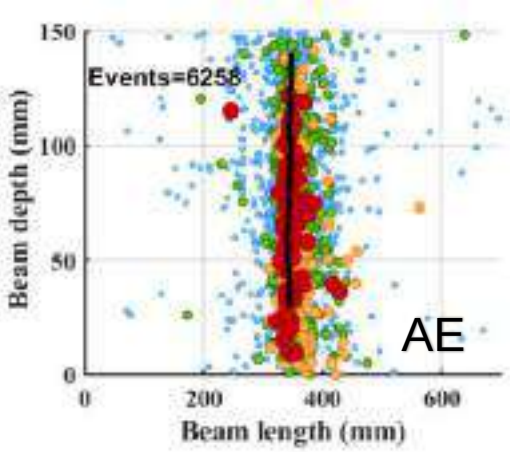
Dr. Keerthana Kirupakaran

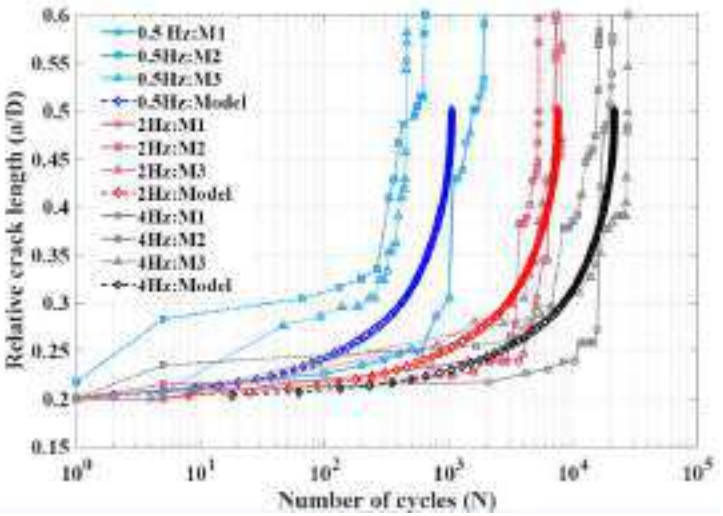
Assistant Professor; Ph.D., IISc Bangalore

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





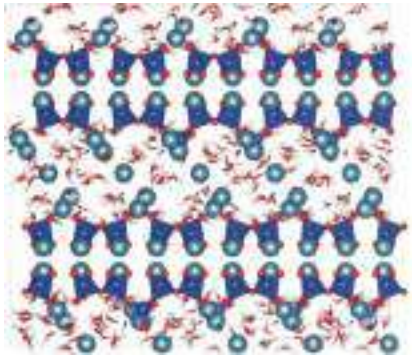




Dr. Aslam Kunhi Mohamed

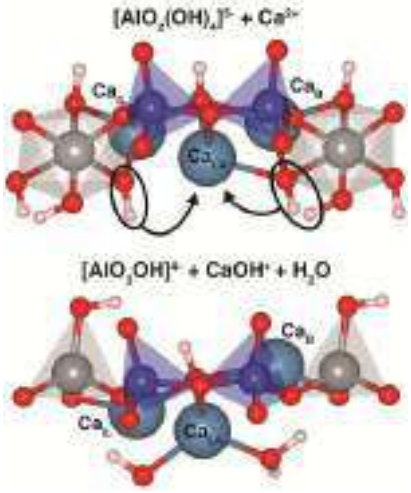
Assistant Professor; Ph.D., EPFL

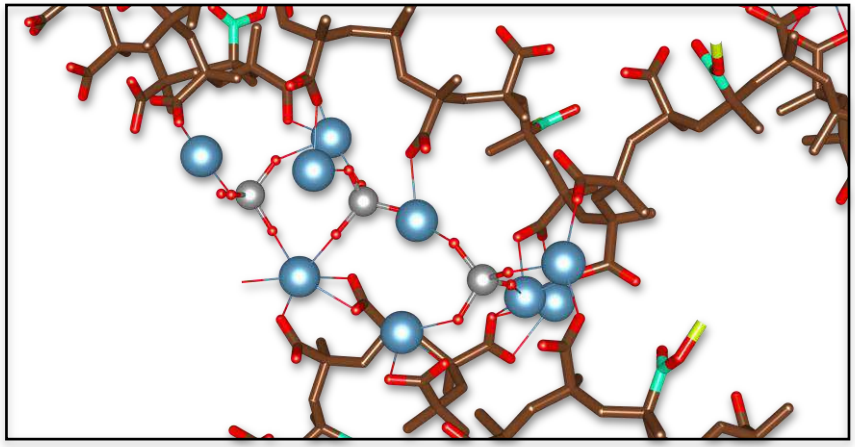
BICM

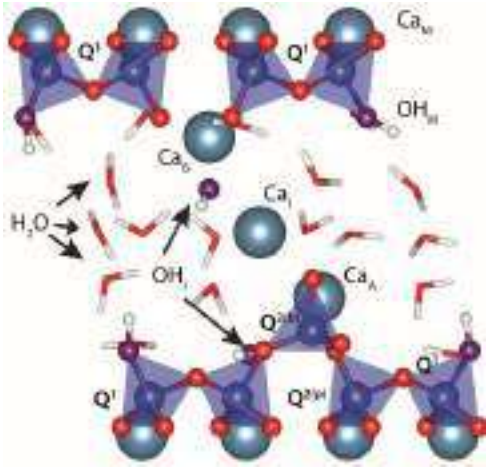


- Molecular modeling of cementitious materials
- Cement hydration at the atomic scale
- Low CO2 cements
- Admixtures

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







Interaction with the industry

and many more…

BTCM graduates are now working as…

- Faculty members
  - IISc Bangalore
  - IIT Bombay, Delhi, Guwahati, Palakkad, Tirupati
  - NIT Trichy, Calicut, Warangal, Allahabad, Surathkal
  - Various other public/private engineering colleges

- PhD students and postdocs
  - Australia, Belgium, Germany, Italy, Switzerland, South Africa, USA, UK
- 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

How to Join us?

- M. Tech.
  - GATE-based merit (Civil/Arch.)
- M.S.
  - GATE Qualification and Interview
  - Direct interviews for project staff (who have spent more than 6 months at IITM) and took courses (with CGPA of >7.5)
- Ph.D.
  - After Masters, NO GATE qualification is needed
- Direct Ph.D.
  - NITs, CGPA >8, Direct Ph.D. Interviews

How to Join us?

- MoU with NITs
  - Department Recommended top students come for a summer internship at IIT Madras
  - Based on performance, they can spend final year at IIT Madras and do courses, project
  - Based on CGPA of > 8 in IIT Courses, Direct PhD
  - MoU with MNIT Jaipur can also be created

BTCM @ IIT Madras

Providing academic leadership in the areas of

Building Science, Construction Materials and Construction Management

BTCM

Building Technology, Construction Materials & Management

Department of Civil Engineering

Indian Institute of Technology Madras