

DR RANJITH K. SOMAN

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PROFILE

I am an early career researcher with a civil engineering background and a PhD which focused on knowledge codification, ontologies, and reinforcement learning in an infrastructure context. I have research and project experience in various infrastructure assets such as urban transit systems and major water projects. I am passionate about applying systems thinking and artificial intelligence in civil infrastructure and keen to educate the next generation of infrastructure professionals on the importance of embedding information technology within the scope of the traditional functions of existing core professional service. I aspire to have an academic career to research and drive innovation for a step-change in infrastructure sustainability.

EDUCATION

PhD in Civil and Environmental Engineering (Passed viva with minor corrections), March 2017-September 2020

Imperial College London, United Kingdom, Thesis: “Automated look-ahead schedule generation using linked-data based constraint checking for construction projects”, Focus: Automating look ahead planning of construction using linked data and reinforcement learning, modelling constraints and information flow in construction and case studies with leading projects to understand challenges of codification of information flow.

PhD Enrichment Scholar, September 2018-March 2019

The Alan Turing Institute, United Kingdom, Focus: Using machine learning algorithms to optimize construction planning and execution.

Research MSc in Civil Engineering (CGPA 8.8), July 2013-May 2016

Indian Institute of Technology Madras (IITM), India, Thesis: “Automated monitoring of launching girder operations using wireless strain sensing network” Focus: Construction planning and control, lean construction, construction project modelling, and smart buildings and automation.

BTech in Civil Engineering (First class with honors, CGPA 8.43), August 2009-June 2013

University of Calicut, India, Focus: Structural engineering, fluid mechanics and water resources engineering, geotechnical engineering, transportation engineering, construction management and environmental engineering.

ACADEMIC EXPERIENCE

Post-doctoral Research Associate, September 2020-present

Centre for Systems Engineering and Innovation, Imperial College London, Responsible for the development of predictive analytics to provide proactive insights for assisting decision making in construction in an AEC production control room environment.

Project Associate, July-December 2016

Building Automation Lab, Indian Institute of Technology (IIT) Madras, Responsible for the development of the virtual model of the building automation system for self-assembly of columns and beams, designing the sensor configurations and control system and preparing the specifications for procurement of necessary hardware.

PUBLICATIONS (4 JOURNALS | 11 CONFERENCES)

Journal articles

1. **Soman, R.K.**, Molina-Solana, Miguel & Whyte, J.K. (2020), Linked-Data based Constraint-Checking (LDCC) to support look-ahead planning in construction, *Automation in Construction*,120, 103369. **(IF: 7.70)**
2. **Soman, R.K.**, & Whyte, J.K. (2020), Codification challenges for data science in construction, *ASCE Journal of construction engineering and management*, 146 (7), 04020072. **(IF: 3.26)**
3. Shi, F., **Soman R.K.**, Whyte, J.K. & Han, J. (2020), Addressing adjacency constraints in rectangular floor plans using Monte-Carlo Tree Search. *Automation in Construction*,115, 103187. **(IF: 7.70)**
4. **Soman, R.K.**, Raphael, B., & Varghese, K. (2017). A System Identification Methodology to monitor construction activities using structural responses. *Automation in Construction*, 75, 79–90. **(IF: 7.70)**

Conference papers

1. Farghaly, K., **Soman, R.K.**, & Whyte, J. (2021), Bridging the gap between Information Management (IM) and Advanced Work Packaging (AWP): Towards AWP Ontology, *36th International Council for Research and Innovation in Building and Construction W78 Conference on ICT in Design, Construction and Management in Architecture, Engineering, Construction and Operations (AECO)*, Luxembourg (Accepted).
2. Wallbaum, M. & **Soman, R.K.** (2021), Towards real-time SCAN-versus-BIM using SLAM; methods, applications and challenges, *European Conference on Computing in Construction, Greece* (Accepted).
3. Farghaly, K., **Soman, R.K.**, & Whyte, J. (2021), Visualizing real-time information through a construction production control room, *European Conference on Computing in Construction, Greece* (Accepted).
4. **Soman, R.K.** (2019), Linked-data based dynamic constraint solving framework to support look-ahead-planning in construction, *36th International Council for Research and Innovation in Building and Construction W78 Conference on ICT in Design, Construction and Management in Architecture, Engineering, Construction and Operations (AECO)*, Newcastle, United Kingdom.
5. **Soman, R.K.** (2019). Modelling construction scheduling constraints using Shapes Constraint Language (SHACL), *European Conference on Computing in Construction (EC³ 2019)*. Crete, Greece.
6. Balasubrahmani, M., **Soman, R.K.**, Whyte, J.K., Mahalingam, A., (2019). Temporality, innovation and megaproject-to-megaproject learning across continents in the case of Crossrail and Nagpur Metro. *35th European Group for Organizational Studies (EGOS) Colloquium*. Edinburgh, UK.
7. Senthilvel, M., **Soman, R.K.**, Mahalingam, A., Whyte, J.K., Raphael, B., Brilakis, I., & Varghese, K. (2018). Towards digital delivery of metro-rail projects in India. *7th World Construction Symposium 2018: Built Asset Sustainability: Rethinking Design, Construction and Operations*. Colombo, Sri Lanka.
8. **Soman, R.K.**, Birch, D., & Whyte, J.K. (2017). Framework for shared visualization and real-time information flow to the construction site. *24th European Group for Intelligent Computing in Engineering (EG-ICE) International Workshop on Intelligent Computing in Engineering*. Nottingham, UK.
9. **Soman, R.K.**, & Whyte, J.K. (2017). A framework for cloud-based virtual and augmented reality using real-time information for construction progress monitoring. *Lean & Computing in Construction Congress (LC3)*. Heraklion, Greece.
10. Senthilvel, M., **Soman, R.K.**, & Varghese, K. (2017). Comparison of handheld devices for 3D reconstruction in construction. *34th International Symposium on Automation and Robotics in Construction (ISARC)*. Taipei, Taiwan.

11. **Soman, R.K.**, Raphael, B., & Varghese, K. (2015). Sensor placement to monitor launching girder operations in segmental construction. *32nd International Symposium on Automation and Robotics in Construction (ISARC)*. Oulu, Finland.

Upcoming journal articles

1. **Soman, R.K.**, & Molina-Solana, Miguel (2021), Automated look-ahead schedule generation using linked-data and reinforcement learning, *Automation in Construction* (Under Review).
2. Farghaly, K., **Soman, R.K.**, Collinge, W., Mosleh, M. H., Manu, P. & Cheung, C., Construction safety ontology development and alignment with Industry Foundation Classes (IFC), *Information and Technology in Construction* (Under Review)
3. Farghaly, K., **Soman, R.K.**, & Whyte, Jennifer (2021), Production control room for sustainable construction, *Journal of Cleaner Production* (In Preparation).

RESEARCH FUNDING (~\$2,464,140)

1. **Named researcher in “AEC Production Control Room (2020)”**
Funder: Innovate UK - Transforming UK construction | Value: \$2,214,000 | April 2020-April 2022, led by MACE
Co-Investigators: Prof Jennifer Whyte, Prof Duncan Wilson, Dr Grant Mills, and Dr Eleni Papadonikolaki.
This project aims to provide a solution to help UK construction be more efficient and proactive rather than reactive, with a scalable and repeatable ‘plug-and-play’ construction management and reporting platform known as the AEC Production Control Room. My role relates to research and development of a predictive analytics engine to aid decision making for complex infrastructure projects.
2. **Principal Investigator in “Upgrading 3D Move for collaborative visualization (2019)”**
Funder: Centre for Systems Engineering and Innovation | Value: \$9271 | March 2019 – September 2019
Co-Investigators: Dr Akeem Pedro, Dr Luigi Mosca, Dr Long Chen and Shanjing Zhou
The proposed project offers opportunities to bring a collaborative visualization environment within a smaller budget. The refined software is expected to improve the visualization experience inside the cave environment. My role was to lead the research for this project and build the game engine environment for visualization platform.
3. **PhD Enrichment Scholarship**
Funder: The Alan Turing Institute | Value: \$4289 | October 2018 –March 2019
The research funding was used to develop and test reinforcement learning methods to generate look-ahead schedules in a major sewage infrastructure project.
4. **Named researcher in “Building resilient infrastructure through metro development (2017)”**
Funder: EPSRC-GCRF Community Building Fund | Value: \$13,838 | November 2017-March 2018
Co-Investigators: Prof Jennifer Whyte, Dr Ioannis Brilakis, Prof Koshy Varghese, Prof Benny Raphael and Dr Ashwin Mahalingam.
This project aimed at fostering collaboration between universities in UK and India to do projects contribute to UN sustainability goals. My role was to contribute using my experience and personal relation in working with Indian metro projects and academics to shape the proposal as well as a joint workshop.
5. **Principal Investigator in “Augmented visualization for improved construction progress monitoring (2017)”**
Funder: Centre for Systems Engineering and Innovation | Value: \$13,021 | March 2019 – September 2019
Co-Investigators : Prof Jennifer Whyte

This project aimed to change the otherwise, manual, laborious, time consuming and error prone construction progress monitoring practice in the construction industry, to presenting all physical and digital data through augmented visualization for efficient construction progress monitoring. This would also provide state of the art collaboration and review platform and enable faster site inspections for construction progress. My role was to lead this project and contribute to the development of the prototype.

STUDENT SUPERVISION

Postgraduate level project

1. Sai Meghashyam, MTech final year project, Indian Institute of Technology Madras, July-September 2016;
2. Sai Chowdesara Rao, MTech final year project, Indian Institute of Technology Madras, July-September 2016; and
3. Ruban Jacob, MTech final year project, Indian Institute of Technology Madras, July-September 2016.

Undergraduate level project

1. John Oo, MEng final year project, Imperial College London, February-June 2021;
 2. Hadrian Lim, Undergraduate research project, Imperial College London, June -October 2018;
 3. Arthur Mun, Undergraduate research project, Imperial College London, June -September 2017;
 4. Joan Rosello Bover, Undergraduate research project, Imperial College London, June - September 2017;
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TEACHING EXPERIENCE

Curriculum design and delivery

1. “*Project management tools*”, one 1-hour lecture in online mode as part of Business and Project Management 2nd Year MEng module, 60 students, Imperial College London, January 2021;
2. “*Mixed reality for construction*”, one 1-hour invited lecture as a part of MACE construction Continuous Professional Development (CPD) Course, 20 senior leaders at MACE, Imperial Business School, January 2019;
3. “*BIM for design and construction*”, three 2-hour tutorials on the part of Innovation in Civil Engineering MSc module, 60 students, Imperial College London, November 2018;
4. “*Virtual reality*”, one 2-hour invited lecture as part of MSc course in Advanced Visualization to 30 students, University of Reading, December 2018; and
5. “*Lean and information technology*” one 2-hour lecture as part of Lean construction MSc module to 60 students, Indian Institute of Technology Madras, December 2016.

Graduate teaching assistant experience

1. “*Business and Project Management*” offered to the 2nd year of the MEng Civil Engineering programme, 9 x 2 hours, spring term, 60 students, Imperial College London, 2021 (Online);
 2. “*Innovation in Civil Engineering*” offered to the MSc Students, 10 x 3 hours, autumn term, 60 students each year, Imperial College London, 2020 (Online), 2019, 2018, 2017;
 3. “*Smart Buildings and Automation*” offered to the MTech students, 20 x 1 hour, spring term, 45 students each year, Indian Institute of Technology Madras, 2015, 2016; and
 4. “*CAD in Civil Engineering*” offered to the MTech students, 20 x 1 hour, autumn term, 30 students each year, Indian Institute of Technology Madras, 2014, 2015, 2016.
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SCHOLARSHIPS AND AWARDS

1. **Best poster award** awarded by **Centre for Systems Engineering and Innovation, Imperial College London** at their annual **Industry Showcase event** in London UK, November 2019;
2. **Second place for Three-minute thesis competition** awarded by the **European Council on Computing in Construction** at their **2019 European Conference on Computing in Construction (EC³ 2019)**, Chania, Greece, July 2019;

3. **First Place for Linked-Data in Architecture and Construction Hackathon** awarded by **Linked Building Data Community Group** at their **2019 Linked data in architecture and construction conference**, Lisbon, Portugal, June 2019;
4. **Top 3 Finalist for Max Boisot Award** awarded by the **European Group for Organizational Studies** at their **2020 European Group for Organizational Studies Colloquium**, Hamburg, Germany, 2020;
5. **Alan Turing PhD Enrichment Award** awarded by the **The Alan Turing Institute- UK's national institute for data science and artificial intelligence** for exemplary PhD work in artificial intelligence, London, UK, 2018;
6. **Best poster award** awarded by **Centre for Systems Engineering and Innovation, Imperial College London** at their annual **Industry Showcase event** in London UK, November 2019;
7. **Skempton scholarship (\$98,940)** awarded by **Department of Civil and Environmental Engineering, Imperial College London** for exceptional PhD proposals, London UK, December 2016;
8. **First place for Corrosion awareness video competition** awarded by **National Institute of Ocean Technology Chennai, India**, August 2013;
9. **Postgraduate research scholarship (\$7610)** awarded by **Ministry of Human Resource Development, India** for exceptional MSc students, Chennai India, July 2013; and
10. **First place for Oral presentation** awarded by **Civil Engineering Association, Indian Institute of Technology Madras** at **Indian Concrete Institute Fest** held at IIT-M, Chennai, India, March 2013.

CONTINUOUS PROFESSIONAL DEVELOPMENT (CPD)

Advanced courses

- “*Applied machine learning boot camp*”, 2-day workshop conducted by Google UK, Imperial College London, September 2019;
- “*Research computing: introduction to high performance computing*”, 1-day workshop, Imperial College London, August 2019;
- “*Systems engineering leadership*”, 1-day workshop, Imperial College London, September 2019;
- “*Model based systems engineering*”, 1-day workshop, Imperial College London, June 2019;
- “*Computing in construction summer school*”, 5-day summer school European Council for Computing in Construction, Senigallia, Italy July 2019;
- “*Linked data in architecture and construction summer school*”, 2-day summer school, LDAC Working committee, Lisbon June 2019;
- “*Research software engineering*”, 20-hour lecture series, Alan Turing Institute, October 2018-January 2018;
- “*Ground zero machine learning*”, 10-hour lecture series, Machine Learning Society, Imperial College London, February 2018-April 2018;
- “*BIM summer school*”, 5-day summer school, Aalto University, June 2018; and
- “*Virtual Reality*” (VR), 10-day summer course, Indian Institute of Technology Madras, July 2015.

Transferable skills courses

- “*Equality and diversity*”, Imperial College London, October 2020;
- “*Data protection and information security*”, Imperial College London, September 2020;
- “*Active bystander training*”, Imperial College London, September 2018;
- “*Intellectual property*”, Imperial College London, September 2017;
- “*Effective speaking in English*”, Imperial College London, August 2017; and
- “*Perfecting presentations*”, Imperial College London, August 2017.

SELECTED PROFESSIONAL MEMBERSHIPS

- International Association for Automation and Robotics in Construction (IAARC)
- European Council on Computing in Construction (EC3)

- World Wide Web Consortium - Linked Building Data Working Group
- Indian Building Information Modelling Association (IBIMA)
- Indian Society for Technical Education (ISTE)
- 4D Construction Group

ENTERPRISE AND EXTERNAL ENGAGEMENT

Industry Engagement

1. **AEC Production Control Room**: Collaborated with **Mace Construction, 3D Repo, Evifile and Mission room** to build a predictive analytics engine for a construction control room. Collaboration involves weekly meetings, co-creating the systems framework and system implementation.
2. **Bentley Systems**: Collaborated with **Bentley systems** to shape and deliver a PhD project leading to integration of findings in their software package. Collaboration involves quarterly meeting with Bentley fellows and senior leadership, co-creation and presenting at their international events.
3. **Thames Tideway, UK**: Collaborated with engineers at **Laing O'Rourke** to collect the end user requirements for the next generation decision support system for look ahead planning. Further, the developed solution was implemented at a **Costain site** and the evaluation was conducted.
4. **Hyderabad Metro Rail Ltd.**, India: Collaborated with Larsen and Toubro engineers to develop an automated progress monitoring system to track site activities of a launching girder. The implementation was tested on a live construction stretch.

Invited panel/workshop member

1. Expert chair: *What is next in 4D BIM*, 4D Construction working group, London, September 2019;
2. Co-organiser: *Digital metro rail construction: UK-India collaborative workshop*, IIT Madras, March 2018;
3. Expert panel member, *Wearables in construction*, Construction Mobile IT (COMIT) conference, London, May 2017;
4. Participant in Centre for Digital Built Britain (CDBB) workshops: *AR and VR for Digital Built Britain*, October 2018 and *Network scoping workshop*, April 2018; and
5. 'Process innovation forum' innovation workshops; 1) *Future of wearables*, October 2017; *drones*, September 2017; 3) *VR and AR in built environment*, September 2017.

Invited speaker to Industry

1. "*Building Information Modelling: Why and What to keep in Mind?*", Larsen and Toubro Construction, Chennai, October 2019;
2. "*Linked-data based dynamic constraint solving framework for effective look-ahead-planning in construction*", Bentley Year in Infrastructure, Singapore, 2019;
3. "*Using linked data to support automation of look ahead planning in construction as a manufacturing process*", Centre for Systems Engineering and Innovation (CSEI) Industry showcase event 2018, Imperial College London, UK, September 2018 (best poster award);
4. "*Using linked data to support automation of look ahead planning in construction as a manufacturing process*", Imperial-BCA DfMA and IDD Leadership 2018, Imperial College London, UK, November 2018;
5. Presentation on "*Codifying Information Flow in Modular Offsite Construction*", Bentley year in infrastructure 2018, London, UK, October 2018; and

6. Three Presentations on "*Codifying Information Flow in construction as manufacturing process*", Multiplex: June 2018, Tideway: May 2018, Laing O' Rourke Explore: April 2018.

Hackathon Participation

1. AEC/FM Hackathon-ISARC 2018, Berlin, Germany, 20/07/2017; and
2. HS2 Hackathon, Catapult, Milton Keynes, UK, 09/12/2017.

INSTITUTIONAL LEADERSHIP EXPERIENCE

- PhD representative – Post graduate research – Staff liaison committee, Department of Civil and Environmental Engineering, Imperial College London 2017-2019;
- Head of careers office, Civil Engineering Research, IIT Madras 2014-2015;
- Head of Post Graduate Cultural Events, IIT Madras 2014-2015;
- Core Member, Civil Engineering Research Expo 2014, IIT Madras;
- Coordinator, Media Club IIT Madras, 2013-2016;
- Publicity Head, Campus newsletter, Government Engineering College, Thrissur 2012-2013; and
- Coordinator, Pain and palliative care society, Government Engineering College, Thrissur 2010-2013.