ICSIC 2019

International Conference on Smart Infrastructure and Construction

8 - 10 JULY 2019 | CHURCHILL COLLEGE, UNIVERSITY OF CAMBRIDGE | UK

#ICSIC2019

Welcome

**Welcome to the International Conference on Smart Infrastructure and Construction 2019**

A warm Cambridge welcome to the delegates of ICSIC 2019. This year marks our second international conference in the increasingly dynamic field of smart infrastructure and construction.

This event brings together world-leading experts; academics, practitioners and policy makers from infrastructure planning, asset management and sensing. Our conference is an opportunity to combine specialisms across disciplines to bring focus to advancing sustainable smart infrastructure, confronting barriers, developing solutions and optimising innovation.

As the Director of CSIC I am fortunate to work with a range of excellent organisations and industry partners, collaborating in a shared vision to transform the future of infrastructure through smarter information. Collaboration is key to our success and ICSIC invites alliance and knowledge share on an international scale.

It is a pleasure to host this conference and our programme reflects the exciting research that is taking place across the smart infrastructure space. On behalf of the organising committee, I wish you an enjoyable and productive time in Cambridge and look forward to meeting many of you at ICSIC.

Dr Jennifer Schooling OBE FICE
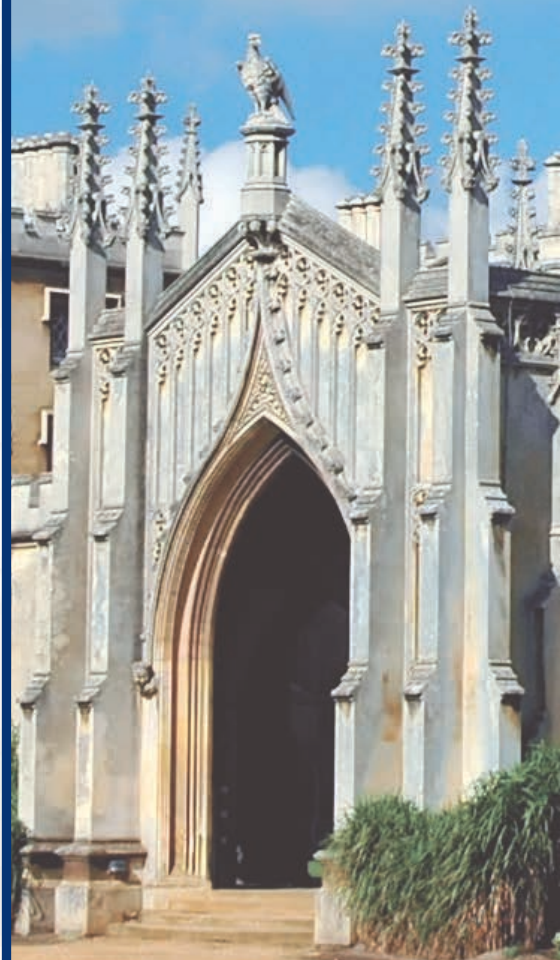
Organisers

International Scientific Committee

Professor Stuart Barr, Newcastle University, UK (Area Chair, Digital Data/Data Analytics)

Professor Michael Batty, University College London, UK

Professor James Brownjohn, University of Exeter, UK (Area Chair, Structural Monitoring)

Dr Ruchi Choudhary, University of Cambridge, UK (Area Chair, Cities)

Dr Matt DeJong, UC Berkeley, USA (Programme Co-Chair)

Professor Yozo Fujino, Yokohama National University, Japan

Dr Chris Goodier, Loughborough University, UK (Area Chair, Construction)

Dr Ying Jin, University of Cambridge, UK (Area Chair, Infrastructure and Policy)

Professor Werner Lienhart, TU Graz, Austria (Area Chair, Sensors)

Dr W Allen Marr, Geocomp, USA

Professor Tom O'Rourke, Cornell University, USA

Dr Ajith Parlikad, University of Cambridge UK (Area Chair, Asset Management)

Professor Bill Spencer, University of Illinois, USA

Dr Jamie Standing, Imperial College, London, UK (Area Chair, Geotechnical)

Professor Giulia Viggiani, University of Cambridge, UK (Programme Co-Chair)

Professor Hehua Zhu, Tongji University, China

CSIC Organising Committee

Dr Jennifer Schooling (Chair)

Dr Giovanna Biscontin

Dr Ioannis Brilakis

Professor Daping Chu

Professor Lord Robert Mair

Welcome to Cambridge

This booklet provides details of the programme, and other useful information relating to the conference. We have also included visitor information about Cambridge and its historic colleges.

Conference venue
Churchill College, Storey's Way, Cambridge CB3 0DS

Registration
The registration desk is located in the Concourse, and will be open at the following times:

Sunday 7 July – 18.00 – 19.30 hrs
Monday 8 July – 08.30 – 18.00 hrs
Tuesday 9 July – 08.30 – 18.00 hrs
Wednesday 10 July – 08.30 – 13.00 hrs

Please come to the desk if you have any queries.

Refreshments and lunch
Refreshments will be available in the Concourse and lunch in the main dining hall at the College at the times indicated in the programme.

Internet access
Internet access is available free of charge at the College via Eduroam and you can collect login details on arrival.

Exhibitions
Exhibitors are located in the refreshment area.

Information for presenters
There will be a laptop and projector available in each room. Please have your presentation saved as a Powerpoint on a USB stick. Most of the lecture theatres use widescreen format (16:9). Please arrive to meet the session chair, and to upload your presentation at least 15 minutes before the session begins.

The session chair will confirm your presentation and question times. You must not exceed this limit, and the session chair will ensure that presentations finish on time.

Social events

Sunday 7 July - Registration and reception

You will be able to register and collect your delegate material from 18.00 – 19.30 hrs from the registration desk in the Concourse. Drinks and canapés will be served.

Dress code – casual or business dress

Monday 8 July – Poster and pints

Try a selection of beers from the Moonshine brewery and see the poster papers (see page 12) Three drinks tokens are included in your delegate badge.

Dress code – casual or business dress

Tuesday 9 July – Dinner at St John's College

The main conference social event gives delegates the chance to enjoy reception drinks in the College gardens from 19.00, before being seated for dinner at 19.30 in the College dining hall.

Dress code – smart casual or business dress

Conference App

The Conference4me smartphone app provides you with the most comfortable tool for planning your participation in the conference. Browse the complete programme directly from your phone or tablet and create your very own agenda on the fly. The app is available for Android and iOS devices.

- To download mobile app, please visit http://conference4me.eu/download or type 'conference4me' in Google Play or iTunes App Store.
- More information can be found here http://conference4me.eu/download

Keynote Presentations

SMART INFRASTRUCTURE AND CONSTRUCTION: SERVING SOCIETY'S NEEDS

Dr Keith Bowers is a tunnelling engineer who has specialised in major transport projects. He is a Director of COWI and is currently assigned to the Lower Thames Crossing project as the Director accountable for development and delivery of the main crossing tunnels. These are 4km long twin highway tunnels forming a key part of the proposed Highways England scheme to provide a new road connection between Kent and Essex. This will be the UK's largest highway tunnel and will involve the use of some of the world's largest ever tunnel boring machines.

Keith was previously Head of Profession for Civil Engineering and Built Environment within the Transport for London (TfL) Engineering Directorate. At TfL he was involved in delivery of numerous infrastructure schemes and, in particular, tunnelling projects for London Underground, Crossrail and on the highway network at Silvertown.

In his earlier career Keith worked on the delivery of the High Speed 1 tunnels and Thameslink Tunnels as part of the Channel Tunnel Rail Link project. Prior to that he was involved in ground engineering applied research and development at the UK's Transport Research Laboratory (TRL).

Keith is a Fellow of the Royal Academy of Engineering and also of the ICE and IMMM. He was awarded a PhD for work on the early application of the "New Austrian Tunnelling Method" to weak rock and soft ground tunnelling in the UK.

ENHANCING URBAN RESILIENCY THROUGH SMART CITY TECHNOLOGIES: EXPERIENCES IN PROTOTYPING SOLUTIONS WITH CITIES

Dr Jerome Lynch is the Donald Malloure Department Chair of Civil and Environmental Engineering at the University of Michigan; he is also Professor of Civil and Environmental Engineering and Professor of Electrical Engineering and Computer Science. In 2016, Dr Lynch was appointed the Director of the University of Michigan Urban Collaboratory, a research institute that works closely with city stakeholders to prototype solutions to urban challenges using smart city technologies. Prior to the University of Michigan, Dr Lynch completed his graduate studies at Stanford University where he received his Ph.D. in Civil and Environmental Engineering in 2002, M.S. in Civil and Environmental Engineering in 1998, and M.S. in Electrical Engineering in 2003. Dr Lynch also received his B.E. in Civil and Environmental Engineering from the Cooper Union in New York City. His current research interests are in the areas of wireless cyber-physical systems, cyberinfrastructure tools for management of sensor datasets, computer vision methods for assessing societal resiliency, and advance sensors for damage detection and structural health monitoring. Dr Lynch has been awarded the 2005 ONR Young Investigator Award, 2009 NSF CAREER Award, 2009 Presidential Early Career Award for Scientists and Engineers (PECASE), 2012 ASCE EMI Leonardo da Vinci Award and 2014 ASCE Huber Award.

R&D GOVERNMENTAL PROGRAM IN JAPAN FOR EFFICIENT MAINTENANCE, RENOVATION AND MANAGEMENT OF INFRASTRUCTURE

Dr Yozo Fujino was Professor of Civil Engineering, University of Tokyo from 1990 to 2014 and now Distinguished Professor of Institute of Advanced Sciences, Yokohama National University. His area of expertise comprises dynamics, control and monitoring of bridges and structures, earthquake- and wind-effects on structures. He is also interested in cable-supported long span bridges. He was appointed to be a policy adviser in the Council of Science and Technology, Cabinet Office, Government of Japan in 2014 and is in charge of a 5-year (2014-2019) large research project (approx. 150 M$US) "Infrastructure maintenance, renovation and management".

Session Overview

Sunday 7 July 2019

18:00 - 19:30	**Registration and Reception**

Monday 8 July 2019

9:00 - 9:30	Welcome Session
9:30 - 10:30	**Keynote Presentation** - SMART INFRASTRUCTURE AND CONSTRUCTION: SERVING SOCIETY'S NEEDS
10:30 - 11.00	Best Paper Presentation
11:00 - 11:30	Refreshments
11:30 - 13:00	**Parallel Sessions - Construction 1/Sensors 1**
13:00 - 14:15	Lunch
13:15 - 14:00	**Sponsor Session - SMARTI ETN - Automated Road Pavements**
13:30 - 14:00	**Sponsor Session - Fiber Optic Sensing Association – Who We Are and What We Do**
14:15 - 15:45	**Parallel Sessions - Cities 1/Construction 2/Sensors 2**
15:45 - 16:15	Refreshments
16:15 - 17:45	**Parallel Sessions - Cities 2/Construction 3/Sensors 3**
18:00 - 19:30	Posters and Pints

Tuesday 9 July 2019

9:00 - 10:00	**Keynote Presentation** - ENHANCING URBAN RESILIENCY THROUGH SMART CITY TECHNOLOGIES: EXPERIENCES IN PROTOTYPING SOLUTIONS WITH CITIES
10:00 - 10.30	Best Paper Presentation
10:30 - 11:00	Refreshments
11:00 - 13:00	**Parallel Sessions - Infrastructure and Policy/Asset Management 1/Geotechnical**
13:00 - 14:15	Lunch
13:30 - 14:00	**Sponsor Session - Fiber Optic Sensing Association - Towards a Billion Sensors**
14:15 - 15:45	**Parallel Sessions - Digital 1/Asset Management 2/Structures 1**
15:45 - 16:15	Refreshments
16:15 - 17:15	**Parallel Sessions - Digital 2/Asset Management 3/Structures 2**
19:00 - 22:00	Conference Dinner at St John's College

Wednesday 10 July 2019

9:00 - 10:00	**Keynote Presentation** - R&D GOVERNMENTAL PROGRAM IN JAPAN FOR EFFICIENT MAINTENANCE, RENOVATION AND MANAGEMENT OF INFRASTRUCTURE
10:00 - 10.30	Best Paper Presentation
10:30 - 11:00	Refreshments
11:00 - 13:00	**Parallel Sessions - Digital 3/Asset Management 4/Structures 3**
12:30 - 13:30	Lunch

MONDAY 8 JULY | 13:30 - 14:00

Fiber Optic Sensing Association – Who We Are and What We Do

The Fiber Optic Sensing Association (FOSA) educates industry, governments and the public about the benefits of distributed fiber optic sensing. Through webinars, videos, white papers, public presentations and public policy advocacy, FOSA provides information on the use of fiber optic sensing to monitor critical infrastructure, enhance public safety and protect the environment.

This session is for those with an interest in the premier trade association for fiber optic sensing technology and the work of its technology committee, public policy committee and economic benefits committee.

MONDAY 8 JULY | 13:15 - 14:00

SMARTI ETN - Automated Road Pavements

Successful development of pavements with sensing capabilities could dramatically transform the economics of pavement preservation/management and ultimately improve the serviceability of roads. Many systems are currently being developed, some of them rely on providing sensing capabilities to the infrastructures to develop tailored forms of structural health monitoring, some others instead use vehicles/users to collect the information needed to monitor the asset. Within the H2020 SMARTI ETN programme (http://smartietn.eu), and other projects at the Nottingham Transportation Engineering Centre (http://nottingham.ac.uk/ntec), some of these approaches are being evaluated and will be presented in this workshop. The aim of this event is gathering all the stakeholders from road pavement design and management, smart infrastructure, structural health monitoring, big data analysis, electrical engineering, computer science, business and any visionary and blue sky thinker from academia and the private sector, to discuss benefits and limitations of automated pavements and to draw a bullet points roadmap that could foster further development and implementation.

TUESDAY 9 JULY | 13:30 - 14:00

Fiber Optic Sensing Association - Towards a Billion Sensors

Distributed Fiber Optic Sensing (DFOS) is problem-solving for many industries: Smart City applications, rail, pipeline, in-well monitoring, perimeter and border security. This introduction provides real-world examples of applications, solutions, benefits, and installation methods and depicts the rapid expansion toward billions of sensing points for the fiber optic sensing industry as a whole.

This session is for those with an interest in the fiber optic sensing market at large, main applications, and future growth as an industry.

09.00	Welcome (Wolfson Hall)
09.30	**Keynote Presentation - Dr Keith Bowers**
10.30	Best Paper Presentation **Distributed fiber optic sensing on a large tunnel construction site: Increased safety, more efficient construction and basis for condition-based maintenance** **Werner Lienhart, Christoph Monsberger, Ferdinand Klug, Fabian Buchmayer** TU Graz, Austria
11.00	Refreshment break
11.30	**Parallel sessions 1**

Track 1 – Sensors 1
Jock Colville Hall

Evaluation of a railway bridge using distributed and discrete strain sensors
Christian Barker[1], Neil Anthony Hoult[2], Hoat Le[3], Vamsi Tolikonda[4]
[1]Queen's University, Canada; [2]Queen's University, Canada; [3]Canadian National Railway Company, Canada; [4]Canadian National Railway Company, USA

Innovative Sensing Solution and SHM for Moel-y-Parc Telecommunication High Guyed Mast
Ki Young Koo[1], Jose Alfonso Jimenez Capilla[2], James Mark William Brownjohn[1]
[1]University of Exeter, UK; [2]Arqiva, UK

Can consensus standards bring wider acceptance of fiber-optic sensors in soil-structure interaction monitoring?
Jey K. Jeyapalan, Wolfgang R. Habel
Civic Enterprises, LLC, USA

Citizens as real-time emotional sensors in smart cities
Ali Jabbari Jahromi[1], Mei-Yee Man Oram[2], Justin Trevan[3], Villupuram Santhanam Shrisankaraan[3]
[1]Arup, Canada; [2]Arup, UK; [3]Arup, Canada

Track 2 – Construction 1
Fellow's Dining Room

Automated drilling for installations inside the Crossrail tunnels
James Douglas[1], Tim Kelly[2], Sandeep Jain[3]
[1]Alstom Transport UK, UK; [2]Costain; [3]MobiBiz Ltd

Monitoring the axial shortening of Principal Tower using embedded distributed fibre optic sensors
Nicholas de Battista[1], Cedric Kechavarzi[1], Nicholas Cheal[2], Ross Harvey[3], Sam Wong[4]
[1]Centre for Smart Infrastructure and Construction, University of Cambridge, UK; [2]Multiplex Construction, UK; [3]WSP Group, UK; [4]Carey Group, UK

A proposed approach integrating DLT, BIM, IoT and Smart Contracts: demonstration using a simulated installation task
Jennifer Li[1], Mohamad Kassem[1], Angelo Luigi Camillo Ciribini[2], Marzia Bolpagni[3]
[1]Northumbria University; [2]University of Brescia; [3]Politecnico di Milano

Exemplar-based building element retrieval from point clouds
Jingdao Chen, Yong K. Cho
Georgia Institute of Technology, USA

MONDAY 8 JULY

13.00	Lunch/ Posters
14.15	**Parallel sessions 2**

Track 1 – Sensors 2
Jock Colville Hall

Assessment of reinforced concrete structures with distributed fibre optic sensors
Andre Robert Brault[1], Neil Anthony Hoult[2]
[1]University of Cambridge, UK; [2]Queen's University, Canada

Monitoring bridge degradation using dynamic strain, acoustic emission and environmental data
Haris Alexakis[1], Andrea Franza[2], Sinan Acikgoz[3], Matthew DeJong[4]
[1]University of Cambridge, UK; [2]Universidad Politécnica de Madrid, Spain; [3]University of Oxford, UK; [4]University of California, Berkeley, USA

Monitoring pumping station performance for maintenance optimisation
Owen James Tarrant, Keith Solts, Steve Carman, Yahya Ugradar
Environment Agency, UK

Monitoring of shaft excavations in clay
Seda S Torisu[5], Njemile E Faustin[1], Mohammed Z E B Elshafie[2], Mike Black[3], Kenchi Soga[4], Robert J Mair[1]
[1]University of Cambridge, UK; [2]Qatar University, Doha, Qatar; [3]Crossrail Limited; [4]University of California, Berkeley, USA; [5]Design Department, Obayashi Corporation

Track 2 – Construction 2
Fellow's Dining Room

Construction hazard awareness and construction safety knowledge sharing epistemology
Rita Yi Man Li[1], Kwong Wing Chau[2], Weisheng Lu[2], Daniel C Wing Ho[3], Muhammad Shoaib[4], Meng Li[5]
[1]Hong Kong Shue Yan University, Hong Kong S.A.R. (China); [2]University of Hong Kong, Hong Kong S.A.R. (China); [3]THEi, Hong Kong S.A.R. (China); [4]National University of Science and Technology, Pakistan; [5]School of Natural and Built Environment, Australia

Water pipes as pre-existing conduits for fibre cable delivery – communications, FTTH, leak detection and asset protection
Michael John Parker
CRALEY Group Ltd., UK

Prefabricated secondary units for overcoming the shortage of houses: a case study of New Zealand
Milad Moradibistouni, Brenda Vale, Nigel Isaacs
Victoria University of Wellington, New Zealand

A personalized safety training system for construction workers
Sheng Xu[1,2], Qingqing Ni[3], Mengge Zhang[3]
[1]School of Economics and Management, Chang'an University, People's Republic of China; [2]Research Center of Digital Construction and Management for Transport Infrastructure of Shaanxi Province; [3]School of Civil Engineering, Chang'An University

Track 3 - Cities 1
Bevin Room

Organicity: lessons from an Experimentation as a Service model for digital civic innovation
Duncan Wilson[1], Shane McLoughlin[2], Martin Brynskov[3]
[1]University College London, UK; [2]Maynooth University, Ireland; [3]Aarhus University, Denmark

Monitoring the performance of an underground hydroponic farm
Melanie Jans-Singh, Paul Fidler, Rebecca Ward, Ruchi Choudhary
University of Cambridge, UK

Feasibility of wearable-based collective sensing to detect environmental barriers for facilitating the elderly's mobility
Gaang Lee[1], Byungjoo Choi[2], Changbum Ahn[3], Sanghyun Lee[1]
[1]University of Michigan, USA; [2]Ajou University, South Korea; [3]Texas A&M University, USA

MONDAY 8 JULY

15.45	Refreshments / Posters

16.15	**Parallel sessions 3**

Track 1 – Sensors 3
Jock Colville Hall

Waterloo Bridge monitoring: comparing measurements from earth and space
Sivasakthy Selvakumaran[1], Graham Webb[2], John Bennetts[2], Campbell Middleton[1], Cristian Rossi[3]
[1]University of Cambridge, UK; [2]WSP, UK; [3]Satellite Applications Catapult, UK

Residential damp detection with temperature and humidity urban sensing
David D. Nepomuceno, Theo Tryfonas, Paul J. Vardanega
University of Bristol, UK

An industry survey on the use of graphene-reinforced concrete for self-sensing applications
Ioanna Papanikolaou[1,2], Abir Al-Tabbaa1, Marco Goisis[3]
[1]University of Cambridge, UK; [2]Costain Group, Maidenhead, UK; [3]Italcementi Heidelberg CementGroup, Bergamo, Italy

Risks and opportunities of using Fiber Optic sensors for long term infrastructure health monitoring systems in an 18 year old installation
Ignacio Robles Urquijo[1], Antonio Quintela Incera[2], Steven Van Vaerenbergh[2], Daniele Inaudi[3], José Miguel Lopez-Higuera[2]
[1]Louis Berger IDC ApiaXXI (WSP Global Inc.), Spain; [2]Universidad de Cantabria, Santander, Spain; [3]Smartec, Manno, Switzerland

Track 2 – Construction 3
Fellow's Dining Room

Exploring the impact of SAP version 10 on the UK construction industry
Evangelos Skoufoglou[1], Fiona Hagan[2]
[1]ithaca7 engineers & designers ltd, UK; [2]boom collective ltd, UK

An annotation tool for benchmarking methods for automated construction worker pose estimation and activity analysis
Dominic Roberts[1], Mingzhu Wang[2], Wilfredo Torres Calderon[1], Mani Golparvar-Fard[1]
[1]University of Illinois at Urbana-Champaign, USA; [2]The Hong Kong University of Science and Technology, Hong Kong, China

A framework of on-site construction safety management using computer vision and real-time location system
Jinyue Zhang[1,2], Daxin Zhang[1,3], Xiangchi Liu[1], Ruiqi Liu[1], Guangqing Zhong[4]
[1]Tianjin University, People's Republic of China; [2]University of Toronto, UK; [3]Tianjin University Research Institute of Architectural Design & Urban Planning, Tianjin, China; [4]IBM, China

Track 3 - Cities 2
Bevin Room

Planning instruments and urban development management tools for smart cities. Case study: Ludwigsburg, Germany
Patrycja-Jadwiga Sankowska
Technische Universität Kaiserslautern, Germany

Agent-Based Model (ABM) for city-scale traffic simulation: A case study on San Francisco
Bingyu Zhao[1], Krishna Kumar[2], Gerard Casey[1,3], Kenichi Soga[4]
[1]University of Cambridge, UK; [2]University of Texas at Austin, Austin, USA; [3]Arup, London, UK; [4]University of California, Berkeley, USA

Developing a city-level digital twin - propositions and a case study
Li Wan, Timea Nochta, Jennifer Schooling
University of Cambridge, UK

TUESDAY 9 JULY | **18:00 - 19:30** | Posters and Pints

Photogrammetry and augmented reality for underground infrastructure sensing, mapping and assessment
Mauricio Pereira, Dan Orfeo, Wilson Ezequelle, Dylan Burns, Tian Xia, Dryver Huston
University of Vermont, USA

Tailoring residential energy provision strategies in fast-growing cities using targeted data collection
André Paul Neto-Bradley[1], Ruchi Choudhary[1,2], Amir Bashir Bazaz[3]
[1]University of Cambridge, UK; [2]Alan Turing Institute, UK; [3]Indian Institute for Human Settlements, India

Using fibre optic cables to deliver intelligent traffic management in smart cities
Andrew James Hall, Chris Minto
Optasense, UK

Urban land recapitalization and regional unified transit network – An imperative action for the New York City long-term competitiveness
Jim Venturi[1], Eugene Chao[2], Calvin Chu[3]
[1]Rethink Studio, New York, U.S.A; [2]Wharton Business School, Philadelphia, U.S.A; [3]Waseda University, Tokyo, Japan

Pressure-based pipe condition assessment for intelligent water network maintenance
Laura Lunita Lopez Vega, Kobus Van Zyl
University of Cape Town, South Africa

Development of 5d BIM-based management system for pre-fabricated construction in China
Chao Chen, Llewellyn Tang, Yue Jing
University of Nottingham, Ningbo, People's Republic of China China

The value of BIM for project management in smart built asset in China
Fang Fang[1], Llewellyn Tang[2], Ren Bin[3]
[1]Chongbang Group, Shanghai, China; [2]The Hong Kong University, Hong Kong, China; [3]China Eastern, Shanghai, China

Prediction models of service performance degradation for metro shield tunnels
Junhua Xiao[1], Dong Liang[1], Xingzhong Nong[2], Nan Wu[3], Jinrong Song[1]
[1]Key Laboratory of Road and Traffic Engineering of the Ministry of Education, Tongji University, Shanghai, China; [2]Guangzhou Metro Design & Research Institute Co., Ltd., Guangzhou, China; [3]Beijing Jiaotong University, Beijing, China

Monitoring of retaining structures on an open excavation site with 3d laser scanning
Yang Zhao[1], Hyungjoon Seo[1], Sinan Acikgoz[2], Jie Wang[1]
[1]Xi'an Jiaotong-Liverpool University, People's Republic of China; [2]University of Oxford , Oxford, UK

Pavement damage detection system using big data analysis of multiple sensors
Cheng Chen[1], Hyungjoon Seo[1], Yang Zhao[1], Bo Chen[1], Junwoo Kim[2], Yeong Choi[2], Minsu Bang[3]
[1]Civil Engineering Department,Xi'an Jiaotong-Liverpool University, People's Republic of China; [2]Computer Science and Software Engineering Department,Xi'an Jiaotong-Liverpool University, People's Republic of China; [3]Electrical and Electric Engineering Department,Xi'an Jiaotong-Liverpool University, People's Republic of China

Process centric building energy management-as-a-service
Athanasios Chassiakos, Stylianos Karatzas
University of Patras, Greece

Effective use of offsite manufacturing for public infrastructure projects in Australia
Tharaka Gunawardena, Priyan Mendis, Tuan Ngo, Behzad Rismanchi, Lu Aye
The University of Melbourne, Australia

Optimising strategic decision making in water networks
Christina Chiu[1], Bojana Jankovic-Nisic[1], Lucy Pocock[2], Laurie Murphy[2], Rand Alkhatib[1], Joshua Cantone[2], Olu EriOlu[1], Jez Downs[3]
[1]Arcadis, UK; [2]Optimatics, USA; [3]Southern Water Services, UK

Occupant-building interaction (OBI) model for university buildings
Nazila Roofigari-Esfaham, P Dongre
Virginia Polytechnic Institute and State University, USA

Insights for systemically resilient infrastructures
Thomas Edward Dolan
UKCRIC, University College London, UK

Acoustic emission feature extraction and classification for rail crack monitoring
Dan Li[1], Weixin Ren Ren[1], Kevin Sze Chiang Kuang[2], Chan Ghee Koh[2]
[1]Hefei University of Technology, People's Republic of China; [2]National University of Singapore, Singapore

TUESDAY 9 JULY

09.00	**Keynote Presentation - Dr Jerome Lynch**
10.00	Best Paper Presentation
	Modelling and evaluation of multi-vector energy networks in Smart Cities
	Edward O'Dwyer[1], Indranil Pan[1], Salvador Acha[1], Shaun Gibbons[2], Nilay Shah[1]
	[1]Imperial College London, United Kingdom; [2]Greater London Authority, United Kingdom
10.30	**Refreshments / Posters**
11.00	**Parallel sessions 4**

Track 1 – Asset Management 1
Fellow's Dining Room

Cognitive facilities management: definition and architecture
Jinying Xu, Weisheng Lu, LingHin Li
The University of Hong Kong, Hong Kong S.A.R. (China)

Sensor and satellite asset alert and management system (SSAAMS)
Simon Andrew Plumb[1], Matthew Watt[1], Craig Ellis[1], Todd Sajwaj[2], Simon Ross[2], Peter Graham[3], Nicole Metje[4], David Chapman[4], Edward Stewart[4], Andrew Quinn[4], Loretta von der Tann[4]
[1]Amey Ltd, UK; [2]Rezatec Ltd., Harwell, Oxfordshire, UK; [3]Senceive Ltd., London, UK; [4]School of Engineering, University of Birmingham, UK

Development of bim-sensor integrated platform for mep piping maintenance
Yue Jing[1], Chao Chen[1], Llewellyn Tang[2], H Xiong[1], Y X Wang[1]
[1]The University of Nottingham Ningbo China, People's Republic of China; [2]University of Hong Kong, China

Automated defect detection for masonry arch bridges
Daniel John David Brackenbury[1], Matthew DeJong[2], Ioannis Brilakis[1]
[1]University of Cambridge, UK; [2]UC Berkeley, USA

Evaluating initial building designs considering possible future changes: the example of the new PET center of the university hospital of Zurich
Miriam Esders[1], Bryan Adey[2], Claudio Martani[2]
[1]Pom+, Switzerland; [2]ETHZ, Switzerland

Track 2 – Geotechnical
Jock Colville Hall

Acoustic emission sensing of pipe-soil interaction: Development of an early warning system for buried pipe deformation
Alister Smith[1], Ian D Moore[2], Neil Dixon[1]
[1]Loughborough University, UK; [2]Queen's University, Canada

Reassessment of Crossrail Tottenham Court Road station excavation design using the observational method optimistic approach a
Ying Chen[1], Giovanna Biscontin[1], Duncan Nicholson[2]
[1]University of Cambridge, UK; [2]Geotechnics, Ove Arup & Partners, London, UK

Evaluating the deterioration of geotechnical infrastructure assets using performance curves
Kevin M Briggs[1], Tom A Dijkstra[2], Stephanie Glendinning[3]
[1]University of Bath, UK; [2]Loughborough University, UK; [3]Newcastle University, UK

Energy assessment technique for retrofit Mine-water district heat network
Bruce Philip[1], John Littlewood[2], Richard Radford[2], Nick Evans[2], Tony Whyman[2], Paul Jones[1]
[1]SPECIFIC, Swansea University; [2]Sustainable & Resilient Built Environment (SuRBE) Group, Cardiff Metropolitan University, UK

Instrumentation and monitoring of a concrete jacking pipe
Bryn Phillips[1,2], Ronan Royston[1,2], Brian Sheil[2], Byron Byrne[2]
[1]Ward and Burke Constructions Ltd, UK; [2]University of Oxford, UK

Track 3 - Infrastructure and Policy
Bevin Room

Pavement instrumentation for condition assessment using efficient sensing solutions
Natasha Bahrani, Juliette Blanc, Pierre Hornych, Fabien Menant
Ifsttar, France

Identifying the benefits of smart infrastructure and construction
David Charles Pocock
Jacobs, UK

Infrastructure readiness for the anticipated transformative changes in transportation
Yufei Huang, Shan Jiang, Mohsen A Jafari, Peter Jin
Rutgers University, USA

TUESDAY 9 JULY

13.00	Lunch/ Posters
14.00	**Parallel sessions 5**

Track 1 – Asset Management 2
Fellow's Dining Room

Integration of regional and asset satellite observations for assessment of infrastructure resilience
Maria de Farago[1], Kajal Haria[1], Tariq Dawood[2], Mark Bush[3]
[1]Telespazio VEGA UK, UK; [2]EDF Energy; [3]Transport for London

Developing a dynamic digital twin at a building level: using Cambridge campus as case study
Qiuchen Lu, Ajith Kumar Parlikad, Philip Woodall, Gishan Don Ranasinghe, James Heaton
Institute for Manufacturing, University of Cambridge, UK

A model for lifecycle cost calculation based on asset health index
Javier Serra Parajes[1], Antonio de la Fuente[2], Adolfo Crespo Márquez[2], Antonio Sola Rosique[3], Antonio Guillén López[2], Eduardo Candón[2], Pablo Martínez-Galán[2]
[1]Enagas, Spain; [2]Department of Industrial Management, School of Engineering, University of Seville, Spain; [3]Ingeman, Association for the Development of Maintenance Engineering, Seville, Spain

Road drainage system localisation and condition data capture
Maria Gkovedarou, Ioannis Brilakis
University of Cambridge, UK

Track 2 – Structural Monitoring 1
Jock Colville Hall

Structural health monitoring of an integral bridge
Sarah Anne Skorpen[1], Elsabe Kearsley[1], Chris Clayton[2]
[1]University of Pretoria, South Africa; [2]University of Southampton, UK

Tunnelling under a heritage structure: distributed sensing data and cracked equivalent beam models
Sinan Acikgoz[1], Matthew DeJong2, Robert Mair[3], A Franza[4]
[1]University of Oxford, UK; [2]University of Berkeley, US; [3]University of Cambridge, UK; [4]University of Madrid, Spain

Estimation of Vehicle Counts from the Structural Response of a Bridge
Tom James Strain, Sam Gunner, Eddie Wilson
University of Bristol, UK

Settlement-induced building damage assessment using MT-InSAR data for the Crossrail case study in London
Valentina Macchiarulo[1], Giorgia Giardina[1], Pietro Milillo[2], Javier González Martí[4], Jordi Sanchez[5], Matthew DeJong[3]
[1]University of Bath, UK; [2]Jet Propulsion Laboratory, Pasadena, USA; [3]University of California, Berkeley, USA; [4]Sixense Group, London, UK; [5]TRE-Altamira, Barcelona, Spain

Track 3 – Digital Data/Data Analytics 1
Bevin Room

Deep learning algorithms for structural condition identification with limited monitoring data
Tong Zhang[1], Ying Wang[2]
[1]King's College London, London, UK; [2]University of Surrey, UK

Unsupervised deep learning for instrumented infrastructure: a case study
Aleksandra Mikhailova[1], Niall M Adams[1,2], Christopher A Hallsworth1, F Din-Houn Lau[1,3], Daniel N Jones[4]
[1]Department of Mathematics, Imperial College of Science, Technology and Medicine, London, UK; [2]Data Science Institute, Imperial College of Science, Technology and Medicine, London, UK; [3]Lloyd's Register Foundation Programme on Data-Centric Engineering, The Alan Turing Institute, London, UK; [4]Mathematical Institute, University of Oxford, Oxford, UK

Leveraging blockchain technology in a BIM workflow: a literature review
Abhinaw Sai Erri Pradeep, Tak Wing Yiu, Robert Amor
The University of Auckland, New Zealand; UK

15.30	Refreshments / Posters

16.00 — **Parallel sessions 6**

Track 1 – Asset Management 3
Fellow's Dining Room

BIM as an Enabler for Digital Transformation
James Robert Heaton[1], Ajith Kumar Parlikad1, David Owens[2], Neill Pawsey[3]
[1]Institute for Manufacturing, University of Cambridge, UK; [2]Costain Ltd, UK; [3]Professional Construction Strategies Group, UK

Fibre optic sensing as innovative tool for evaluating railway track condition?
Ivan Vidovic, Matthias Landgraf
Graz University of Technology, Institute of Railway Engineering and Transport Economy, Austria

National-scale inspection of flood defence infrastructure with remotely sensed data
Owen James Tarrant, Claire Hollingsworth, Crispin Hambidge
Environment Agency, UK

Track 2 – Structural Monitoring 2
Jock Colville Hall

Damage assessment of a railway bridge using fibre optic sensing and LiDAR data
Sam Henry Cocking[1], Simon C Ye[1], Matthew J DeJong[2]
[1]University of Cambridge, UK; [2]University of California, Berkeley, USA

Image-based multiview change detection in concrete structures
Apichart Buatik, Ittipon Pasityothin, Krisada Chaiyasarn
Thammasat University, Thailand

Track 3 – Digital Data/Data Analytics 2
Bevin Room

Automatic pavement crack detection based on image recognition
Cheng Chen[1], Hyungjoon Seo[1], Yang Zhao[1], Bo Chen[1], Junwoo Kim[2], Yeong Choi[2], Minsu Bang[3]
[1]Civil Engineering Department, Xi'an Jiaotong-Liverpool University, People's Republic of China; [2]Computer Science and Software Engineering Department, Xi'an Jiaotong-Liverpool University, People's Republic of China; [3]Electrical and Electric Engineering Department, Xi'an Jiaotong-Liverpool University, People's Republic of China

Using artificial intelligence for automating pavement condition assessment
Omer Deniz Aslan[1], Eren Gultepe[2], Issa Ramaji[3], Sharareh Kermanshachi[4]
[1]University of North Florida, USA; [2]University of North Florida, USA; [3]Roger Williams University, USA; [4]University of Texas at Arlington, USA

A convolutional neural network approach to the semi-supervised acoustic monitoring of industrial facilities
Jeffrey Bynum, Gabriel Earle, David Lattanzi
George Mason University, USA

WEDNESDAY 10 JULY 2019

09.00	Keynote Presentation - Dr Yozo Fujino
10.00	Best Paper Presentation **On the derivation of rail roughness spectra from axle-box vibration: development of a new technique** Tobias D Carrigan, Paul RA Fidler, James P Talbot University of Cambridge, UK
10.30	Refreshments / Posters
11.00	**Parallel sessions 7**

Track 1 – Asset Management 4
Fellow's Dining Room

Managing bridge scour risk using structural health monitoring
Andrea Maroni[1], Enrico Tubaldi[1], John Douglas[1], Neil Ferguson[1], Dimitri Val[2], Hazel McDonald[3], Stewart Lothian[4], Alistair Chisholm[5], Oliver Riches[5], Douglas Walker[3], Euan Greenoak[4], Christopher Green[4], Daniele Zonta[1]
[1]University of Strathclyde, Department of Civil and Environmental Engineering, Glasgow, UK; [2]Heriot-Watt University, School of Energy, Geoscience, Infrastructure and Society, Edinburgh, UK; [3]Transport Scotland, Trunk Road and Bus Operations, Glasgow, UK; [4]Network Rail Scotland Route, Glasgow, UK; [5]ARUP Scotland, Edinburgh, UK

Can information hurt? On the negative value of information of structural health monitoring
Denise Bolognani[1], Andrea Verzovio[2], Daniele Zonta[1,2], John Quigley[2]
[1]University of Trento, Italy; [2]University of Strathclyde, UK

Prioritization of responsive maintenance tasks via machine learning-based inference
Eirini Konstantinou[1], Ajith Kumar Parlikad[1], Alex Wong[2], Charlotte Broom[2]
[1]University of Cambridge, UK; [2]Redbite Solutions, Cambridge, UK

Track 2 – Structural Monitoring 3
Jock Colville Hall

Digital twin models for maintenance of cable-supported bridges
Changsu Shim, HwiRang Kang, NgocSon Dang
Chung-Ang University, Korea

Field deployment of an ambient vibration-based scour monitoring system at Baildon Bridge, UK
Kasun Kariyawasam, Paul Fidler, James Talbot, Campbell Middleton
University of Cambridge, UK

Structural assessment for an old steel railway bridge under static and dynamic loads using fibre optic sensors
Tee Bun Pin[1], Siew cheng Lee[1], Chong Mun Fai[1,2], Ku Sani Ku Mahmud Mahamud[3], Hisham Mohamad[4]
[1]Smart Sensing Technology Sdn. Bhd., Selangor, Malaysia; [2]Dynamic Pile Testing Sdn. Bhd., Selangor, Malaysia; [3]Evenfit Consult Sdn. Bhd., Kuala Lumpur, Malaysia; [4]Civil & Environmental Engineering Dept., Universiti Teknologi PETRONAS, Perak, Malaysia

Optimal sensor placement strategy for the identification of local bolted connection failures in steel structures
Suryakanta Biswal, Ying Wang
University of Surrey, UK

Track 3 – Digital Data/Data Analytics 3
Bevin Room

Using statistical models and machine learning techniques to process big data from the Forth Road Bridge
Donghui Xu[1], Brian Chong[1], Ian Main[1], Michael Mineter[1], Robert De Bold[1], Michael Christopher Forde[1], Cameron Gair[2], Patrick Madden[3], Ewan Angus[3], Carlton Ho[4]
[1]University of Edinburgh, UK; [2]Transport Scotland, UK; [3]Amey Consulting, UK; [4]University of Massachusetts, MA, USA

The importance of analysing data from instrumented infrastructure
F. Din-Houn Lau[1,2], Niall M Adams[2]
[1]Lloyd's Register Foundation Programme on Data-Centric Engineering, The Alan Turing Institute, UK; [2]Imperial College London, London, UK

Introducing data-centric engineering to instrumented infrastructure
Liam John Butler[1,5], Din-Houn Lau[2,5], Gregory Alastair[2,5], Girolami Mark[2,5], Elshafie Mohammed ZEB[3,4]
[1]Lassonde School of Engineering, York University, UK; [2]Imperial College London, UK; [3]Qatar University; [4]University of Cambridge, UK; [5]Lloyd's Register Foundation Programme on Data-Centric Engineering, The Alan Turing Institute, UK

Making geology relevant for infrastructure and planning
Ricky L. Terrington[1], Stephen Thorpe[1], Holger Kessler[1], Asal Bidarmaghz[2], Ruchi Choudhary[2], Mingda Yuan[2], S Bricker[1]
[1]British Geological Survey, UK; [2]University of Cambridge, UK

Exhibitors will be located in the Concourse adjacent to the registration desk and refreshments.
Stand personnel will be available for discussions during the refreshment breaks and at lunch times and all other times throughout the conference.

Please see the conference app for a stand description.
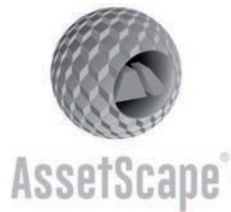
Many people visit Cambridge each year to see the historic university, its buildings and the beautiful **College Backs**. Walking tours around the city centre are available daily.

King's College Chapel is probably the most famous building in Cambridge, completed by Henry VIII, with its fan vaulted ceiling, stone carvings and Tudor stained glass which was almost miraculously saved from destruction by Cromwell's iconoclasts during the Civil War.

Cambridge University **Botanic Garden** is a 40 acre, Grade II* listed heritage garden in the centre of Cambridge and supports University teaching and research - highlights include striking seasonal colour in the Winter and Autumn Gardens; the richly fragranced Scented Garden; colourful Bee Borders; a relaxing Woodland Garden and Lake. Alpine and tropical plants in the Glasshouse Range are also perfect for a cooler day's visit.

There is a **market** in the centre of the city which is open daily, as well as a range of shops in several small shopping malls – Lion Yard, **Grand Arcade** and the Grafton Centre each with a range of small independent and larger high street stores. There is also a choice of **galleries and museums**, contemporary and classic, many of which are are free to visit.

Must-see things in Cambridge include:

- Visit the fabulous Colleges, including King's College Chapel. where you will see an exhibition of the history of the College, the world's largest fan vaulted ceiling and the Adoration of the Magi by Rubens. You will also have access to the College grounds (when open)
- Visit the Parker Library at Corpus Christi College. this unique collection, ranging from the Canterbury Gospels (brought to England by St Augustine and used at coronations of Monarchs in Canterbury Cathedral) is one of the finest sets of Anglo-Saxon manuscripts in the world, and rare printed scientific books including Newton's Principia.
- Visit Trinity College Great Court, site of the famous `Great Court Run' held every year and featured in the movie `Chariots of Fire'.
- Hire a punt (chauffeur driven or self-drive) and navigate the `Backs' of the River Cam.

KEY

Room	Name	Details
1	Wolfson Hall	Main auditorium - accessed via the covered walkway at the end of the foyer
2	Bevin Room	Ground floor - accessed via the covered walkway at the end of the foyer
3	Jock Colville Hall	Follow outside path - turn left at the end of covered walkway leading to Wolfson Hall
4	Fellow's Dining Room, Dining Hall	First floor - accessed through the dining hall - take the door at the back left of the hall
5	Concourse	Ground floor - far end of the foyer

For **registration** please use the main entrance and follow signage.

Refreshments will be served in the Concourse.

Lunch will be served in the Dining Hall.

CSIC Cambridge Centre for **Smart Infrastructure & Construction**

CSIC is an Innovation and Knowledge Centre funded by EPSRC, Innovate UK and industry. We develop cutting edge sensing and data analysis models to provide a powerful platform for delivering data to enable smarter whole-life asset management decisions, for both new infrastructure and existing assets. CSIC collaborates with partner organisations across policy, standards and industry adoption to effect transformative change, deliver benefits to all stakeholders and establish the UK as a global leader in digital construction.

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