POST EVENT REPORT
Shaping a Digital World
Harnessing digitally enabled innovation
ICE Engineering Knowledge

CELEBRATING ICE’S BICENTENARY IN 2018

We’ve been progressing and promoting excellence across the built environment, and enabling members and their networks to innovate and take informed action, for over 200 years.

ICE Engineering Knowledge creates valuable content and a wide selection of events to enhance skills, enlarge your network of contacts and most importantly: shape a better society.

Differentiated by our international reach, influence, charitable mission and rich heritage, we are uniquely placed to advance civil engineering.

Our self-funding model ensures income is invested directly back into sharing knowledge.

ICE IN NUMBERS...

92,000 MEMBERS  |  68,000 UK  |  22,000 INTERNATIONAL

EXPERT PAPERS
And state of nation reports on
National Needs Assessment, Devolution & Digital

1,161,672 UNIQUE VISITS TO ICE WEBSITE

800 EVENTS
REGIONAL, NATIONAL & INTERNATIONAL

10,061 EVENTS DELEGATES

ICE EXHIBITIONS
22,000 VISITORS

UPCOMING...

Invisible Superheroes Exhibition

Celebrating civil engineers transforming our world
Coming December 2017
One Great George Street, London
ICE’s Digital journey

2011
**FIRST BIM**
conference in the UK launched by ICE

2013
**BCI AWARDS**
ICE’s judges introduce a focus on technology

**BIM ACTION GROUP**
is created

**CLIENT REQUIREMENTS**
focus at ICE BIM event

2014

2016
**A1 LEEMING TO BARTON**
Carillion Morgan Sindall JV present their award winning project

**NATIONAL NEEDS ASSESSMENT**
report includes a section on digital

**INFRASTRUCTURE TRANSFORMATION**
campaign on the impact of new technologies

2015

**LEVEL 2**
Mark Bew announced BIM implementation stages at ICE BIM event

**PRESIDENTIAL THEME**
Digital introduced by Tim Broyd, ICE’s new president

2017

**STATE OF THE NATION**
Digital outlined the biggest challenge as behavioural change

**BIM FOR PROCUREMENT**
webinar in association with BEIS

**PROJECT 13**
is launched from transaction to outcome-based enterprise

**TRANSPORT SECURITY WORKSHOP**
where engineers question how their role matters

**INDUSTRY FRAGMENTATION**
is addressed at Digital procurement workshop

**INTELLIGENT ASSETS & DATA MANAGEMENT**
discussed at Transport Asset Management event

**SHAPING A DIGITAL WORLD**
accompanies industry through the 9 recommendations made in the State of the Nation Digital report
“Success in the new normal of a digital world is entirely a function of good leadership; empowerment encourages innovation.”

Alex Janzen OBE, Contractors’ Client Director and Executive Officer to CEO, UK & Europe, Atkins
Harnessing Digitally Enabled Innovation

KEY TAKEAWAYS FROM OPENING PLENARY

Infrastructure needs to adapt quickly and make use of emerging technology first

Everybody needs to be onboard while this change is being embraced, and within that, management should allow the moral courage to say ‘it’s ok to fail’

The best way to get original and innovative ideas is by teamwork, and within that team there should be a good breadth of diversity; diversity of gender, race, upbringing and belief

Cyber security needs to be considered from the onset of the digital revolution

FACTS 3 KEY REQUIREMENTS

Explicit Leadership expectations

A well understood Culture

Empowered Staff

- An increasingly mobile workforce and the rising usage of collaboration tools allow for new ways of working
- Millennials want senior leadership to embrace digital
- Mental resilience needs to be protected
- You shouldn’t have to search for info at work, the ‘right’ info should come to you
- Diversity does NOT equal gender. Society needs to embrace inclusivity

Has the digital revolution already started or is it about to start?

91% It has already started
5% It is about to start
3% I’m not sure

Where are you on your digital transformation journey?

5% Not started
20% Developing our digital strategy
15% Engaging with key stakeholders
35% Initiating change management within the organisation
24% More advanced and already seeing positive results
WHAT WILL YOU FOCUS ON AS A RESULT OF THIS DISCUSSION?

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<thead>
<tr>
<th>Percentage</th>
<th>Focus Area</th>
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<tbody>
<tr>
<td>32 %</td>
<td>Instilling a ‘no-shame-in-failing’ mentality</td>
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<tr>
<td>29 %</td>
<td>Invest in change management</td>
</tr>
<tr>
<td>39 %</td>
<td>Increase transparency and sharing of information with collaborators</td>
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</table>
ENABLING COLLABORATION

We should create supply webs not supply chains, backed by collaborative technology

Long term interoperability needs to be widespread now.

Condense the data we need into a set of systems which are interoperable so information isn’t repeated.

Data is the new currency and is most likely to be taxed in the near future.

Intellectual Property: a mechanism is required to get positive user outcomes, then share the rewards clients need.

Invest in your staff: currently 1.2 days of training per person per year, but in the Netherlands they allow for 10 days per person per year.

In everything you are able to share without breaking confidentiality or losing a bid – DO SHARE! That includes your failures, not just your successes.

It is our responsibility to prioritise the development of the UK over the development of individual companies.

Current leaders do not fully understand the power of digital.

I rather see it as a bottom up approach.

3% A great deal

34% I rather see it as a bottom up approach

60% Current leaders do not fully understand the power of digital

“I really enjoyed being on the collaboration panel and meeting such interesting and engaging panel and audience members. Great.”

“Eye opening. It was great to hear from people who have a vision for the future. It is quite lonely knowing that there must be a better way, but not having like minded people around to make this happen. Friday’s event reinforced my belief that the digital age is here and we need to embrace it or be left behind.”

Simon Colvin
Pinsent Masons

Marzia Bolpagni
Politecnico di Milano

Sasha Reed
Bluebeam

Duncan McCormick
Topcon
Do you feel there is a sufficient connection between research and industry, in digital advancements for engineering?

No, more connections need to be made 63%

Yes, it is very connected 34%

“Digital disruption is much talked about and comes in many forms, the key to making that disruption a positive development for your business is to start to work on a change in the company culture to enable experimentation alongside the core business.”

Jeremy Silver, CEO, Digital Catapult

MAJOR PROJECTS AS SKILLS INCUBATOR

Major projects feature an uplift in skills, knowledge and expertise, largely from the experience of workers being on the job. This uplift should be accounted for in project planning, funding and affordability assessments.

The uplift should also be accounted for as an aspect of sustainability. Major projects can act as a model for the “incubation” idea, including how to maintain and transfer the uplift once the project ends. The next steps are how to measure the uplift and how the transfer/preservation can take place.

Introduction of new technologies and skills is hindered by not involving end users in the development stage, thus making them more reluctant to try-out new and innovative ideas/practices.

Digitally Enabled Engineer?

There is a huge discrepancy between university curriculums teaching engineering, and the office and on-site world.
LEARNING NEW BEHAVIOURS TO BECOME MORE EFFECTIVE

The performance of your team is a direct reflection of you and the environment you create for it.

- Create a strategic approach and drive the overall transformation. Don’t focus too much on the technology or any particular solution.
- Don’t consider digitalisation on its own and account for wider challenges e.g. urbanisation, demographic change, globalisation, environmental sustainability etc.
- Industry must take lead technical change and not be led by the technology.
- Learn from past transformations in engineering sectors don’t just look forward.

Behavioural science should underpin any change process being applied within an organisation. **Consider the concepts below:**

- **Reinforcement** - behaviour change occurs because of reinforcement, either positive or negative.
- **Shaping concept** – need to provide support to achieve positive change. You wouldn’t throw your child in the deep end of a swimming pool and expect them to work it out themselves (well, some might…) – but in the workplace this kind of scenario often happens (like rolling out new technology/laptops but no guidance on how to get benefits from them).
- **Consequence history** – behaviour is shaped by past experiences.
- **Consequence chain** – messaging and direction from the top of an organisation can get confused and diluted, so needs proper planning and cascading.
- **Leadership** – important to create right environments with positive reinforcement to achieve desired outcomes.

Digital technology and AI might completely change your role as an infrastructure professional. How does this make you feel?

- **76%** Excited! I can’t wait to work more with technology.
- **5%** Threatened! I think my job will disappear.
- **12%** Neutral… I don’t think my role will change.
- **7%** Scared! Robots are taking over the world.

**LIVE POLLS**

Nathan Baker
ICE

**Majid Al-Kader,**
Babcock International

**Alan Cheung,**
Costain

**Peter Cooper,**
ARUP

**Sorrela Smith,**
Laing O’Rourke

**Mat Colmer,**
Digital Catapult
Resilience

ENHANCING RESILIENCE
Led by Jennifer Whyte
Professor of Systems integration
Laing O’Rourke / RAEng
Imperial College London

Data is the new currency

WHAT WILL YOU FOCUS ON AS A RESULT OF THIS DISCUSSION?

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<tr>
<td>16 %</td>
<td>70 %</td>
<td>14 %</td>
</tr>
<tr>
<td>Fix fragility</td>
<td>Improve information flow</td>
<td>Improve control</td>
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</table>

Fix fragility  70 %  Improve information flow  14 %  Improve control
ELECTRICITY CAPACITY FOR DIGITAL

What does true customer-centricness mean?

- Consumer has complete control; can make their own decisions
- Designed around customers’ real behaviour and in their best interests, not taking advantage of people’s behaviour
- Consumer gets real time, easy-to-understand information about how much energy they/their appliances are using

If not. Why not?

- Lots of the required systems depend on Wi-Fi coverage which is not yet good enough, even in parts of London
- Challenges around where to position batteries within houses, often not even part of new developments
- Lots of upgrading required to create truly automated systems that deliver widespread benefits, and the cost will likely fall on the consumer
- Adding multiple battery storage devices per street will put existing infrastructure under serious strain
- A lack of thinking about impacts on people; lack of effective governance

The consumer

- Getting people to engage and understand the systems is very important unless we get to a point of full automation
- Customers generally just want energy available at all times and their bills to be as low as possible
- Gamification can have a role in engaging people – getting people to “play the system” and make real-time decisions – but again depends on their will and understanding
- Lots of people simply don’t trust their provider – would need winning over to try a new method
- Many face energy poverty – their approach is simply not to use energy unless they have to; lots of engrained/traditional mind-sets

Technology and blockchain

- Blockchain can offer the consumer control so they don’t have to rely on the current major providers
- It’s the outcome that’s important not the method of saving or paying – you can use things without really needing to understand them
- Data considerations – is it right for behavioural data to become part of the process, does it have a value that will come to be exploited?

Major reform of governance and provider structure is needed to make customer-centricness a reality

1. Simplicity
2. Control
3. Information

Hard to make mental jump to truly envisage the digital future, but only then will we work out what’s needed
MAINSTREAMING SECURITY MINDEDNESS

When facing cyber security and cyber resilience ‘people are the solution’ but 60-80% of the security threat to a company is sourced internally.

Educate your staff and train everyone, not just the ICT department.

Adopt an appropriate and realistic level of security.

Make sure all the security basics are in place and up to date.

Remember that security that doesn’t work for people, doesn’t work.

Who do you think is most responsible for ensuring secure practice within your organisation?

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Responsible Party</th>
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<tbody>
<tr>
<td>12%</td>
<td>CEO and Board</td>
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<tr>
<td>2%</td>
<td>Head of Security</td>
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<tr>
<td>7%</td>
<td>IT Department</td>
</tr>
<tr>
<td>79%</td>
<td>Everyone</td>
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</tbody>
</table>

Do you feel you understand the implications of GDPR to your organisation?

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Response</th>
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<tbody>
<tr>
<td>51%</td>
<td>No</td>
</tr>
<tr>
<td>33%</td>
<td>Somewhat</td>
</tr>
<tr>
<td>16%</td>
<td>Yes</td>
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</table>

Which threat do you believe your organisation is protecting its data and systems against the most?

<table>
<thead>
<tr>
<th>Threat</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Own employees’ mistakes</td>
<td>39%</td>
</tr>
<tr>
<td>Own employees’ malicious intent</td>
<td>7%</td>
</tr>
<tr>
<td>Web lobbyists</td>
<td>5%</td>
</tr>
<tr>
<td>Professional criminals</td>
<td>42%</td>
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<tr>
<td>Nation states</td>
<td>7%</td>
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</table>

NATIONAL SECURITY IS MORE IMPORTANT THAN NATIONAL PRODUCTIVITY

“Open, constructive discussions that made you think about what you can do yourself”

Educating staff through the ‘cyber hood’ campaign undertaken with aggregate industries is a good example of sharing in a collaborative and co-ordinated manner. This philosophy is discussed by Laing O’Rourke CEO at board level, which shows how it is a priority.

National Cyber Security Centre highlights: “security is a journey not a destination”

The main issue of lacking security is lack of understanding; the supply chain isn’t aware of what to do to create a secure workplace, and this confusion creates vulnerability. The IASME Consortium believes when the safety procedures are properly in place it can cover 99% of vulnerabilities.
ENHANCING RESILIENCE THROUGH DIGITAL CONNECTIVITY

Difficult for digital to reduce existing vulnerabilities in legacy infrastructure.

Not going to achieve 100% resilience, but need enhancement to absorb shocks and stresses.

Need to aim not to be error-free, simply to not be disabled by errors, that’s the achievable resilience.

Difficult to promote: how to make this topic more appealing?

Cross-sector collaboration is required.

Digitally connected infrastructure systems often tightly coupled and complex; it is hard to foresee ramifications.

“Further enhanced my appreciation of the value of data to the delivery of the built environment. A great day with some well chosen, thought provoking speakers. Took much away and will take some time to digest and integrate. “

Good examples of understanding resilience

1. Water with catchment management approach. Ofwat mandating resilience also helped.

2. High reliability organisations i.e: energy developing demand management.

Who is responsible for enhancing resilience?

- 36% Government
- 50% Infrastructure owners/operators
- 5% Regulators
- 9% Everyone

Will digital systems enhance resilience, inform resilience, or create fragility? Reflecting on what you heard today, most likely outcome of digital transformation?

- Create fragility 17%
- Enhance resilience 39%
- Inform resilience 43%
Productivity is the driver for digitalisation

WHAT WILL YOU FOCUS ON AS A RESULT OF THIS DISCUSSION?

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<thead>
<tr>
<th>%</th>
<th>Action</th>
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<tbody>
<tr>
<td>33</td>
<td>Embedding BIM Level 2</td>
</tr>
<tr>
<td>28</td>
<td>Create a Digital Innovation team</td>
</tr>
<tr>
<td>39</td>
<td>Invest in efficiency initiatives</td>
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</table>
CHANGING HOW INFRASTRUCTURE IS DESIGNED

People refusing to change in fear that their “empires” will become obsolete due to technology
Realise the advantages of using digital technology to drive a whole life asset approach and minimise risk
Just increasing productivity of delivery isn’t enough, we need to talk about improving productivity of infrastructure itself
Data is valuable for analysis and profiling amongst other uses. The focus should shift towards better management of data instead of collecting information

Develop whole life cycle assessment models to better compare competing technology and feed into investment decisions
Utilise digital tools and methodologies for determining and monitoring true economic value of new technologies, weighing up future costs against those of the present
Complete cradle to grave understanding
Deliver most benefit in a collaborative proactive digital environment where operations, construction, design, supply chain, procurement, IT, asset management, finance and any other groups relying on asset data, work together to maximise asset efficiency, and minimise risk to realise or improve upon, pre-defined outcomes

MAXIMISE ASSET PRODUCTIVITY

“Very healthy debate; lovely to see value placed on data and opportunities for digital tech to support infrastructure productivity enhancements. Now we need to convert the rest!”
INCREASING ON-SITE PRODUCTIVITY THROUGH INNOVATION

The need for more integration across the supply chain with smarter products and smarter processes.

No value in data: value comes from knowledge but knowledge built on incomplete data has incomplete value.

The ‘jump’ lifting mechanism improves subcontractors’ rate of progress – all materials are lined up and ready for the day’s activities.

Twitter: Blended loads used in ‘jump factories’ is creating 40% transport saving suggests Shaun Tate @MaceGroup. Not too shabby. #DigitalBuilt

The Augmented Worker - “hands free and heads up” resulting in projects delivered on time and within budget, real-time visualisation of projects, better implementation of BIM.

“Let’s be ambitious and tackle productivity as it is now defined: Outcomes for a given Whole Life Cost, in every dimension: financial, social and sustainability.”

Alain Waha, Productivity Stream Leader

WHY DIGITAL?

- Real business benefit
- Standardisation
- Cost savings
- Profit
- Not just compliance

Susan Hone-Brookes
Manufacturing Technology Centre

What is the biggest barrier to construction productivity improvement?

Contractual arrangement: 34%
Onsite execution (including procurement): 20%
Current design processes: 14%
Lack of technology push: 12%
Lack of incentive: 20%

The same question when asked at the end of the discussion.

Contractual arrangement: 40%
Onsite execution (including procurement): 16%
Current design processes: 18%
Lack of technology push: 8%
Lack of incentive: 18%

Matt Gough
Mace

Shaun Tate
Mace

Jaimie Johnston
Bryden Wood

Chris Freeman
Advanced Manufacturing Research Centre
FUNDING IS A POTENTIAL BLOCKER TO FULL BIM LEVEL 2 IMPLEMENTATION BY 2020

Do your research and look at what is out there to help you. Who and what can you collaborate with?

Don’t look at the bottom line first off, initial expenses could save you money in the long run.

BIM

See PAS1192:2 for greater information about BIM Level 2 components, but in summary there are standard processes to reach the second maturity level, examples of which are data exchange, COBie and PDF.

Common Data Environment (CDE) should become **cognitive** through the use of AI, and deliver greater value from data as a ‘Cognitive Data Environment’

“**The event was even better than I thought it would be. It has given me ideas that I have taken back with me up my productivity at work**”

“**Enjoyed listening to experienced individuals who have a passion in delivering innovative and cost effective solutions**”

View the i3P Technology Roadmap

<table>
<thead>
<tr>
<th>Strategic Theme 1 - Digital Transformation</th>
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“**bim-level2.org**”

“**bimtaskgroup.org**”

“**toolkit.thenbs.com**”

“**ukbimalliance.co.uk**”

“**bimregions.co.uk**”

“**theB1M.com**”

“**ciria.org/bim/cube**”

John Eynon
UK BIM Alliance

Michael Bartyzel
BuroHappold

Paul Davison
Northern Ireland Water

Andrew Gamblen
Willmott Dixon

Richard Park
Yorkshire Water
New technology is not the challenge, behaviour is

Key takeaways from closing plenary

- We make day to day change quickly as an industry but are slow at strategic change.
- Return on investment is often prioritised, but it shouldn’t really come into play.
- Enable innovation with a ‘no shame to fail’ mentality.
- Improve little by little daily, and keep your goals achievable.
- Always prioritise security.
- Social acceptance of data. Are we ready to embed sensors on us?

- Enable digital thinkers. Construction managers need to think big scale, buildings aren’t just products they all have a design purpose and a desired outcome.
- Looking forward we need innovation management, and larger companies should break the mould, look beyond the bottom line and mobilise technology. Utilising new entities such as I3P to truly innovate, Project 13 to move from transactions to enterprises, and UK BIM Alliance for BIM to become business as usual.
- There’s a chance computers may become more intelligent than humans, but we need to let humans decide what artificial intelligence is allowed to do morally.
- We should be prepared for low probability but high impact events.
Your Shaping a Digital World Journey with ICE

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<tbody>
<tr>
<td><strong>Raised Awareness</strong></td>
<td>Implement change management</td>
<td>Leave competition aside and effectively collaborate to create a better working environment to compete again</td>
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<td>Transforming operating business models</td>
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<tr>
<td></td>
<td>Empower staff</td>
<td>Asset owners and operators to understand what capabilities they need to develop</td>
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<td>Full interoperability</td>
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<td></td>
<td>Embrace digital at leadership level</td>
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<td>Improving value by eliminating error</td>
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<tr>
<td><strong>Assess security at personal, physical and cyber level</strong></td>
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<td>Map interdependencies of systems</td>
<td>Data as a currency</td>
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<td></td>
<td>Educate and invest in your staff</td>
<td>Data as an asset</td>
<td>Move towards a customer centric system</td>
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<td></td>
<td>Increase value of data though improved analytics and governance</td>
<td>Develop intelligent transport networks</td>
<td>Optimising through-life performance through the development of smart assets</td>
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<tr>
<td><strong>Evaluate the end to end cycle of infrastructure</strong></td>
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<td>Focus on the outcomes for the end users and whole life cycle cost approach</td>
<td>Deeper BIM implementation</td>
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<td>Funding models for BIM Level 2 to be fully embedded</td>
<td>Fully integrated programme team with key suppliers contributing</td>
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<td>Improving productivity, quality and safety by increasing the use of manufacturing</td>
<td>Real-time digitally enabled production systems</td>
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<td>Asset management integrated with delivery</td>
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<tr>
<td><strong>Move away from collecting information and start managing data</strong></td>
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<td><strong>Delivering better, more certain outcomes using digital technologies</strong></td>
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**BY 2025**

The infrastructure industry should be in a position to become

- Fully integrated
- Outcome driven

A fully interoperable, highly secure and less fragmented supply chain
**What next?**

Shape a digital world by joining ICE’s campaign activities in 2018

- Get involved in project groups
- Advise on the curation of knowledge content
- Actively share your life stories and innovative ideas
- Voice your concerns and find solutions to your most pressing challenges

| JAN | Lecture & Webinar |
| FEB | Roundtable |
| FEB | Roundtable |
| MAR | Roundtable |
| MAR | Webinar |
| APR | Roundtable |
| APR | Webinar |
| MAY | Conference |
| MAY | Webinar |
| JUN | Webinar |
| JUL | Workshop |
| SEP | Webinar |
| SEP | Conference |
| SEP | Conference |
| NOV | Joint Lecture |

Get involved in project groups
- Smart asset management lecture and security roundtable with Topcon
- Enhancing collaboration with Allplan
- The next generation leadership skills requirements with Berwick Partners

Advise on the curation of knowledge content
- Achieving full interoperability with Bluebeam
- Increasing infrastructure resilience and reducing vulnerabilities
- Integrating information systems with Bluebeam

Actively share your life stories and innovative ideas
- Understanding behavioural science
- Intelligent transport network management
- Collaborating using the cloud with Bluebeam

Voice your concerns and find solutions to your most pressing challenges
- Transforming business models and digitising the supply chain
- Application of technology: skilled assembly in a factory environment (safe) off site build
- Innovation in product design and technology
- Managing smart motorways
- Smart transport network management

**ice.org.uk**