### INNOVATING THE FUTURE OF INFRASTRUCTURE

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CHAIRMAN’S FOREWORD

Since I was appointed Co-Chair in May 2016 we have seen i3P move from strength to strength. That success is in no small part due to the strong foundations put in place by Tom Hayball and Crossrail’s CEO, Andy Byford.

Over that time, we’ve seen innovation increasingly become a core part of the transformational approach to our industry. Government. On i3P, innovation is one of our key principles. i3P has been clear to our supply chain that without it we won’t realise the full benefits, or best place by Thames Tideway and Crossrail programme’ mindset. i3P now provides a collaborative, industry-wide forums for evaluating ideas and de-risking them through trialling with client members. These targets are ambitious and so we will need to draw on the best ideas from the wider industry through i3P to achieve them.

Heathrow has set out its ambition to deliver expansion in a different and better way. We are committed to being industry leaders in safety and wellbeing, increasing productivity by 25% per annum, continuing to be a responsible neighbour to our local communities, and ensuring that Expansion is carbon neutral.

It is a privilege to be Co-Chair of i3P. The need to deliver infrastructure in a smarter and more collaborative way has never been stronger. i3P has been actively concerned about making even more progress in the year ahead.

The collaboration between HS2 and i3P is playing a vital role in driving the initiatives that will ensure that the sector has the right capability to respond to new priorities, most notably in the areas of digital and low-carbon technologies. i3P is now the go-to-place for innovation in the industry and there is a real sense that our sector has a consistent voice about the challenges ahead of us. It has the necessary focus and commitment to respond to them and seize the opportunities they create.

Early in 2016 we meet the i3P governance structure to include a Strategic Board that would oversee the delivery of i3P’s remit and drive its delivery and wellbeing. We have also established a Delivery Leadership Group that oversees and drives delivery, whilst collaborating with other enabling initiatives like the DTI’s Transport Research and Innovation Board (TRIB) and the Transport Infrastructure Efficiency Strategy (TIES). The level of engagement across these organisations is now considerable and demonstrates the greater cohesion we’ve been able to create.

Our ambition remains to foster a mindset that sees innovation as a sector, we will have a dedicated collaborative, industry-wide forums for evaluating ideas and de-risking them through trialling with client members. These targets are ambitious and so we will need to draw on the best ideas from the wider industry through i3P to achieve them.

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We will test these targets by focusing on four priority areas in the next year:

1. Lead the sector in transitioning from on-site construction to off-site manufacture and assembly.
2. Explore and utilise methods to reduce carbon in the end-to-end process.
3. Choose our four-logistics Hubs, and integrate them into our plans.
4. Ensure our programme is digitally enabled.

These targets are ambitious and so we will need to draw on the best ideas from the wider industry through i3P to achieve them. For example, we are already seeing the benefits of the sponsorship of two 3P Priority Projects.

The first is investigating Low-carbon Materials. Heathrow will use 4.5 million tonnes of steel in delivering Expansion. The sheer scale of our construction means that even small reductions in the carbon contained within our materials will make a huge difference to our overall footprint, helping us to meet our commitment to net-zero carbon.

The other is Offsite Manufacture Logistics. With Heathrow’s location at the edge of London, it is imperative that we reduce the volume of people, machinery and freight accessing the site. We see a future where our terminal buildings are manufactured offsite, consolidated in one of our logistics hubs and then transported to Heathrow for assembly. This will be more affordable, safer and better for our local communities, whilst ensuring that communities across the UK feel the economic benefits of Expansion.

Successful delivery of these benefits is as much about leadership, culture change and learning as it is about innovation, a theme reflected in our Delivery Model. This year we have worked together rather than what work we do. As it is clear that i3P delivers ideas around behaviour, culture and collaboration, this approach has brought great and innovative ideas around what we do.

I3P connects Heathrow with the ideas that will turn our ambitions into reality. Over the next year, I look forward to working with our industry partners through i3P to champion the opportunities to drive improvements and innovation across the infrastructure sector.

Phil Wilbraham
Expansion Programme Director, Heathrow. Co-Chair of i3P

EXECUTIVE SUMMARY

We met the i3P governance structure to include a Strategic Board that would oversee the delivery of i3P’s remit and drive its delivery and wellbeing. We have also established a Delivery Leadership Group that oversees and drives delivery, whilst collaborating with other enabling initiatives like the DTI’s Transport Research and Innovation Board (TRIB) and the Transport Infrastructure Efficiency Strategy (TIES). The level of engagement across these organisations is now considerable and demonstrates the greater cohesion we’ve been able to create.

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i3P is a client-led community of organisations that operate within these sectors, convening and aligning companies and key stakeholders around a common and ambitious innovation agenda. An inclusive community that is committed to active collaboration, it is this combined and coherent effort that is developing and delivering the innovation projects that will, over time, re-define the way we work.

For organisations and companies that work with i3P the value comes from leveraging their current Research, Development and Innovation (RDI) programmes. Across the membership the combined investment on RDI is over £1bn a year and i3P provides the opportunity to direct this through a portfolio of strategically aligned, industry-wide collaborative projects that align with the targets of Construction 2025 and deliver impact at scale for the sector.

“The team at KTN is proud to be hosting i3P on behalf of members and our broader i3P community. It is our role to provide support and facilitation, to help to shape delivery priorities and to ensure there is a continuity that not only adds value today but enables progressive innovation and continued transformation for future projects and programmes.”

Colin Tattam, Director, Knowledge Transfer Network
i3P is a client-led community of organisations operating in the infrastructure and construction industry that is committed to collaborative innovation for the transformation of our sector.

i3P aspires to be a force-for-change in the infrastructure and construction sector, convening and aligning organisations to adopt a collaborative approach in order to drive positive impact and transformational change.

Companies and organisations that work with us derive value in different ways, these depend on position in the supply chain and / or chosen business model:

• Client organisations establish a single customer voice for all like-minded clients, providing route to market visibility and clarity on what innovation outcomes they want and need. This enables the increased adoption of common standards and ways of working that support increased productivity and safety, as well as driving collaboration both through and across the supply chain.

• Supply chain organisations are able to engage with a single client voice that drives improved efficiency and reduced rework. It also enables more confident adoption of innovative methodologies and materials.

• Other supply chain companies, including SMEs, are able to engage with a single client voice for infrastructure that facilitates visibility of future client and asset requirements and enables the subsequent adoption of transformational innovations through providing a route to market and scalability.

As the delivery engine for innovation in infrastructure and construction, i3P has already deployed an active programme of work through which these approaches are starting to drive impact, examples of which can be seen in the pages following.

SUCCESS TO DATE

KTN positioned as the independent Secretariat to i3P (2016)

Through strategic partnership with The Manufacturing Technology Centre (MTC), developed and launched Technology Roadmaps for the sector (July 2017)

Established an influential relationship with CLC, BEIS, IPA and Innovate UK, establishing government support through the Construction Sector Deal

Launched a new programme of seven collaborative i3P Priority Projects in 2018 focused on the delivery of strategic outcomes for the sector

Completed a programme of Discovery Projects with i3P and five other academic organisations (2017-18)

Created and hosted i3P SPARK, a competition that provided £100k of seed corn investment for 3 innovation projects

Delivered a workshop of collaborative i3P Priority Projects in 2018 focused on the delivery of strategic outcomes for the sector

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Completed an i3P Advanced Material Development Group collaboration with the chemical industry to drive the development of new, more sustainable materials

Delivered the first i3P Impact Project (Zones of Influence) which confirmed the opportunity to reduce asset protection costs if this industry adopted proven common standards

Delivered a programme of Discovery Projects with MTC that explored the use and application of new and emerging technologies (2017-18)

Working with the CLC, established the Future Materials Pathway for the industry to unlock the potential for future investment in the sector

Completed Innovation investment Priorities research with UCL in August 2019 to identify the strategic priority themes in which the industry must invest
Tideway is committed to supporting the UK Government in significantly reducing the carbon footprint of infrastructure. It offers a framework for managing carbon throughout the project lifecycle, from the feasibility stage through to the end of the asset’s life. During the early stages, the ability to influence and reduce the carbon emissions is much higher. Therefore, the collaboration of the supply chain and early contractor involvement are key to achieving the targets.

Tideway recognised that reducing carbon emissions was not only good for the planet, but also good for project efficiency. Tideway and the Main Works Contractors (MWCs) are investing money to innovate and promote their vision of leaving a lasting legacy to the construction industry. They adopted the principles outlined in PAS2080 to effectively manage carbon emissions and introduced greenhouse gas emissions governance and review from concept through to design and build.

Tideway outlined a number of carbon footprint objectives for the MWCs to meet whilst monitoring progress and success of the works against the accepted footprint.

The MWCs developed a Carbon Management Plan and Policy, setting out their corporate commitments to managing their emissions, including monitoring CO2e footprint from construction activities and managing the emissions across the supply chain. The MWCs report quarterly to the Project Manager on carbon use, showing progress against the targets as well as innovative procedures to reduce their footprint. Whenever the actual carbon emissions exceed the forecast, the MWCs follow the carbon intervention procedure, stating why there is an excess and what actions need to be taken to meet the targets.

“In Climate Change is one of the biggest threats to our current existence and it is clear from the scientific evidence that we as an industry are a major contributing factor both locally and globally. It is also clear that we need to change things now not later. At Tideway we’re moving as much material as possible by river which has numerous benefits including reductions in emissions, but there’s more that can be done before we finish and I look to the innovation community to deliver these improvements.”

Andy Mitchell, CEO, Thames Tideway Tunnel
Robotics and automation's appeal to the construction industry is multi-dimensional.

i3P members listed the two closely related topics' potential to improve productivity, health and safety, profitability, and quality as the top drivers for adoption. Indeed, many of them are already speeding ahead, with drone technology for aerial scanning, for example, already in regular use and proving its worth.

Outcomes
- Tele-operated robots, i.e. remotely controlling or monitoring machinery and equipment in real-time, ideal for avoiding the health and safety risks in hazardous environments.
- Automated data capturing, data sharing and decision-making, i.e. the rapidly developing technology of sensors and the Internet of Things that is set to enable everything from autonomous plant and delivery vehicles to whole-life maintenance monitoring.
- 3/4 axis robotics and robot arms, i.e. relatively versatile machines at a high technology readiness level that can be put to a wider range of tasks. Although ideal for off-site component or module assembly, there is also scope for on-site tasks aimed at improving accuracy and productivity either on or offsite. For example, Crossrail's Elizabeth Line has invested in several sophisticated examples, with a gantry system for placing rails, a concrete batching train, and an automated drilling rig.
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Cementitious materials

Despite the enormous social and economic gains that come from them (infrastructure projects have a disproportionate effect on carbon footprints), indeed 4% of global emissions are contributed by the use of just one material: cement, a constituent of concrete, a material commonly used in infrastructure assets such as bridges and tunnels.

The challenge
- The construction industry is an essential part of any economic system. However, it is also one of the largest emitters of greenhouse gases and a significant contributor to climate change.

The outcome
- The project leaders are currently considering developing a proposal for grant-funding from the Transforming Construction challenge fund to run a smart materials collaborative project.
THE CHALLENGE
The circular economy concept, or ‘circularity’, entails gradually decoupling economic activity from the consumption of finite resources for societal good. It is based on keeping products and materials in use, designing out waste, and regenerating natural systems. It builds economic, natural, and social capital, all underpinned by a transition to renewable energy sources.

Perhaps because infrastructure assets are so fundamentally important and long-lived, its principles are only just beginning to be applied to the sector. Also, making the circular economy happen is as much about behavioural change and fresh thinking as it is about technological innovation. It is for these reasons that this discovery project was handled differently, consisting of interviews with i3P members to set the parameters, followed by a show-and-tell workshop in October 2018 where member organisations demonstrated practical examples of circular economy thinking in real projects.

For example, Anglian Water were able to save time, money and precious resources by reversing the flow along existing pipework to a reservoir rather than building a whole new pipeline. Similarly, the Environment Agency now understand that delaying upstream water by natural means is a more effective fluvial flood defence than building protective infrastructure downstream.

UP RESPONSE
The project mapped the current state of play in the industry, discovering a myriad of challenges connected to lack of knowledge, evidence, incentive, and motivation. Equally, it found that business-as-usual business cases, data management, contractual conditions militated against adopting circular economy strategies.

The workshops identified strategies for overcoming the barriers centred on the themes of better data management, collaborative working and, overwhelmingly, research. The gaps in knowledge undermine confidence and hinder the necessary longer-term return on investment periods needed for the theory to work.

Plenty of short-term tactics currently exist, including adjusting contracts, briefs, specifications, and licences to actively promote circularity. However, the project concluded that the concept itself needs to be better defined in the context of infrastructure development and operation. What does good circularity look like? How can it be measured and benchmarked? How does it fit with sustainability business cases, and end-of-life arrangements for assets?

OUTCOMES
The project concluded that client leadership was the primary catalyst for beneficial change, linked to cogent articulation of the issues. By demanding circularity in their projects, clients have it in their power to change the market, and i3P has an important influence role to play in developing evidence through case studies, engaging the supply chain, and facilitating collaboration for industry-wide benefit. This Discovery project has fed directly into the current i3P Priority project Optimise & Challenge Design-Better Carbon Outcomes.
DECARBONISING INFRASTRUCTURE THROUGH STANDARDISATION OF DESIGN

Duration: December 2018 – November 2019

Project sponsor: HS2

Lead: Atkins

Partners: Anglian Water, Arup, Costain, Environment Agency, Jacobs, KTN, Skanska, Tideway

Funding: Contribution in kind, looking to apply for ISCF funding

This project tested the success factors in the delivery of lower carbon infrastructure solutions. It aims to use best practice case studies to define a collective stakeholder vision of carbon reduction across a project lifecycle and develop a standardised project approach to inform and drive better project outcomes. In turn, this will drive efficiency with a resulting carbon dividend and cost savings.

It also enables like-for-like measurement and benchmarking of an asset’s ‘greenness’, a critical factor in the successful issuance of green or climate bonds. These increasingly popular funding vehicles for green infrastructure projects all require the transparent and consistent disclosure of carbon costs, which can be very challenging to define, monitor and compare.

Many carbon reduction innovations already exist but are not yet routinely or extensively implemented on projects. While programmes start with ambitions for system-wide innovations like standardisation, these tend to get watered over time either under financial pressure or because of vigilance fatigue. i3P provides a unique forum to identify and address these blockers to successful carbon innovation implementation.

Working with the Green Construction Board, the project team is focusing on the potential value of PAS 2080: Carbon Management in Infrastructure to help to overcome some of these blocks. While still developing, this management standard encourages all members of a project’s value chain to agree consistent, transparent protocols for using data, reporting, quantification, benchmarking, target-setting, and continuous improvement for climate change mitigation. Signing up to common goals encourages collaboration, which will incentivise better technical solutions, including standardisation.

The project leaders currently have an open call for evidence to collect best practice case studies of real projects in carbon management through the design and construction process, and will develop a thought piece to share their insights. They intend to develop a carbon management framework to support PAS 2080 setting out practical steps to enable more successful implementation on projects, making it relevant to project roles, defining specific actions to be taken, and clarifying the benefits.
A practical investigation part-funded by i3P used data created during construction of a large diameter shaft at one of Tideway’s drive sites. This produced real-world evidence allowing the extent and severity of impacts to be more accurately predicted during the design of large diameter shafts on major infrastructural projects.

The challenge
The excavation and construction of large diameter shafts are common in large infrastructure projects, particularly if they involve deep tunneling for transport or if an open shaft is required on a Tideway project, of sewers capable of coping with the 21st century’s effluents from a major capital city. While there is good real-world evidence for the actual impact of shafts up to 17m in diameter, there is far less for larger sizes. Inevitably, this affects how one assesses risks derived from calculations for the extent of the zone of influence, with important knock-on consequences to the extent of impact assessments and level of assurance to be provided by the project.

Construction of shafts is not just a question of shoring up the sides to avoid collapse. As the construction progresses, the ground surrounding the excavation also moves, threatening the structural integrity of built structures above or below ground within a certain radius. Structures have varying tolerances to ground movement, and so the impact on them depends on the engineers, contractors and their clients. In particular, stakeholders—third-party owners of buried utility services, for example—are more likely to err on the side of caution and require extensive risk mitigation measures before they give their consent for the works to go ahead. This may build in unnecessary and potentially unneeded time, cost and disruption to the infrastructure project, reducing value for money.

The response
The project team conjured that more real-world data could foster more assurance during the design process that leads to better project outcomes. The project also made use of LiDAR in an innovative way to measure surface ground movements resulting from the construction of the 30m diameter Carnwath Road shaft. Typically to date, LiDAR had only been used for ground profiling. Its resolution had not been good enough to predict small ground movements. This project used higher resolution LiDAR able to determine smaller ground movements against accurate survey data, demonstrating its ability to detect horizontal movement as well. The team pitched their proposal both to Tideway and to i3P, who saw an opportunity to improve the industry’s understanding and validation by collaborating on this joint-funded project.

The outcome
Although the findings have yet to be fully peer-reviewed, initial results appear to validate the methodology used for smaller diameter shafts, allowing specific calibration of the approach for large-diameter shafts. The project also validated the accuracy of so-called heat maps produced by LiDAR against topographical survey data, providing hope for the usefulness of the technology’s horizontal ground movement measurements too.

This jointly-funded project highlights the potential gains to be made by collaborating outside of any one organisation in order to work towards redefining industry standards. i3P’s collaborative model and strategic aims provide plentiful opportunities to identify common challenges and work towards addressing them collaboratively for exponential progress.

ZONES OF INFLUENCE

Duration: October 2017 – ongoing

Project sponsor: Tideway

Lead: Atkins–Arup joint venture

Partners: SHR Tulip-Morgan

Sindal-Balfour joint venture (BBM JV)

Funding: £30,000 from I3P, £30,000 from Tideway, £5,000 from BBM JV

THE CHALLENGE
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The introduction of connected and autonomous methods and machines will disrupt all aspects of the construction industry. The possible benefits of this new technology are vast and indicate that CAP should be explored, developed and adopted across the sector.

The research programme is taking a multi-disciplinary approach to understand the adoption of CAP across the industry. Firstly, in collaboration with IHR members, Highways England are engaging in a series of workshops to identify the ecosystem that will be influenced by CAP technologies, and hence develop a roadmap for their introduction. The first of these workshops has identified the wide range of stakeholders that will influence, and/or be influenced by, automation in construction.

The roadmap will determine the trends and drivers, the opportunities that are available as a result of these, and how these opportunities might be realised in the short, medium and long-term future. A key focus will be to address the social, technological, commercial and legislative challenges.

In parallel with these workshops, the research programme is investigating the current state of CAP technology, both in construction and in parallel industries such as mining, agriculture, logging, and manufacturing. This will provide state of the art in CAP and will be used to support the selection of technologies for a live demonstration. The demonstration will offer manufacturers and developers an opportunity to display their existing and prototype technology to the wider community. The demonstration will hence increase the visibility of automation as an emerging method to support improved safety, efficiency and productivity in the construction sector. It will fuel innovation and adoption across the sector and will encourage collaboration across stakeholders.

The Connected & Autonomous Plant (CAP) project has been commissioned by Highways England, under the Innovation Designated Fund, to develop a roadmap for the implementation of automation in construction, part of the digital roads vision. The project will work collaboratively with industry, including IHR, to identify how connectivity and automation can be used to resolve some of the key challenges faced by the construction sector, including safety, efficiency and integration of people and machine equipment.

CHALLENGES

With its clear potential benefits, Highways England are keen to encourage future development and adoption of new areas of technology. However, there is a diverse range of potential applications for CAP, and there is currently no industry-wide strategy to direct its medium- and long-term focus.

WRITING TOWARDS A ROADMAP

This has been commissioned by Highways England to work with industry to deliver this project. The work will consult industry experts to understand the state-of-the-art across all aspects of construction. A group of industry stakeholders will be established, to assist in the creation of a clear vision for the future of CAP in the UK, and to deliver a roadmap to address the social, technological, commercial and legislative challenges. A key aspect of this roadmap will be exploring the potential of extending or integrating with existing databases concerning the built environment. The project will also demonstrate current CAP technologies to industry, to encourage further development and adoption across the sector.
The Construction Sector Deal is part of the Government’s Industrial Strategy published in November 2017 that sets out the foundations for an ambitious partnership between the Government and industry to transform the sector.

Construction underpins our economy and society. Few sectors have such an impact on communities across the UK or have the same potential to provide large numbers of high-skilled, well-paid jobs.

The Department for Business, Energy and Industrial Strategy (BEIS) and the Construction Leadership Council (CLC) have identified and committed to addressing many of the key challenges and opportunities facing the UK Construction sector.

i3P has been instrumental in supporting this partnership, engaging in round 1 of the Industrial Strategy Challenge Fund ‘Transforming Construction’ competition, with i3P members successfully securing funding for 8 of the 23 projects.
Key investments to date have included:

- £72m in the Construction Innovation Hub, Coventry - The Hub will focus on stimulating collaboration in the construction sector and consists of a consortium including Manufacturing Technology Centre (MTC), the Buildings Research Establishment (BRE) and the Centre for Digital Built Britain (CDBB) at the University of Cambridge.

- £36m in the Active Building Centre, Swansea - The centre will look at energy generation, storage and release technologies and ways to commercialise and increase adoption of this infrastructure.

- £7m in research activity - including establishing a research community dedicated to construction (Network Plus) which will bring together experts in the digital, energy, construction and manufacturing space. Led and managed by The Bartlett, UCL’s Faculty of the Built Environment, with co-investigators & staff from Imperial College London and WMG, University of Warwick.

- £48.5m in industrial led Collaborative R&D and demonstration programmes - where £12.5m has been invested in 23 projects in the first round of Collaborative R&D.

### i3P Brokered the Industrial Strategy Challenge Fund - Transforming Construction (ISCF-TC) Collaborative R&D Round 1

Of the 23 projects funded in the first round of Collaborative R&D, i3P’s involvement is evident in at least 8 of these:

- **Optimising equipment use in construction with BIM, IoT & data analytics by GearBuddy** [with Costain]
- **LAMP - Live Automated Materials Plan by Cartoonishly Consult Ltd** [with Skanska]
- **The Learning Camera by BAM Nuttall**
- **AI-Optimised Pathways for Schedule Execution by NPlan** [with Kier]
- **Big Data and Machine Learning-enabled Automated BIM for Projects (Auto-BIM) by Balfour Beatty**
- **CORE by Octagon IO** [with Bam Nuttall]
- **PLASMA by Vinci** [with Skanska]
- **AROPCQA by Laing O’Rourke** [with HPC]

### LAMP [developed with Skanska]

LAMP is a large and ambitious project that is developing an internet of things framework which also includes sensors and other monitoring equipment.

The next and final round of R&D and Demonstrator funding for ISCF-TC opened on the 28th August (2019). i3P is taking an active role in shaping the industry’s response to this opportunity, gaining representation as a key stakeholder that develops and drives innovative and ambitious partnerships.
i3P PARTNERSHIPS & KEY CONNECTIONS

i3P set out in 2016 to develop and maintain relationships with key stakeholders that would enable it to be influential in driving transformational change in the industry. In conjunction with the Construction Leadership Council (CLC), this led to Government support for the industry through the Construction Sector Deal and opportunities through the Industrial Strategy Challenge Fund (ISCF).

Strong linkages have been formed between industry and Government through the Transforming Infrastructure Performance (TIP) report and the Transport Infrastructure Efficiency Strategy (TIES). This has led to mutually supportive relationships that ensure full alignment between the needs of the private and the public sectors.

i3P has developed strong engagement with both the CLC and the Infrastructure Client Group (ICG) through the i3P Strategy Board and the CIG. This is critical in ensuring alignment of client organisations across the industry around a single agenda for transformational change. This client commitment to delivering value-adding outputs from the portfolio of projects delivers confidence to the supply chain that ensures their engagement and support in project delivery. This collaborative approach to innovation is attracting attention and engagement from other sectors such as the chemical industry and the geospatial community which will drive cross-sector collaboration to mutual benefit.
TIES is led by a taxeforce, which is Chaired by Mike Brown MVO, Commissioner
Transport for London and includes representatives from the partners and key
stakeholders such as the Construction Leadership Council (CLC) and the Infrastructure
and Projects Association (IPAS). The strategic aims to drive efficiency through:
• Increasing our understanding of cost and performance through benchmarking;
• Enabling delivery through improved business processes, such as the development
of business cases and commercial strategies;
• In order to underpin increasing deployment of innovation and digital technologies
in March, TIES published its: ‘One Year On’ Report, which outlined progress in its
first year of delivery and set a number of commitments for the year. There were a
number of key achievements including an initial analysis that estimated that rolling
out automated design, where possible, could lead to savings up to £6bn across the
transport infrastructure pipeline.

The report also highlighted where transport clients are adopting innovative
technologies across their programmes. These included Network Rail’s Modular
Stations Programme, delivering efficiency savings of 50% in the design process;
savings in excess of £1m at TfL’s Bank Station through the installation of real time
technology to enable efficient construction; and savings of approximately 20% in
design and construction costs at Highway England through standardised bridge
design where these can be adopted in the programme.

TIES’ focus since has been on driving a programme of work to benchmark key asset
costs across our sector. In turn, this will feed into a broader programme of work to
benchmark achievement of more strategic objectives, such as reducing carbon. This in
turn will underpin the increasing deployment of digital and innovative technologies.

Working with stakeholders, such as the Construction Leadership Council (CLC),
and Innovate UK, TIES is developing an evidence base to highlight the benefits
of innovation when compared to traditional methods of design, construction, and
maintenance of our assets. This data will help to shape future investment cases and
provide an effective mechanism for sharing knowledge, ideas and expertise.

As one of the CLC’s strategic guiding minds, TIES is working with other participants
to shape and influence its work and future projects. Individually, TIES partners are playing
key roles in i3P activity, including leading priority projects.

TIES will report on progress in its ‘Two Years On’ report in Spring 2020.
i3P PARTNERSHIPS & KEY CONNECTIONS

GOVERNMENT

NIC (National Infrastructure Commission)
BEIS (Department for Business, Energy & Industrial Strategy)
IPA (Infrastructure & Projects Authority)
Department for Transport
Environment Agency
Innovation Unit
Core Innovation Park (Transforming Construction Alliance)

INDUSTRY INITIATIVES

KTN (Knowledge Transfer Network)
CLC (Construction Leadership Council)
CDS (Construction Demand Side) Project13
DTTSG (Digital Transformation Task Group)
DFTSG (Digital Framework Task Group)
IPRI (Innovate Right Initiative)
CIRIA (Construction Industry Research and Information Association)

RESEARCH BASE

CCSIC (Cambridge Centre for Smart Infrastructure & Construction)
CSIC (Construction Scotland Innovation Centre)
UKCRIC (UK Collaboratorium for Research in Infrastructure)

TRADE ASSOCIATIONS

Build UK
CECA (Civil Engineering Contractors Association)
MIA (Major Projects Association)
Construction Products Association (CPA)
Major Projects Hub (part of MPA)

OTHER

CITB (Construction Industry Training Board)
Emerging Buildings Wiki

Please note this list is regularly reviewed.
One i3P goal is to be the “go to place” for collaborative innovation in the UK infrastructure and construction industry, providing the capability to strategically focus innovation to deliver outcomes that will solve the major challenges and respond to the huge opportunities that face our industry.

We encourage the sharing of innovations that have already been successfully implemented and delivered value. This is achieved via the Innovation Portal which enables members to upload and download content, provides a trusted collaborative space and directly connects members from different organisations together to share expertise and ideas. This sharing of innovations online catalyses broader benefit on real-world projects.

By establishing a truly collaborative culture of innovation across both infrastructure clients and their supply chains, i3P creates a “safe space” to identify areas for potential industry advancement, share ideas, and enable members to collaborate on projects that drive increased value at scale across the infrastructure industry. Some examples of this in action are highlighted in the next pages.

Our mantra is ‘Collaborate to Innovate’.
MOTIVATION & CONTEXT

Through delivering high-value works that lie on the critical path of any given project, a small amount of redundant material is often generated. In order to protect higher risk parts of a task or project, such spare materials are ordered to mitigate such critical and severe risks (to either cost, programme, or safety). This can also happen when orders are made to account for breakage, yet the company is bound by the large minimum order quantities from suppliers to cover what is often a minimal shortfall.

These leftovers are either returned to the supplier at a reduced rate, sent to landfill (at a cost to the business for both transport and disposal) or given away as an exemption notice to 3rd parties. Another alternative is that materials are transported back to regional site yards and left to degrade, often forgotten about and taking up valuable space.

No proper system existed internally to facilitate site-based reuse of materials (provided they are fit for purpose), resulting in large financial and environmental impacts to the business.

INNOVATIVE SOLUTION

An internal listings page for spare materials on all sites across the business. The page facilitates point-to-point materials trades between projects, however it does not facilitate online transactions and will list the items only.

The day to day management of materials is done point-to-point, the responsibility will lie with the nominated site contacts to validate the condition of materials, evaluate if they are fit for purpose, and decide which path adds the most value for the business, be it return to supplier, landfill, or reuse on another site.

BENEFITS

Recovery of value through reuse and elimination of waste. It reduces the amount of embedded carbon in projects through the reuse of materials. Through improving communication across the business, this will ensure that sites are more aware of ways to reduce waste, reuse materials, and also circulate examples of good products throughout the business the ensure our drive for continuous improvement is saturated across all levels and sectors.

KEY FACTS

- Internal listings page built using internal expertise and resource
- Delivered by the IT team with input from Procurement, Project Management, Operations, Plant, Legal and Logistics to ensure a considered approach
- Return on investment achieved in less than four weeks of launch

Published: 7 December 2018
i3P Partner: Murphy

LIGHTING ASSET PERFORMANCE MEASUREMENT TOOL (LAPM)

MOTIVATION & CONTEXT

This task is proposed in response to:

• Customer complaints of flickering and discomfort glare from LED lighting
• A risk to customer safety due to reduced visibility
• A need to understand how the LED lamp degrades
• A need to improve practices when measuring lighting performance – workforce safety, cost and network disruption

INNOVATIVE SOLUTION

The task aims to develop a tool to measure the performance of LED lighting, preferably for the whole carriageway from a moving vehicle at speeds appropriate to the road in a single pass. LED technology is still new, it may operate optimally for a certain number of hours and then rapidly degrade.

BENEFITS

The main goal is to enable workforce to measure and monitor LED performance cycle, identify and pinpoint when and how fast it degrades and stop operating to British Standard. Another driver is to develop safer and more efficient ways of working to inform cyclic maintenance schedules and ensure the asset operates optimally throughout its lifecycle.

Published: 4 March 2019
i3P Partner: Highways England
Intelligent Transport Systems
SHELL GAS-TO-LIQUID (GTL) FUEL TRIAL

MOTIVATION & CONTEXT
The scheme involves significant earthworks constructing the UK’s largest flood storage reservoir. The site is situated on a nature reserve and close to a local school. Birmingham is actively consulting on the new Clean Air Zone proposed for 2020. The contractor, Jackson Civil Engineering recognised this was a good opportunity to trial GTL fuel in site plant to reduce the levels of harmful pollutants such as nitrogen oxide (NOx) and particulate matter (PM) being emitted, to improve local air quality.

INNOVATIVE SOLUTION
Rather than being derived from crude oil, GTL Fuel is created from natural gas using the ‘Fischer-Tropsch’ process which produces more consistent and uniform molecules compared to conventional crude oil refining. This means the fuel has more efficient combustion properties inside standard diesel engines, resulting in lower emissions of pollutants such as NOx and PM. This can help to reduce engine noise, with reductions of between 3-5dB reported by some users.

BENEFITS
There are lower emissions of pollutants such as NOx and PM and reduced engine noise, with reductions of between 3-5dB reported by some users. The most significant difference noticed on-site between GTL and diesel is that, due to the clean burn, you can’t smell it, or see it, which is not the case with diesel. Also, it is less harmful to the environment when spilled compared with conventional diesels. Overall this helps to create a healthier working environment for workers and reducing impact to the local community.

KEY FACTS
The Perry Barr trial is still in the early stages with all site plant using GTL fuel since August 2018. On average, around 1,500 to 2,000 litres of fuel is used on site each week. Previous trials in the Netherlands produced a reduction in NOx emissions of 13%, a reduction in particulate matter of 22% and a reduction in carbon monoxide of 28%.

UTILITY POLES FOR OVERHEAD LINE POWER DISTRIBUTION

MOTIVATION & CONTEXT
• Existing solutions had drawbacks.
• Steel lattice tower
• Typically higher voltage application
• Structurally efficient use of material however significant quantity of steel angle bars.
• Complicated foundations (rake angle and hip angle)
• Leading to complex installation methodologies
• Footprint, visual environmental impact
• Stone access tracks needed for concrete wagons, steel delivery and cranes
• Working platforms needed for cranes and piling
• Remote locations
• Remote locations

INNOVATIVE SOLUTION
• Modular
• Lightweight solution

BENEFITS
• Advanced composite material: Ultra-strong polyurethane resin and E-glass fibres, leading to a long and narrow bundle of fibre
• Versatility: Standard sized modules that can be used to build custom length and strength
• Safety: Increased asset life span, risk to climbing operatives and third parties
• Structural integrity: Compared to wood pole structures, increased spans length, reduced number of structures, reduced labour, less land take, reduced materials, similar footprints to wood pole, strength characteristics of steel lattice towers
• Transportation and Handling: “Russian doll” transportation, lightweight, sectionalised design, can be manual lifted
• Reduced Land-take – fewer poles – reduction in landowner objections/consultation

Published: 31 July 2018
i3P Partner: Balfour Beatty
Themes: Delivering efficiencies through the Lifecycle
Health & Safety
Sustainable solutions

Published: 29 November 2018
i3P Partner: Environment Agency
Theme: Sustainable solutions
Area / Department
Site: Perry Barr and Witton Flood Risk Management Scheme

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i3P Future Focus

- Develop 2021/22 Priority Project Programme
- Develop 2022/23 Priority Project Programme
- Develop collaborative cross-sector relationships
- Publish i3P Innovation Investment Priorities research
- Develop new i3P Innovation Portal
- I3P SME Engagement Programme
- Increase diversity of i3P membership
- Collaborate with CLC to develop future industry roadmaps
- Collaborate with IOG to deliver Digital Transformation agenda
- Further develop strategic partnerships with key stakeholders
- Further develop strategic partnerships with key stakeholders
- Increase diversity of i3P membership

i3P Annual Report 2019
SMEs deliver 54% of total UK turnover in the infrastructure and construction sector, nearly double that of large companies at £191bn each year. Despite the size of the sector and the growth in construction tech, there is untapped opportunity to fast track productivity growth by tackling three key challenges:

- **Fragmentation.** Over 190,000 SMEs work in construction and infrastructure consulting in the UK alone (excluding sole traders). It is hard for Clients & Tier 1 organisations to find and assess technologies from innovative SMEs.

- **Earnings.** SMEs earn on average 78p in every pound, with revenue per head 22% lower than in large firms in Professional Services such as Engineering Advisory. Increasing productivity by 5p per hour would add £35bn to the sector each year.

- **Trust.** The adoption of innovative technologies is held back by the lack of trust in working with new suppliers and the different ways of working between SMEs and Clients / Tier 1s.

The i3P SME programme will target the points of friction that inhibit effective collaboration. Over an 18 month period the programme will:

1. Understand and target the barriers that are preventing effective working between start-ups/SMEs and Clients/Tier 1s

2. Build & launch a Marketplace of innovative SMEs for i3P members. Creating a single place where i3P members can access trusted SMEs, recommended by members, for members.

3. Drive & evidence impact, with data insights on SMEs growth, value, skills and services. Engaging with industry bodies to drive collaboration.

i3P is launching a new programme, supported by Innovate UK to unlock innovation hidden in the SME supply chain. Enabling the adoption of new technologies to drive productivity and support the growth of high performing SMEs.

I3P worked with:

Elspeth Finch MBE, IAND

Colin Evison, Bam Nuttall

Elspeth Finch MBE, IAND

Colin Evison, Bam Nuttall
Although we are at the heart of the Construction Sector Deal and the £170m Transforming Construction challenge, our objectives extend beyond these. Ultimately, we want to gain the trust of Government and society by delivering economic, social and environmental value, setting in train a virtuous cycle of continuous improvement and a clear case for continued support for the sector. Delivering against this ambition relies fundamentally on strong governance. We have a Strategy Board and, since 2018, a Delivery Leadership Group (DLG). Between them they ensure maximised impact with the best return on investment for the benefit of members, the infrastructure construction sector, and UK plc as a whole.

Our Strategy Board performs a crucial role in overseeing and coordinating our efforts to respond to Government policy, acting as the voice of the industry and helping to identify and attract funding. Our DLG has a more hands-on remit. It translates this ambition into coherent plans and tangible outputs, exploring and setting the agenda for how we deploy resources and galvanise projects into delivery.

Working constructively across our innovation forums and programme of projects, DLG explores opportunities for wider engagement. For example, it has leveraged our association with KTN to broker mutually beneficial relationships with more distant supply chain partners and, notably, experts from other sectors. The Low-Carbon Materials project, for example, welcomed input from the chemical industry, and there has been a useful exchange of information with the geospatial community.

Transparency in decision making has been an important strand to i3P’s success. For example, the DLG established a system of gateways for evaluating research ideas aligned to the Construction Leadership Council’s targets. This clarity has encouraged strong interest both from within and outside the membership, and underpinned, for example, the Dragon’s Den-style SPARK event in 2018. The key outputs are our Priority Projects, designed to translate new processes and the best ideas around emerging technologies (identified in the i3P’s Discovery Projects) into deployable innovations.

The work does not stop there. The projects’ findings will be validated for their tangible benefits for industry, clients and society as a whole over time. Validation breeds trust, which attracts funding, setting in train that virtuous spiral of mutually beneficial and progressive impacts for government and industry.

To date, i3P has focused its efforts on Government targets, and intends to maintain that momentum. However, we are conscious that there will be wider opportunities to improve productivity and increase efficiency. In pursuit of these, we have proactively commissioned research led by University College London to explore additional, alternative, or better options for optimising the long-term value of infrastructure investment. The work mapped out the landscape for what is currently being researched and what promising areas are underinvested so that we can quantify the value and readiness of the opportunities. This research informs the industry on where the best returns are likely to come, critical in identifying the strategic priorities that require greater inward investment.

The DLG has also made a concerted effort to extend and consolidate its influence by fielding representatives in other important complementary industry initiatives, including the Construction Leadership Council (CLC), Infrastructure Client Group (ICG), Property 13 and the Transport Research and Innovation Board (TRIB).

With these foundations in place, i3P can now face the future with confidence. Our precedent and possibility most valuable achievement is to have brought a famously fragmented and divided industry together. The work is important and right at a time when the industry, increasingly driven by Government sector support in place, must be driven and driven hard to deliver the innovation vision for a thriving, rewarding and value-adding industry through innovation – in all its shapes and sizes.

With Government sector support in place and maintained, and i3P at the heart of it, it’s an exciting time for infrastructure and construction. We’re proved that we can put our house in order, and it’s time to scale up our efforts to drive real, lasting, beneficial impact.
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<th>STRATEGY BOARD MEMBERS</th>
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<td>Ann Bentley</td>
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<td>Catherine DeMarco</td>
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<td>Sam Stacey</td>
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<td>Colin Tattam</td>
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<td>Mark Thurston (Co-Chair)</td>
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