Results of Competition: Transforming UK Construction: Demonstrator Projects

Competition Code: 1908_ISCF_DEMO_TRANSF_CONSTRUCT

Total available funding is £22,000,000

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
LAING O'ROURKE SERVICES LIMITED	Product Based Building Solutions - High Productivity Digital Integrated Assured DfMA for Lifecycle Performance	£1,514,362	£757,181
ACTIVEPLAN CONSULTING LIMITED		£161,812	£113,268
AUTODESK LIMITED		£42,951	£0
BUILDING RESEARCH ESTABLISHMENT LIMITED		£187,102	£187,102
DEFENCEKNOWLEDGE LIMITED		£94,474	£66,132
HOARE LEA LLP		£119,525	£59,762
OCTAGON I/O LTD		£457,544	£320,281
Project Frog		£32,617	£0

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University of Cambridge		£235,344	£235,344
University of Sheffield		£249,992	£249,992

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Project description - provided by applicants
Productivity is a critical factor for the UK economy -- especially in the construction industry. . As stated in the Farmer Review of the Construction Industry, we need to "modernise or die", and this is recognised by the Construction Sector Deal. While offsite manufacturing techniques improve both quality and productivity, a step change is needed to realise the true potential of Design for Manufacture and Assembly (DfMA). That step change is product-based design solutions and manufacturing capacity that unlocks optimised construction and extends efficiency throughout the delivery cycle. We call this **Product Based Building Solution (PBBS) DfMA 70:60:30** -- with 70% of the building being premanufactured, providing 60% greater productivity and 30% faster construction than traditional approaches. The potential improvements to productivity are enormous, with only a small team of skilled technicians needed to place and integrate the pre-manufactured and quality controlled building components. The key to realising this potential lies in having good products and approaching the early design process with product-based solutions in mind, rather than trying to apply them as an after-thought. As such, Laing O'Rourke, AMRC, Hoare Lea, Autodesk, Project Frog, BRE, ActivePlan, Dynamic Knowledge, Converge, University of Cambridge have aligned to demonstrate this product-based approach to design and construction -- an approach that could radically change the industry. By creating a product-based approach to buildings, we have the potential to transform site construction to a place of assembly of pre-engineered and certified building products. Together, we will: * Evidence **lower carbon lifecycles, targeting a 30% operational reduction** -- based on integrating heating and cooling systems within the structure -- and a **50% saving in embodied carbon** through a reusable structural system with predicable performance through smart commissioning and better science. * Demonstrate **productivity improvements in each delivery phase** -- design, manufacture and assembly -- through physically and digitally enabled process efficiency and waste elimination. * Use a product-based architecture with defined and repeatable interfaces to provide quality and certainty in delivery. This will include **facades, frame, internal walls and finishes, pods, and building services and controls**. This will enable: * **Digital demonstration** of configuration to products sets to a range of sector applications using real-world building examples * **Physical demonstration** of integrated product-based building solutions at full scale for a representative building at Explore Industrial Park * **Evidence of productivity and performance** assurance metrics and benchmarking to support further scaling up and adoption

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
LAND SECURITIES P L C	Automated Construction Project - 105 Sumner Street	£7,820,217	£1,955,054
BRYDEN WOOD TECHNOLOGY LIMITED		£82,679	£28,938
EASI-SPACE LTD		£78,897	£35,504

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Project description - provided by applicants

Automated Construction Project -- 105 Sumner St, Southwark, London

The project will aim to validate and showcase the benefits that can be delivered using Platform Design for Manufacture and Assembly (P-DfMA) techniques, Modern Methods of Construction (MMC) and digital technologies on a large-scale new build commercial office development.

It will use a hybrid steel and concrete structural platform that was developed as part of an Innovate UK First Phase Challenge Fund research project on Automated Construction. The structural platform developed as part of the R&D project will provide the chassis for the office floor space and the project will include the development of cladding and building services components to create a reusable 'kit of parts' based solution for offices.

The objective is to showcase the development as an innovation led demonstrator project to deliver buildings 'Faster, Better and Cheaper' adopting manufacturing-based techniques and processes.

The project team features industry leading organisations including; Landsec, Bryden Wood, Piercy and Company, Gardiner & Theobald, Mace and Sir Robert McAlpine. The scale and ambition of the project will be a catalyst for change and we hope a major step forward in proving the new business and financial metrics, whole life performance, and supply chain adoption needed to accelerate the transformation of the construction sector.

We believe this will be the first building of its kind to be designed and constructed on this basis.

Project Details

Project: Two new build commercial office buildings, built around a publicly accessible internal courtyard, in total comprising c135,000 sqft. It will be 9 storeys high with reception and basement areas. The development will be a high quality and sustainable building with a vastly improved streetscape and public realm continuing the transformation of Southwark.

Client: Landsec the UK's leading Real Estate Investment Trust.

Vacant possession: 21st of October 2019\.

The demolition, sub-structure and enabling works have been procured and a contract placed.

Main construction works are scheduled to commence 20th April 2020\. Target programme completion is the 7th February 2022\.

The design is at Stage 3 and has planning approval. A Section 73 planning application has been submitted for some minor amendments (to be determined by January 2020).

Early stage due diligence and market feedback work is underway in advance of procuring the main construction works.

Areas Addressed

* Digital Methods
* MMC and Platform based approaches
* Whole life performance
* Business models, procurement, analytics, benchmarking and metrics
* Financial assurance, warranty and lending

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
BLACC LTD	SEISMIC II	£473,620	£213,129
ELLIOTT GROUP LIMITED		£1,978,083	£692,329
Manufacturing Technology Centre		£1,089,267	£1,089,267
MCAVOY GROUP LIMITED - THE		£724,042	£253,415
NCC OPERATIONS LIMITED		£256,968	£256,968
Swansea University		£190,829	£152,663
TATA STEEL UK LIMITED		£1,124,782	£281,196

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Project description - provided by applicants
The SEISMIC consortium members have successfully delivered SEISMIC I; the development of a standard structural frame platform and connector with a complementary digital configurator, the frame has now been adopted by the Construction Innovation Hub (The Hub). SEISMIC II will continue this work, to develop repeatable components for the platform frame which will deliver a world leading solution for mass production of government built assets. The Construction Sector Deal requires the delivery of better performing buildings that are built quickly, at a lower cost and be energy and carbon efficient. The project aims to deliver these metrics through a 'demonstrator' manufactured by the consortium members for industry wide exploitation. The demonstrator will be offered to the Hub, as a 'market ready' example to aid the onward 3-year development programme. SEISMIC II will build on the achievements of SEISMIC I, progressing to develop core platform elements, namely the external walls, floor and roof elements of the building. It will also seek to enable supply chain engagement to develop existing products to the standard SEISMIC frame solution to create a true platform of reconfigurable components reducing waste, cost and carbon dioxide emissions and increasing speed of delivery. SEISMIC II will develop a maturity matrix tool which will be used to support the productionisation of the construction supply chains companies. In addition, the project seeks to widen sector engagement, from school deployment, into other sectors. Following the principles of Platform-Design for Manufacturing Assembly (P-DfMA) the consortium will develop components to maximise the passive performance facilitating the design of energy positive buildings with embedded data driven metrics providing better-performing buildings, built more quickly at lower cost. The project substantially decouples the work from the construction site, giving opportunity to develop production facilities in areas of economic deprivation. The UK has 12 of the 20 poorest regions in Northern Europe. The industrial partners are well placed to invest in these regions once the market is predictable, mass volume & standardisation is established, and continuity of pipeline is in place. Proposed consortium members, Blacc, Elliott, McAvoy and MTC are industry leaders in the adoption of MMC, they have delivered the UKRI SEISMIC I project to standardise school components and develop an online configurator tool. SEISMIC II will strengthen this foundation with new partners Tata Steel, Active Building Centre and National Composites Centre, all leading organisations in their fields.

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TOTALLY MODULAR LIMITED	STELLAR	£571,012	£314,057
Citizen Housing		£239,539	£47,908
JALI LIMITED		£106,802	£74,761
SPACIOUS PLACE CONSTRUCT LTD		£387,110	£212,910
T.D.S. MIDLANDS LIMITED		£411,522	£288,065
University of Wolverhampton		£304,336	£243,469

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Project description - provided by applicants

The UK faces an unprecedented housing shortage; 3.9 million new homes must be built just to meet current demand. Despite this, just half the homes needed are being built and the shortfall continues to increase.

Modern methods of construction, such as off-site manufacturing of houses in factories, promise lower-cost, higher-quality homes constructed in days instead of months. This is particularly beneficial to suppliers of social housing (e.g. housing associations, local authorities), who are facing ever greater challenges in delivering quality affordable homes. However, housing associations often need small volumes of customised properties to suit infill and brownfield sites, which does not match with the needs of factory owners to sell high volumes of near-identical properties. Concentrating manufacturing in a handful of large, centralized factories also increases transportation and impacts the local workforce.

STELLAR offers social housing developers and owners the tools and business models they desperately need to provide affordable homes across the UK in line with demand. Our model centralises complex and high-cost design, frame manufacturing and warranty tools within a central virtual 'hub', supporting SME-operated 'spoke' factories near to the point of need.

To achieve this, we will combine and enhance the UK's best available tools and knowledge, delivering:

1. **3D 'digital twin' factory planning tool** to ensure fit to need and support capital investment
2. **Parametric Modelling tool for SMEs**, enabling them to optimise house design and ringfence production slots
3. **A UK first, open-access 'Should-Cost' Model** driven by parametric design to generate accurate build costs
4. **A Modular Build Design App**, directly informing production, enabling HAs to specify homes that meet their needs.
5. **Demonstration home(s)** -- Homes designed and produced through the hub-and-spoke model and STELLAR toolkit will be installed in client specified configurations. They will come complete with a suite of unobtrusive miniature IoT enabled environmental and usage sensors to enable energy and operational performance data to be monitored and analysed. A period of occupation will then be completed prior to future-casting to confirm environmental performance, whole-life cost and longevity, and provide a strong return on investment.

The committed and highly innovative STELLAR consortium includes modular steel frame specialists, home builders and highly respected academics. We form a complete value chain that will last beyond this project. The team has attracted positive attention from organisations including National Housing Associations and the House of Lords, who recently sought Totally Modular's input to upcoming national strategies.

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YTKO LIMITED	Enabling Housing Innovation for Inclusive Growth	£162,780	£113,946
ARCADIS (BAC) LIMITED		£97,909	£48,954
BOKLOK HOUSING LIMITED		£58,155	£14,539
Bristol City Council		£536,326	£536,326
BUILDING RESEARCH ESTABLISHMENT LIMITED		£223,266	£223,266
KNOWLE WEST MEDIA CENTRE		£152,256	£106,579
LEGAL & GENERAL HOMES HOLDINGS LIMITED		£170,155	£42,539
MODULOUS LIMITED		£294,914	£162,203

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PROJECT ETOPIA UK LIMITED		£227,349	£131,862
SNUG Homes Limited		£219,523	£107,566
TEMPO HOUSING MODULAR UK LTD		£197,824	£114,738
TOTALLY MODULAR LIMITED		£211,765	£122,824
UNIT 9 LIMITED		£301,095	£180,657
ZED PODS LTD		£231,914	£132,191

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Project description - provided by applicants
Bristol City Council (**BCC**) is a leader in the use of modern methods of construction (MMC)-based housing solutions; an exemplar for the wider UK. Bristol has a range of social and community-led housing developments planned for 2020-21, including **c.458 homes to** be delivered using innovative MMCs provided by a range of manufacturers. BCC views these developments as a unique opportunity for a step-changing '**demonstrator**' project, assembling a unique supply and demand-side collaboration. It will deliver a major programme of integrated innovation in product and manufacturing processes, data capture, testing and assessment across a spectrum of MMC-based solutions, with providers ranging from local start-ups to national companies. Construction costs, whilst essential enabler, are excluded from eligible costs for Innovate UK. The 'momentum resourcing' provided by Innovate UK funding will enable BCC to integrate inter-departmental expertise, addressing council-level barriers to the delivery of new homes in a coordinated manner. It will enable us to create a nationally replicable delivery model that encourages the use of MMC-based solutions in balancing the supply of new homes with growing demand. Building on CLC metrics we will define '**key performance indicators' (KPIs**), benchmarked against existing housing delivery models. KPIs will include social impacts, public perception and occupant experience as well as supply chain efficacy **(respective savings of 50% and 33% in time and cost targeted in line with ISCF targets),** whole-life performance, quality and environmental impact. These KPIs will inform a major programme of data/information capture from participating MMC supply chains. * The main outcome will be a '**council change model**' supported by a **decision-support 'toolbox'**, enabling local authorities across the UK to address development challenges using MMCs and taking account of local issues (social value, procurement, demographics, skills, location, supply chain capacity, economic, technical and environmental), specific development needs, and supply chain capacity. * Project learning and supply chain collaboration will enable suppliers to deliver effective product, process and supply chain innovations; collaboration with BCC will increase confidence in future demand, facilitating capacity planning and investment. Whilst BCC is key to project delivery, the lead partner will be YTKO (a Bristol-based company working closely with BCC) supported by BRE in project administration and coordination. 9 MMC-based housing solution providers are participating. Stakeholders including other councils, the CIH (data shared with the 'Whole life performance' workstream) and other public-sector and commercial bodies.

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GLOBAL HOME TECHNOLOGY LTD	Global Home Pilot Demonstrator	£5,229,241	£2,353,158
BECKHOFF LIMITED		£506,724	£177,353
BOUYGUES (U.K.) LIMITED		£167,517	£41,879
BURO HAPPOLD LIMITED		£251,819	£62,955
SUPERMASSIVE UX LTD		£1,138,241	£512,208
University of Surrey		£641,182	£641,182

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Project description - provided by applicants
New build mass housing developers have prevented the UK housing supply from freefall, however, the buildings created are inherently frozen in time. Although a buyer can be involved in the design process, once the house is signed-off they are on their own. As homeowners, they are suddenly expected to become building maintenance experts, responsible for mechanical and structural repairs. Updating and altering internal spaces requires sourcing quality trade skills (a significantly time-consuming process), and becoming construction experts, architects and interior designers; to understand the possibilities of how the building could be changed to meet their evolving needs. For many, at the extreme, moving can be easier than adjusting these rigid buildings. Global Home is our vision for the future of the adaptable, modular, smart home for the Mass House Building (MHB) market. We have **design engineered the world's first fully modular, re-configurable, digitally integrated home, suitable for mass production** and ready to plug-in to the smart cities and communities of the future. IUK demonstrator funding will scale up the single modular unit, GH1 proof of concept, enabling the design, development and construction of a 5 storey residential, digitally integrated, adaptable, modular lifetime residential development (GHPilot). The ground floor will be demonstration space and the remaining floors will house postgraduate/international students. **GHPilot will be a pre-production, inhabited, active building demonstrator** (TRL 9) that will become a showcase for future investors, orders and innovators, completing the product development lifecycle, establishing supply chains, production facilities. The precision engineered modular GHPilot is configurable and customisable to meet its user's needs and preferences. The home adapts to the user, rather than the user adapting to the home. GHPilot is designed to allow expansion vertically, horizontally and technologically. At the touch of a button, interior areas expand or contract through modules that move around a structural central core, from which the home's services are managed and distributed. **Novel future proof designs** will be built in to enable users to physically transform personal and social space to meet their changing needs through movable walls but also with additional plug in modules, i.e. nursery or entertainment spaces. GHPilot will **demonstrate a large-scale-viable MHB product and process** enabling homes to be built **75% faster, 33% cheaper with dramatically reduced carbon emissions and increased whole-life performance**. GHPilot will also showcase the GHConnect technology platform product, enabling integration of GH technology into third party homes at point of construction.

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MACE LIMITED	AEC Production Control Room	£1,843,660	£460,915
3D REPO LTD		£614,945	£276,725
EVIFILE LIMITED		£313,806	£141,213
Imperial College London		£237,105	£237,105
MISSION ROOM LIMITED		£159,097	£71,594
University College London		£433,352	£433,352

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Project description - provided by applicants
Construction projects are infamous for delays, omissions, overruns and often spiraling costs. In line with the Governmental Industrial Strategy Construction Sector Deal, our aim is to improve the performance of UK construction by better, more efficient and proactive rather than reactive project management. We, therefore, propose to build a scalable and repeatable 'plug-and-play' construction management and reporting platform that will be tested on three major infrastructure projects in the UK. This digital project management platform will be accessible via physical site-mounted 'AEC Production Control Rooms' that will display a suite of preconfigured performance metrics using real-time data, facilitating forward planning and collaborative decision making at team, project and portfolio level. A fourth HQ-mounted Master Control Room will enable benchmarking across different projects remotely. Clients, planners, site managers and engineers will be able to track real-time project performance and take action based on insights. These stakeholders will, for the first time, be able to objectively compare _'what was planned'_ versus _'what has been delivered'_. Such a solution will track the status of each construction element (for instance all structural steel elements) from design, approval, manufacture and delivery, all the way to site fitting/completion, and facilitate future opportunities for operational cost savings via Digital Twin capabilities at the national level. A feedback loop will enable predictive analytics such as early risk warnings, benchmarking across different portfolio projects and continuous 4D planning. All information will be set out clearly in both physical and digital space so that the parties involved can either collaborate remotely, or in person within the AEC Production Control Room on site. Some of the barriers to adoption so far include lack of consistent digital and data architecture; contract models to support open and transparent data exchange; and capability at every level of the supply chain, from client (portfolio) to workforce (package) level. Together, our highly innovative and award-winning project team will demonstrate a path forward to overcome each of these barriers, offering a new way of working for the construction industry in an open and collaborative way. Being able to demonstrate the AEC Production Control Room on three major construction projects will enable us to share the benefits, outcomes, and designs with the industry in order to encourage widespread adoption and support an unprecedented quantum leap to a high-performing construction industry.

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SKANSKA TECHNOLOGY LIMITED	AACE: AI-enabled Automated Cost and carbon Estimating	£236,543	£106,444
HS2 LTD		£54,000	£0
Manufacturing Technology Centre		£149,963	£149,963
MOTT MACDONALD LIMITED		£50,300	£17,605
NOMITECH LTD		£190,896	£124,082
ROYAL INSTITUTION OF CHARTERED SURVEYORS		£0	£0

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Project description - provided by applicants

Vision

The construction industry is currently very inefficient at designing solutions from concept with accurate **cost** & **carbon** data. This current state often leads to delays and cost inflation which are accepted as the norm within the sector (McKinsey, 2016). The vision is to deliver a solution that bridges this gap by developing a standard data structure and mapping methodology that enables an automated quantity take-off from Uniclass to Standard **Methods of Measurement** (MoM) in cost planning.

This solution will enable construction projects to leverage the full benefits of Building Information Modelling (BIM), leading to shorter pre-construction phases, reduced project management costs, greater visibility of carbon emissions and overall improved cost & carbon control.

AACE (AI-enabled Automated Cost and carbon Estimation) will be an applied demonstrator, proof of concept (80% industrial and 20% experimental), focusing on commercial growth for the consortium partners as well as productivity improvements for the sector. AACE will deliver:

* Development of a software solution to **automate take-offs** from the BIM model using **Artificial Intelligence** (AI)
* An information workflow that enables the efficient use of BIM models in a process of project take-offs for cost and carbon planning and estimation
* Deployment of a comprehensive and standardised approach to whole life cost and carbon estimation

The project consortium consists of:

* **Skanska** - Cost and carbon estimating technical specialists
* **Nomitech** -- SME - provider of 5D BIM software and development
* **Mott MacDonald** - BIM authoring and developing standardised libraries
* **MTC** -- Expertise in developing and implementing AI solutions
* **HS2** -- Infrastructure owner providing a demonstrator environment and route to market
* **RICS** -- professional body responsible for setting and regulating standards in surveying. It has an extensive experience in production and distribution of cost and carbon libraries

The best practice guidelines and standardised libraries will be openly shared to commercial and carbon estimating specialists through RICS. AACE outputs will be disseminated to the wider construction industry (i3P and Construction Innovation Hub).

Benefits

Skanska estimate that these improved data flows and working practices will significantly reduce project pre-construction and constructions costs by c.13% across the delivery life-cycle. This will:

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* reduce carbon by 30% and 10% embodied and operational carbon respectively
* deliver cost savings of c.£2.4m pa for Skanska, potentially leading to a £2.5bn saving across the sector

AACE forms part of strategically aligned projects that have been reviewed and endorsed by i3P to maximise the industry-wide impact.

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NSAR LIMITED	Transport Infrastructure Efficiency Strategy Living labs	£593,309	£415,316
ACCELAR LIMITED		£249,762	£174,833
Akerlof Ltd		£35,665	£24,966
BRYDEN WOOD TECHNOLOGY LIMITED		£161,058	£96,635
COSTAIN LIMITED		£2,799,898	£1,399,949
Department for Transport		£515,000	£0
EXPEDITION ENGINEERING LIMITED		£638,680	£287,406
Highways England		£465,000	£0

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HS2 LTD		£615,000	£0
KIER CONSTRUCTION LIMITED		£47,792	£23,896
Manufacturing Technology Centre		£969,451	£969,451
NETWORK RAIL INFRASTRUCTURE LIMITED		£310,535	£310,535
Office of National Statistics		£35,308	£35,308
POWERCUBE LIMITED		£548,900	£384,230
ROYAL INSTITUTION OF CHARTERED SURVEYORS		£304,800	£213,360
SOCIAL PROFIT CALCULATOR LTD		£154,028	£107,820
STRATEGIC RAIL CONSULTANTS LIMITED		£1,028,060	£719,642
TRANSPORT FOR LONDON FINANCE LIMITED		£1,676,182	£0
University of Dundee		£264,852	£264,852
University of Leeds		£313,920	£313,920
University of the West of England		£949,782	£949,782
WALKER CONSTRUCTION (U.K.) LIMITED		£1,901,332	£665,466

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WHOLE LIFE CONSULTANTS LIMITED		£264,164	£184,915
X-TREME SYSTEMS LIMITED		£1,436,166	£646,275

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Project description - provided by applicants
Over the next few years, the construction sector will witness a wave of infrastructure projects (£60 billion of spend each year over the next decade) and ground work will be undertaken to set future financial settlements. The pace of this growth, and the size of this opportunity, demands a construction sector that is the best in the world. To maximise the opportunities to drive efficiency savings across the delivery of the transport infrastructure pipeline, this proposal brings together key UK Transport Client groups, Suppliers and academic experts to establish a Transport Infrastructure Efficiency 'Living Lab' to build capability within delivery, innovation and managing construction risk. The UK has had a modest track record of infrastructure delivery with some programmes completed late; over budget; failing to secure the benefits expected; or cancelled after a significant investment. With the increasing challenge and complexity of the government's pipeline of major projects, the capacity to deliver is being stretched. The estimation of cost and schedule can be improved and major projects and programmes are tending to avoid innovation risk. These attitudes to uncertainty and risk are deeply engrained and cultural, with inconsistencies across Departments and ALBs. Together, they create barriers to the greater uptake of Modern Methods of Construction and driving productivity. This proposal offers a strategic, scalable and sector wide approach with Government, Client Groups, Suppliers and Academia working in partnership. To overcome these challenges, the 'Living lab' will work in collaboration with i3P and the CIH to tackle the systemic issues that still obstruct the use, integration and adoption of innovations that could drive productivity and wider social benefits through major construction schemes. It will be a catalyst for cultural change, shifting focus within infrastructure delivery decision-making from the costs of construction to an understanding of its whole life value. _Statement from Professor Lord Robert Mair, Cambridge University, Chair of the DFT Science Advisory Council and Member, Transport Research & Innovation Board:_ _"This demonstrator is a transformative collaboration. It uses data, technology and Modern Methods of Construction within live transport infrastructure projects to showcase the value of data visualisation through real-time data control rooms and demonstrates where we can drive even greater productivity and efficiency through innovation transfer. By implementing advanced construction and engineering techniques on live projects, we will deliver significantly better outcomes for society and provide the evidence needed to scale how we drive productivity across the transport infrastructure sector."_

Note: you can see all Innovate UK-funded projects here: https://www.gov.uk/government/publications/innovate-uk-funded-projects
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