Construction Leadership Council

INNOVATION IN BUILDINGS WORKSTREAM

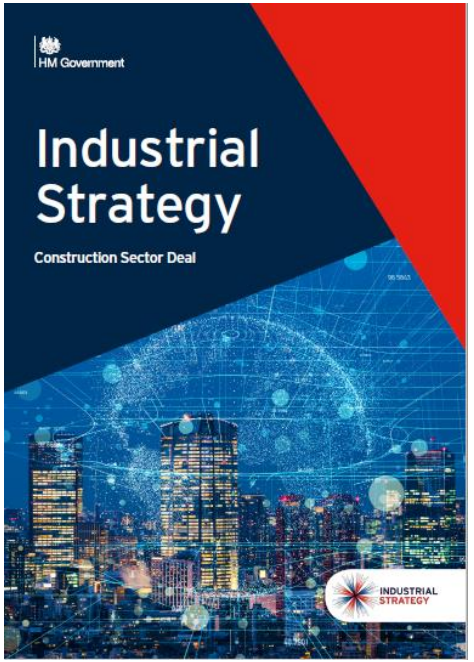
OFFSITE CONSTRUCTION SHOW 2019

CLC's Purpose

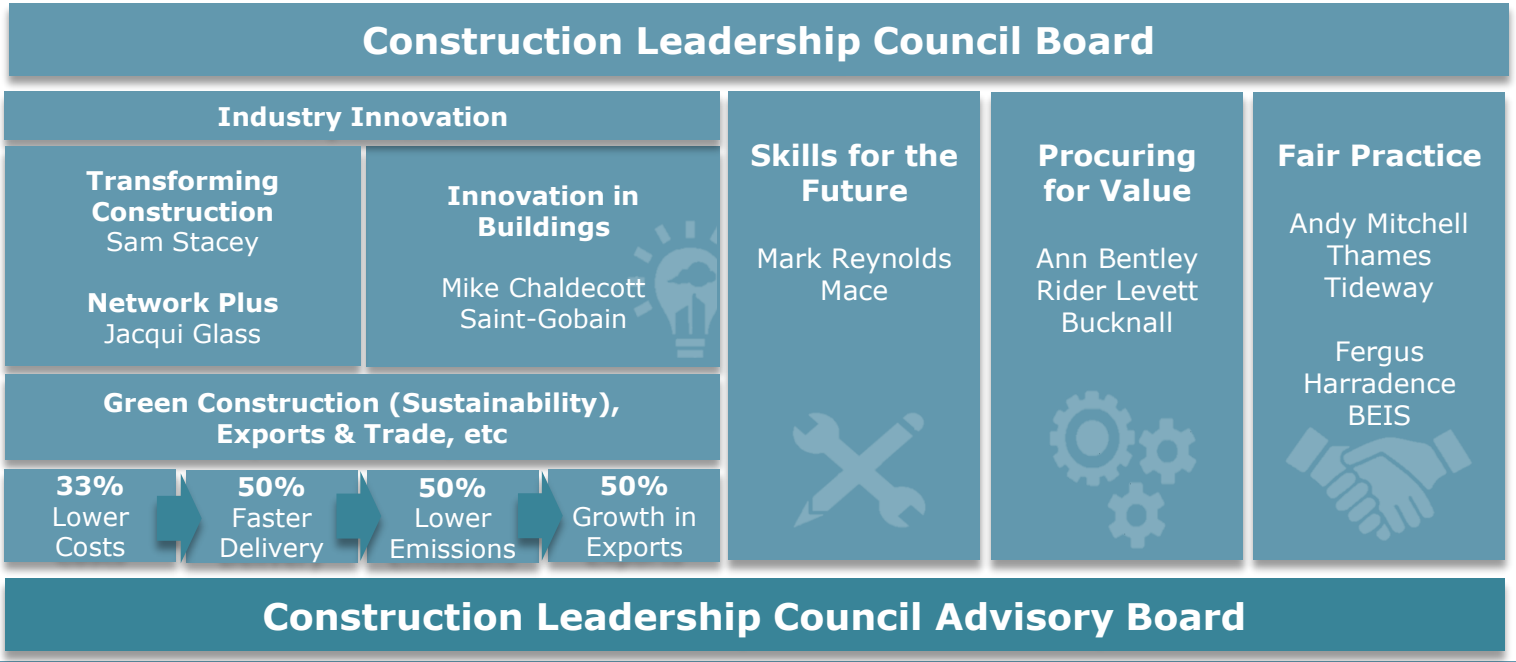
Works with industry and government to identify and deliver actions supporting UK construction in building greater efficiency, skills and growth

Website: www.constructionleadershipcouncil.co.uk

- Lead the delivery of the Construction Sector Deal
- Bring the industry together to work towards improved performance
- Maintain progress towards the 2025 Strategy Goals
- Support key industry initiatives

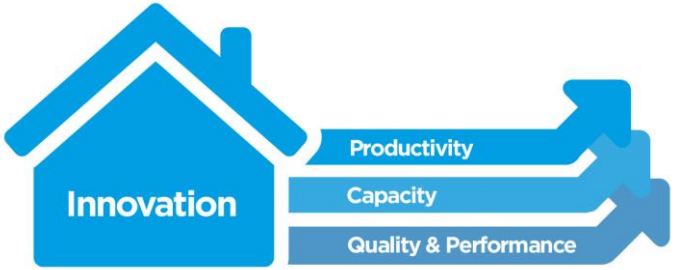


CLC Structure



The Construction Leadership Council's Innovation in Buildings Workstream

- Embedding innovative construction techniques
- Initially focusing on Homes and schools
- Increase take up of Smart Construction



SAINT-GOBAIN

'Smart Construction'

Building design, construction and operation that through collaborative partnerships makes full use of digital technologies and industrialised manufacturing techniques to improve productivity, minimise whole life cost, improve sustainability and maximise user benefits.

Industry Roadmapping

- Involving over 40 industry experts
- Identifying barriers and solutions to the take up and the commercialisation of 'Smart Construction'
- The reports can be found at: http://www.constructionleadershipcouncil.co.uk/workstream/innovation/

Who is involved?

and many more…

Working Groups

Mike Chaldecott
Saint-Gobain
CLC Innovation in Buildings

Centres of Excellence & Collaboration	Demonstrator Projects, Measures & Business Case	Demand Creation, Investment & Volume Surety	Risk-averse Culture, Lending, Valuation & Insurance	Schools
Shelagh Grant	**Simon Cross**	**Adam Locke**	**Mark Farmer**	**Tim Carey**
The Housing Forum	BRE	Laing O'Rourke	Cast	Willmott Dixon

Centres of Excellence Signposted

11 physical centres

4 knowledge networks

http://www.constructionleadershipcouncil.co.uk/centres-of-excellence-in-the-uk/

Centres of Excellence in Smart Construction for Housing

Construction Leadership Council — 14-Dec-18

Innovation in Buildings Workstream — V1.1

Construction Leadership Council

Centre	URL	Address	Centre email	Centre contact number	Smart construction capabilities, capacity, knowledge: Offsite manufacturing	BIM & Digital construction	High performance building
Physical Centres							
Advanced Manufacturing Research Centre (AMRC)	http://www.amrc.co.uk	AMRC with Boeing University of Sheffield Advanced Manufacturing Park Wallis Way Catcliffe Rotherham S60 5TZ	enquiries@amrc.co.uk	0114 222 1747	✓	✓	
Building Research Establishment (BRE)*	http://bregroup.com	Bucknalls Lane Watford Herts WD25 9XX	enquiries@bre.co.uk	0333 321 8811	✓	✓	✓
Construction Scotland Innovation Centre	http://www.cs-ic.org/innovationcentre/	Construction Scotland Innovation Centre Unit 3B 3 Watt Place Hamilton International Technology Park Blantyre G72 0AG	hello@cs-ic.org	0141 212 5250	✓	✓	✓
Innovative Design Lab (IDL)	https://research.hud.ac.uk/institutes-centres/idl/	Queensgate Huddersfield HD1 3DH	P.Tzortzopoulos@hud.ac.uk	0148 44 2222 88		✓	✓

Dashboard of Metrics

Smart Construction Brochure

Construction Leadership Council

2018

SMART CONSTRUCTION
A GUIDE FOR HOUSING CLIENTS

INTRODUCTION

WHAT IS SMART CONSTRUCTION?

Smart construction is building design, construction and operation that through collaborative partnerships makes full use of digital technologies and industrialised manufacturing techniques to improve productivity, minimise whole life cost, improve sustainability and maximise user benefits.

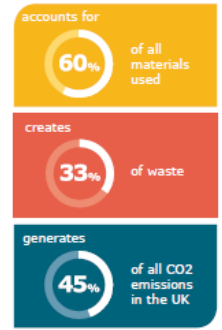
This way of working can not only transform the housing industry, but also maximise the benefits of a home for the occupants and provide them with a better quality of life.

WHY DO WE NEED SMART CONSTRUCTION?

We need to build more homes, more quickly. The Government aspires to a housing market that delivers 1.5 million homes by 2022, and 300,000 homes per year on average by the mid-2020s.

Meeting this growing demand will stretch the house building sector beyond its current capacity. This can be met by improving the productivity of the sector, making more efficient use of the people and resources available through the use of smart construction. Productivity in the construction industry poses a huge challenge. While productivity in manufacturing has steadily grown over the last two decades, it's remained the same in construction – with a recent diagnosis suggesting a sector productivity gap of ~£15b against the average of other sectors.

The construction industry:



Metrics Guide for Smart Construction

SIMPLE METRICS GUIDE FOR SMART CONSTRUCTION

Smart construction is still a relatively new way of working in the industry, but we're already seeing the advantages of it thanks to a number of key projects.

We've selected several case studies, which illustrate the key features and benefits of smart construction.

By choosing a range of parameters, we've set a number of quantitative measures to show how smart construction performs against traditional methods.

There are some areas such as risk, wellbeing design and circular economy where there are currently no quantitative measures in place and as a result are looked at on a qualitative level.

And because these projects are still fairly new – these figures and results are just the beginning.

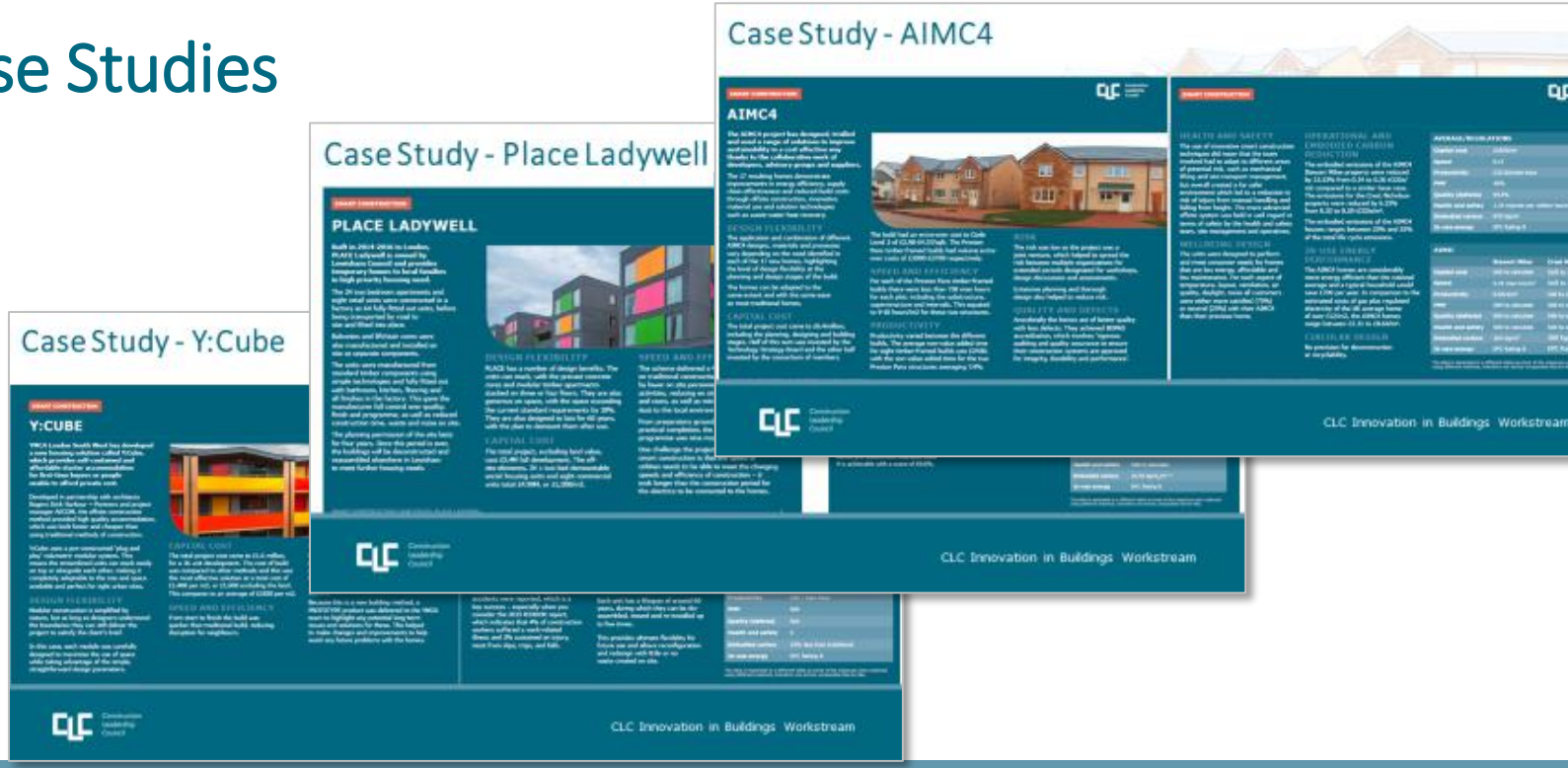
As time progresses, attitudes and behaviours change, and the industry realises the benefits of smart construction, we hope to encourage more organisations to use these measures and come forward with their own examples of innovative projects that show just how beneficial smart construction is.

Construction Leadership Council

METRIC	DESCRIPTION	2020 TARGET
Capital cost	The costs associated with the construction of the building per metre square of gross internal floor space £ / m^2	£1480
Speed	The elapsed time at which the building was built from the first day the first man hour on site was registered to HSE to the last day, captured as days / m^2	0.14
Productivity	The efficiency at which a building is being constructed by looking at the ratio of capital cost to man hours recorded on site reflected as £ / man hour	£31
Pre-manufactured value	Calculated by the gross capital cost of the project take away the prelims and site labour costs. The result of this is then divided by the capital cost and is reflected as a %	50%
Quality	This is calculated by 1 minus the cost of post-completion defects as set out by NHBC over the total build cost reflected as a %	99.5
Health and safety	The number of people injured over a year for each million hours worked by a group of employees or workers	1.79 injuries per million hours worked
Embodied carbon	This refers to the amount of embodied carbon associated with the production and transport of materials used in the construction of homes per metre square of gross internal floor space reflected as $kgCO_2e/m^2$	700 $kgCO_2e/m^2$
In-use energy	This refers to the in use energy efficiency performance and its environmental impact, identified through EPC ratings	EPC Rating A
Waste generated	This is the ratio of volume of construction phase waste that has been generated represented for every £100K of the capital cost Volume (m^3) construction waste/£100K project value	8.2

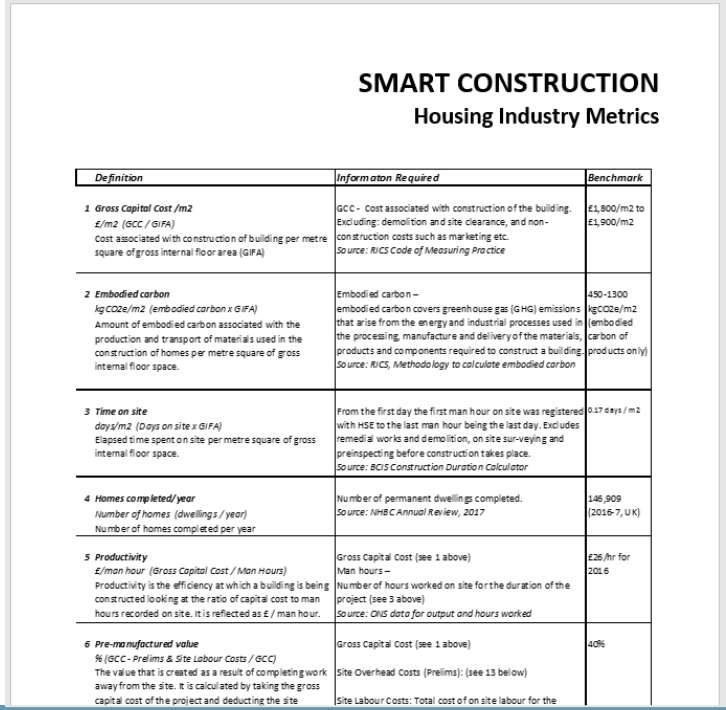
Construction Leadership Council

Suite of Case Studies



Guidance Document for Metrics

Status: Soon to be published



SMART CONSTRUCTION

Housing Industry Metrics

Definition	Information Required	Benchmark
1 Gross Capital Cost /m2 *£/m2 (GCC / GIFA)* Cost associated with construction of building per metre square of gross internal floor area (GIFA)	GCC - Cost associated with construction of the building. Excluding: demolition and site clearance, and non-construction costs such as marketing etc. *Source: RICS Code of Measuring Practice*	£1,800/m2 to £1,900/m2
2 Embodied carbon *kgCO2e/m2 (embodied carbon x GIFA)* Amount of embodied carbon associated with the production and transport of materials used in the construction of homes per metre square of gross internal floor space.	Embodied carbon – embodied carbon covers greenhouse gas (GHG) emissions that arise from the energy and industrial processes used in the processing, manufacture and delivery of the materials, products and components required to construct a building. *Source: RICS, Methodology to calculate embodied carbon*	450-1300 kgCO2e/m2 (embodied carbon of products only)
3 Time on site *days/m2 (Days on site x GIFA)* Elapsed time spent on site per metre square of gross internal floor space.	From the first day the first man hour on site was registered with HSE to the last man hour being the last day. Excludes remedial works and demolition, on site sur-veying and preinspecting before construction takes place. *Source: BCIS Construction Duration Calculator*	0.17 days / m2
4 Homes completed/year *Number of homes (dwellings / year)* Number of homes completed per year	Number of permanent dwellings completed. *Source: NHBC Annual Review, 2017*	146,909 (2016-7, UK)
5 Productivity *£/man hour (Gross Capital Cost / Man Hours)* Productivity is the efficiency at which a building is being constructed looking at the ratio of capital cost to man hours recorded on site. It is reflected as £ / man hour.	Gross Capital Cost (see 1 above) Man hours – Number of hours worked on site for the duration of the project (see 3 above) *Source: ONS data for output and hours worked*	£26/hr for 2016
6 Pre-manufactured value *% (GCC - Prelims & Site Labour Costs / GCC)* The value that is created as a result of completing work away from the site. It is calculated by taking the gross capital cost of the project and deducting the site	Gross Capital Cost (see 1 above) Site Overhead Costs (Prelims): (see 13 below) Site Labour Costs: Total cost of on site labour for the	40%
7 EPC rating *Integer (1 to 7)* Energy Performance Certificates record how energy efficient a property is and what its environmental impact is, using A-G ratings (A – being the most efficient/environmentally friendly and G – the least).	Average EPC rating for houses built. Average value calculated by giving a value 1-7 to A-G ratings respectively. *Source: Government data on EPCs lodged.*	B (SAP rating 81-91)
lity rating *1 - Cost of post-completion defects / GCC)* ility of homes is captured by looking at the cost of t-completion defects of a building as set out by the iC over the total capital cost. It is calculated as 1 us the cost of post-completion defects over the total d cost, reflected as a %	Gross Capital Cost (see 1 above) Cost of post-completion defects: Industry statistics or satisfaction levels *Source: NHBC survey data*	99.4%
l level 2 *Companies using BIM level 2 as % of total)* measure refers to Building information modelling at l 2 which involves developing building information in llaborative 3D	BIM Level 2 certification evidence *Source: industry*	No data currently available
ste generated *me (m3 construction waste x 100k / GCC)* ratio of volume of construction phase waste that been generated in the construction of the home esented for every £100k of the capital cost	Total volume of construction phase waste produced in m3 - This includes waste from construction phase only. Gross Capital Cost (see 1 above) *Source: BRE SmartWaste data based on median value for residential projects completed during 2016*	10.2m3
s ISO9001 accredited *(if companies certified)* 9001 is the quality management system standard sets out quality requirements for facilities, people, ning, services and equipment of an organisation. As a sure it would be calculated as the total number of panies certified against ISO9001 over the total ber of companies in the industry/sector, expressed percentage.	Evidence of company ISO9001 accreditation *Source: industry*	No data currently available
ty *ries per million hours worked* frequency rate is the number of people injured over ar for each million hours worked by a group of loyees or workers.	Number of injuries per year (as reported as per RIDDOR) Total hours worked per year OR Average weekly hours worked. *Source: Calculated as per Injury Frequency Rates guidance from HSE20 using injury rates from RIDIND*	2.24
liminaries ite overheads x no. of homes / GCC of site) looks at the costs attached to prelims in construction which e sometimes referred to as 'site overhead' divided by the cost per home built reflected as a percentage	Preliminary cost (Site overhead cost) Main contractor's preliminaries are items which cannot be allocated to a specific element, sub-element or component. Main contractor's preliminaries include the main contractor's costs associated with management and staff, site establishment, temporary services, security, safety and environmental protection, control and protection, common user mechanical plant, common user temporary works, the maintenance of site records, completion and	No data currently available

Demand Report

"Unlock the supply and demand conundrum affecting the provision of additional housing adopting Smart Construction"

- Aggregation of Demand
- Standardisation
- Procurement

Homes England

Procurement

- Developing a “model contract” for SMART Construction
- Trial of strawman contract with housing clients
- Work with King’s College London

MMC Definitions

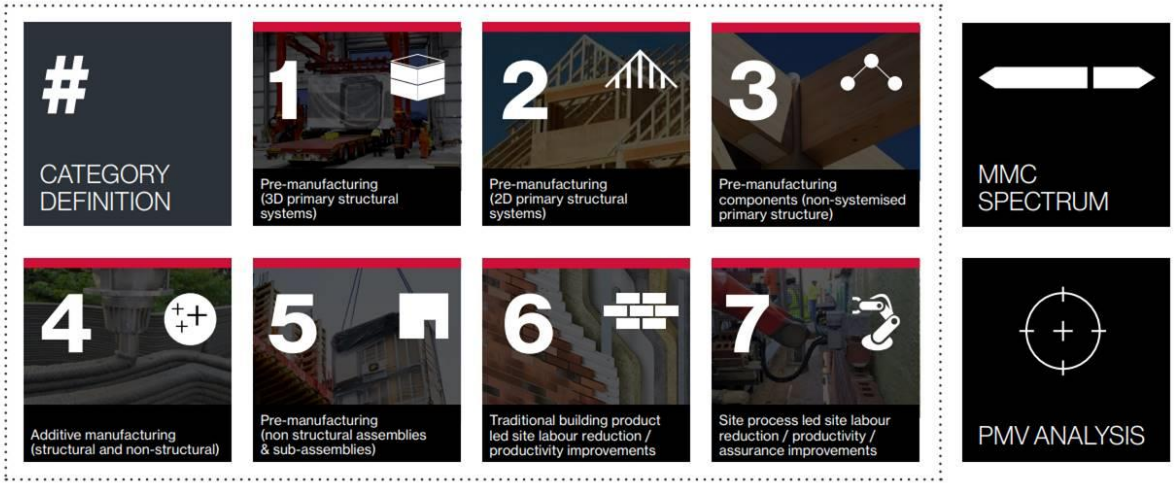
http://www.cast-consultancy.com

Cast
REAL ESTATE & CONSTRUCTION CONSULTANCY

Ministry of Housing, Communities & Local Government

Category DEFINITIONS

The term 'pre-manufacturing' encompasses processes executed away from final workface, including in remote factories, near site or on-site 'pop up' factories. The pass test is the application of a manufactured led fabrication or consolidation process in controlled conditions prior to final assembly / install. On-site 'workface factories' are included in Category 7).



Quality Assurance

Status: Soon to be developed

Develop a unified quality assurance ‘scheme’ for assessing MMC technologies. This would then act as a gateway to acceptance of the final homes for warranty, mortgage and building insurance offers

Schools Report

Department for Education

Status: Soon to be published

Barriers and solutions to the adoption of innovation and smart construction in school building?

Workshop on 9 December to agree 2020 activity

Contact Details

Construction.enquiries@beis.gov.uk


Construction
Leadership
Council

Construction Sector Deal
Transforming Construction Programme

Offsite Construction Show 2019

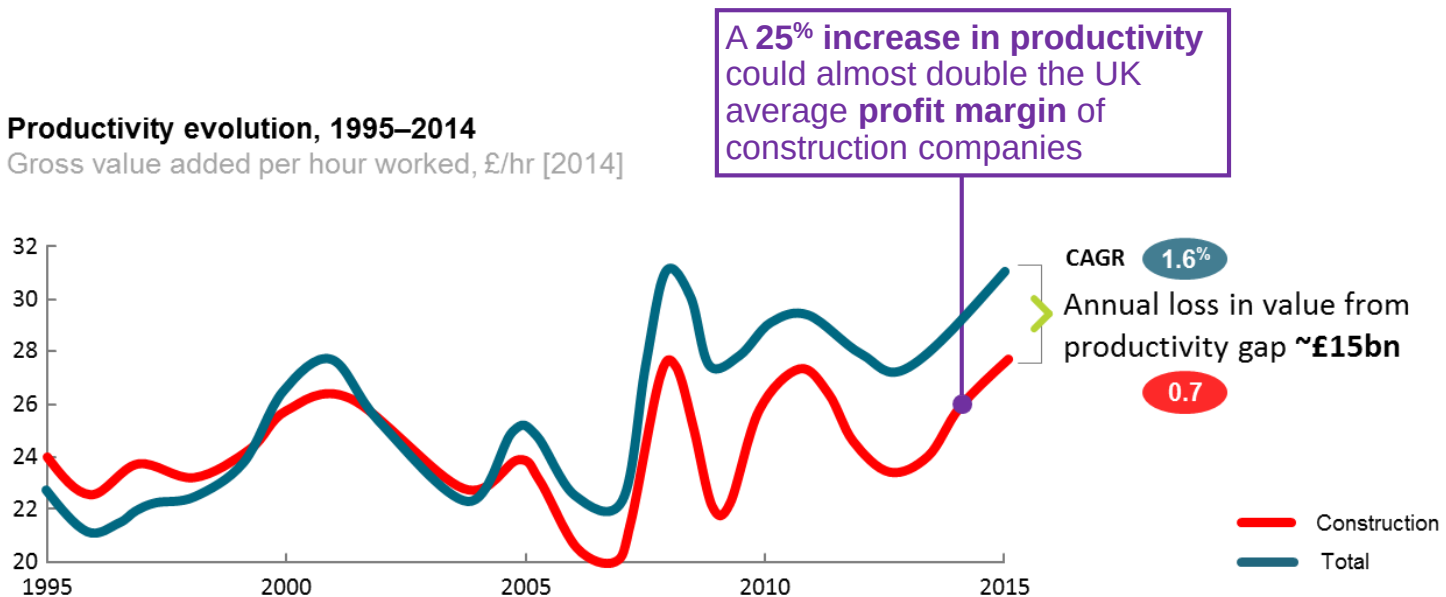
Transforming Construction: Why?

We account for
9%
of GDP

We employ
2.6 million
people

We create
turnover
In excess of
£100bn

Transforming Construction: Why?



SOURCE: McKinsey and Construction Leadership Council

Construction Sector Deal

Lower costs

33%

reduction in the initial cost of construction and the whole life cost of built assets

Faster delivery

50%

reduction in the overall time, from inception to completion, for newbuild and refurbished assets

Lower emissions

50%

reduction in greenhouse gas emissions in the built environment

Improvement in exports

50%

reduction in the trade gap between total exports and total imports for construction products and materials

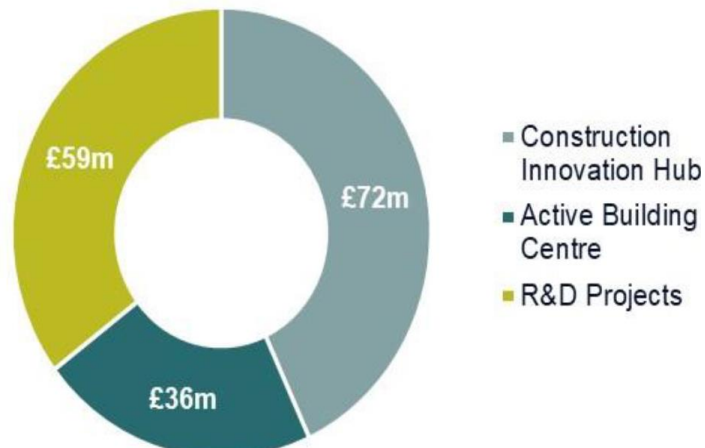
Transforming Construction Programme

£170m
Government funding

£250m
Matched industry funding

4 years
of funding

Sustainable
long-term model



Department for Business, Energy & Industrial Strategy

Transforming Construction Programme

Demonstrating innovative technologies which: address the

- environmental carbon challenge
- enable cost effective energy harvesting to reduce fuel poverty
- Deliver positive social, economic and environmental impact

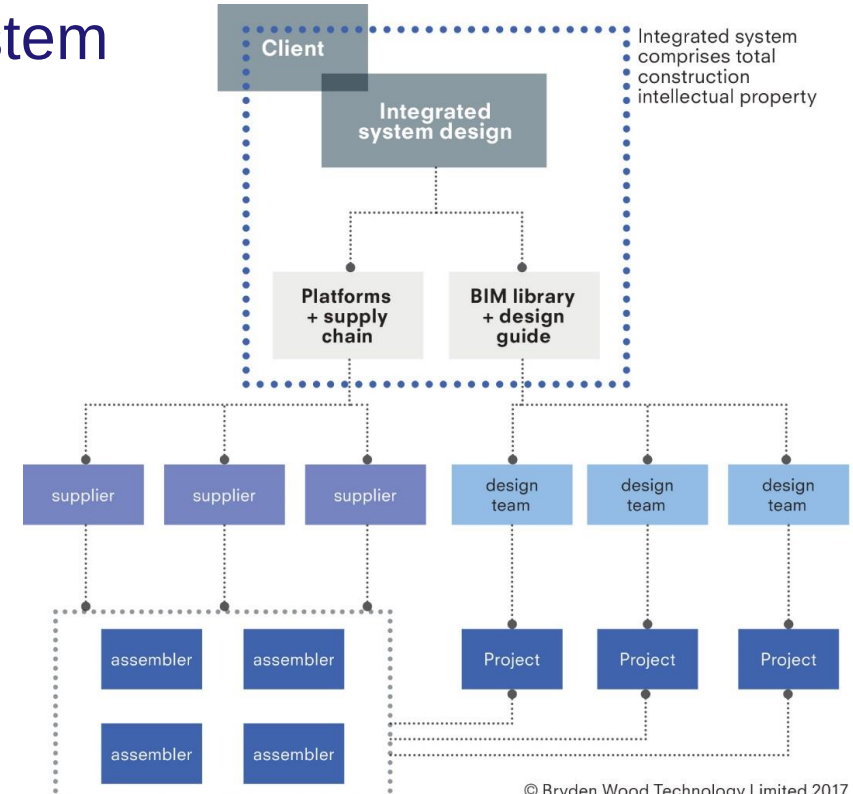
CONSTRUCTION INNOVATION HUB

Objective: to develop a platform design and delivery concept that can:

- Reduce cost, delivery time and lifetime carbon emissions
- Integrate active renewable energy systems
- Boost productivity and increase whole life value

A new construction eco-system

- Digital design using BIM
- Draws on digital versions of platform components
- Components manufactured offsite, assembled onsite
- Supply chains build up around components and systems



R&D Projects: First Competition

Information

- Data interoperability
- Digital integration platform
- From BIM to machine control
- AR for efficiency
- IoT for site plant
- IoT and concrete curing
- IoT and thermal performance
- LIDAR for cranes

Machine learning

- AI and logistics
- AI for programme prediction
- AI and BIM
- AI and component tracking
- AI for site safety
- AI and progress monitoring
- AI for quality
- Alexa for sites

Product and process

- Panelised housing
- DfMA for housing
- Modular Homes
- Industrialised homes
- Energy active prefab
- Smart piles
- Frame optimisation
- Modular steel

- Robot clusters
- 3D concrete printing
- Non-prismatic concrete

R&D and Demonstration Projects: Second Competition

£36m total R&D funding available

Two competitions will run in parallel:

£26m Demonstration fund
£10m Collaborative R&D fund

Spending Profile:

£27m in FY20/21
£8m in FY21/22

£26m Demonstration

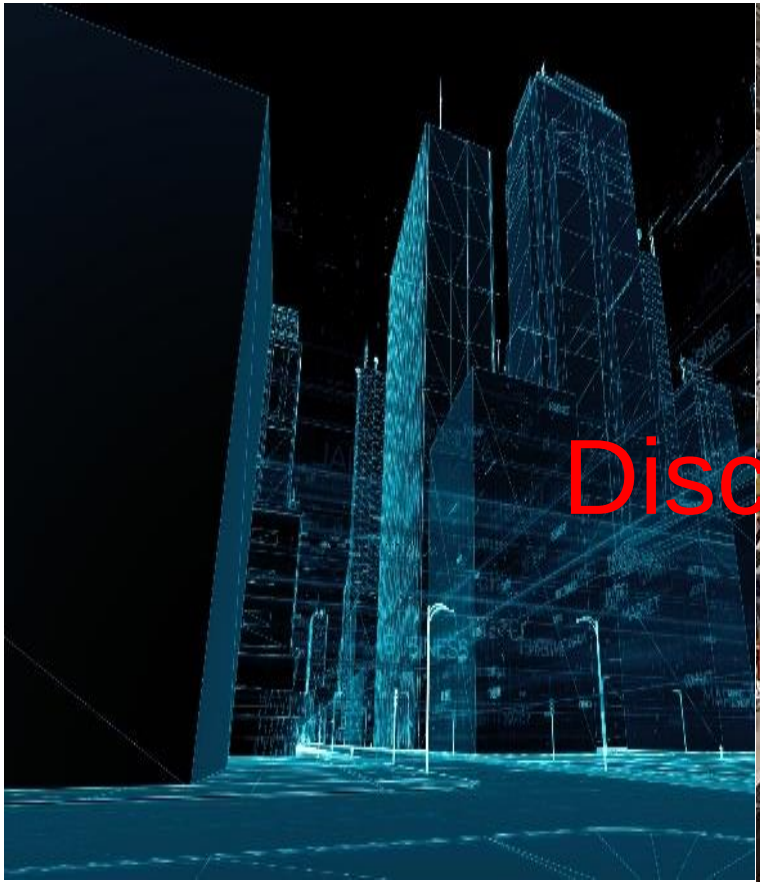
- Opens 28th August 2019
- Closes 6th November 2019
- Projects start 1st April 2020

£10m CR&D

- Opens 28 August 2019
- Closes 30th October 2019
- Projects start 1st April 2020

Sector Deal: Driving the Transition to Offsite

- **Presumption in favour of offsite** – 5 Departments will procure offsite solutions where this delivers VFM
- **National Digital Twin** – Digital Frameworks Task Group developing a set of principles and the framework for built environment data, which will guide the development of digital twins, support the development of BIM standards and ensure the NDT delivers public good in perpetuity
- **Project 13** – support the adoption of Project 13 approaches within the construction sector – to drive a more collaborative and efficient business model.



Discussion