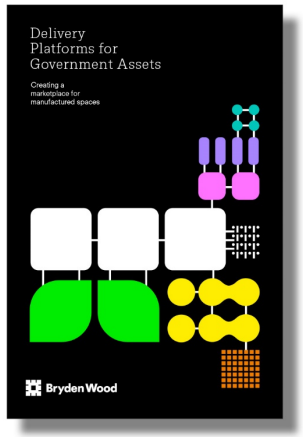
AUTODESK UNIVERSITY

UK Government backs a Platform approach to industrialized construction

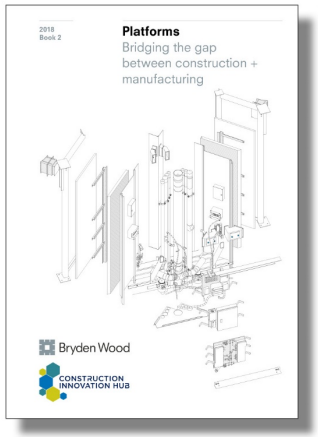
Jaimie Johnston MBE

Director and Head of Global Systems, Bryden Wood
Platform Design Lead, Construction Innovation Hub | @Jaimie_BW

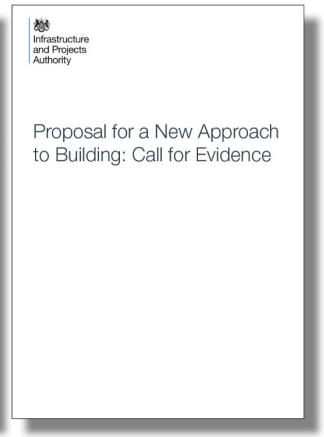
Delivery Platforms for Government Assets



Platforms: Bridging the gap between construction + manufacturing



Proposal for a New Approach to Building



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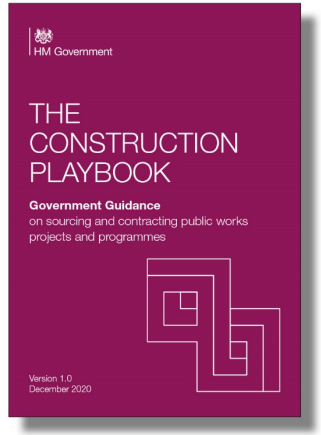

The Construction Playbook

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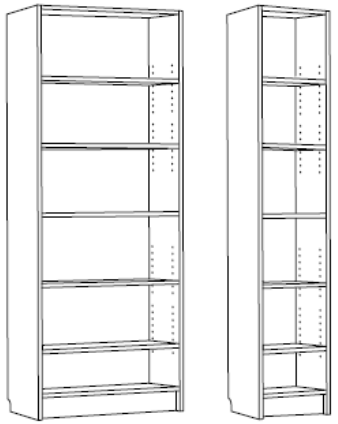
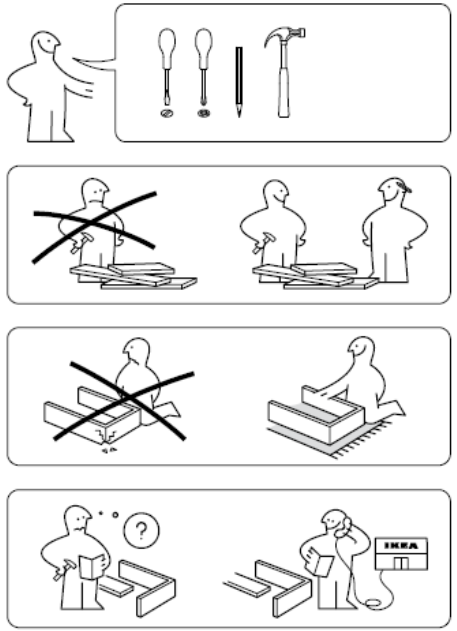
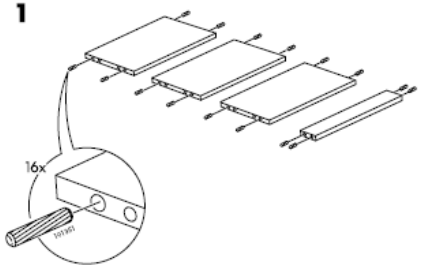
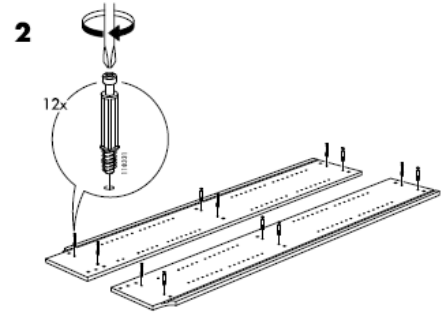
What are construction platforms?

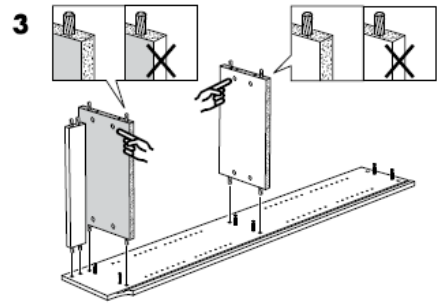
BILLY

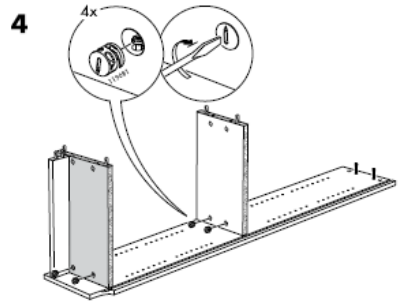


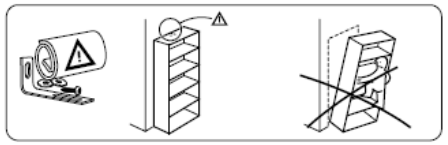


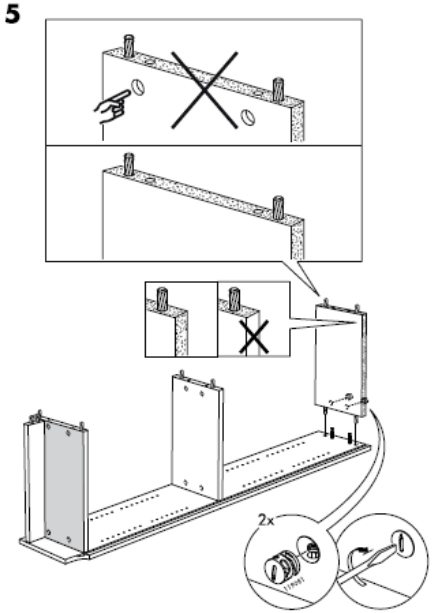


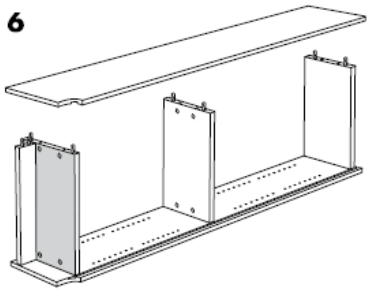


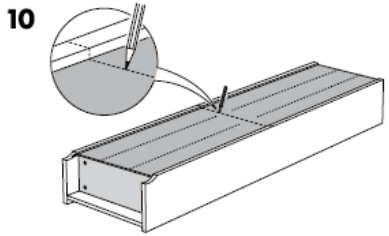


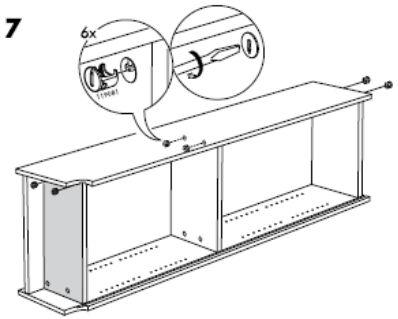


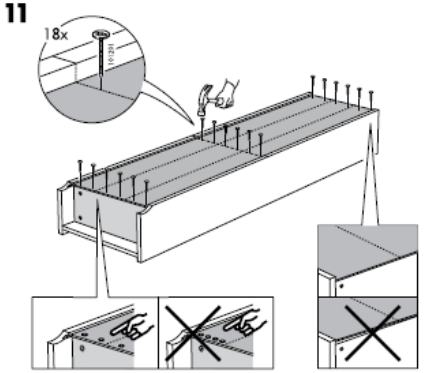


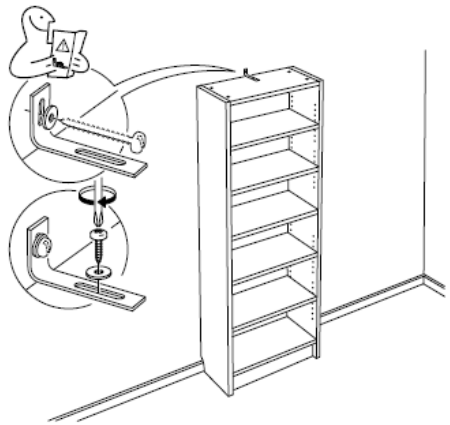












‘Platforms identify features of assets that could be shared and then harmonise those features’

- This approach provides the opportunity to create common ‘kits of parts’.
- Harmonised cross-sector demand enables their manufacture in high volume, with configuration allowing delivery of multiple asset types across sectors (e.g., schools, apartments, healthcare facilities).

Transforming Infrastructure Performance: Roadmap to 2030, IPA, 2021

Infrastructure and Projects Authority

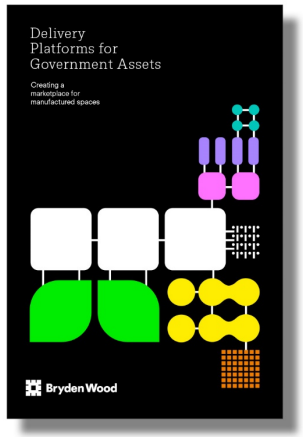
https://www.youtube.com/watch?v=hVQnE35CRvo

Transforming Infrastructure Performance

Addressing the need for social infrastructure using a platform approach

Evolution of an idea

Delivery Platforms for Government Assets



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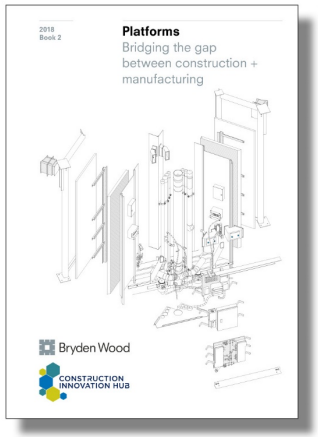

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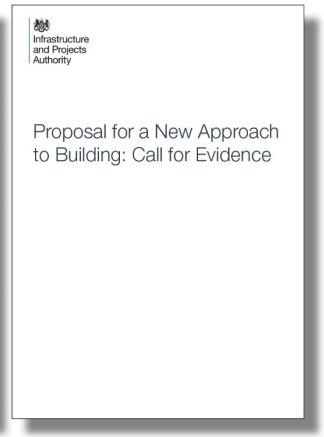

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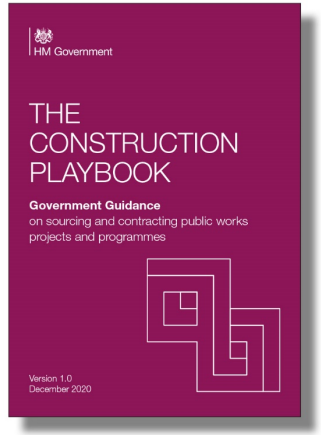

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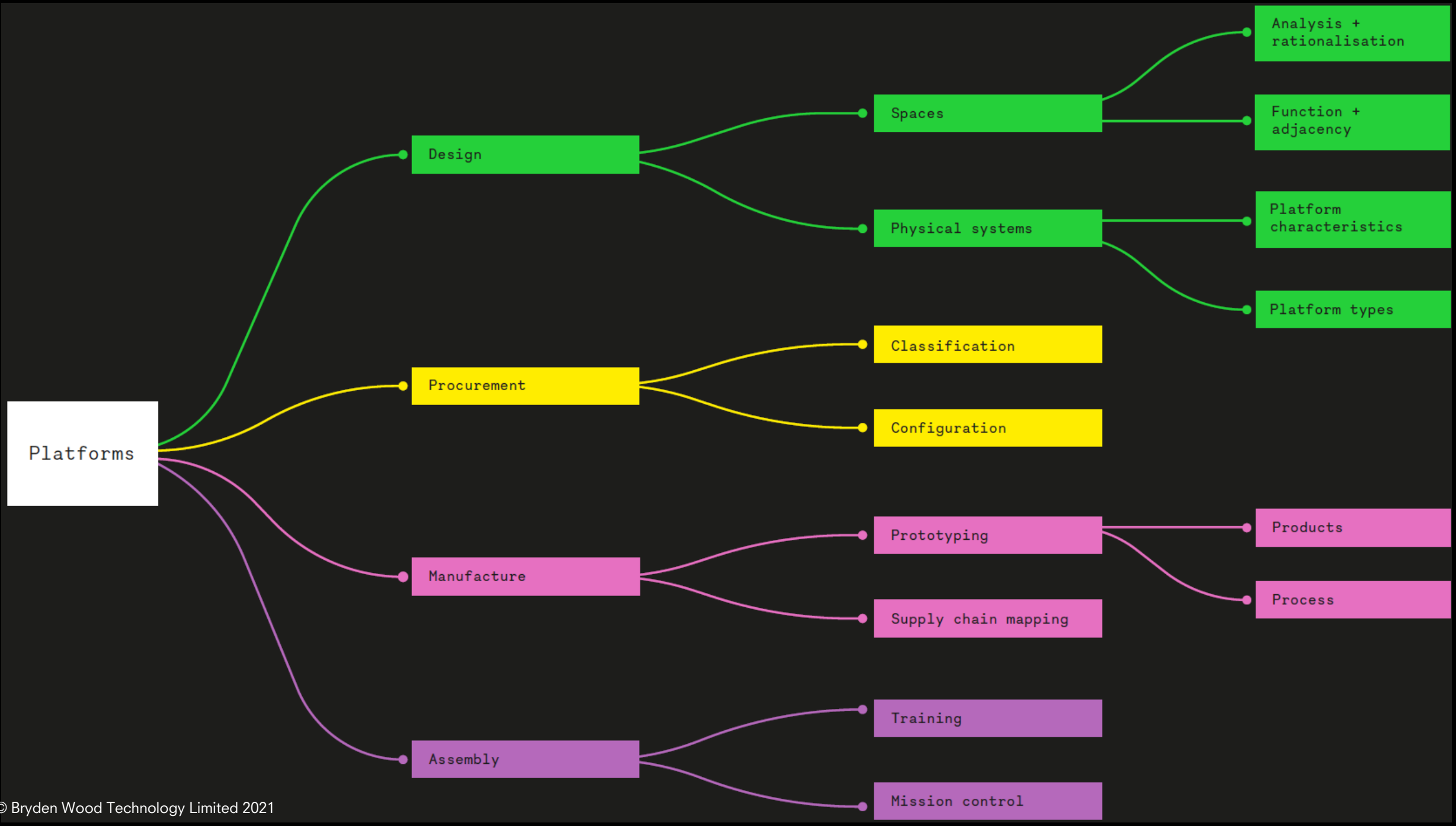
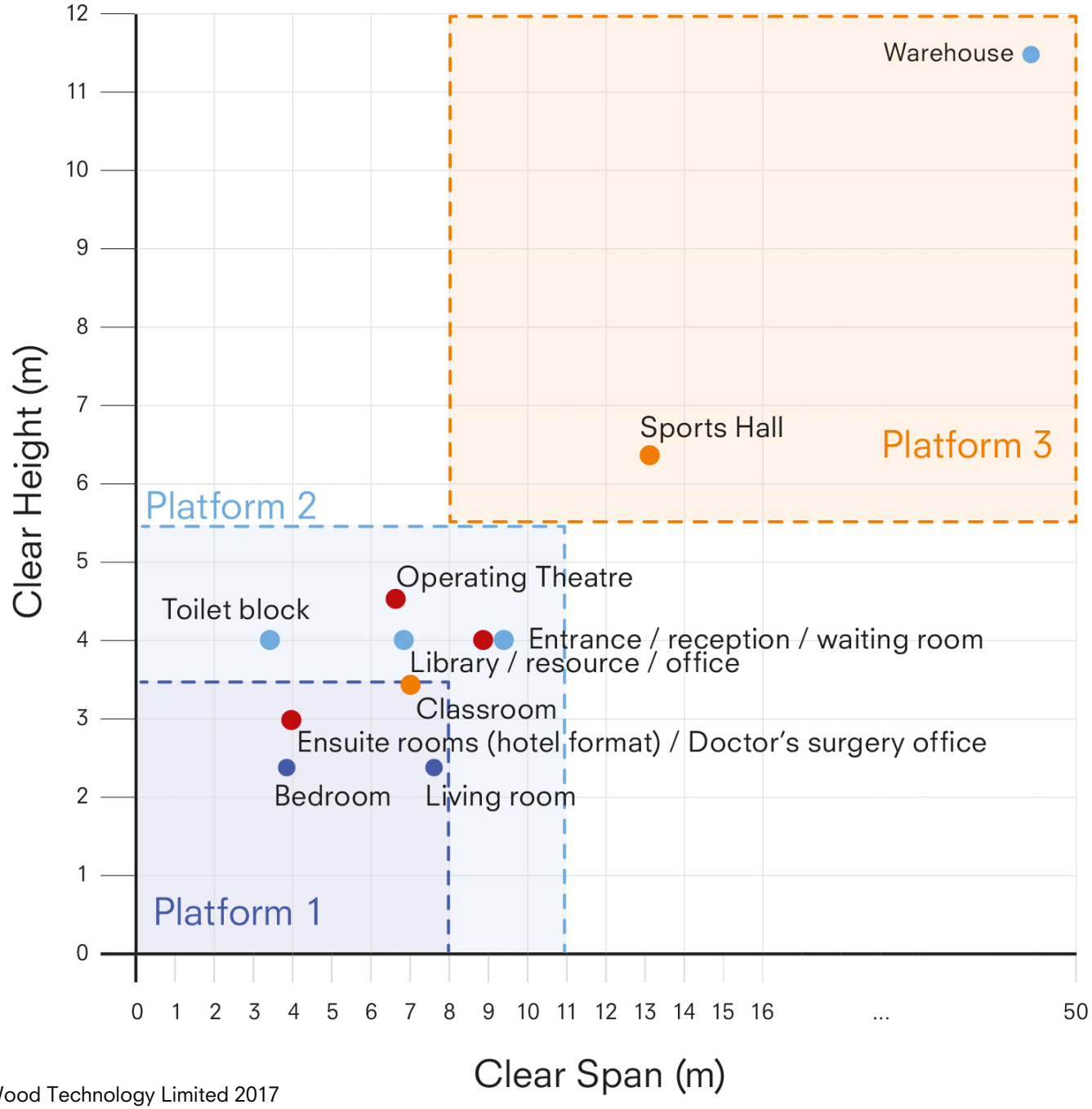




Residential

Offices

Health

School

Infrastructure and Projects Authority

Ministry of Justice

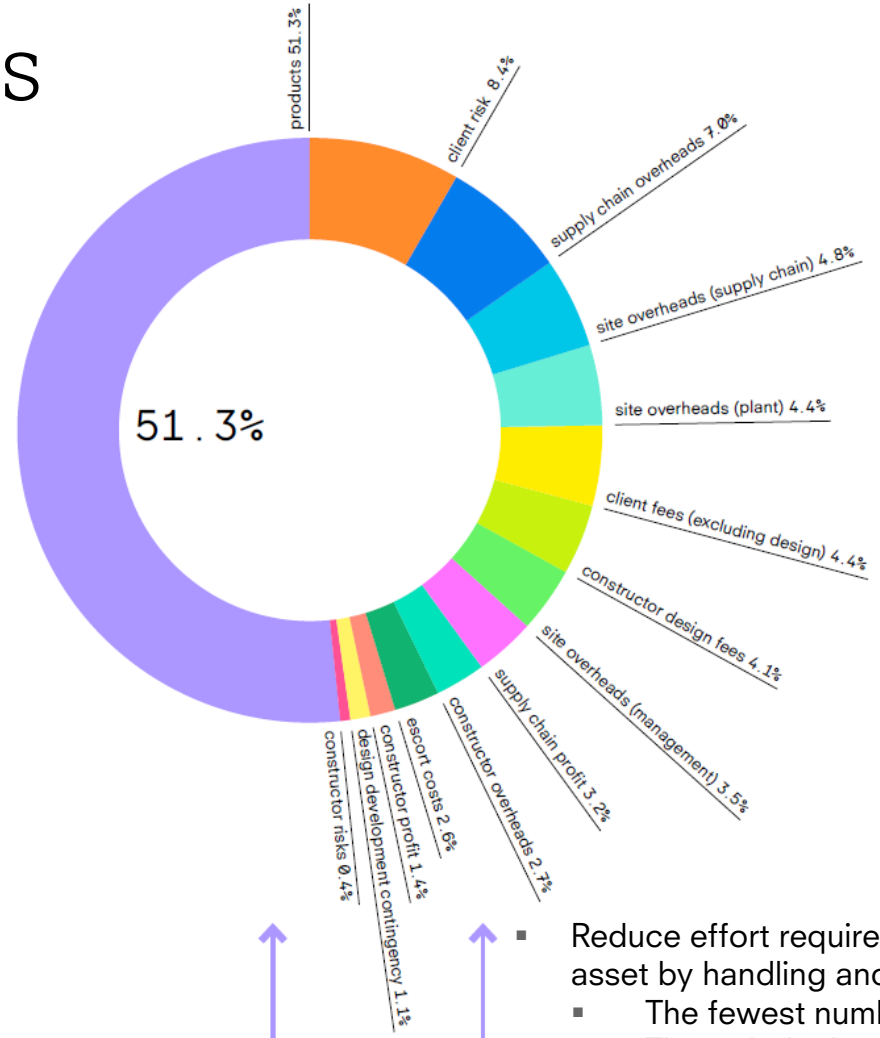
Department for Education

Department of Health

Ministry of Defence

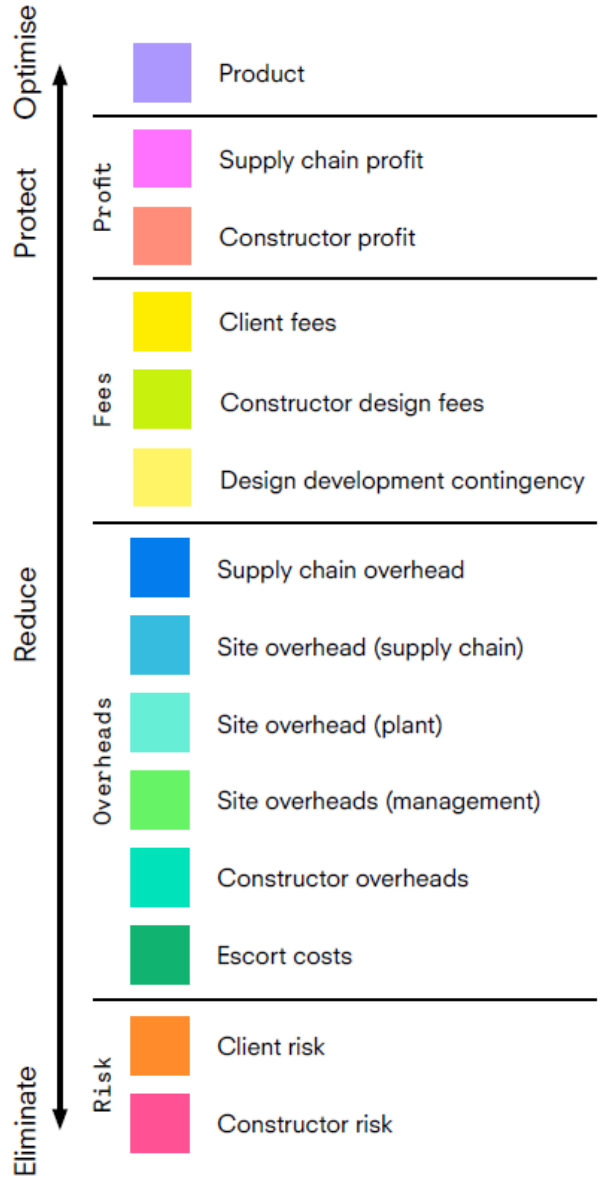
Department for Transport

Drivers



Use the least amount of raw material

- Reduce effort required to turn raw material into the finished asset by handling and / or moving material:
  - The fewest number of times;
  - Through the least amount of processes;
  - With up skilled and / or highly productive people;
  - Using the least number of people overall;
- Locate activity where it is best suited, rather than mandating 'on site' or 'off site';
- Deliver materials + elements to site at the right time, in the right sequence, with the correct information.



Bryden Wood

What are the benefits?

Breaking the traditional relationship between time, cost and quality

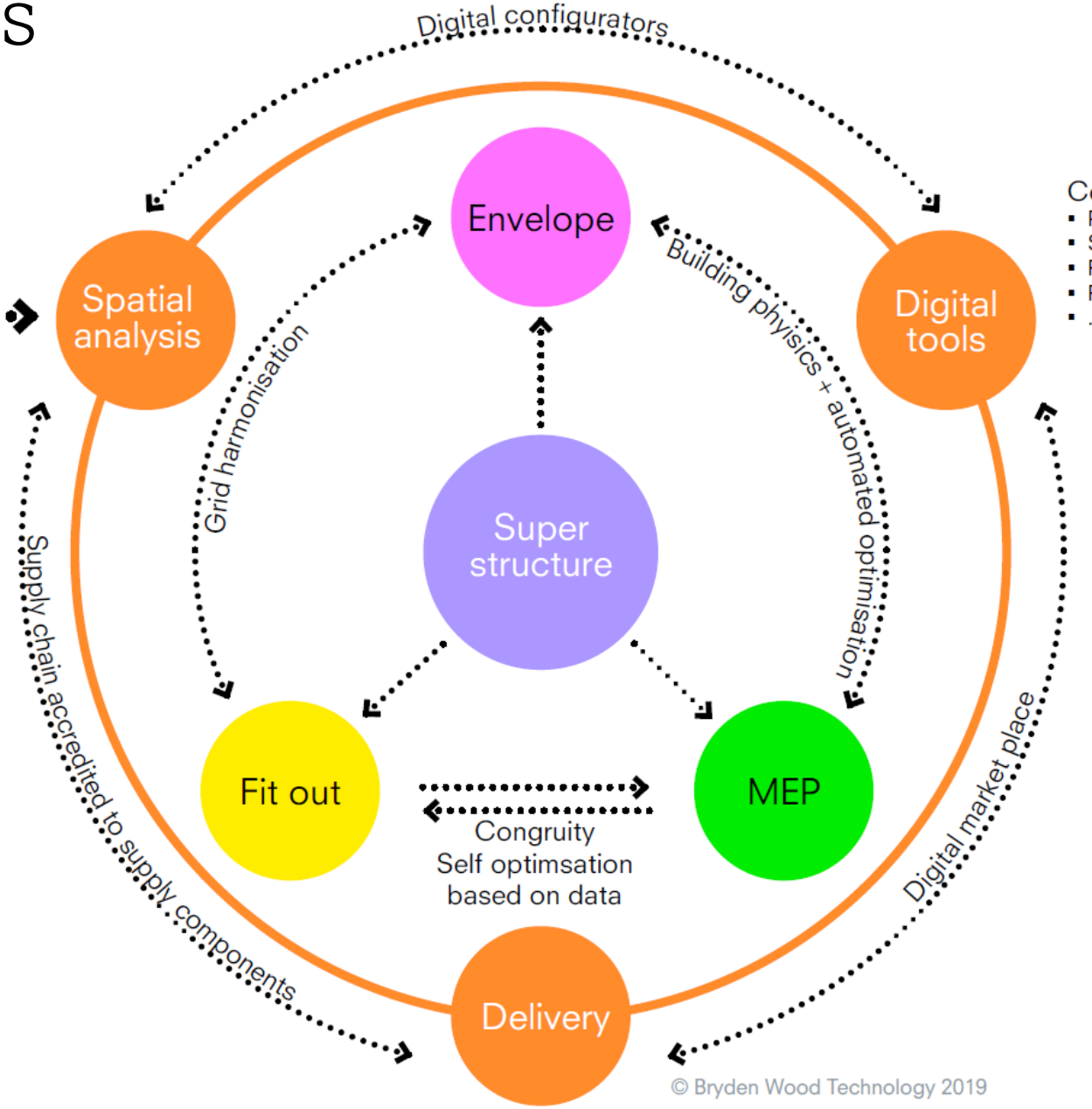
- Less material (with associated cost, carbon, transport…);

- Fewer components, enabling:
  - Economies of scale;
  - High levels of optimisation and manufacturing levels of quality;
  - Distributed, resilient supply chain (from major manufacturers to local SME's)
  - Greater control of logistics, training, on site activities, etc.

- Standardised processes (in manufacture and assembly) enabling:
  - Diversification of the sector (new jobs and skills, potential to upskill non-construction operatives);
  - Improved health + safety;
  - Increased productivity (and speed of assembly);
  - Reduced reliance on trades and workmanship (more consistent whole life performance);
  - Potential to automate (in design, manufacture + assembly).

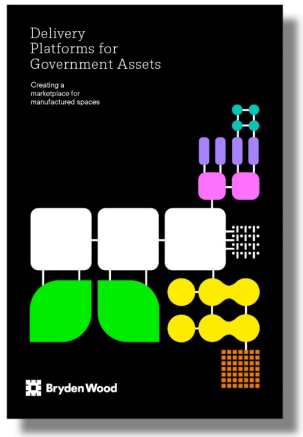
Components

Standardised requirements
- Stakeholder perspectives;
- Analysis of spaces:
  - Space types + performance characteristics;
  - Adjacencies + flows;
  - Technical specifications;
  - Dimensional grids.
- Grouping spaces to form a brief



Configurators + algorithmic design
- PRISM
- SEISMIC
- REM
- RAI:D
- ...

Delivery Platforms for Government Assets



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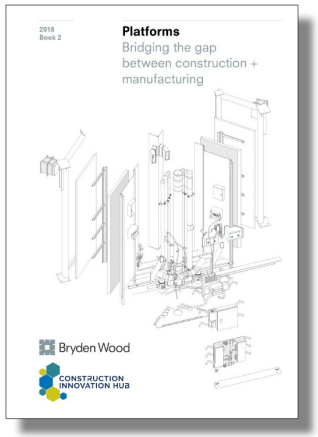

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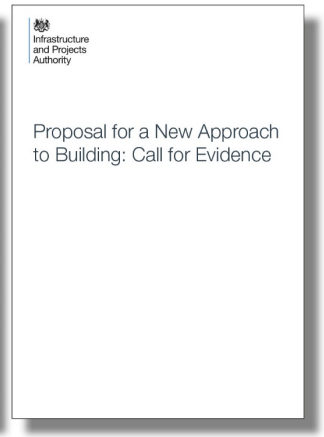

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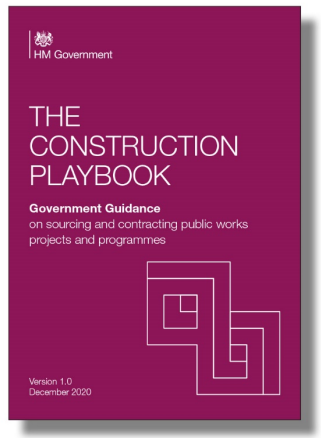

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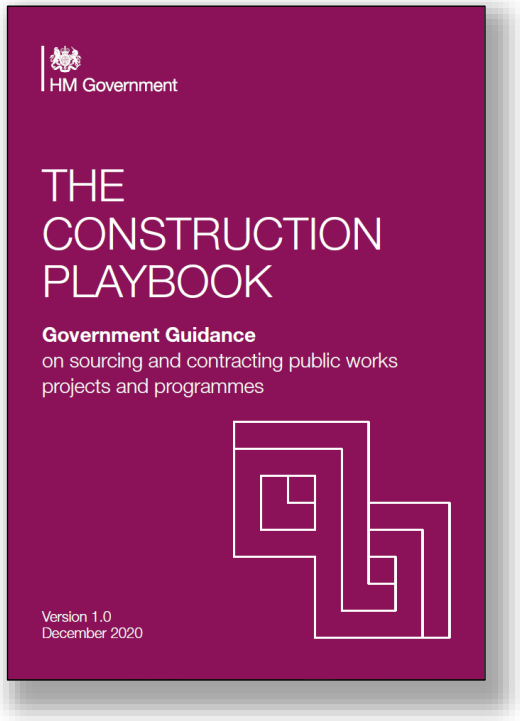
Policy drivers for Platform adoption



"The Construction Playbook captures commercial best practices and specific sector reforms… These are set out in 14 key policies which all central government departments are expected to follow on a 'comply or explain' basis."

Harmonise, digitise and rationalise demand

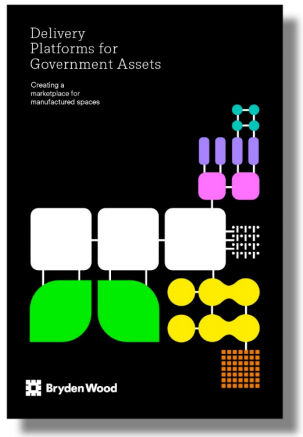
Contracting authorities should seek opportunities to **collaborate in order to develop and adopt shared requirements and common standards**. This should be done to enable standardised and interoperable components from a variety of suppliers… This will create a more resilient pipeline and drive efficiencies, innovation and productivity in the sector.

Platform approaches

We will look to procure construction projects based on **product platforms comprising of standardised and interoperable components and assemblies**, the requirements for which will be part of a digital component catalogue.

Future procurements and frameworks should support this with the development of a market and supply chain that can develop and deliver designs based on these platform approaches, manufacture and supply components, and innovate to improve and develop these over time.

Delivery Platforms for Government Assets



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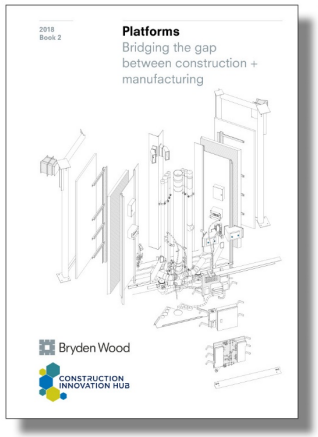

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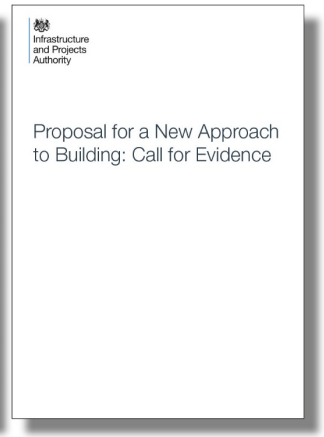

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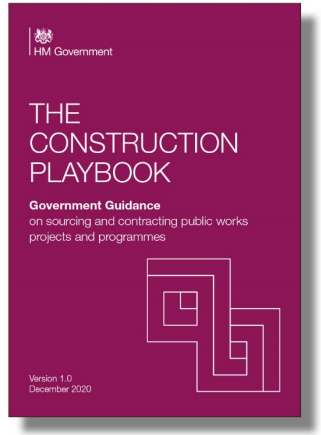

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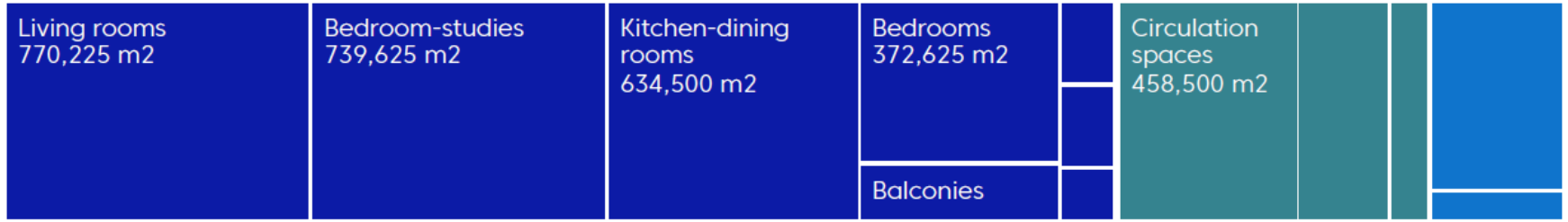
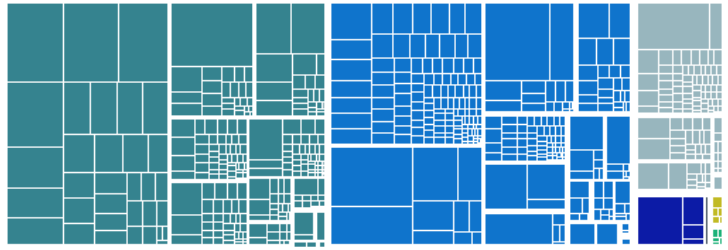
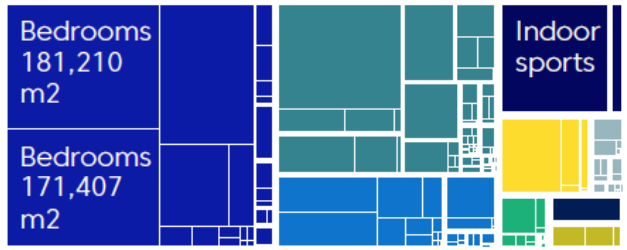


Department for Education

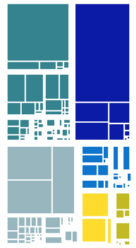
Department of Health & Social Care



Ministry of Defence



Ministry of Justice



- Administrative, commerical and protective service spaces
- Communications, security, safety and protection spaces
- Cultural, education, scientific and information spaces
- General spaces
- Heating, cooling and refridgeration spaces
- Industrial spaces
- Medical, health, welfare and sanitary spaces
- Recreational spaces
- Residential spaces
- Sport and activity spaces
- Waste disposal spaces and locations

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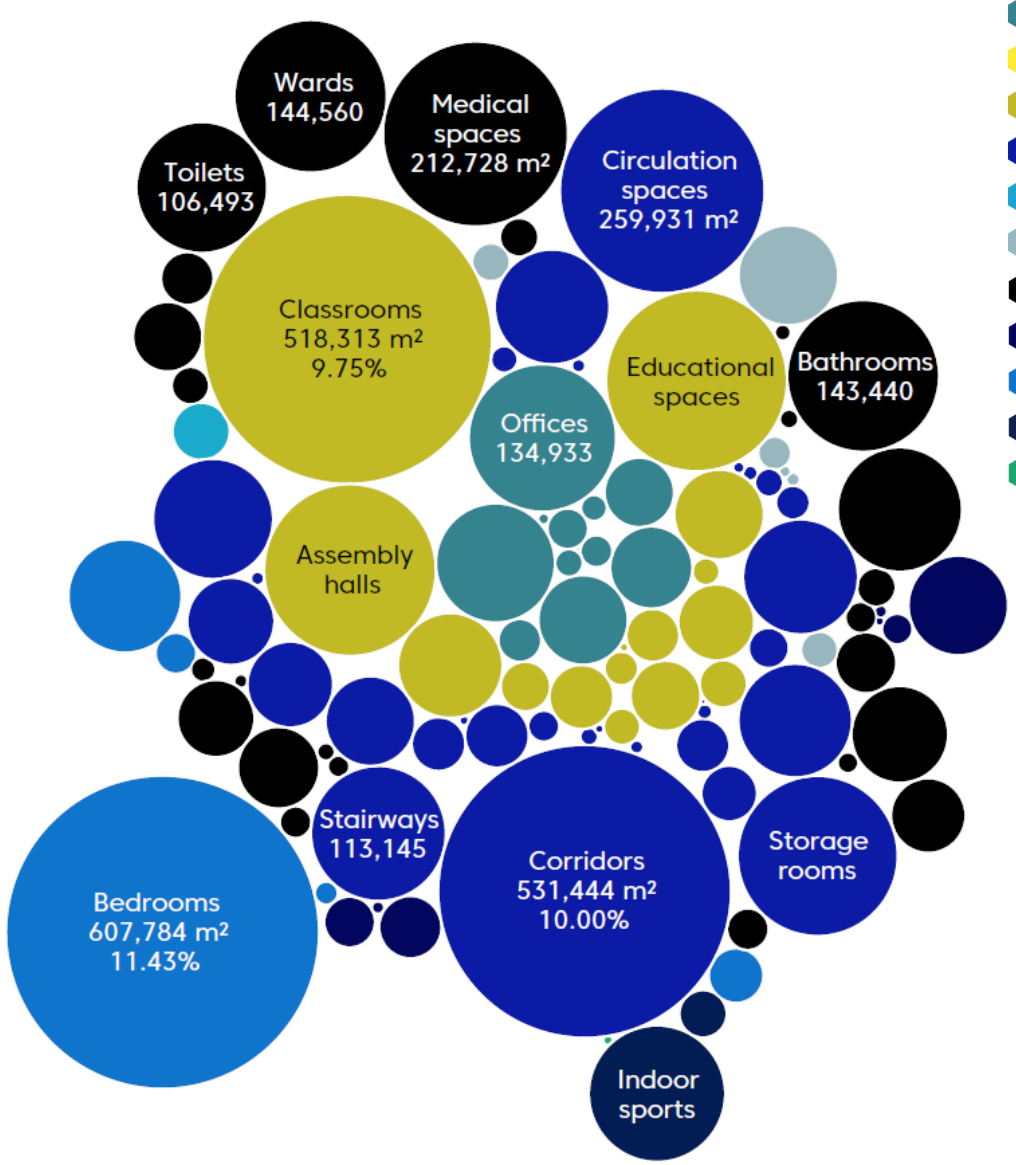

Area of spaces

- Administrative, commerical and protective service spaces
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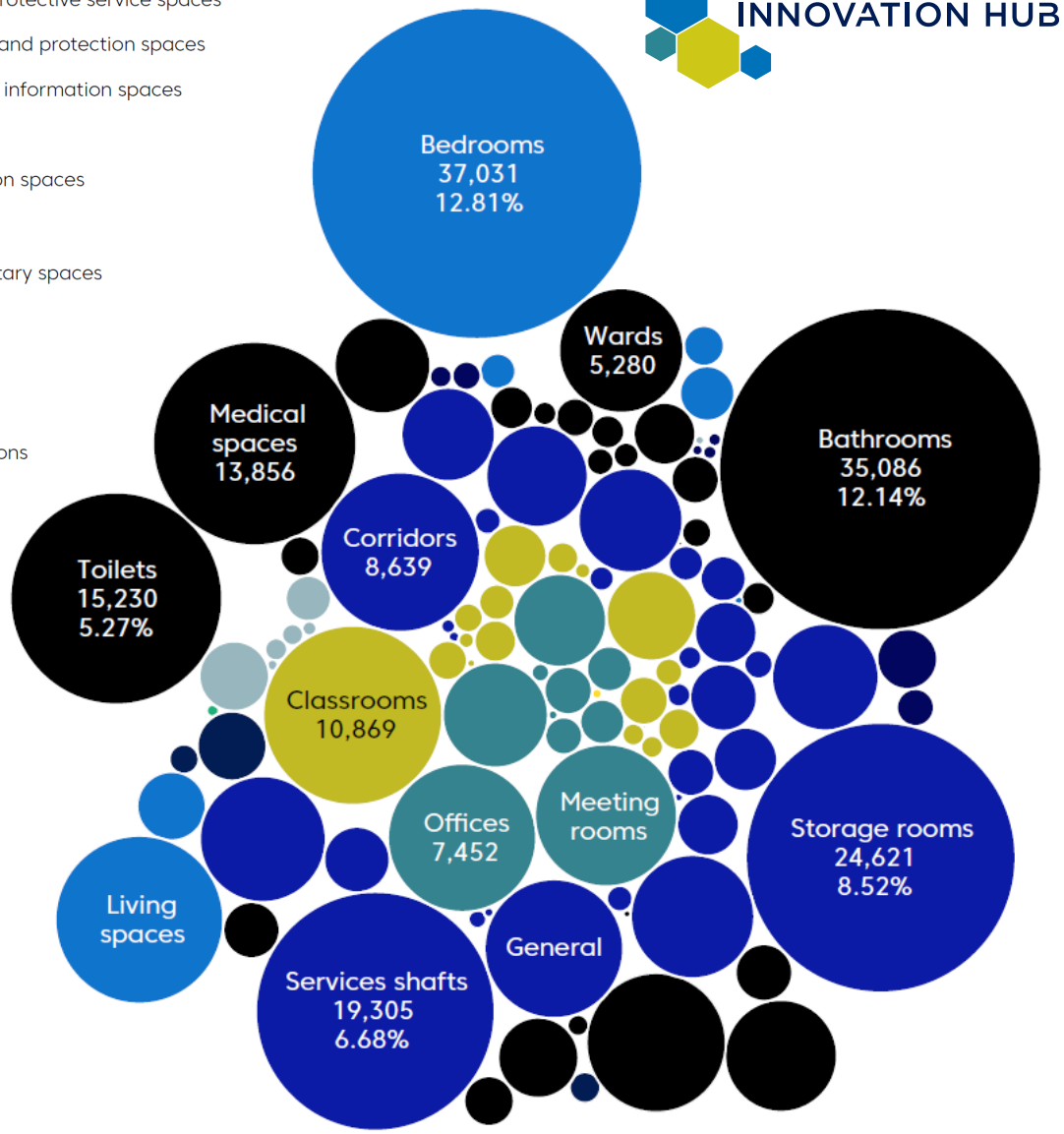

Frequency of spaces

c£35bn

the estimated value of the pipeline that could be delivered with a defined range of mid-span (~8m) platform construction systems, based on geometry alone.

c£13bn

the estimated value of the pipeline that could be delivered with the Hub's Platform Construction System.

104

different names for toilet spaces across the estate. This highlights the need for a common, machine–readable, way of naming spaces to accurately analyse and harmonise future demand.

50%

More than 50 percent of space types across the pipeline are not department specific — hallways, bathrooms and storage areas could be delivered with a standardised platform solution.

38%

of spaces across the new build pipeline will be 'Residential Spaces', presenting a secondary market for the private sector. If the Hub's Platform Construction System demonstrates how it can be used to deliver 'more beautiful, more sustainable, better quality homes in all parts of the country[1]', it could potentially be used to deliver private sector homes, student accommodation, and hotels domestically and internationally.

?

The majority of departmental specifications are open to interpretation. Units can vary across departments — . dB or NR are both used for acoustic performance. Improved standardisation of requirements — not least nomenclature — is needed to unlock the potential for solutions that deliver pan-government.

Trends

0

The government is committed to bringing all greenhouse gas emissions to net zero by, or ahead of, 2050. Platform construction systems must understand and minimise their GHG emissions footprint throughout their lifecycles.

Buildings need to be highly adaptive so that they can be reconfigured/repurposed across the required 60–year service life.

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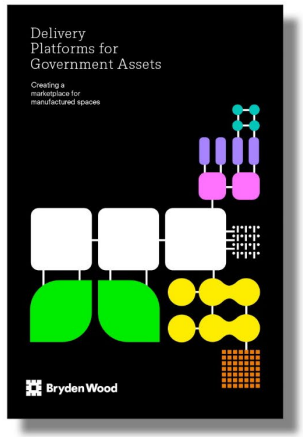

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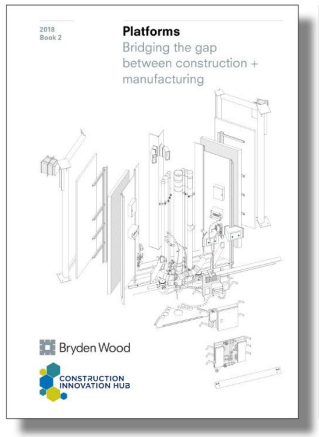
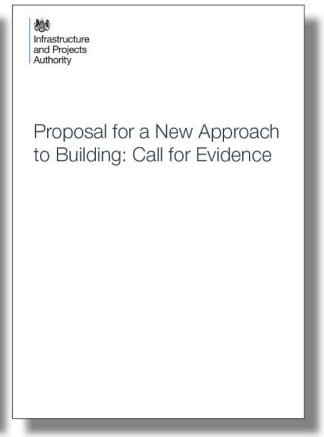


Proposal for a New Approach to Building



'We will use a set of digitally designed components across multiple types of built asset... a single component could be used as part of a school, hospital, prison building or station.'

Platform Design Programme 'Defining the Need'

Transforming Infrastructure Performance: Roadmap to 2030

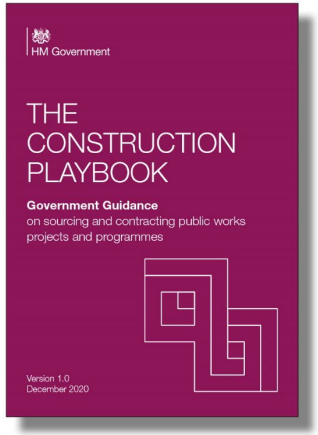
'A mandated approach: in the next two years the government will set out a requirement for platform approaches to be adopted.'

2017 | 2018 | 2019 | 2020 | 2021

Autumn Statement
'The government will use its purchasing power to drive adoption of modern methods of construction...'

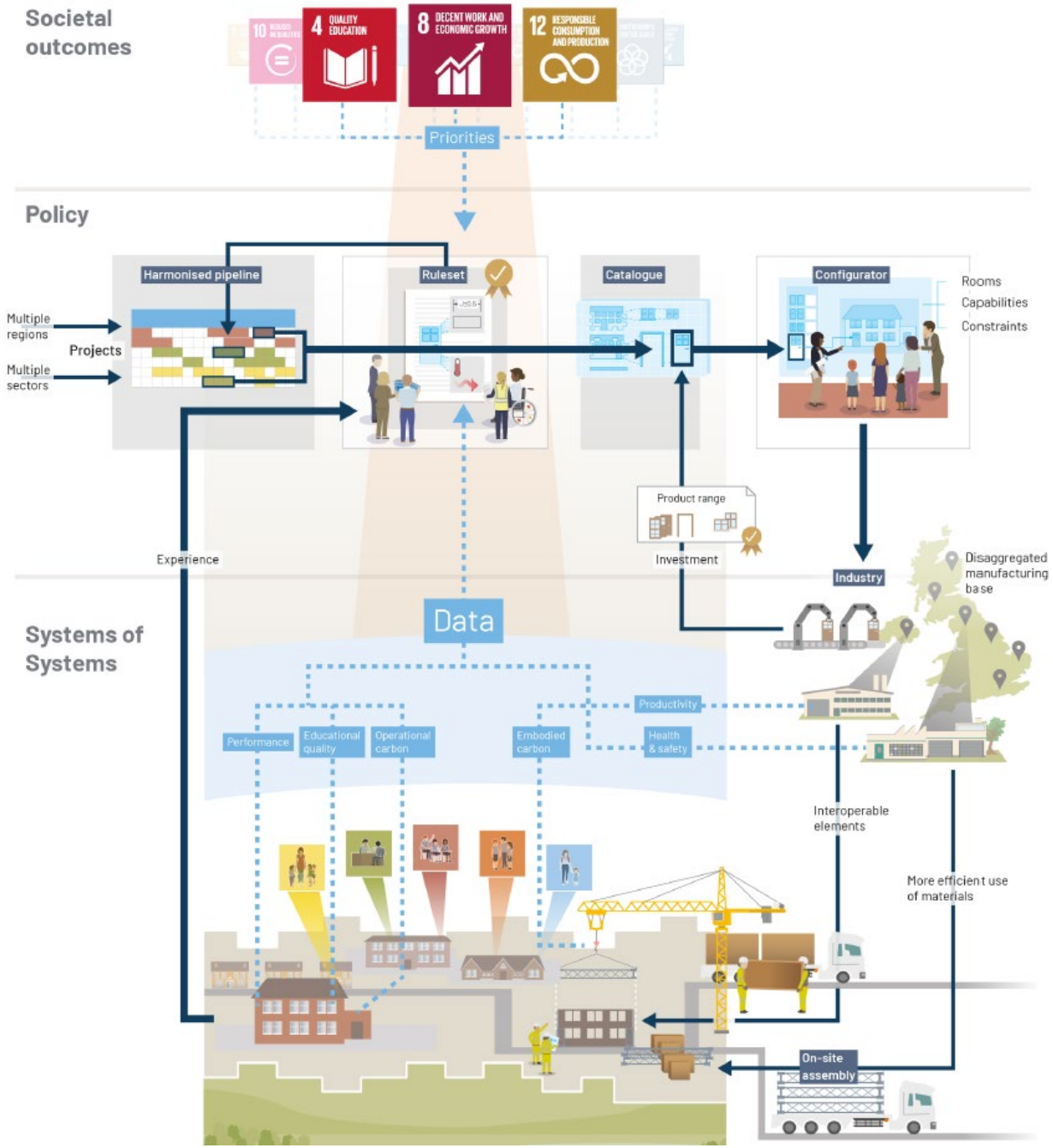
CONSTRUCTION INNOVATION HUB

Construction Innovation Hub awarded £72 million to drive innovation + technological advances in the UK construction and infrastructure sectors.



The Construction Playbook

'We will procure projects based on product platforms comprising of standardised and interoperable components and assemblies, the requirements for which will be part of a digital component catalogue.'



The Problem

The way that we deliver our buildings is inefficient and too often based on delivery of bespoke outputs in sector and project silos. Missed opportunities to leverage scale through the use of standardised, interoperable elements leads to inefficiency in design, production, logistics and assembly. Further, these missed opportunities hinder the creation of a disaggregated manufacturing base and associated stable employment, continuous improvement, and the ability to reliably deliver high quality, high performing, energy efficient buildings at scale.

The Vision

There would be a common supplier agnostic ruleset through which we would harmonise and filter repeatable elements of the built environment to provide visible demand. The products to address this demand would be manufactured by a disaggregated supply chain, creating stable and inclusive forms of employment. Products would be offered via machine readable catalogue, with product competition based on a range of performance considerations.

Automation through the use of configurators would enable a greater focus on value led elements of the design process, and assembly would employ digital workflows, machinery and robotics. Digital models and twins would enable assurance and feedback throughout delivery and use.

The Benefits

- Structural industry benefits. Platforms can open the construction industry to productivity and efficiency akin to the manufacturing industry, creating productive capacity and enabling the creation of inclusive stable manufacturing employment.
- Factory conditions in construction. Delivery via repeatable productive activities enables predictability and automation to improve health and safety, reduce waste, increase productivity and speed of assembly, and address the skills gap.
- Feedback loops. Currently operational data from an asset only provides insight on that specific asset. Platforms can enable data to inform the whole ecosystem, from rules to product catalogue.

Infrastructure and Projects Authority

A mandated approach: in the next two years the government will set out a requirement for platform approaches to be adopted for social infrastructure

Digital configurators

Configurators

Roads
Highways England

The Tube
TfL

Homes
Mayor of London

Homes
Prism to Platforms

Data centres
*****

Robotics
Open source

Rail
Network Rail

Cycling
DfT

Schools
DfE

Pharmaceutical
GSK

Industrial
Innovate UK

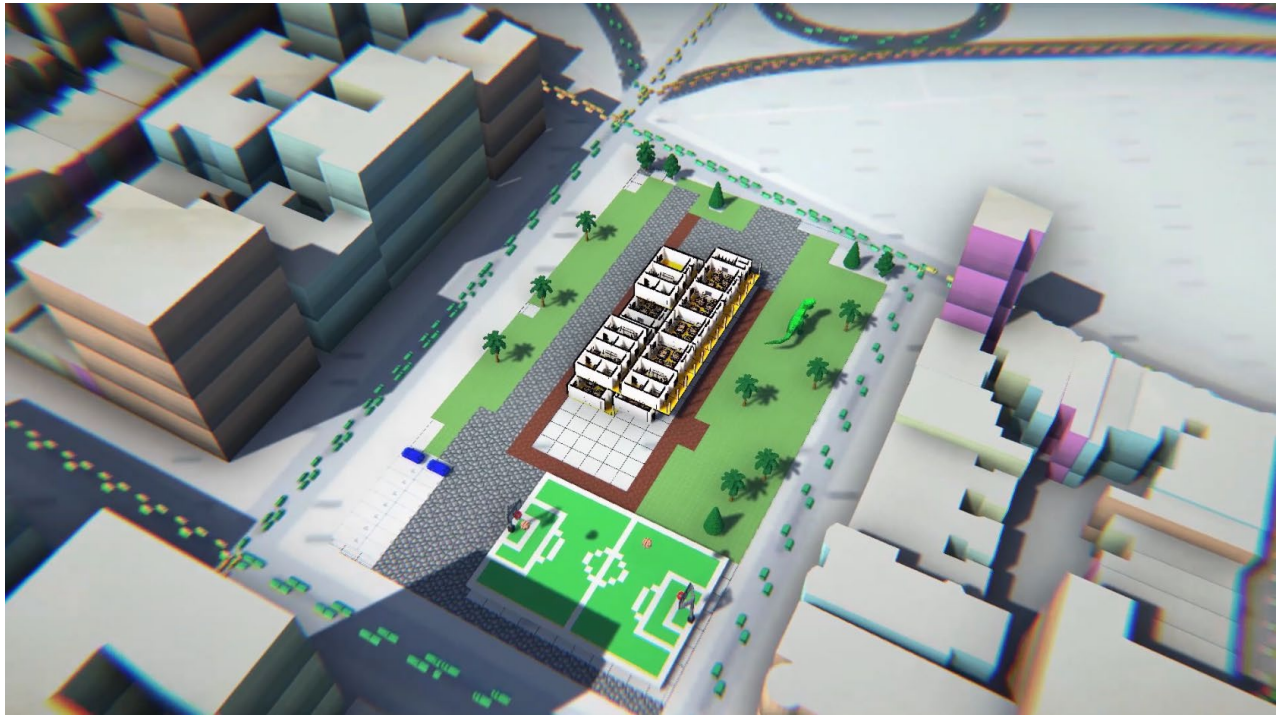
SUPPORTED BY

MAYOR OF LONDON

Department for Education

PRISM design accelerator for
Precision Manufactured Homes

prism-app.io



Seismic design configurator for
systemised schools

seismic-school-app.io

Case study
The Forge, London

Platform 0

Low cost, rapid assembly temporary or permanent accommodation (multi occupancy rooms to family apartments);
Disaster relief / displaced populations / large scale construction camps.

Platform 1

Cellular accommodation, single occupancy rooms;
Single living accommodation, secure accommodation, student rooms etc.

Platform 2

Mid span (up to 8m) multi sector use;
Education, healthcare, apartments, offices etc.

Platform 3

Office planning grid (9m x 9/10.5/12m);
Commercial / high end residential etc.

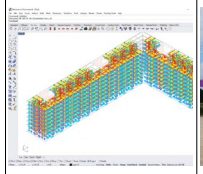
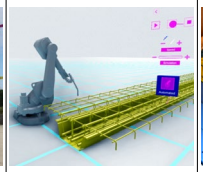
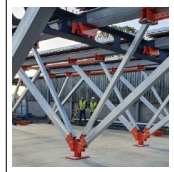
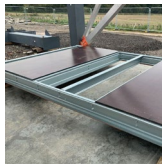
Platform 4

Long span (up to 36m);
Logistics centres / distribution / warehouses etc.

£35 billion market

The Forge

Common elements – products + process

	Automated model generation	Site visualisation + tracking	Robotic welding of components	Colour coding	Simple automation	Repeatable, standardised tasks	Brackets	Props	Shuttering	Concrete pumping	Robotic levelling	Reach stackers	Merlo telehandler
													
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Proven + tested

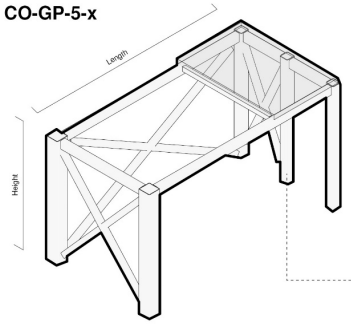
Achievable but untested

Not required

Landsec

Structure

CO-GP-5-x



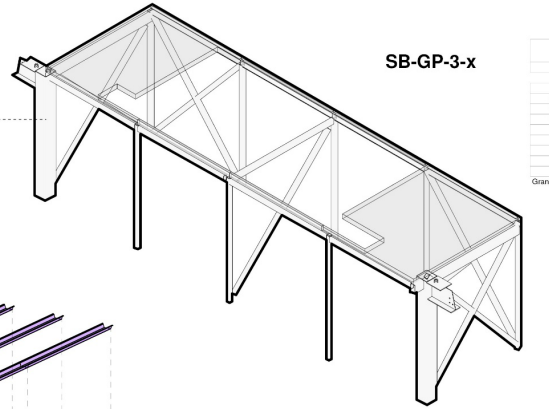
Part List

Element	Section	Count
Floors	Comflor 60 Metal Deck	1
Structural Columns	SHS250x250x16	3
Structural Columns	SHS350x350x12.5	2
Structural Framing	RHS150x100x10	1
Structural Framing	RHS250x150x10	5
Structural Framing	SHS150x150x10	6
Grand total: 18		

Types per Component

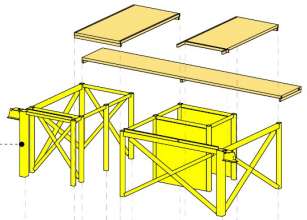
Component Type Name	Count	Height [mm]	Weight [kg]
CO-GP-5-2	1	3250	4215.10
CO-GP-5-3	1	3350	4294.24
CO-GP-5-4	1	3435	4355.07
CO-GP-5-5	6	3500	26441.60
CO-GP-5-6	2	3700	9133.80
: 11			48439.81
Grand total: 11			48439.81

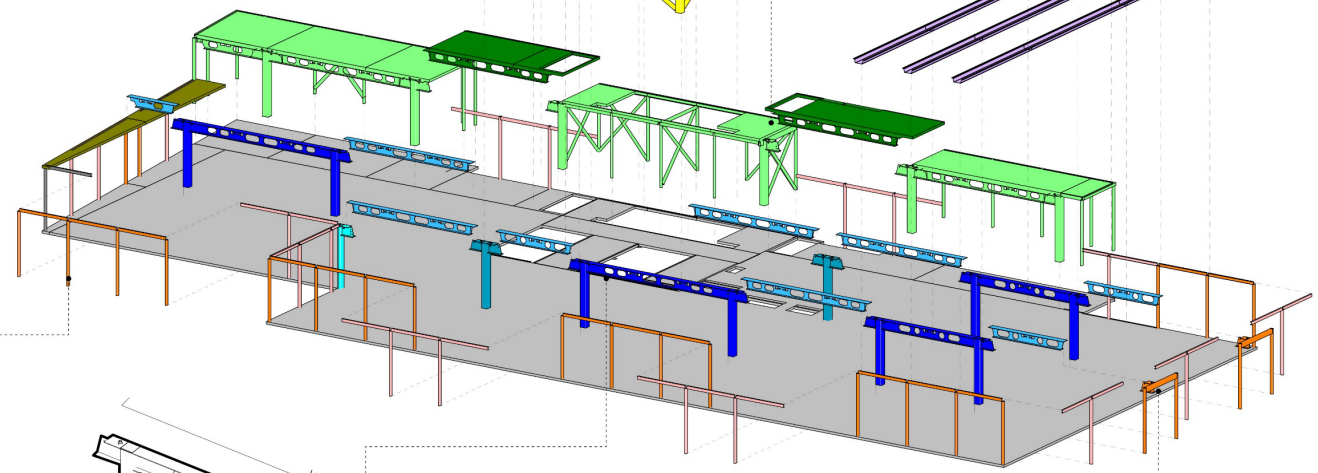
SB-GP-3-x



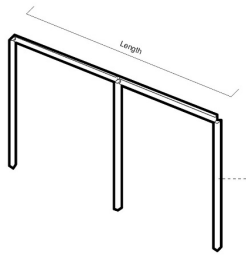
Part List

Element	Section	Count
Floors	Comflor 60 Metal Deck	4
Structural Columns	RHS150x100x10	4
Structural Columns	SHS100x100x10	4
Structural Columns	SHS350x350x12.5	2
Structural Framing	Fabricated Stub - 0.75m	2
Structural Framing	PFC180x75x20	4
Structural Framing	RHS150x100x10	5
Structural Framing	RHS250x150x10	3
Structural Framing	SHS120x120x10	10
Grand total: 38		





CL-GP-5-x



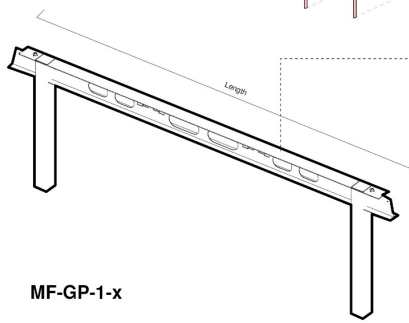
Part List

Element	Section	Count
Structural Columns	RHS150x100x10	3
Structural Framing	PFC150x75x18	2
Grand total: 5		

Types per Component

Component Type Name	Count	Length [mm]	Height [mm]	Weight [kg]
Block A				
CL-GP-5-1	1	5800	1800	336.50
CL-GP-5-2	4	5800	3200	1953.58
Block A: 5				2290.08
Block B				
CL-GP-5-3	2	5000	3700	941.93
CL-GP-5-4	1	6000	3700	501.67
CL-GP-5-5	2	6000	3700	981.67
Block B: 5				2425.28
Grand total: 10				4715.36

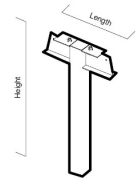
MF-GP-1-x



Types per Component

Component Type Name	Count	Length [mm]	Height [mm]	Weight [kg]
Block A				
MF-GP-1-1	2	6000	3200	3301.83
MF-GP-1-2	6	6000	3500	10382.38
MF-GP-1-3	2	6000	5000	4162.88
MF-GP-1-4	1	9000	3200	1988.22
MF-GP-1-7	8	9000	3500	16329.68
MF-GP-1-8	1	9000	3700	2094.20
MF-GP-1-9	2	9000	5000	4592.42
Block A: 22				42851.62
Block B				
MF-GP-1-5	1	9000	3350	2002.71
MF-GP-1-6	1	9000	3435	2025.23
MF-GP-1-7	6	9000	3500	11260.32
MF-GP-1-8	2	9000	3700	3724.97
Block B: 10				19013.22
Grand total: 32				61864.84

MF-TS-7-x



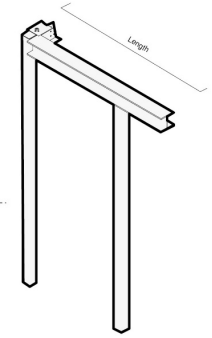
Part List

Element	Section	Count
Structural Columns	SHS350x350x12.5	1
Structural Framing	Fabricated Stub - 0.75m	1
Structural Framing	Fabricated Stub - 0.75m	1
Grand total: 3		

Types per Component

Component Type Name	Count	Length [mm]	Height [mm]	Weight [kg]
Block A				
MF7.1	1	1500	3200	569.83
MF7.3	10	1500	3500	6095.73
MF7.4	3	1500	3700	1908.20
MF7.5	1	1500	5000	808.28
Block A: 15				9382.03
Block B				
MF7.2	1	1500	3350	590.94
MF7.3	18	1500	3500	9417.62
MF7.4	4	1500	3700	2147.37
MF7.6	2	1500	6785	2091.94
Block B: 25				14247.86
Grand total: 40				23629.90

CL-GP-4-x

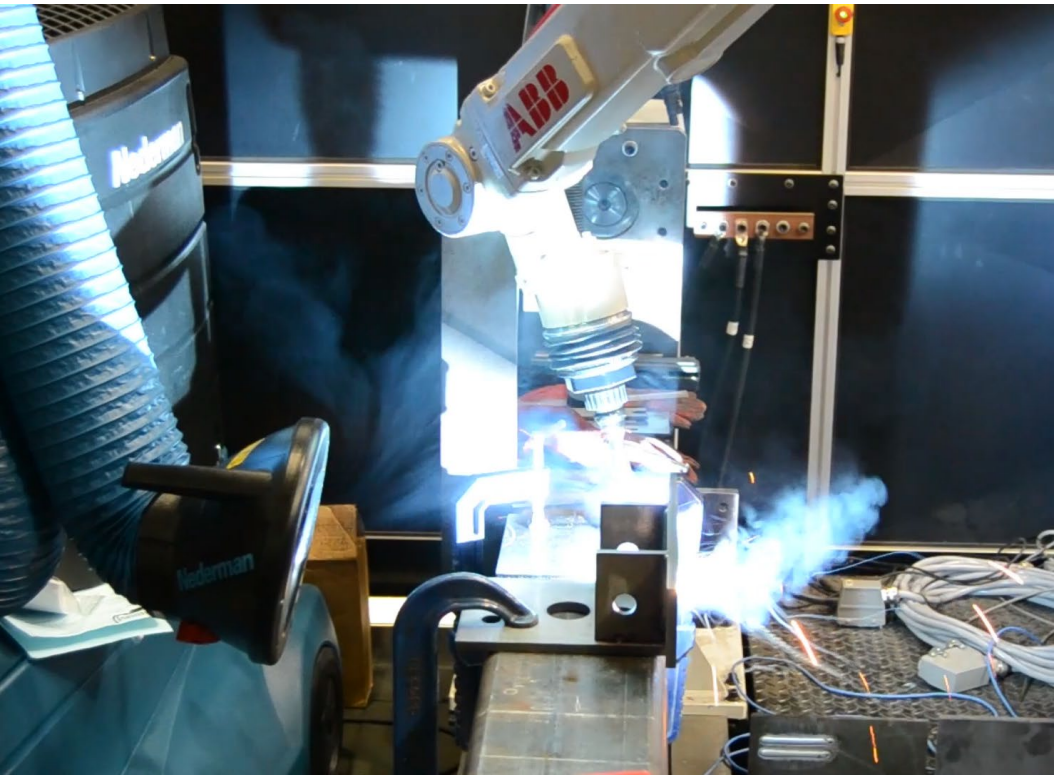


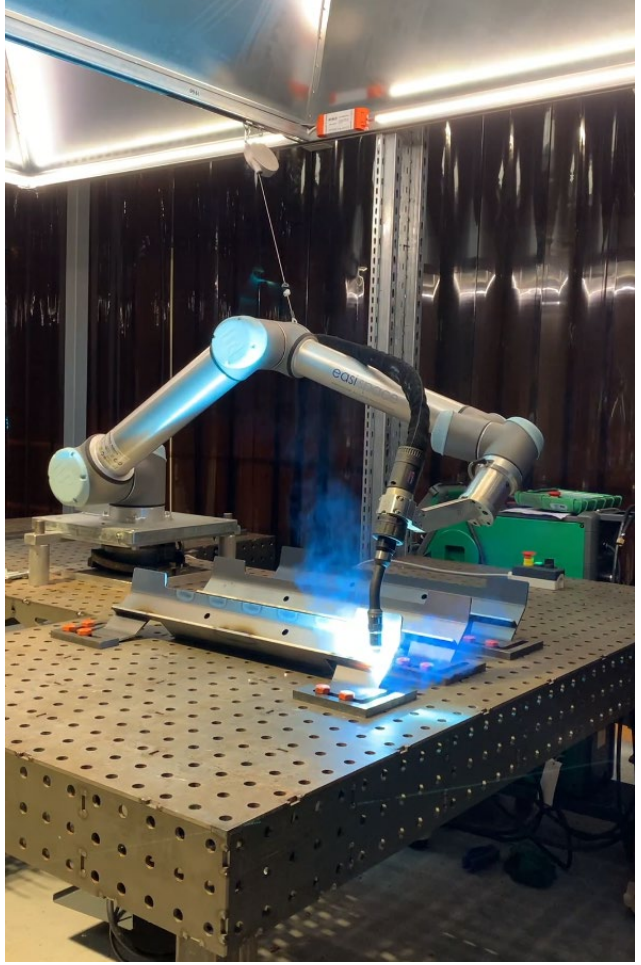
Part List

Element	Section	Count
Structural Columns	SHS250x250x12.5	2
Structural Framing	Fabricated Grider Stub 750 mm	1
Structural Framing	UC356x406x235	1
Grand total: 4		

Types per Component

Component Type Name	Count	Length [mm]	Height [mm]	Weight [kg]
Block B				
CL-GP-4-1	1	4000	6400	2340.93
Block B: 1				2340.93
Grand total: 1				2340.93

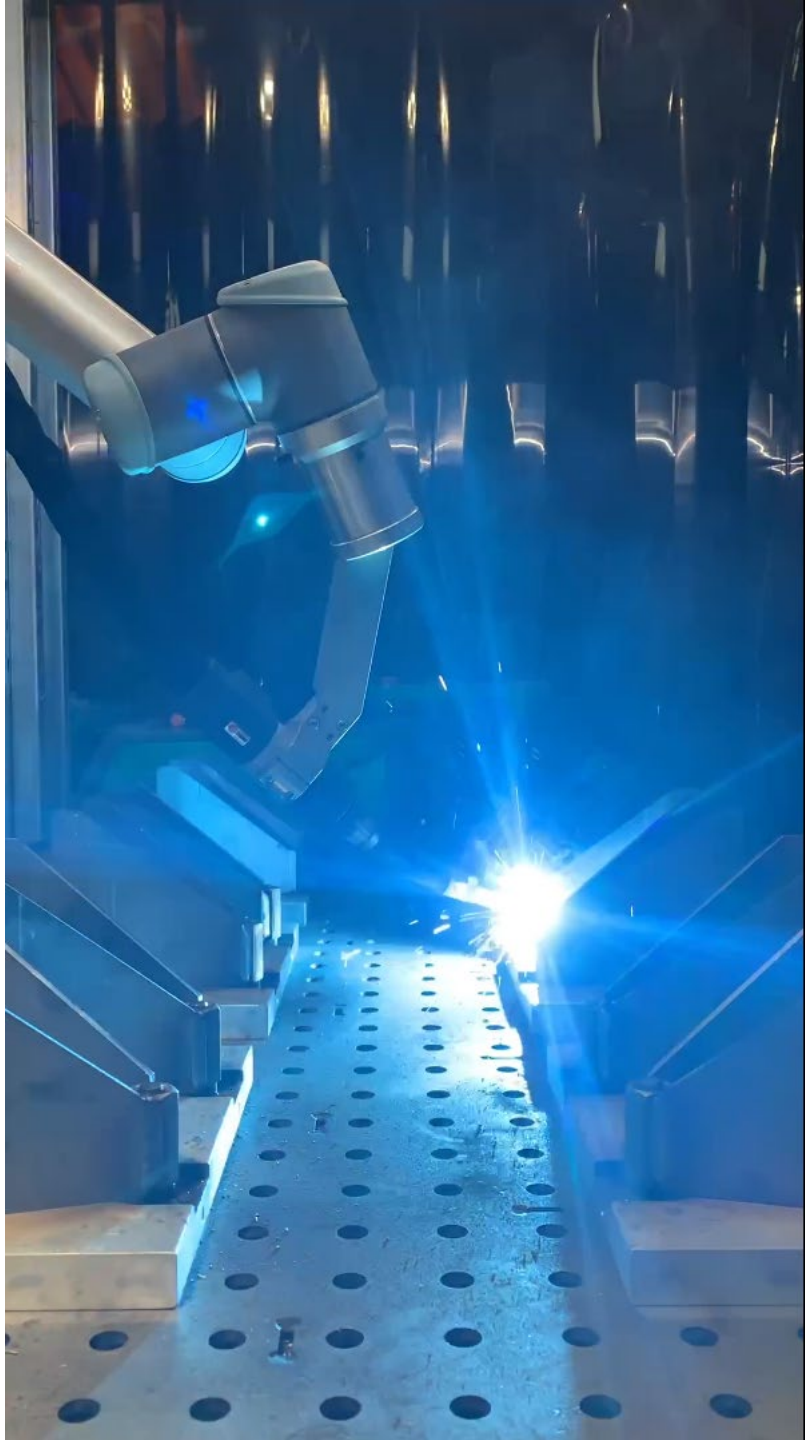




easi space

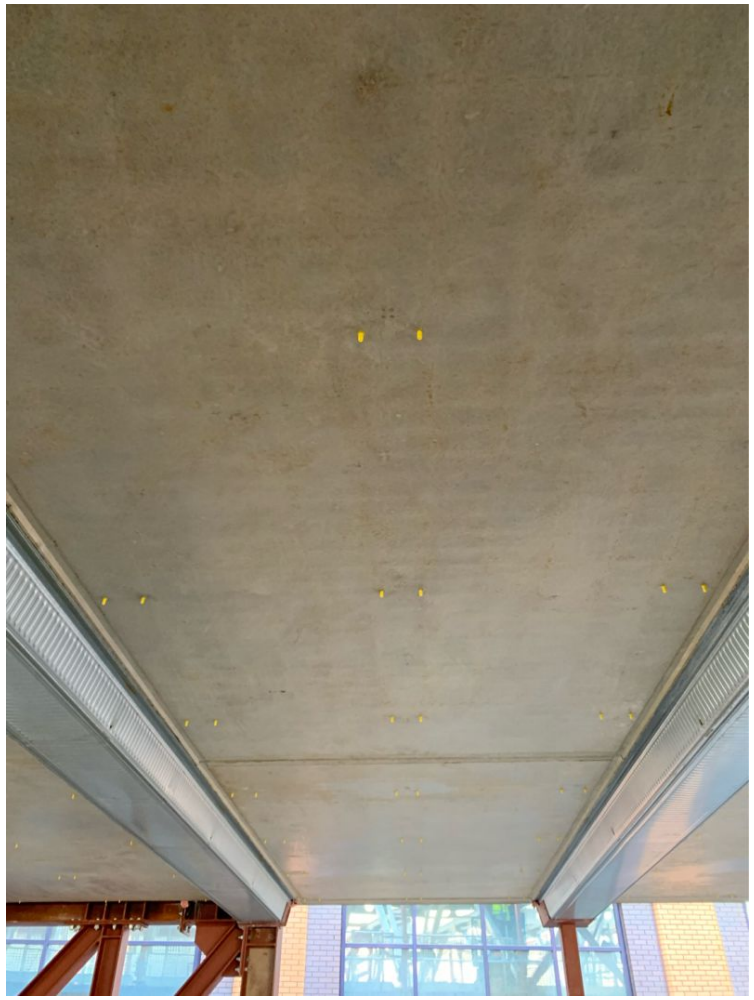
Environmentally And Socially Impacting Spaces

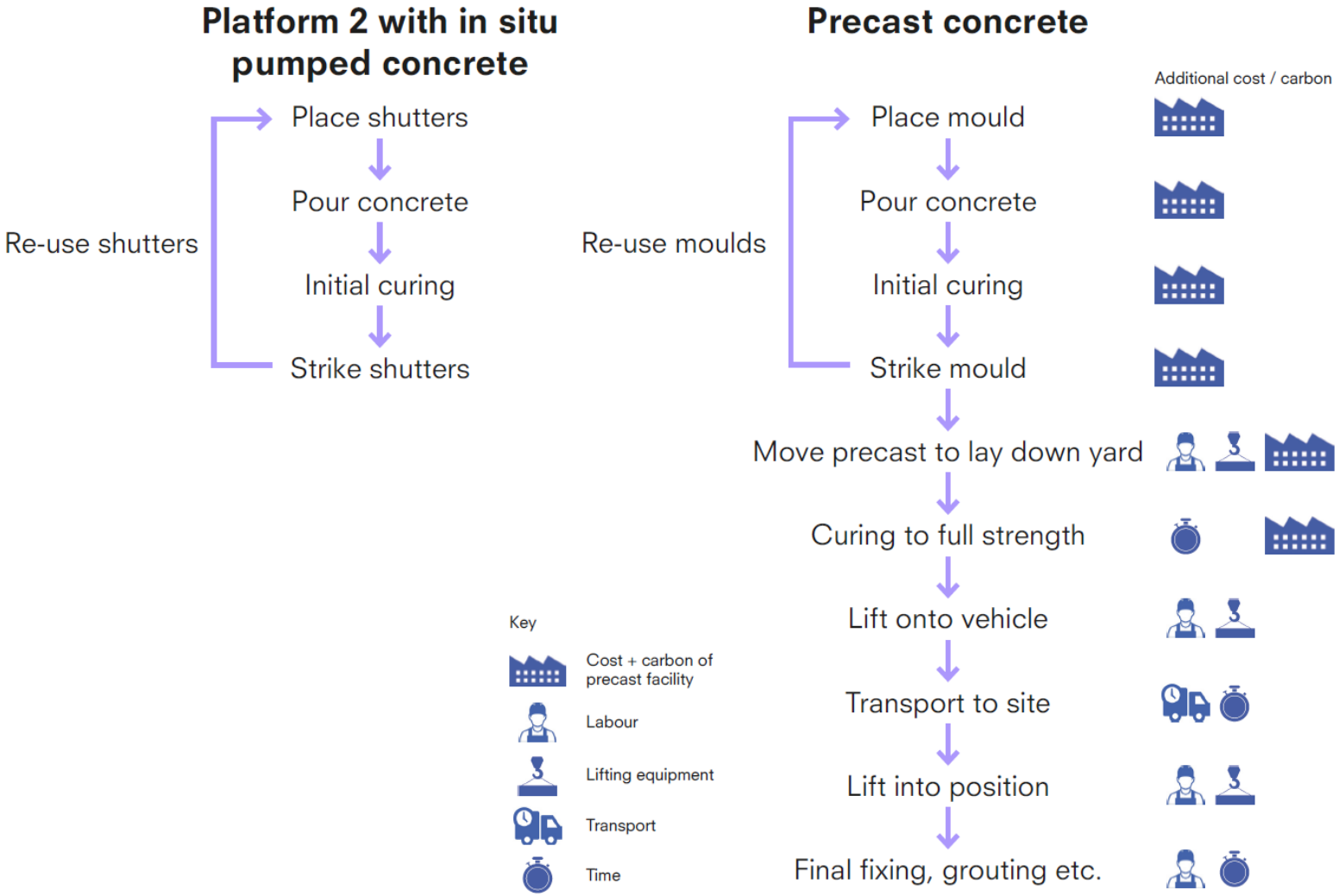
UK Research and Innovation




https://vimeo.com/394805860

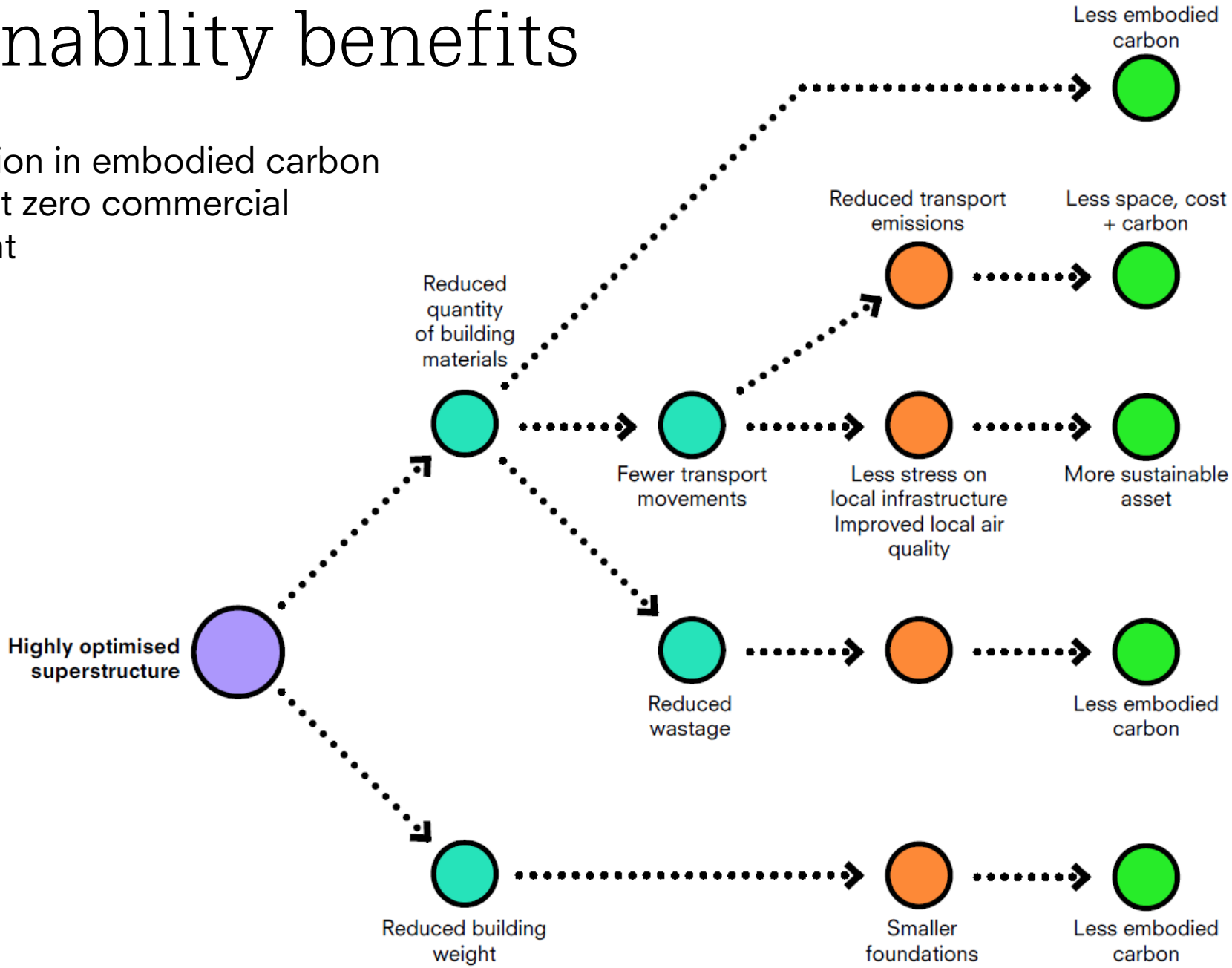
In situ vs. pre cast concrete





Sustainability benefits

- 22% reduction in embodied carbon
- UK's first net zero commercial development



Façade

Type 05

T5B

Model	Width	Height	Count
T5 Angle	340	3500	4
T5 Angle	340	3700	2
Total			6

Type 02

T2C

Model	Width	Depth	Height	Count
T2C	1500	300	3500	29
T2C	1500	300	3700	9
T2C	1500	400	3500	3
T2C	1500	400	3700	1
Total				39

Type 02

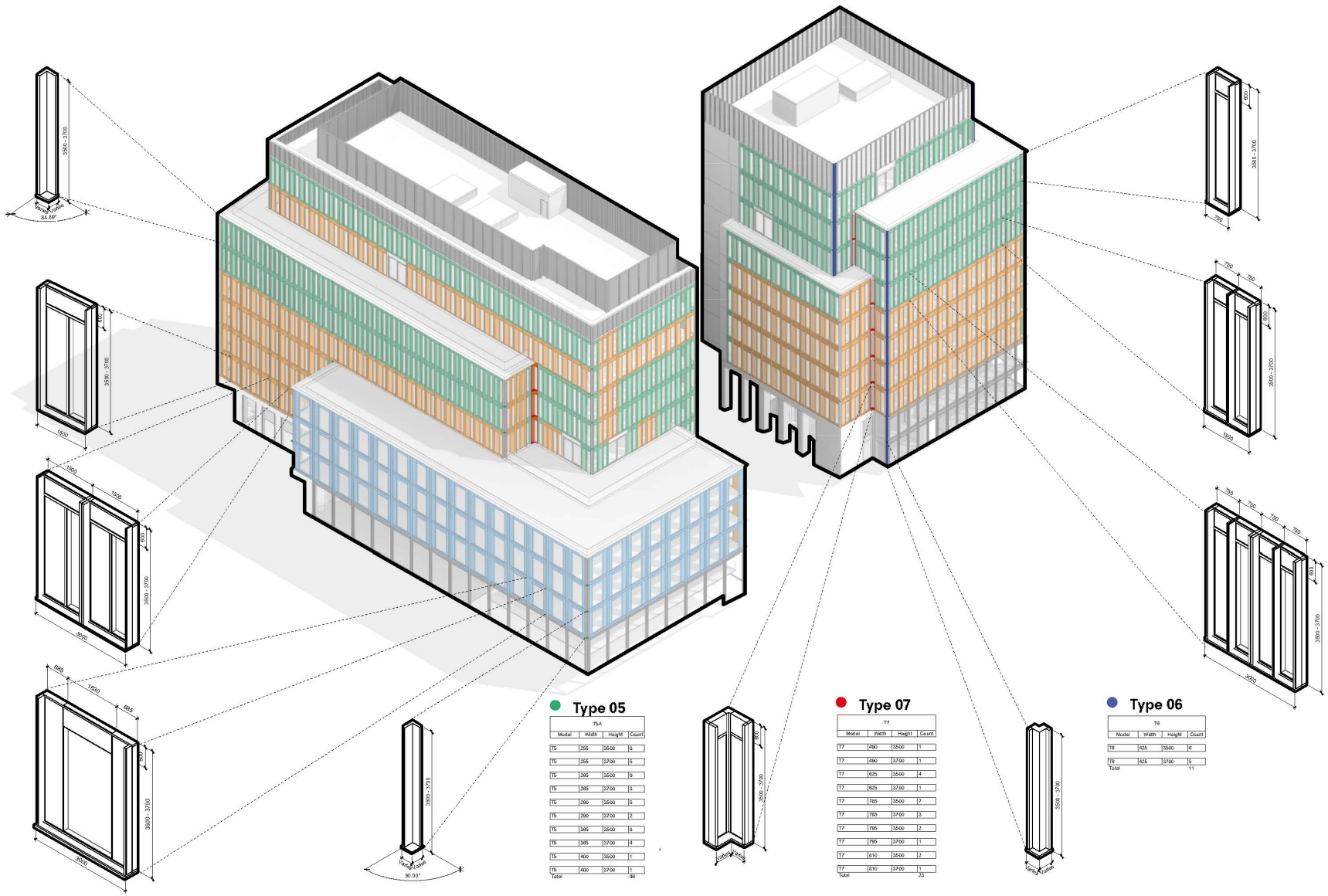
T2B

Model	Width	Depth	Height	Count
T2B	3000	300	3500	114
T2B	3000	300	3700	16
T2B	3000	400	3500	52
T2B	3000	400	3700	15
Total				197

Type 01

T1B

Model	Width	Depth	Height	Count
T1B	3000	400	3500	50
T1B	3000	400	3700	25
Total				75



Type 05

T5A

Model	Width	Height	Count
T5	255	3500	6
T5	255	3700	5
T5	285	3500	9
T5	285	3700	3
T5	290	3500	5
T5	290	3700	2
T5	385	3500	6
T5	385	3700	4
T5	400	3500	1
T5	400	3700	1
Total			48

Type 07

T7

Model	Width	Height	Count
T7	490	3500	1
T7	490	3700	1
T7	625	3500	4
T7	625	3700	1
T7	765	3500	7
T7	765	3700	3
T7	795	3500	2
T7	795	3700	1
T7	810	3500	2
T7	810	3700	1
Total			25

Type 06

T6

Model	Width	Height	Count
T6	425	3500	6
T6	425	3700	5
Total			11

Type 03

T3D

Model	Width	Depth	Height	Count
T3D	750	300	3500	28
T3D	750	300	3700	14
T3D	750	400	3500	8
T3D	750	400	3700	3
Total				51

Type 03

T3C

Model	Width	Depth	Height	Count
T3C	1500	300	3500	11
T3C	1500	300	3700	13
T3C	1500	400	3500	1
T3C	1500	400	3700	1
Total				26

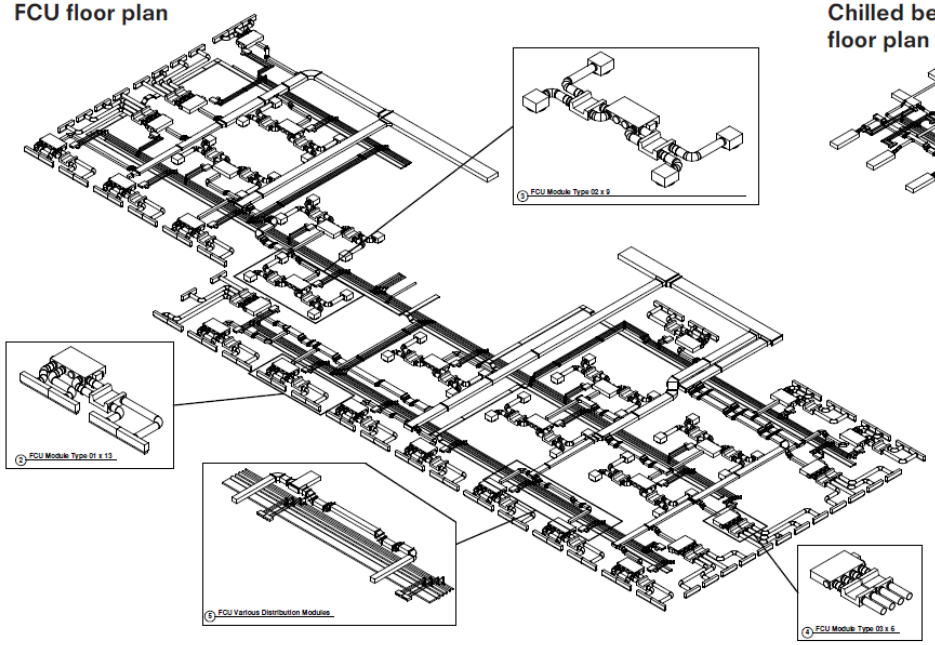
Type 03

T3B

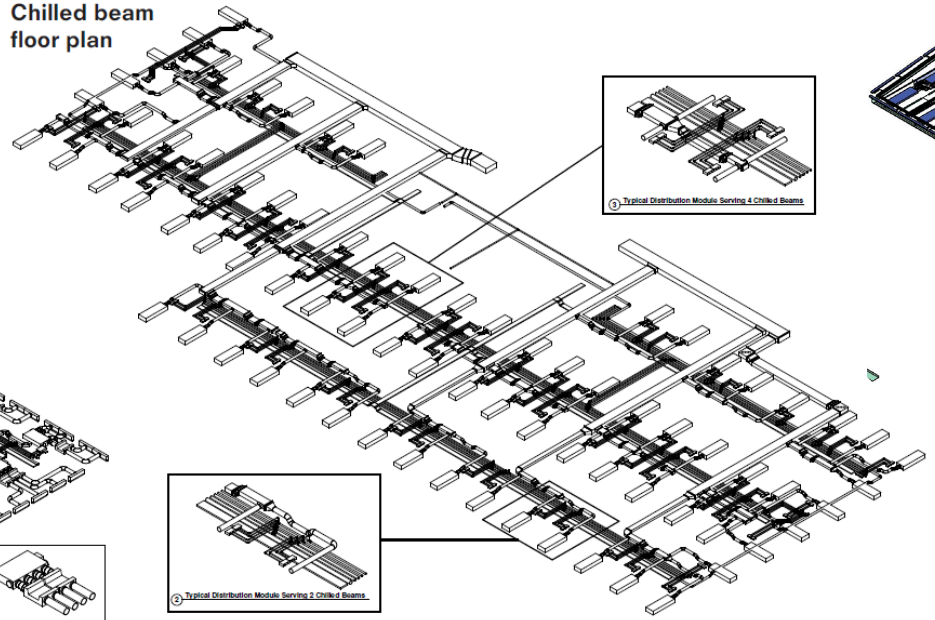
Model	Width	Depth	Height	Count
T3B	3000	300	3500	33
T3B	3000	300	3700	60
T3B	3000	400	3500	22
T3B	3000	400	3700	22
Total				157

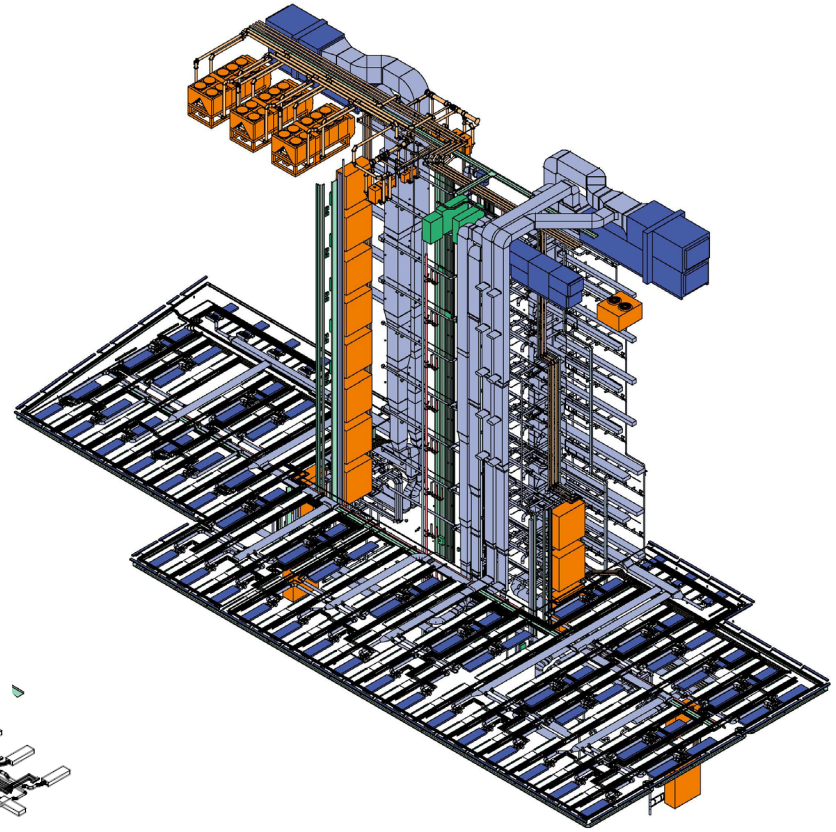
MEP

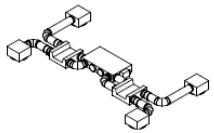
FCU floor plan



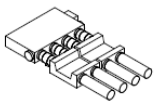
Chilled beam floor plan



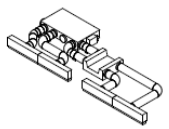




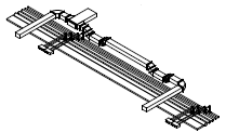
FCU module type 01



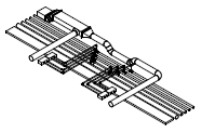
FCU module type 02



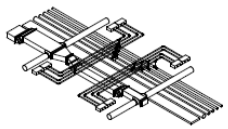
FCU module type 03



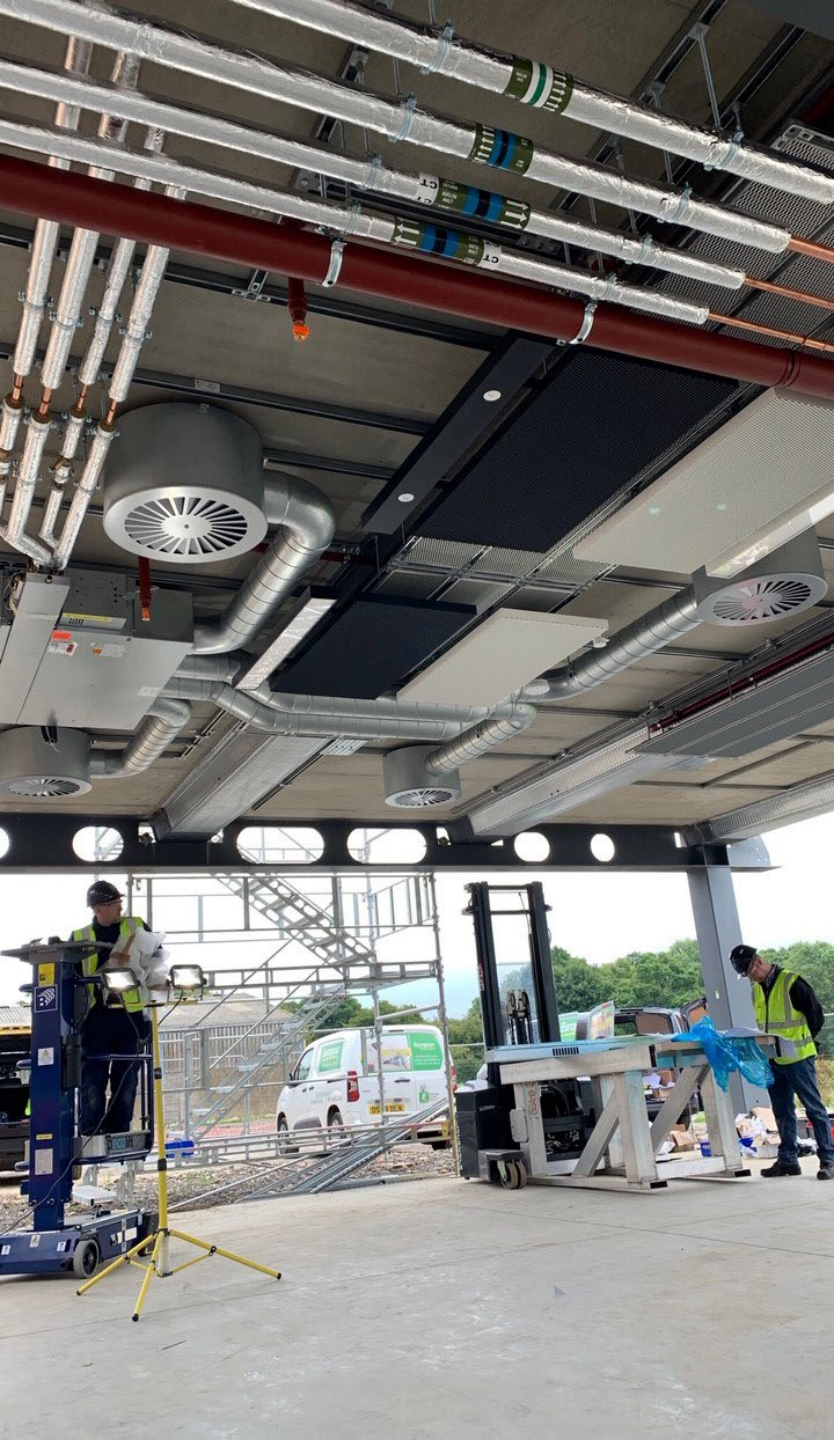
FCU various distribution modules

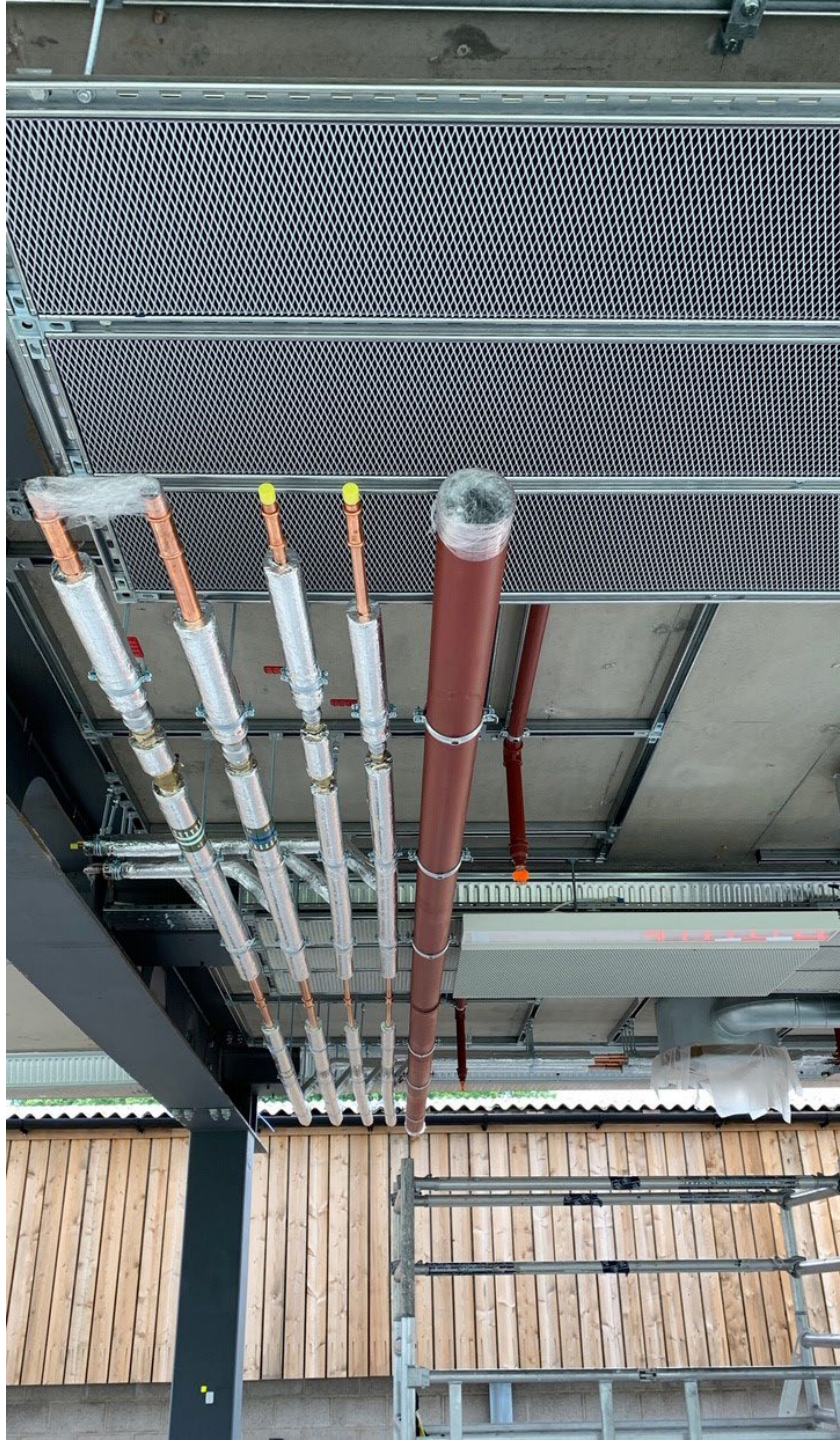


Typical distribution module serving 2 no. chilled beams



Typical distribution module serving 4 no. chilled beams





Chain reaction of benefit