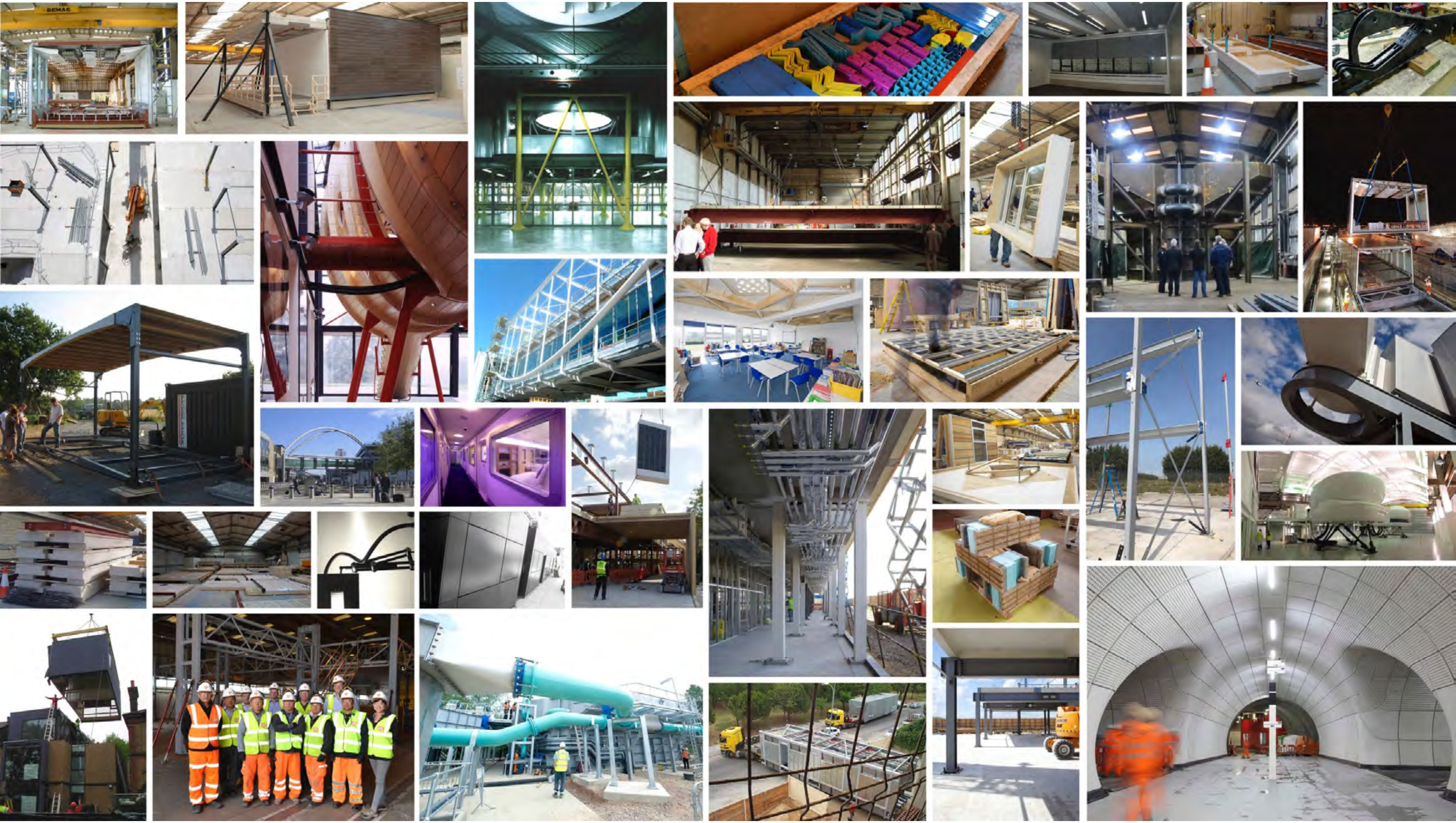
Automated design + delivery

A Platform approach to DfMA

Bryden Wood

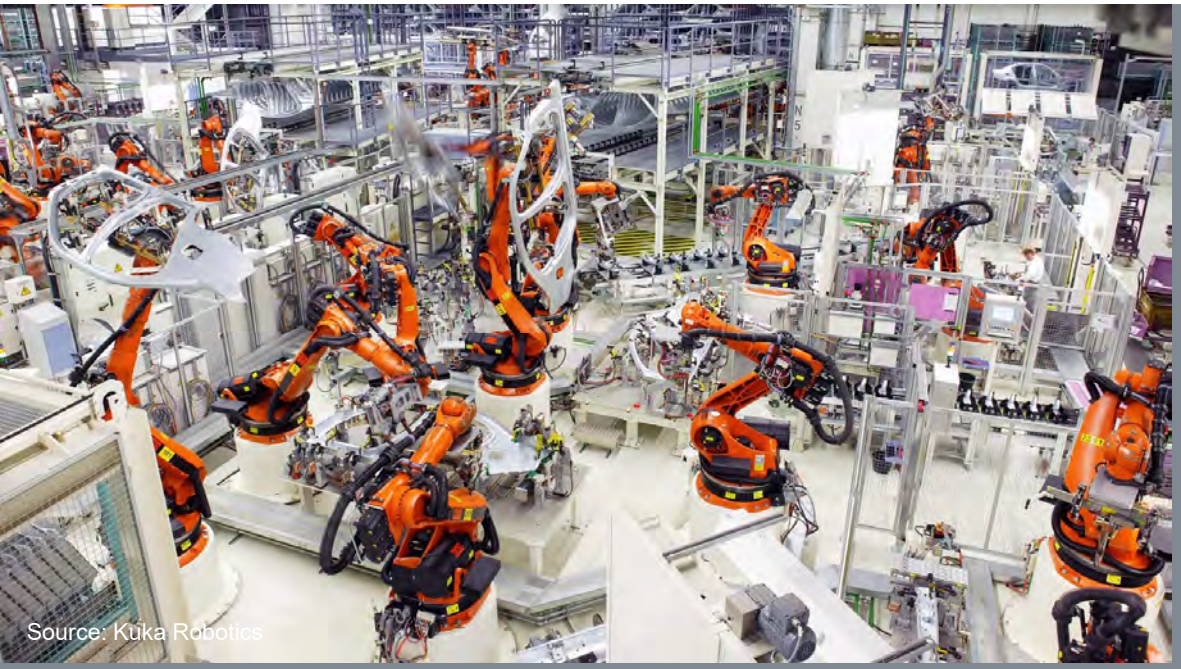
Buildoffsite Direction Group
3rd September 2019


DEMAG

2.5 billion

more people will live in cities by 2050

Source: United Nations Department of Economic and Social Affairs



Source: Kuka Robotics

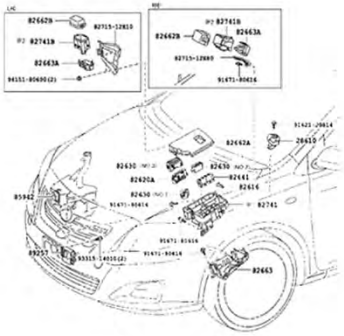
Source: Taylor Farms

Source: MIT Technology Review

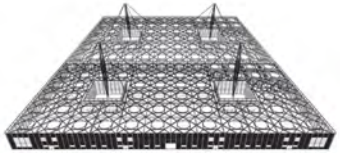
Source: MaRS Discovery District

Source: Getty images

Platforms bridge the gap between manufacturing and construction

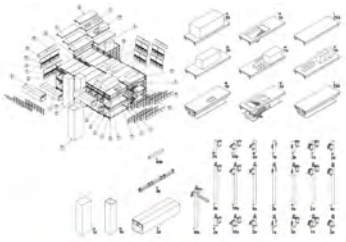
Component	Platform	Outcome
 Engine block	 Chassis	 Car
 Shipping container	 Global freight infrastructure	Low cost, reliable global trade + supply chains
Uber	iPhone	Peer-to-peer ride sharing, food delivery and transportation network

Platforms combine design, manufacture, and procurement principles holistically to ensure a **greater degree of rationalisation and integration**



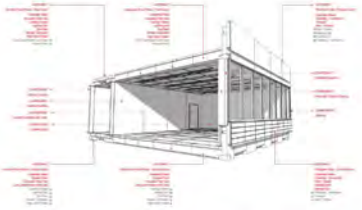
1995 - ongoing
Igus GmbH

2004
BAA Pier segregation product



2007 - 2009
GSK 'New Ways'

2008 - 2014
EcoCanopy Schools



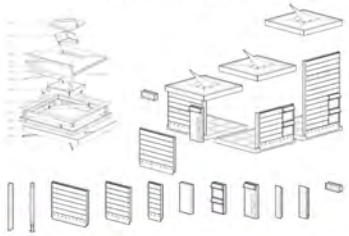
2009
Herts BSF programme

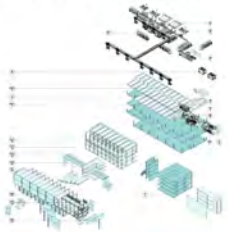
2009 - ongoing
Circle Hospitals

2015 - ongoing
GSK 'Factory in a Box'

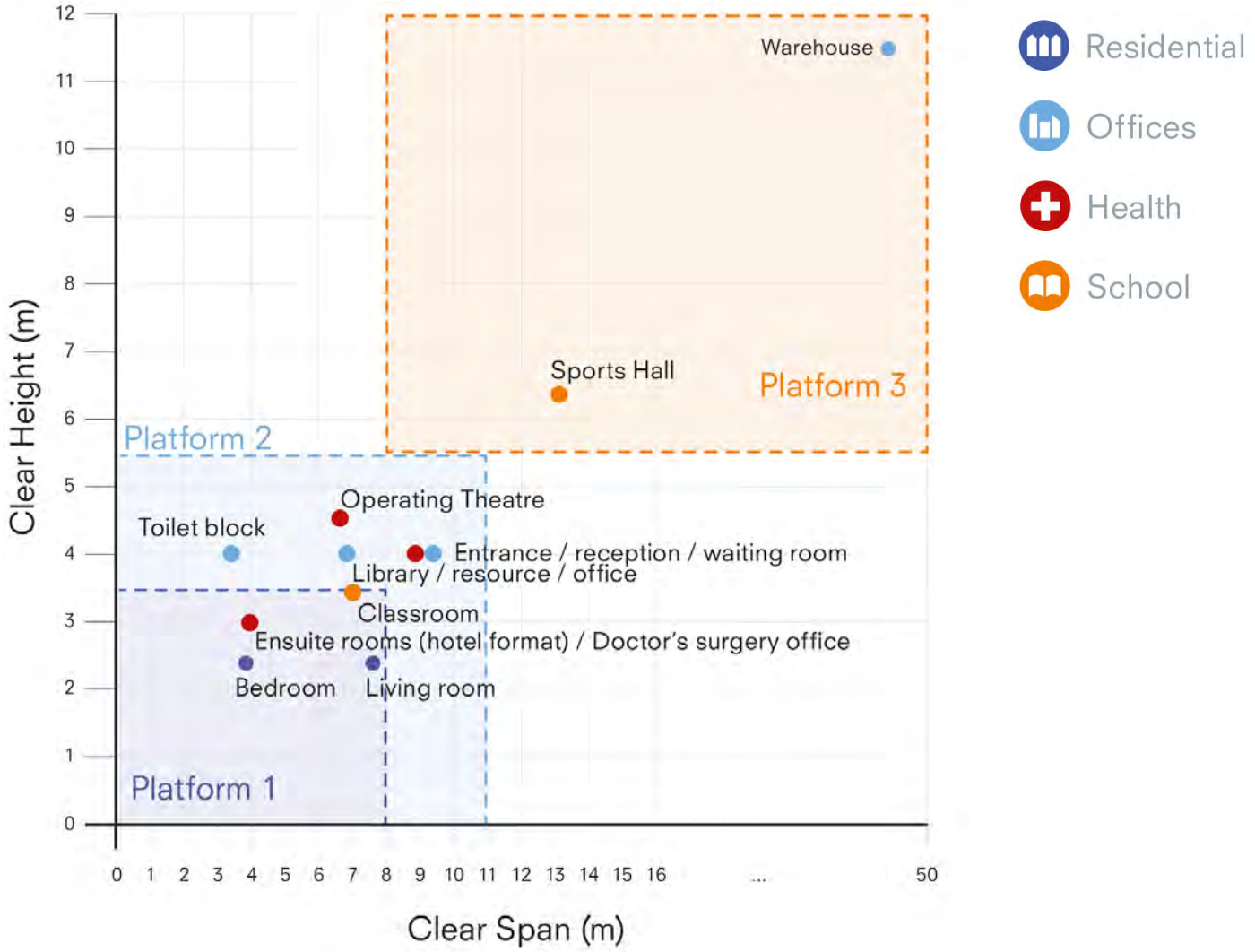
2012 - 2014
Gutenborg, St. Petersburg

2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015

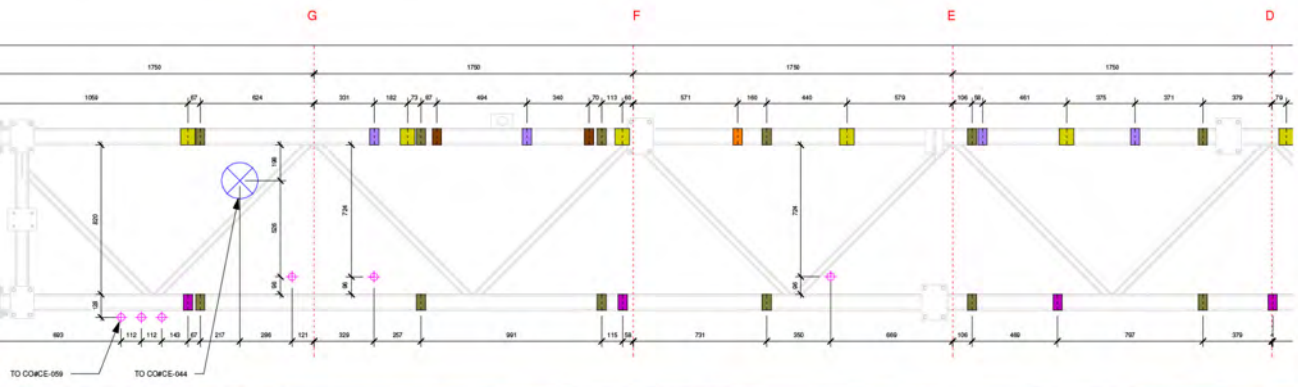




A Platform-based approach to construction



Platforms manifest themselves as a **‘kit of parts’** of pre-engineered components, assemblies and products that **go together in pre-defined ways**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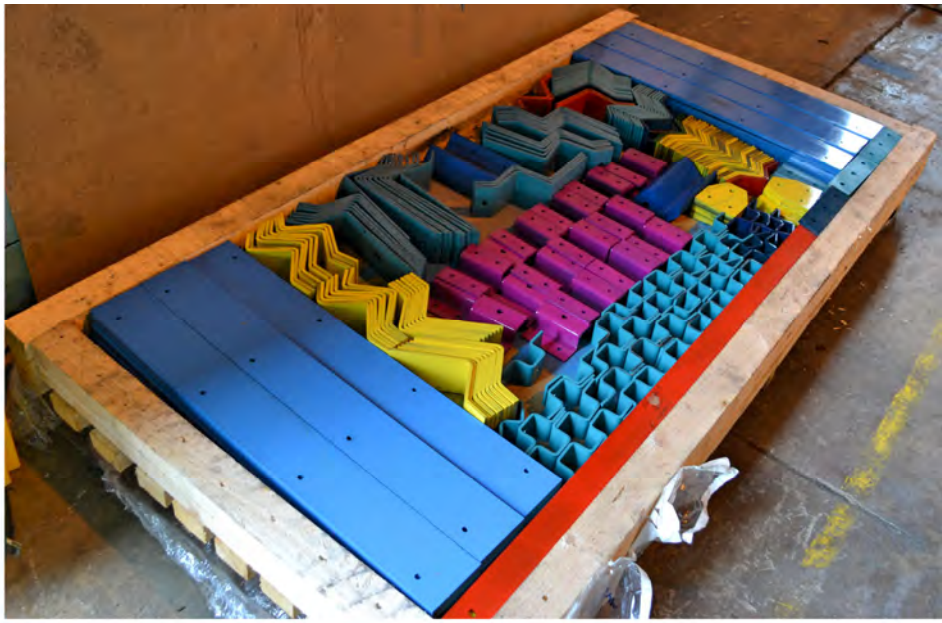
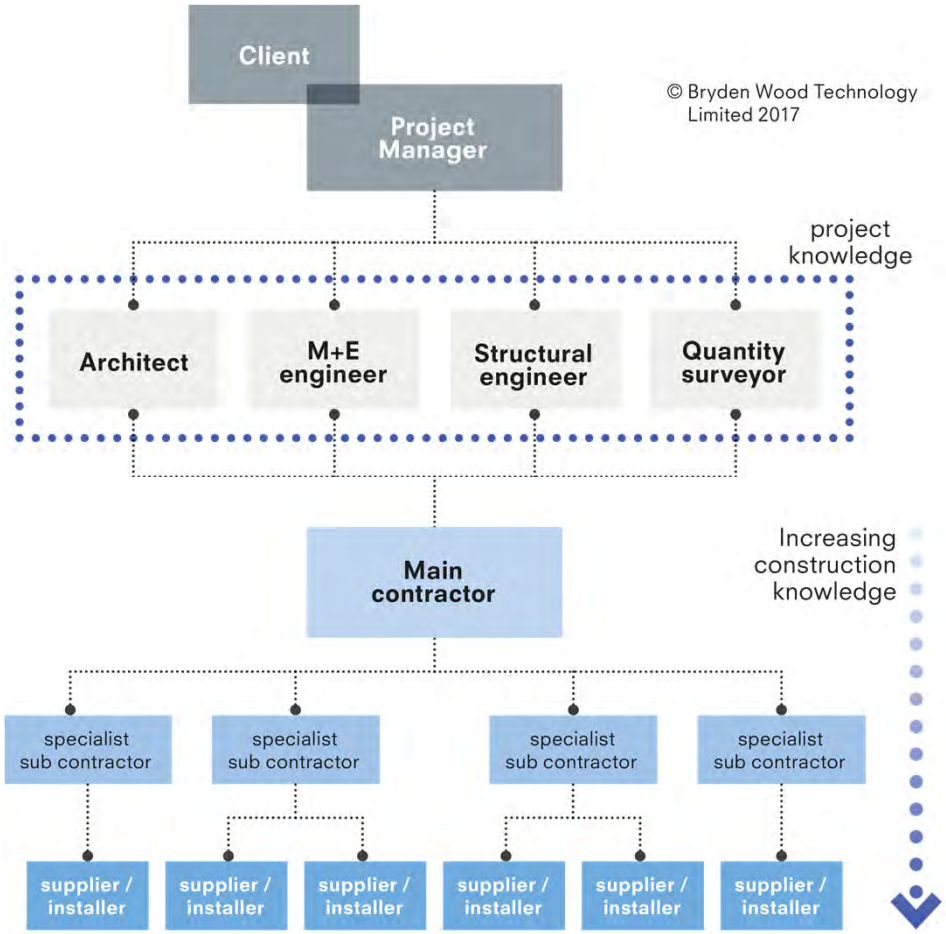


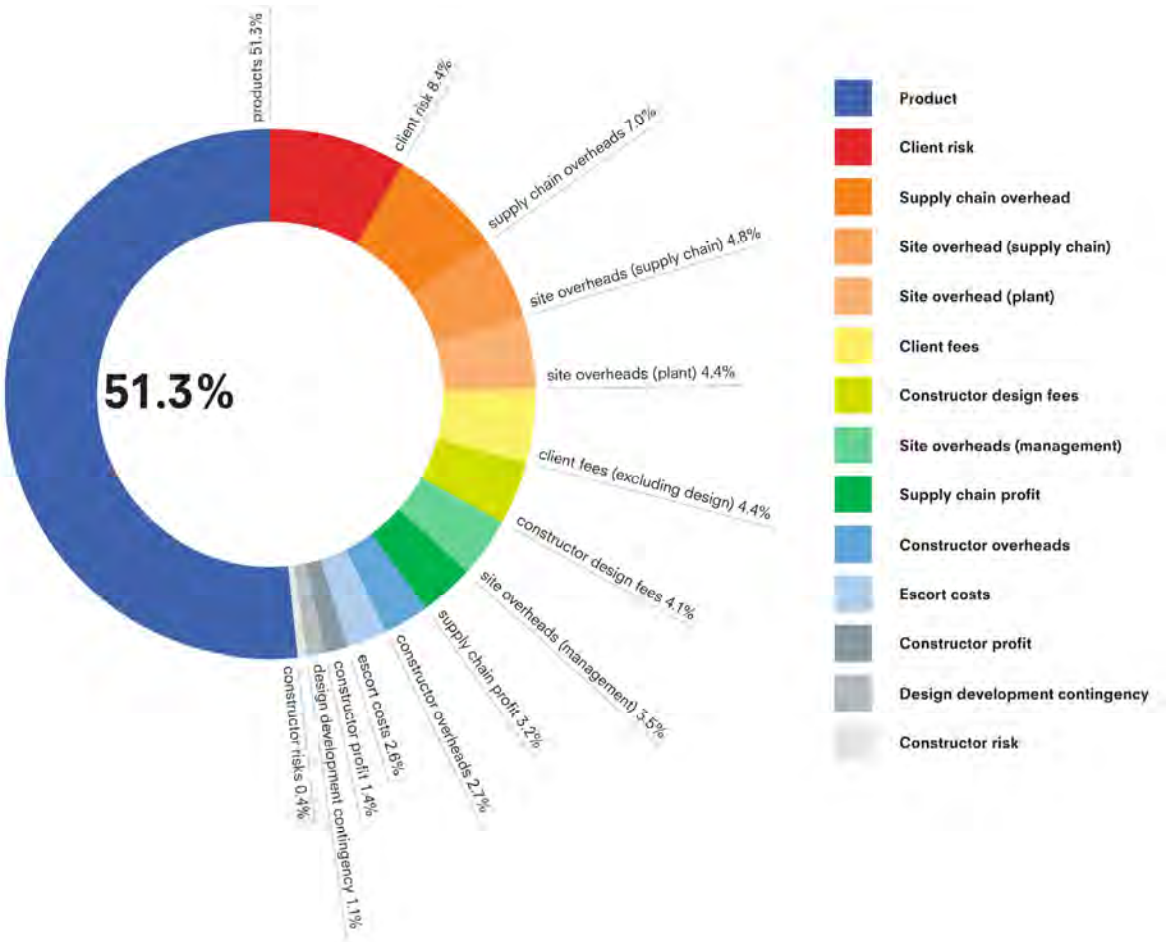

V420


gsk
10000192301

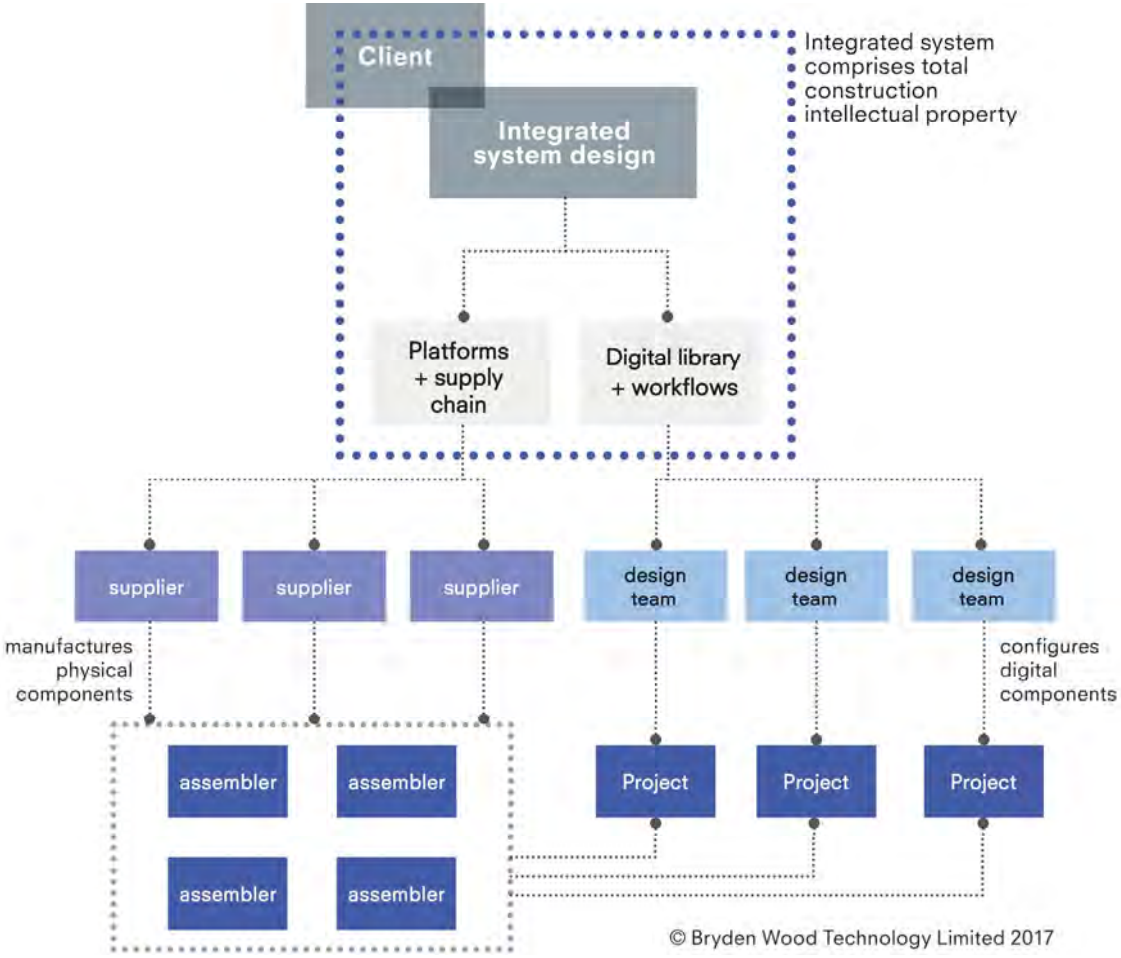
Benefits for **clients** and the **supply chain**

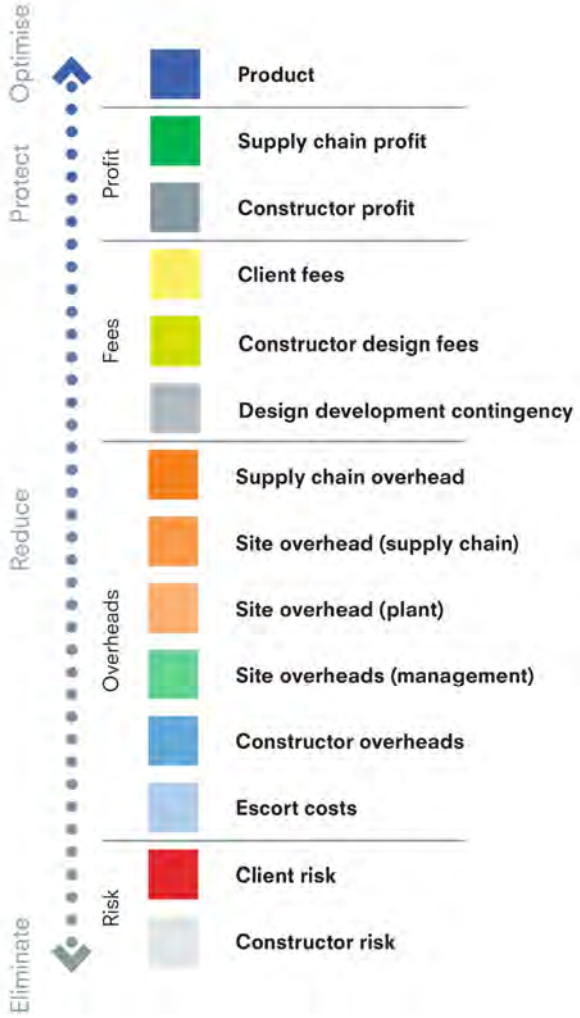
Current state





Platform enabled



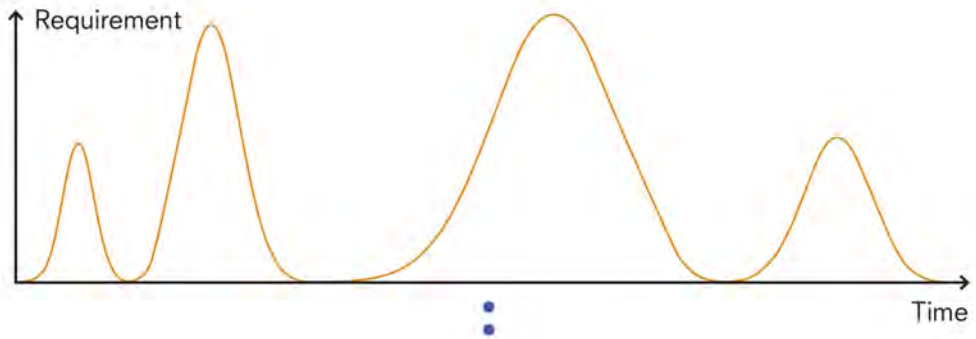


"Platforms could achieve a **33% reduction** in capital cost"

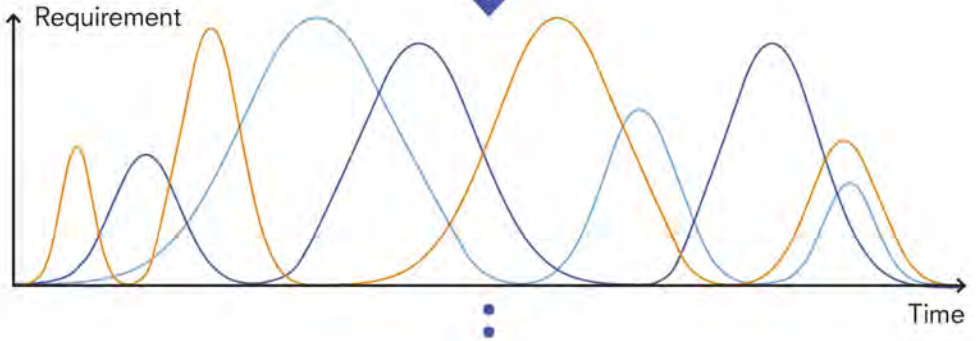
* This is a theoretical maximum saving under idealised conditions based on work to date, but we will work towards realising this.

Turner & Townsend

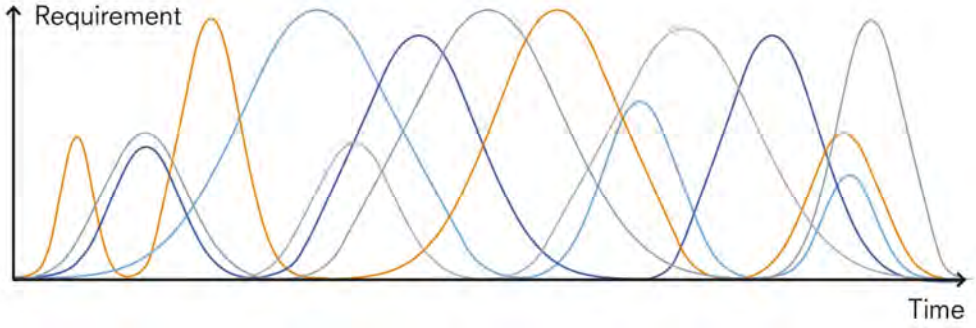
Requirements for single programme - often currently served by one factory

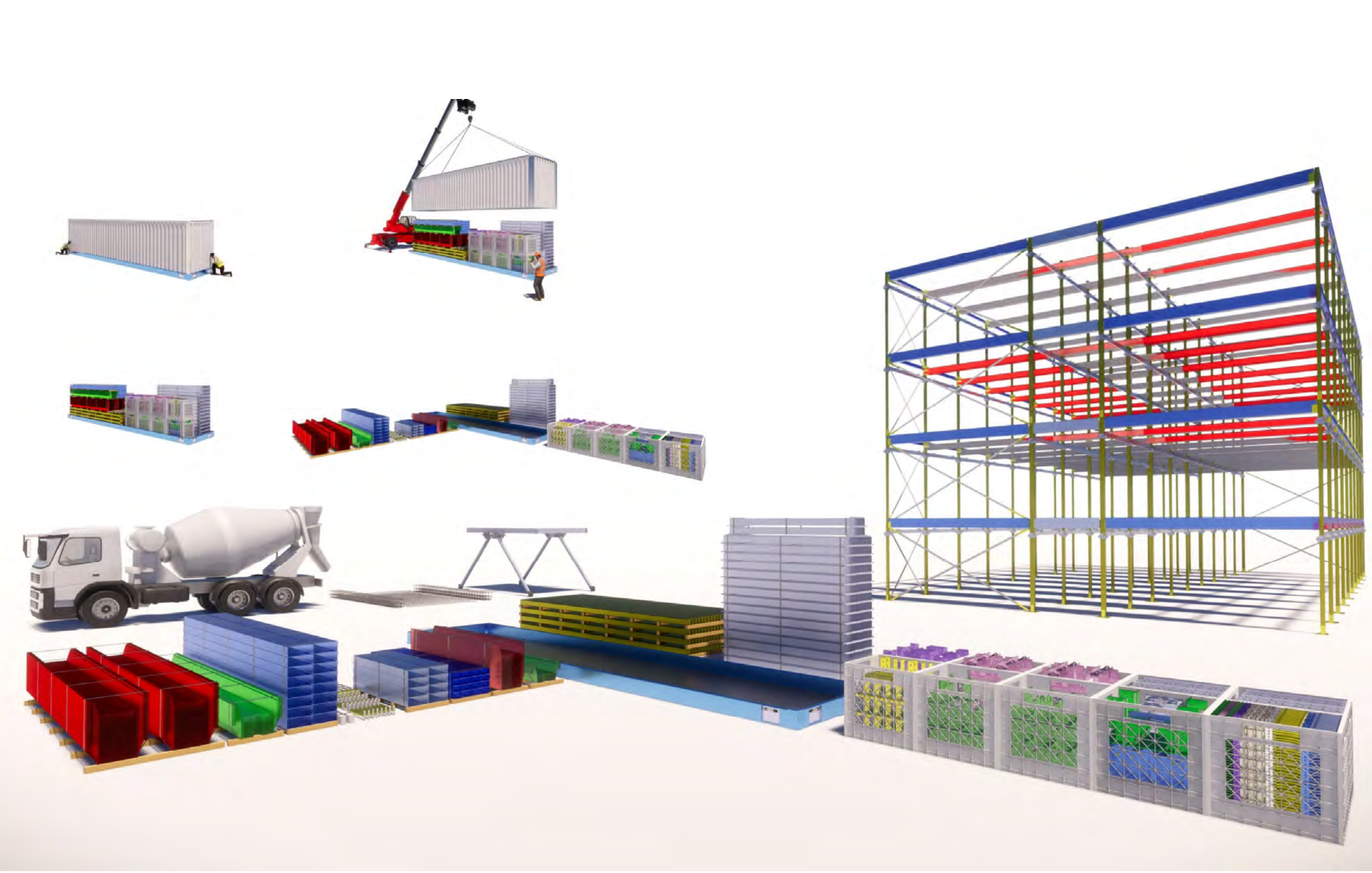


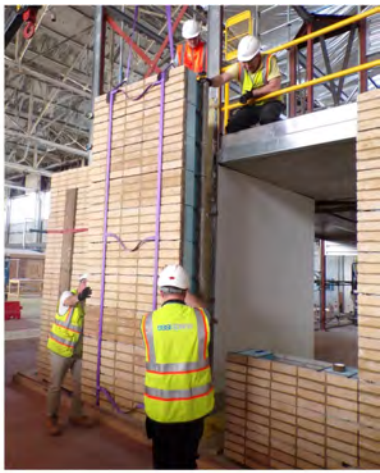
Aggregating the requirements for multiple programmes (through the use of shared components) starts to create a consistent pipeline



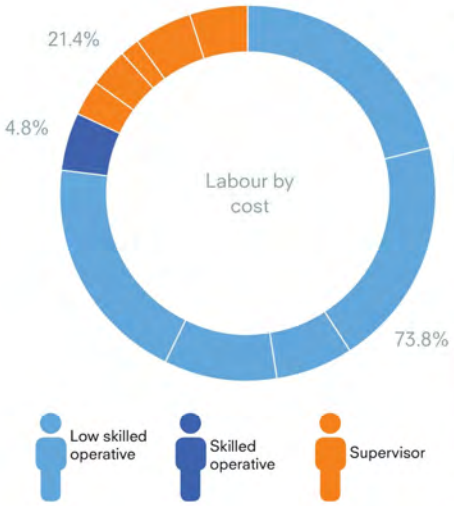
Eventually a level workload is created, which can be split across multiple facilities working at a known and predefined level of output

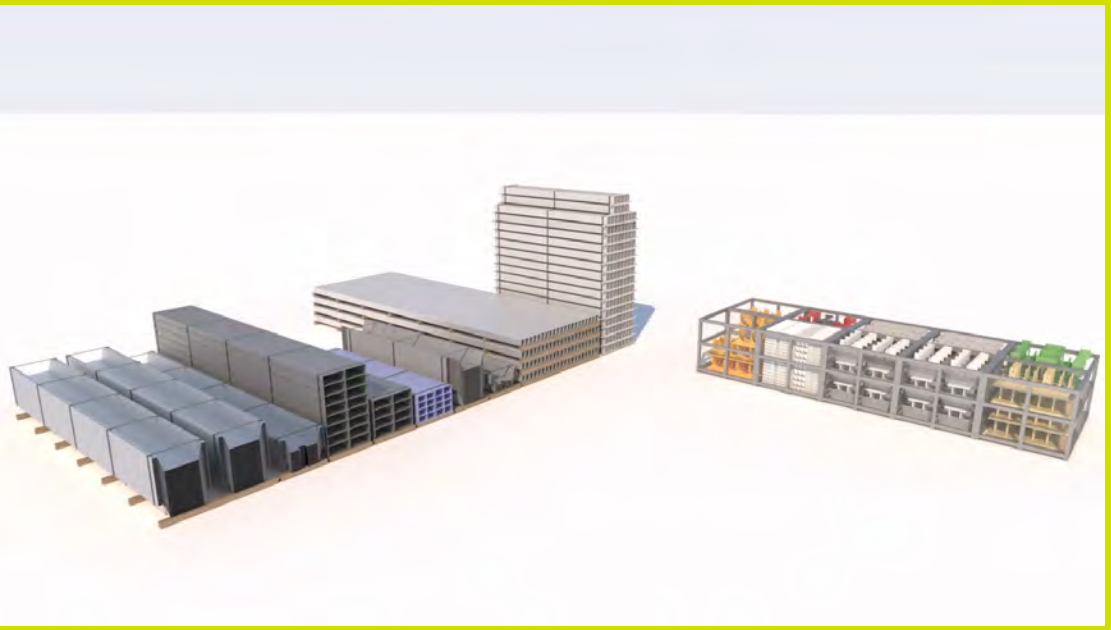






Prototyping facility





Potential for **wider application in the industry**

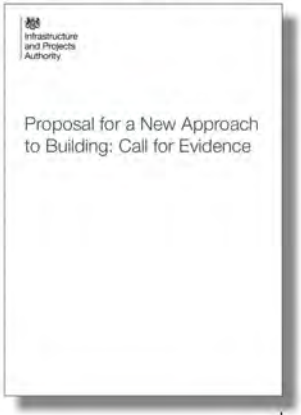
Delivery Platforms for Government Assets

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

Funding competition: Establishing a Core Innovation Hub to transform UK construction

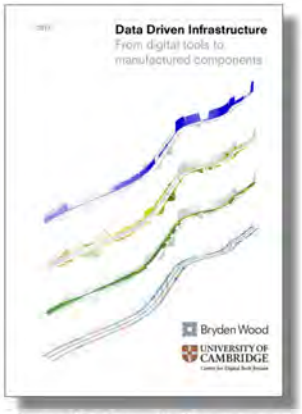
Off-site manufacture for construction: Building for change

Proposal for a New Approach to Building



May June July August September October November December January February March April May June July August September October November

2017 2018



Data Driven Infrastructure

Transforming Infrastructure Performance

Platforms: Bridging the gap between construction + manufacturing

Construction Sector Deal

CONSTRUCTION INNOVATION HUB

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

Infrastructure and Projects Authority

Our proposal: a Platform approach to Design for Manufacture and Assembly (P-DfMA)

A platform approach means we will use **digitally designed components across multiple types of asset and apply those components wherever possible**, minimising the need to design bespoke components.

For example, a single component could be used as part of a **school, hospital, prison building or station**.

The three principles are:

1. Design for manufacture;
2. Use a Platform approach;
3. Open for manufacture, use and procurement.

CONSTRUCTION INNOVATION HUB

PLATFORM DESIGN OPEN CALL OVERVIEW

What do we mean by 'Platforms'?

Whilst there is significant interest in Design for Manufacture and Assembly approaches and for using Modern Methods of Construction to deliver better buildings, there is some confusion as to what the term 'Platform' means in the context of buildings. Perhaps it could help to consider the approach taken in the automotive sector.

Modern cars are manufactured and assembled using a platform approach. This programme aims to implement a similar approach for buildings.

Cars have a chassis – a structural frame to which all other components are attached. Different chassis types are required for different car types (think large SUV and small hatchback), although many chassis types are similar for a particular type of car, e.g. family saloon.

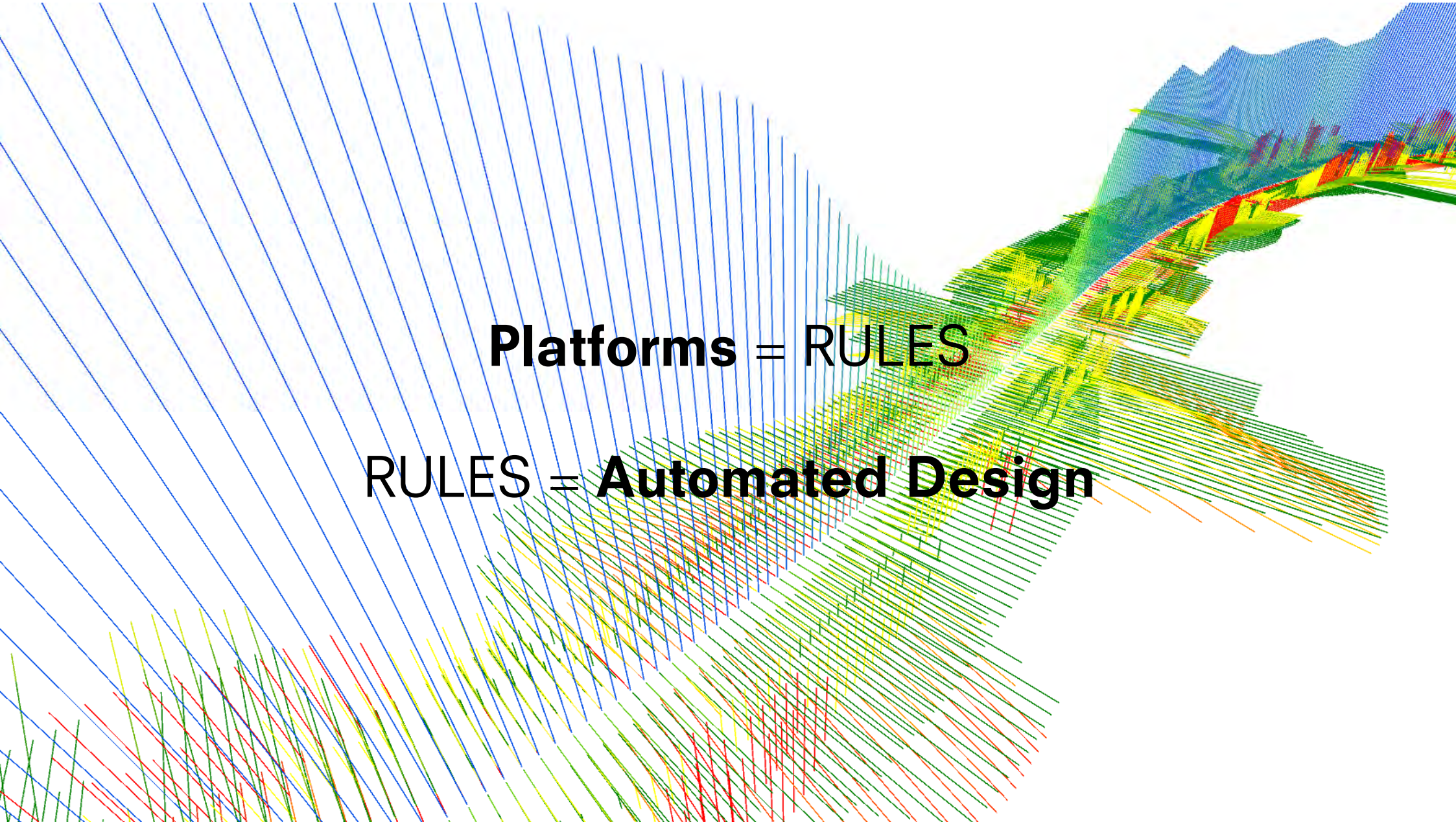
The car's components – engines, doors, wheels etc – are designed to connect to the chassis. Different components can be fixed to the same chassis. Equally components can also be designed and manufactured to fit to more than one chassis.

The chassis and individual components all comply with strict design, tolerance, quality and performance criteria. When assembled into the finished product – the car – the motor manufacturer warrants to the consumer and demonstrates to regulators that the completed product complies with all required safety and performance criteria,often backed up by testing, e.g. NCAP.

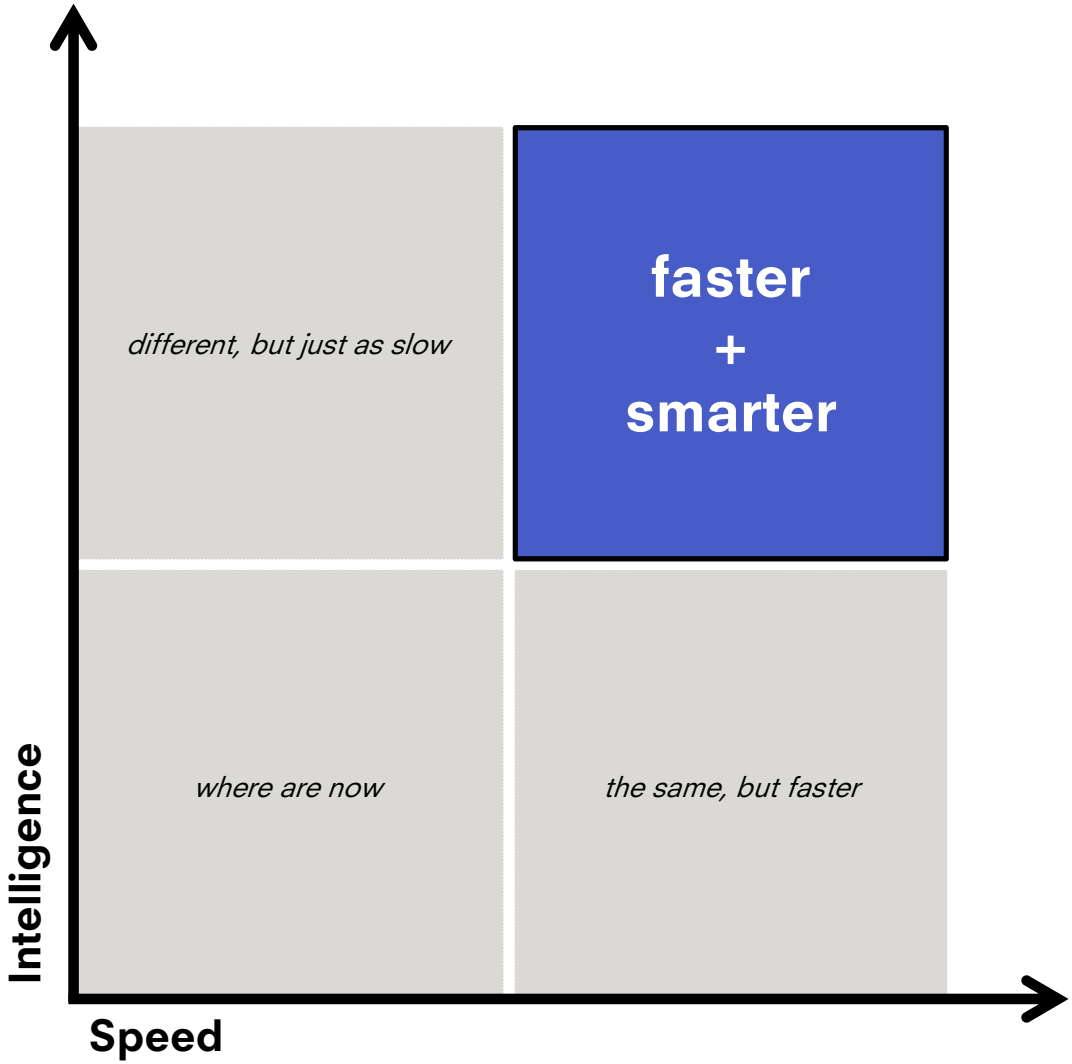
For the purposes of this programme we are going to test and develop these principles for a particular building type – a hypothetical school.

https://constructioninnovationhub.org.uk/platform-design-open-call/

Automated **design**

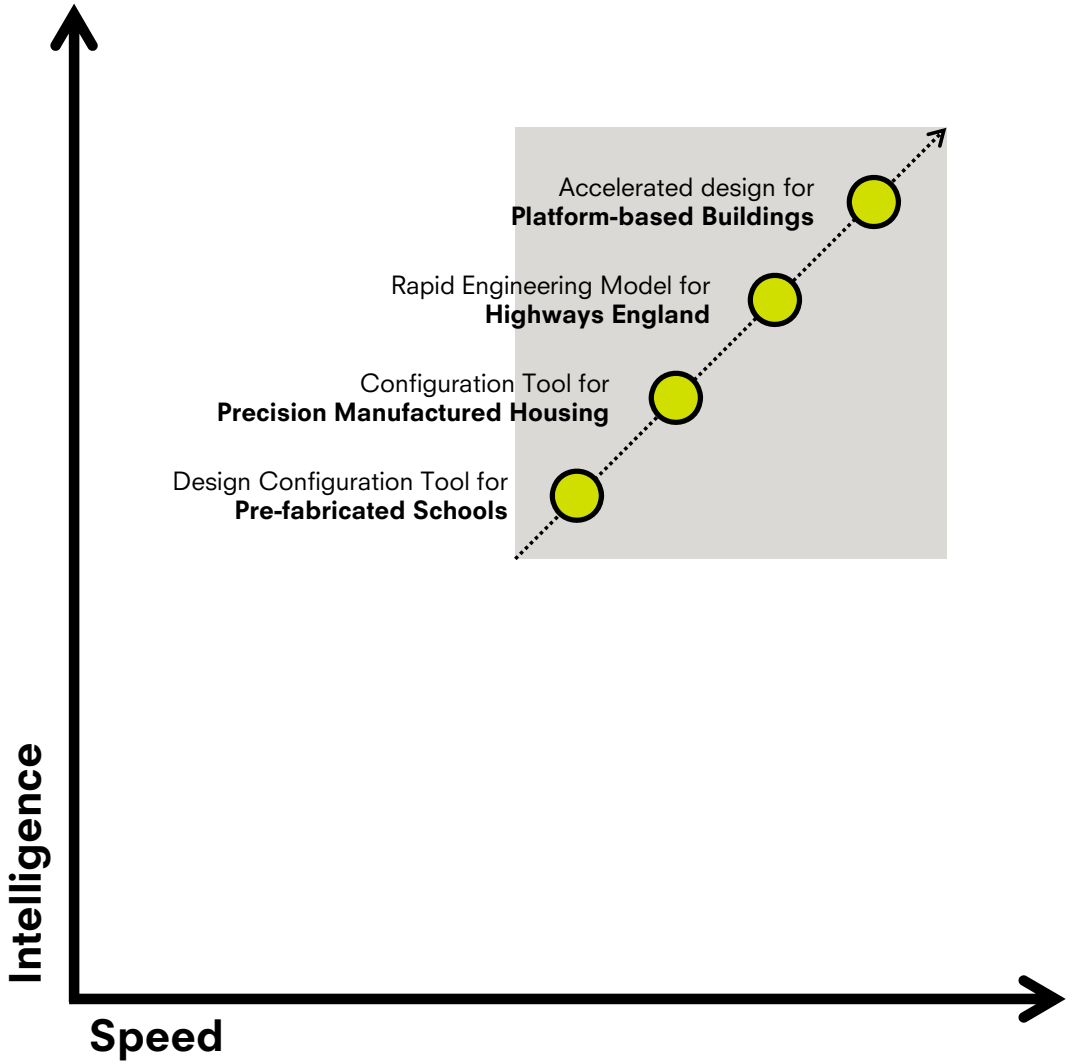

Platforms = RULES
RULES = **Automated Design**

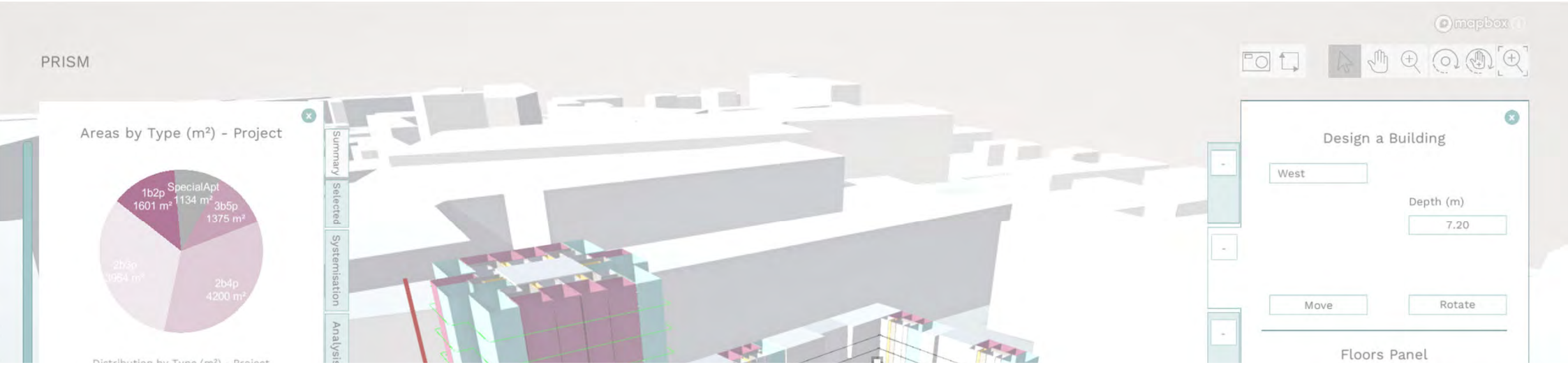
Automated Design =



Automated design

Towards a platforms approach

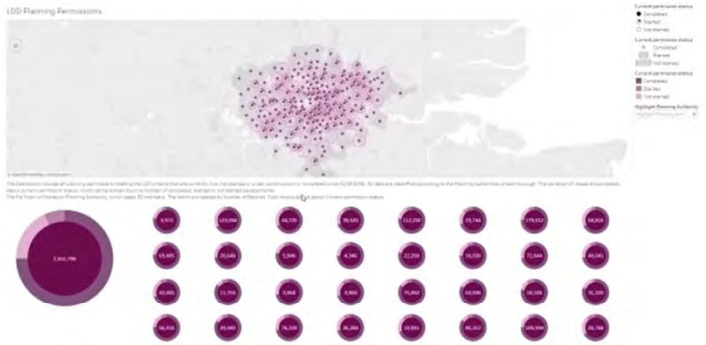


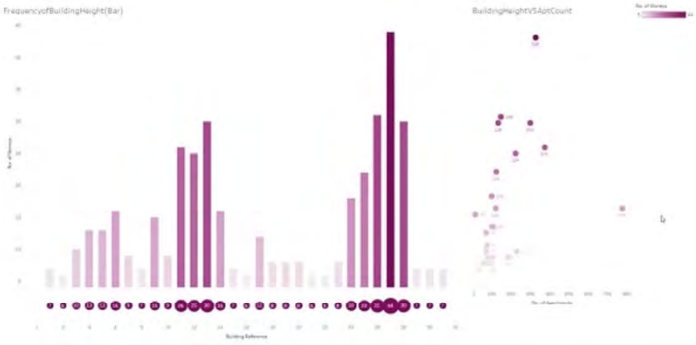


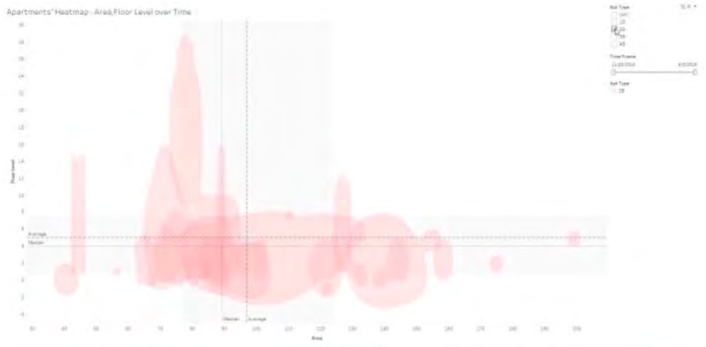
PRISM Design Configuration for **Precision Manufactured Homes**

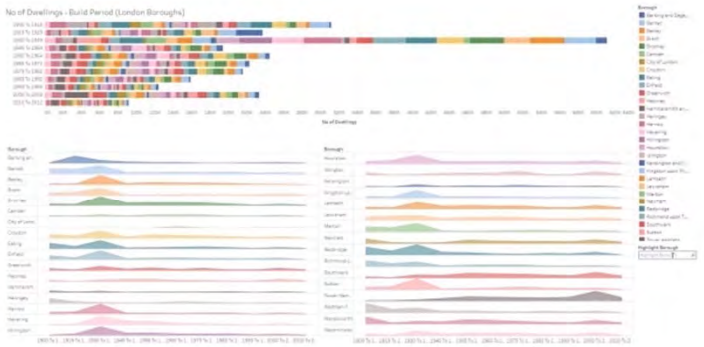
prism-app.io

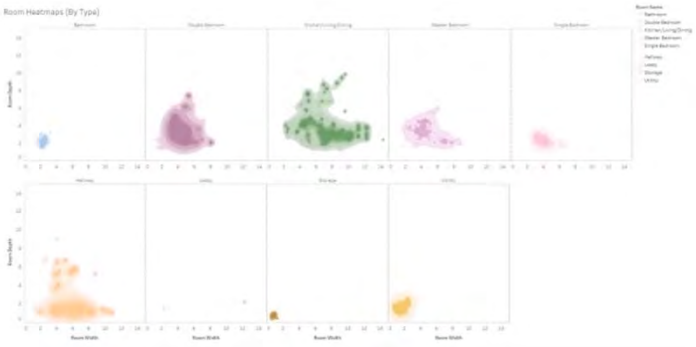
SUPPORTED BY
MAYOR OF LONDON







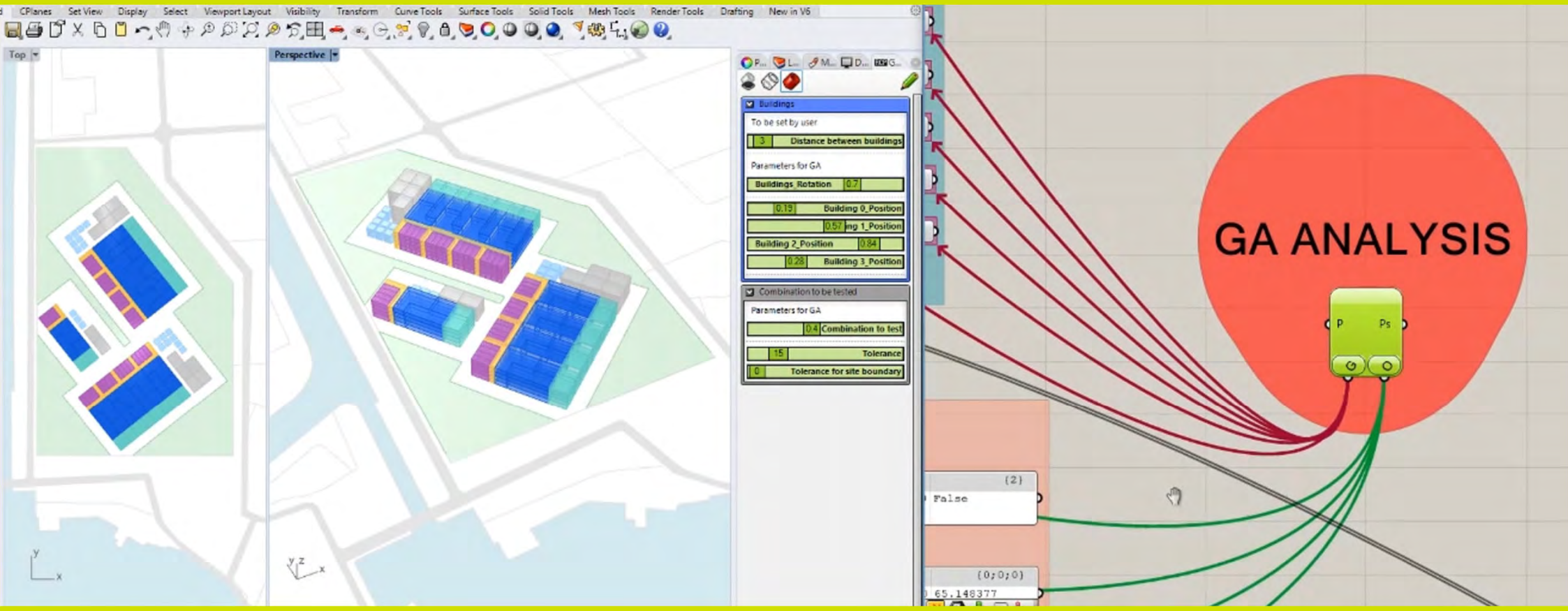




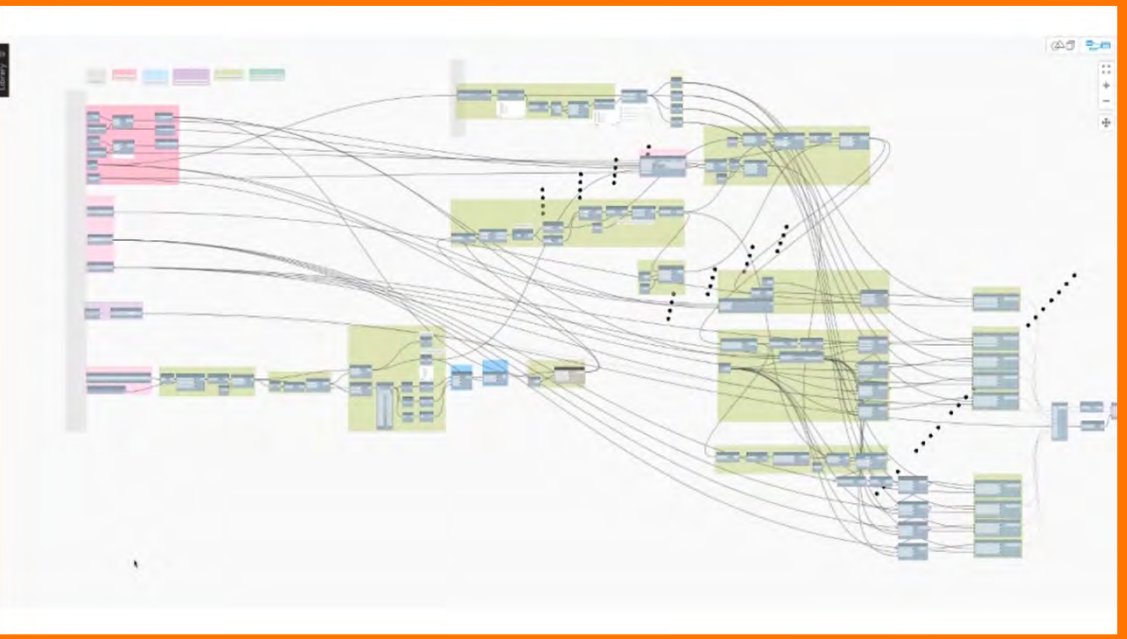
Interactive Dashboards

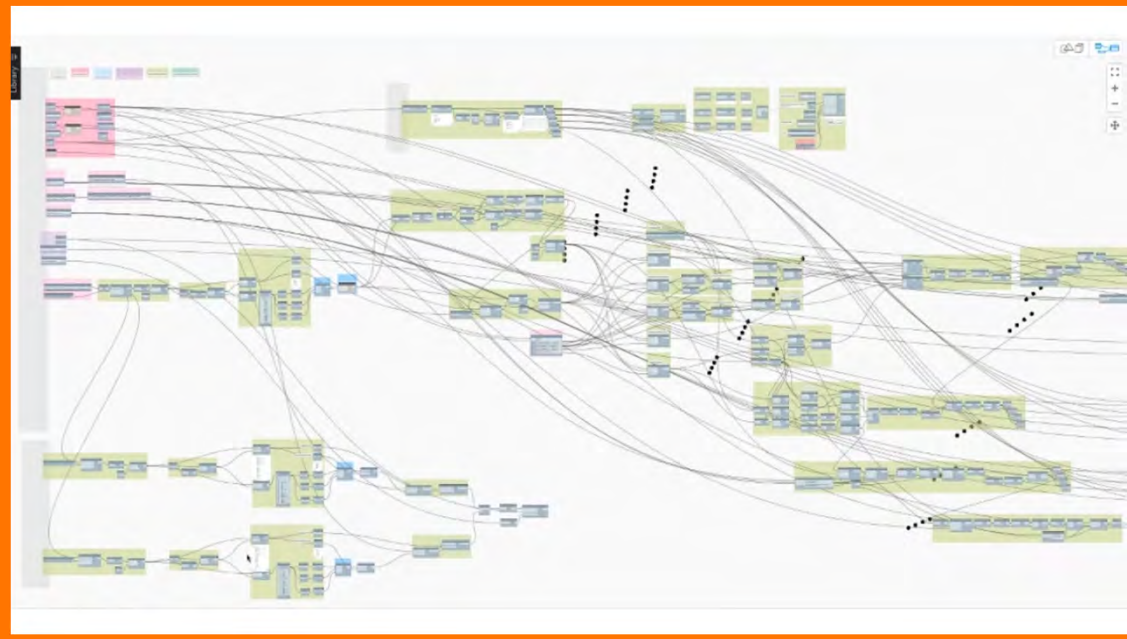
Apartment Parameters, Building Tenure Room Schedules


D.A.S.H
Apartment Areas for: West Building
SpecialApt 846 m²
3b5p 1660 m²
1b2p 4197 m²
Apartment Area Distribution
min
max
min
max
West Building
NIA: 10,068 m² / 108,371 ft²
NetToGross: 63.69%
GIA to GEA: Infinity%
Plant-Room Area: 790 m² / 8,507 ft²
Reception Area: 158 m² / 1,701 ft²
Rest Grd-Flr Area: 1,310 m² / 14,098 ft²
Number of Levels: 7
Total Height: 23.9 m
Total number of apts: 234
Net to Gross
64%
40%
80%
General
Selected
Manufacturing
Construction
Sun
Map Layers
Notifications
Mass Apt. Modifications
Resolve and Retain
Resolve Residuals
Individual Apt. Modifications
Apartment Type:
2b3p
Combine Adjacent
Resolve To All
Combine
Undo
Swap
Mirror Interior
Populate Apartments

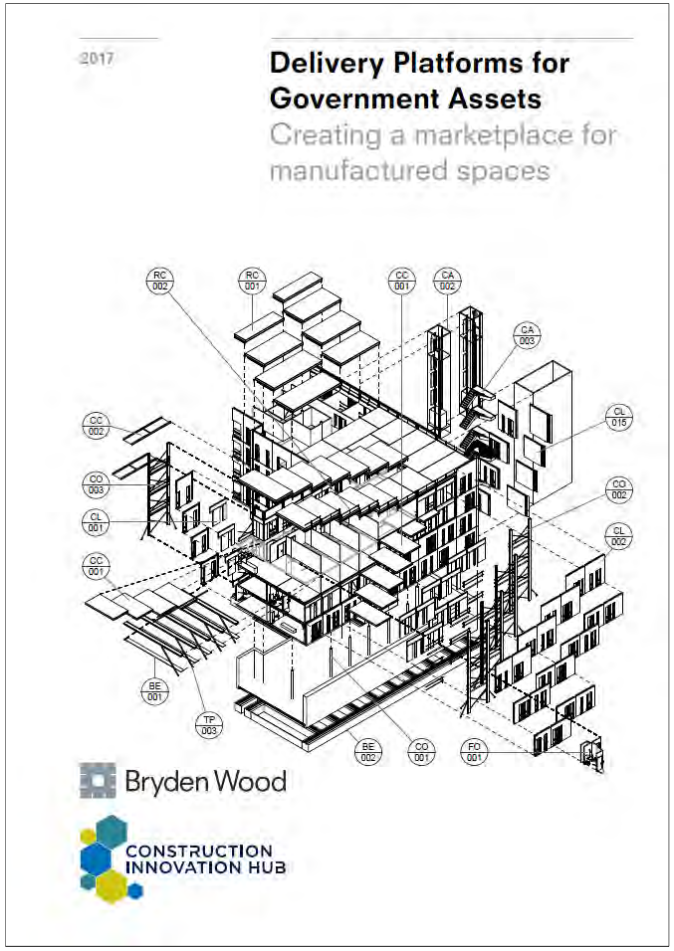


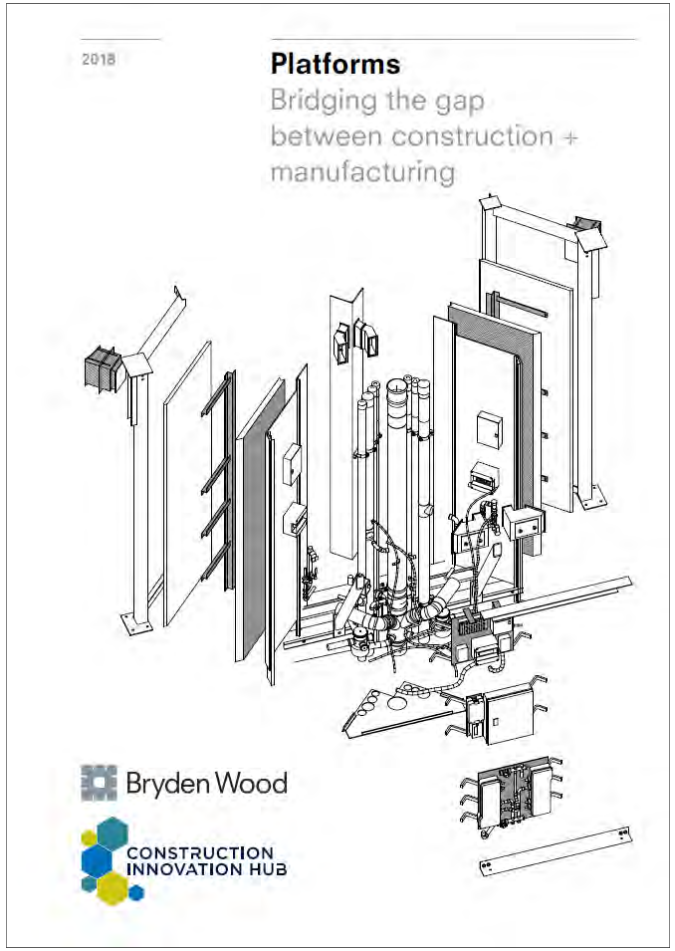
Optimise site layouts using a **genetic algorithm**





Digital assembly from a known **library of components**





brydenwood.co.uk/perspectives/178/

Thank you.

@Jaimie_BW
@BrydenWood

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