Automated Construction: Why manufacturing is the future of the sector

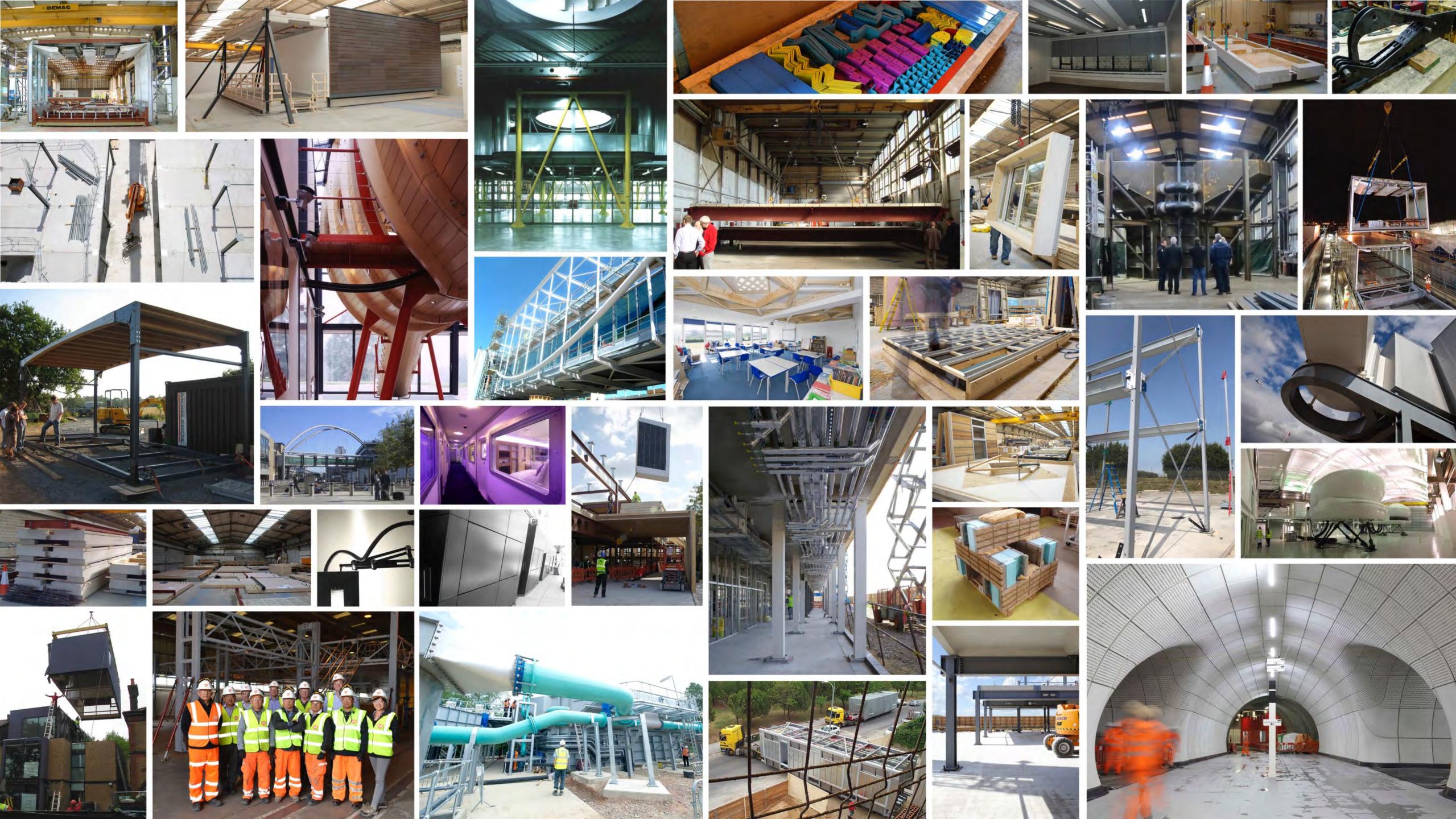
Jaimie Johnston

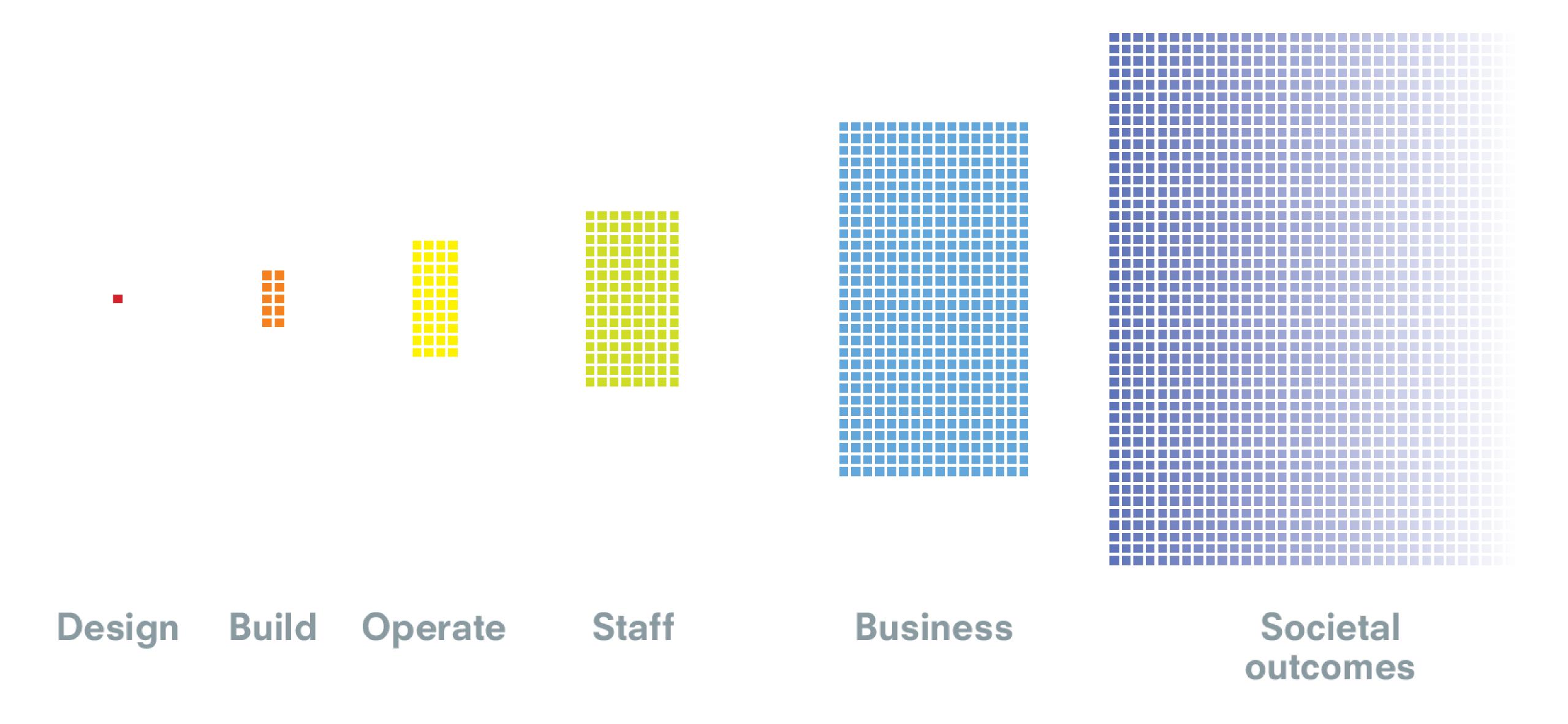
Head of Global Systems, Bryden Wood

@Jaimie_BW

CONNECT & CONSTRUCT SUMMIT

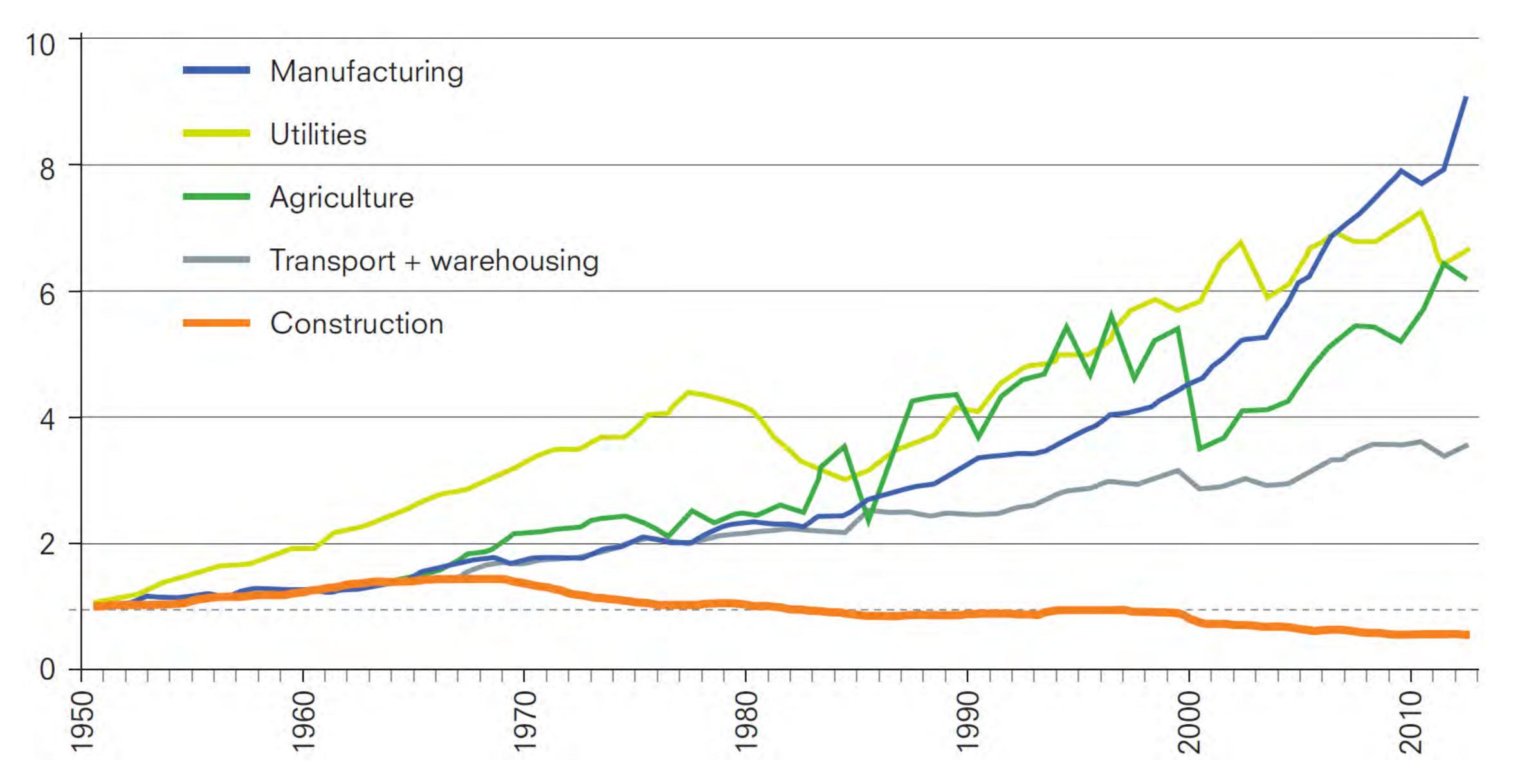


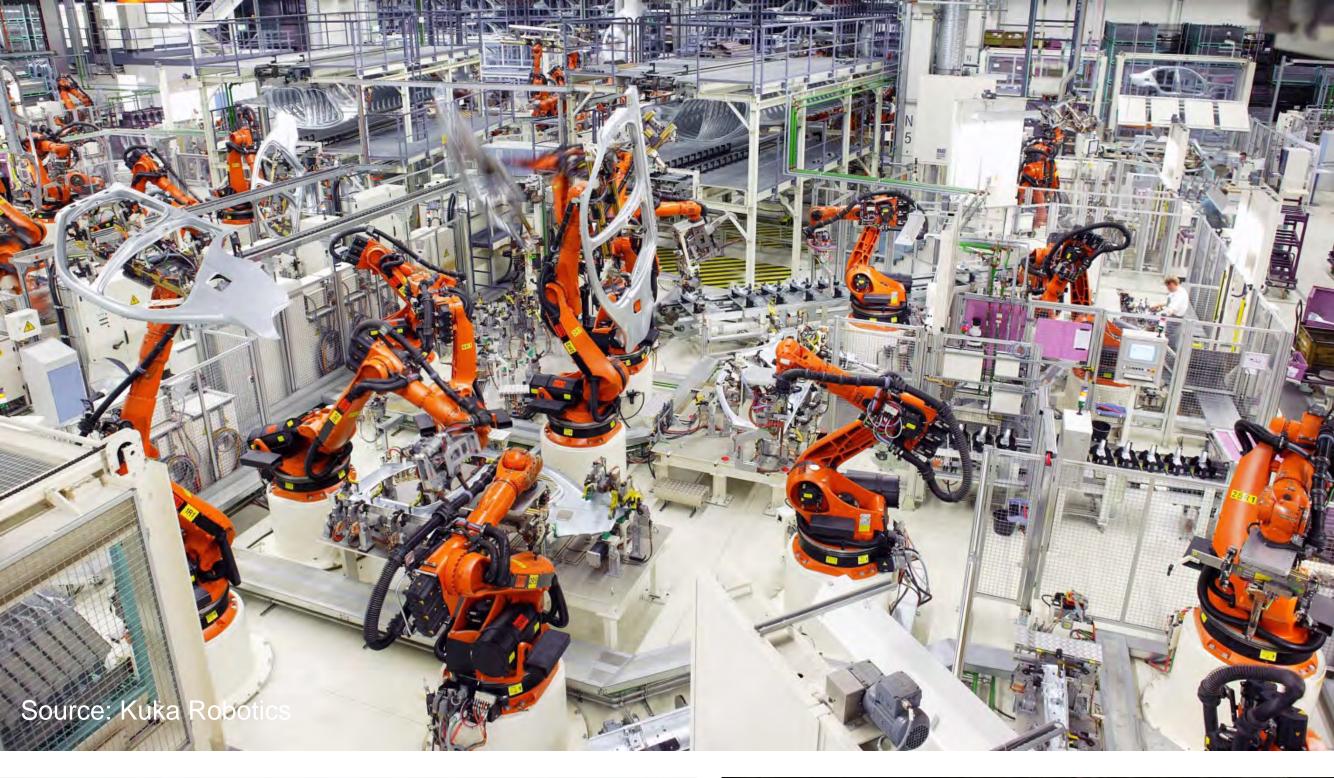




To improve societal outcomes through a better performing built environment

2.5 billon more people will live in cities by 2050

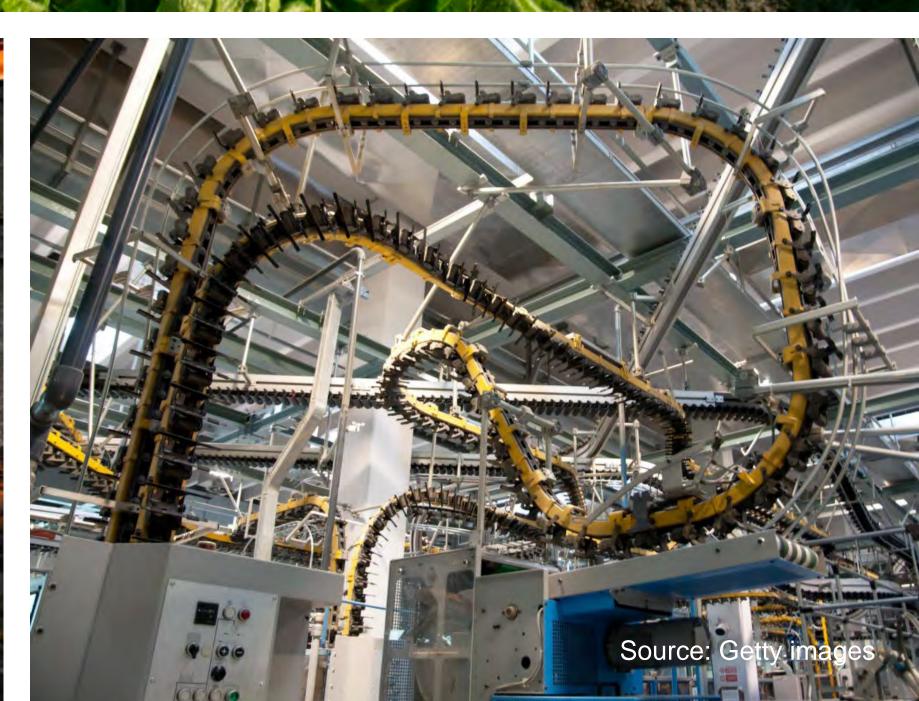




















1990's





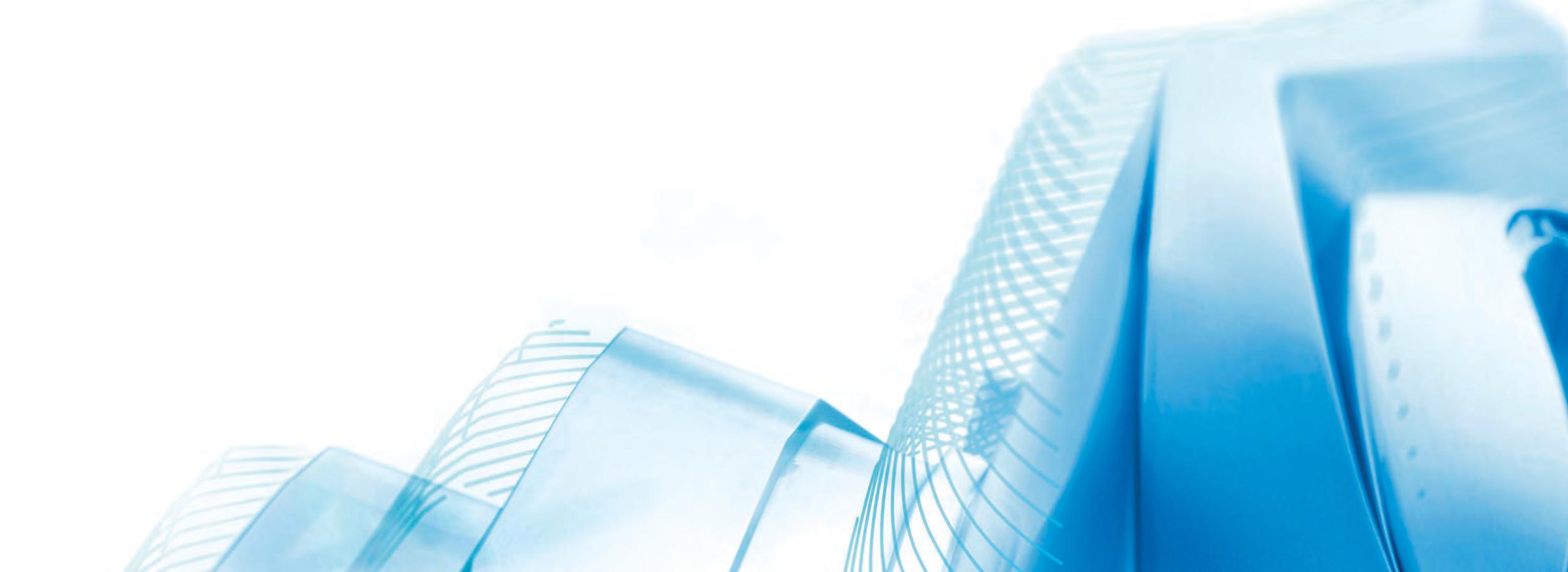


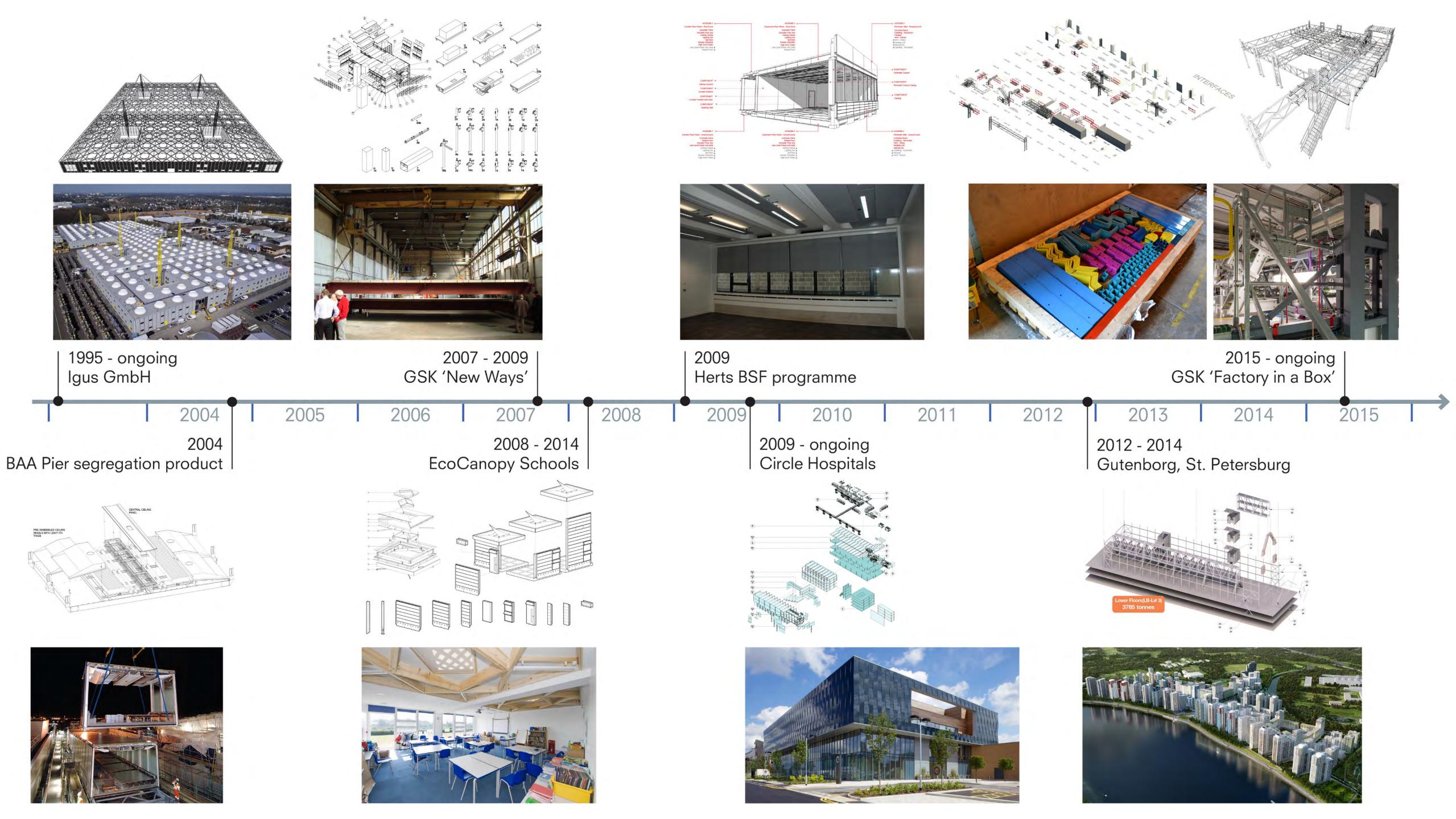


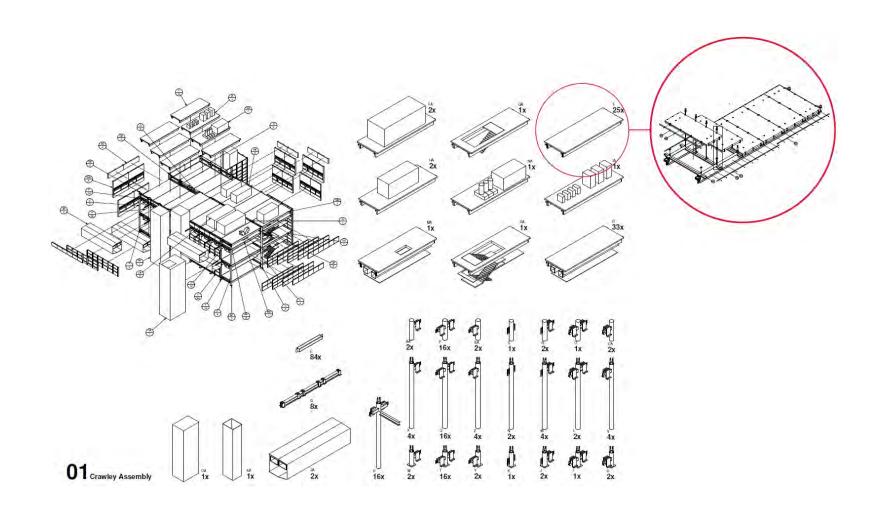


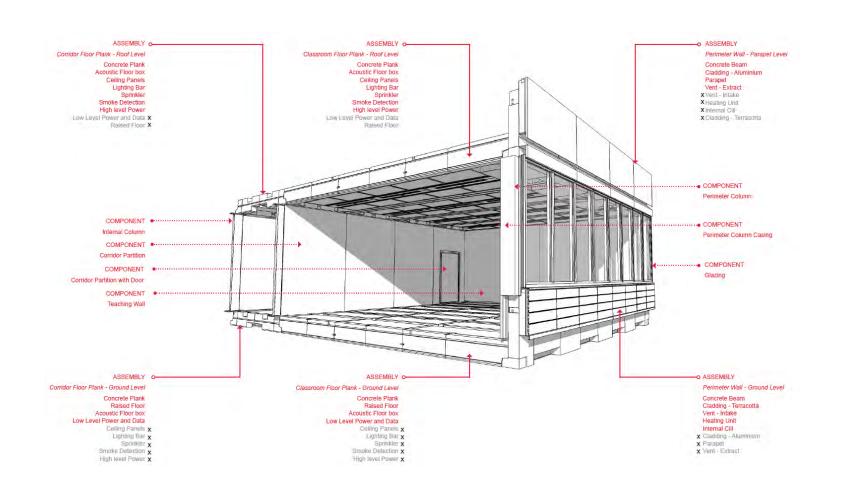
Founded 1998

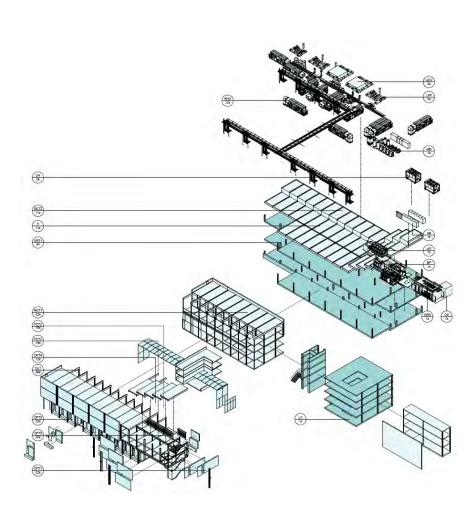
Leverage standardization without relinquishing individuality











GSK 'NewWays' 2007

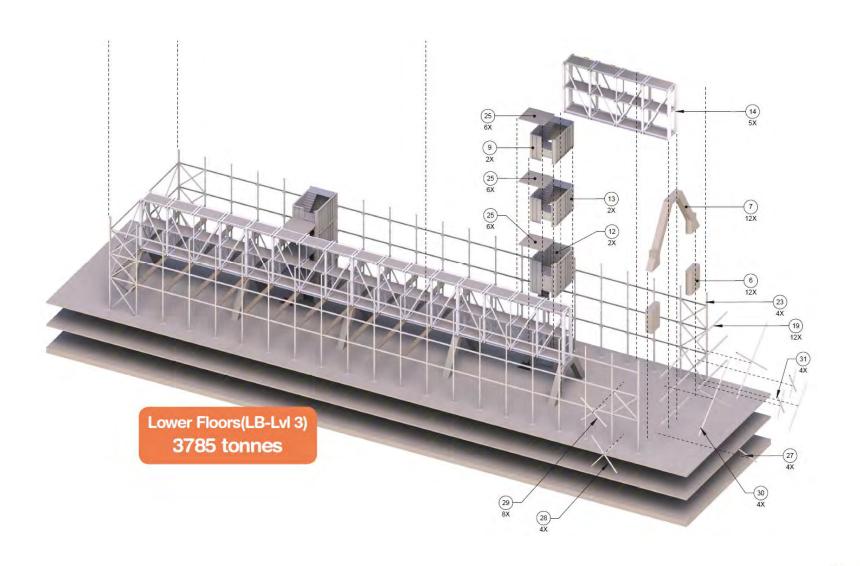


Schools for the Future 2009 • • • • • Circle Reading 2009





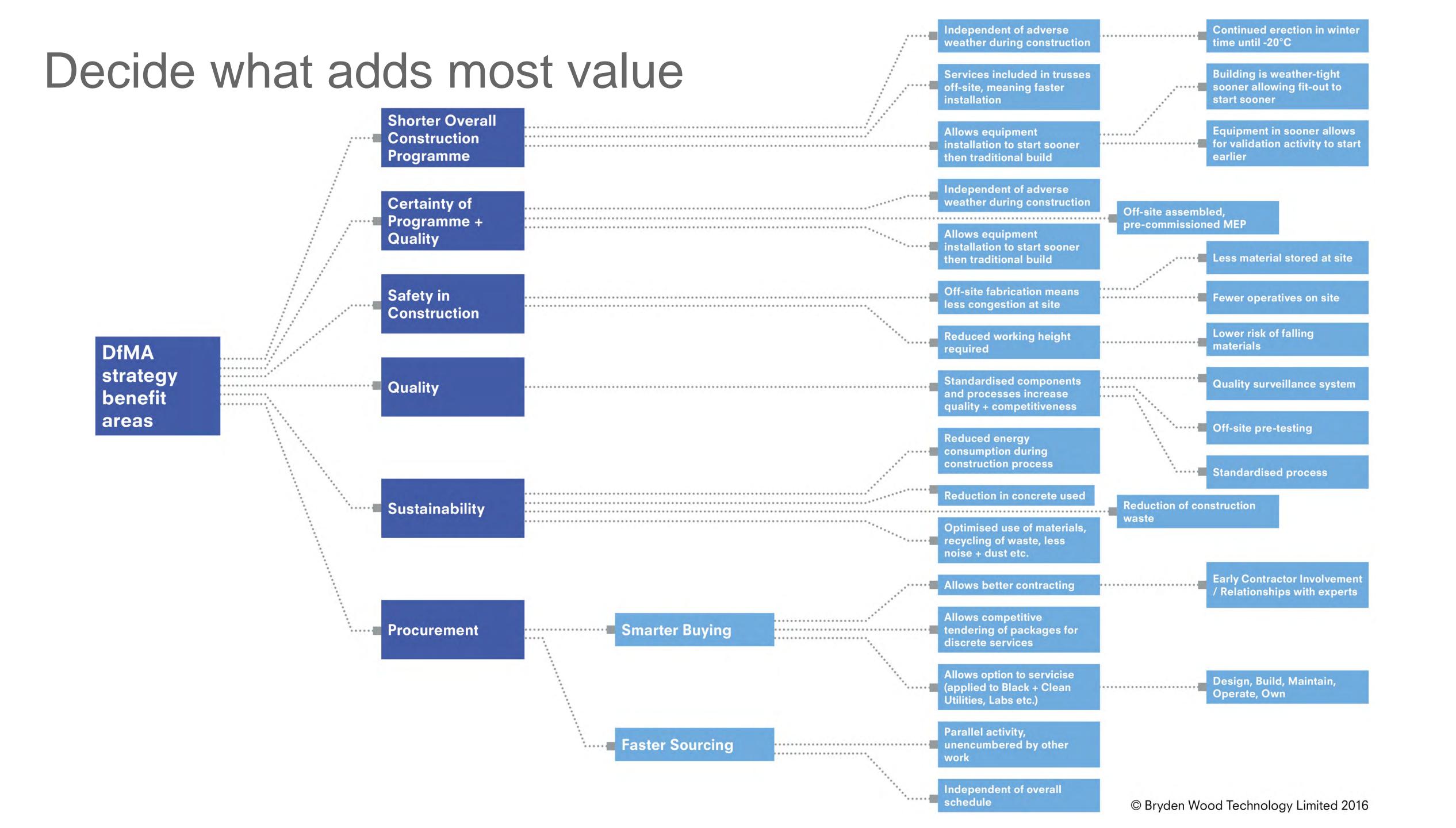




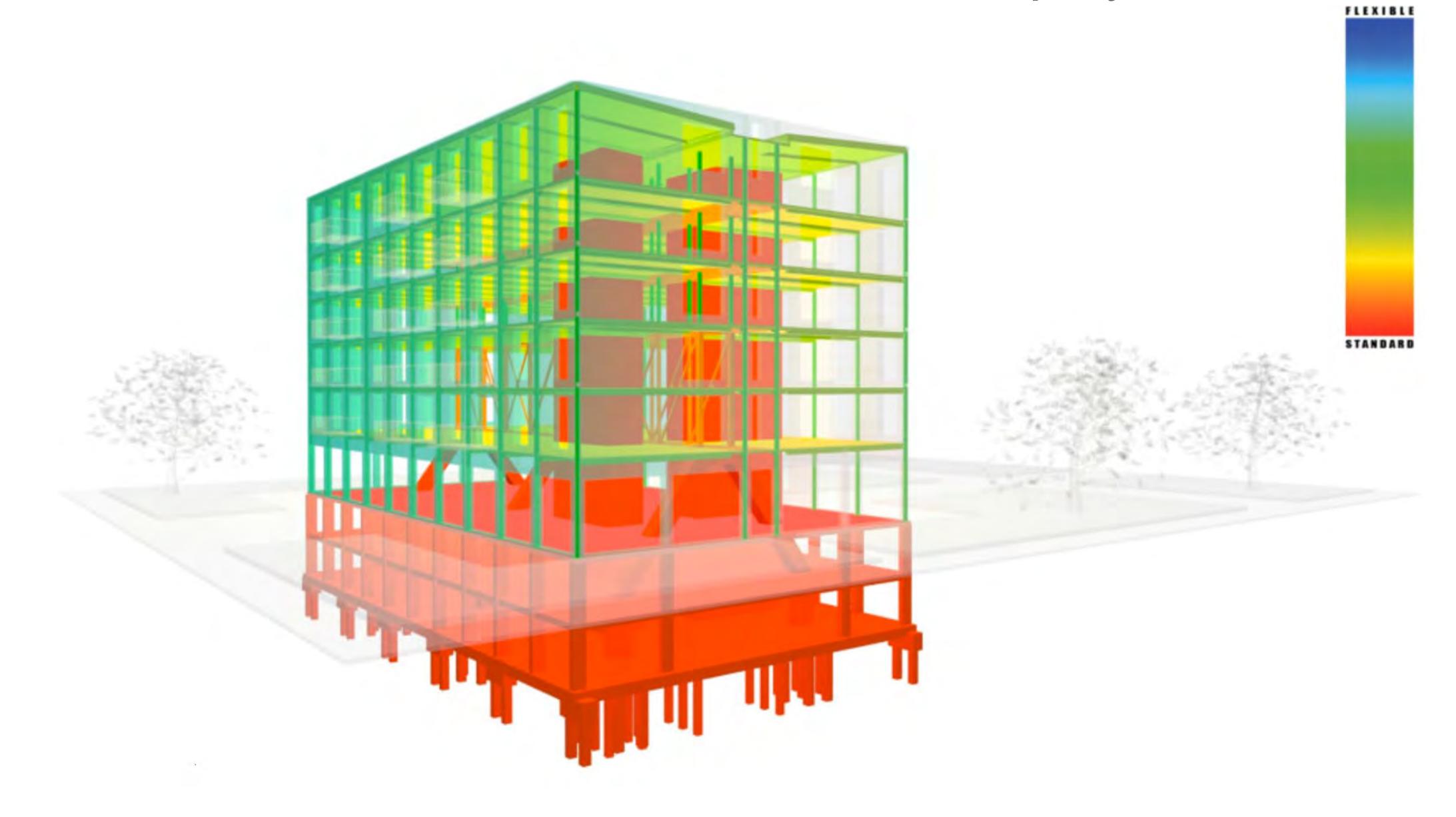
Gutenborg 2013







Decide where standardization should be deployed



Decide on the pace of adoption

Increasing improvments in site productivity

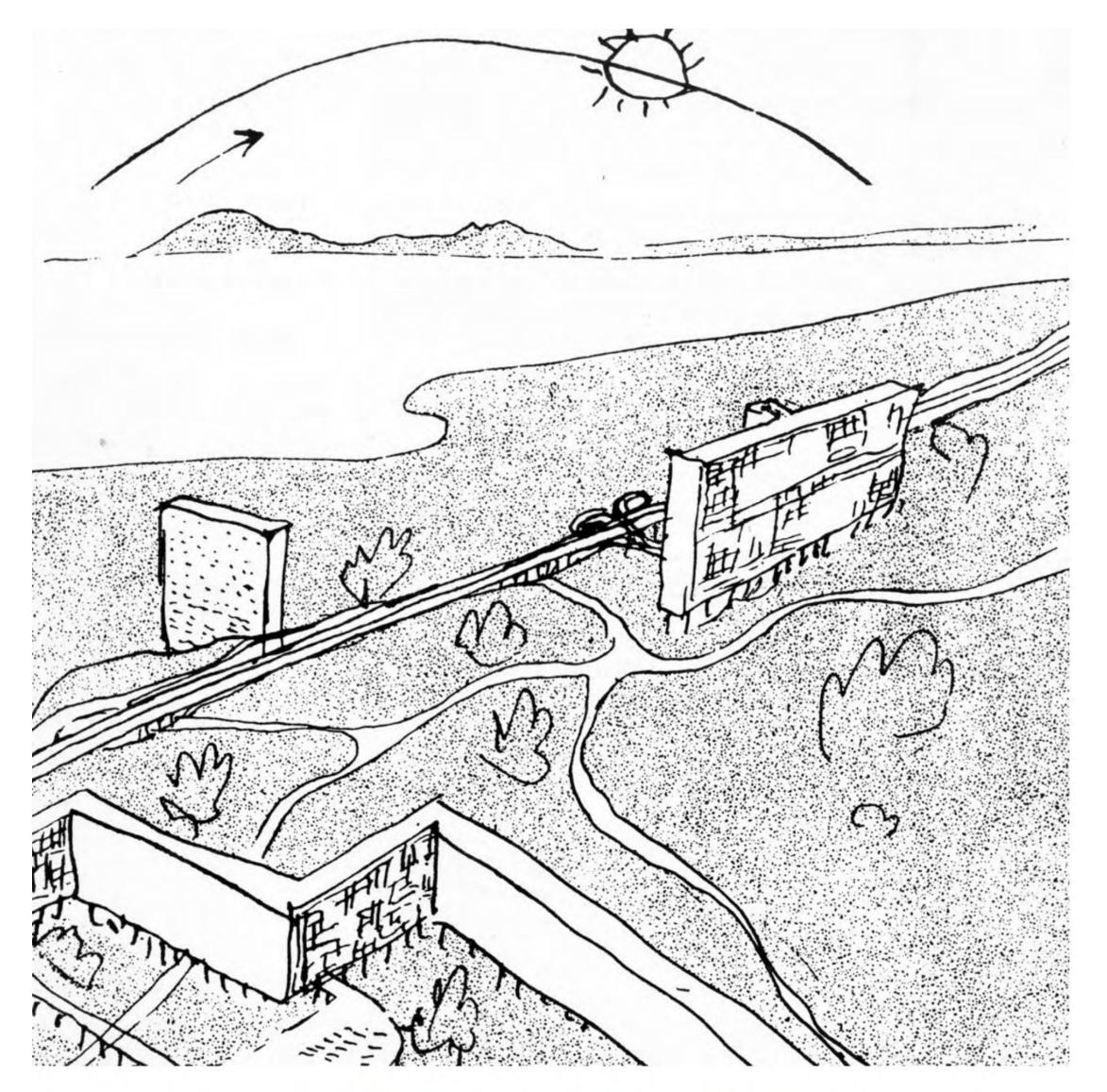
Increasing efficiency of BIM workflows

Reduced reliance on skilled labour

- Traditional build
- Traditional build with standard interface
- Traditional build with off site manufactured (OSM) elements
- Project specific OSM
- Product
- System build
- Component build

Don't forget it's

Design for Manufacture + Assembly



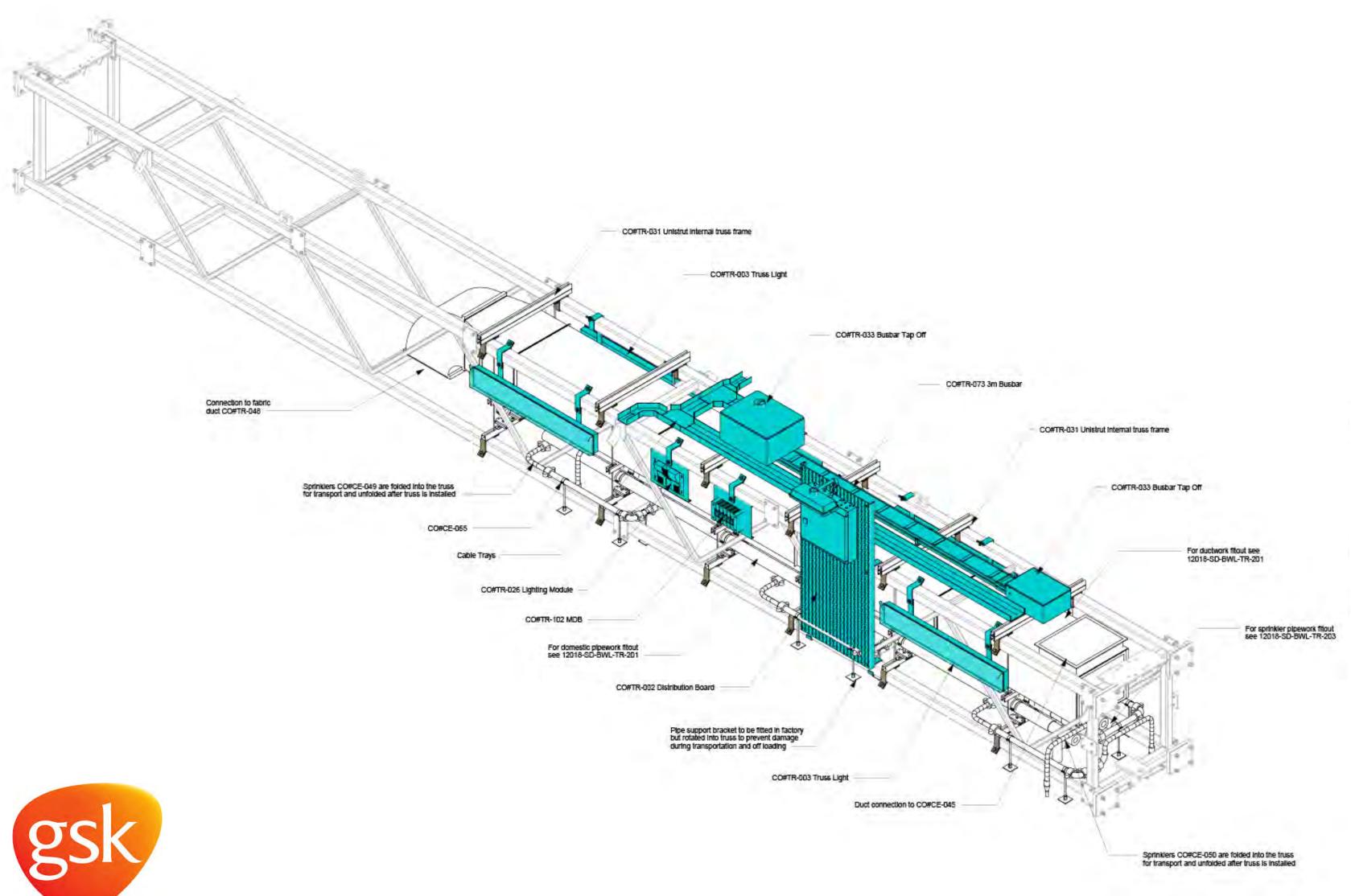
10% of the time 90% of the value

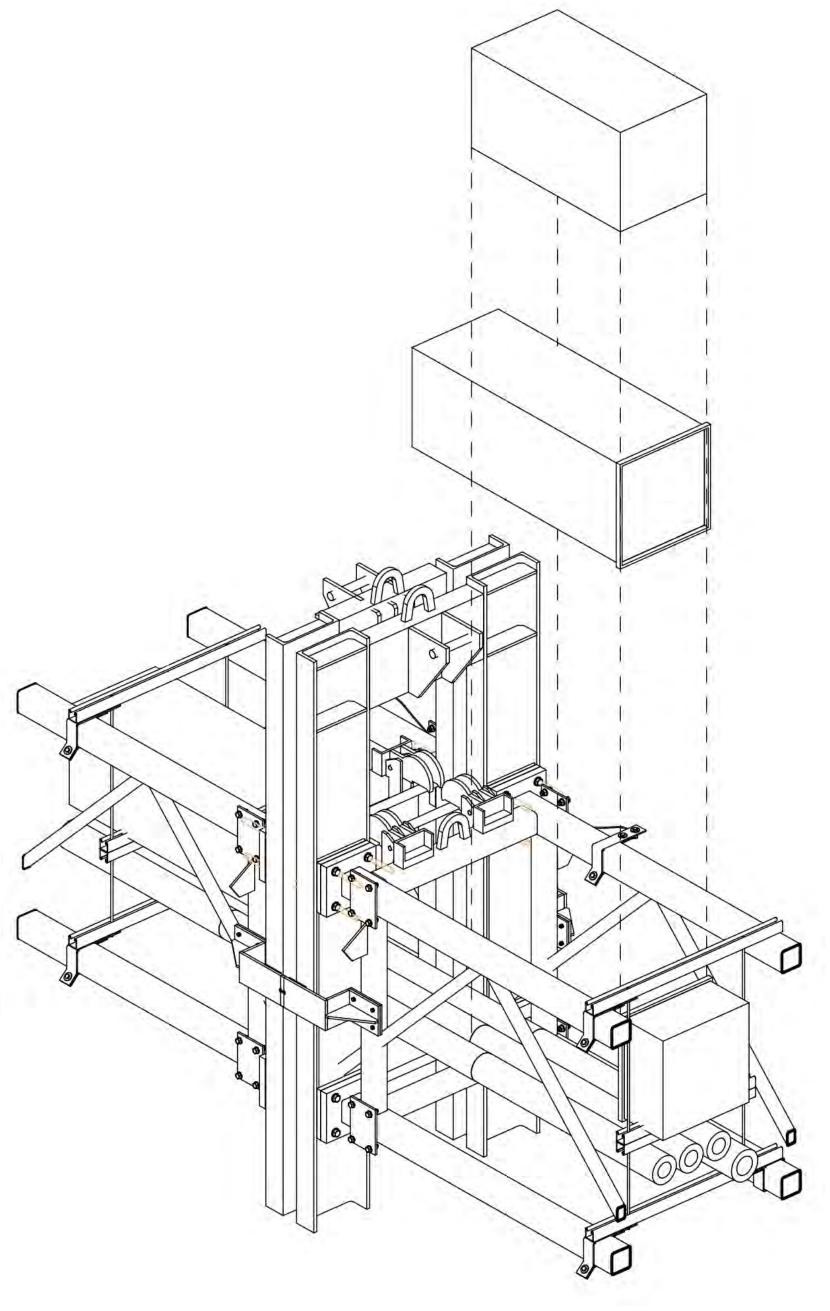


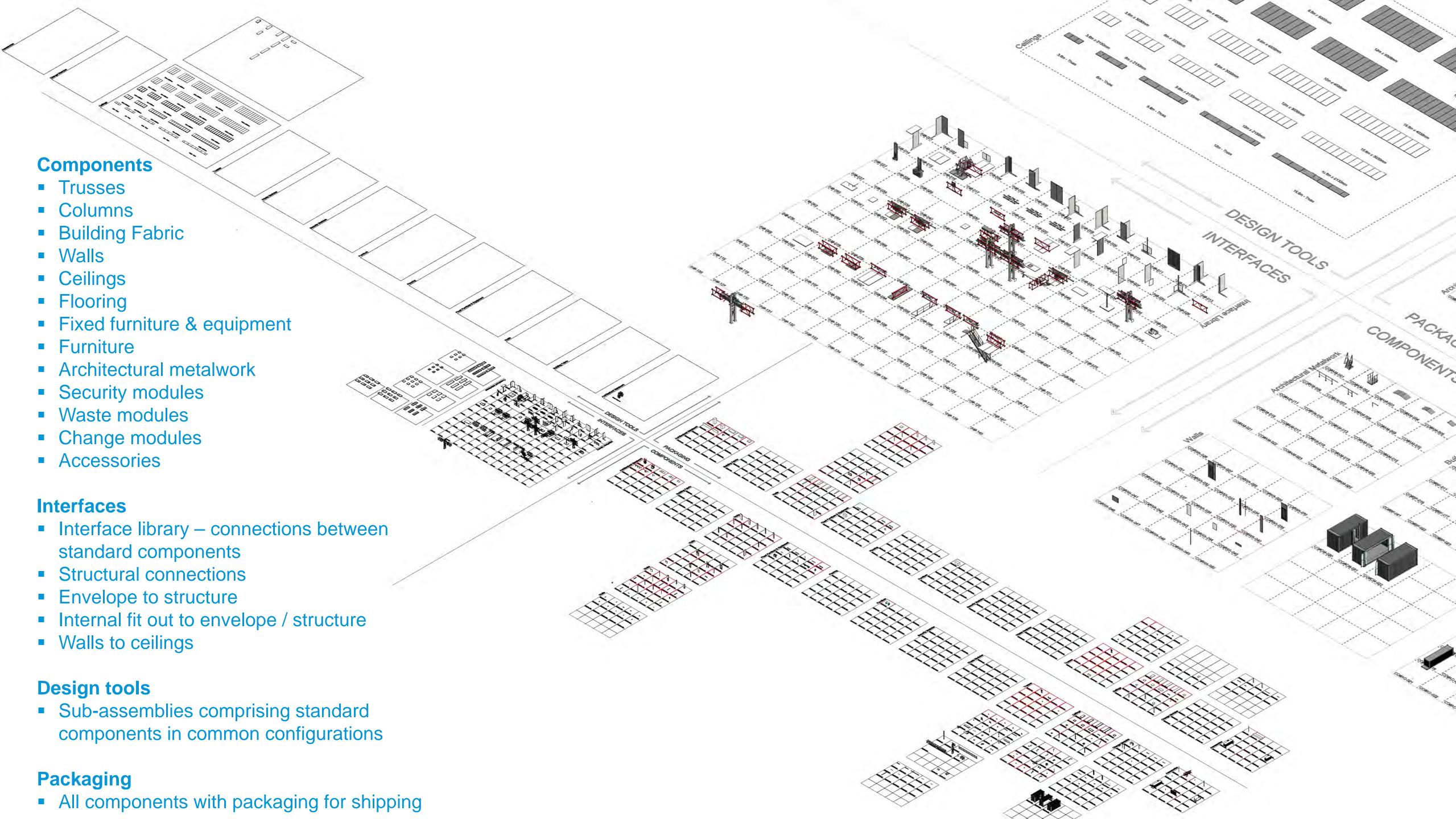
90% of the time 10% of the value

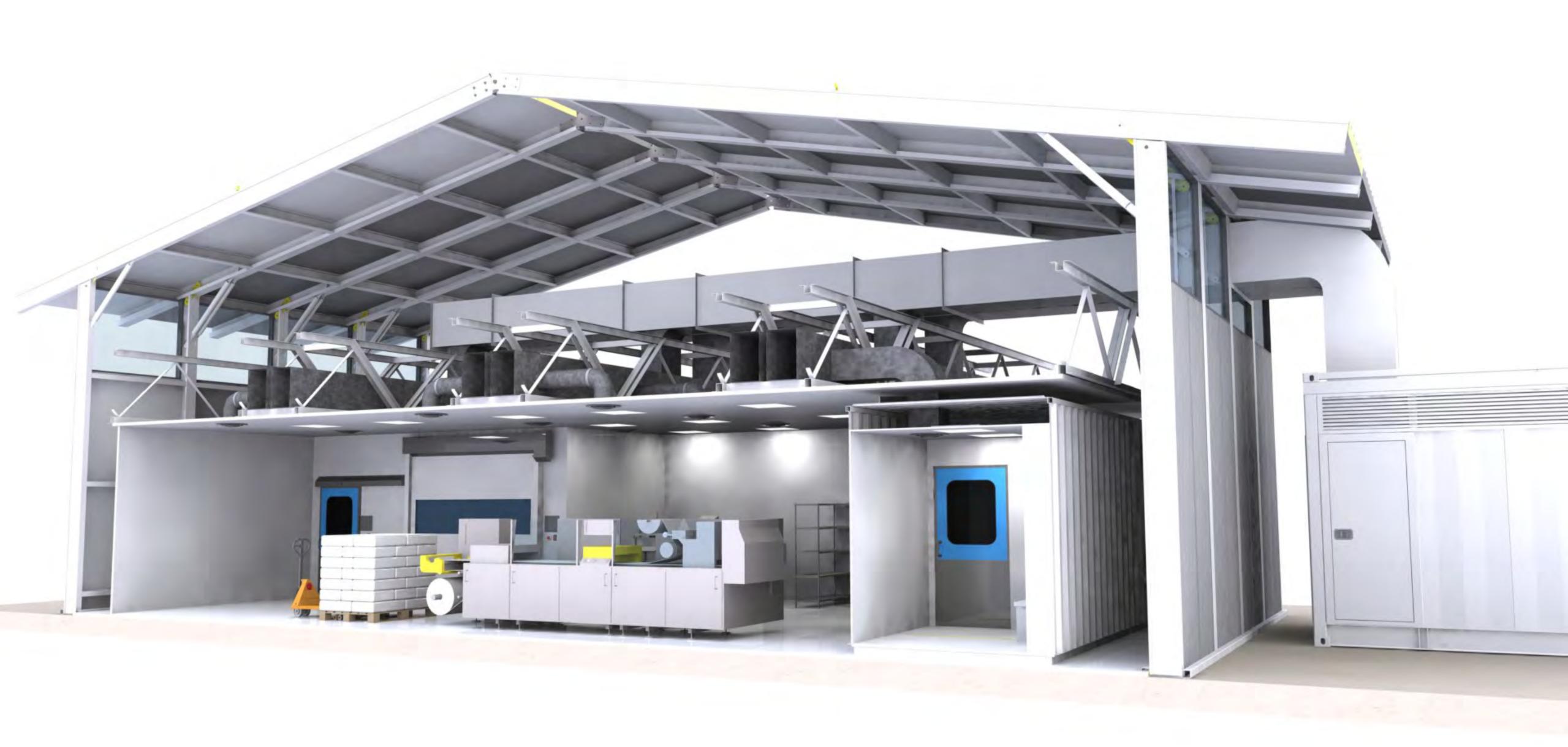
Vith thanks to David Miller

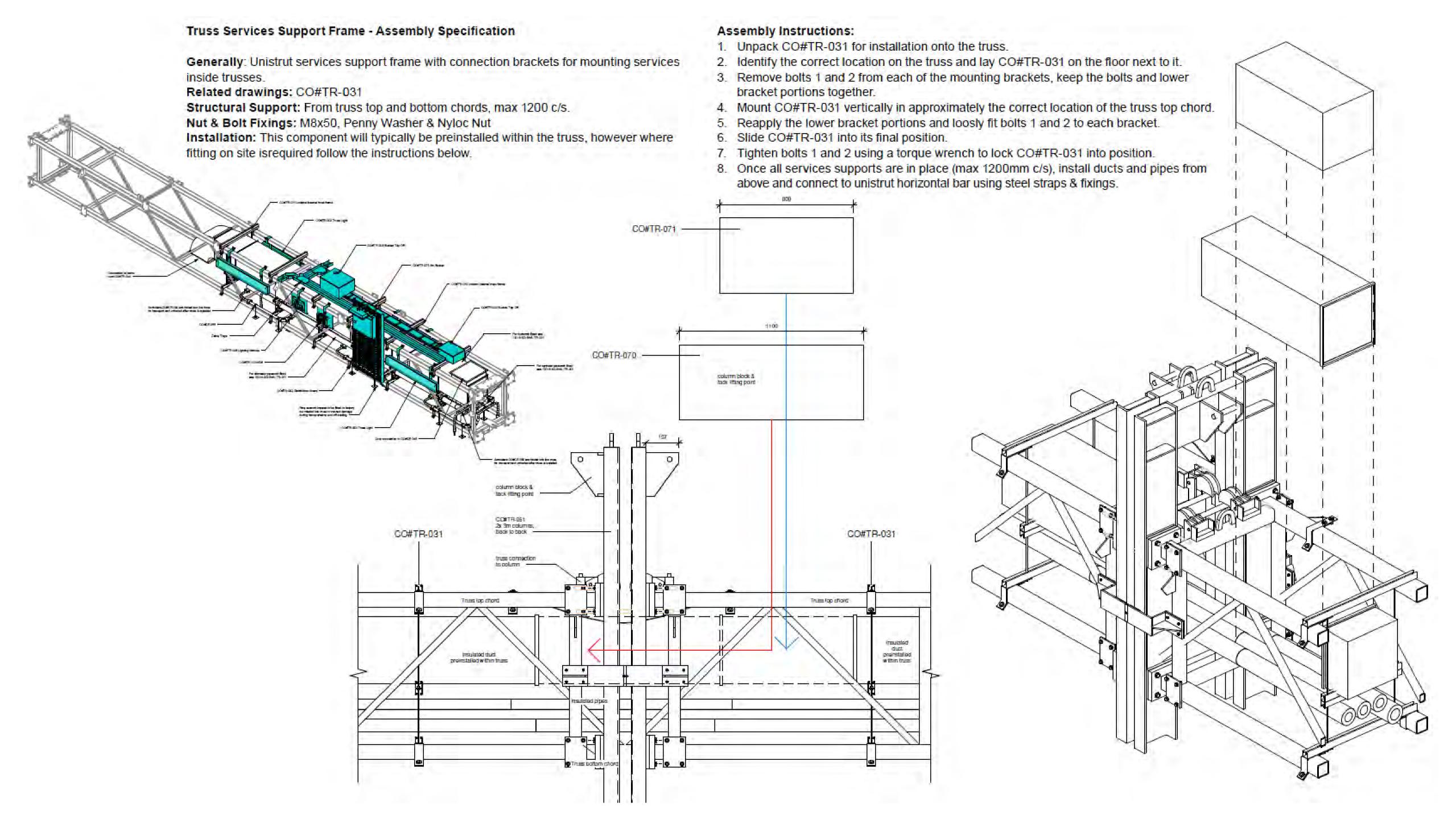
GlaxoSmithKline 'Factory in a Box'

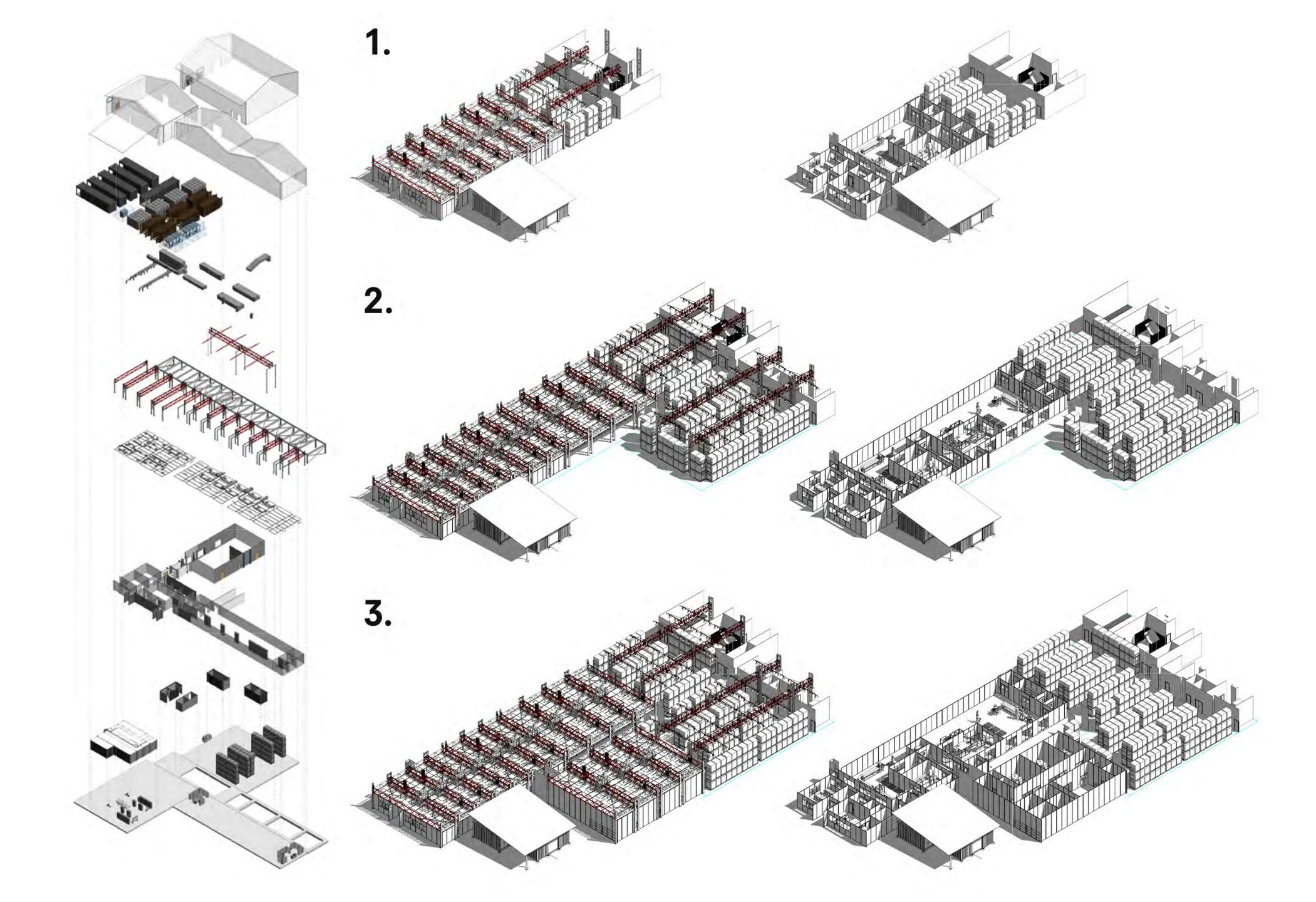


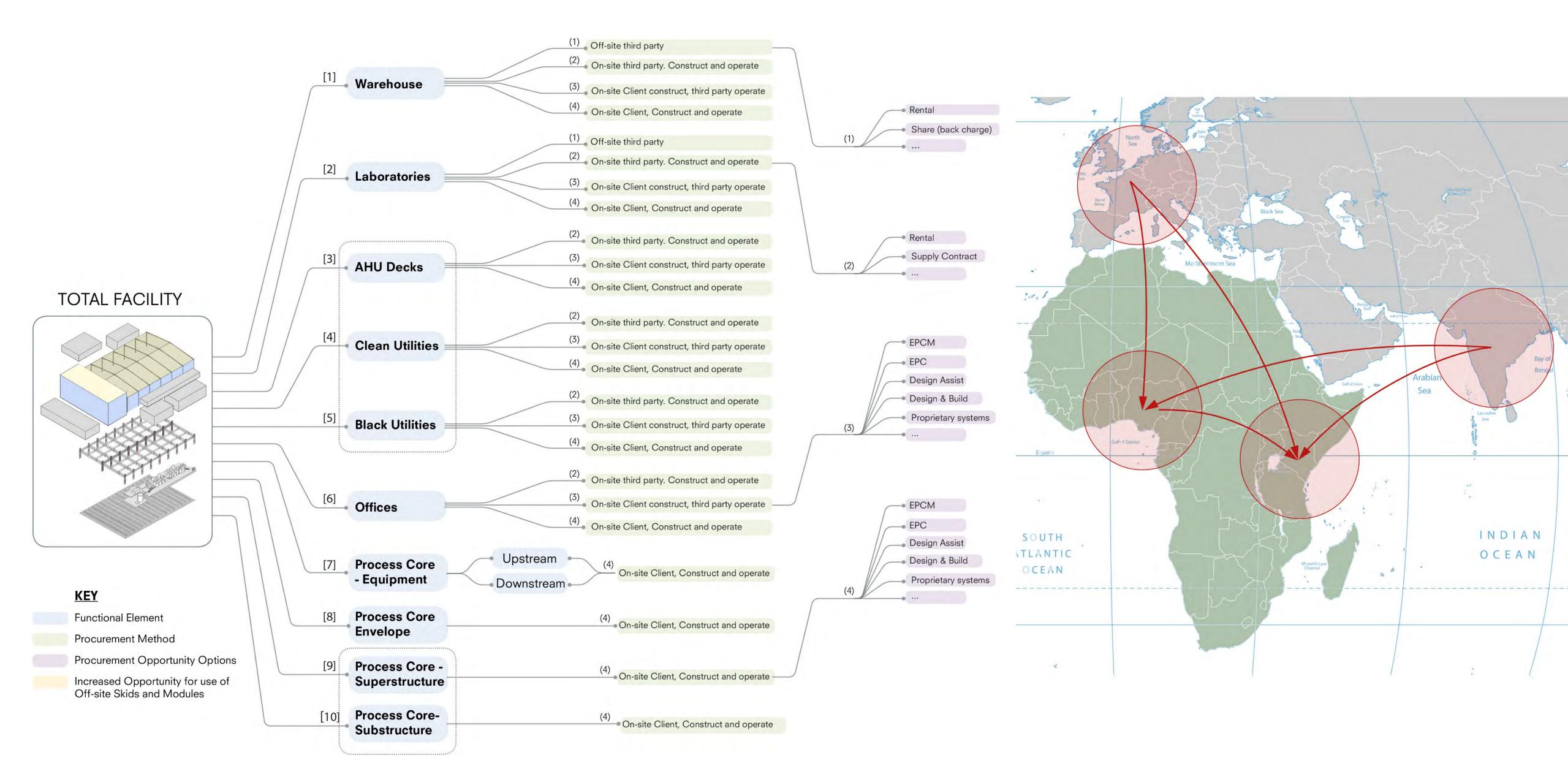


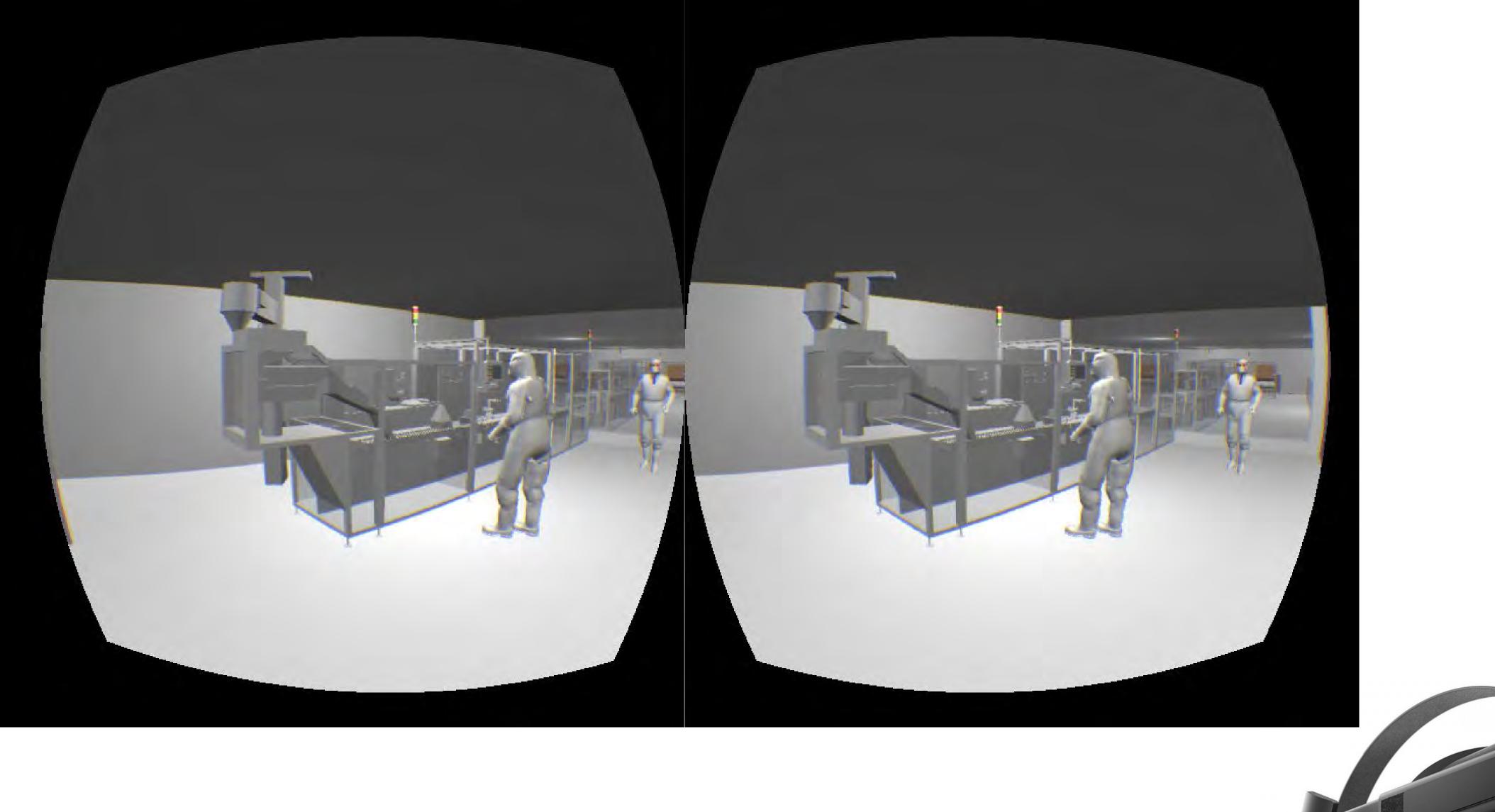


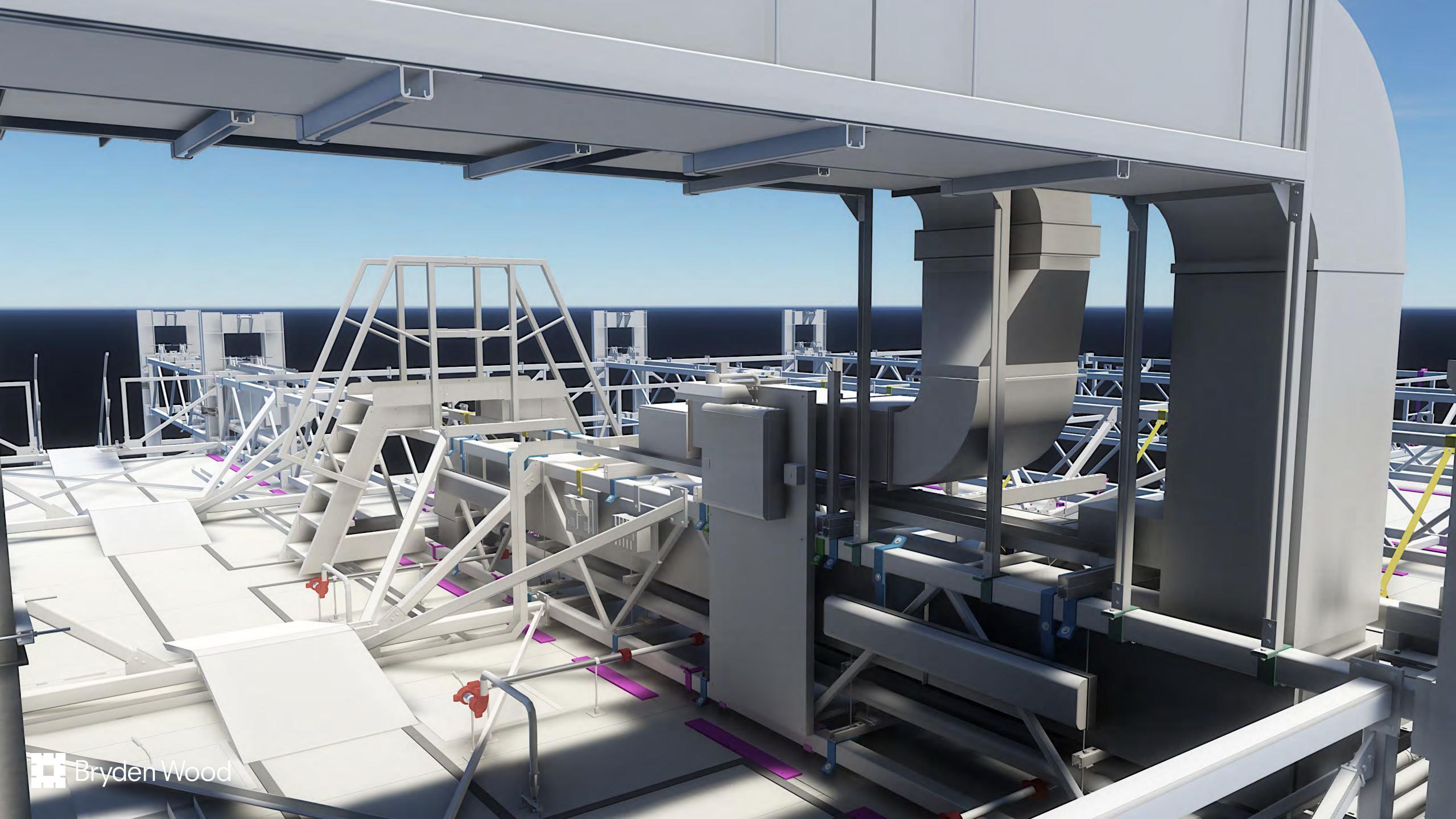


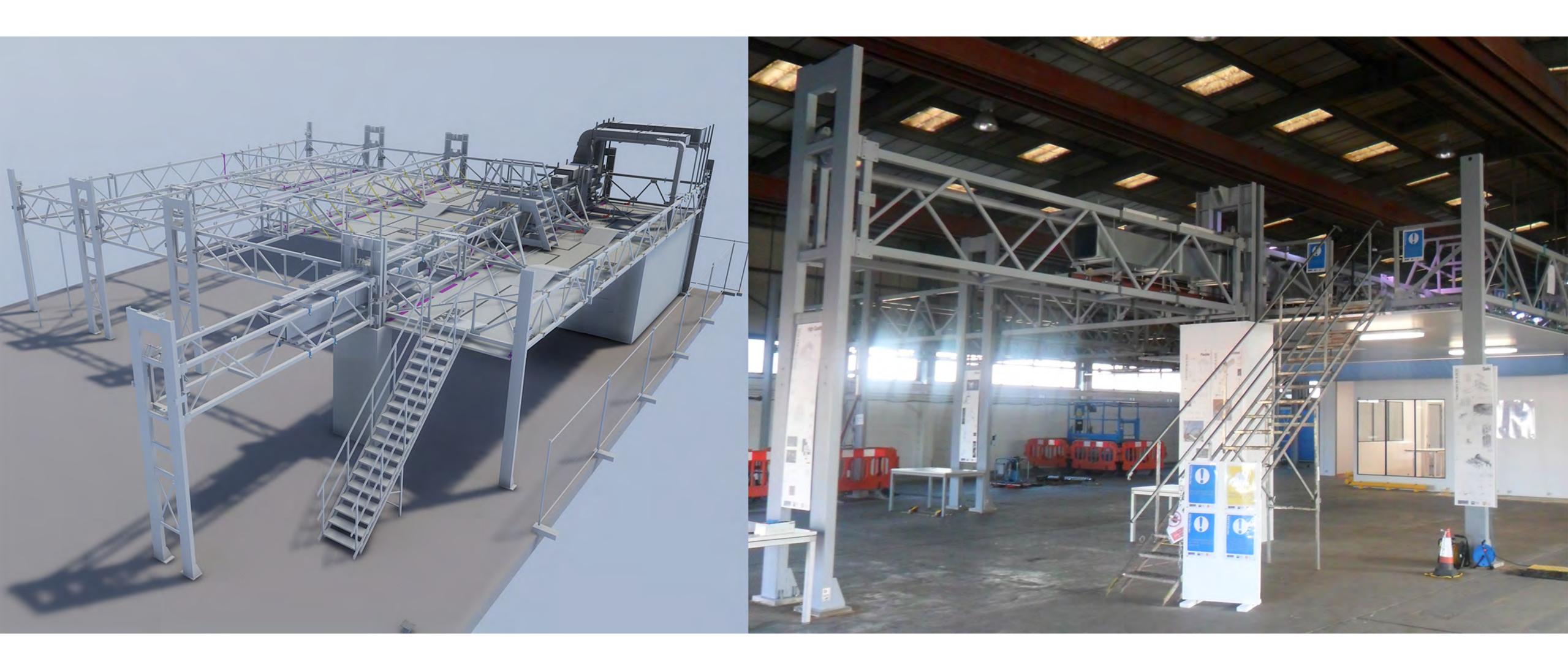




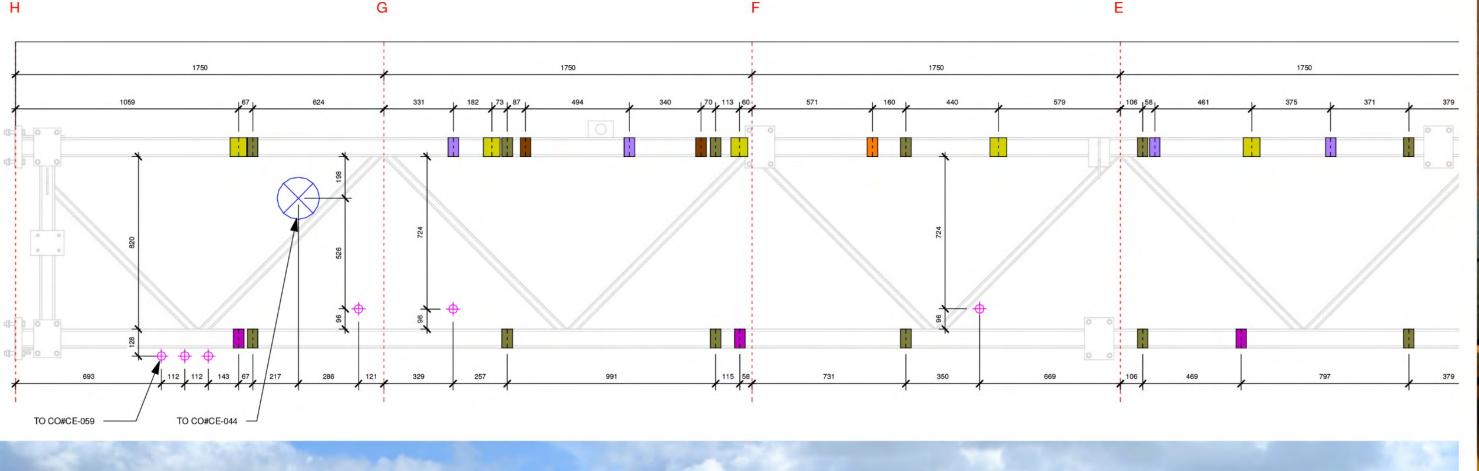




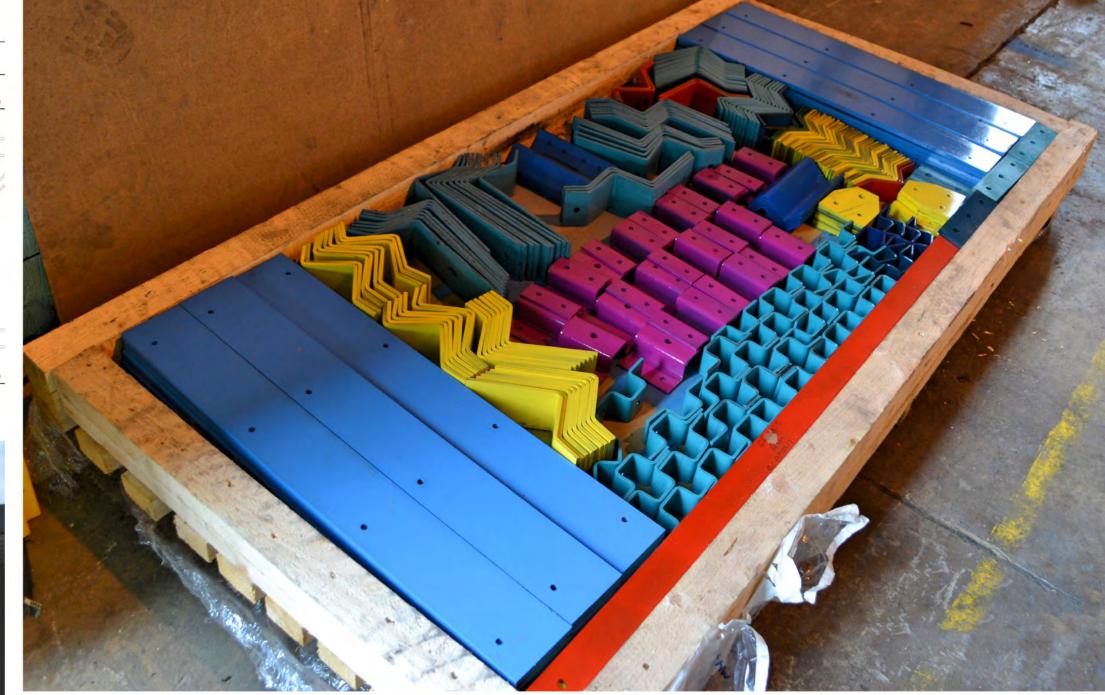




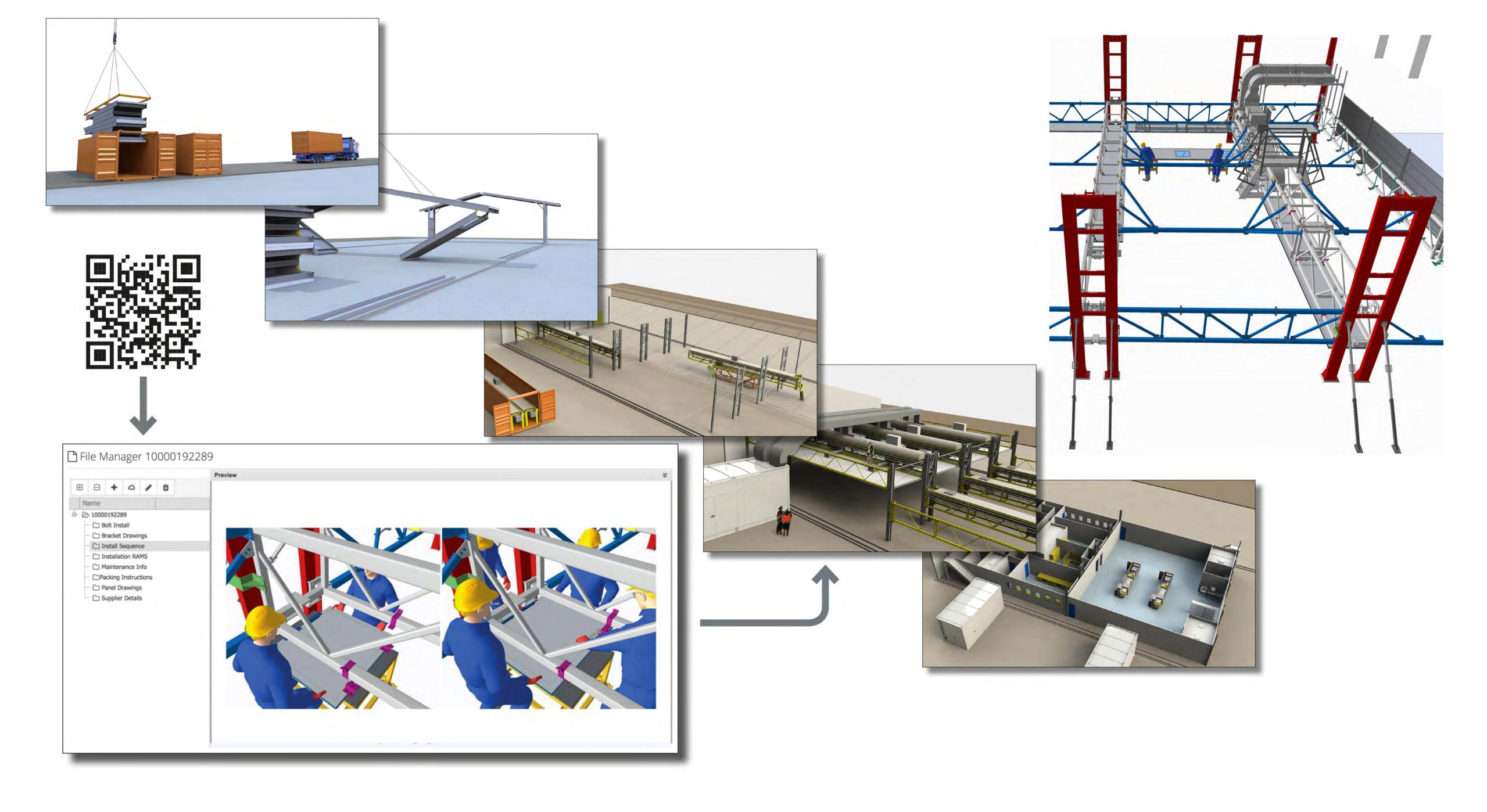




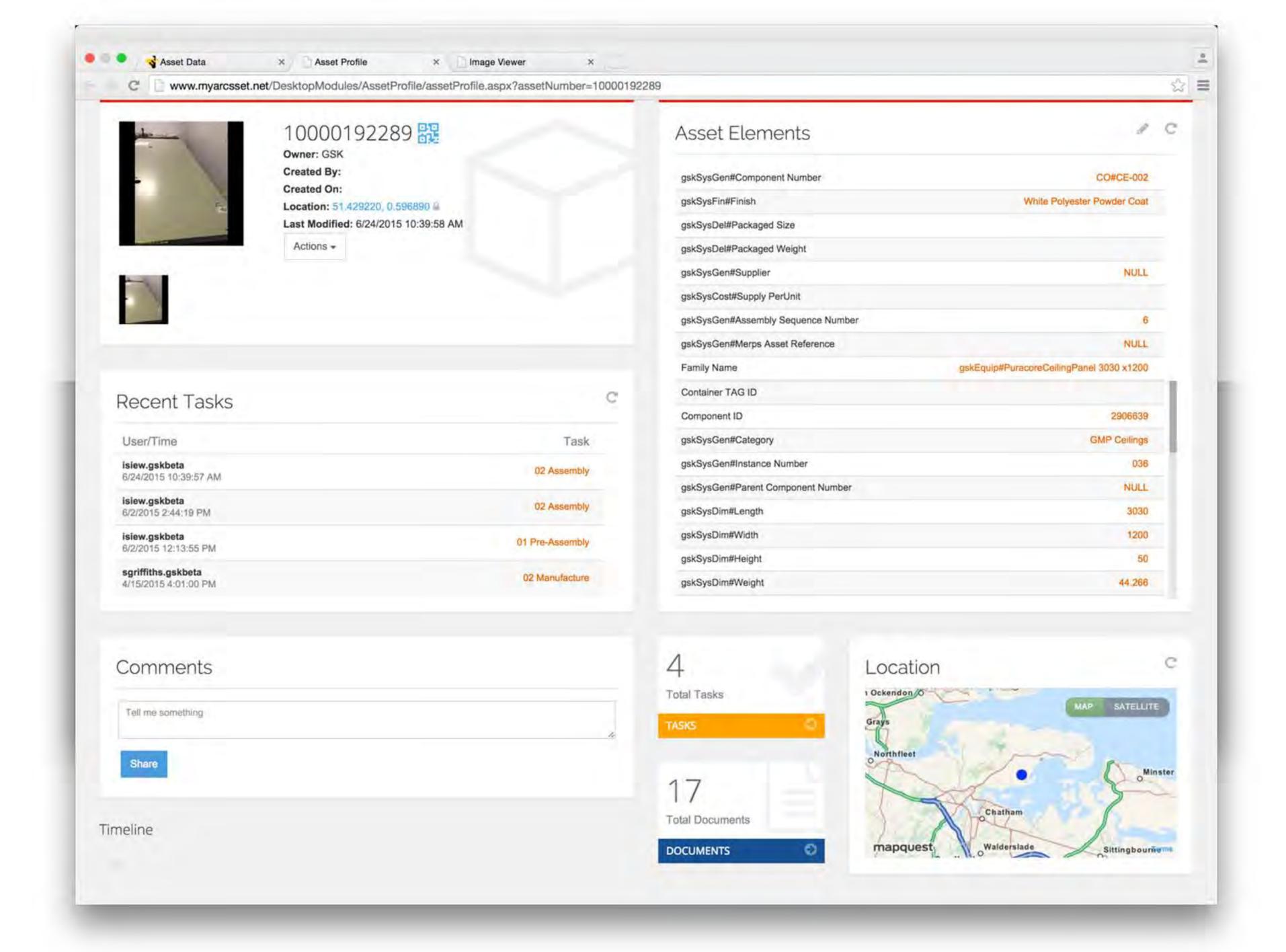






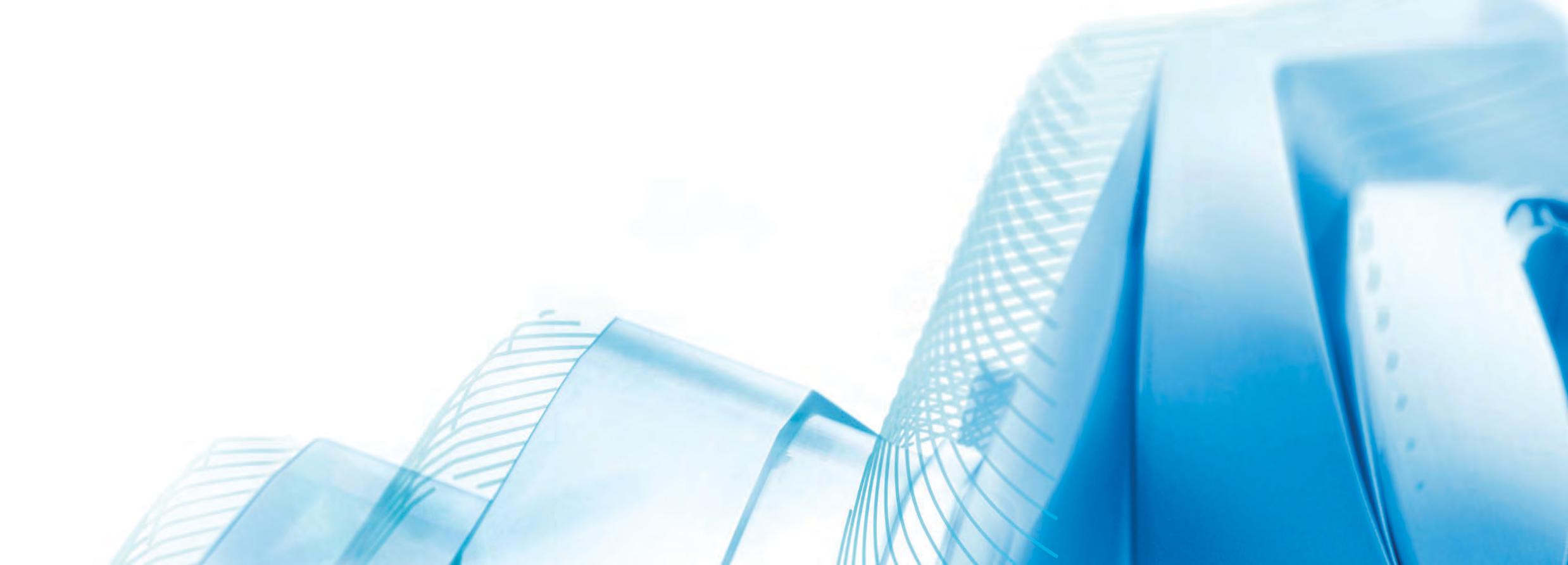








Current state: the evolution of **Platforms**



Why haven't any of the existing systems already transformed the sector?

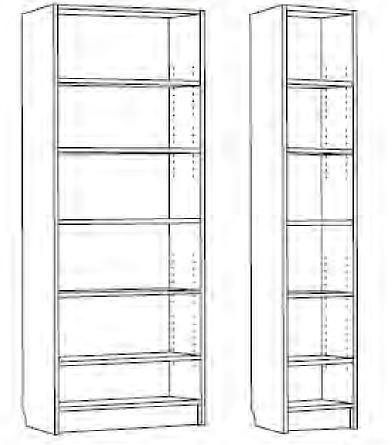




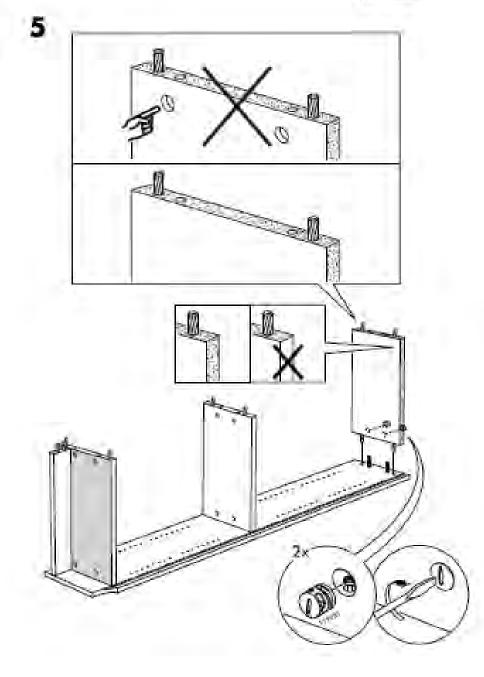
1886 1913

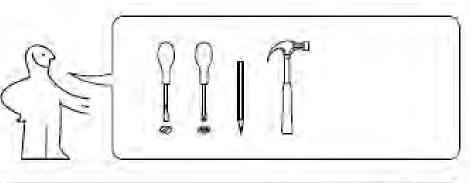


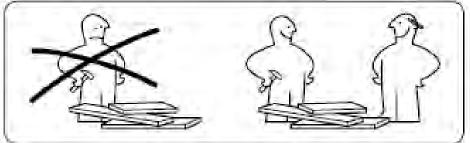
BILLY

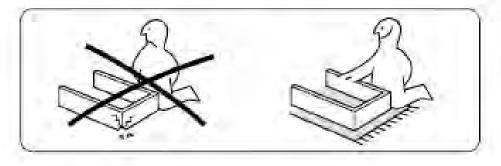


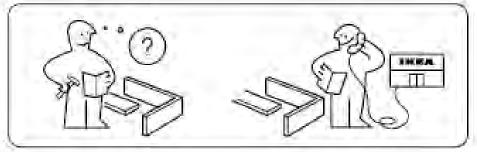


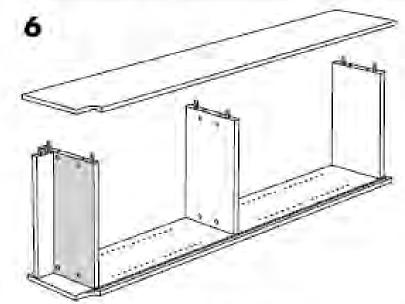


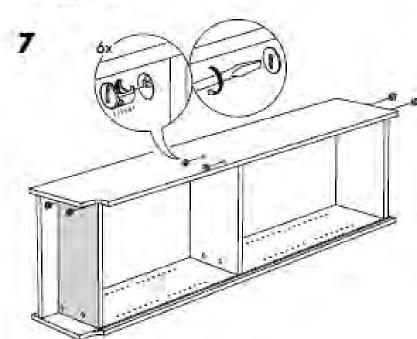


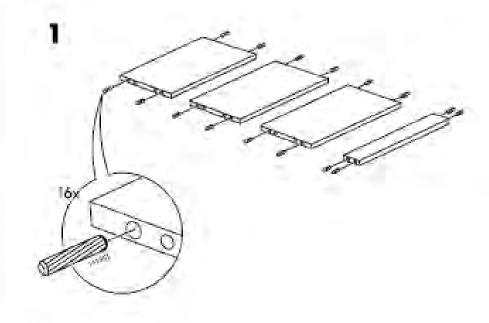


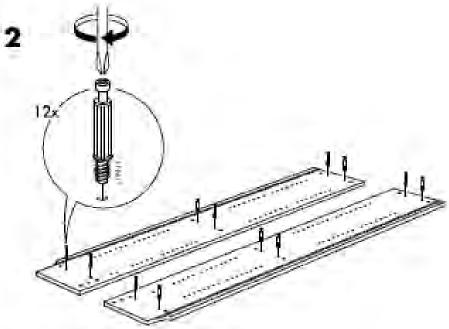


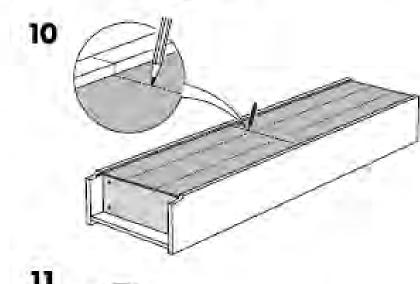


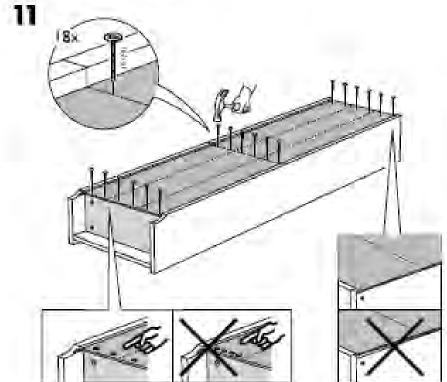


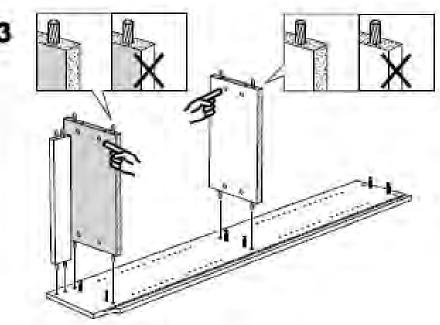


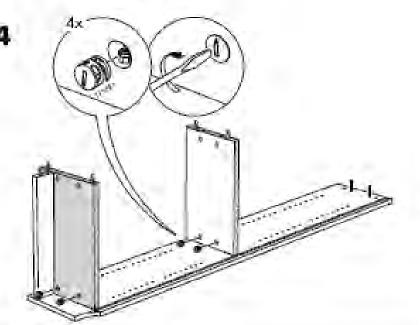


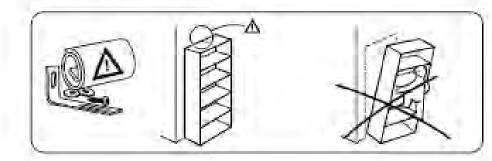


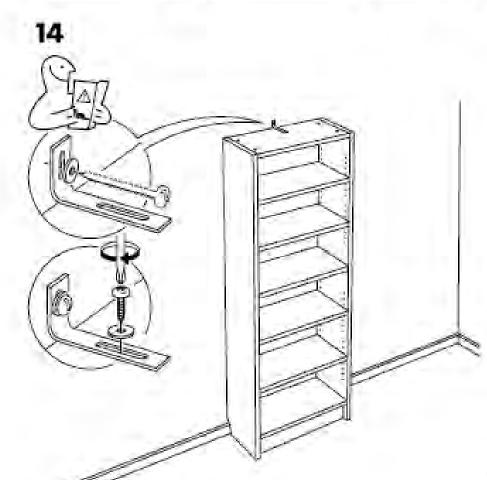












Source: IKEA

Platforms bridge the gap between manufacturing and construction

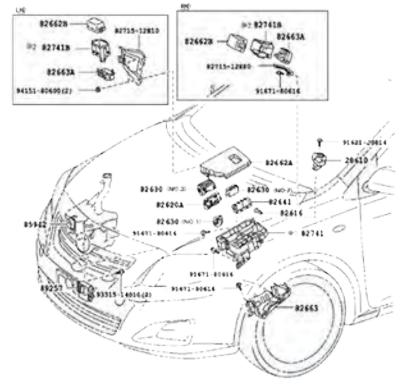
Component

Platform

Outcome









Engine block

Chassis

Car









Low cost, reliable global trade + supply chains

Shipping container

Global freight infrastructure



Peer-to-peer ride sharing, food delivery and transportation network



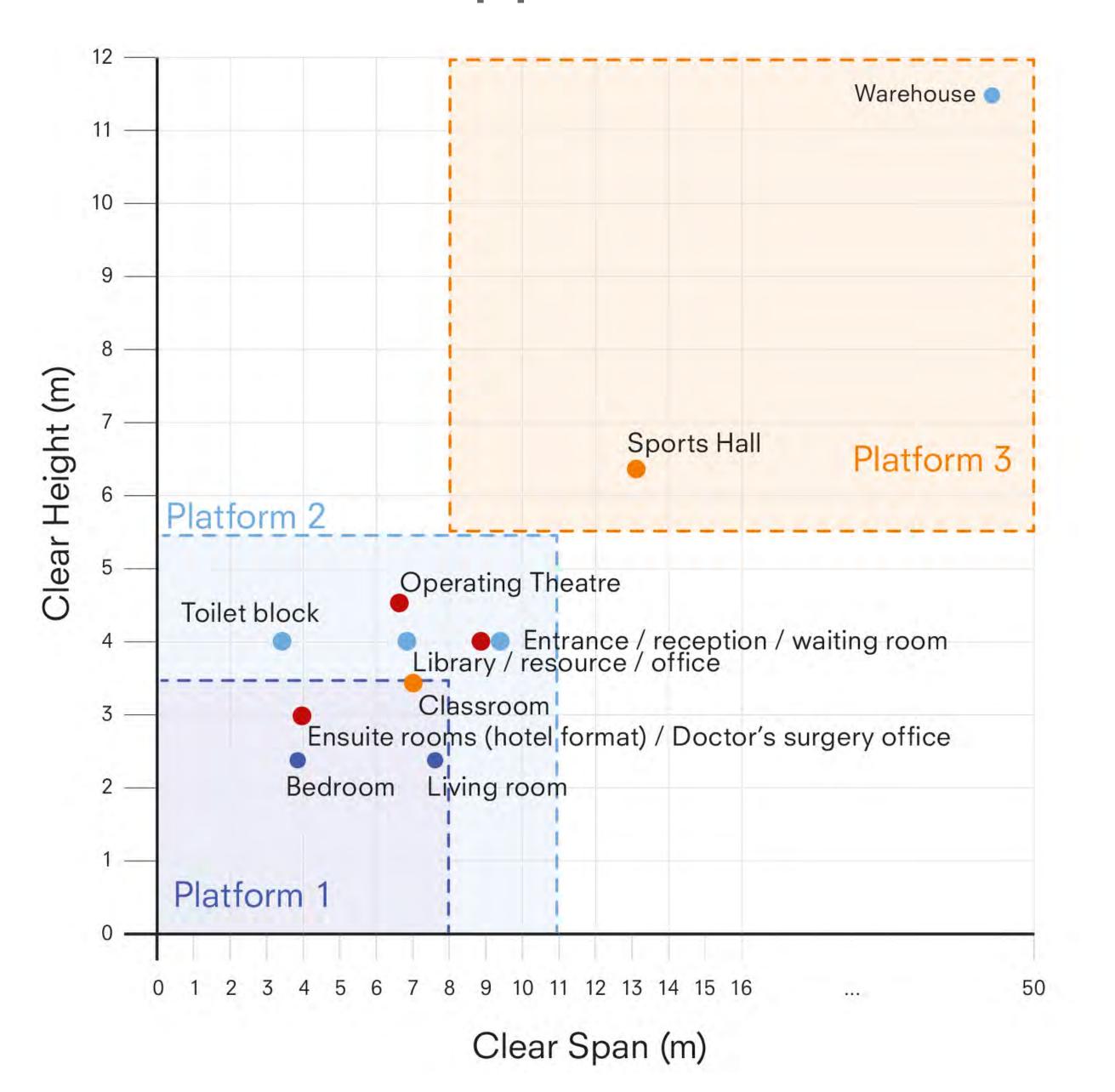






Platforms combine design, manufacture, and procurement principles holistically to ensure a greater degree of rationalisation and integration

A Platform-based approach to construction



III Residential





C School





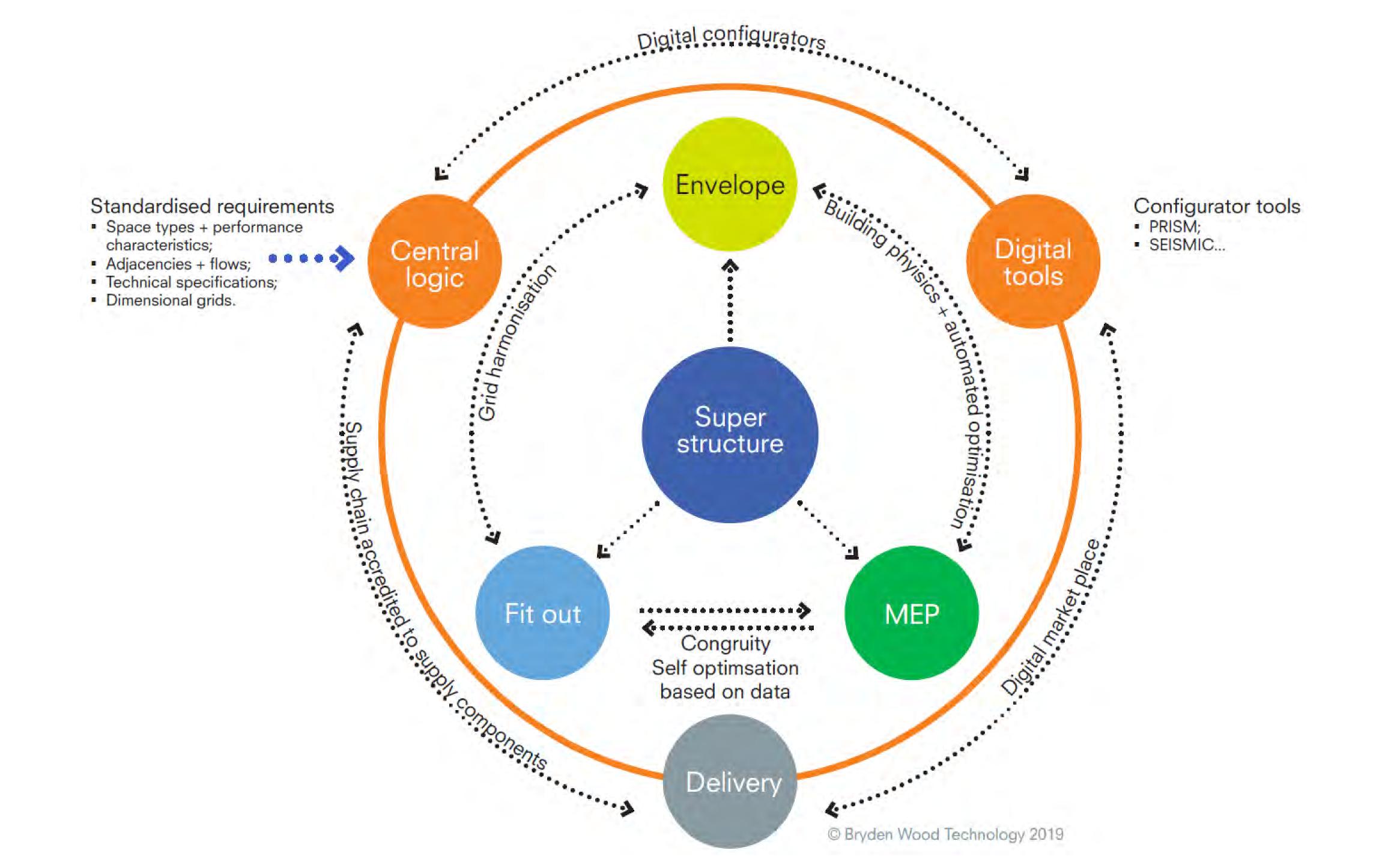








Platforms manifest themselves as a 'kit of parts' of pre-engineered components, assemblies and products that go together in pre-defined ways





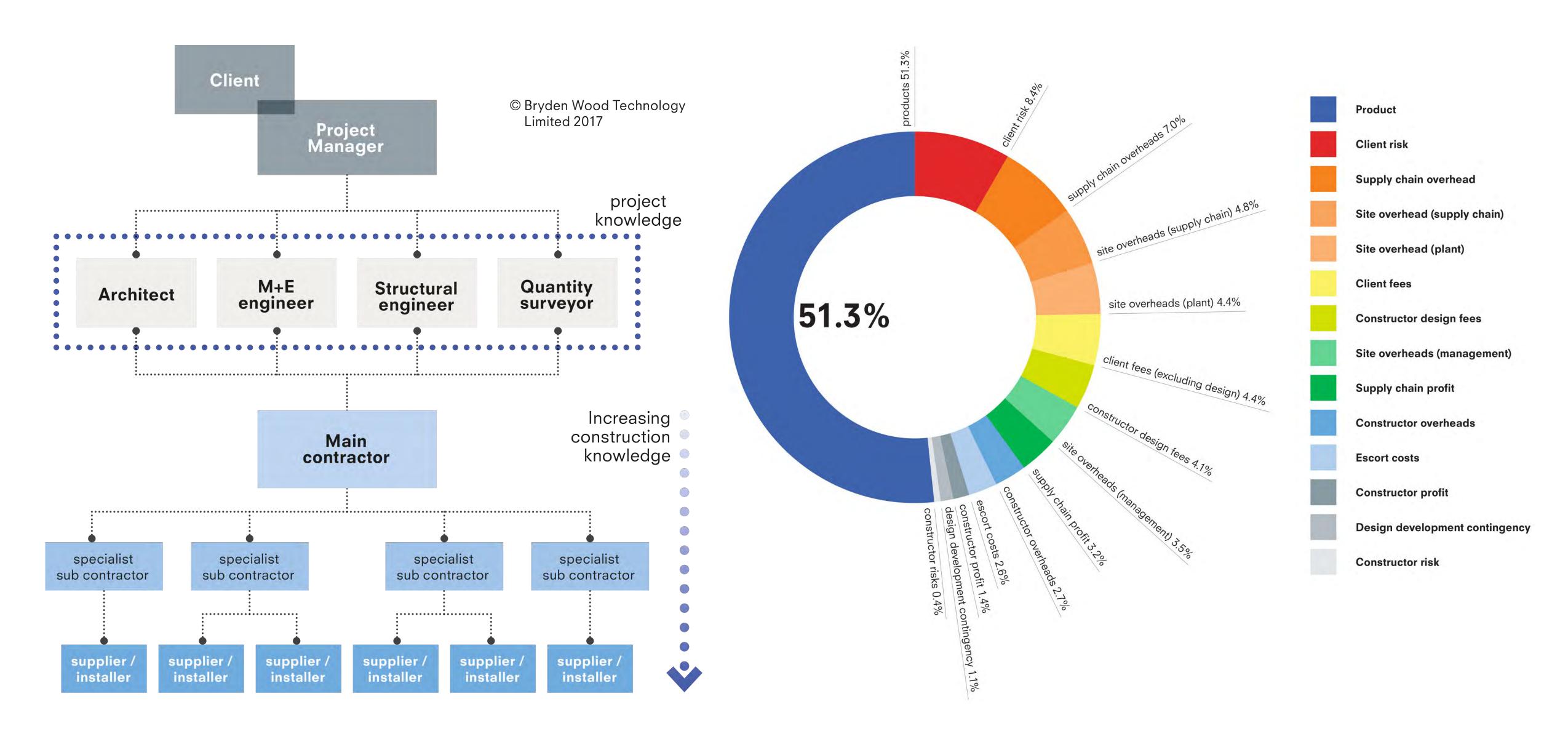




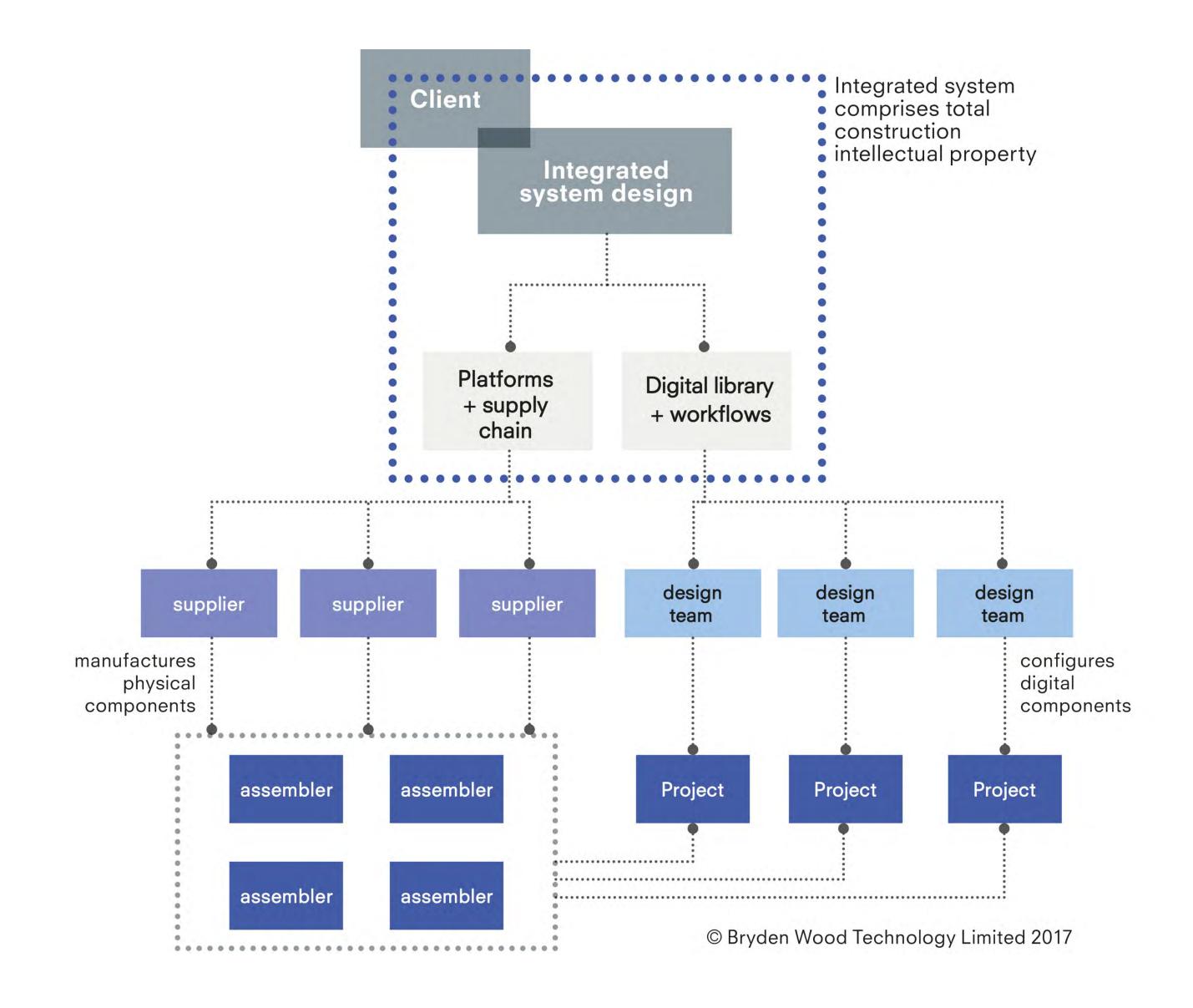


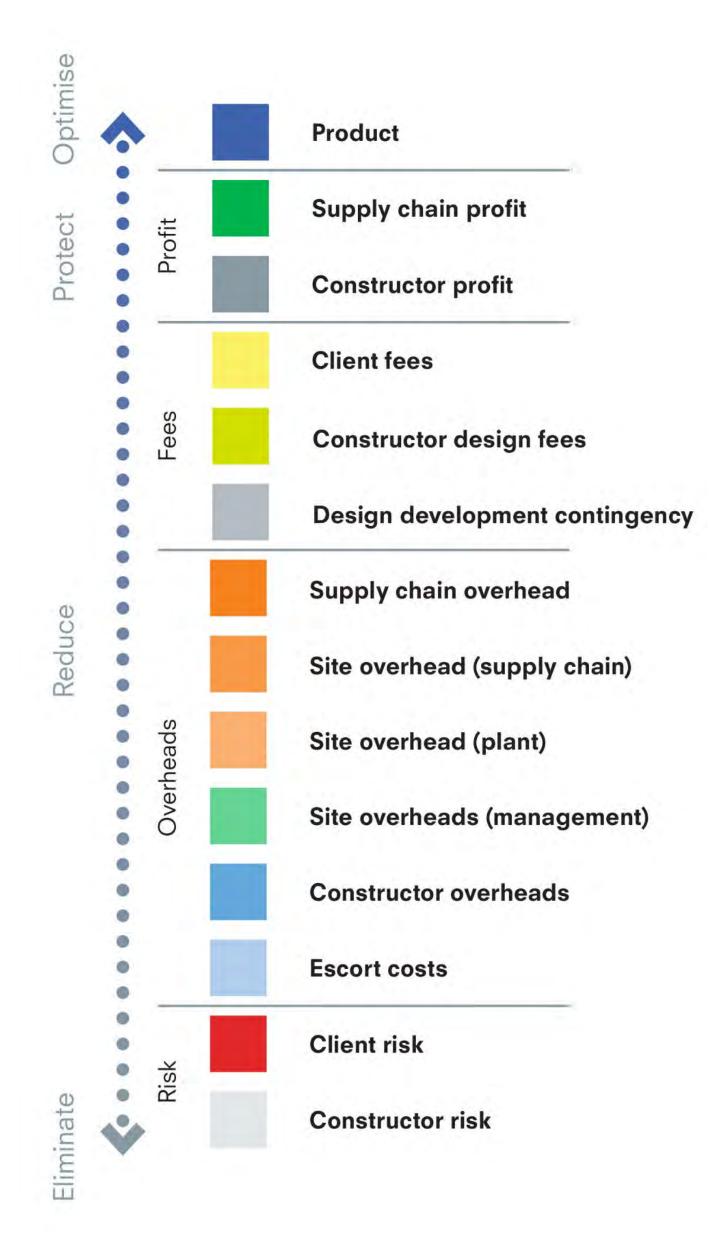
Benefits for clients and the supply chain

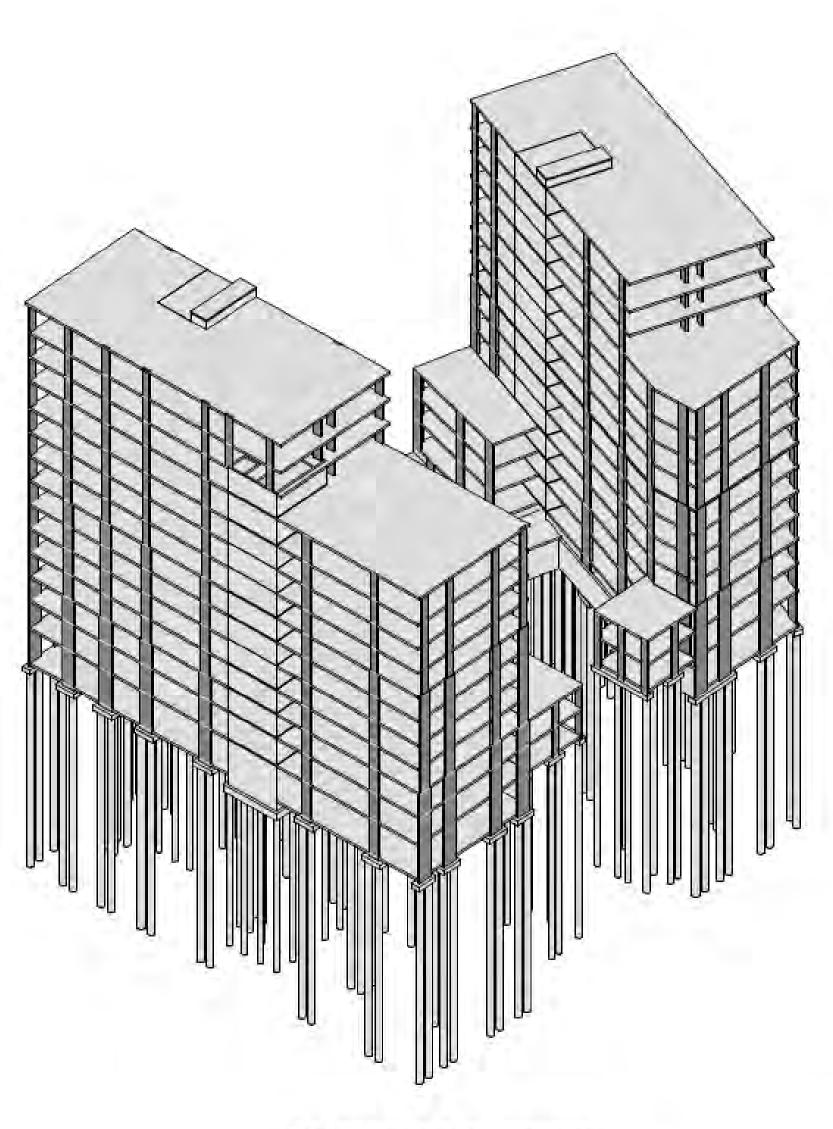
Current state



Platform enabled

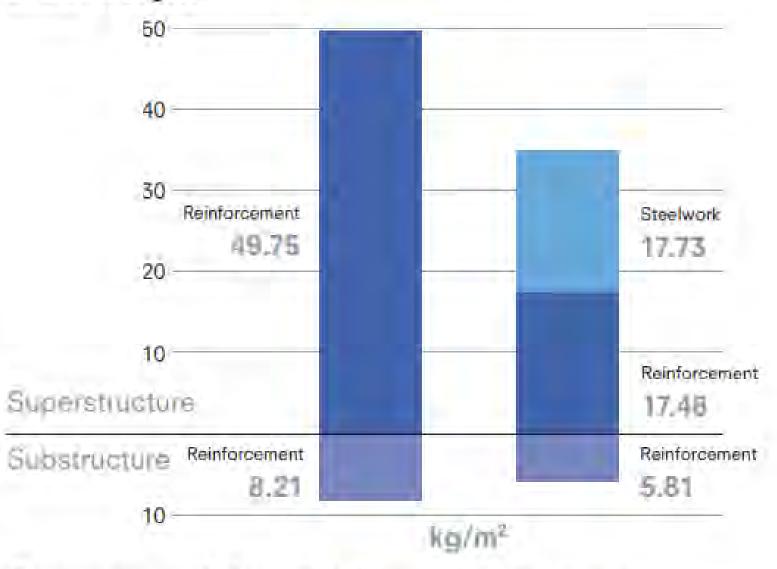


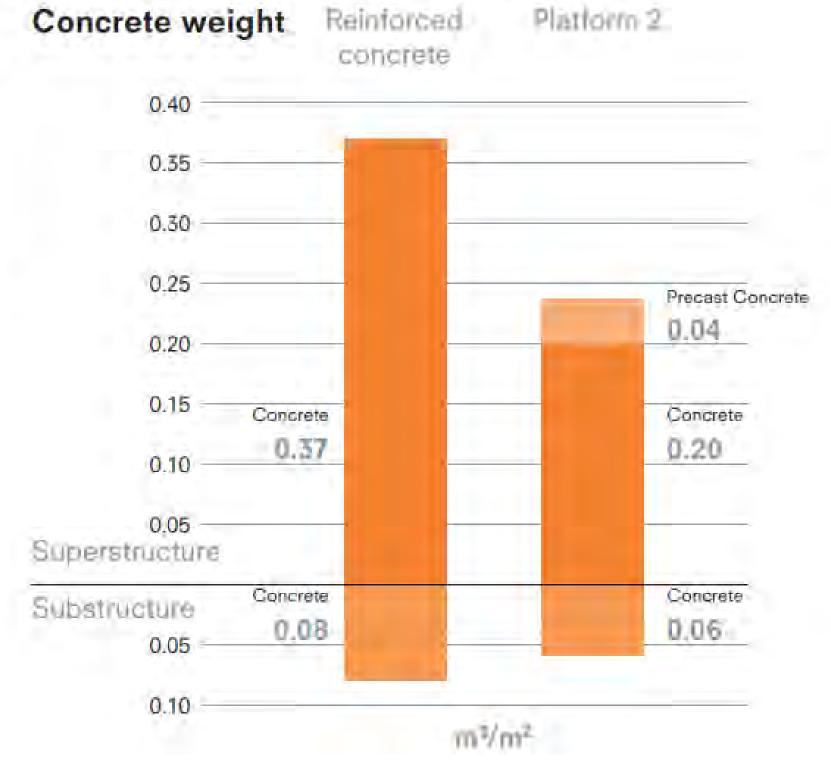


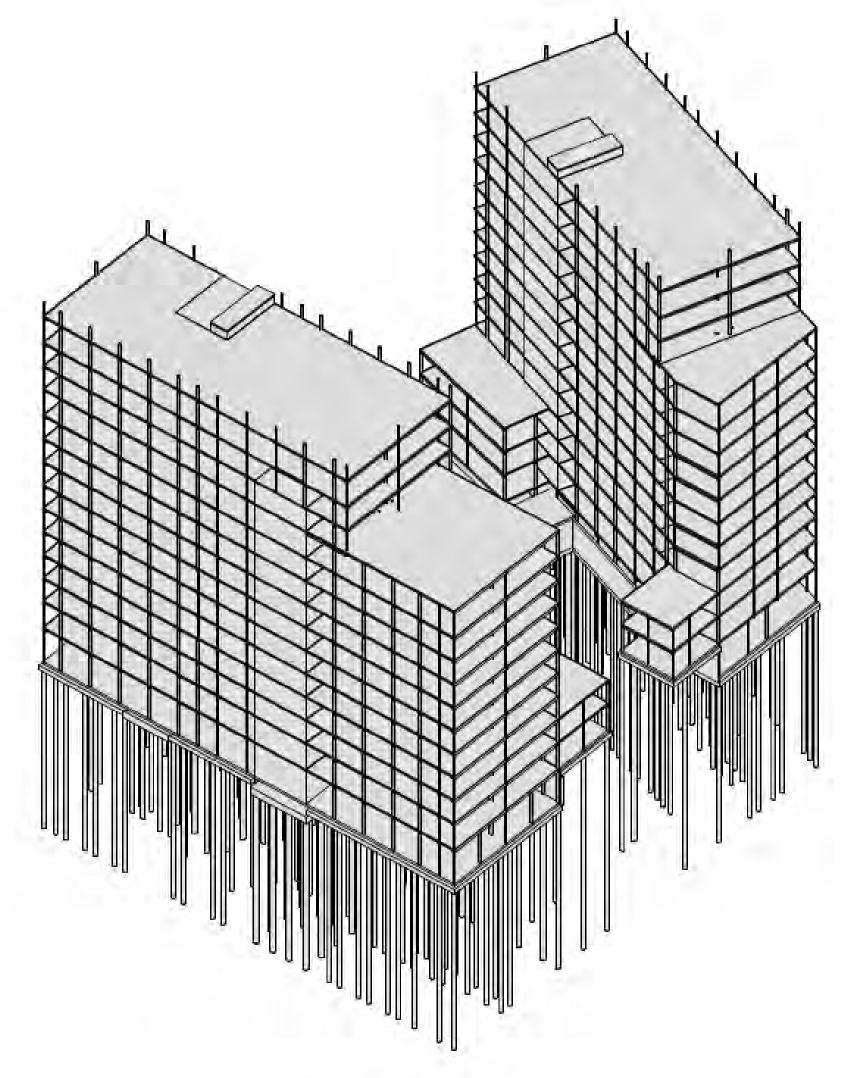


Reinforced concrete

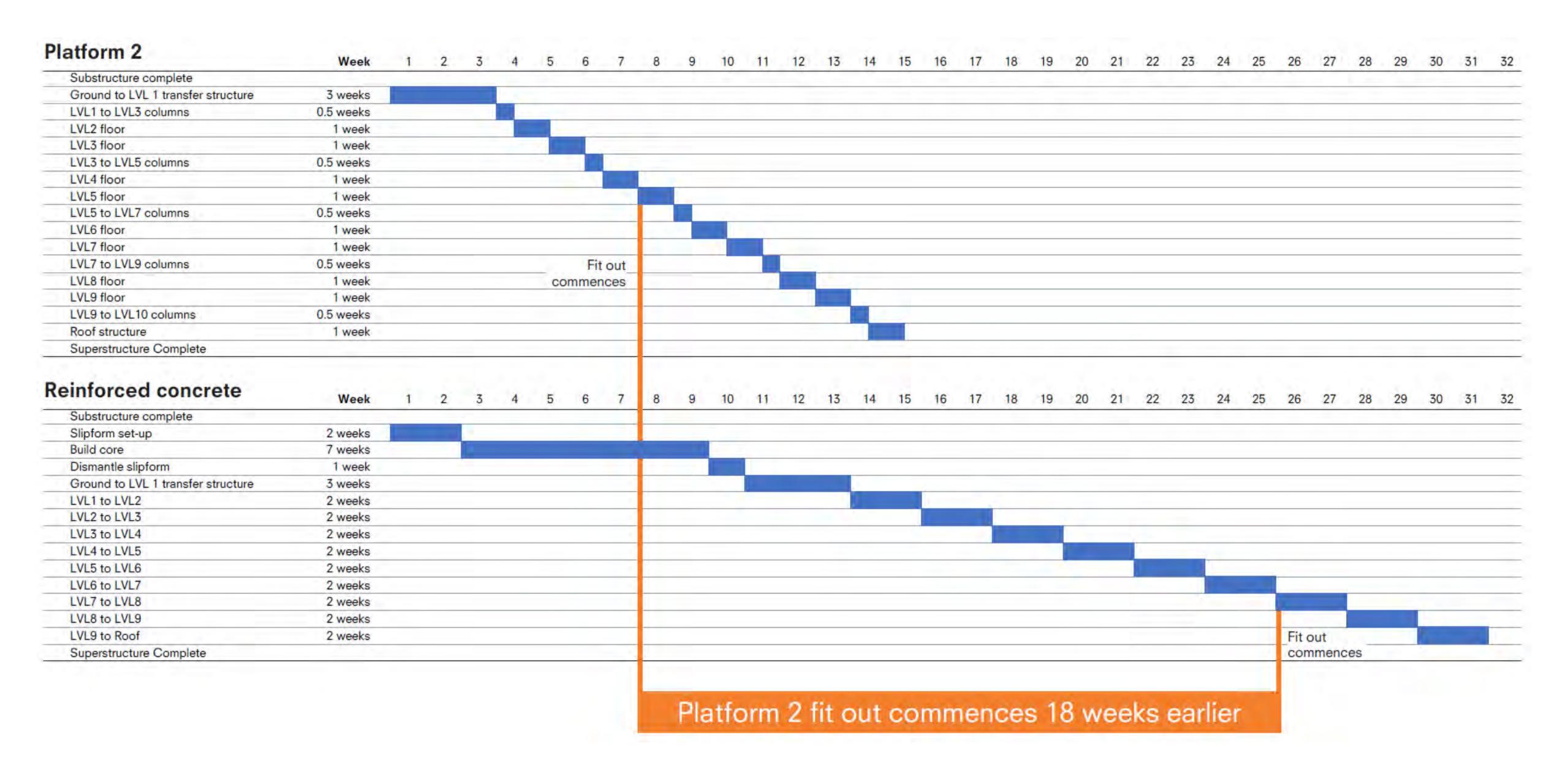
Steel weight





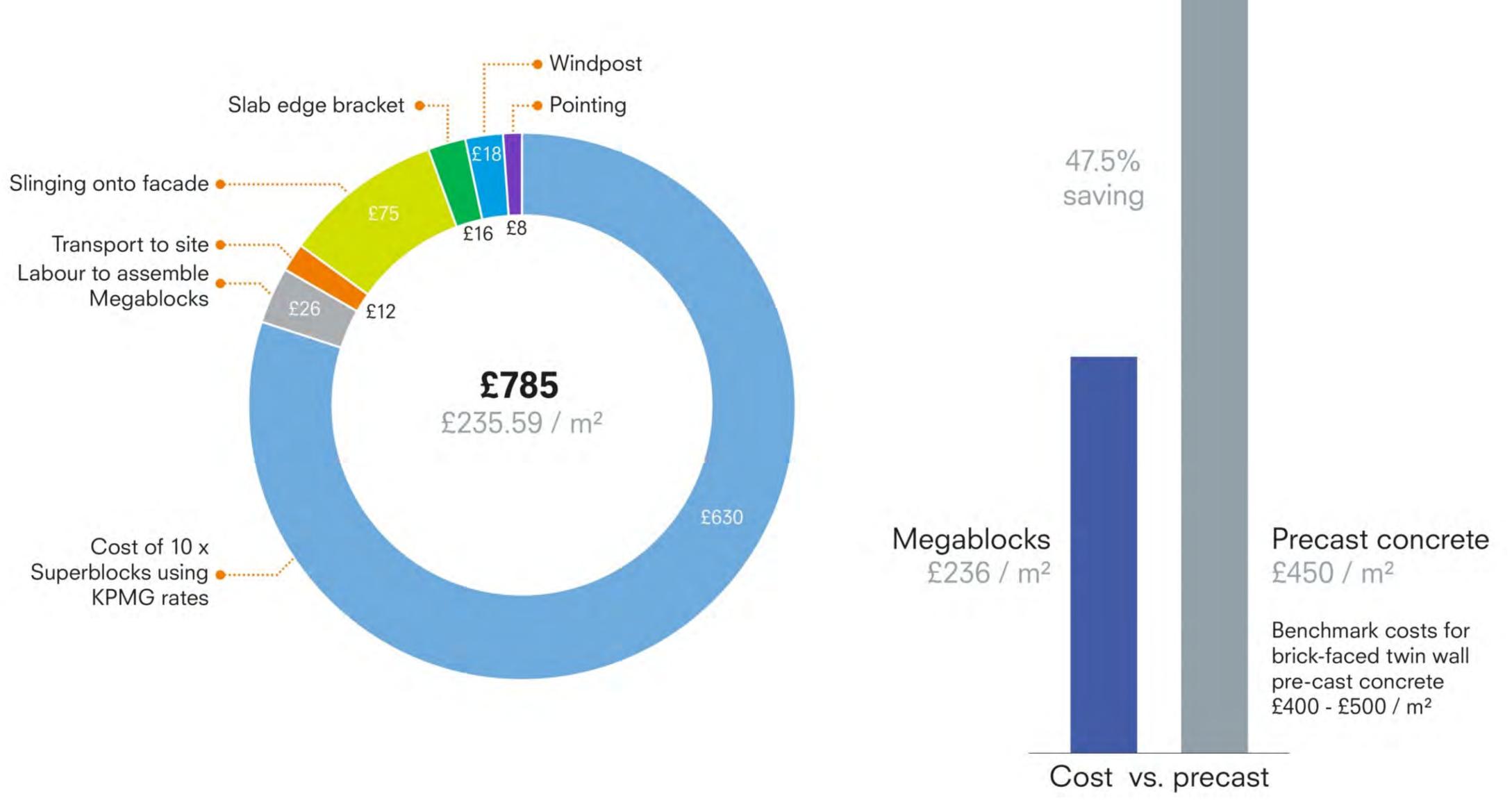


Platform 2

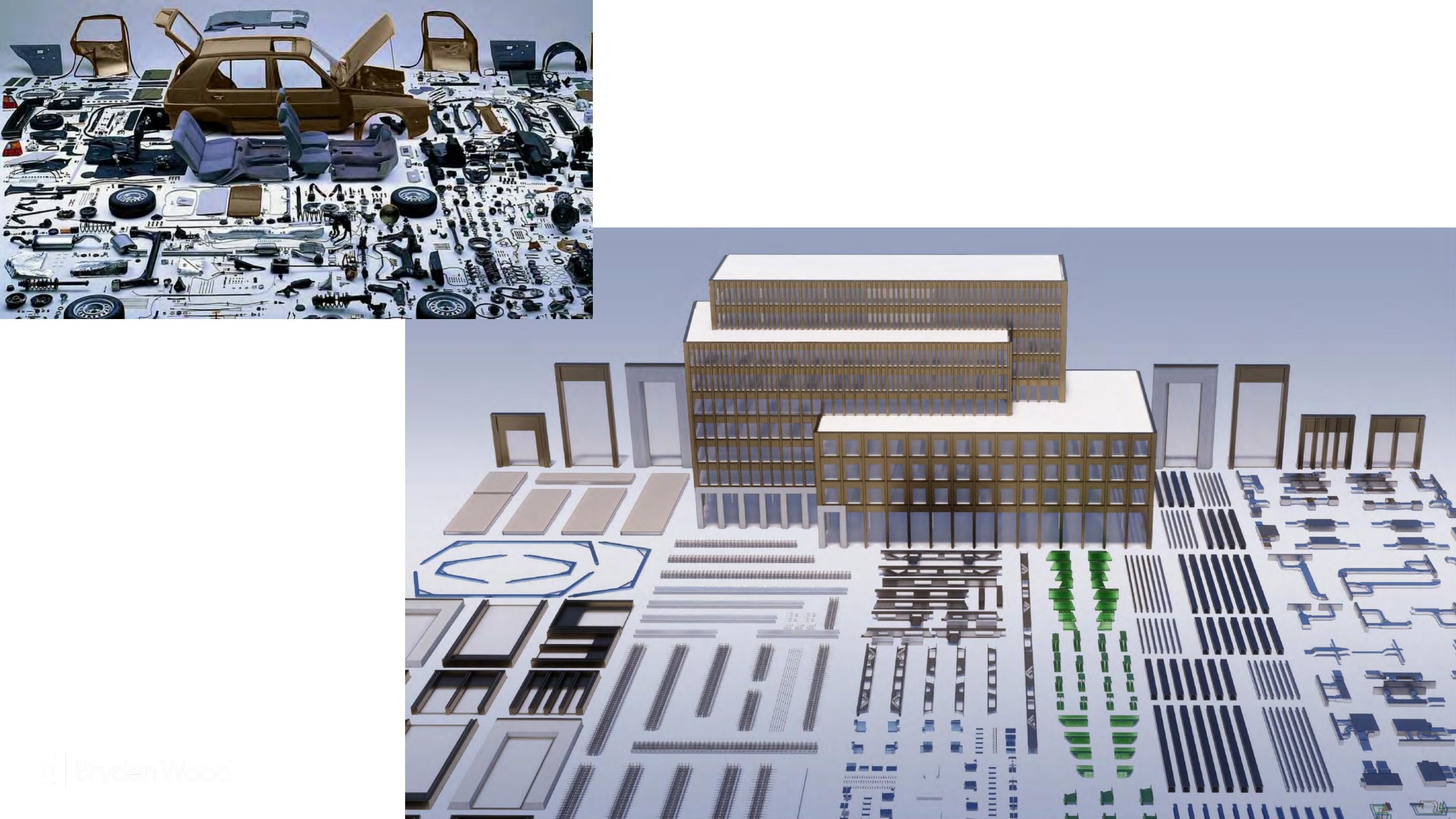


"Platforms could achieve a 33% reduction in capital cost"





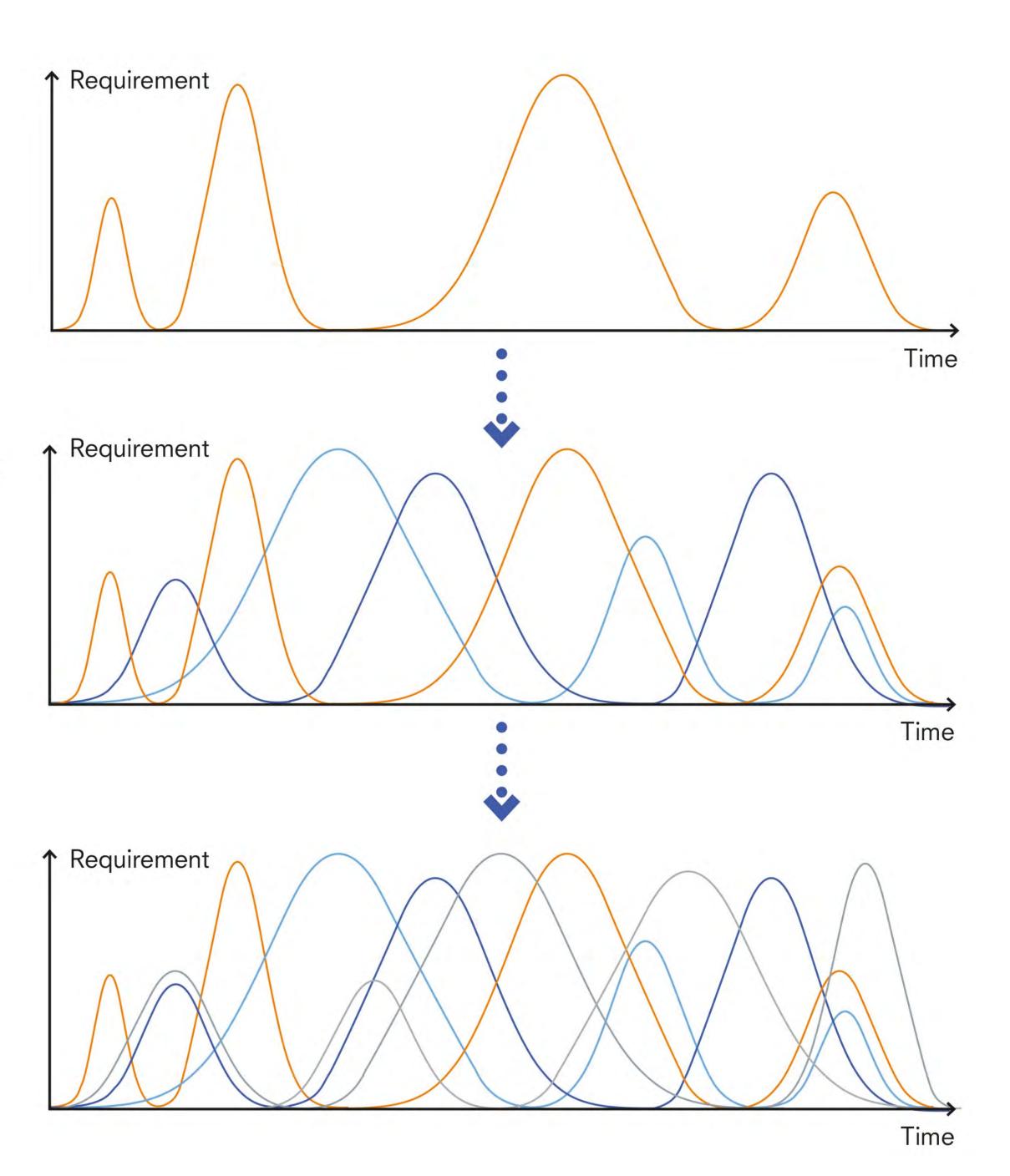


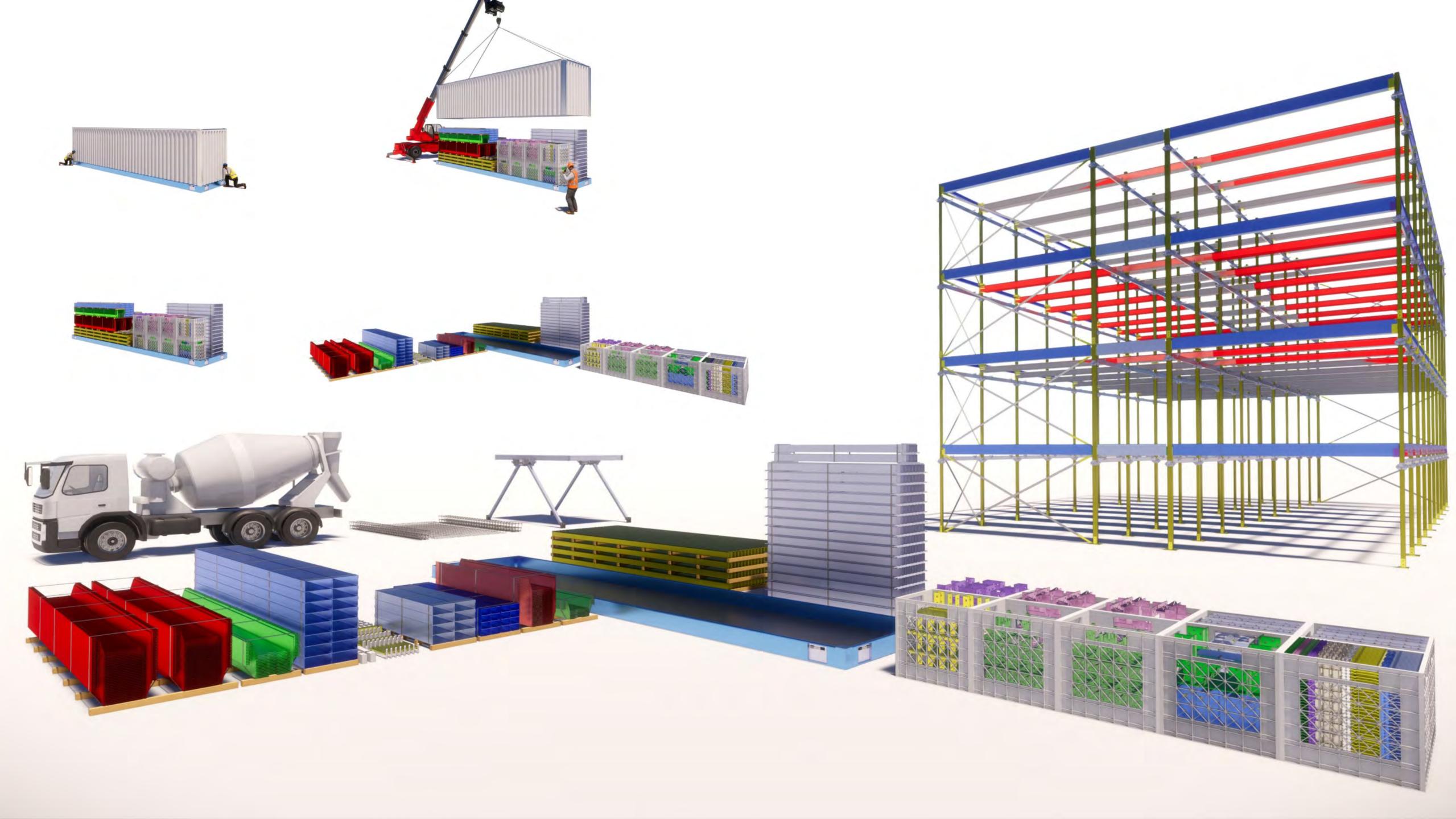


Requirements for single programme - often currently served by one factory

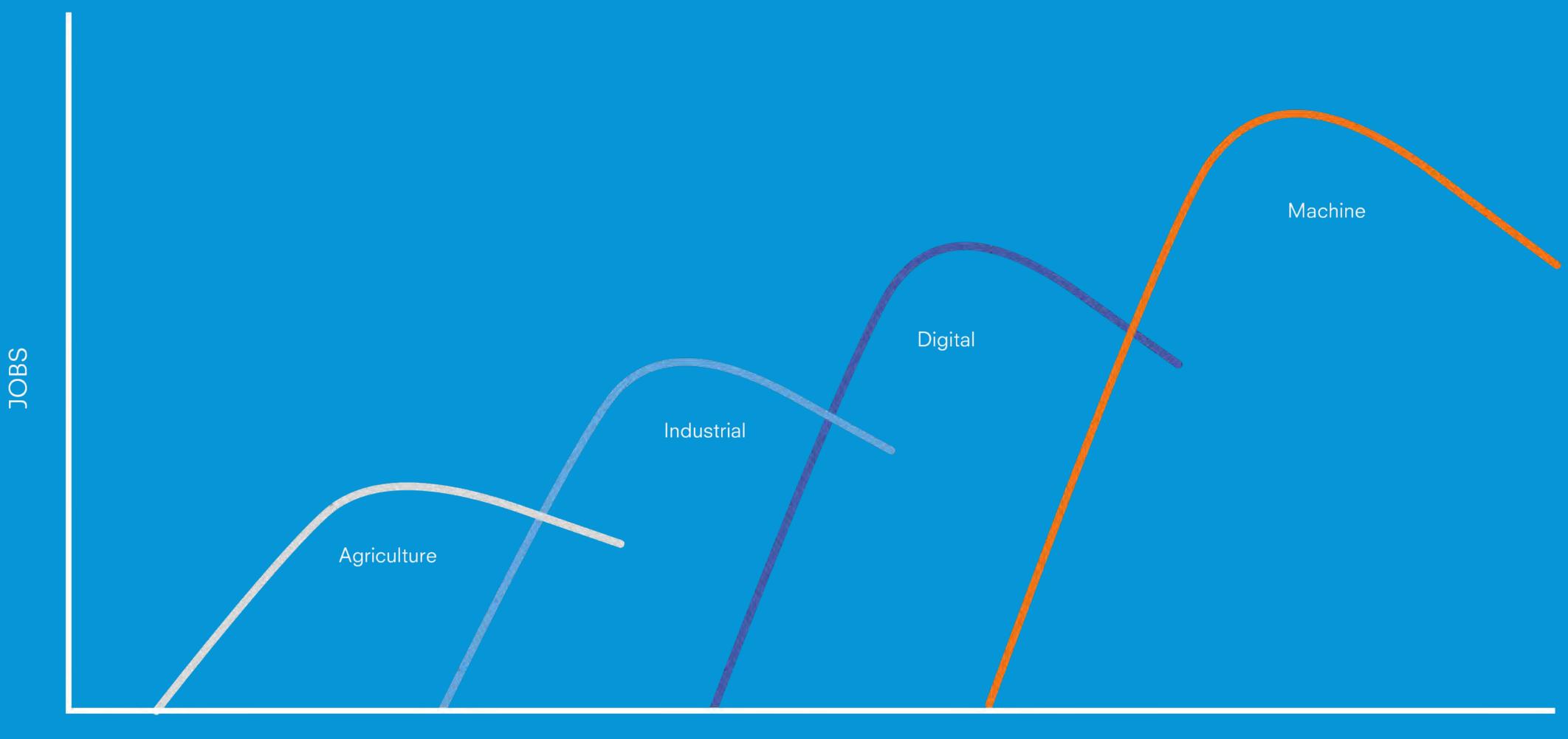
Aggregating the requirements for multiple programmes (through the use of shared components) starts to create a consistent pipeline

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





Each Industrial Revolution results in an increase in jobs

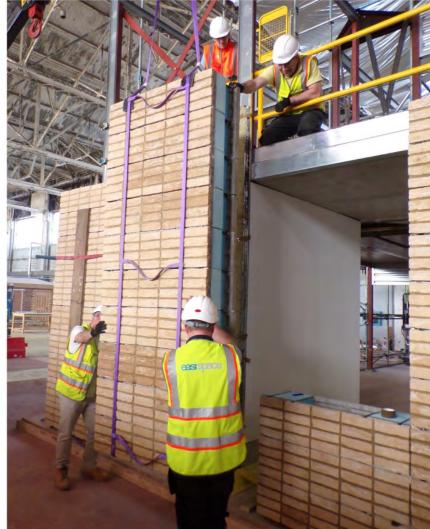




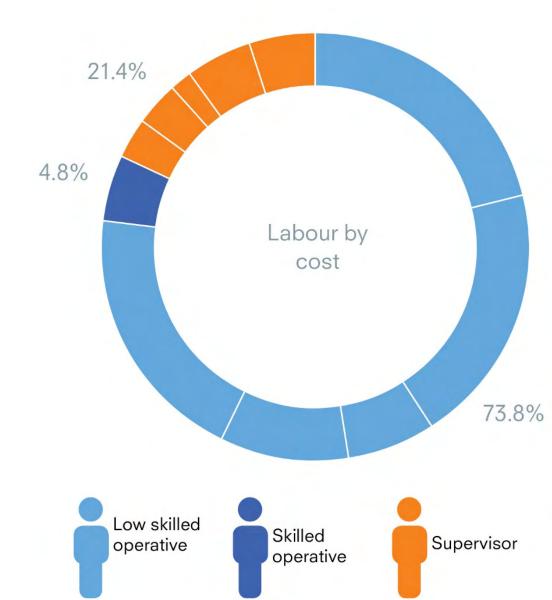








Manufacture using low skilled labour









Scaling up – achieving wider adoption in the industry

"The designer grants the Client an irrevocable, royalty-free, worldwide and non-exclusive licence in perpetuity to use, copy and reproduce the Materials for any purpose whatsoever."

Proposal for a New Delivery Platforms for Platforms: Bridging the gap between Approach to Building Government Assets construction + manufacturing **Delivery Platforms for** Bridging the gap **Government Assets** Autumn Statement Creating a marketplace for manufactured spaces 'The government will use its purchasing power to Proposal for a New Approach to Building: Call for Evidence drive adoption of modern methods of construction...' Bryden Wood UNIVERSITY OF CAMBRIDGE UNIVERSITY OF CAMBRIDGE August September October November December January February March August September October November April May 2017 2018 Infrastructure and Projects Authority CONSTRUCTION Industrial Transforming Infrastructure INNOVATION HUB Performance Strategy Construction Sector Deal Construction Innovation Hub awarded £72 million to drive innovation + technological advances in the UK construction and infrastructure sectors. Transforming Infrastructure Construction Sector Deal

HM Government

Performance



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

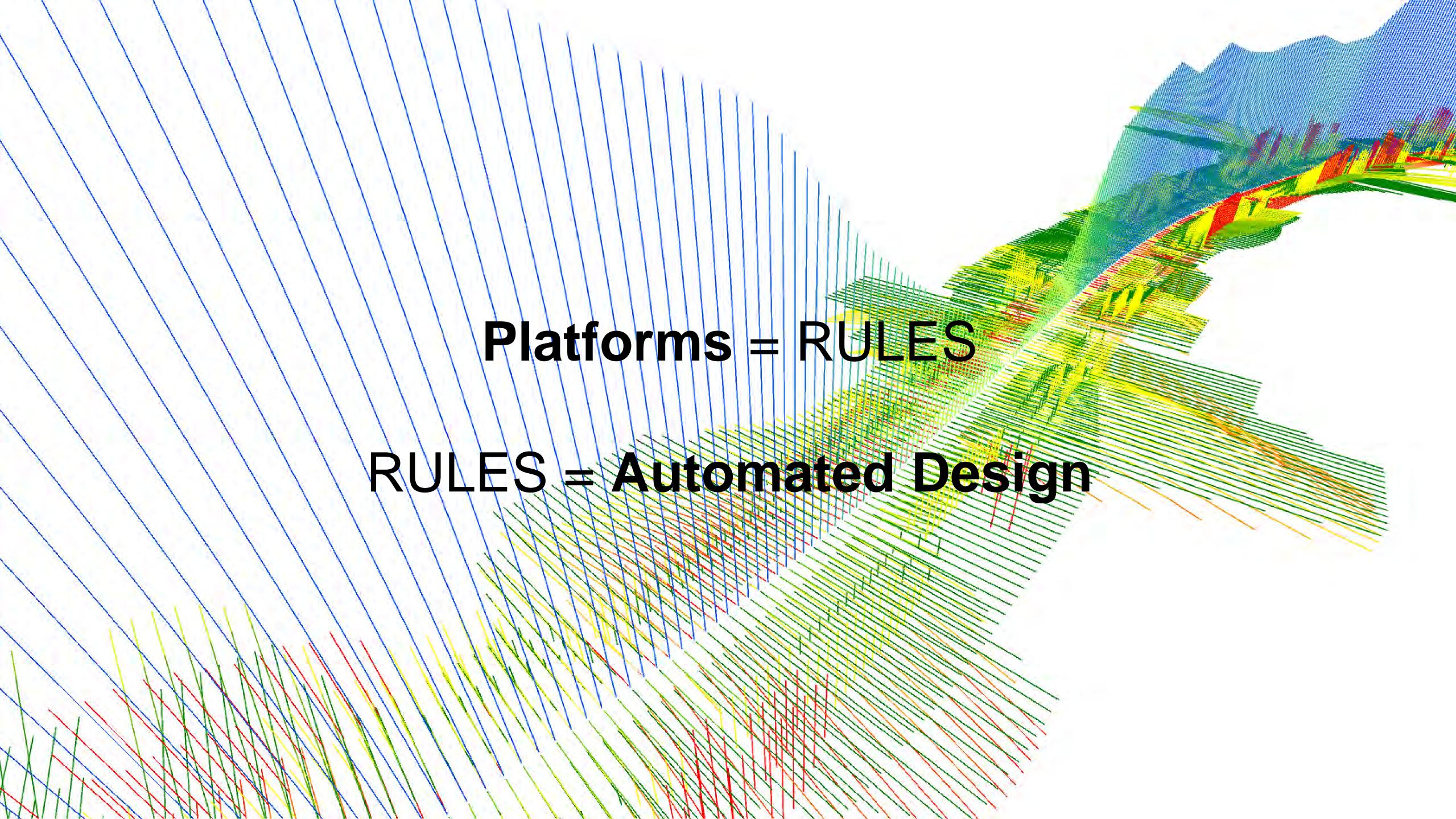
A platform approach means we will use digitally designed components across multiple types of asset and apply those components wherever possible, minimising the need to design bespoke components.

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

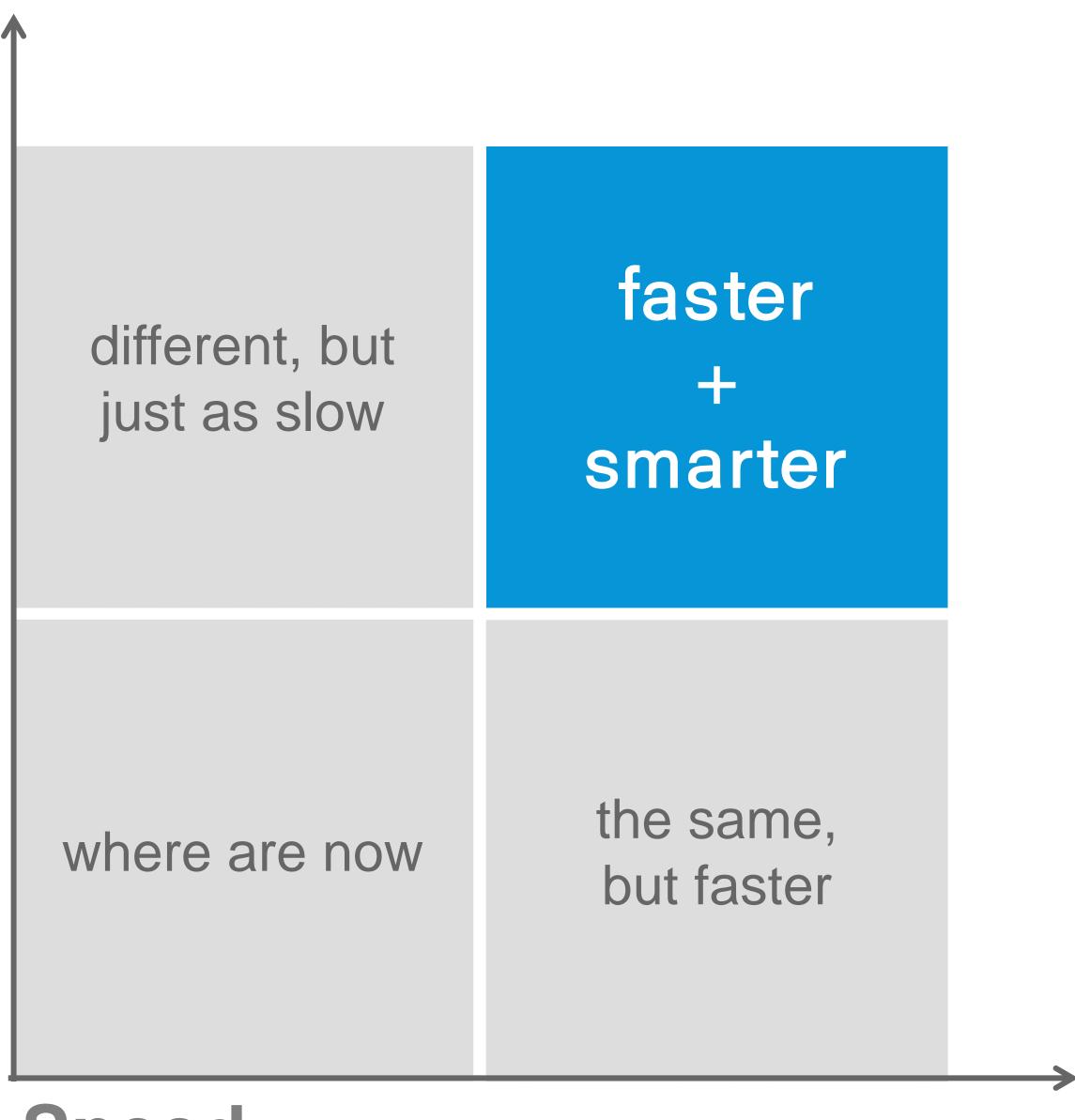
The three principles are:

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

Automated design



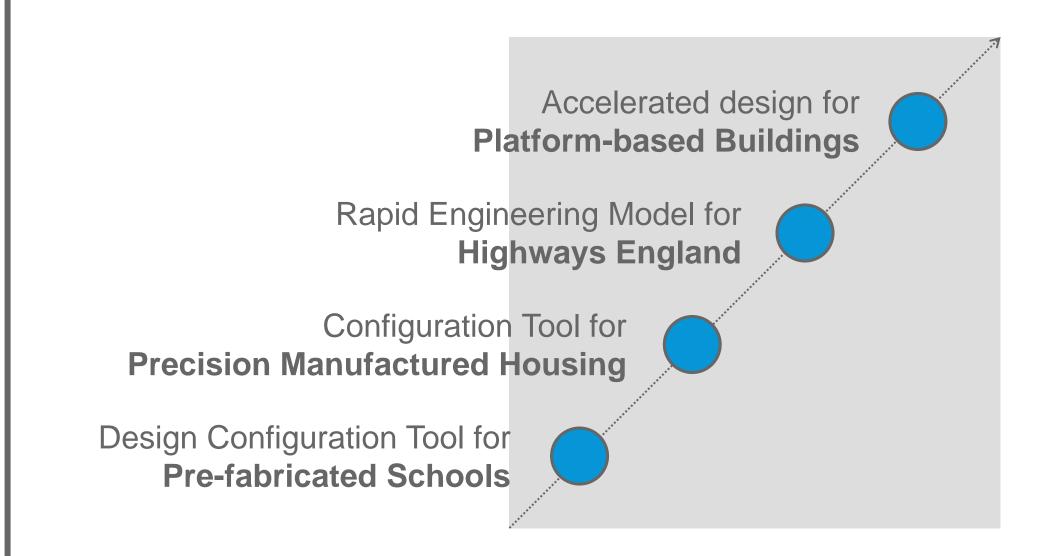
Automated Design —



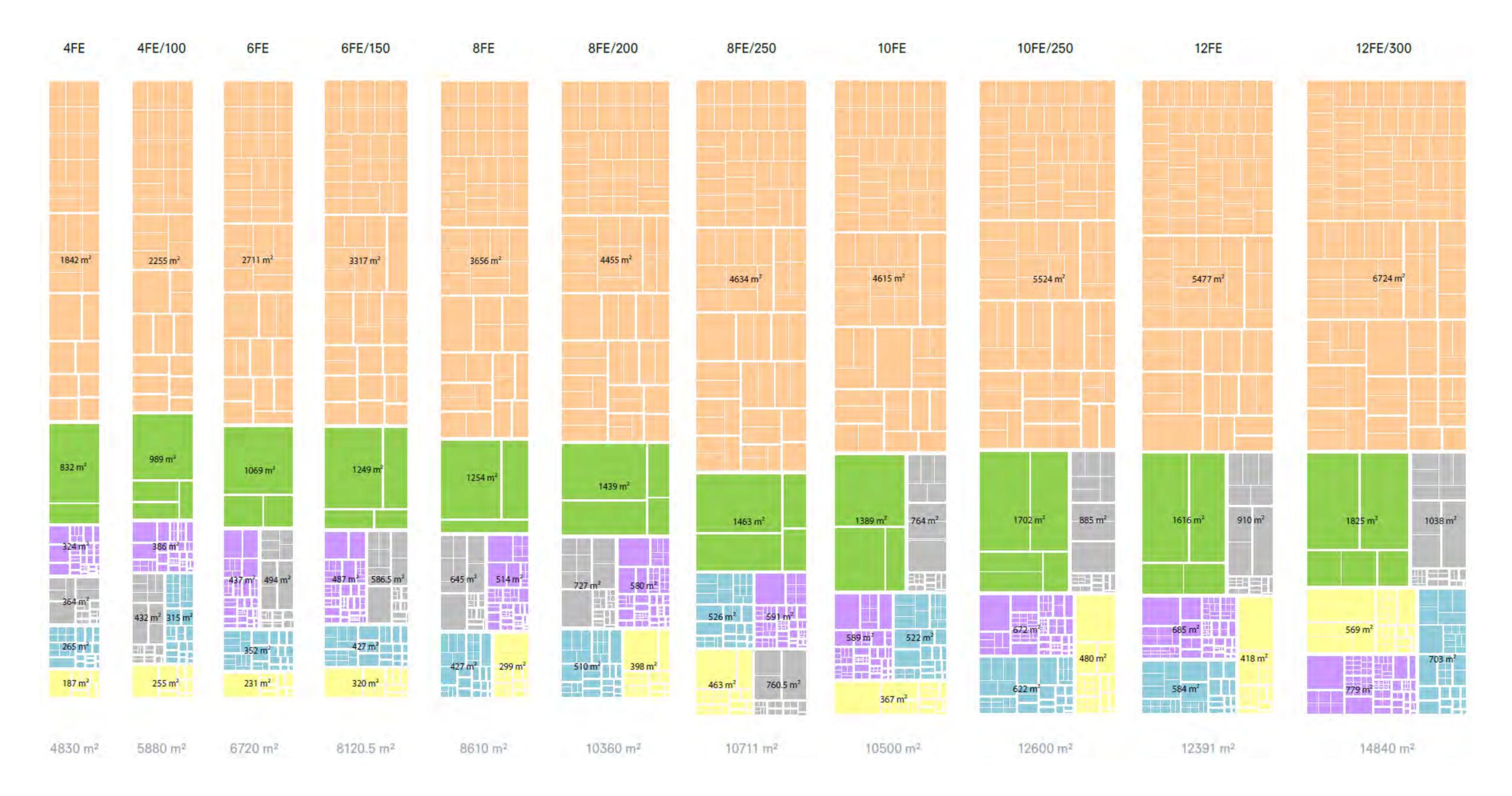
Speed

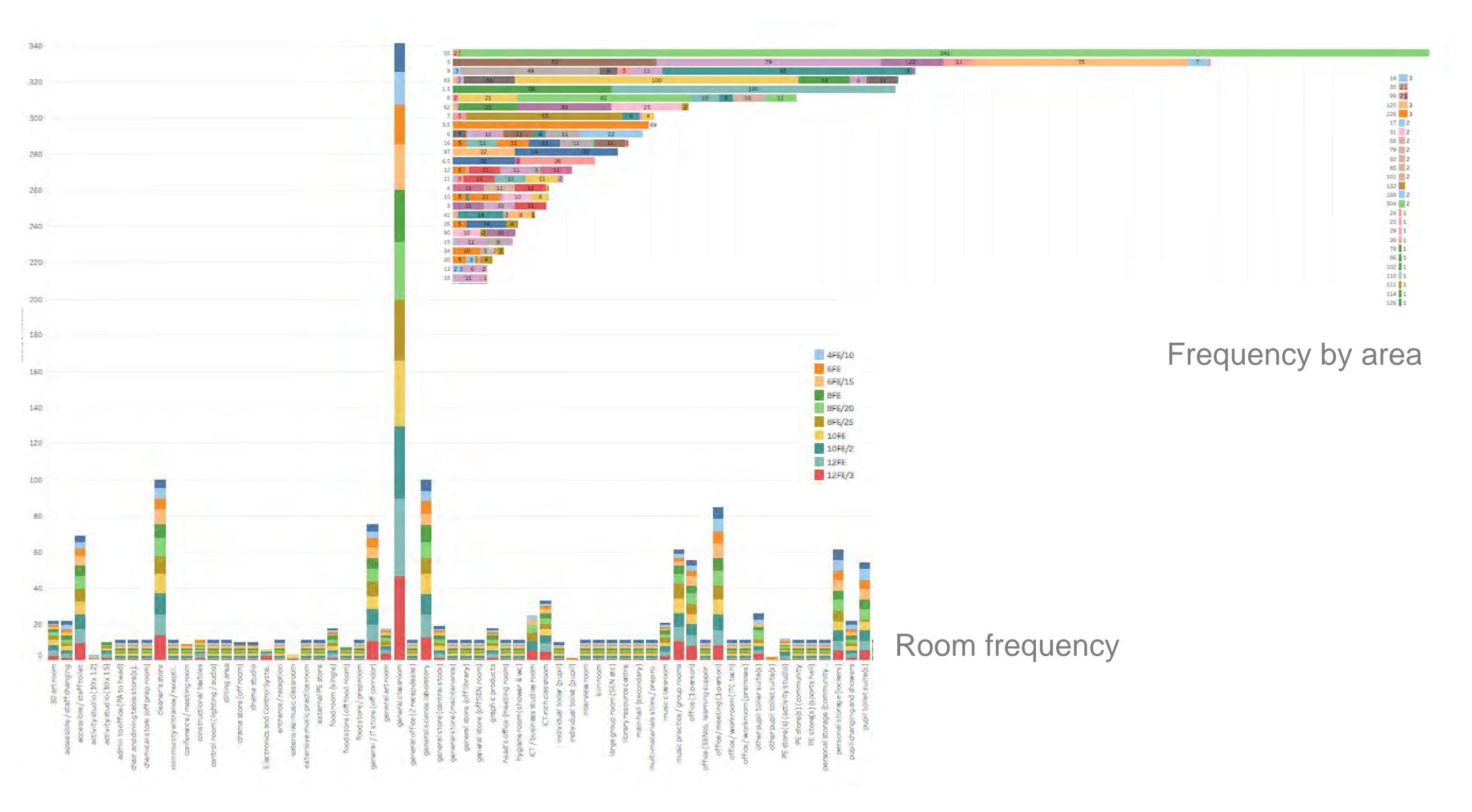
Automated Design

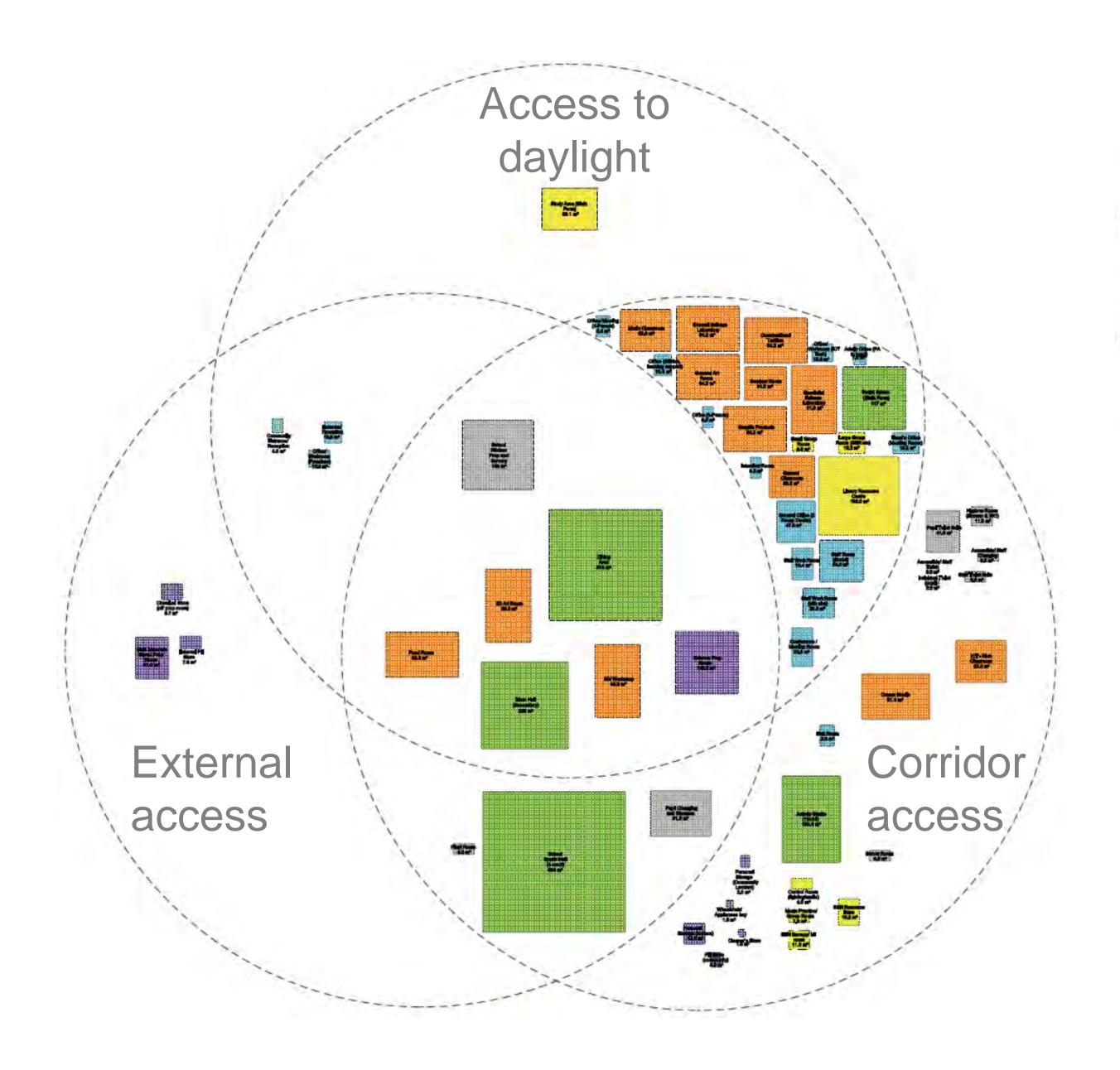
Open source apps + workflows

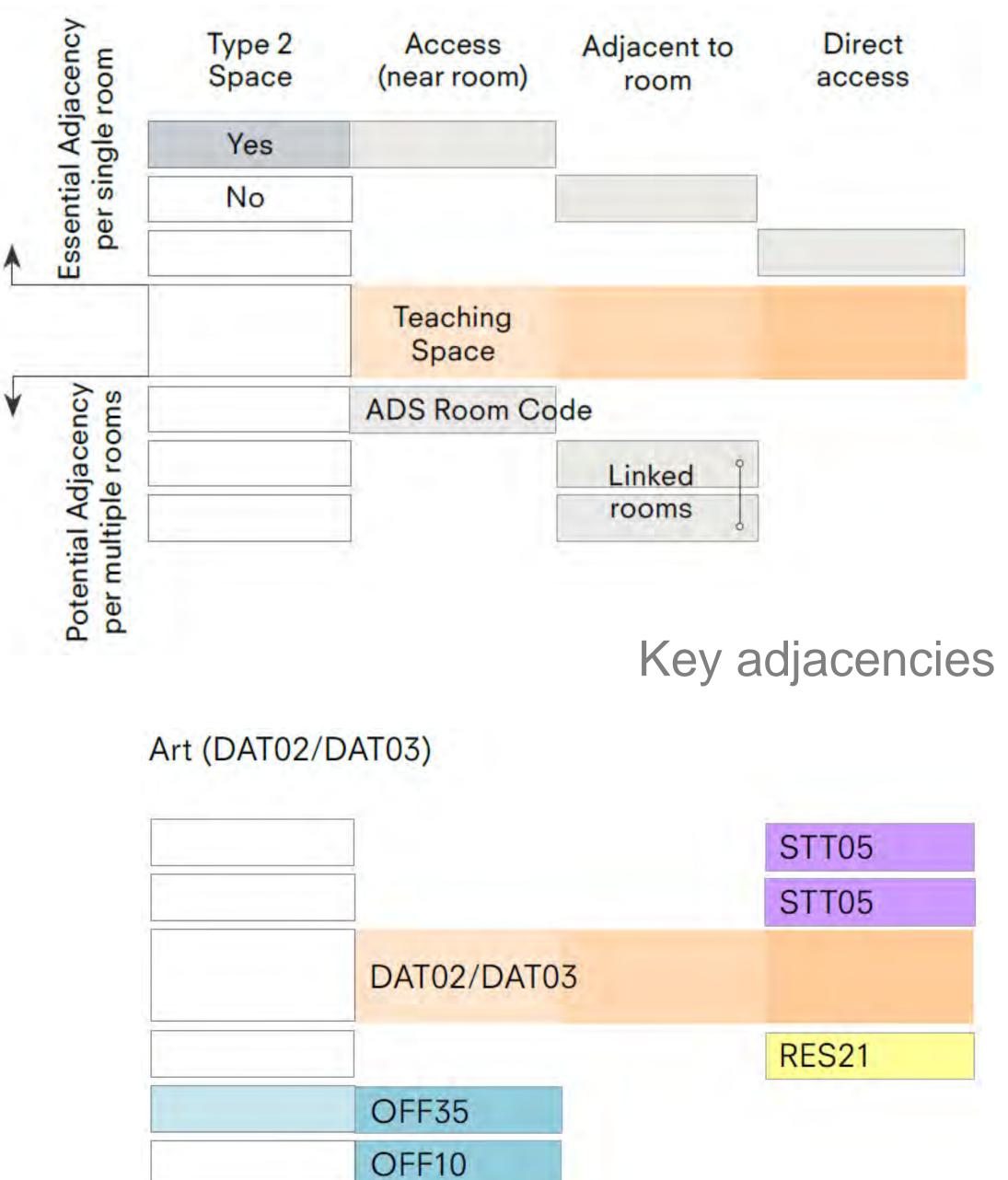






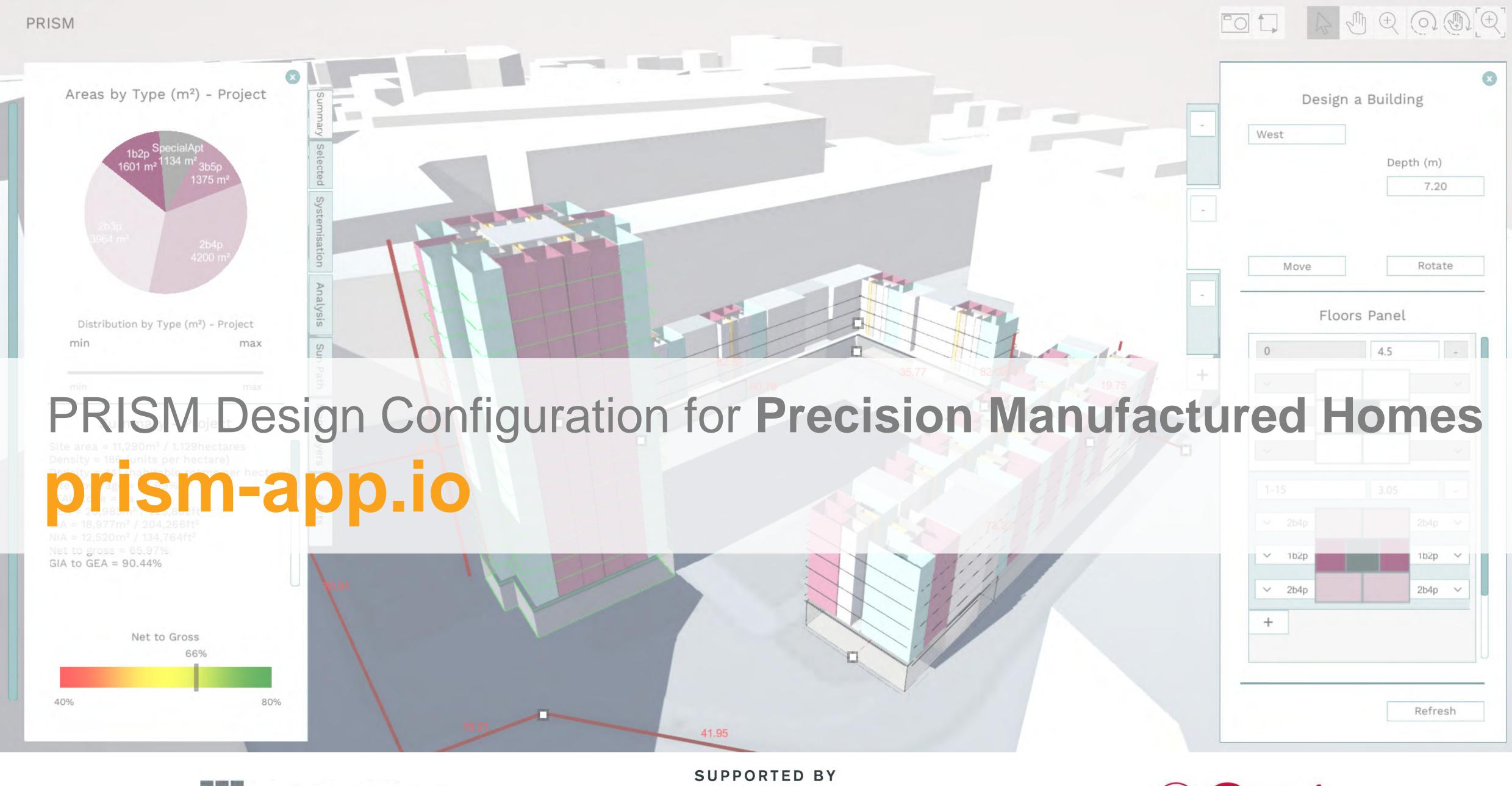












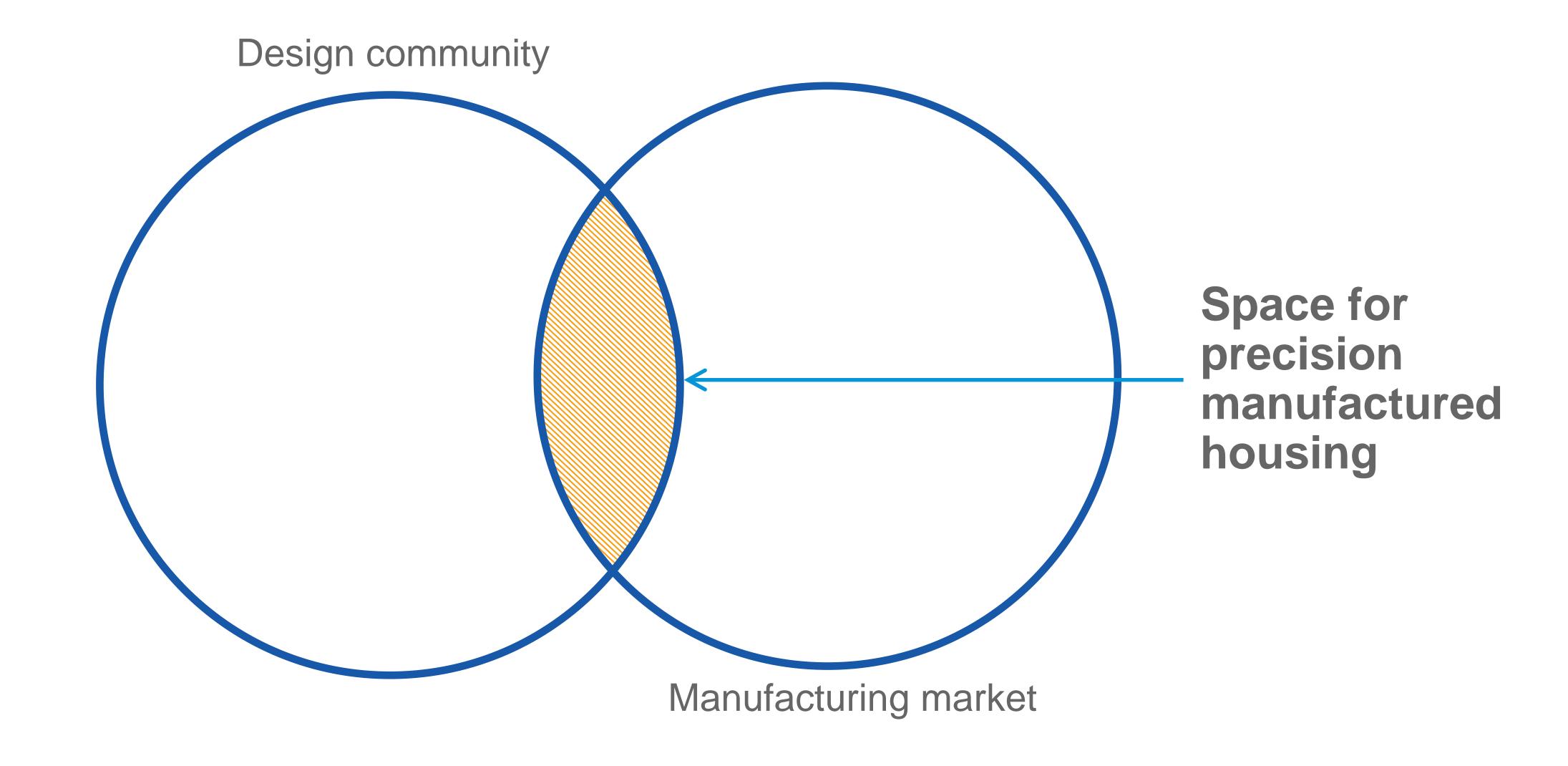


MAYOR OF LONDON

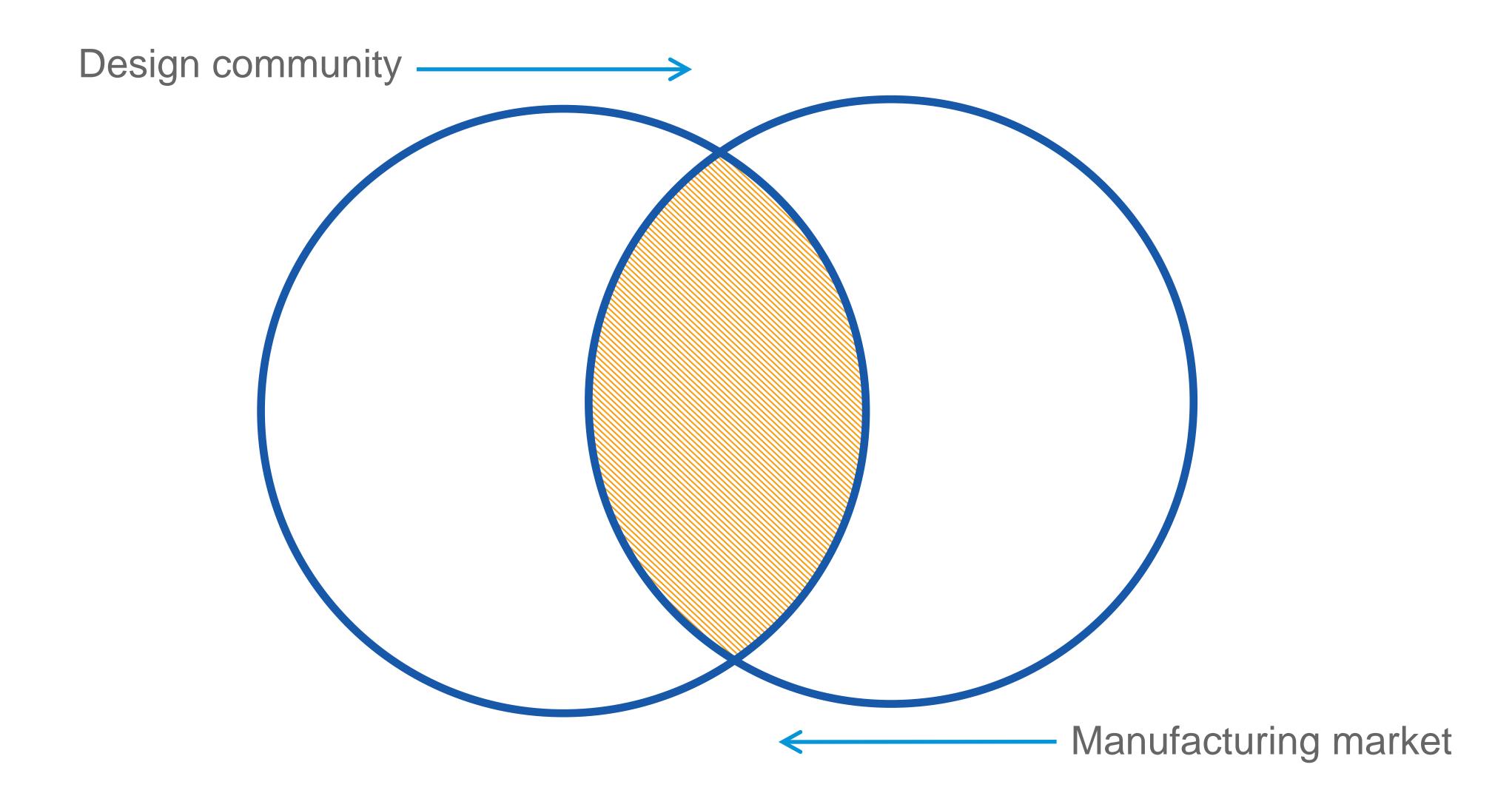


mapbox

Current state

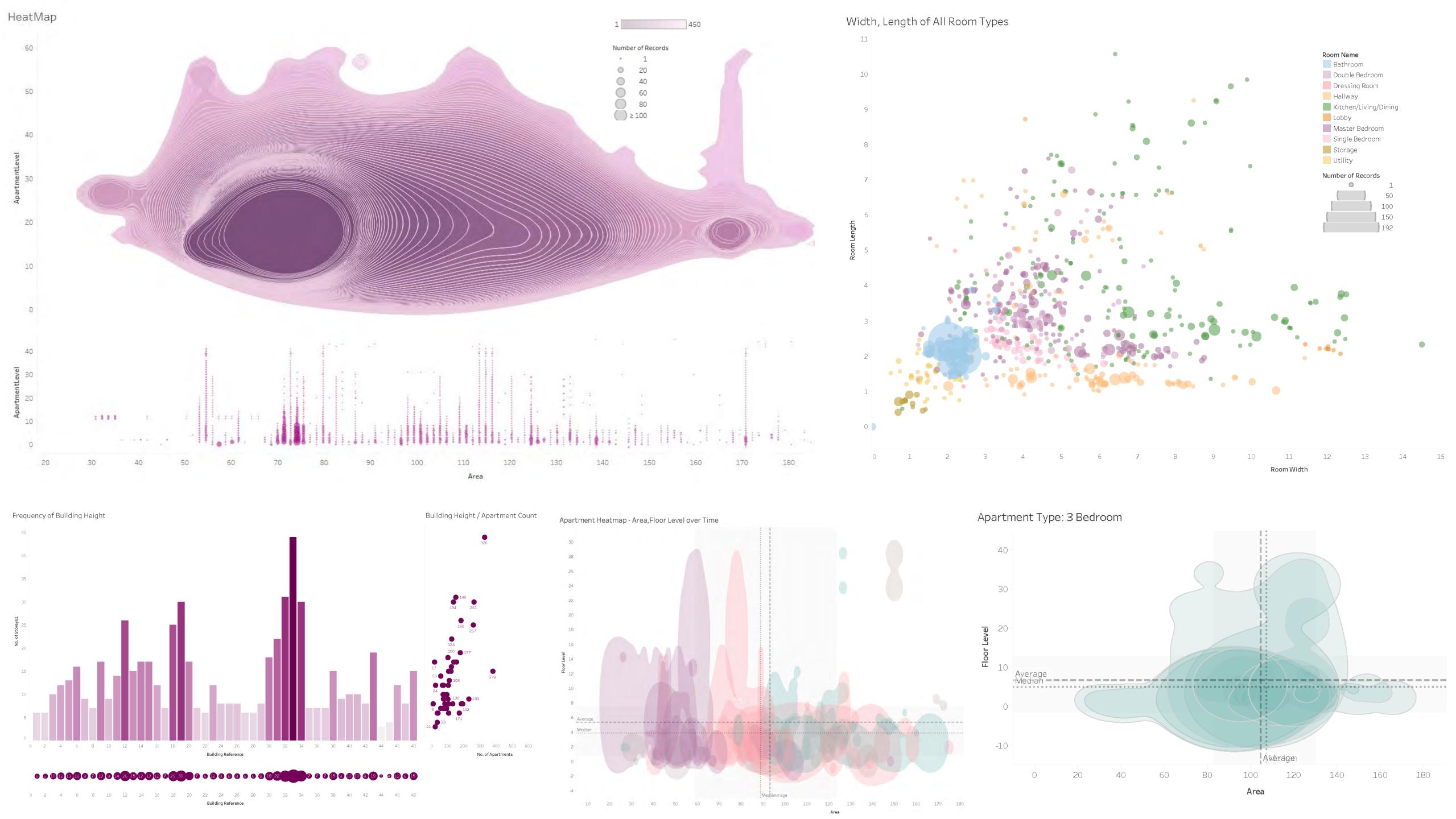


Future state



How did we go about it?

- 1. Data analysis of London housing
- 2. Capture spatial design rule sets
- 3. Capture manufacturing systemisation rule sets
- 4. Create a digital toolkit



How did we go about it?

- 1. Data analysis of London housing
- 2. Capture spatial design rule sets
- 3. Capture manufacturing systemisation rule sets
- 4. Create a digital toolkit

Apartment central logic and parametric design



How did we go about it?

- 1. Data analysis of London housing
- 2. Capture spatial design rule sets
- 3. Capture manufacturing systemisation rule sets
- 4. Create a digital toolkit







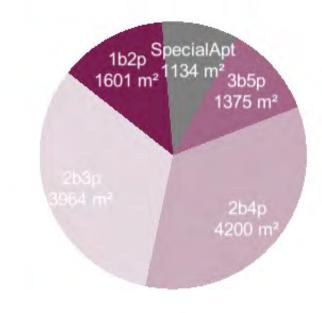






Areas by Type (m²) - Project

PRISM



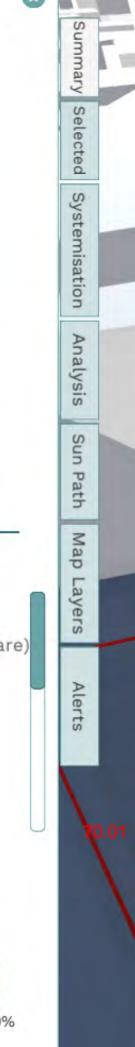
Distribution by Type (m²) - Project min max

max

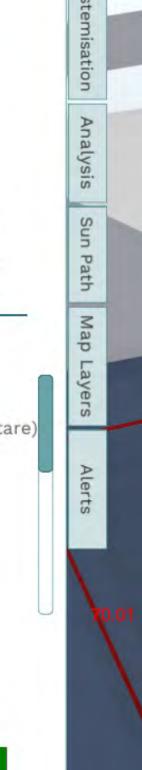
Summary - Project

Site area = 11,290m² / 1.129hectares Density = 186 (units per hectare) Density = 441 (habitable rooms per hectare) Site Coverage = 24.69% PTAL Zone = 6a $GEA = 20,983m^2 / 225,862ft^2$ GIA = 18,977m² / 204,266ft² NIA = 12,520m² / 134,764ft² Net to gross = 65.97% GIA to GEA = 90.44%

Net to Gross











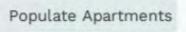










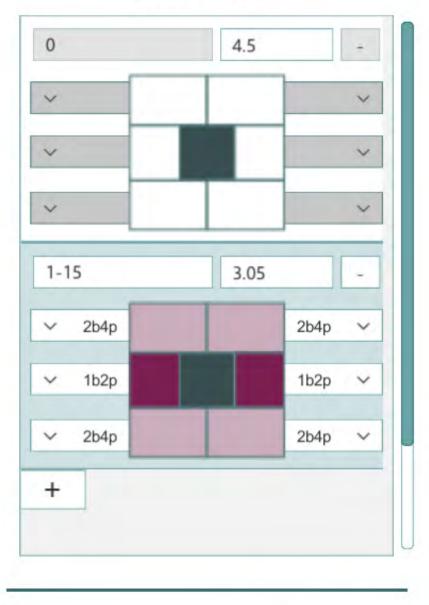




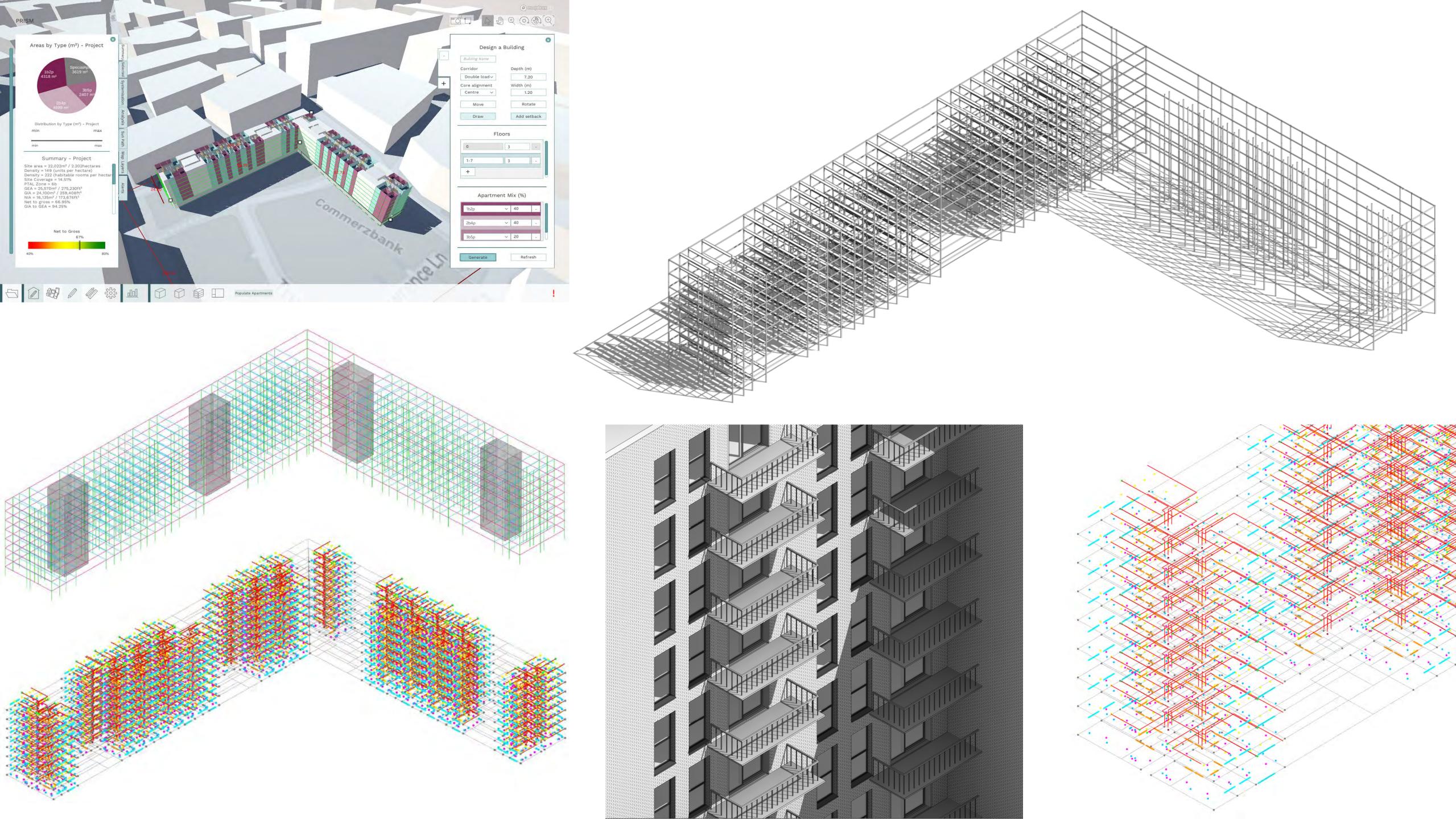
Depth (m) 7.20

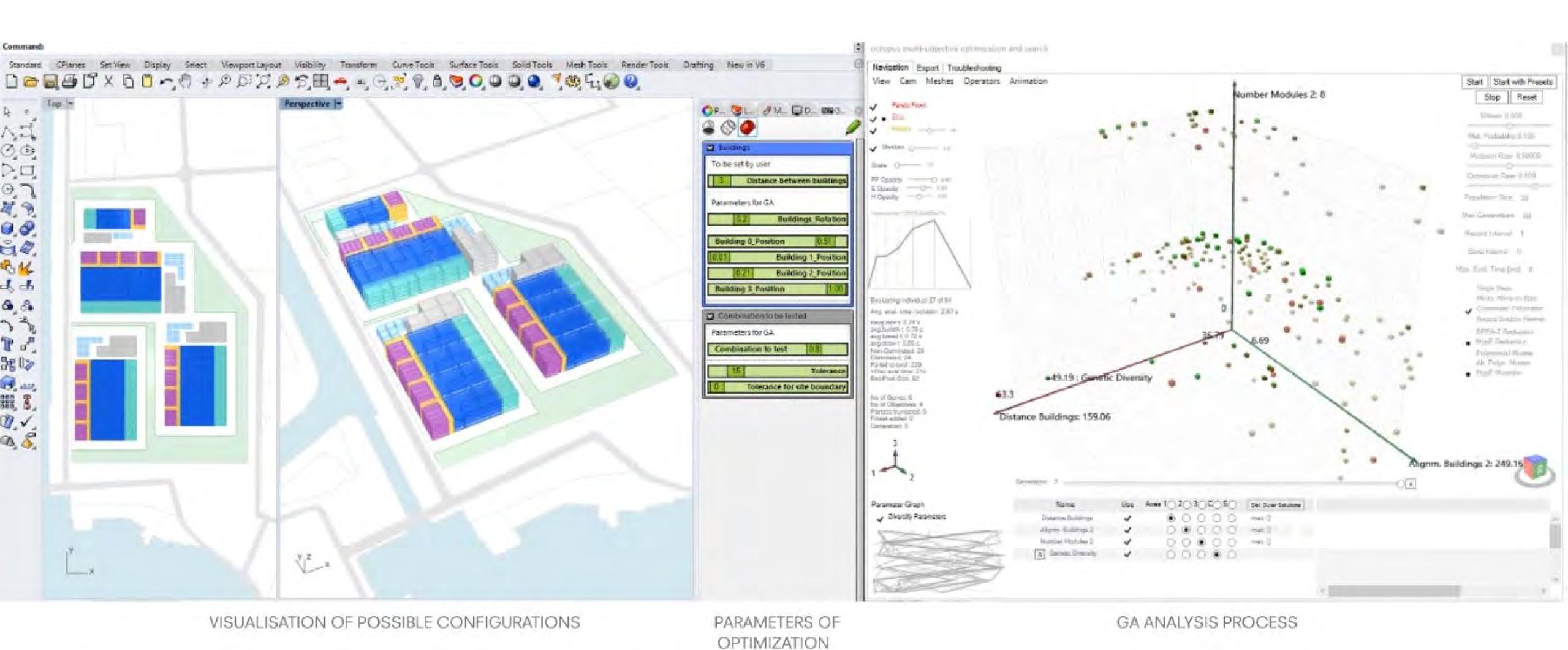
Rotate

Floors Panel

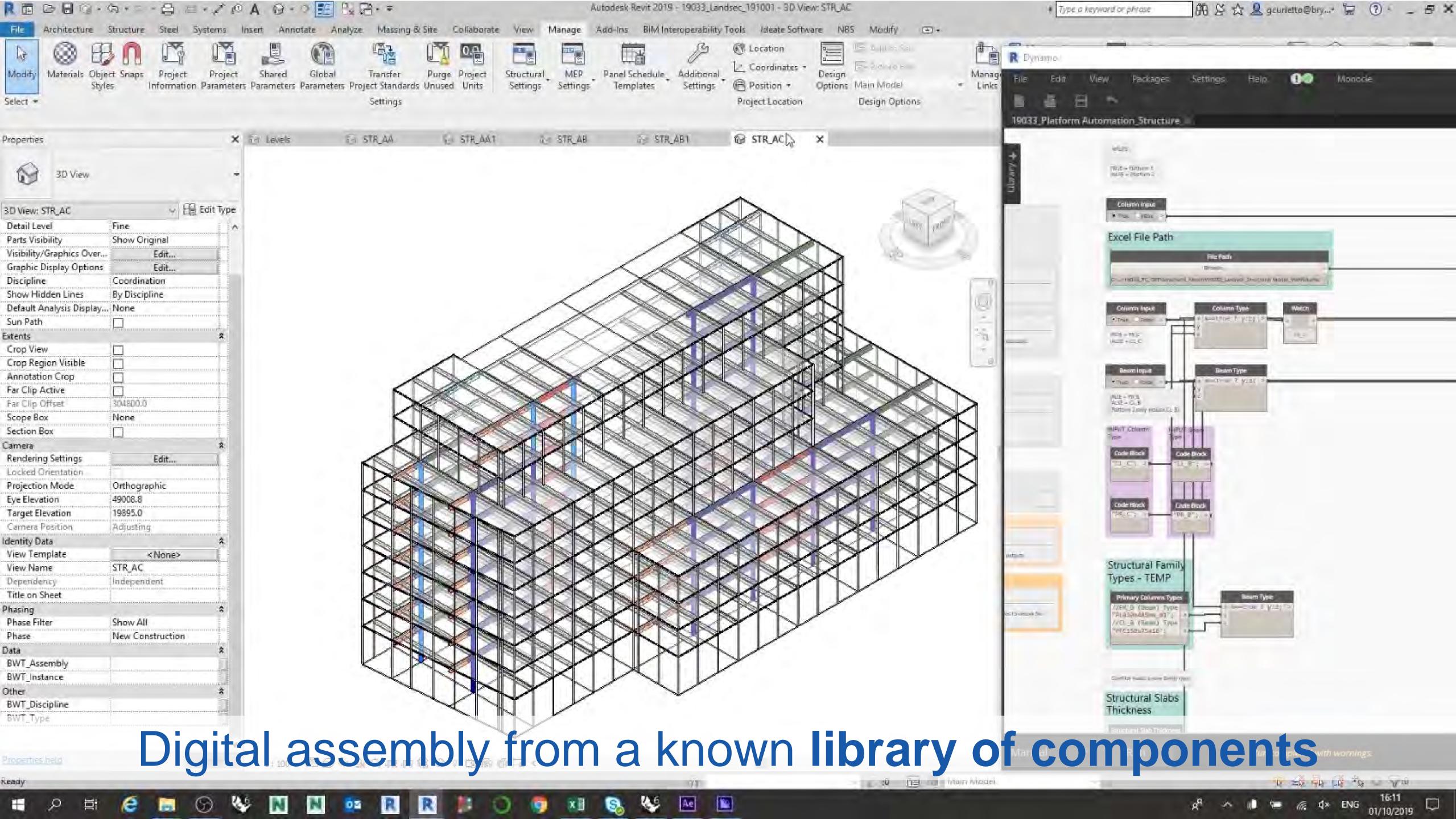


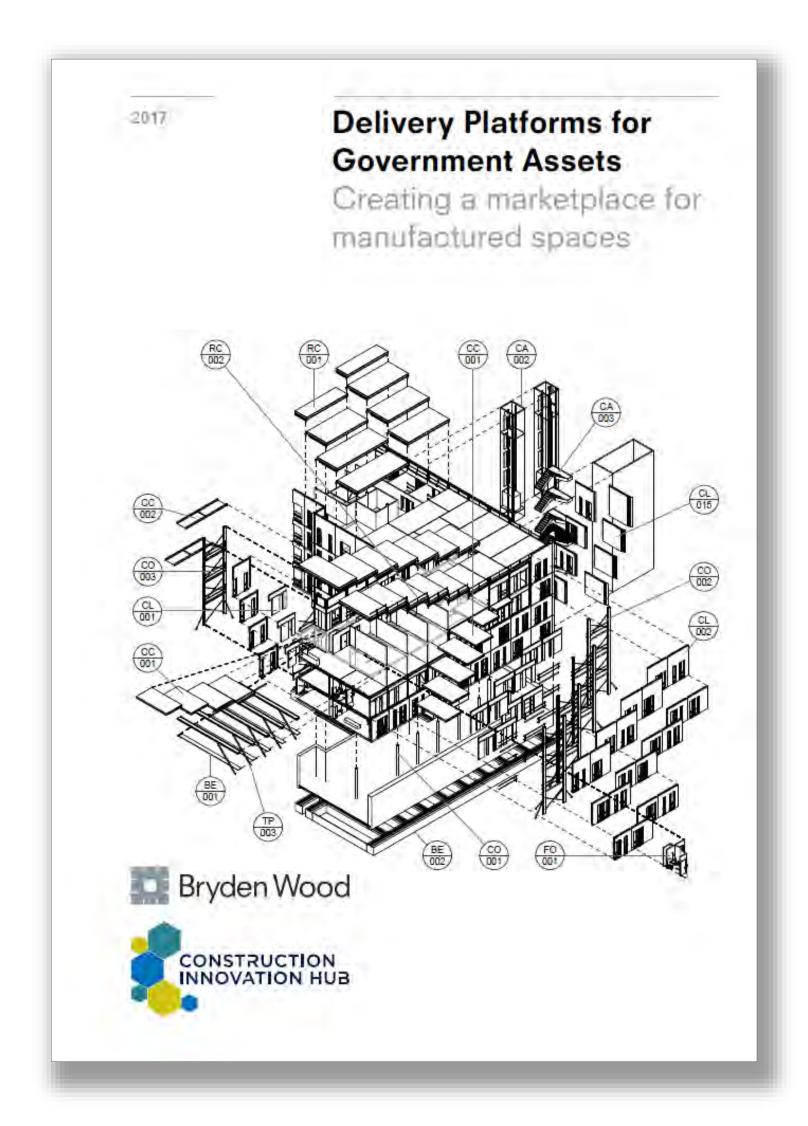
Refresh

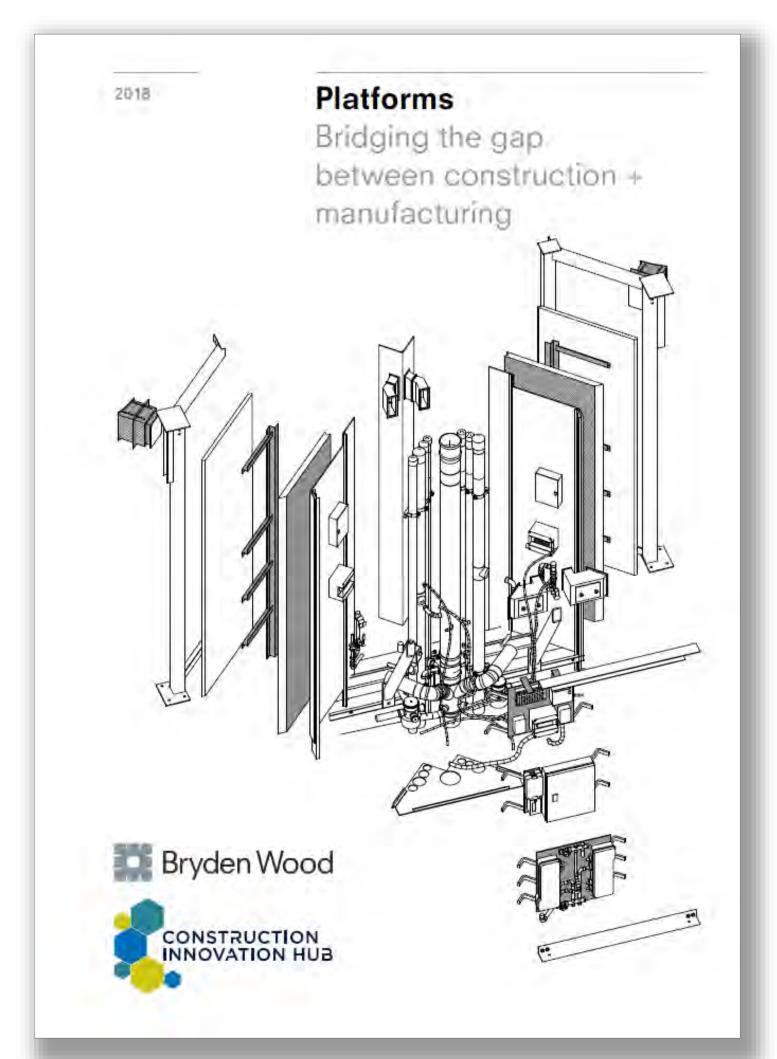




Optimise site layouts using a genetic algorithm









brydenwood.co.uk/perspectives/178/



Autodesk and the Autodesk logo are registered trademarks or trademarks of Autodesk, Inc., and/or its subsidiaries and/or affiliates in the USA and/or other countries. All other brand names, product names, or trademarks belong to their respective holders. Autodesk reserves the right to alter product and services offerings, and specifications and pricing at any time without notice, and is not responsible for typographical or graphical errors that may appear in this document.

© 2019 Autodesk. All rights reserved.

