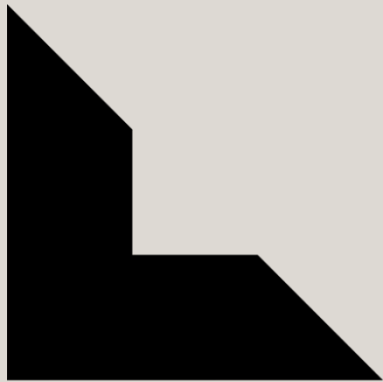


CIRIA tour of The Forge 15th January 2024

Transforming Construction at The Forge

Neil Pennell – Head of Design Innovation
& Property Solutions, Landsec
Ryan Kimber – Director, Bryden Wood



Landsec



About Landsec

- We are one of the leading real estate companies in the UK, with a £10.1 billion* portfolio comprising c24m sq ft, including:
 - Central London Offices
 - Major Retail Destinations
 - Mixed-Use Urban Neighbourhoods
- Our purpose:
 - Sustainable places
 - Connecting communities
 - Realising potential

* Portfolio value at 30 Sept 2023



Focused on delivering sustainably

Sustainability embedded throughout our business

OUR VISION: We design, develop and manage places that enhance the health of our environment and improve quality of life for our people, customers and communities, now and for future generations

We will design, develop and manage places to tackle climate change, enhancing the health of the environment by achieving net zero and going beyond.

TARGETS

Reduce absolute scope 1,2 and 3 GHG operational emissions by **47% by 2030 and 90% by 2040** compared with a 2020 baseline.

Reduce average **embodied carbon by 50%** compared with a typical building by 2030.

Developed **£135m net zero transition investment plan.**



We will be a fair and responsible business in everything we do.

TARGET

All Landsec colleagues to have individual objectives to **support the delivery** of our vision.

We will create opportunities and inclusive places to change lives, supporting communities to thrive.

TARGET

Investing **£20m** into a Landsec Futures Fund empowering 30,000 people towards the world of work, **creating £200m of social value** in our local communities by 2030.

Leading on climate resilience is a strategic priority for Landsec as it helps us ensure our business remains relevant and creates value over the long term

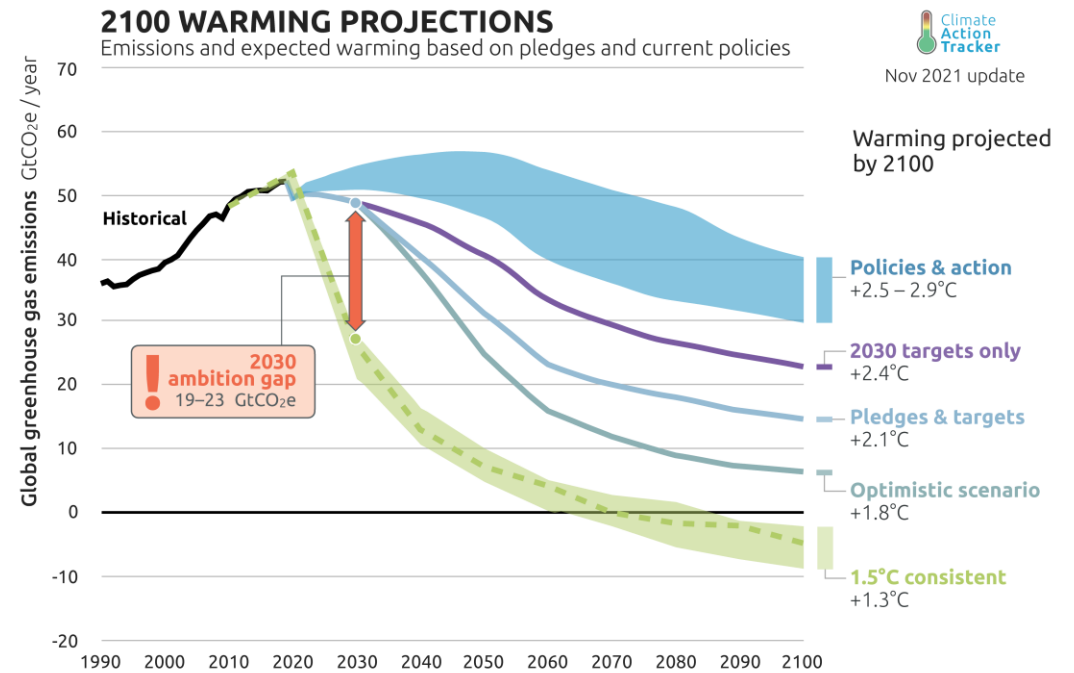
— Climate Change is considered a principal risk to the real estate sector, particularly transition risks:

Policy and Legal

- Minimum Energy Efficiency Standard regulation: EPC B or above by 2030
- Introduction of performance-based energy rating system
- TCFD climate disclosure mandatory for all UK listed companies
- Possible introduction of carbon tax or carbon cap-and-trade scheme

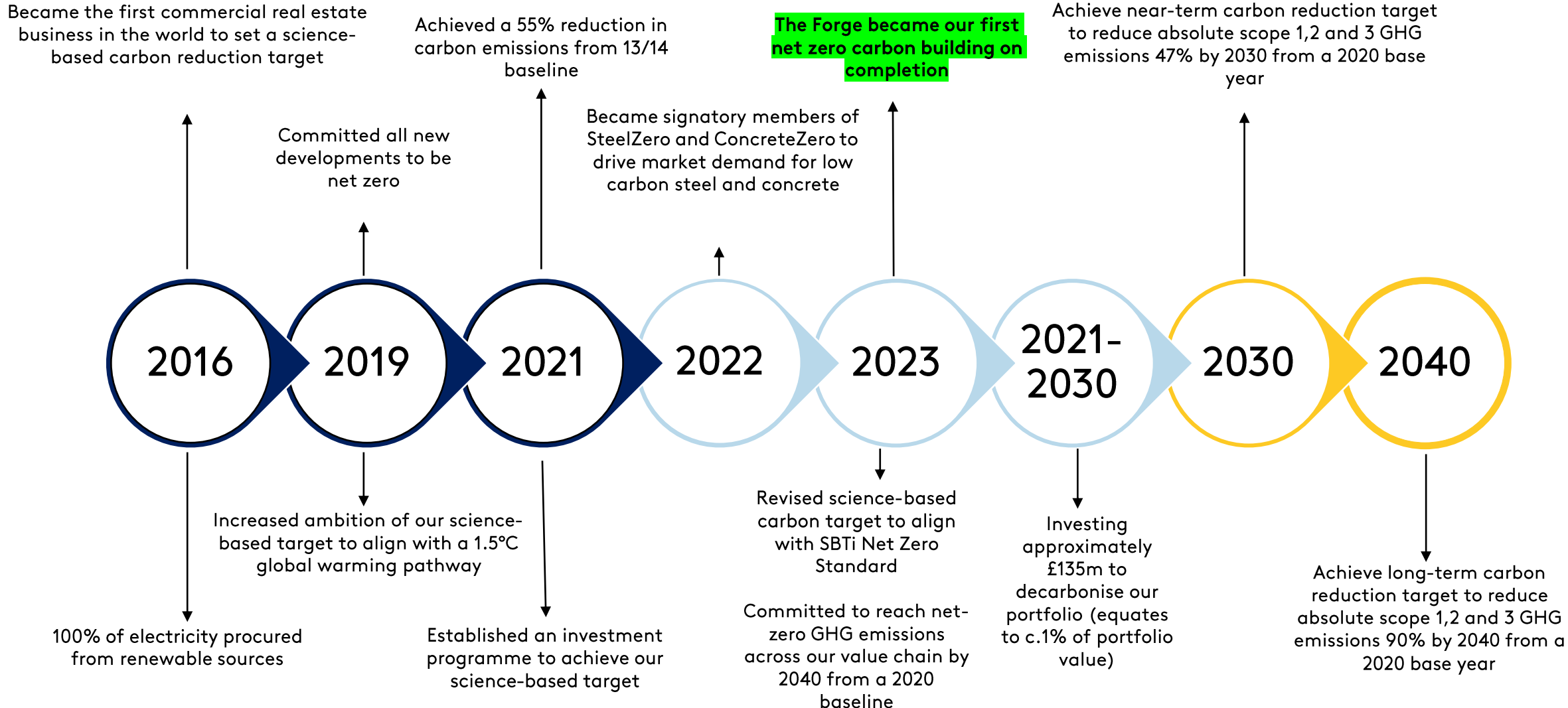
Market

- Change in customer demands: increase in the number of companies setting net zero and science-based targets



Source: climateactiontracker.org

Our transition to net zero



Our Net Zero Carbon Strategy

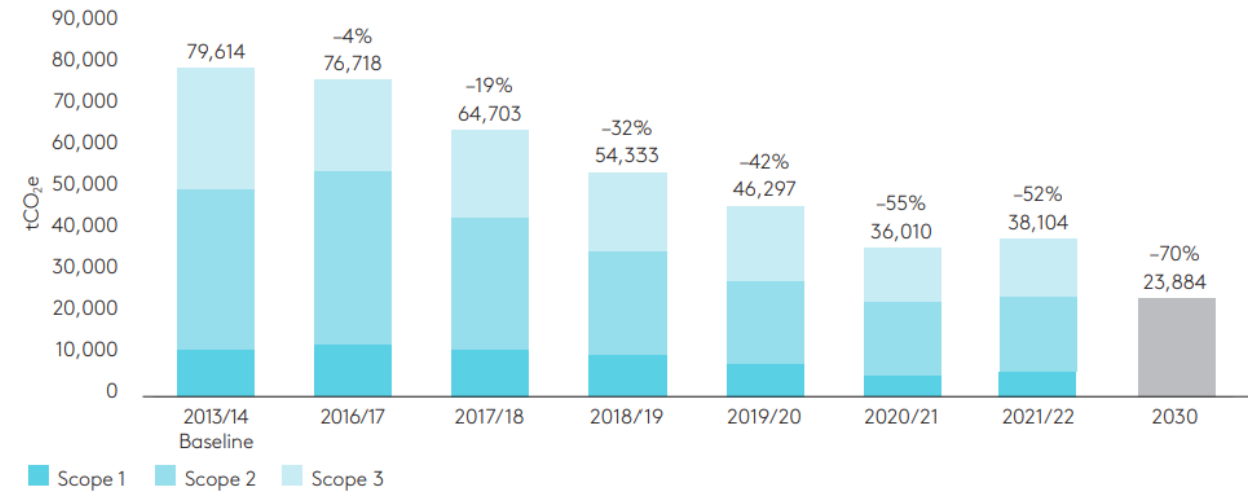
As a leader in our sector, we've committed to becoming a net zero carbon company.

In line with our ambitious science-based target, our net zero strategy involves the following 5 actions:

- Reducing the carbon emissions in our operational portfolio
- Procuring 100% renewable electricity and increasing the amount of renewable electricity we generate on our sites
- Reducing the carbon emissions associated with our construction activities
- Using an internal shadow price of carbon to drive investments towards low carbon alternatives
- Offsetting the remaining carbon from our construction activities, and any remaining fossil fuel energy consumed

Landsec carbon reduction target performance

Chart 2



All our new developments are designed to be net zero

The Forge, Southwark



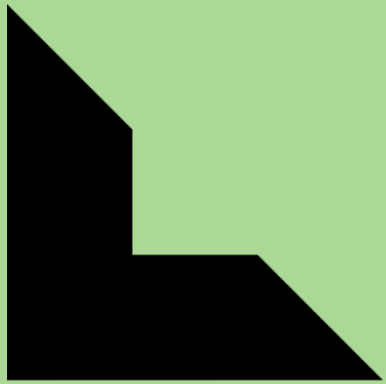
- c37% reduction in embodied carbon vs design stage
- Modern Methods of Construction (P-DfMA) – kit of parts
- All electric building and highly energy efficient (NABERS UK 5 stars)

Timber Square, Southwark



- 50% lower embodied carbon than typical building
- Retention of the existing structure and cross laminated timber for the structure
- All electric building and highly energy efficient (NABERS UK 5 stars)

The Forge – Net Zero Carbon



Landsec

The Forge – Net Zero Carbon in practice

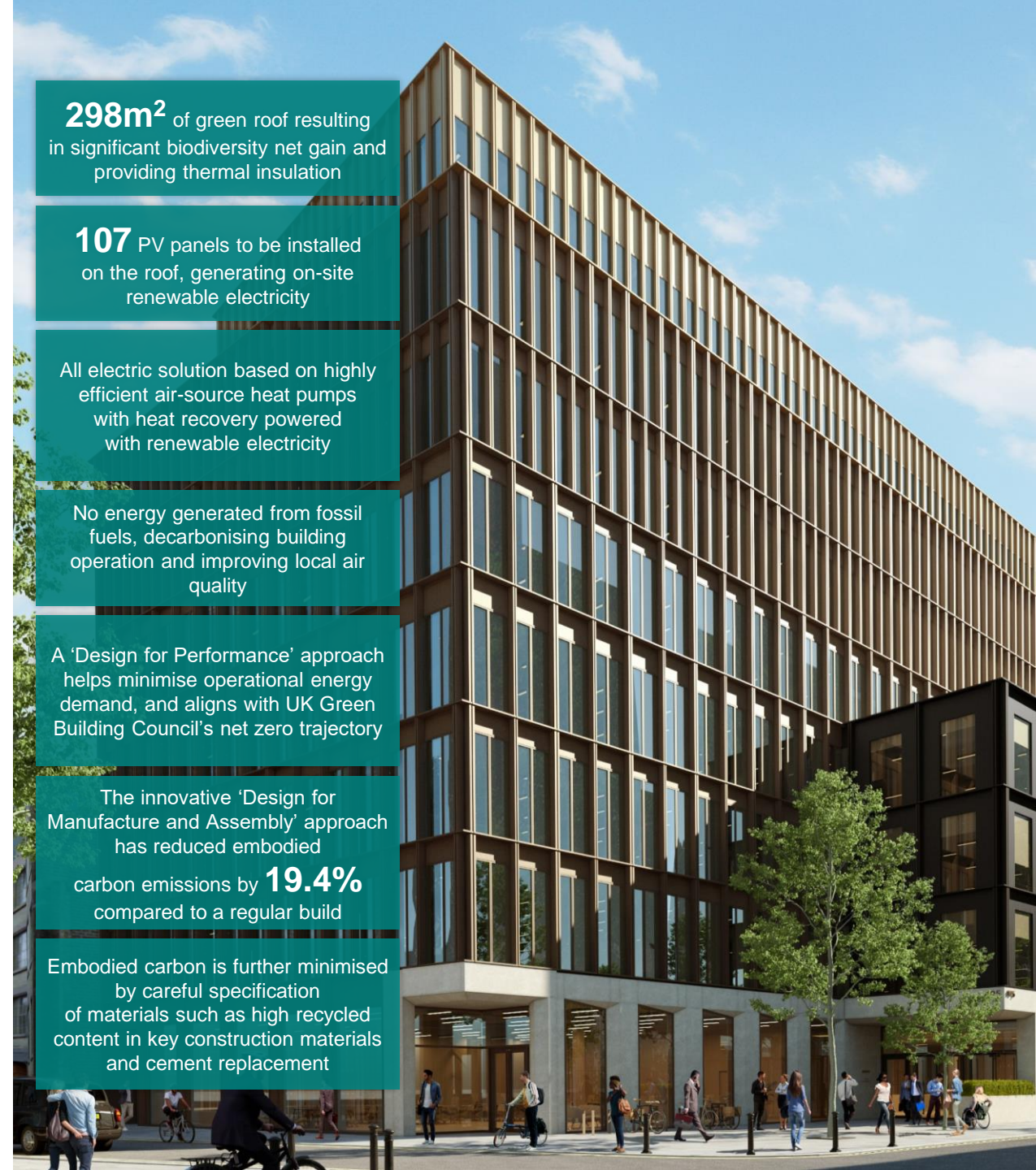
The Forge is our first net zero carbon development, designed to meet the UK Green Building Council's framework definition of a net zero carbon building:

Net zero carbon in construction:

- Whole life carbon assessment undertaken at an early stage and continuously updated through design to track embodied carbon reductions.
- Any remaining embodied carbon emissions will be offset by purchasing third party carbon credits

Net zero carbon in operation:

- All electric building based on air-source heat pumps powered with 100% renewable electricity + solar PV
- 'Design for Performance' modelling demonstrating that the building will have an energy performance aligned with the UKGBC net zero targets



298m² of green roof resulting in significant biodiversity net gain and providing thermal insulation

107 PV panels to be installed on the roof, generating on-site renewable electricity

All electric solution based on highly efficient air-source heat pumps with heat recovery powered with renewable electricity

No energy generated from fossil fuels, decarbonising building operation and improving local air quality

A 'Design for Performance' approach helps minimise operational energy demand, and aligns with UK Green Building Council's net zero trajectory

The innovative 'Design for Manufacture and Assembly' approach has reduced embodied carbon emissions by **19.4%** compared to a regular build

Embodied carbon is further minimised by careful specification of materials such as high recycled content in key construction materials and cement replacement

Embodied Carbon Reduction using P-DfMA

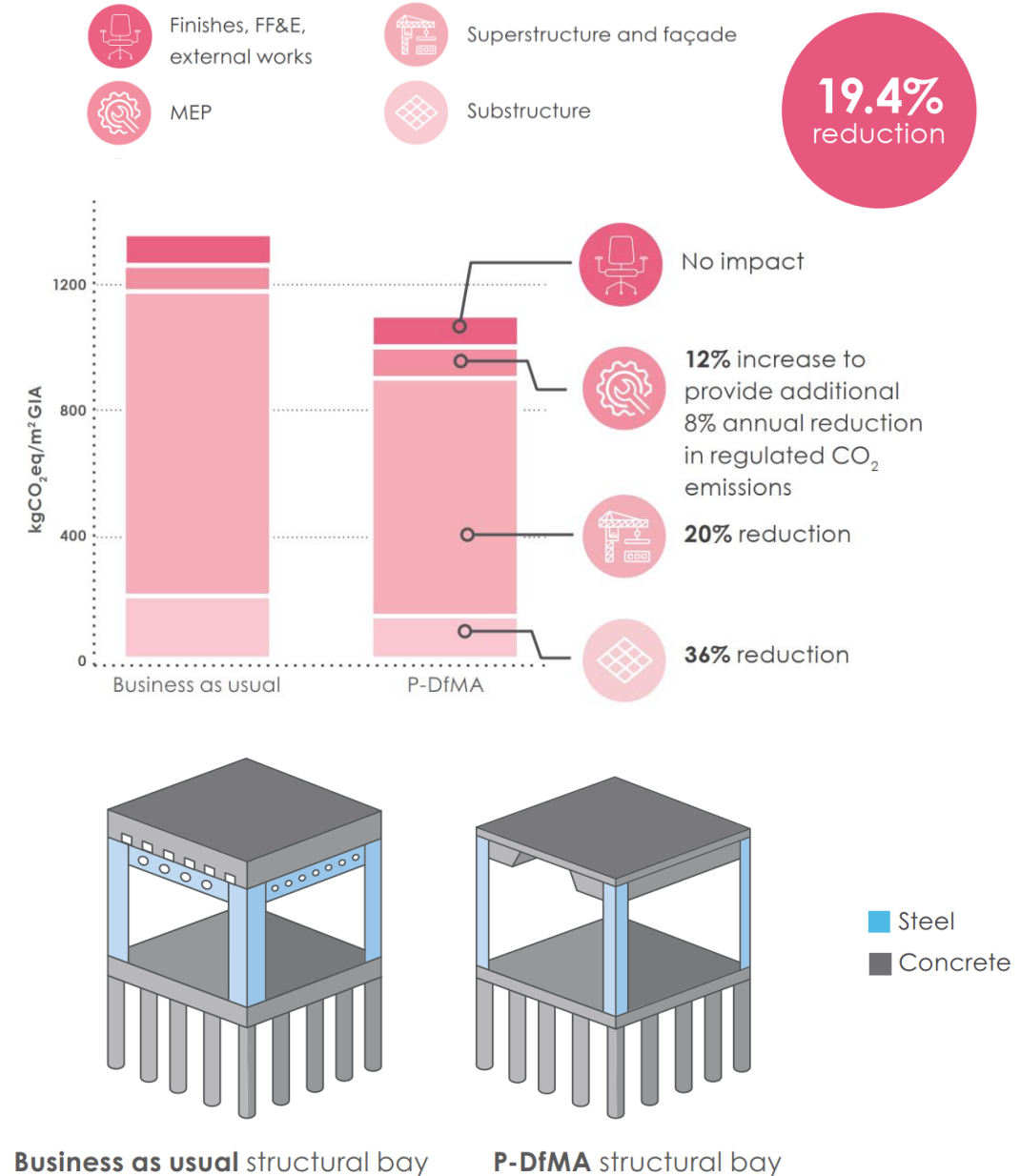
Net zero carbon in construction

An independent comparison between traditional construction and the P-DfMA design identified a **19.4%** reduction in embodied carbon intensity from:

- Reduced material quantities
- Use of lower carbon intensity materials
- Reusable temporary works kit of parts
- Reduction in waste due to P-DfMA methods
- Fewer vehicle movements

Remaining carbon use will be offset using Gold Standard accredited schemes and publicly reported

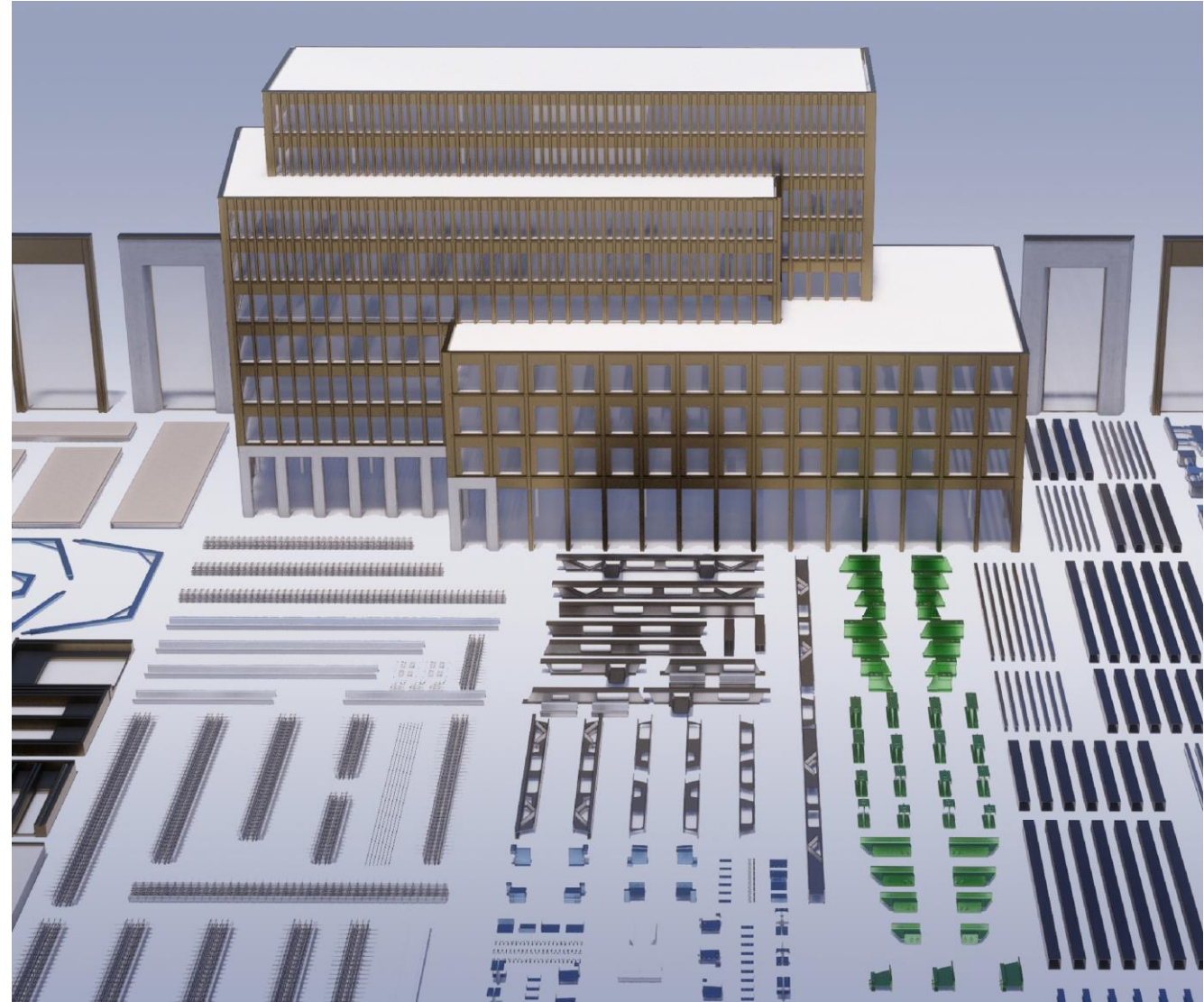
Overall embodied carbon reduction **c39%**



Reducing embodied carbon at The Forge

Net zero carbon in construction

- › 80% standardisation in superstructure, facade and M&E resulting in 19.4% reduction in embodied carbon
 - 18.4% less steel in the frame
 - Ribbed slab results in 13% less concrete
- › Early engagement with supply chain was key
 - Testing of high levels of cement replacement
 - 65% recycled content in the aluminium façade
- › The Forge is currently tracking an embodied carbon intensity of **c. 850kgCO₂e/m²**



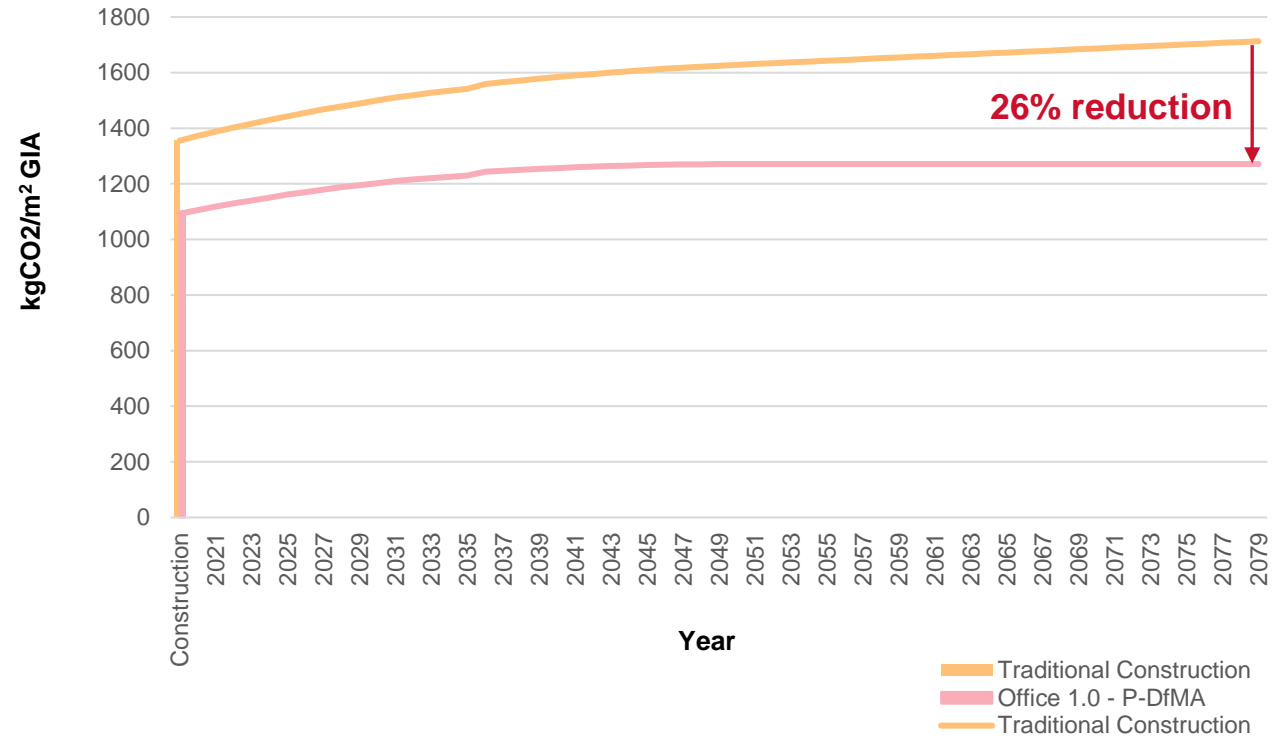
Lifecycle Carbon Reduction

Net zero carbon in use

- Design for Performance pioneer scheme
- 5 Star NABERS UK rating
- Over the life-time of the building (60 years) achieves a 26% reduction in lifecycle carbon intensity
- All electric building – no gas boilers
- Uses high efficiency air source heat pumps for heating and cooling and water source heat pumps for hot water
- Electricity supply from fully renewable sources (using green REGO backed tariffs, self-generation and CPPA's)

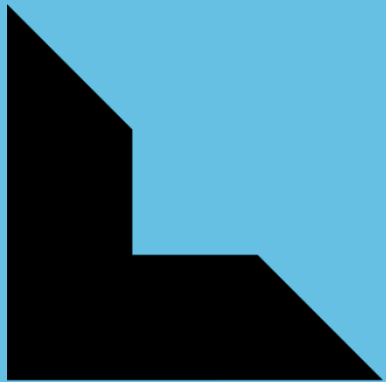
The national electricity grid will be decarbonised by 2050 to meet government targets, allowing The Forge to be zero carbon without the need to directly source renewable supplies

Lifecycle Carbon Intensity



To allow a direct comparison operational carbon is generated using BRUKL documentation
Embodied carbon includes stages A1-A5 only

P-DfMA putting theory into practice @The Forge



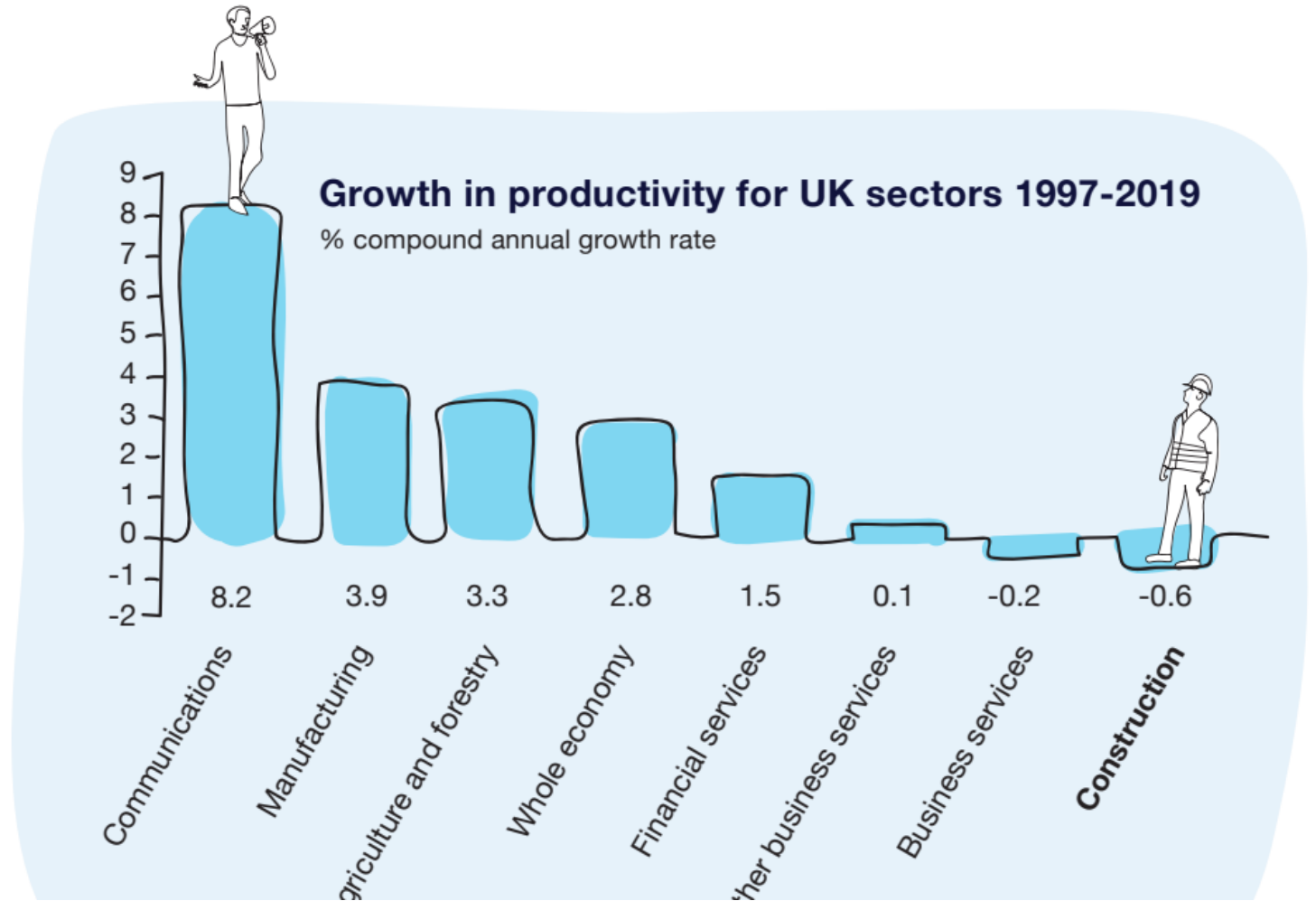
Landsec

Construction Productivity Challenge

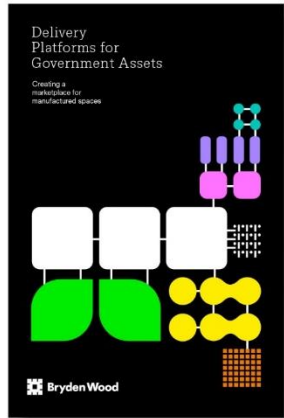
- UK construction productivity growth has fallen by an average of -0.6% each year between 1997 and 2019

(research by Oxford Economics)

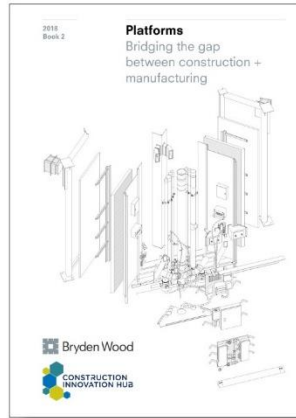
- The goal is to overhaul a highly fragmented industry that lacks transparency and suffers from a lack of trust.



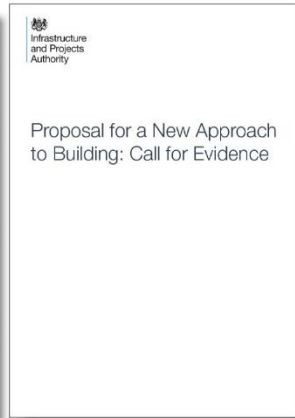
Delivery Platforms for Government Assets



Platforms: Bridging the gap between construction + manufacturing



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.'

'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.'

Bryden Wood

2017

2018

2019

2020

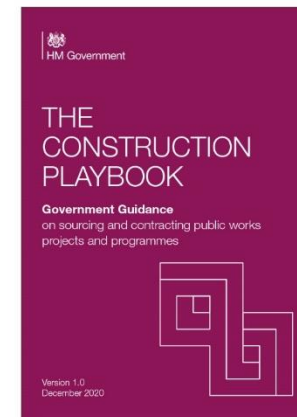
2021



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



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



The Construction Playbook

Benefits of Standardisation



Manufacturers
invest in efficient
processes and
automation



Standardised
installation
processes



Reduced
Carbon, based
on material
selection



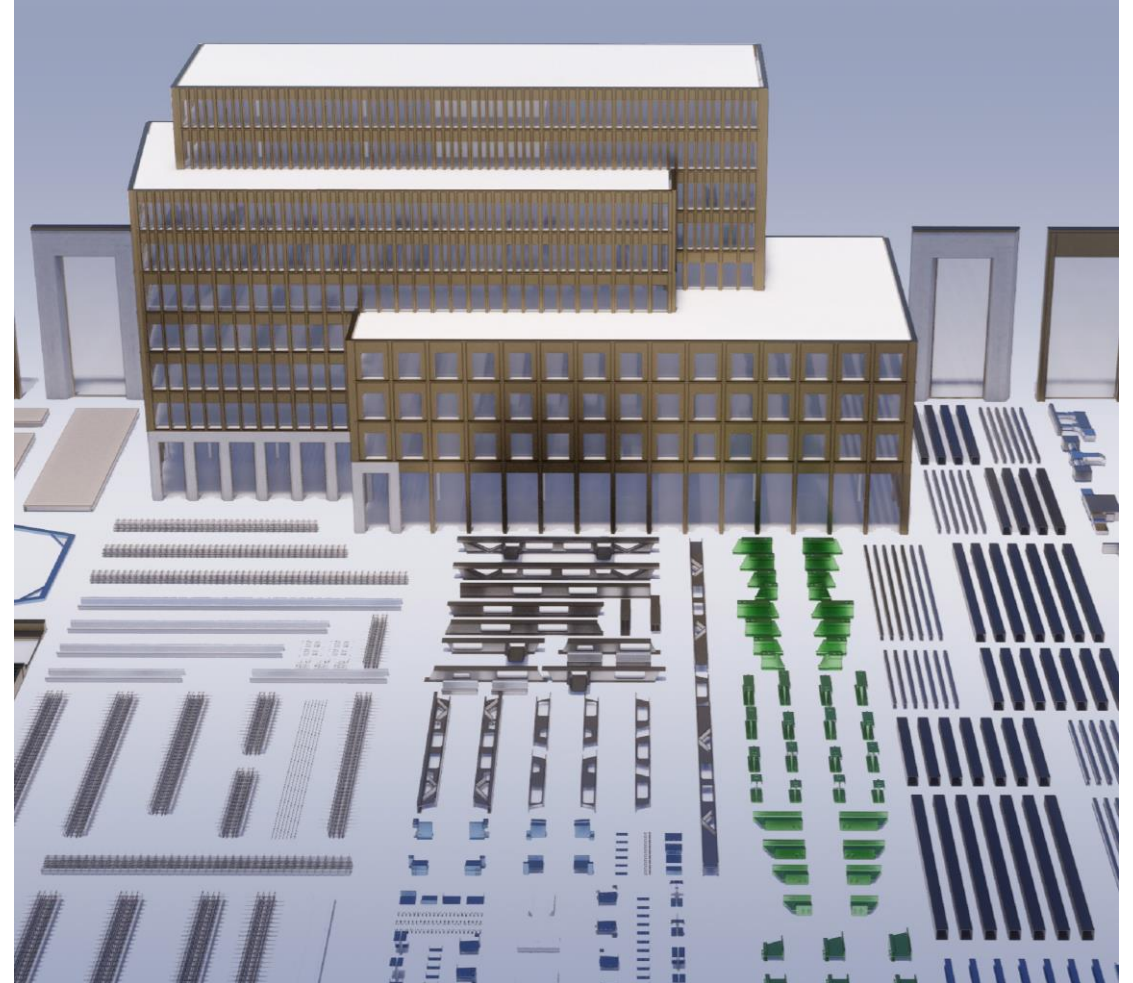
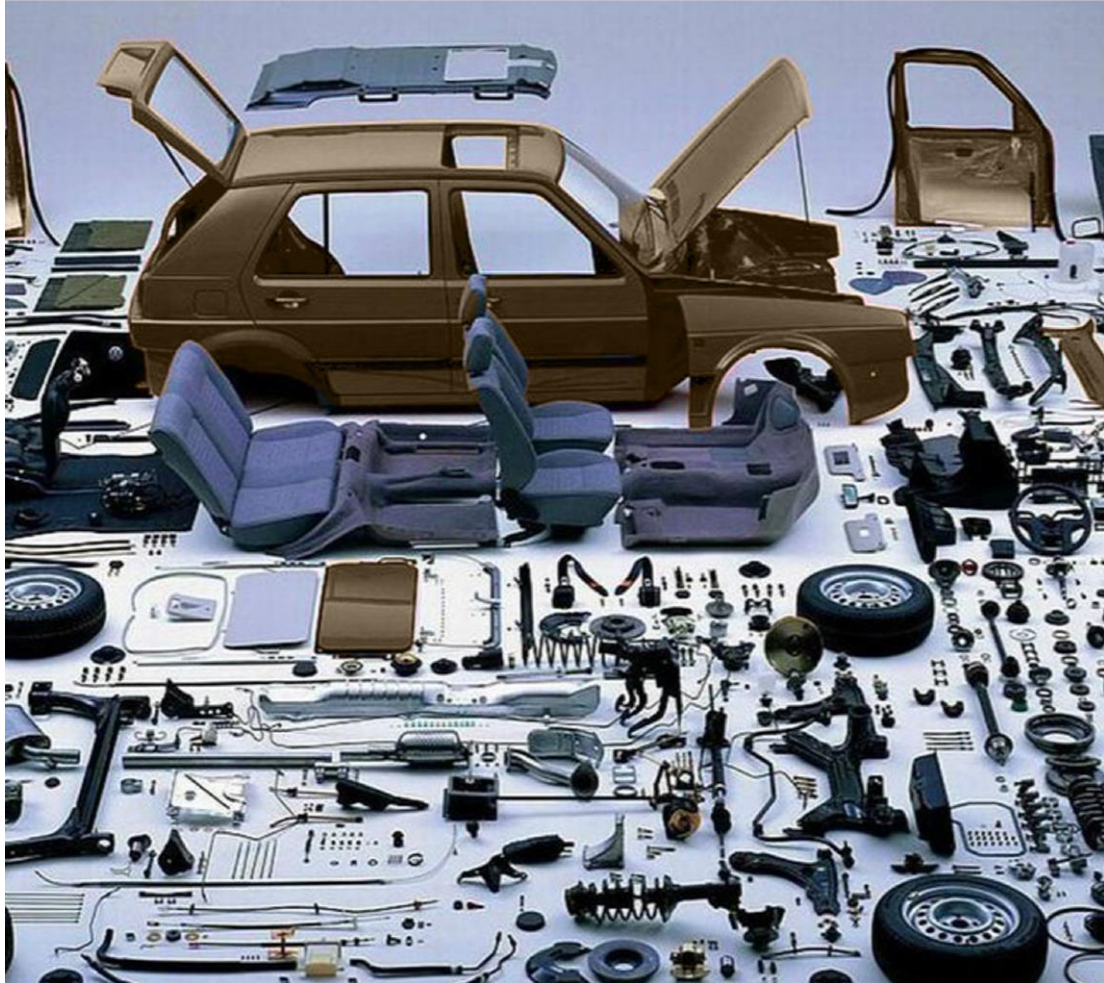
Reduced waste



Improved
Design
Efficiency

Office 1.0 Product Initiative

Platform - Design for Manufacturing and Assembly (P-DfMA)



Design for Manufacture + Assembly Approach

DfMA

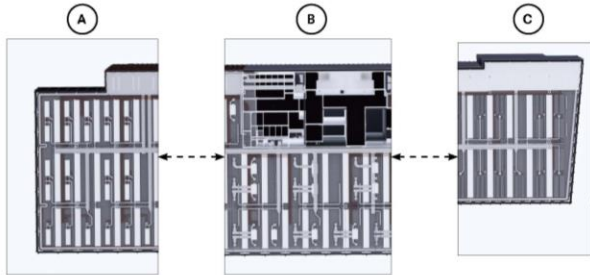
Value-led Design Approach

£

Inherent Compliance with Landsec Design Guides



Flexibility - Terminal Unit Heating / Cooling Solutions



Exposed Structural Aesthetic - Hybrid Steel / Concrete

Façade

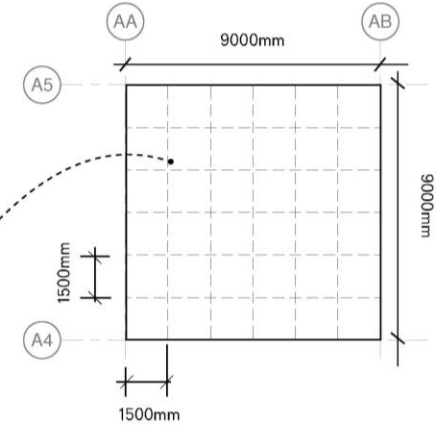
Super structure

Fit out

MEP

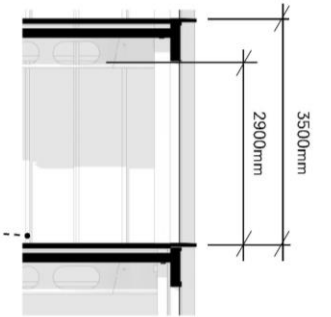
Micro columns - Improved quality of space

9m Structural Grid

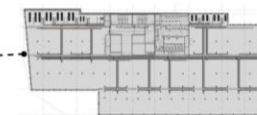


1.5m Planning Grid

3.5m Floor to Floor Height



2900mm above FFL



2.9m Perceived Ceiling Height



Bryden Wood

Common repeatable processes

Design processes

- Automated configuration of digital components
- Data flow into logistics, manufacturing + assembly processes

Manufacturing processes

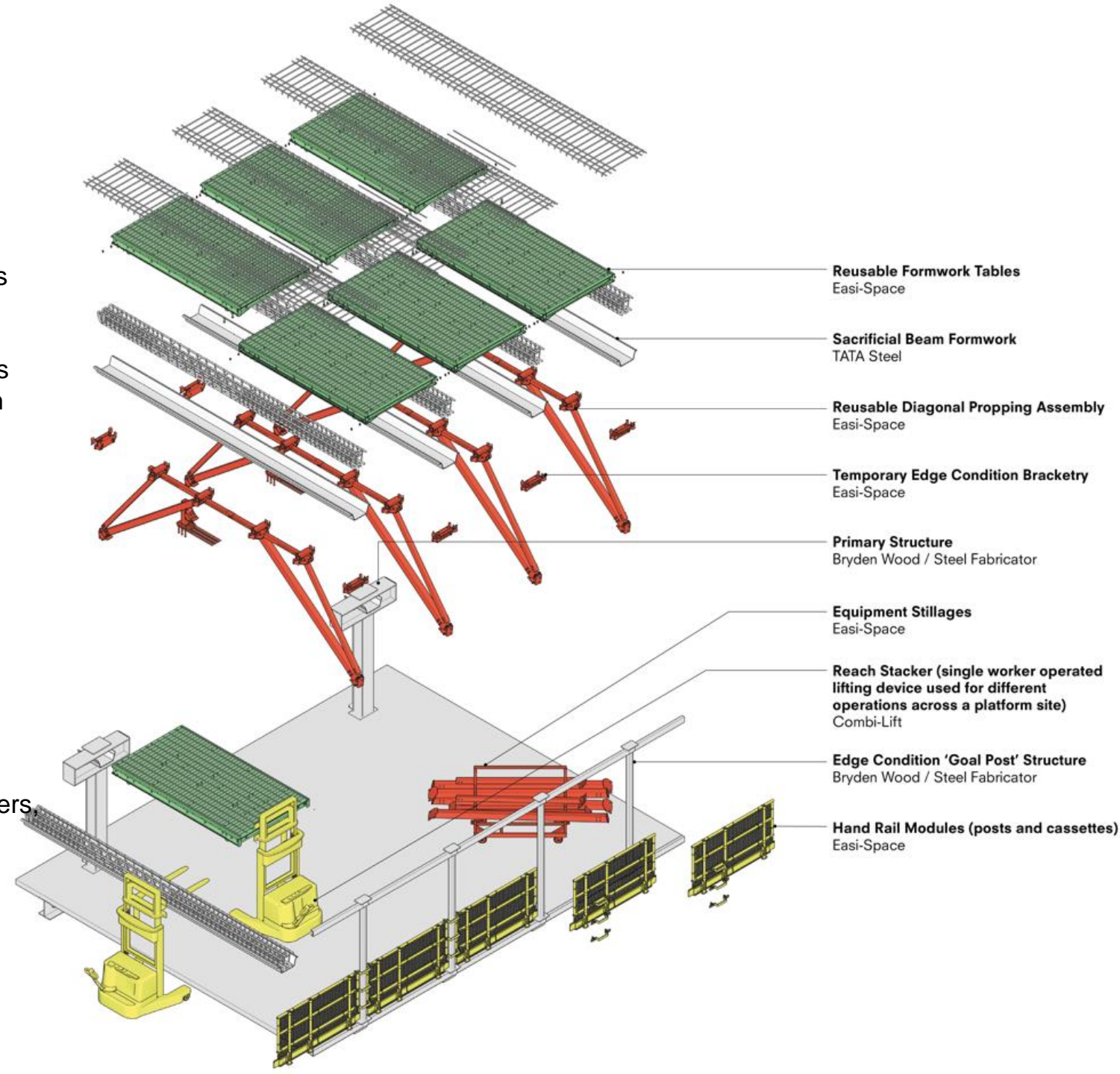
- Robotic cutting and welding of brackets and temporary works
- Jigging and cutting of columns, beams and permanent beam shutters

Assembly processes

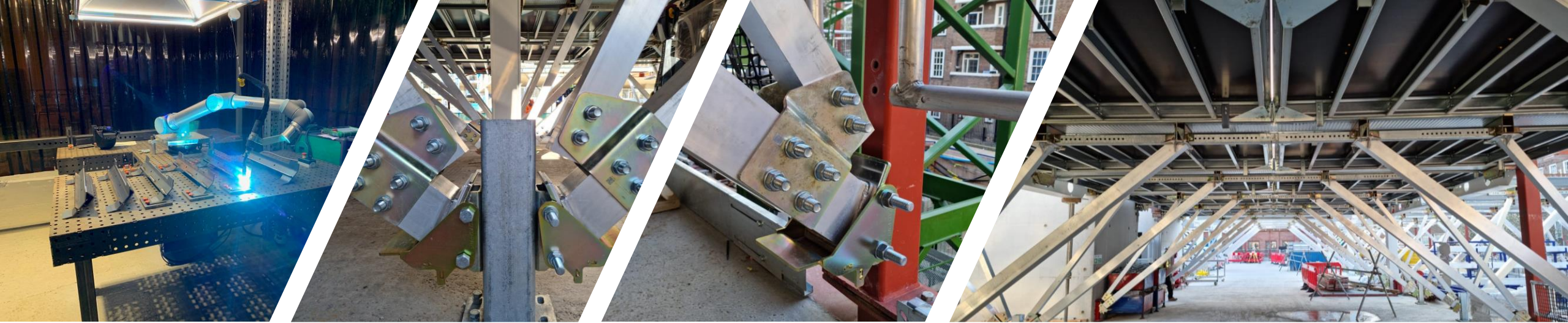
- Colour coding for QA
- Micro column pre-assembly including temporary handrails
- Micro column lifting and placement
- Permanent shuttering lifting and placement
- Slab shuttering lifting and placement
- Temporary works lifting, placement and striking
- Temporary works re-use in the next bays / floors

Equipment

- Reach stackers / modified forklifts for lifting permanent shutters, slab shutters and temporary
- Stillages for shutters and temporary works

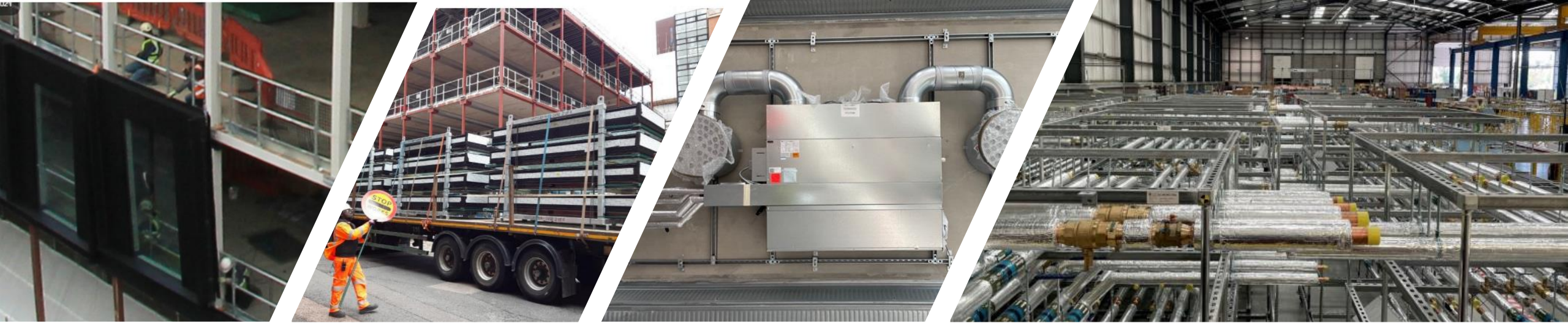






P-DfMA kit of
parts - structure

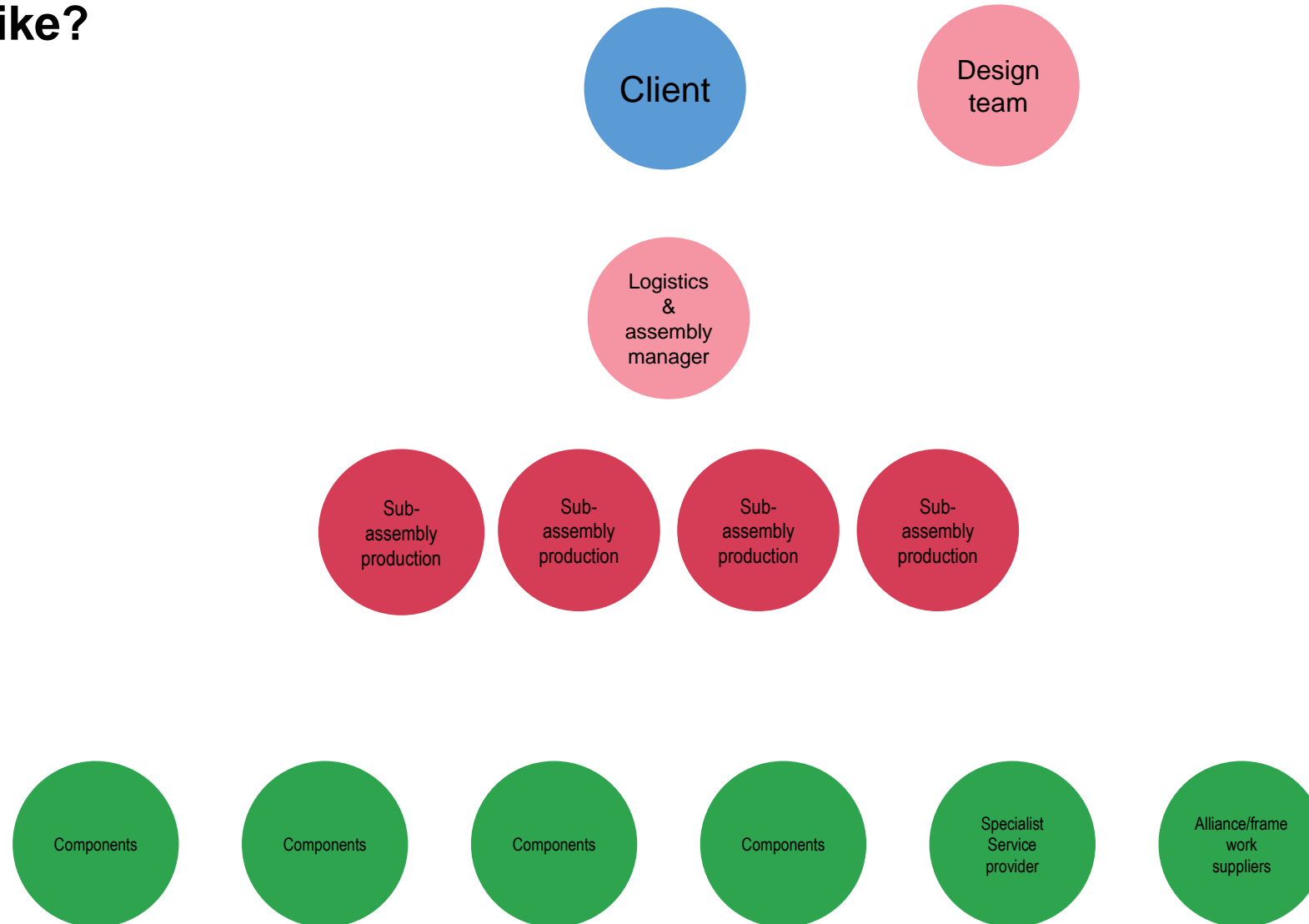




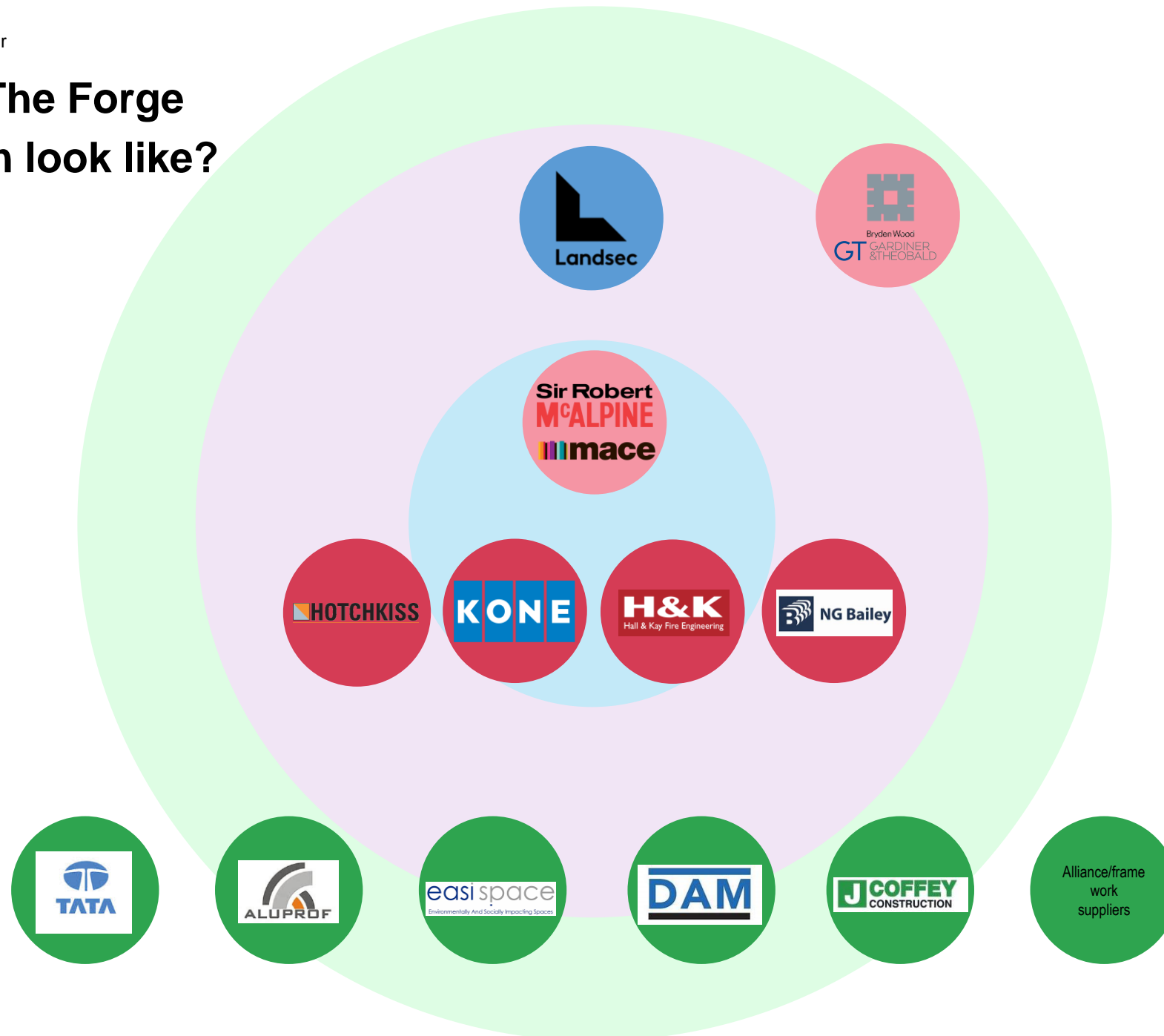
P-DfMA kit of parts –
unitised cladding and
M&E services



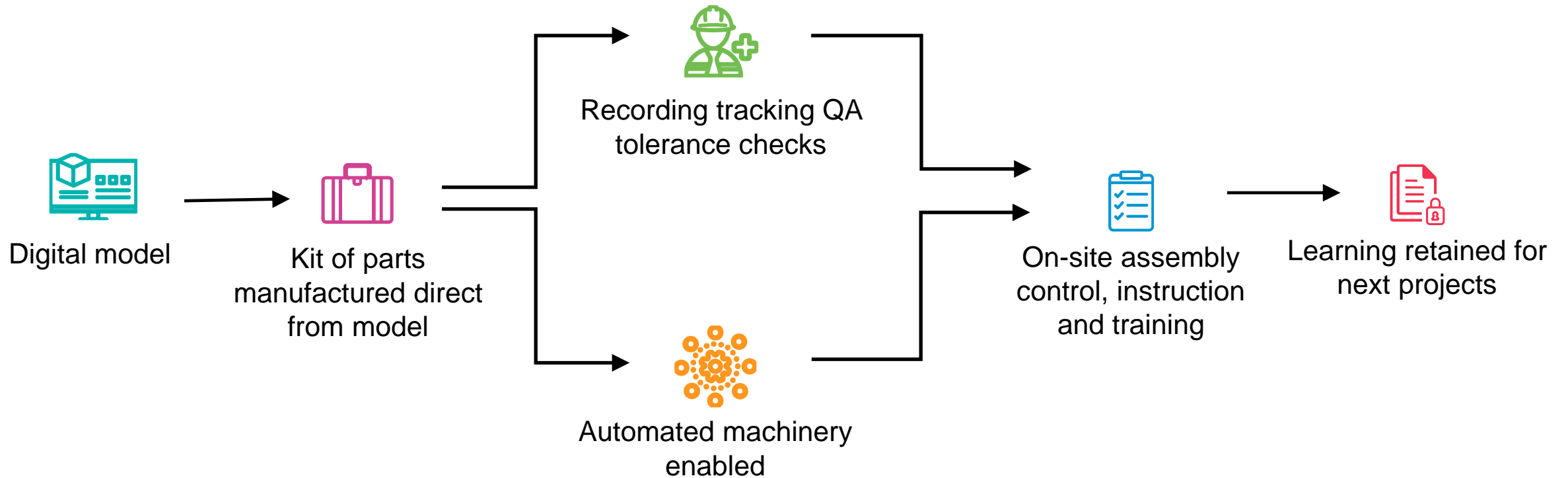
What does The Forge supply chain look like?



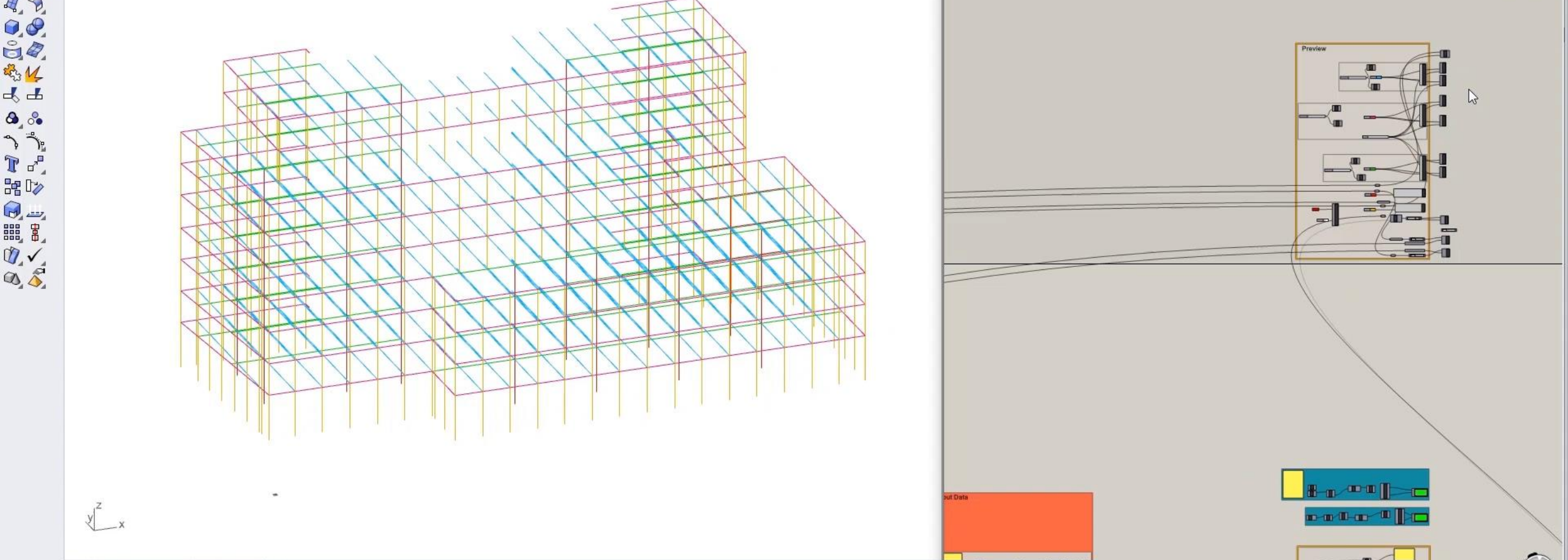
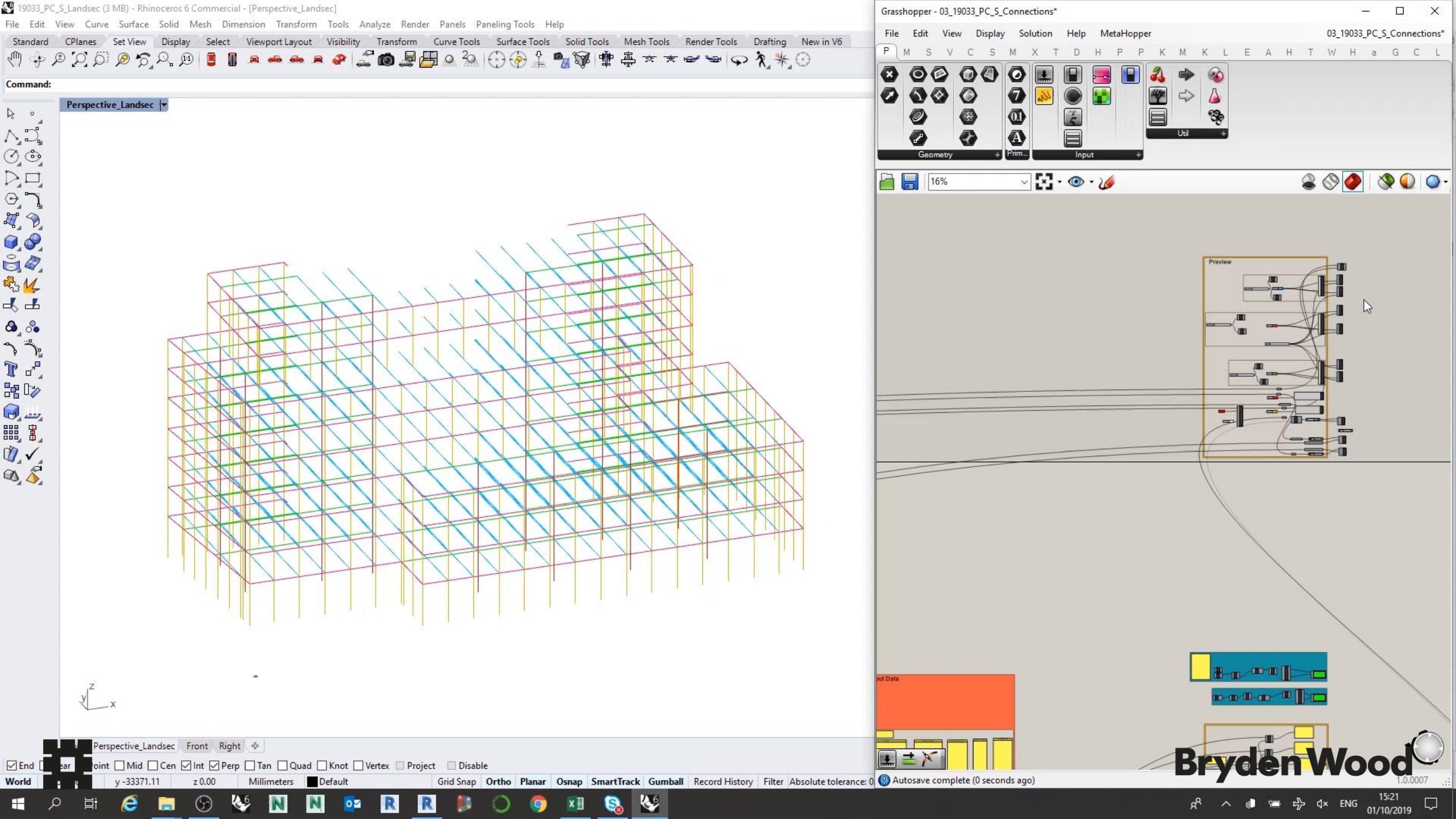
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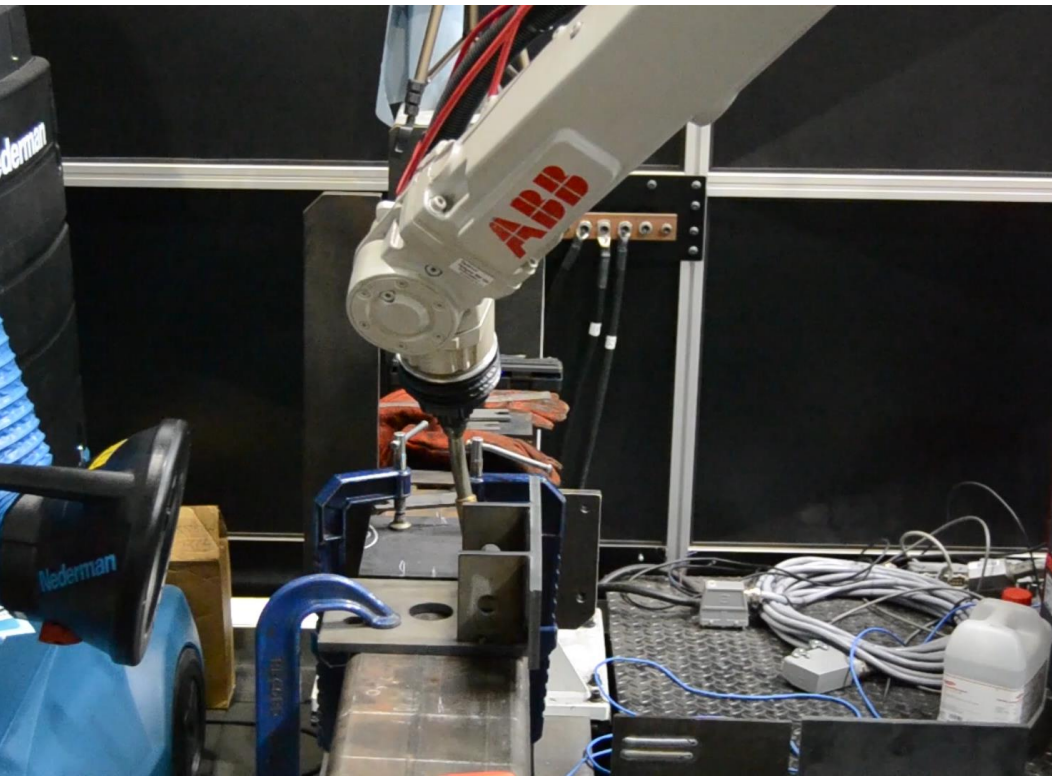


Integrated Digital Technology



Following ISO 19650-5 and ISO 19650-6 principles





Bryden Wood



Landsec

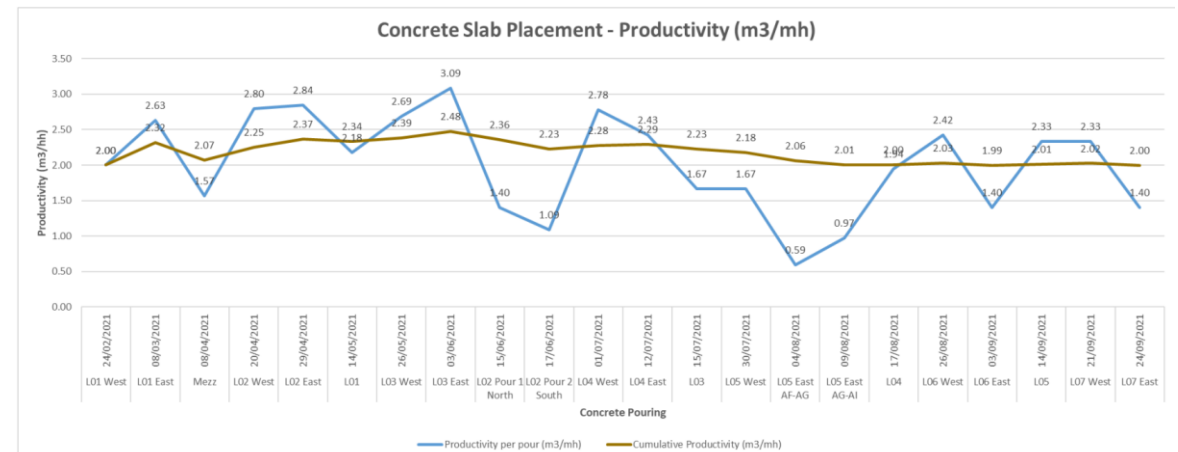
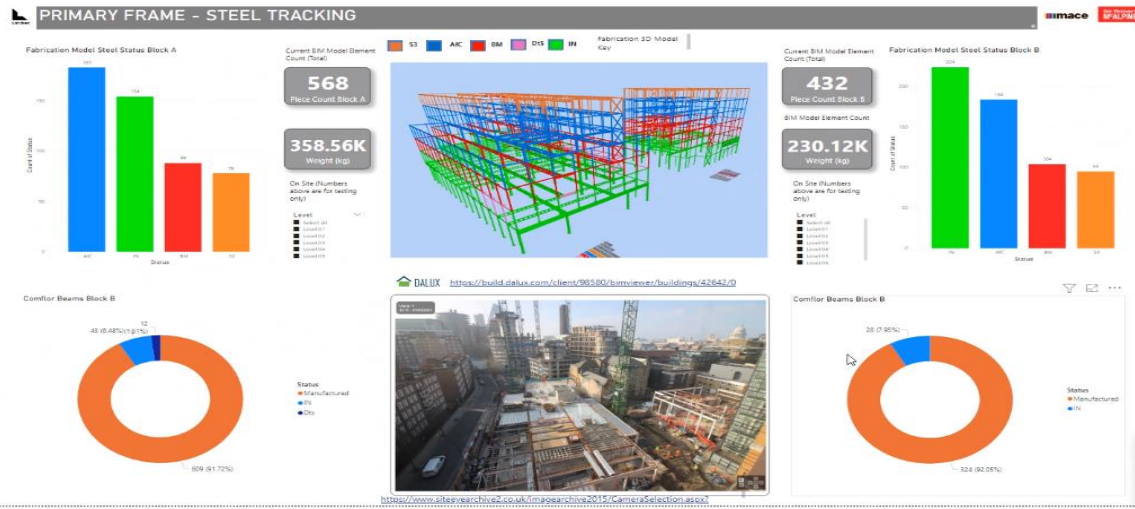
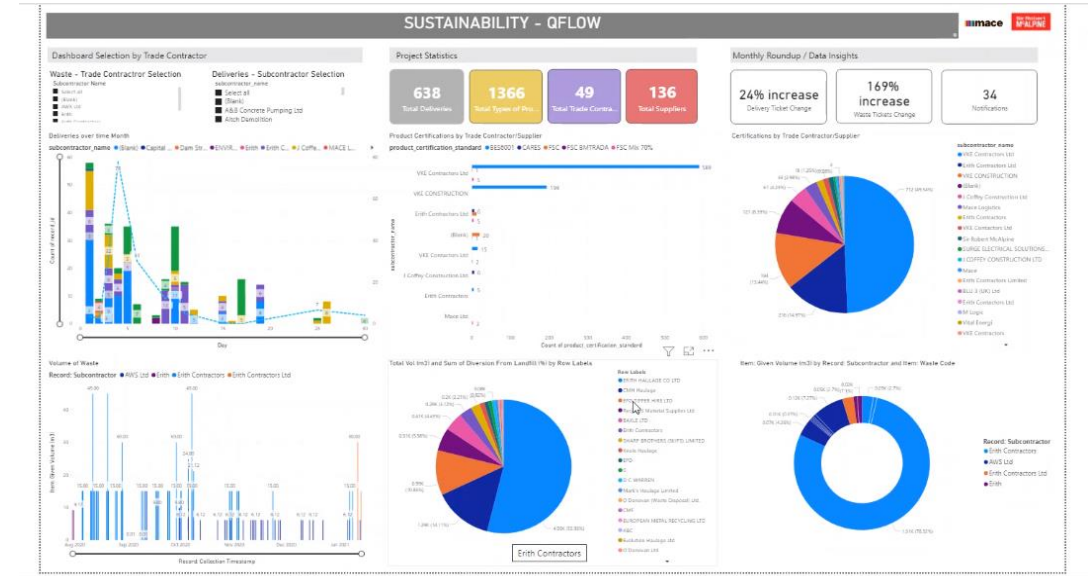
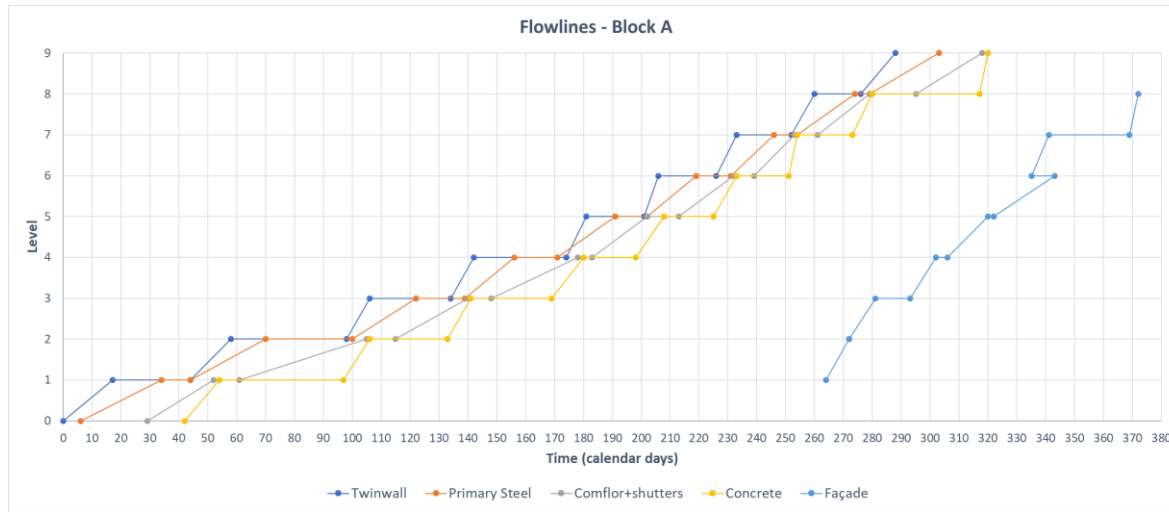
easi space

Environmentally And Socially Impacting Spaces



UK Research
and Innovation

Data led decision making



Key learnings and next steps



Landsec

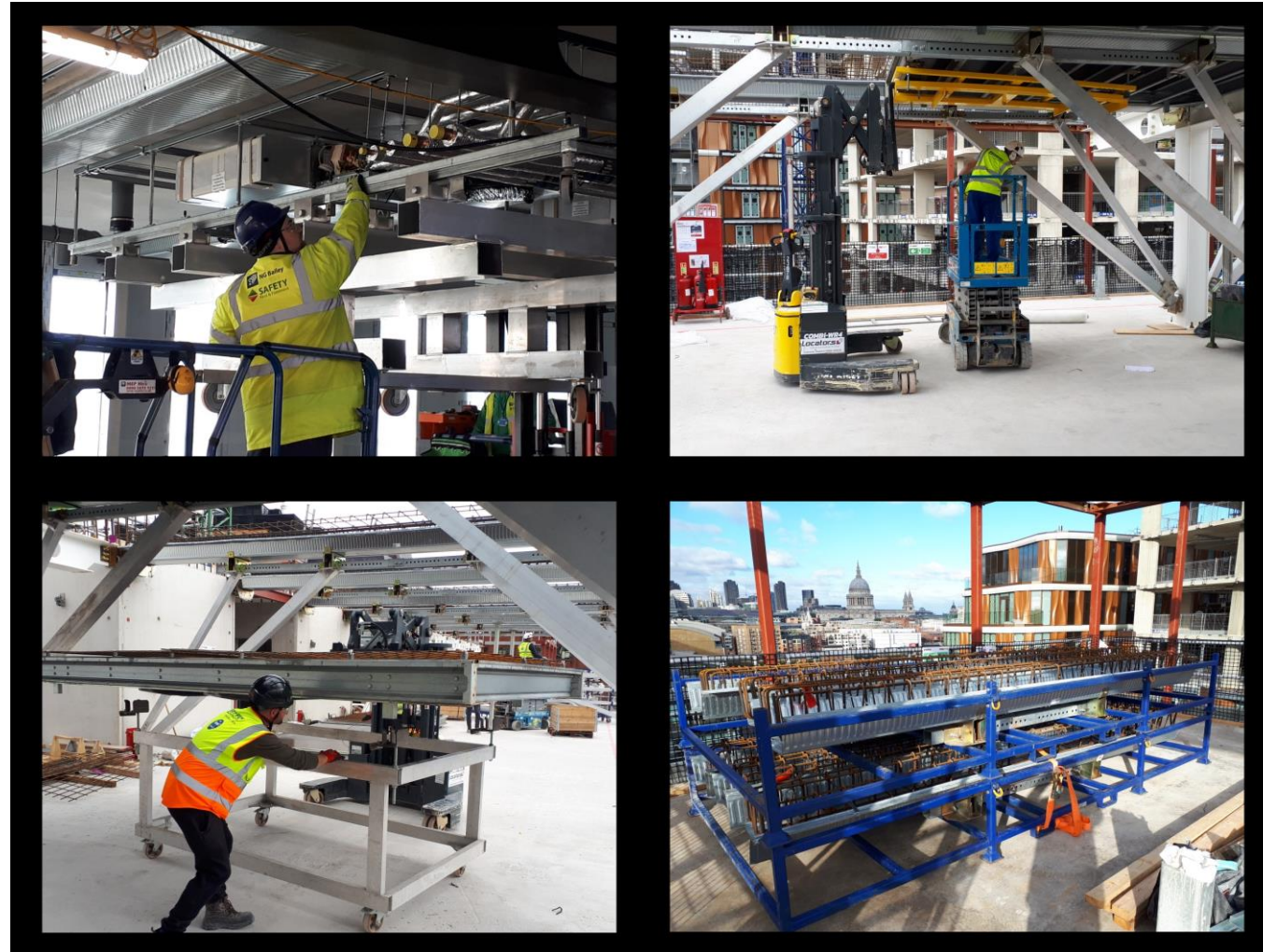
Key innovations

- Net zero carbon
- Value led design thinking
- P-DfMA ‘kit of parts’
- Prototype development
- Supply chain disintermediation
- Collaborative contracting model
- Digital process transformation
- Productivity measurement



Process improvements

- Faster, better, safer, greener & cost-effective construction
- Increased off-site manufacturing
- On-site assembly methodologies
- Automated processes
- Breaking down silo's
- Reducing the use of materials and resources
- Improving productivity
- Data led decision making



Next steps

We need to:

- Re-think the design process
- Re-engineer procurement
- Re-imagine construction logistics
- Re-invest in smart manufacturing
- Re-skill the workforce
- Re-set behaviours





**LANDSEC'S FIRST
NET ZERO CARBON
DEVELOPMENT**



**THE BEST OF BANKSIDE'S
CULTURE, ENTERTAINMENT
AND DINING**



Providing a host of carbon and cost saving features to occupiers.



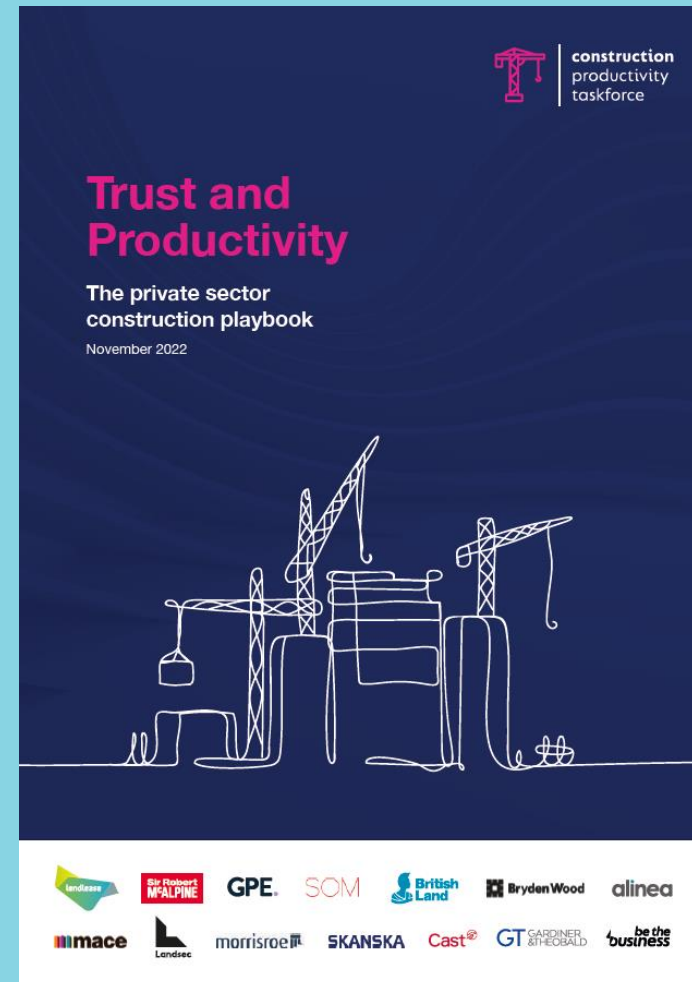
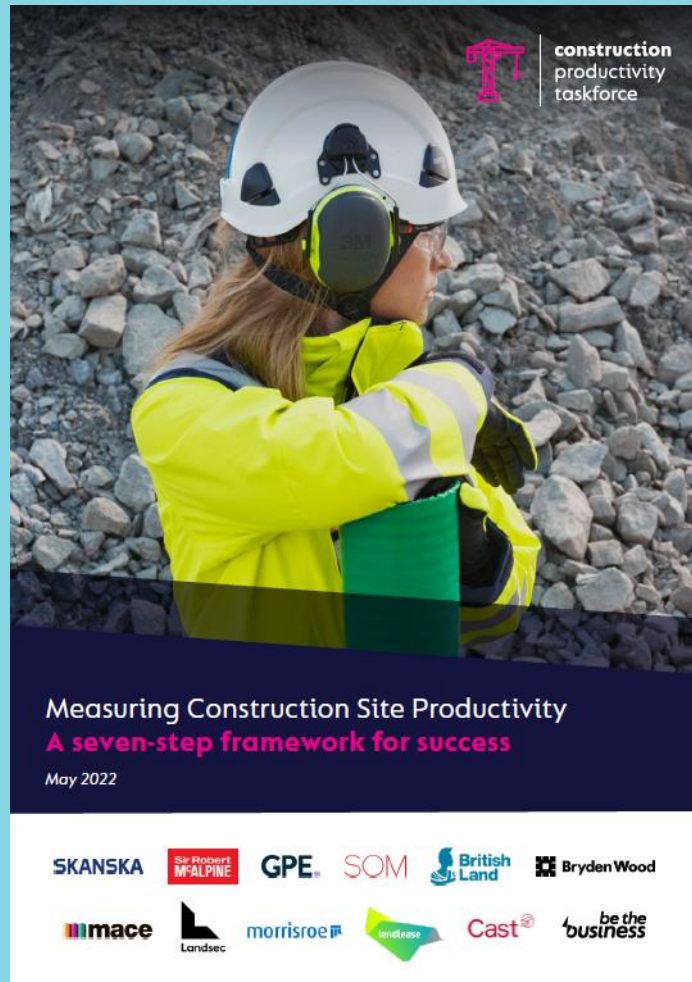
**139,000 SQ FT OF
GRADE A OFFICE SPACE
WITH ROOM TO BREATHE**



RECUTTERS
LANE



The Construction Productivity Taskforce – making the case for change



Changing the face of construction through innovation & collaboration



construction
productivity
taskforce

The 10 drivers for success

Trust and Productivity proposes 10 drivers for success that should underpin any project.



Form effective partnerships



Benchmark objectives



Adopt portfolio and longer-term contracting



Allocate risk fairly and appropriately



Adopt an outcome-based approach



Pay fairly



Embed digital information flows and technologies



Assess the economic and financial standing of suppliers



Involve the supply chain early



Promote innovation and continuous improvement