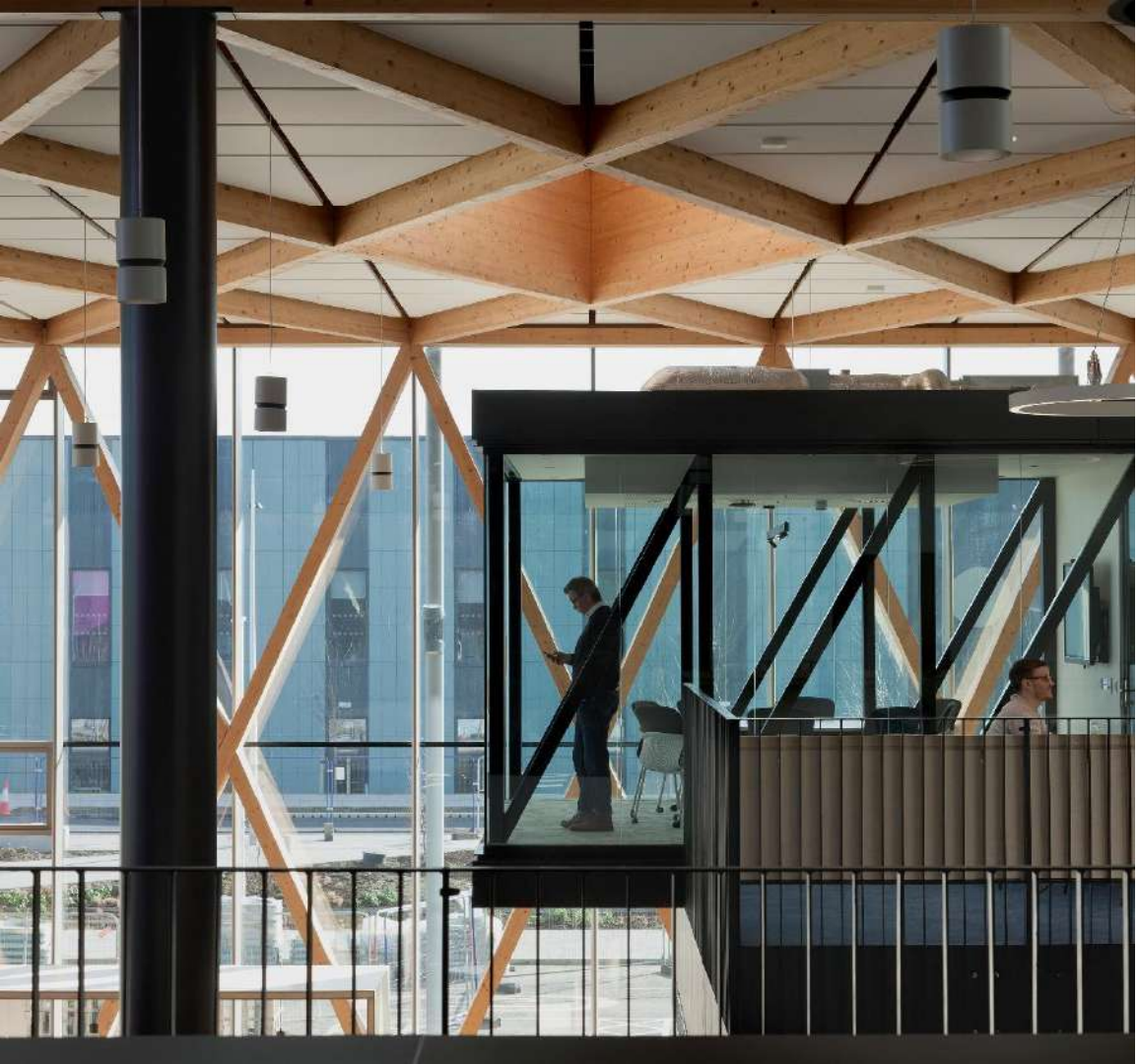
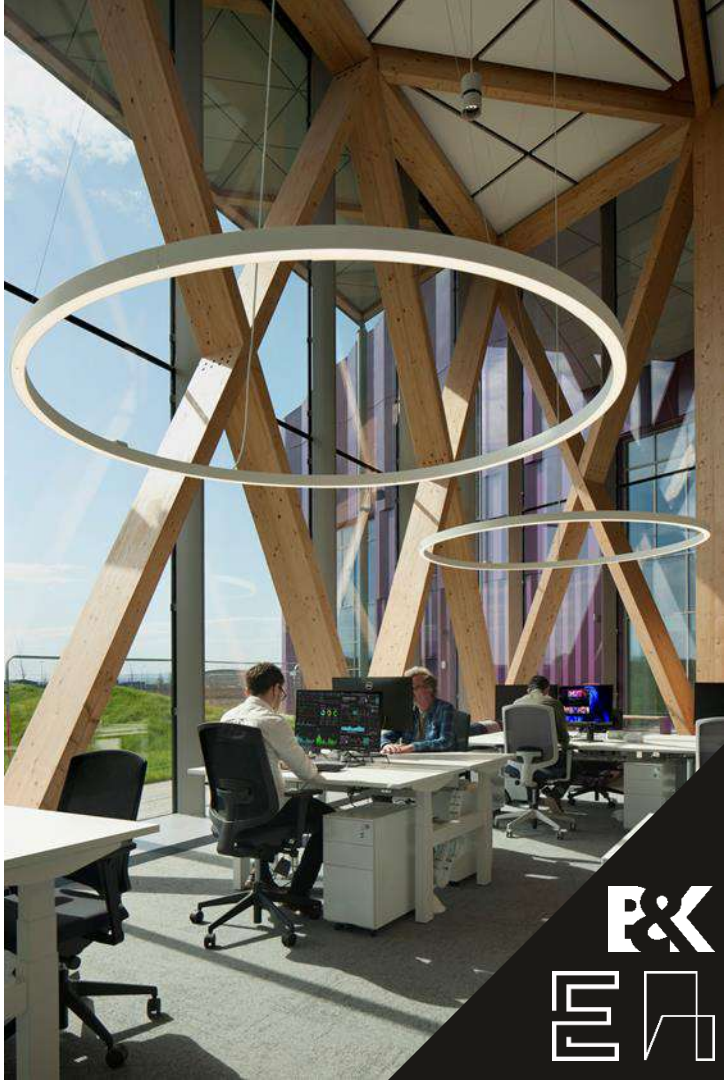

NMIS
National Manufacturing
Institute Scotland
NMIS

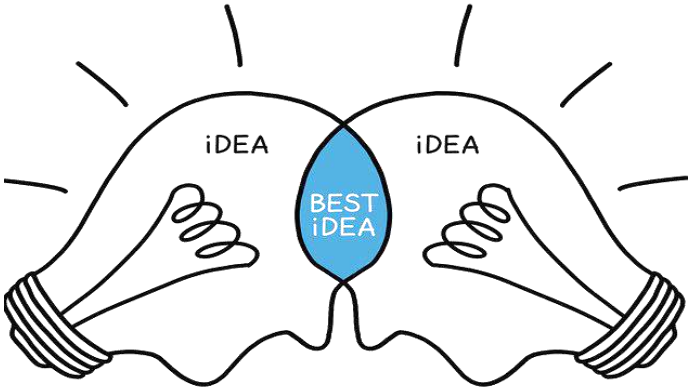
*"The **National Manufacturing Institute Scotland** is an industry-led international centre of manufacturing expertise where research, industry and the public sector work together to transform skills, productivity and innovation to attract investment and make Scotland a global leader in advanced manufacturing."*

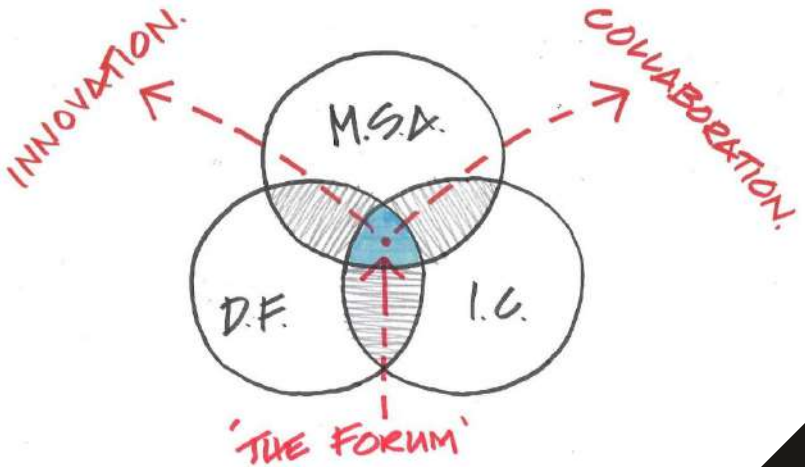
Scottish Government





This facility is about creating an **open and collaborative environment** where knowledge and creativity can be shared.





3 component parts to the project:

1. Digital Factory 2050

"Digital Factory 2050 will be a beacon for the regeneration of manufacturing."

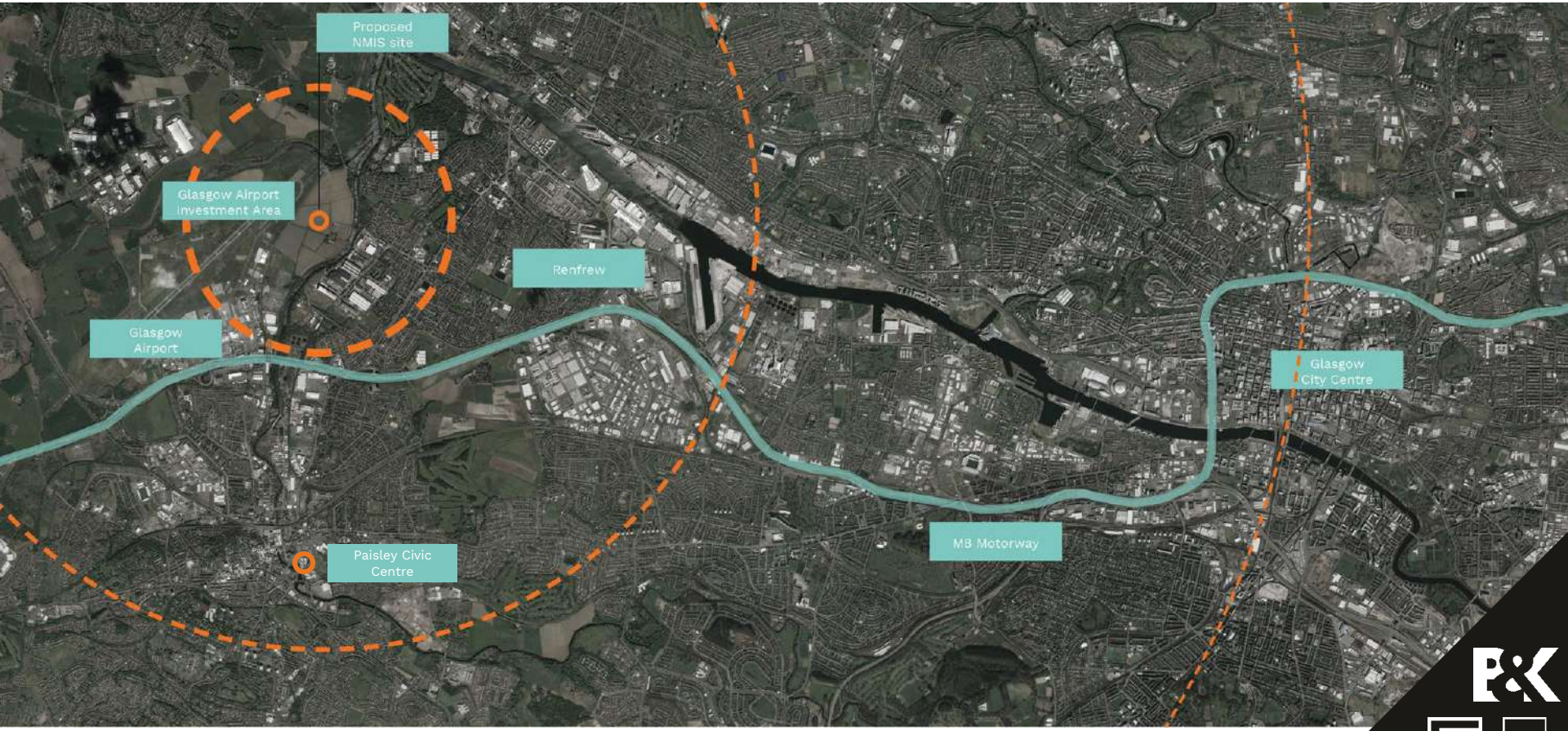
2. Innovation Collaboratory

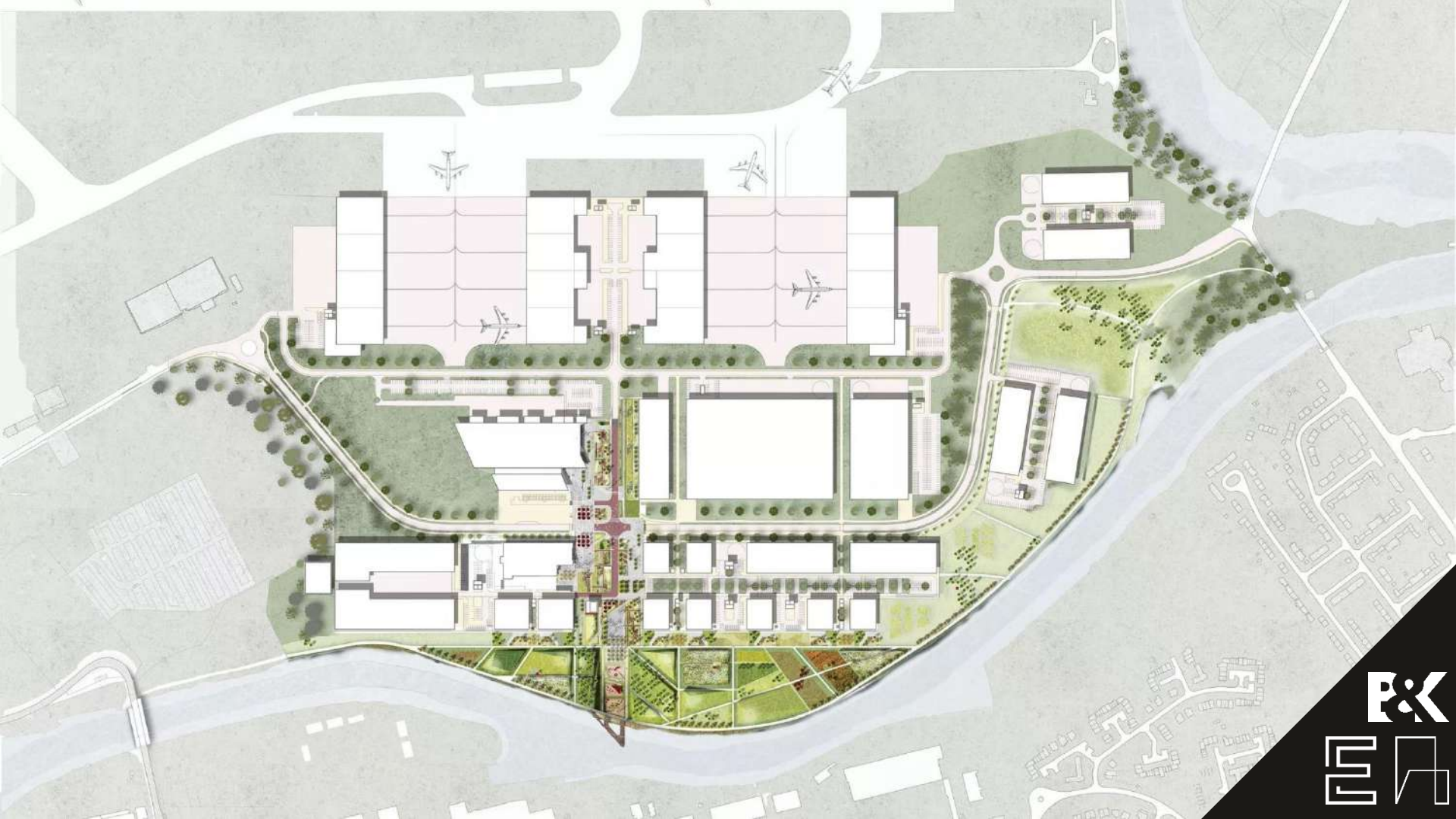
“The Innovation Collaboratory will be a HUB for innovation in design and manufacture - an incubator for new tech-based digital manufacturing.”

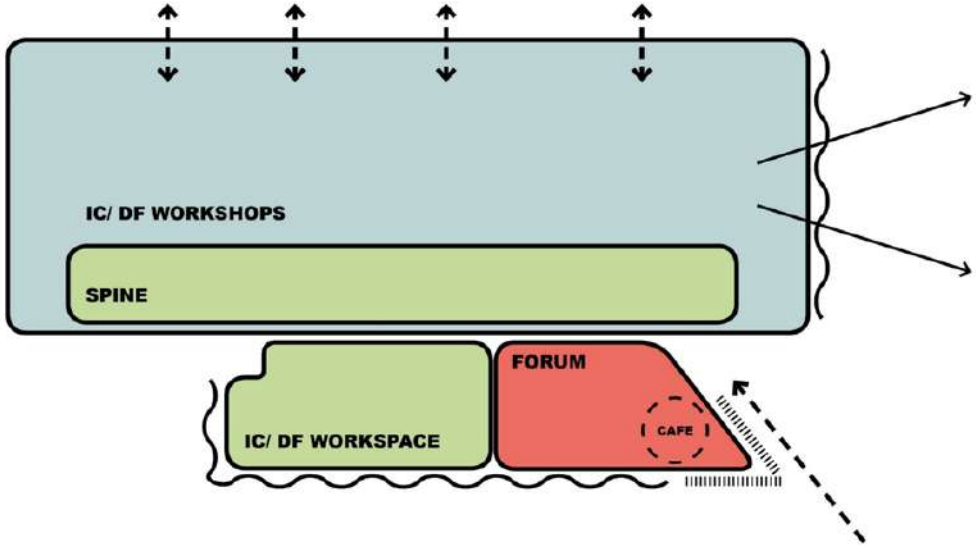
3. Manufacturing Skills Academy

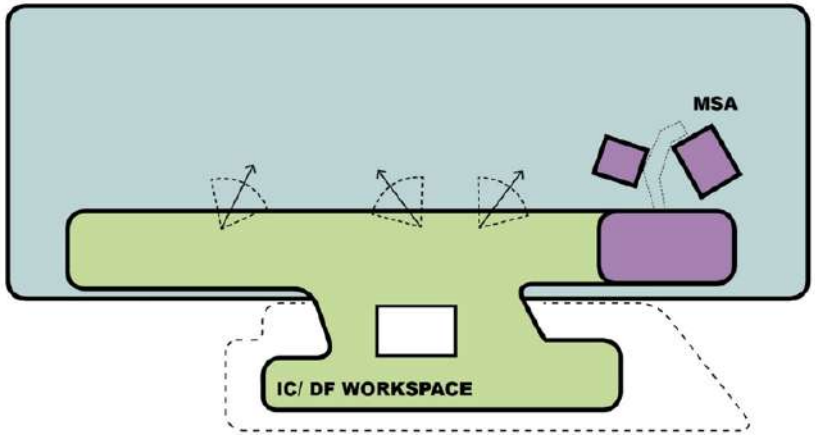
"The Manufacturing Skills Academy will support SAMRA – a Scotland-wide collaboration in skills and talent development for advanced manufacturing technologies.

“The Forum”

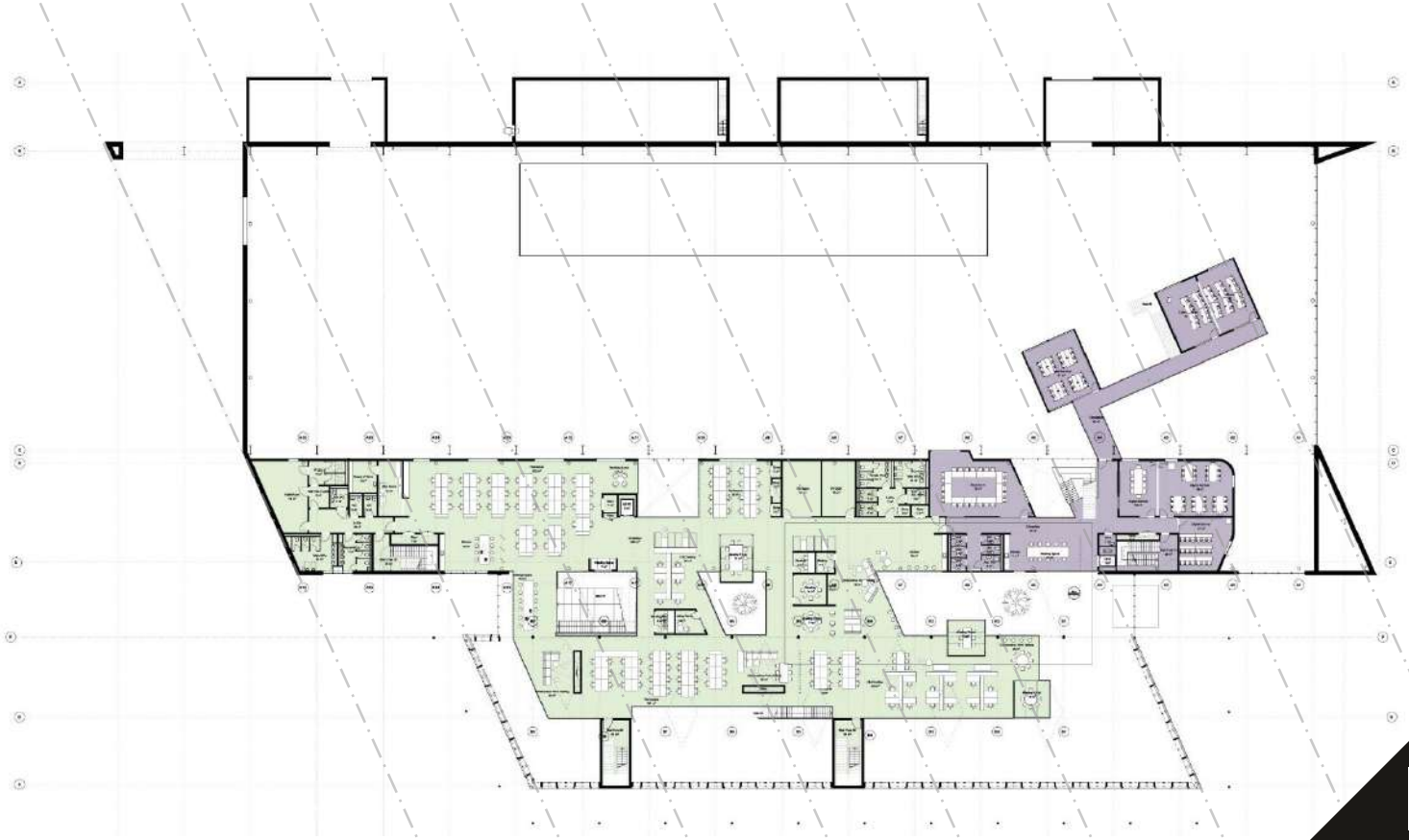

Proposed NMIS site
Glasgow Airport Investment Area
Renfrew
Glasgow Airport
Glasgow City Centre
M8 Motorway
Paisley Civic Centre




IC/ DF WORKSHOPS
SPINE
FORUM
CAFE
IC/ DF WORKSPACE


MSA
IC/ DF WORKSPACE


Workshop
Manufacturing Skills Academy
The 'Forum'
Workspace

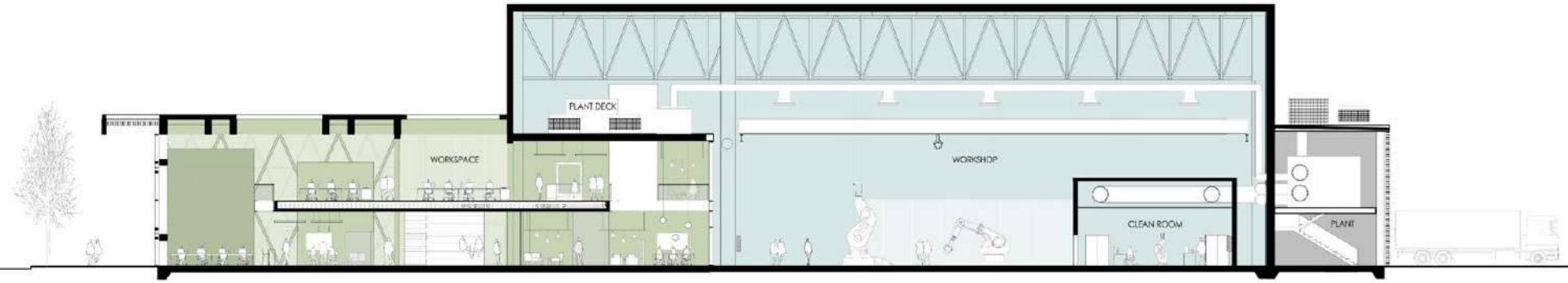


Workshop

Manufacturing Skills Academy

The 'Forum'

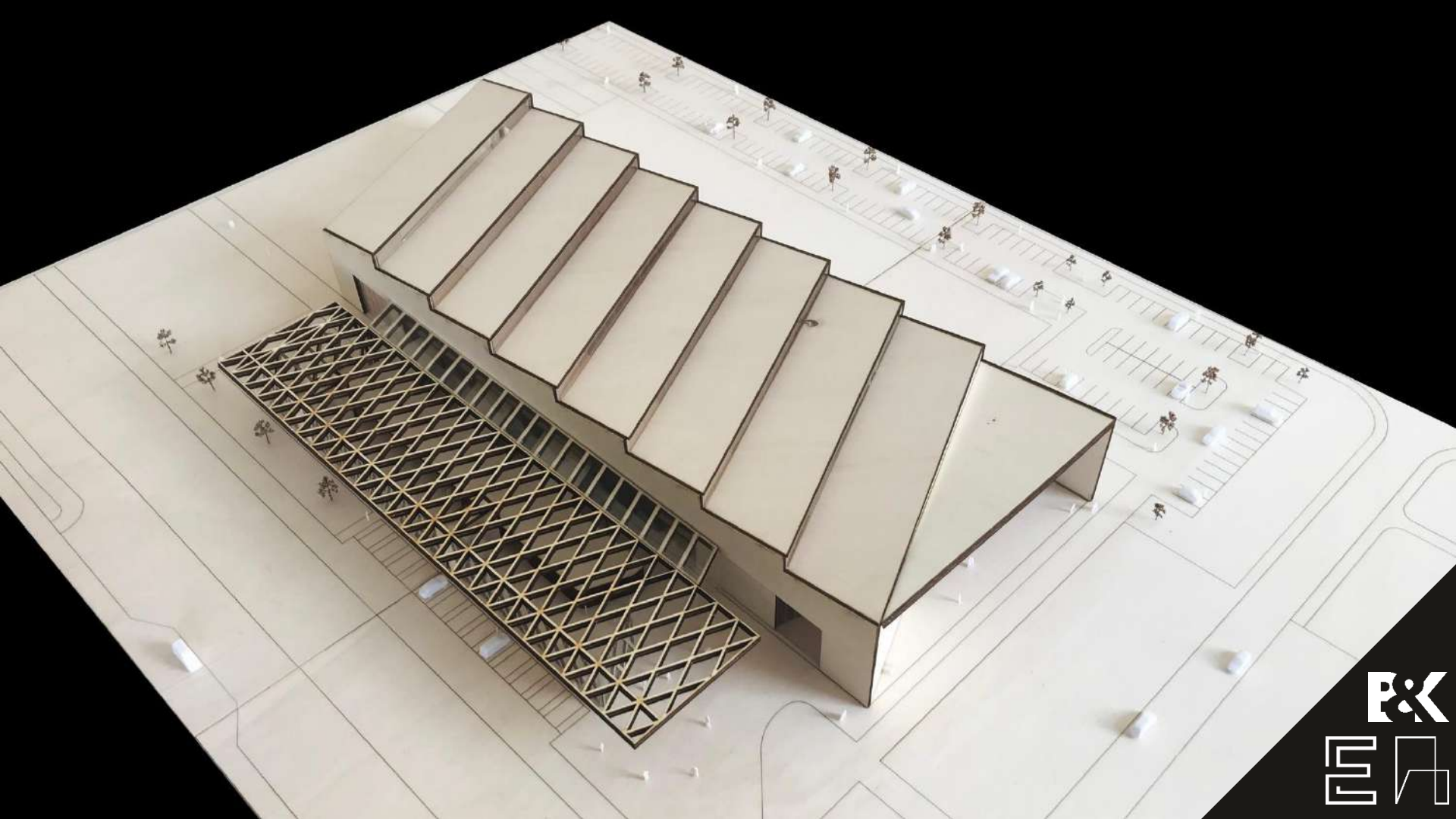
Workspace


PLANT DECK
WORKSPACE
WORKSHOP
CLEAN ROOM
PLANT

National Manufacturing Institute Scotland
Aerial View

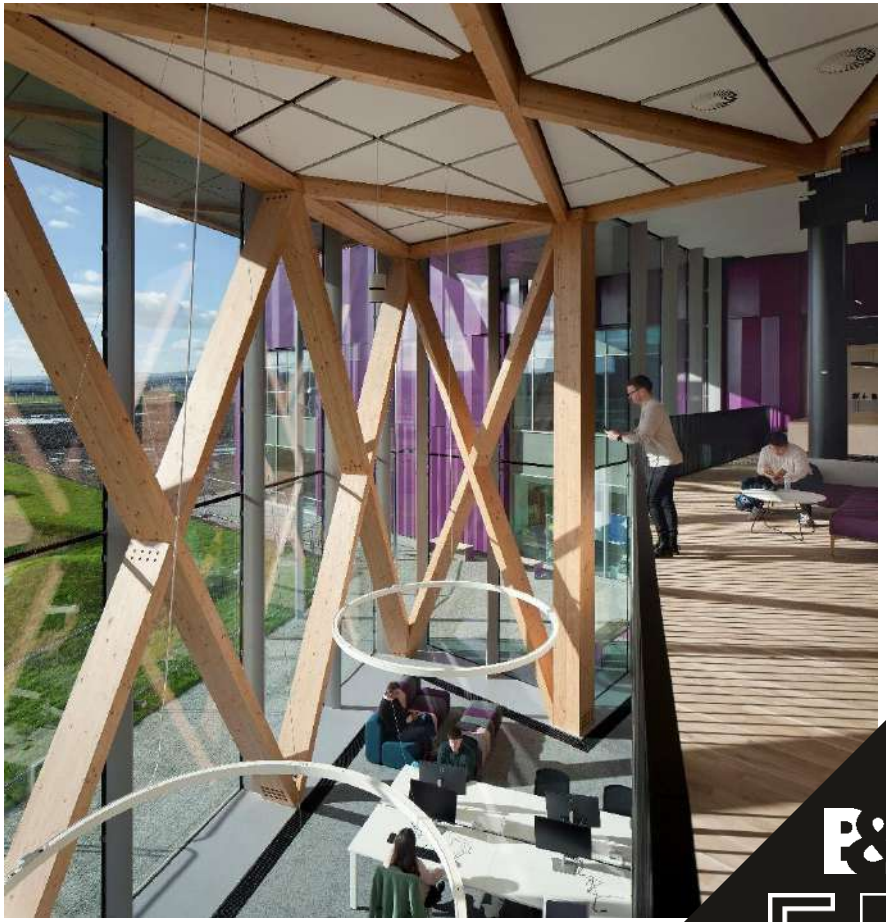
Creating a “Sense of Place”

A Research Campus with a unique character and identity – experimentation and innovation on show within a landscaped setting adjacent to a major international airport.



Timber Diagrid

A timber diagrid skin sits over the office & forum spaces to create an innovative structure that is highly visible both externally and internally, becoming a unique identity for the NMIS facility.

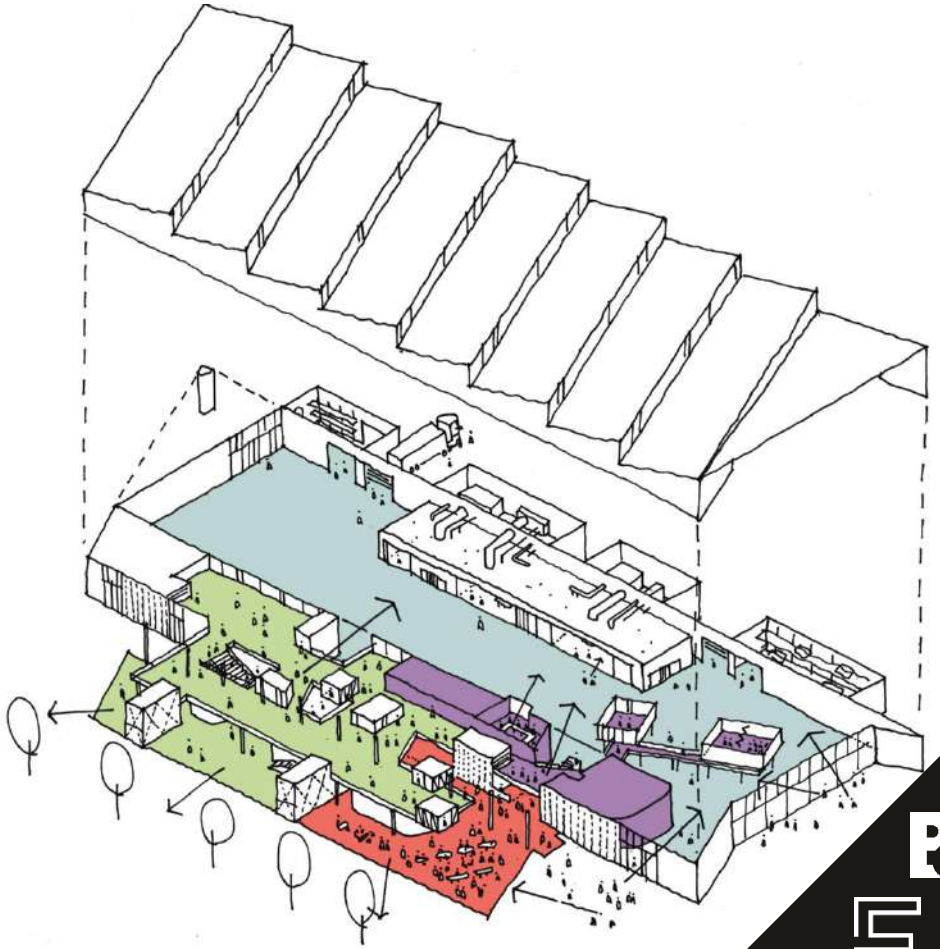


"The NMIS project will create a building that is carbon neutral for energy, and which will demonstrate exemplary climate change and sustainability attributes."

University of Strathclyde Brief

Sustainability

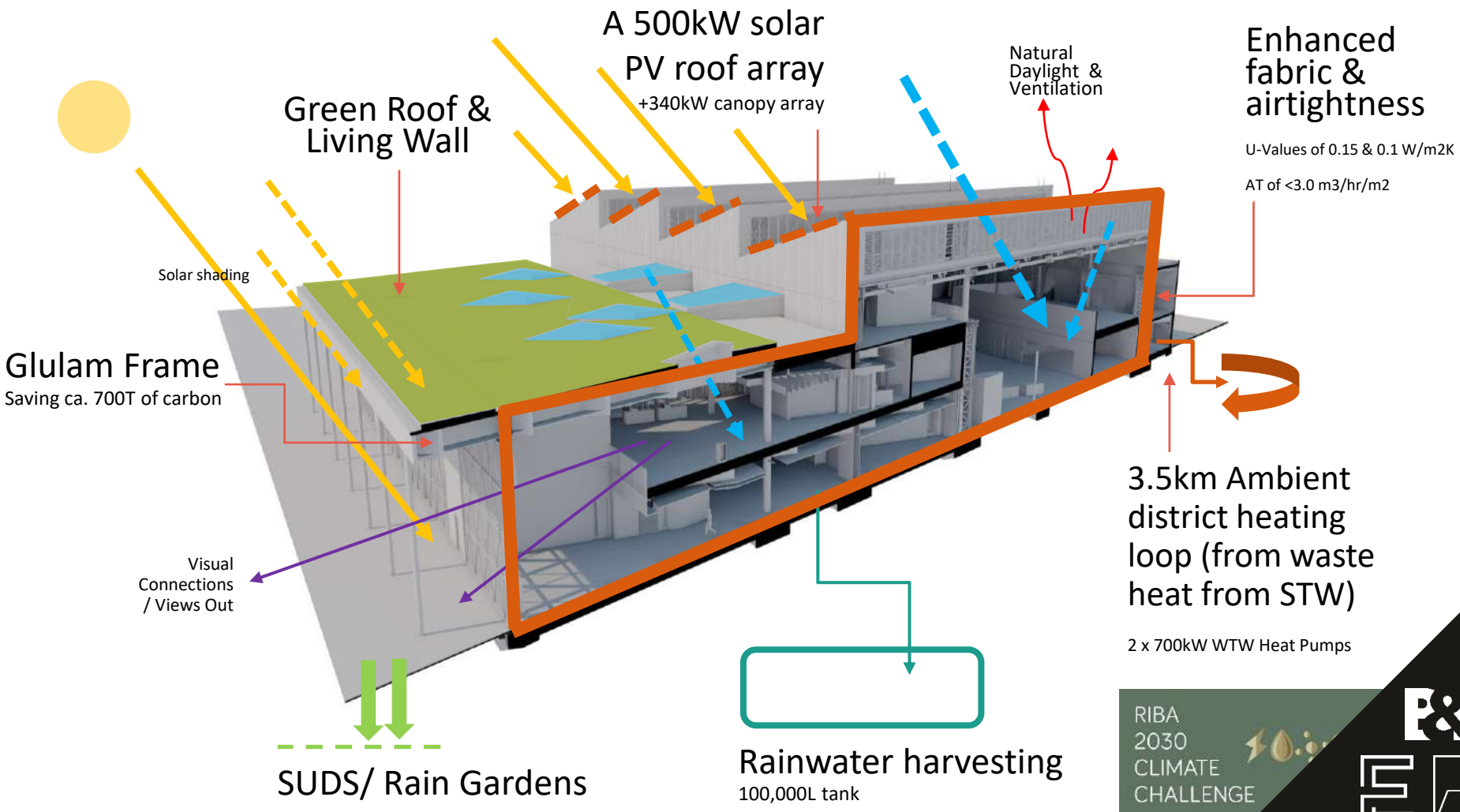
- The new National Manufacturing Institute Scotland (NMIS) is set to be one of **Scotland's leading Institutes** with a high public profile.
- NMIS seeks to be **innovative, ambitious, collaborative and bold** in creating a sustainable building using **clean, low carbon infrastructure** to meet the climate action ambitions of the University, Renfrewshire Council, Scottish Enterprise, Salix Finance, the Scottish Funding Council and the Scottish Government.



Sustainability Achievements

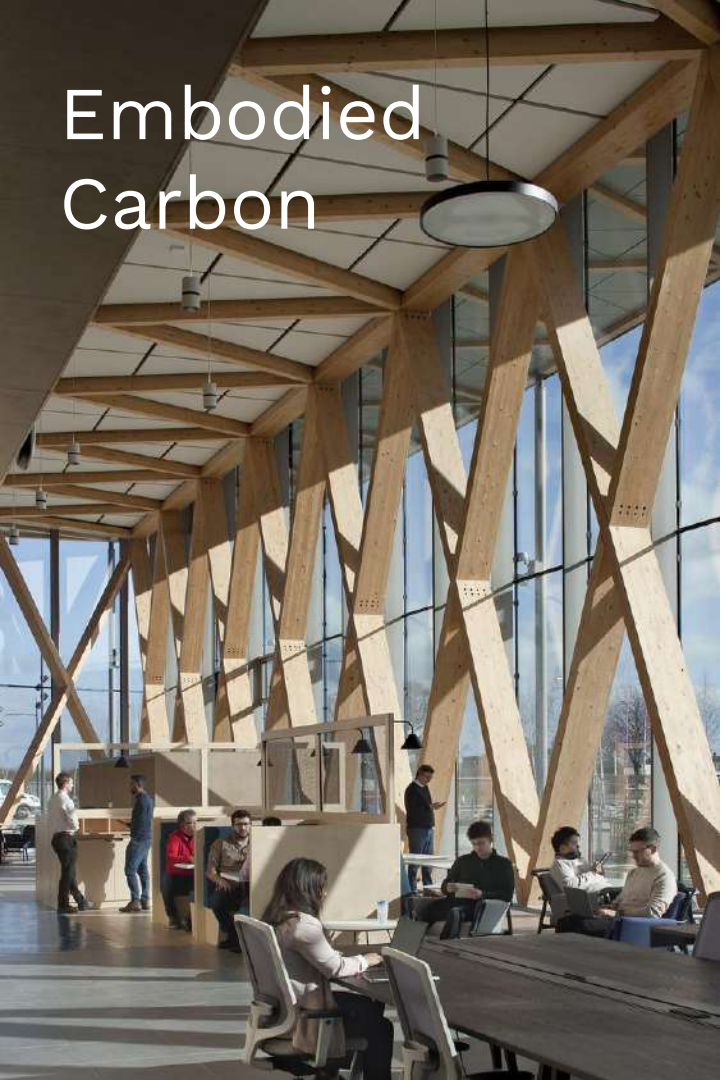
- University's First Carbon Neutral/ Net Zero (Regulated) Energy Building
- BREEAM Outstanding
- RIBA Sustainable Outcomes

RIBA Sustainable Outcomes

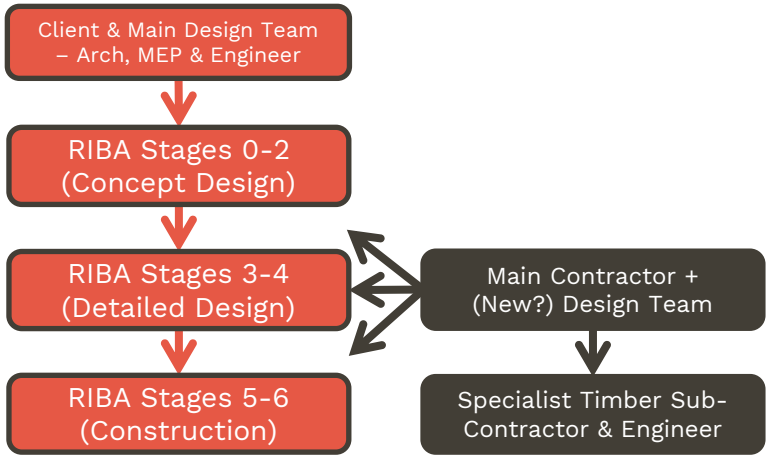

A 500kW solar PV roof array
+340kW canopy array
Green Roof & Living Wall
Natural Daylight & Ventilation
Enhanced fabric & airtightness
U-Values of 0.15 & 0.1 W/m2K
AT of <3.0 m3/hr/m2
Solar shading
Glulam Frame
Saving ca. 700T of carbon
Visual Connections / Views Out
3.5km Ambient district heating loop (from waste heat from STW)
2 x 700kW WTW Heat Pumps
SUDS/ Rain Gardens
Rainwater harvesting
100,000L tank
RIBA 2030 CLIMATE CHALLENGE

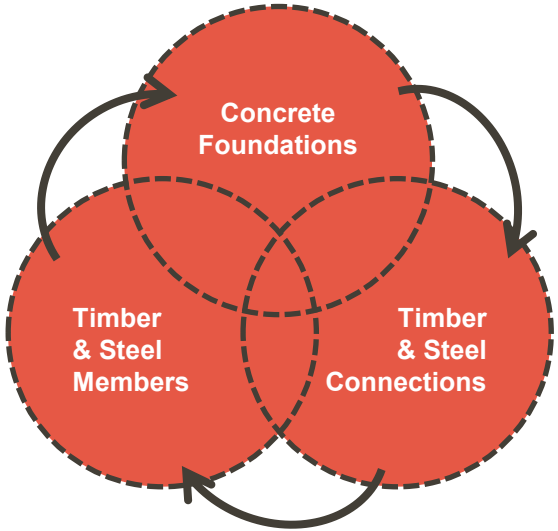
Operational Carbon

Embodied Carbon

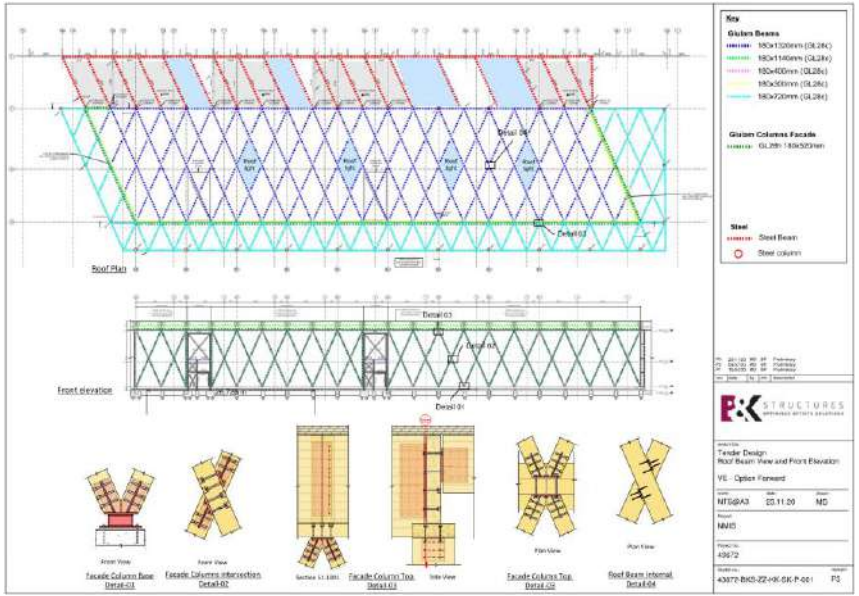


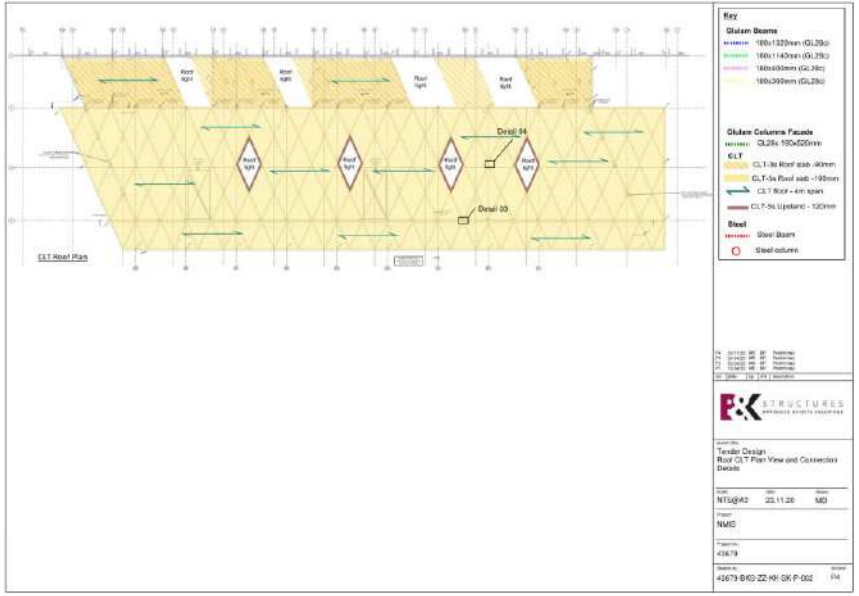
Early Engagement – Design Process



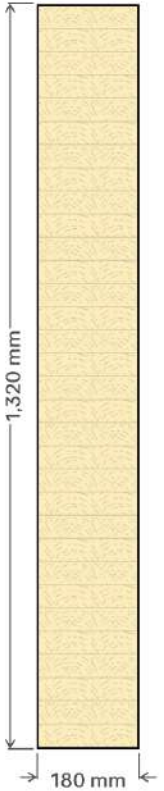


Early Engagement – Initial Input & Support

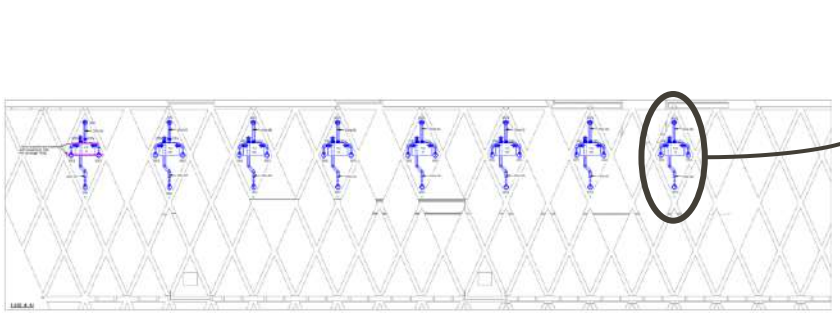


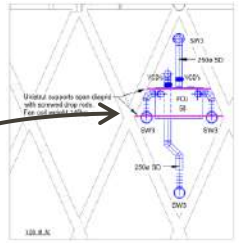


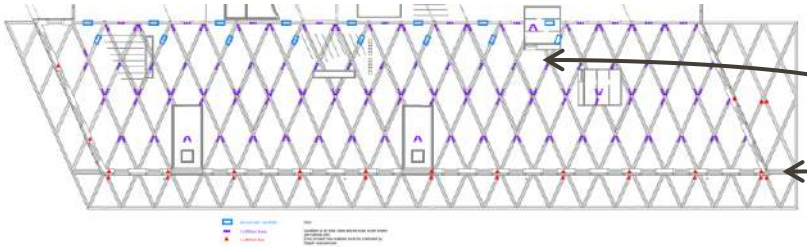
Clear Brief – Architectural Form

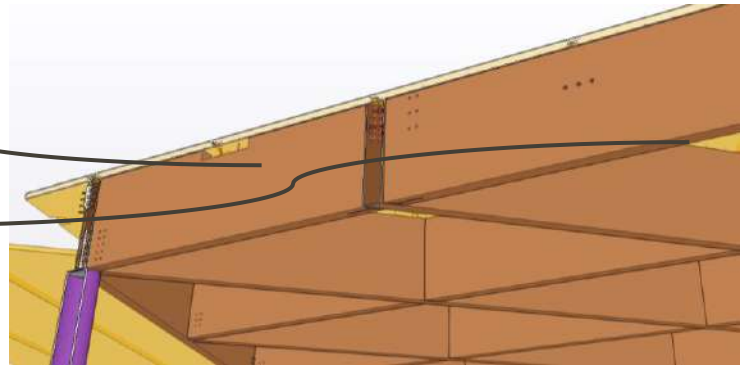


Clear Brief – MEP Strategy

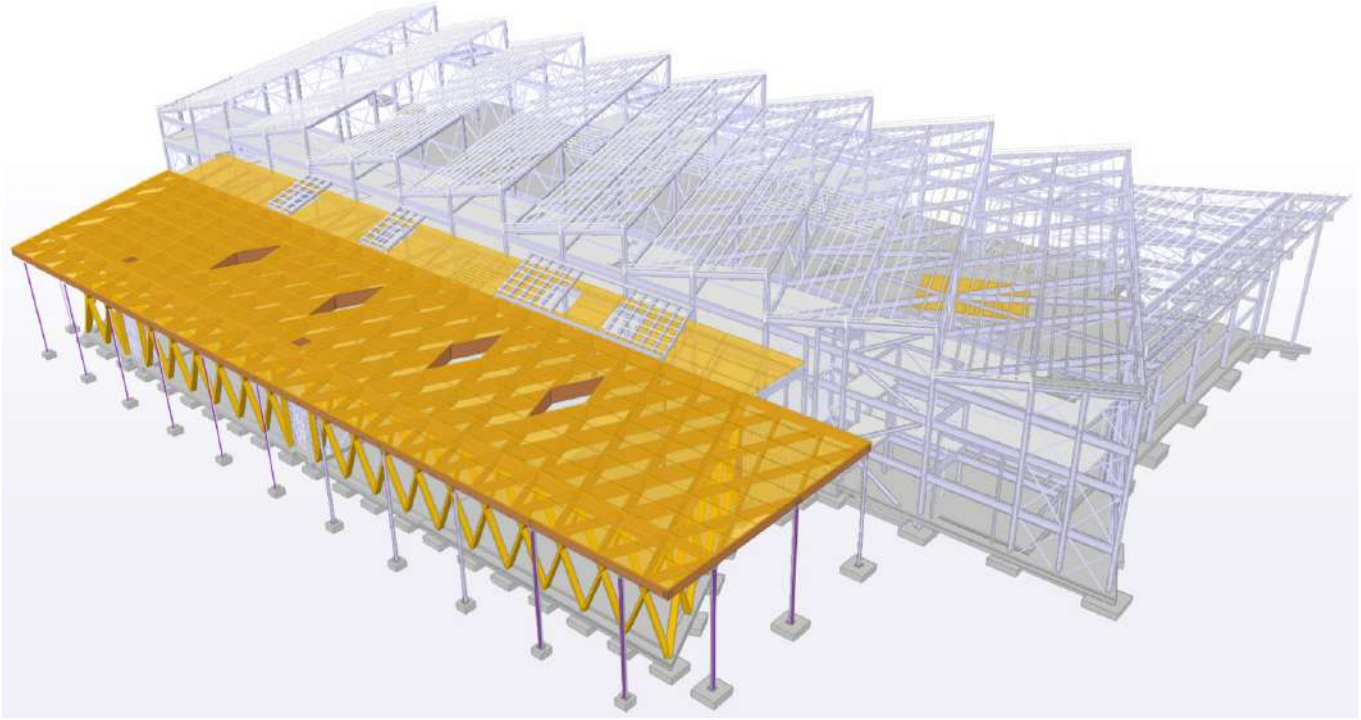




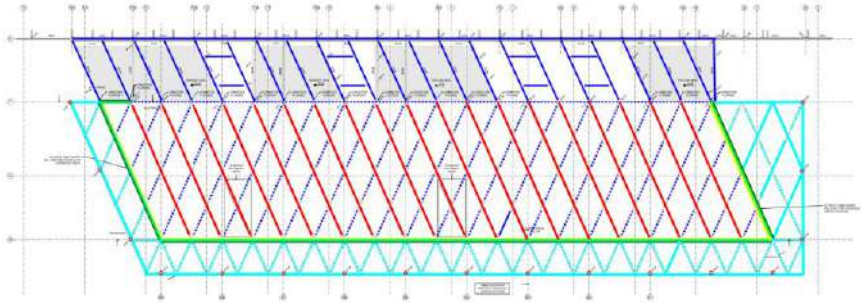


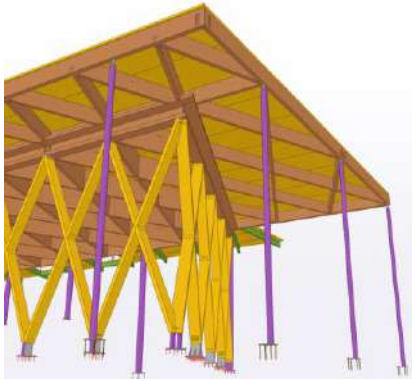


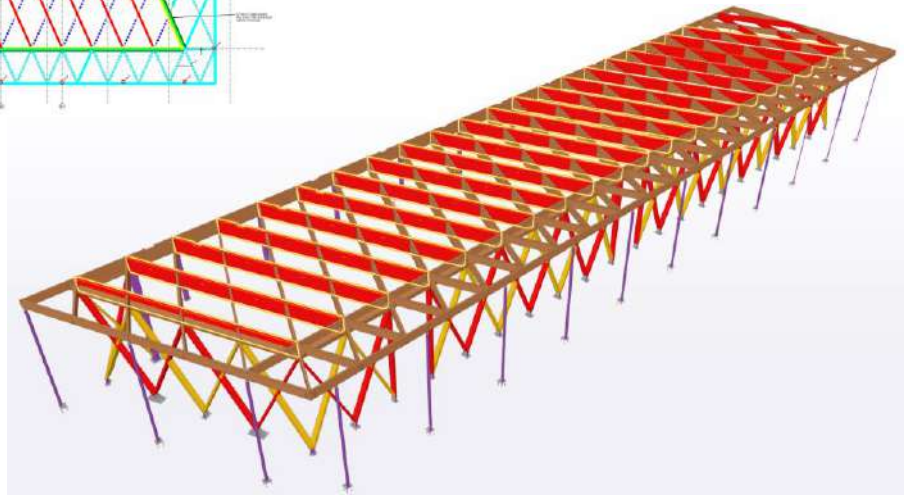
Structural Strategy - Overview



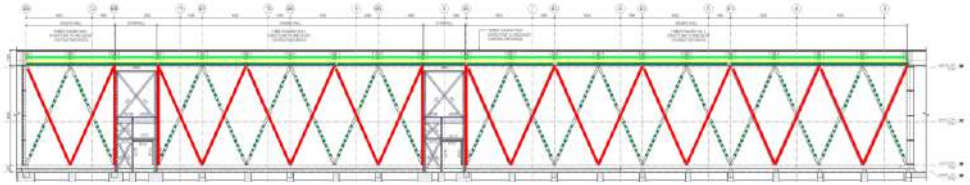
Structural Strategy - Roof

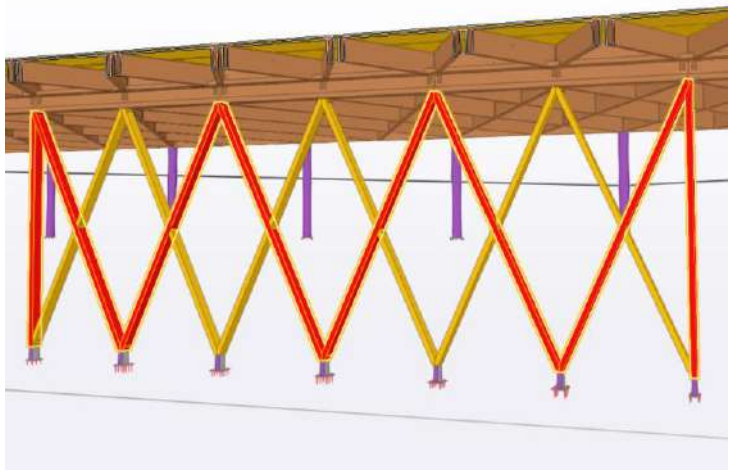




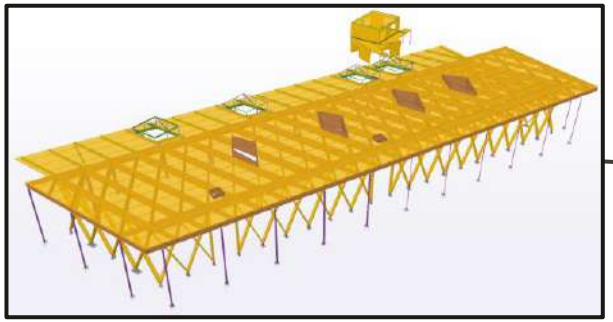


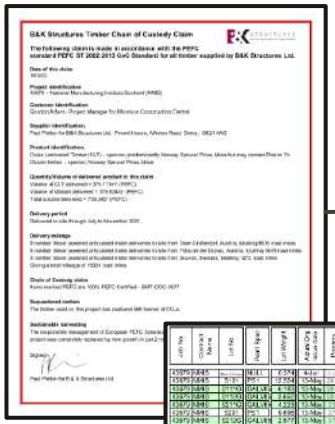
Structural Strategy - Supports





Counting Carbon – Detailed Interrogation




B&K Structures Timber Chain of Custody Claim

The following claim is made in accordance with the PEFC standard PEFC ST 2002:2013 CoC Standard for all timber supplied by B&K Structures Ltd.

Date of this claim:

Project identification:

Customer identification:

Supplier identification:

Product identification:

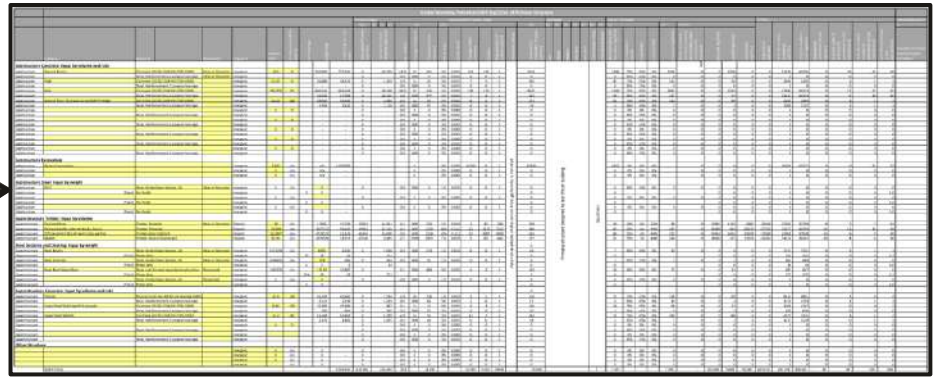
Quantity/volume of delivered product in this claim:

Delivery period:

Delivery mileage:

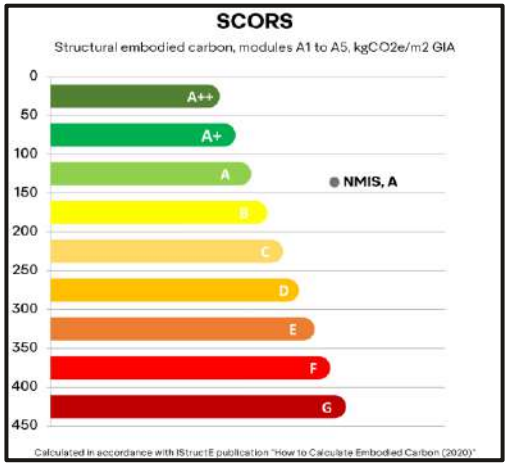
Chain of Custody claim:

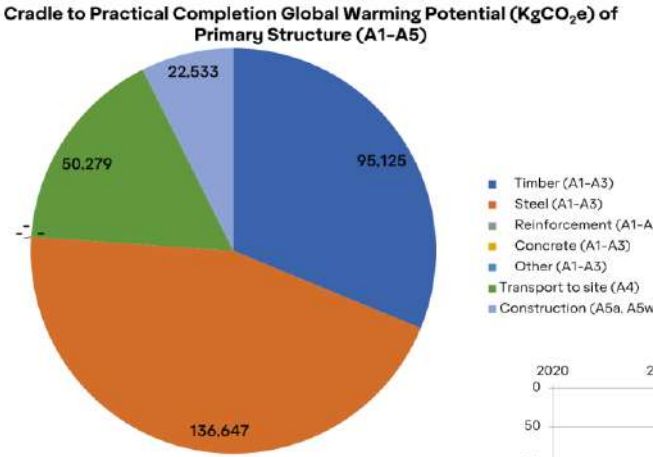
Sustainable harvesting:

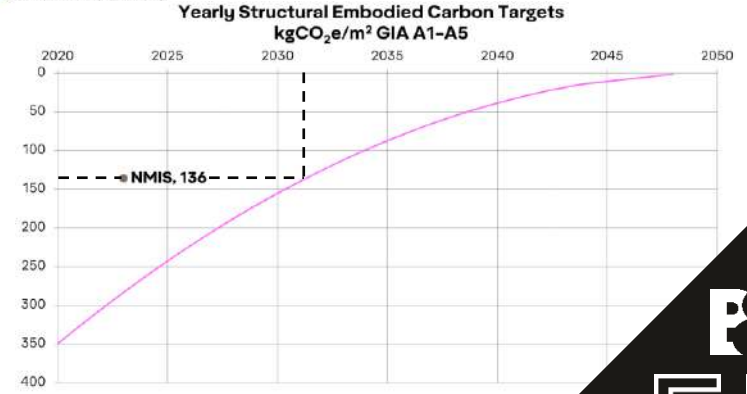


- In-house embodied carbon calculator
- Incorporates best practice guidance from RICS, IStructE, ICE DB 3.0 database & various manufacture EPD information

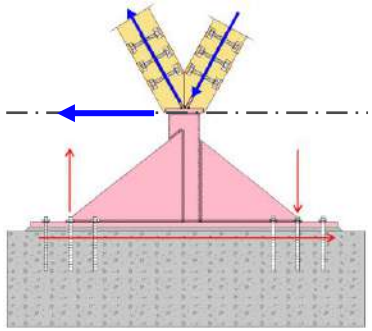
Counting Carbon – Summary Outputs

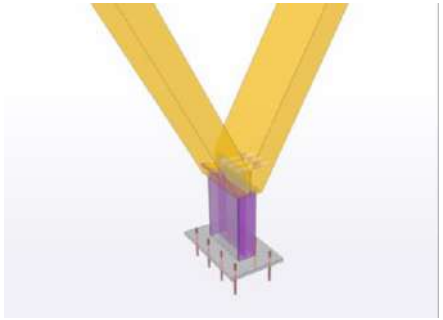


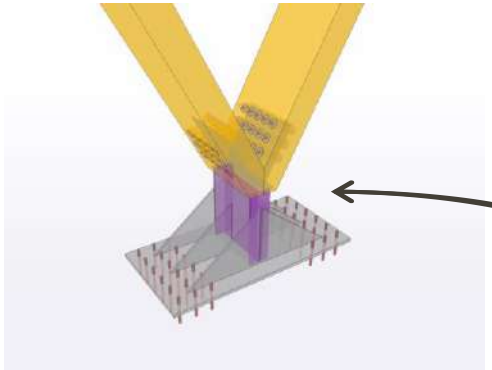


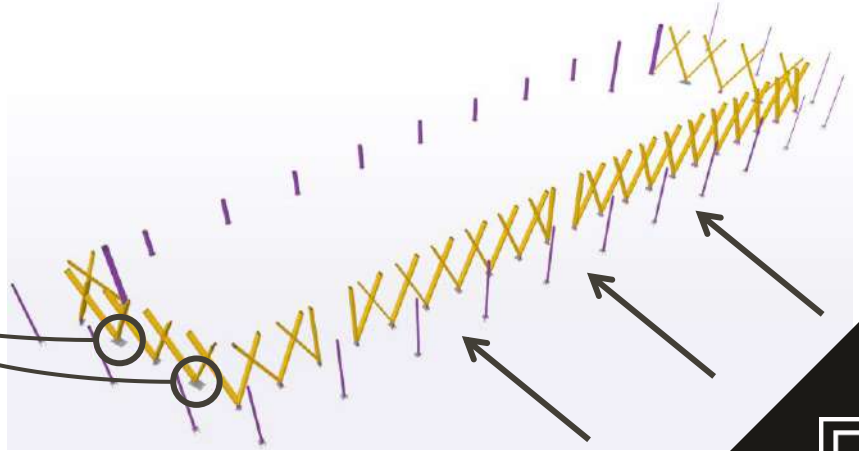


Structural Strategy – Overall Stability

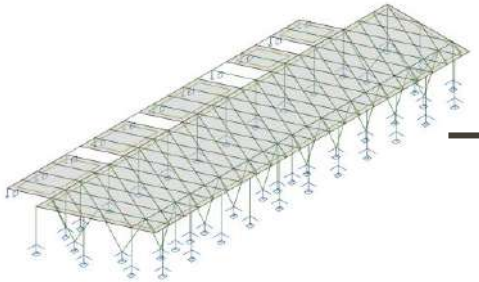


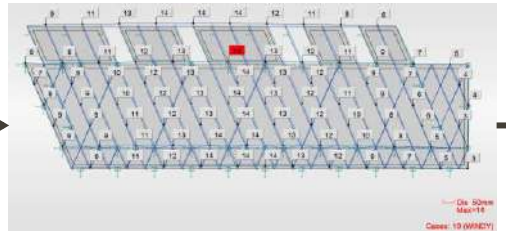


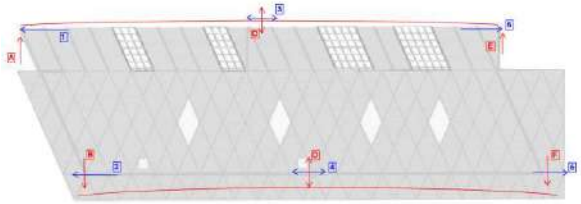




Structural Strategy – Roof Stability

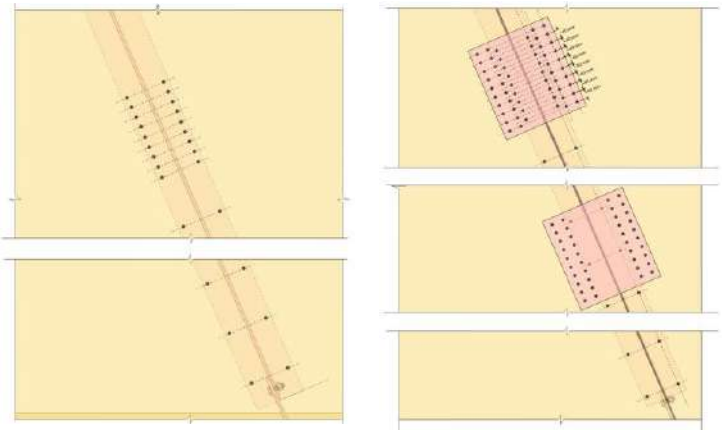


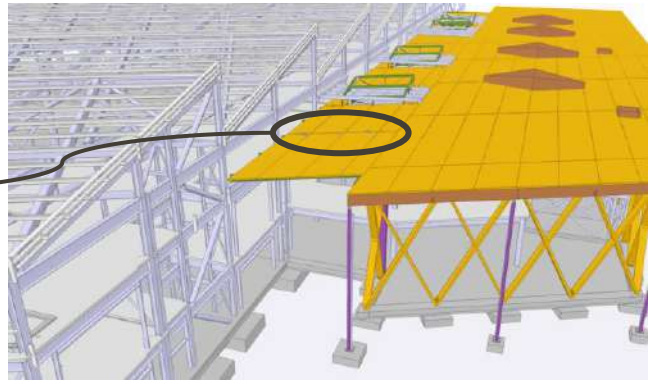




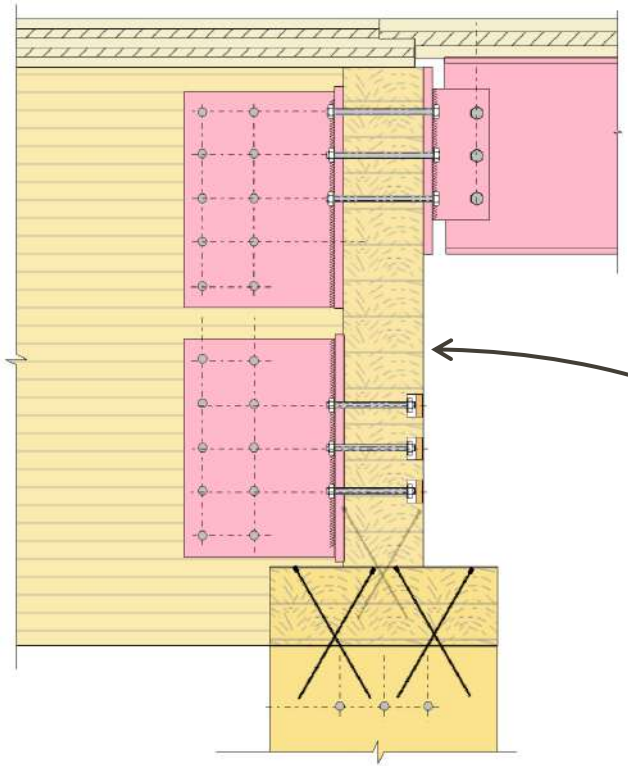
3 - Movement parallel to grid E:
Swelling during construction: +2mm (based on average moisture change from 12% to 15%).
Shrinkage during early operation: -2mm (based on average moisture change from 15% back to 12%).
Shrinkage during use: -2.7mm (based on average moisture change from 12% to 8%).
Thermal expansion/contraction: +0.6mm/-0.6mm (based on +/-15oC temperature change during service).
Sway due to wind loads on glulam roof: +/-4mm.
Maximum expansion = 2+4.0+0.5+0.5 = 6.3mm
Maximum contraction = -2.7-4.0-0.5x0.5 = -7.1mm

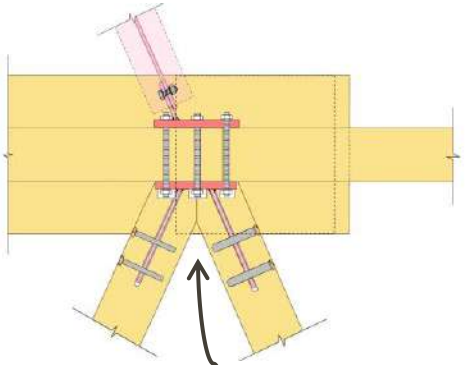
C - Movement perpendicular to grid E:
Swelling during construction: +5.1mm (based on average moisture change from 12% to 15%).
Shrinkage during early operation: -5.1mm (based on average moisture change from 15% back to 12%).
Shrinkage during use: -6.8mm (based on average moisture change from 12% to 8%).
Thermal expansion/contraction: +1.7mm/-1.7mm (based on +/-15oC temperature change during service).
Sway due to wind loads on glulam roof: +/-14mm.
Maximum expansion = 5.1+14.0+0.5x1.7 = 20.0mm
Maximum contraction = -6.8-15.0-0.5x1.7= -22.7mm

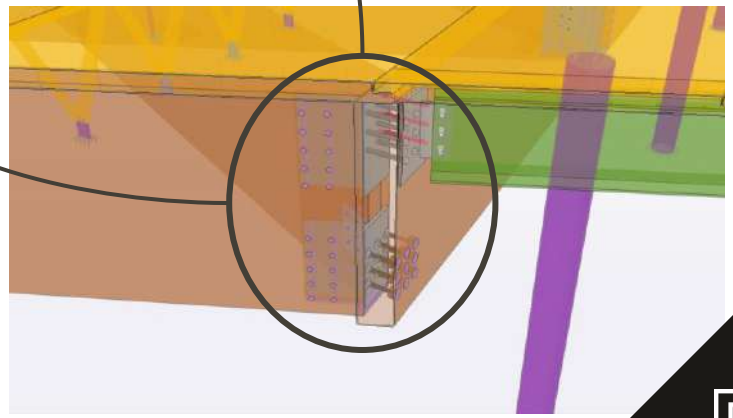




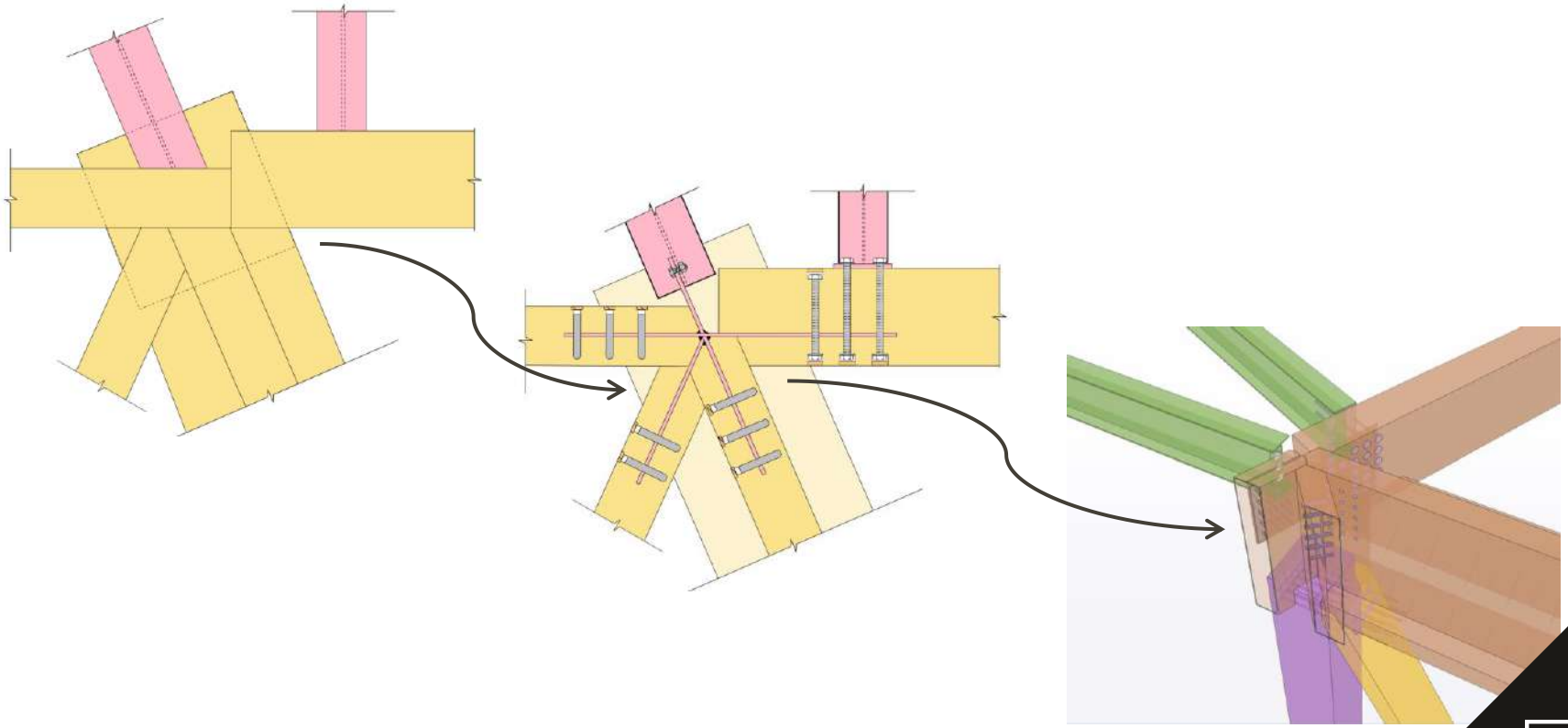
Connection Strategy – Main Intent



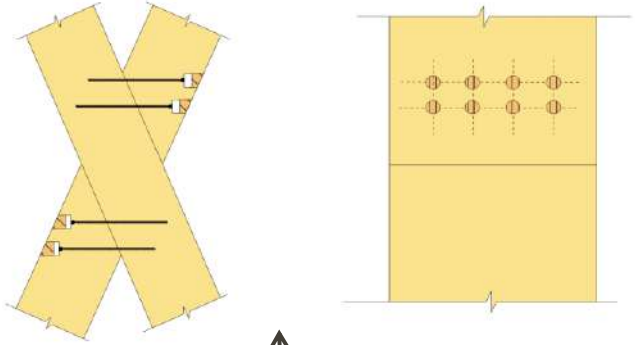


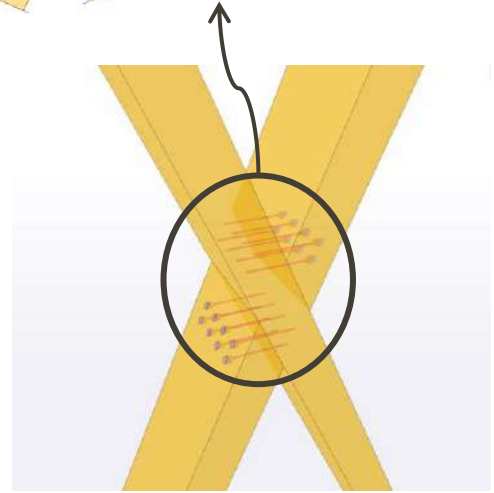


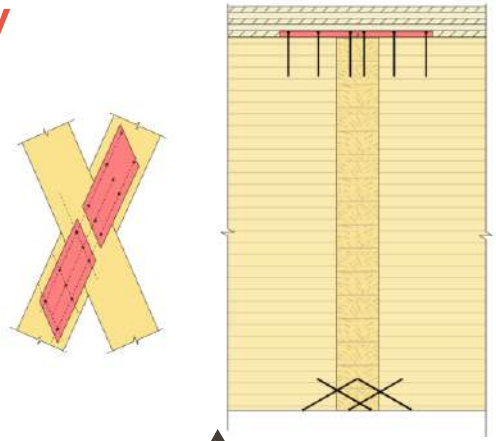
Connection Strategy – Complex Geometries

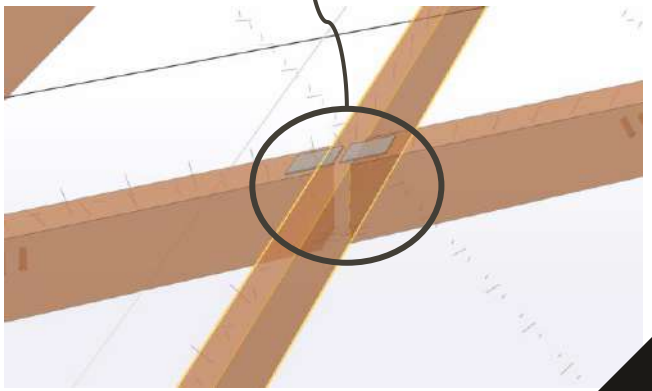


Connection Strategy - Simplify

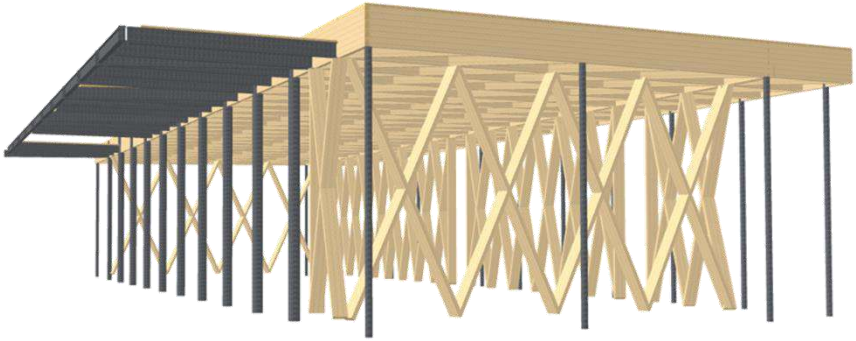








Modelling



Complexity

Timber Supply

380 m³ of CLT Delivered

380 m³ of Glulam Delivered

566 tonnes of sequestered carbon

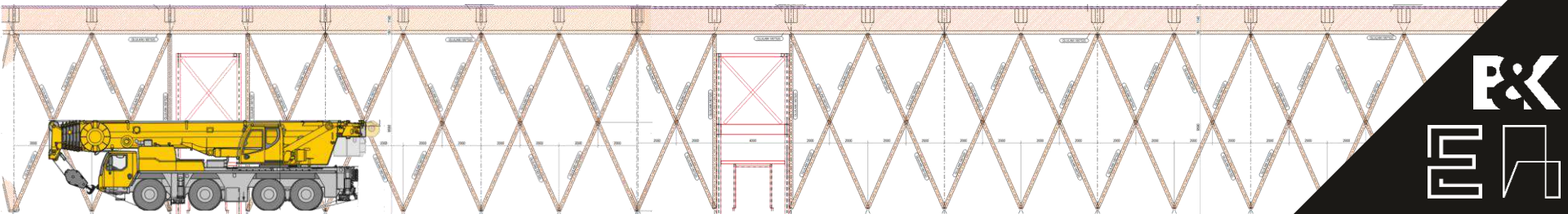
2 minutes 46 second grow-back time

Installation

Installation

Programme

Detailed Design & Co-ordination	20 Weeks
Structural Steel Fabrication	12 Weeks
CLT Manufacture	13 Weeks
Glulam Manufacture	10 Weeks
Installation	15 Weeks



Moisture

Moisture Management Plan

Water Management Plan	
Stage	**Process**
Stage 1	Design & Detailing
Stage 2	Manufacture & Transportation
Stage 3	Timber Superstructure Installation
Stage 4	Post Timber Superstructure Installation
Stage 5	Building Occupancy

Responsibility Level	Description
1	Lead; Overall responsibility of this item and responsible for final coordination.
2	Direct Input; Input is required by this stakeholder for coordination to be carried out.
3	Indirect Input; Input not directly required, however some level of input may be useful / requested.
N/A	No Input; Input not required.

1.0 Design & Detailing

Water Management Plan				Responsibility Matrix				
				Principle Designer				
Stage	Process	Ref	Activity	Architect	Structural Engineer	Specialist Timber Subcontractor	Main Contractor	Others*
Stage 1	Design & Detailing	1.1	Consider the correct use of materials for moisture prevalent areas (i.e kitchens, bathrooms and plant rooms)	1	2	3	3	N/A
		1.2	Consider the use of engineered timber in areas of significant risk to moisture ingress (i.e flat roofs, plant rooms, terraces and balconies)	1	2	3	3	N/A
		1.3	Consider the use of engineered timber in areas of moisture retention and design to limit the consequence of failure in these areas (i.e blue and green roof areas)	1	2	3	3	N/A
		1.4	Consider the consequences of waterproofing failure on the timber structure and design to limit the consequence of such failure	1	2	3	3	3
		1.5	Consider the specification of factory bonded membranes to be included in the floor / roof build-up in high moisture risk areas including the maintenance of those systems	1	3	2	2	3
		1.6	Consider the specification of early warning / moisture monitoring sensors for use in high moisture risk areas including the maintenance (including the powering of those systems)	1	3	2	2	3
		1.7	Consider any tint specified to be applied to the engineered timber and how this may impact the future visual finish following natural settlement and shrinkage	1	3	3	3	3
		1.8	Provide guidance on the availability of CLT products and allowable service classes	2	2	1	3	N/A
		1.9	Design building geometry to limit water traps in temporary and permanent condition, particularly around timber elements	1	2	3	3	N/A
		1.10	Detail weep-holes / outlets in engineered timber / structural steelwork as mitigation measure in event of water ingress	1	2	2	3	N/A
		1.11	Design roofing system appropriate for the structural materials and geometry, including the limiting of flat roof areas above timber elements	1	2	3	2	2
		1.12	Develop a bespoke manufacture, delivery and installation (up to hand-over) moisture control plan, considering the particular risks and challenges of each specific building	3	3	1	2	N/A
		1.13	Develop water management / temporary drainage strategy for construction	3	3	2	1	N/A
		1.14	Consider how movement / shrinkage is accommodated within the building design	1	2	2	3	3

Thank you for listening

Ross Barrett
Design Director
HLM Architects

Steve Peet
Associate Engineer
Engenuiti

Alex Brock
Pre-Construction Manager
B&K Structures