

CONSTRUCTION
SCOTLAND
INNOVATION
CENTRE



Accelerating Offsite

Transforming Housing Delivery in Scotland
Kainga Ora: Building Momentum Quarterly Event
14th May 2021

A quick introduction to us...

Stephen Good

CEO @ CSIC

- Background in Architecture & Urban Regeneration, Sustainable Construction & Digital Manufacturing
- Likes: innovators, risk-takers & old VW's
- Life motto: "Those who think the world can't be changed should get out of the way of those changing it"



Lucy Black

Director of Innovation & Engagement @ CSIC

- Background in Economic Development, Innovation Delivery & International Collaboration
- Likes: Pacman, NZ wine (or any wine!) & coloured spreadsheets
- Life motto: "Share your enthusiasm. Walk your talk. Dance and sing in the rain. Make today worth remembering"



So who are **CSIC**....?

**We are Scotland's
national innovation centre
for the built environment.**



Our Vision

A better built environment that delivers inclusive and sustainable economic, social and environmental impact.

Our Mission

To mainstream an innovation culture that accelerates the transition to zero carbon.

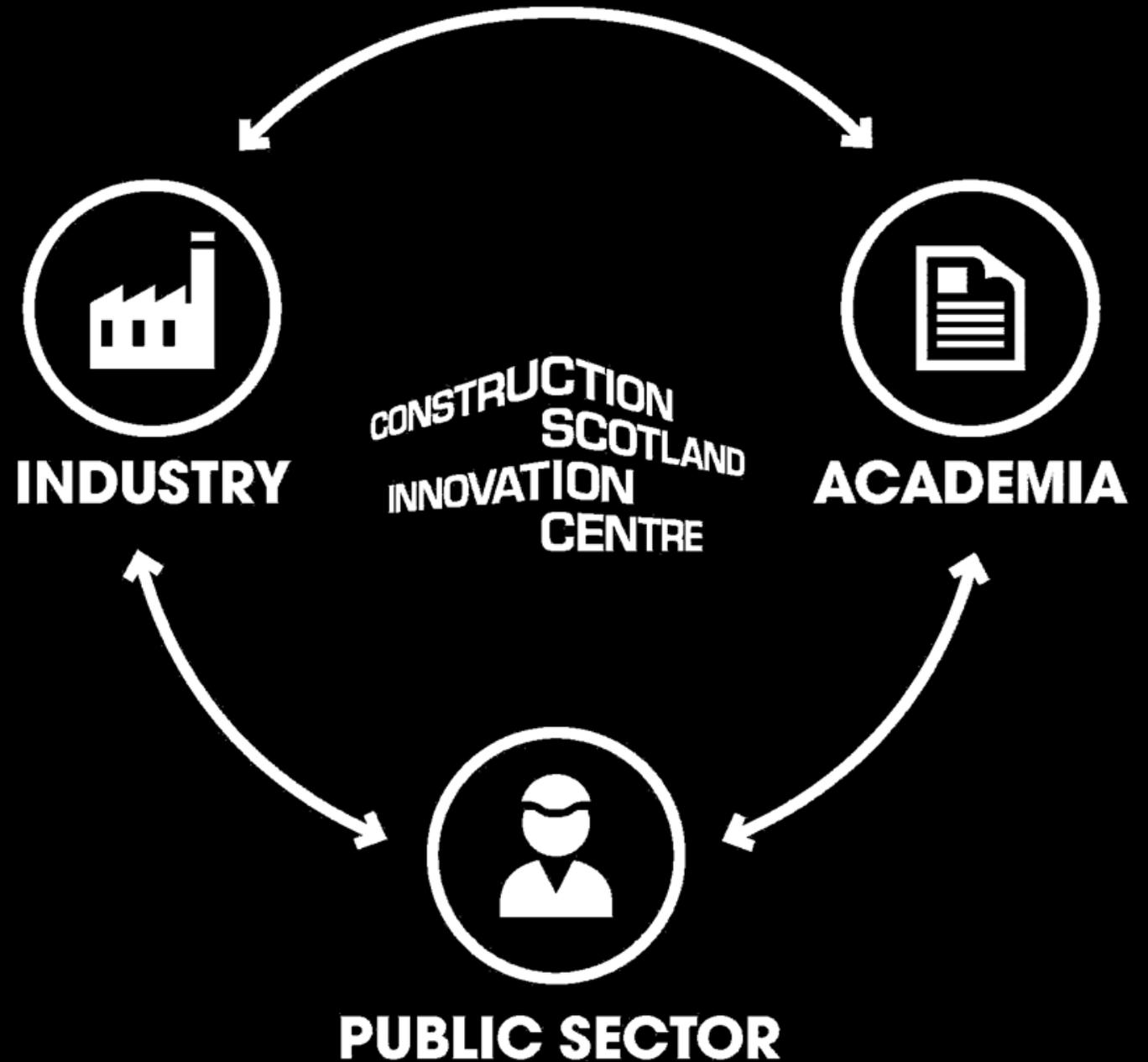


We are one of seven Scottish Innovation Centres supported by



One of our most valuable assets is our connected ecosystem

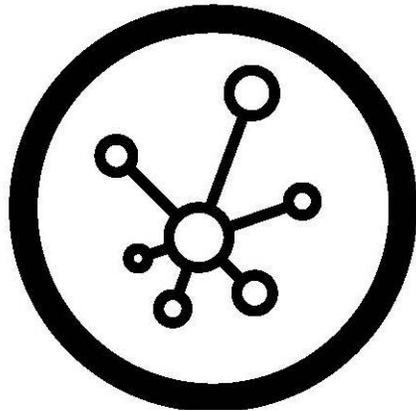
We link together...



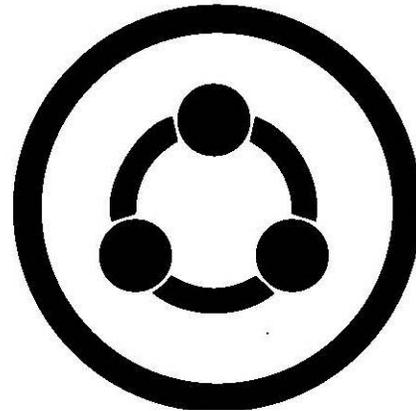


We believe
innovation is change
that **unlocks** new
value.

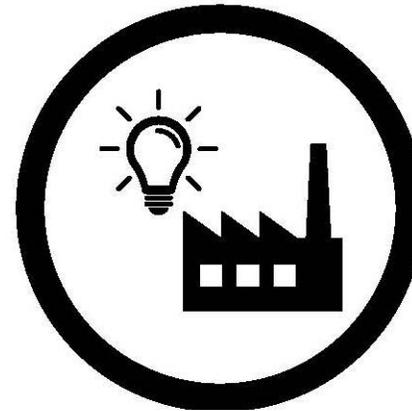
WE STRUCTURE SUPPORT ACROSS FOUR CHANNELS:



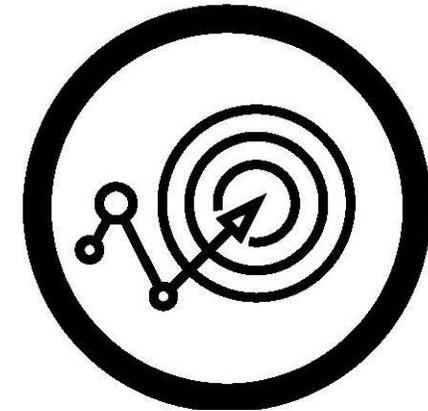
**OUR CONNECTED
ECOSYSTEM**



**COLLABORATIVE
PROJECTS**



**OUR INNOVATION
FACTORY**



**FUTURE SKILLS
PROGRAMMES**



OUR INNOVATION FACTORY

CONSTRUCTION
SCOTLAND
INNOVATION
CENTRE

OUR INNOVATION FACTORY



the UK construction industry's first dedicated digital manufacturing, prototyping & future skills centre of excellence

Andrew Wolstenholme
UK Construction Leadership Council

**CONSTRUCTION
SCOTLAND
INNOVATION
CENTRE**



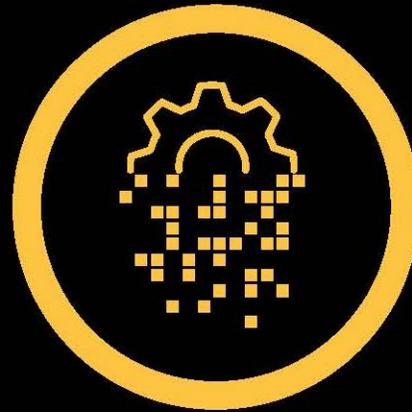
WE DELIVER IMPACT ACROSS FOUR PROGRAMME AREAS:



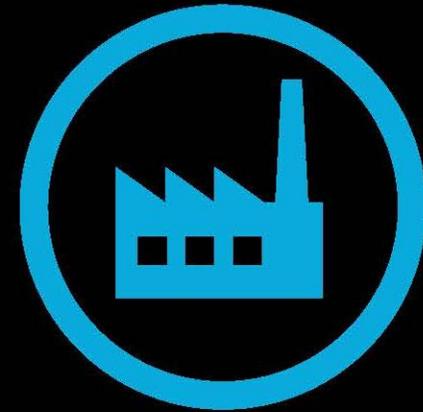
**CULTURE
CHANGE**



**BUILDING
SUSTAINABLY**



**DIGITAL
TRANSFORMATION**



**ADVANCED
MANUFACTURING**

BUILT ENVIRONMENT INNOVATION MASTERS PROGRAMME

20 fully funded MSc's/year driving innovative R&D



CULTURE
CHANGE



BE A PART OF
INNOVATION



INNOVATE
THE FUTURE
BUILT
ENVIRONMENT
WITH US

CONSTRUCTION
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INNOVATION
CENTRE

YOUNG LEADERS' FORUM

Our young leaders ecosystem, driving change across the built environment, reverse mentoring, disrupting the status quo



CULTURE
CHANGE

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CENTRE

YOUNG LEADERS' FORUM



MULTIPLY

The UK's First Commercially Manufactured
Hardwood Cross laminate timber structure



BUILDING
SUSTAINABLY



K-BRIQ: THE WORLDS FIRST 90% RECYCLED BRICK

A simple, innovative and environmentally friendly solution that addresses the construction waste challenge



**BUILDING
SUSTAINABLY**

KENOTEQ

i-CON PLATFORM

i-Con provides resources that address challenges faced by the sector to aid recovery and build resilience for a better future underpinned by innovation.



DIGITAL
TRANSFORMATION



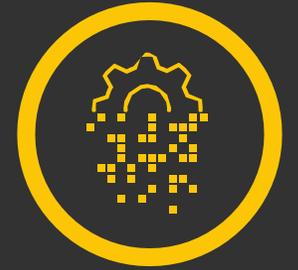
i-con

#BUILDBACKBETTER

TOGETHER

BE COVID SMART

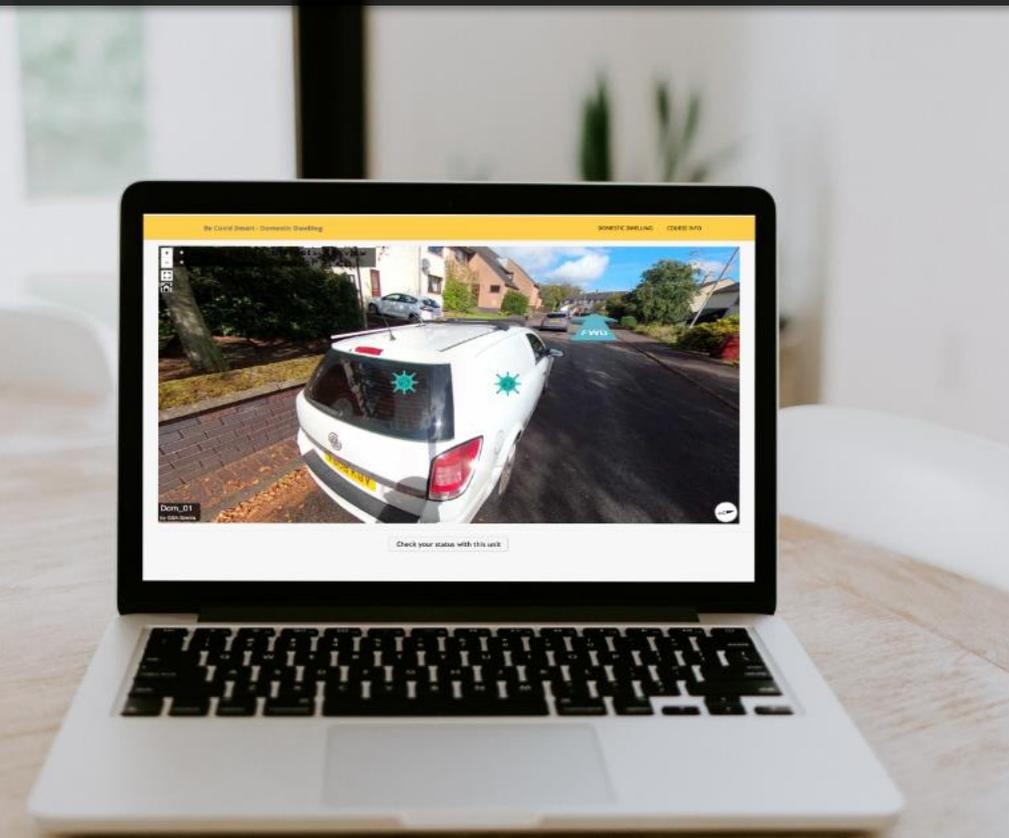
An free online immersive learning tool to promote safe working and learning in construction during Covid-19



DIGITAL
TRANSFORMATION

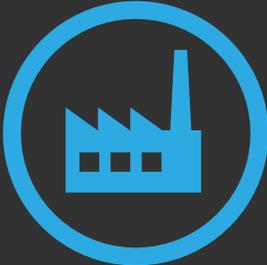
- 0 information hotspots to view
- 0 questions to answer

Drag to explore



OFFSITE READY

A train the trainer programme to promote best practice in teaching offsite manufacturing skills



ADVANCED
MANUFACTURING



GAME CHANGER

TEACHING INNOVATION IN CONSTRUCTION

CITY OF GLASGOW COLLEGE **CONSTRUCTION SCOTLAND INNOVATION CENTRE** **CwC** **Edinburgh Napier UNIVERSITY**

MOBIE **classofyourown** **Funded by citb**

Ministry of Building Innovation and Education

Launch webinar 23rd April • Sign up here

MAKE IT SMART HUB

A one-stop-shop for construction and manufacturing innovation in the Highlands & Islands



ADVANCED
MANUFACTURING



/EXPLORE
Innovation



/LEARN
Innovation



/CONNECT
Innovation



/DO
Innovation

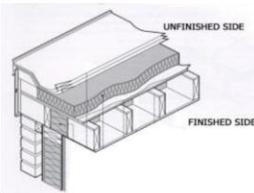
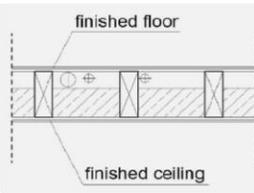


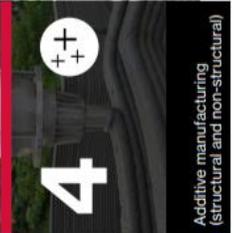
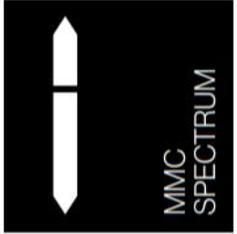
Offsite in Scotland

Renowned expertise...



Offsite categorisation...

SUBCATEGORIES		CATEGORIES						
		2-D Elements			3-D Modules			
		Walls	Floors	Roofs				
0		Uninsulated open panels: with first skin on only one side (e.g. OSB on one side of timber panels).		Uninsulated floor panels with decking only on one side and exposed joists/beams.		Uninsulated open panels: with first skin on only one side (e.g. OSB on one side of timber panels).		Uninsulated modules whose surfaces have first skin on only one side.
1		Insulated open or closed panels without finished linings (e.g. SIPs).		Insulated floor panels without finishes.		Insulated open or closed panels without finished linings.		Insulated modules without finished linings.
2		Insulated closed panels finished on one side (either internally or externally).		Insulated floor panels finished on one side (either upper or lower side).		Insulated closed panels finished on one side (either internally or externally).		Insulated modules with finished lining on one side (either internally or externally).
3		Insulated closed panels fully finished internally and externally, with integration of services (i.e. with electrical and mechanical services, windows and doors).		Insulated floor panels fully finished on the upper and lower sides, with integration of services (i.e. with electrical and mechanical services).		Insulated closed panels fully finished internally and externally, with integration of services (i.e. with electrical and mechanical services, windows).		Modules fully finished on all sides, with integrated services (i.e. with electrical and mechanical services, windows and doors).



3 Pre-manufacturing components (non-systemised primary structure)

7 Site process led site labour reduction / productivity / assurance improvements

2 Pre-manufacturing (2D primary structural systems)

6 Traditional building product led site labour reduction / productivity improvements

1 Pre-manufacturing (3D primary structural systems)

5 Pre-manufacturing (non structural assemblies & sub-assemblies)

CATEGORY DEFINITION

4 Additive manufacturing (structural and non-structural)

Technical capability.



OSS – CCG(OSM) et al



ENU - Timber Testing Facility



ENU – Trimble Technology Lab



CSIC - Innovation Factory

Offsite Solutions Scotland

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OFFSITE SOLUTIONS
SCOTLAND

Strategic alignment...



Enablers



Forest Products



Manufacturers



Value Add

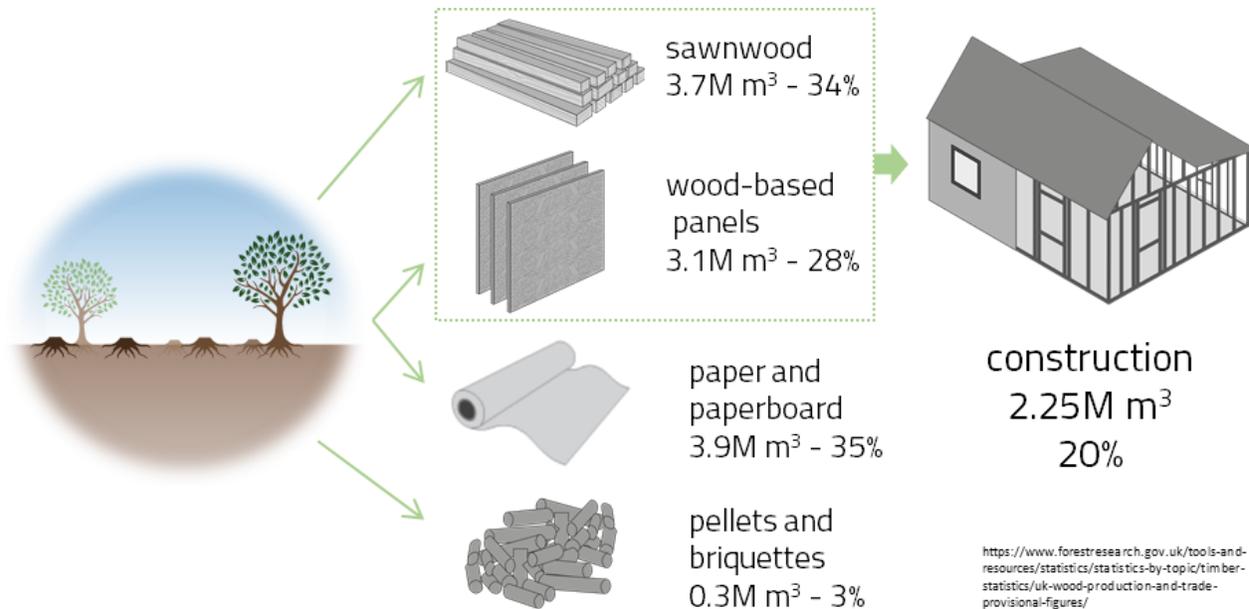


Diverse solutions...



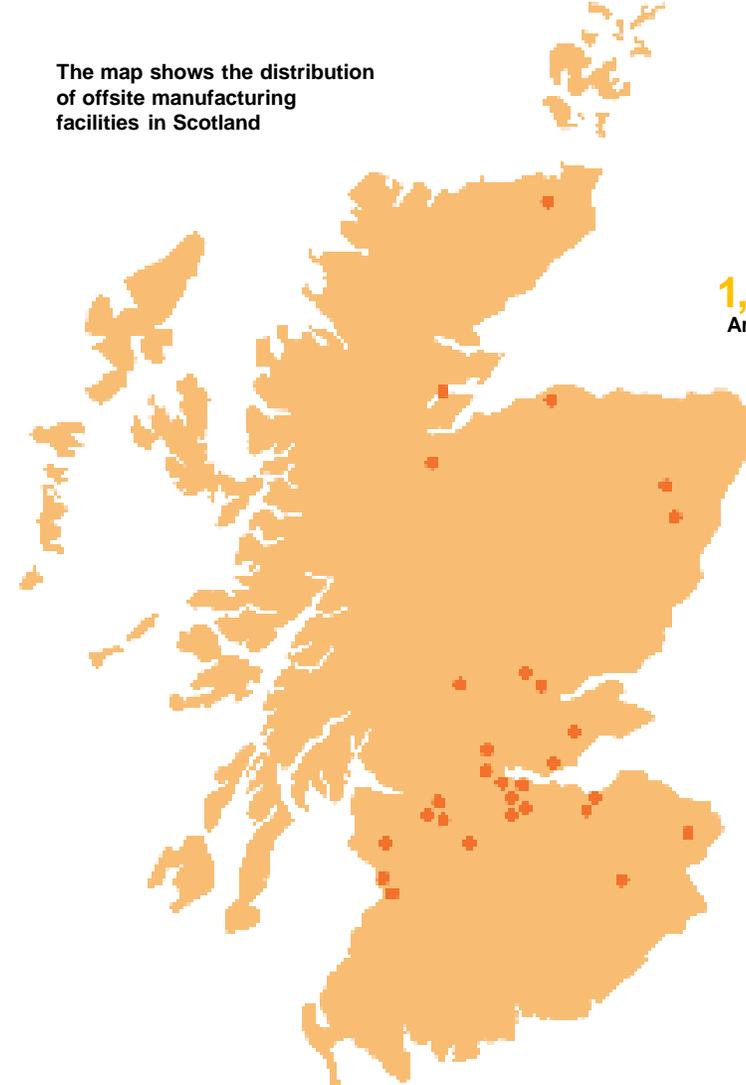
Sustainable growth...

- **86% new build housing in Scotland uses timber frame construction**
 - of which 78% is open panel timber
 - of which 14% is advanced closed panel timber
 - of which 8% is volumetric timber
- **The UK requires approx. 300,000 homes per annum**



The current value of the offsite sector in Scotland **£300 MILLION**

The map shows the distribution of offsite manufacturing facilities in Scotland



89% 

Of the waste generated during offsite manufacture is recycled

1,800 PEOPLE 
Are currently employed within the Scottish offsite sector

CONSTRUCTION SCOTLAND INNOVATION CENTRE

LIVING LAB

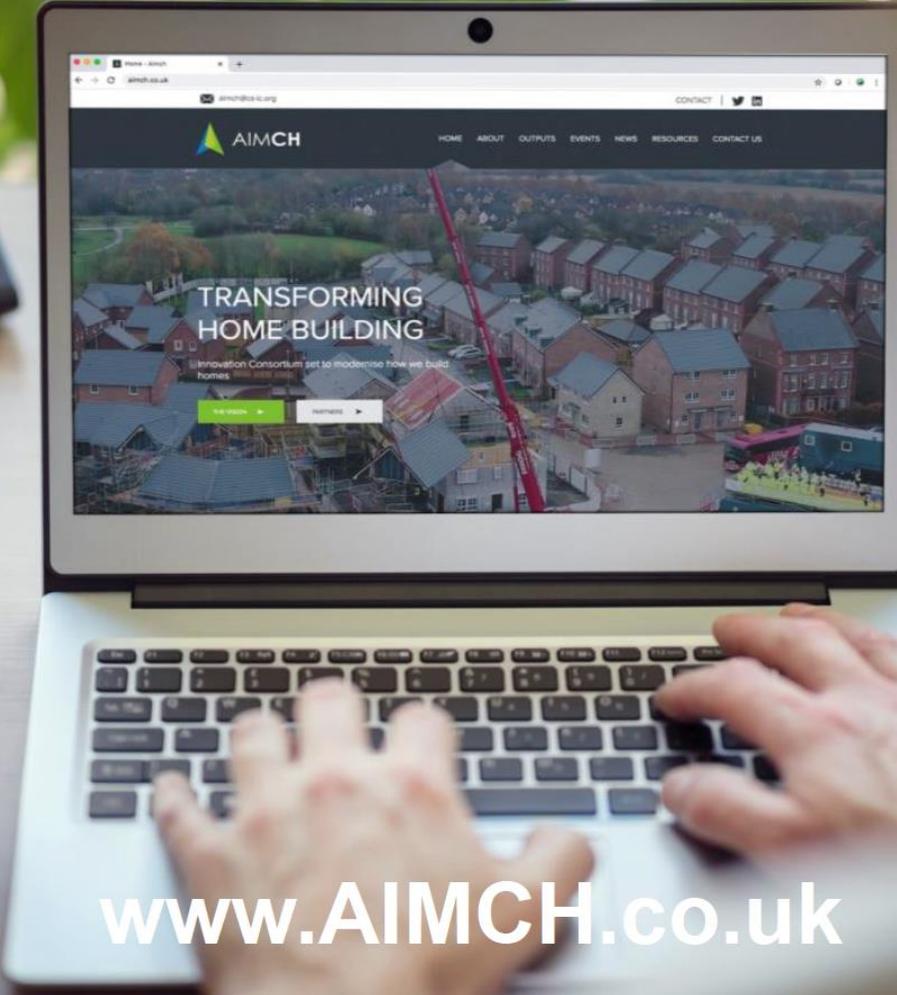
A series of innovative projects which serve as ideal case studies for the use of homegrown mass timber products. These projects are not directly funded by the SBRI Phase 2 funding, but are predicated on the outputs of the proposed project.



Case Study #01



**TRANSFORMING
HOW WE BUILD HOMES**



www.AIMCH.co.uk



AIMCH: PARTNERS



**£6.2M 3 YEAR
PROJECT WITH £4M
IUK FUNDING**

**FOUR KEY
INDUSTRY PARTNERS**

**TWO RESEARCH &
INNOVATION PARTNERS**

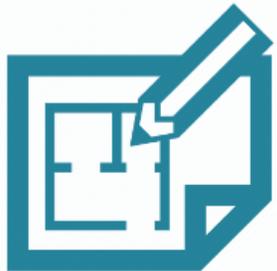


AIMCH: OBJECTIVES



To deliver modern methods of construction (MMC), using panelised offsite systems (OSM) that are cost neutral, higher quality, faster, safer, robust and more productive than traditional masonry methods of construction.

**DIGITAL WORKING
AND
STANDARDISATION**



**OFF SITE
MANUFACTURING &
INTEGRATED
SUPPLIERS**



**ON SITE LEAN
ASSEMBLY &
MONITORING**



**HOMES FOR
SALE OR RENT**



AIMCH: INNOVATION JOURNEY



AIMCH: PREDICTED OUTCOMES



MMC and panelised OSM for same cost as masonry, that is faster, more productive, safer and higher quality

- ✓ Improve build quality
- ✓ Improve HSE
- ✓ More attractive careers
- ✓ Reduce time to build
- ✓ Increase productivity
- ✓ De-risk construction
- ✓ Improve predictability
- ✓ Reduce waste time and materials
- ✓ Increase PMV
- ✓ Mainstream Panelized Offsite

KPI	MMC compared with traditional
Cost	Equal or cheaper
Time	Half the time to build
Quality	¼ of the cost of defects
PMV	Increase from 5% to 30%

AIMCH: PREDICTED IMPACT

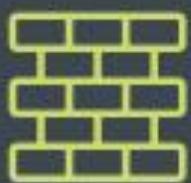


STATISTICS



120,000

Additional homes each year for the same or less cost than traditional craft methods.



30%

**Faster
build
time**

35,000

The number of UK homes to be potentially impacted by AIMCH partners delivery each year.



AIMCH: OUTPUTS TO DATE



DFMA GUIDE TO TIMBER PANELISED MMC

DFMA (Design for Manufacture and Assembly) is an important consideration to optimise and maximise the use of panelised MMC systems. DFMA is an

[READ MORE](#)



DESIGN STANDARDISATION AND PRODUCT FAMILIES

Standardisation is critical to an effective industrialised housing approach. The automotive industry has shown how standardisation can be

[READ MORE](#)



GUIDE TO CREATING A BIM HOUSING MANUAL

Building Information Modelling (BIM) is a process which can bring benefits to any housing development. It brings new challenges to the way we

[READ MORE](#)



DIGITAL BUSINESS SYSTEM

The project is currently developing a single seamless digital system (an Enterprise Resource Planning or ERP system) that will allow businesses

[READ MORE](#)



DESIGNING A FUTURE FACTORY

As AIMCH partners, Stewart Milne Group (SMG) and The Manufacturing Technology Centre (MTC) collaborated to test modelling technology used in

[READ MORE](#)



ADVANCED MMC PROTOTYPING – MODULAR ROOF INSTALLATION

AIMCH is transforming how we build homes. The project's ambition is to scale up and deliver modern methods of construction (MMC), using panelised

[READ MORE](#)



ADVANCED MMC PROTOTYPING

AIMCH is transforming how we build homes. The project's ambition is to scale up and deliver modern methods of construction (MMC), using panelised

[READ MORE](#)



ADVANCED MMC PROTOTYPING

Over the past year Barratt Developments PLC has developed and erected six closed panel timber frame units on a live development near Warrington.

[READ MORE](#)



MIDWAY POINT PROJECT OVERVIEW

This short video provides a snapshot of the first 18 months of the 3 year AIMCH project and the significant progress that has been made during

[READ MORE](#)



TRANSFORMING HOUSEBUILDING: KEY FINDING FROM THE AIMCH...

This webinar provided industry with a comprehensive overview of the first 18 months of the 3 year AIMCH project and the significant progress that

[READ MORE](#)



DESIGNING A FUTURE FACTORY - MATHEMATIC MODELLING

The project has developed a factory simulation with a business case that outlines the returns for future investment in a new world class factory

[READ MORE](#)



PRODUCTIVITY MAPPING AND LITERATURE REVIEW

The University of Dundee in association with Whole Life Consultants Ltd was commissioned by the Construction Scotland Innovation Centre (CSiC) on

[READ MORE](#)

Work package 5:
Guide to Creating a BIM Housing Manual
February 2021

Logos: mtc, L&Q, CONSTRUCTION SCOTLAND INNOVATION CENTRE, FORSTER, Stewart Milne GROUP, BARRATT DEVELOPMENTS PLC, INDUSTRIAL STRATEGY, UK Research and Innovation

www.aimch.co.uk

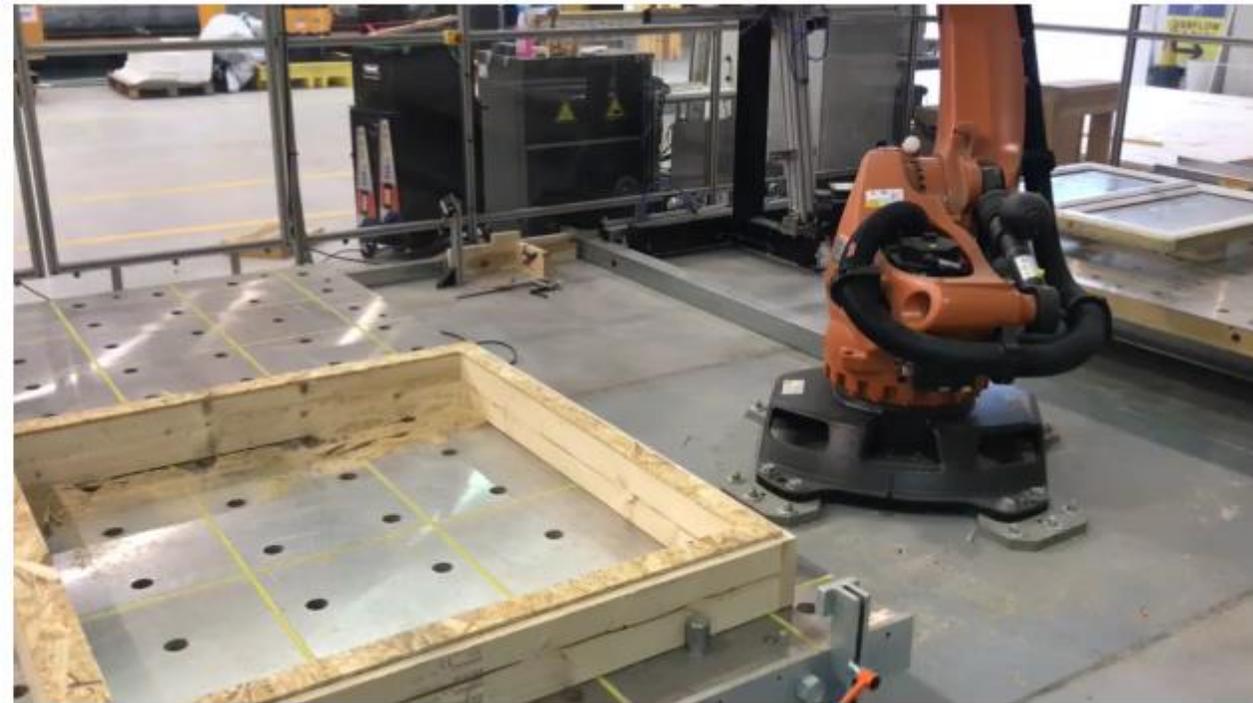
Work package 5:
Design Standardisation Studies & Product Families
February 2021

Logos: mtc, L&Q, CONSTRUCTION SCOTLAND INNOVATION CENTRE, FORSTER, Stewart Milne GROUP, BARRATT DEVELOPMENTS PLC, INDUSTRIAL STRATEGY, UK Research and Innovation

www.aimch.co.uk

www.aimch.co.uk/outputs

AIMCH: SITE v FACTORY



Case Study #02

Edinburgh Homes Demonstrator



20,000 affordable homes are required in the next 5 years across 6 Scottish Local Authorities

This needs to be delivered in a way which improves:

- ❖ **Quality and consistency;**
- ❖ **Greater standardisation;**
- ❖ **Faster and more affordably;**
- ❖ **and to zero carbon standards**



Offsite Housing Research Project



Affordable Housing



Analysis of 3,500 scientific documents

Offsite Construction



Review of 500 academic publications

Expert Interviews



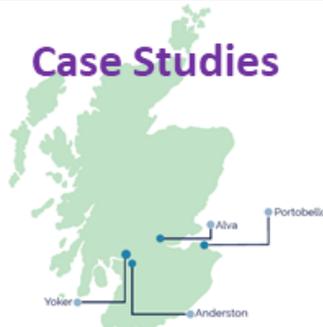
- Offsite construction
- Provision of affordable housing

Desktop Study



Offsite construction sector in Scotland:
Productivity and Growth

Case Studies



Offsite Housing Projects in Scotland

Co-Design Workshops



Key stakeholders involved in the delivery of affordable housing in Scotland



Edinburgh Napier
UNIVERSITY



OFFSITE SOLUTIONS
SCOTLAND

SCOTTISH
FUTURES
TRUST

EDINBURGH
THE CITY OF EDINBURGH COUNCIL

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SCOTLAND
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CENTRE

Key Objectives



**DFMA and
Standardisation**



**Off Site
Manufacturing**



**On Site
Factory
Assembly**



**Affordable
Housing**



Initial Project Outcomes



Edinburgh Home Demonstrator

CONSTRUCTION SCOTLAND INNOVATION CENTRE

OPPORTUNITY
Scotland needs more affordable homes, cheaper and faster. A recent report evidences the potential contribution offsite manufacturing offers to address the challenges faced by the affordable housing sector in Scotland.

Uptake of offsite manufacturing by councils and housing associations remains at low levels however due to a variety of factors including cost competitiveness.

PROJECT
The City of Edinburgh Council advocates a new collaborative delivery solution that cause disruptive innovation across the entire affordable housing supply chain within South East Scotland.

The Edinburgh Home Demonstrator Programme will show that a new business model based on collaborative procurement, whole-life costings, development pipeline and greater standardisation can transform the productivity and performance of affordable housing.

SUPPORT
Total Project Value: £128,941
CSIC Funding: £39,271

OUTCOMES

- A new business model based on collaborative procurement that promotes offsite
- Digital catalogue of standardised parts and assemblies that can be used collaboratively
- Demonstrate this model on around 1000 homes to net-zero carbon standards.

LOCAL VALUE ADD

- Adds resilience to local offsite supply chain and secures employment
- Reduces poverty and other living hardships through more robust affordable housing rent
- Improved environmental performance of affordable homes with benefits to residents.

PROJECT DURATION
October 2020 – May 2024

Innovation Support: Process Innovation
Sub Sector: Housing

www.cs-ic.org/library/edinburgh-home-demonstrator/

**CONSTRUCTION
SCOTLAND
INNOVATION
CENTRE**

6

**Scottish Local
Authorities**

1,000

**Repeatable,
Sustainable &
Affordable Homes**

10

**Mass
Customisable
House Types**

1

**New Blueprint for
Procuring Value**

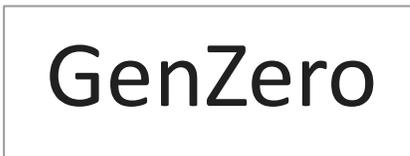
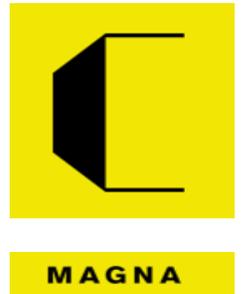
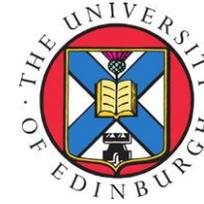
Case Study #03

Bio-OSM:

Scotland's First Offsite Manufactured, Homegrown, Mass Timber Dwelling



Collaboration partners...



KOTO



LAMELLA PREP

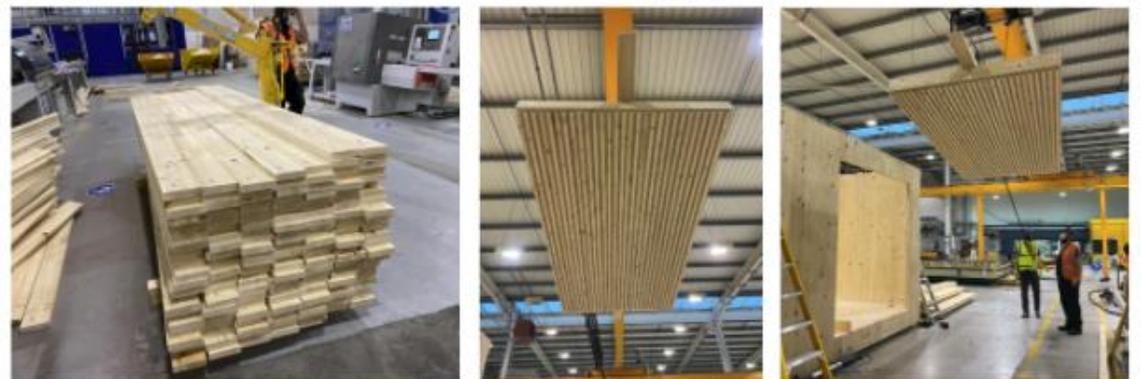
CLT MANUFACTURE



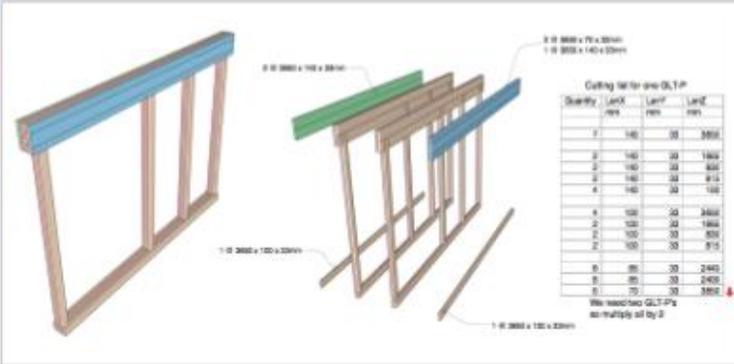
GLT MANUFACTURE



NLT MANUFACTURE



GLTP MANUFACTURE



MODULE ASSEMBLY



COP26 Demonstrator...



Case Study #04

NearHome Working Hubs: Building 20 minute Communities from an Offsite Kit-of-Parts

The NearHome approach produces
535kg CO₂e/m² FA
during construction compared to
2953kg CO₂e/m² FA
for a typical traditional office building

Meaning 1/5th the carbon emissions



NearHome Working Hubs: Building 20 minute Communities from an Offsite Kit-of-Parts



1 **A sustainable approach to retrofit which minimises waste.** The kit of parts can be reused multiple times and the structure is made of local natural materials with a reduced carbon footprint. Furthermore, at their eventual end of life, the subassemblies can be easily disassembled into their constituent parts for full reuse or recycling.

3 A product that **prioritises value as well as costs.** NearHome is designed to be in line with typical fit out costs, but has the added advantage of a sustainable approach with a greatly reduced carbon footprint. Because of its minimal reliance upon external structure it can also be utilised to retrofit buildings where cost may have been a prohibitive factor.

5 An open source toolkit which has been **deliberately designed to be simple to replicate**, providing opportunities for potential users and construction firms across the country. In future phases the design will be continually refined to ensure that it is accessible to as many companies as possible.

7 Built in flexibility which means the **structure can also be used to form a standalone building** as well as a retrofit. We recognise that not all locations that would benefit from a hub office may have a suitable building in place to retrofit, so the kit of parts can be used to construct a new build office if required.

2 **Support for the creation of a network of hub offices** throughout Scotland, reducing the amount of car travel and providing a workplace option within walking/cycling distance for users. This will enable healthier lifestyle choices and reduce the amount of car journeys undertaken for commuting.

4 **Supporting users' health and wellbeing.** The latest research in reducing the impact of COVID-19 has been taken into account when pulling together the design. The use of timber as the main material has also been shown to be beneficial in reducing stress levels. All materials have low or no Volatile Organic Compound content, resulting in an improved air quality.

6 **Promoting the use of Scottish timber.** Recent research by members of the NearHome team has proven the viability of Scottish timber as a building material. The use of this product provides support to the economy and mitigates for the vagaries around the availability and fluctuating costs of imported alternatives.

8 Inclusion of a **state of the art, yet low cost, IoT sensor network** which will allow non-intrusive and effective monitoring of the building and the occupancy rate. This will provide hard data to help refine the design in further phases and improve the performance.

Thank you.

Any questions..?

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