



Cast

REAL ESTATE & CONSTRUCTION CONSULTANCY

The Industrialisation Challenge For Homebuilding

Solving Market Failures Through Policy Led Interventions

Mark Farmer

CEO, Cast Consultancy

Kainga Ora Webinar

August 2020

MMC & Industrialisation

Context

THE FARMER REVIEW OF THE UK CONSTRUCTION LABOUR MODEL

A REMINDER:
WHY THE
'MODERNISE
OR DIE'
CHALLENGE?

MODERNISE OR DIE

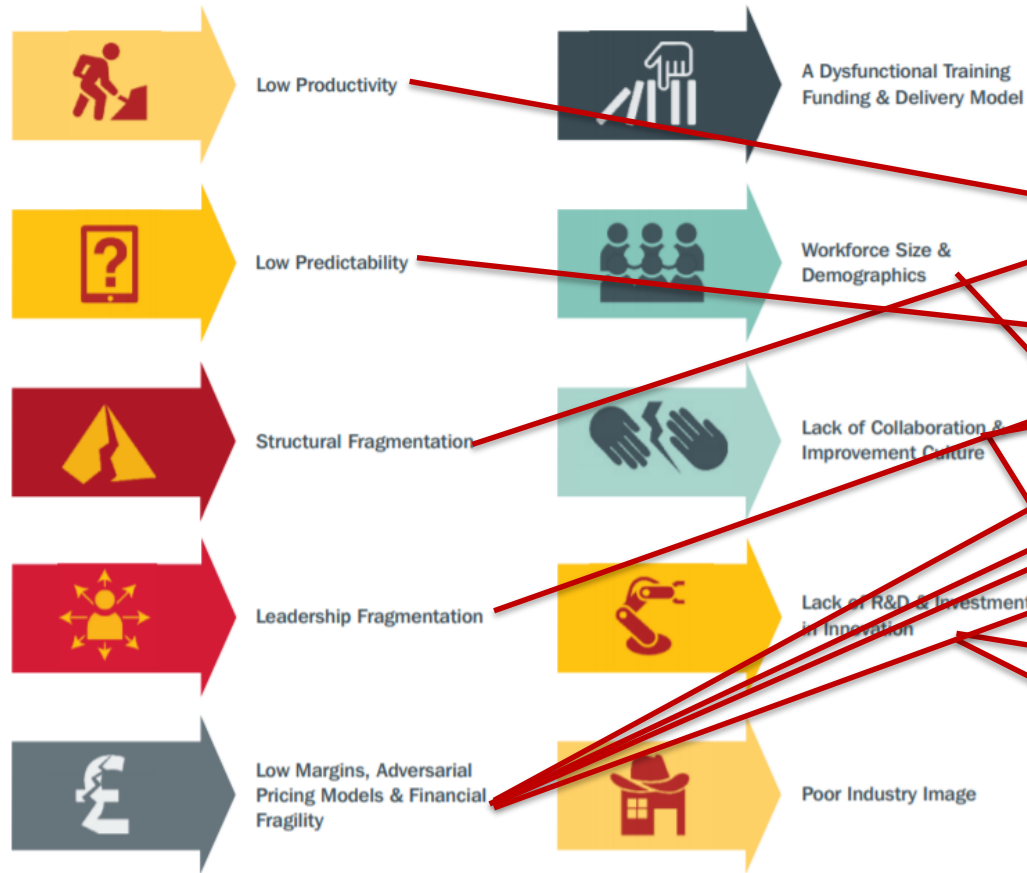
Time to decide the industry's future



Cast

SYMPTOMS

The critical symptoms of failure and poor performance have been identified in this review as:



Farmer Review 2016

THE NEED FOR TRANSFORMATION

As an important contributor to our economy, a major employer, and a key industry supporting the wellbeing of all New Zealanders, it's vital we have a thriving construction sector. But like many around the world, our construction sector is under stress and underperforming.

The sector is an ecosystem of diverse participants – suppliers, constructors, designers, engineers, maintainers, regulators and customers. Ecosystems depend on the high performance of all parts – where one falls, there can be a knock on effect across the sector. The problems facing the industry are well known and these were reinforced during engagement with the sector in the development of this plan. The challenges include:

- › skills and labour shortages in most trades and professions
- › poor health and safety performance including mental health
- › a slowness to innovate and adopt new technologies in construction practice, design and materials
- › limited uptake of modern methods of construction such as prefabrication
- › a lack of collaboration and knowledge sharing to take the sector forward

- › fragmented leadership in an industry of many small players
- › a poor understanding of risk and who should bear it
- › poor business management practices
- › low margins
- › a lack of clear and consistently applied regulations
- › poor procurement skills
- › distrust between parties

These issues add up to stagnant productivity and consequent higher costs, and also contribute to damaging business failures. They also affect the industry's ability to provide the quality houses and infrastructure we need to support our growing and changing population.

There is no one silver bullet to fix these issues – some of which have been plaguing the sector for decades. This plan includes a range of programmes that will work together to meet the challenges and build a stronger and more resilient sector that works for the benefit of all New Zealanders.

Construction Accord Transformation Plan 2020

The Symptoms Are Very Real In Homebuilding - UK & New Zealand

BBC Sign in News Sport Weather iPlayer Sounds

NEWS

Home UK World Business Politics Tech Science Health Family & Education

Business Your Money Market Data Companies Economy

Builder Persimmon lacks minimum house standards, report finds

17 December 2019 [f](#) [📧](#) [🐦](#) [✉](#) [Share](#)



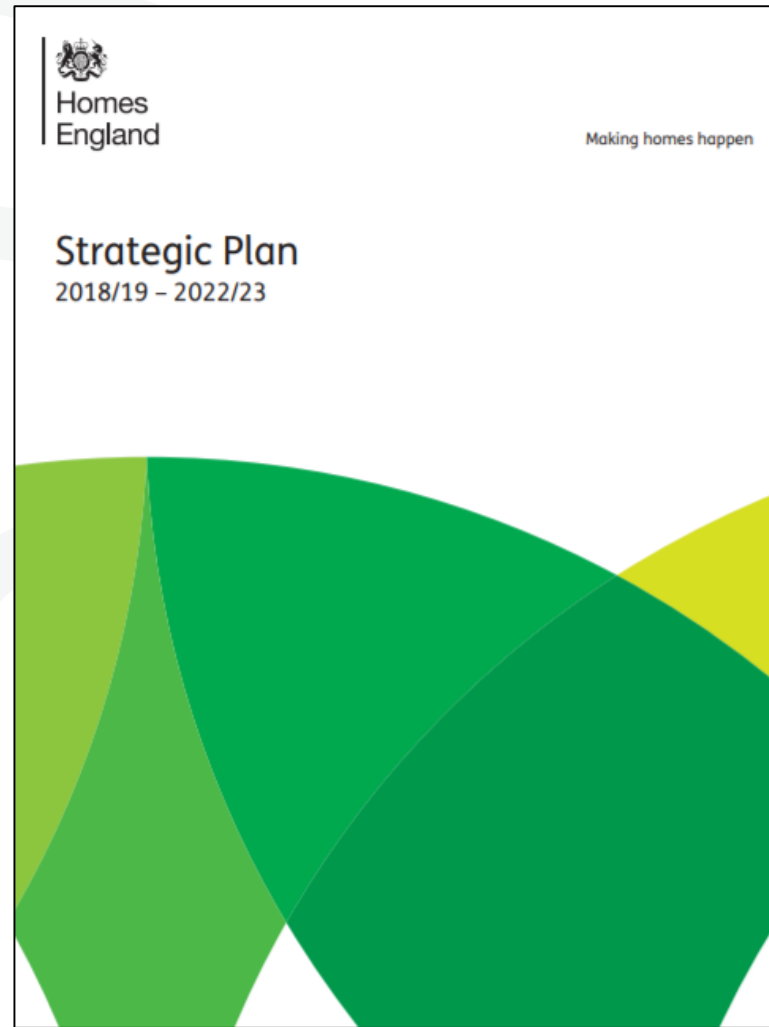
newsroom.

NZ is still building leaky homes

Newsroom Staff 21/11/2019



Construction Failure Has Been Combined With Housing Market Failure - UK & New Zealand



Construction Failure Has Been Combined With Housing Market Failure - UK & New Zealand



Annex A: Functions of Kāinga Ora–Homes and Communities⁷	
(1) The functions of Kāinga Ora–Homes and Communities are the following:	
Housing	(g) to provide a leadership or co-ordination role in relation to urban development, including by
(a) to provide rental housing, principally for those who need it most:	(i) supporting innovation, capability, and scale within the wider urban development and construction sectors:
(b) to provide appropriate accommodation, including housing, for community organisations:	(ii) leading and promoting good urban design and efficient, integrated, mixed-use urban development:
(c) subject to subsection (2),—	(h) to understand, support, and enable the aspirations of communities in relation to urban development:
(i) to provide people with home-related financial assistance; and	(i) to understand, support, and enable the aspirations of Māori in relation to urban development:
(ii) to make loans, or provide other financial assistance, to local authorities and other entities for housing purposes:	Other
(d) to give people (including people on low or modest incomes who wish to own their own homes) help and advice on matters relating to housing or services related to housing:	(j) any regulatory functions conferred or imposed on Kāinga Ora–Homes and Communities by or under any other enactment (e.g. if entered on an appropriate register to do so):
(e) to provide housing or services related to housing as agent for the Crown or Crown entities:	(k) any other functions conferred or imposed on Kāinga Ora–Homes and Communities by or under this Act or any other enactment.
Urban development	(2) The function in subsection (1)(c) applies only to the extent that—
(f) to initiate, facilitate, or undertake any urban development, whether on its own account, in partnership, or on behalf of other persons, including—	(a) Kāinga Ora–Homes and Communities acts on behalf of the Crown; or
(i) development of housing, including public housing, affordable housing, homes for first-home buyers, and market housing:	(b) the assistance is—
(ii) development and renewal of urban environments, whether or not this includes housing development:	(i) authorised by regulations made, or an approval given by the Ministers, for the purpose of the restrictions in sections 161 to 164 of the Crown Entities Act 2004; or
(iii) development of related commercial, industrial, community, or other amenities, infrastructure, facilities, services, or works:	(ii) not of a type to which those restrictions apply.

MMC & Industrialisation

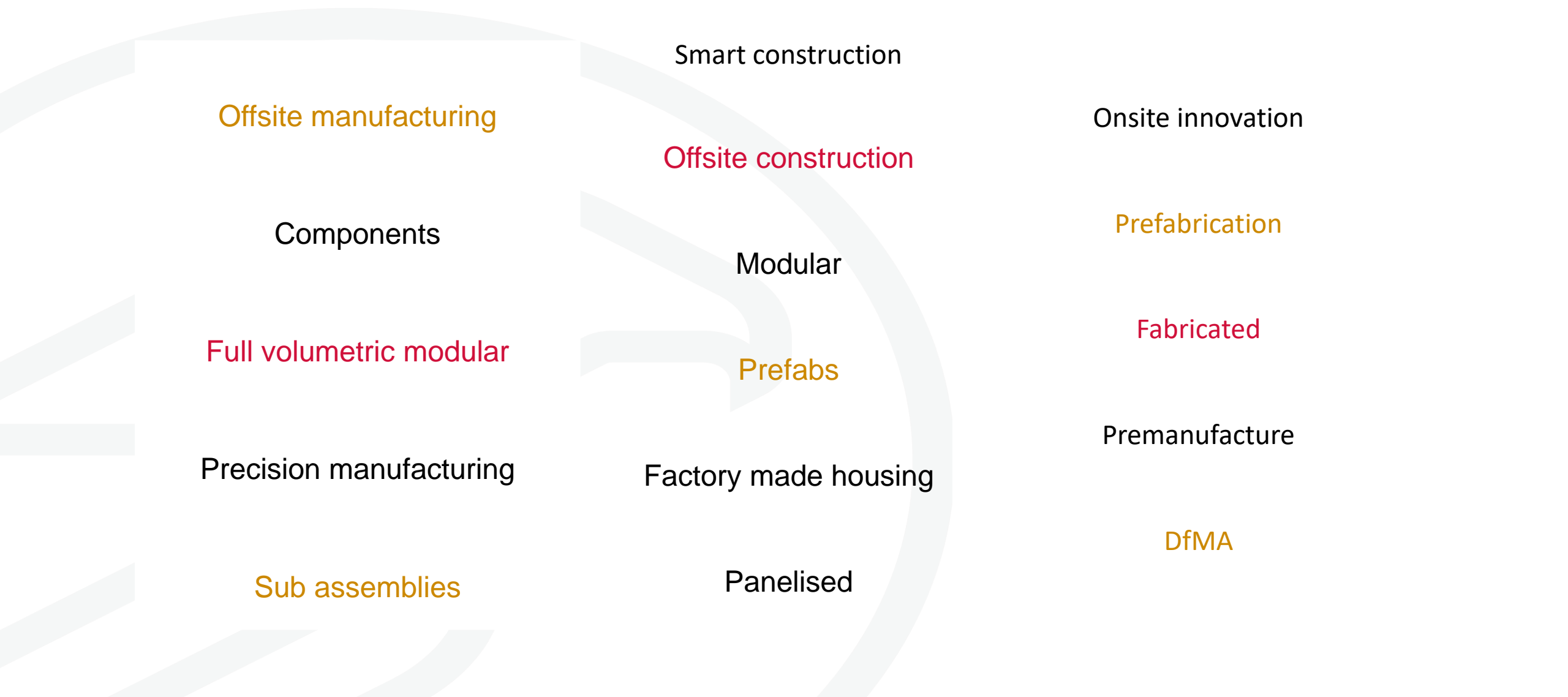
Market Failure Points

There Is One Overarching Need To Drive Change

A DEMAND STIMULATION LED TRANSFORMATION PLAN

1. Unifying Language

Everyone is using different terminology!



So That's Why The UK Has Defined It

Category **DEFINITIONS**

The term 'pre-manufacturing' encompasses process workplace, including in remote factories, near site or pass test is the application of a manufactured led fa in controlled conditions prior to final assembly / insi are included in Category 7).

# CATEGORY DEFINITION	1 Pre-manufacturing (3D primary structural systems)	2 Pre-manufacturing (2D primary structural systems)	3 Pre-manufacturing components (non-systemised primary structure)
4 Additive manufacturing (structural and non-structural)	5 Pre-manufacturing (non structural assemblies & sub-assemblies)	6 Traditional building product led site labour reduction / productivity improvements	7 Site process led site labour reduction / productivity / assurance improvements

Independent report
**Modern Methods of Construction
working group: developing a definition
framework**

The Modern Methods of Construction (MMC) definition
framework has been developed by a specialist sub-group of



2019 - MODERNI METODI DI COSTRUZIONE

2019 - MODERNI METODI DI COSTRUZIONE

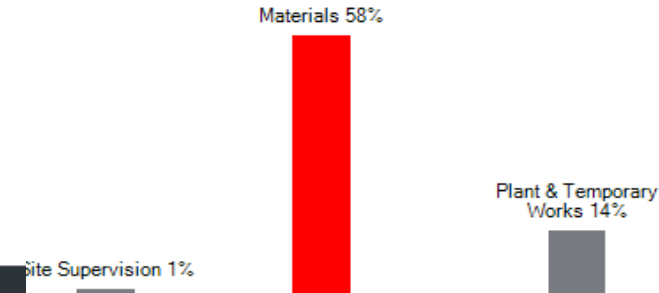
rebuilditalia.it

SELECT BUILDING TYPOLOGY: **Low rise apartments (<5 storeys)**

Total PMV:
58%

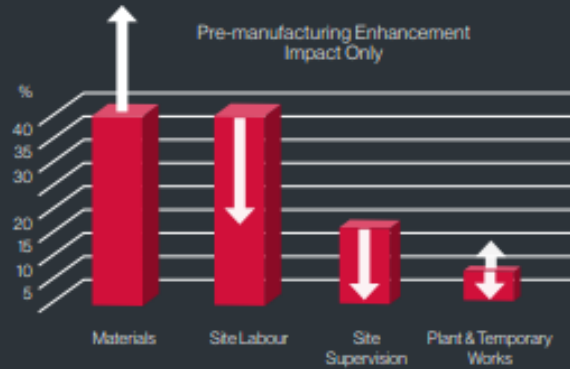
Pre-manufactured value (PMV)

Analysis of projects using MMC and their proportion of pre-manufactured value (PMV)



Clear selection **Calculate PMV** Save results

CATEGORIES 1-5 PRE-MANUFACTURING LED APPROACHES



- General shift of site labour to controlled manufacturing processes
- Speed reduces site preliminaries including supervision
- Possible upward pressure on logistics / craneage

CATEGORIES 6-7 SITE PROCESS LED APPROACHES



- Low wastage reduces total manufactured material content
- Productivity improvements on-site reduces labour requirements
- Better planning & digital augmentation reduces supervisory needs
- Possible use of autonomous equipment and robotics could increase plant
- Can be used in conjunction with Categories 1-5 pre-manufacturing

ARE YOU USING PRE-MA...
ARE YOU USING PRE-MAN...



CHOOSE

SELECT STRUCTURAL CATEGORIES



Category 2: PRE-MA...

SELECT NON STRUCTURAL CATEGORIES



1

2

3

4

5

6

7

MMC SPECTRUM

PMV ANALYSIS

LESS LED SITE LABOUR REDUCTION / PRODUCTIVITY / ASSURANCE IMPROVEMENTS

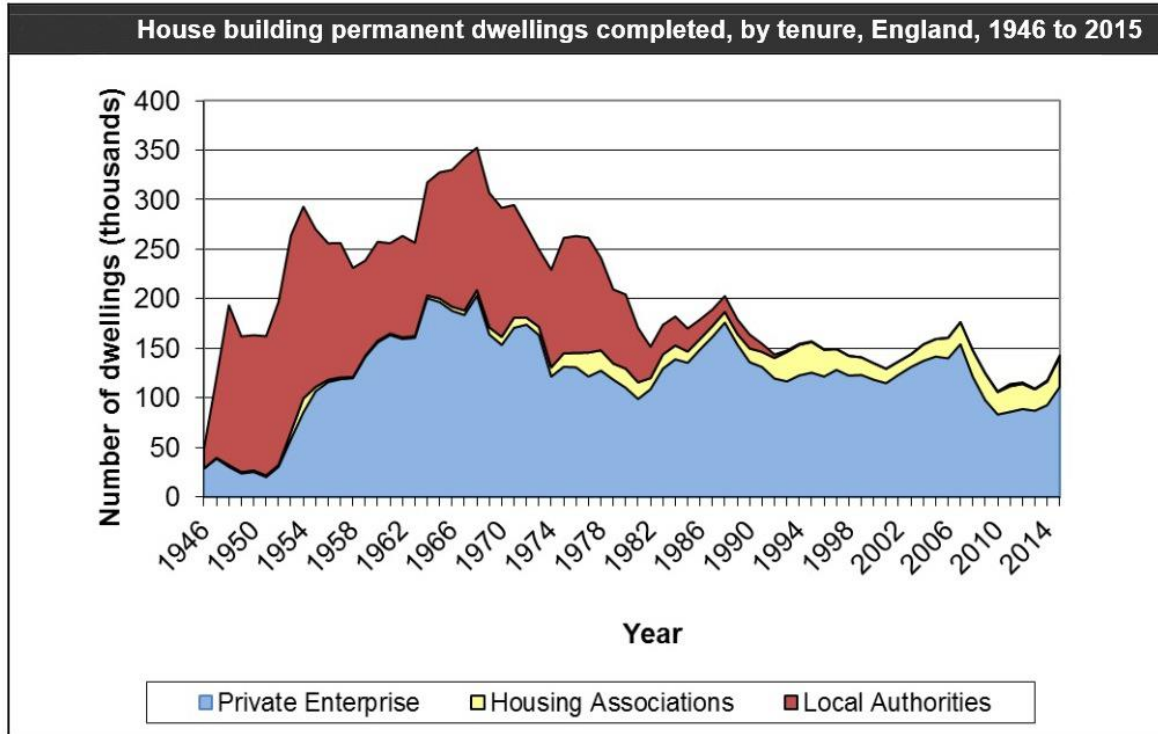
Insulation measures - weatherproof & environmentally controlled enclosure
Standardised or sacrificial temporary works - modular scaffold, tunnel formwork
Connected lean delivery framework - digitally enabled workflow platform
Augmentation - visual (ie AR/VR)
Augmentation - physical (ie exoskeletons, assisted materials distribution)
Productivity planning tools (GPS, wearables etc)
Robotics & drones (rebar, masonry, plastering, decorating, surveying)
Plant & equipment & drones (driverless cranes, diggers etc)
Verification tools (photogrammetry, site worker video, LIDAR scanning)

2. Aggregation & Collaboration

Aligning Land & Capex Commissioning With Manufacturing Capacity

3. Political Ideology & Need For Programmatic Delivery

MMC Needs Acyclical Stable Demand & A Visible Pipeline



Infrastructure and Projects Authority

Analysis of the National Infrastructure and Construction Procurement Pipeline 2020/21

June 2020

Reporting to Cabinet Office and HM Treasury

DfE announces winners for £3bn offsite schools framework

January 16, 2020

The Department for Education (DfE) has revealed the winners of the £3bn offsite schools framework 'to cultivate innovation and modernise the industry by increasing the adoption of MMC'

4. Collaboration & New Delivery & Procurement Models

Lobbying Groups Are More Focused On Their Bit Of The Cake Than Growing The Cake Through Materials & Product Innovation - Mostly Driven By Materials Sector 'Tribalism'

How is the CLT industry responding to the combustibles ban?

By Joey Gardiner | 31 January 2019



Proponents of cross-laminated timber were up in arms when the government announced its plans to ban combustible materials from the external walls of high-rise buildings. But now the nascent industry is fighting back, reports Joey Gardiner

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Steel and concrete are climate change's hard problem. Can we solve it?

Heavy industry produces more carbon dioxide than the entire US. Perfect the new technologies that could clean it up and we can score a crucial climate victory

Designers Also See MMC & Automated Design As A Threat!



Architects hit out at offsite drive

By Elizabeth Hopkirk, Joey Gardiner | 7 November 2019



Homes built with modern methods of construction are “blight” on communities, designer says

PRISM: Changing An Industry Mindset - The Difficult Move To DfMA

RIBA

Design through a prism

Written by Martyn Day
Published: 18 July 2019

RIBA Plan of Work
Designing and Assembling

The London Mayor's office has sponsored the development of a free application for developers to help conform to London's spatial planning rules and assist in deciding which rapid off-site construction technology best fits their design.



Assembly overlay
Part Designing for Manufacture
www.ribaplanofwork.com

www.offsiteschool.com/DfMA

	5 Construction	6 Handover and Close Out	7 In Use
Projecting the	Off-site manufacturing and on-site Construction in accordance with the Construction Programme and resolution of Design Queries from site as they arise.	Handover of building and conclusion of the Building Contract.	Undertake In Use services in accordance with Schedule of Services.
Designing	Update the Construction Strategy, including a logistics plan that ensures the right materials, plant and operatives are deployed in the right place at the right time. Commission the building progressively and capture 'As-Constructed' Information. Consider how DfMA impacts the Construction Programme.	Consider how to capture commissioning and 'As-Constructed' information in a manner that will assist the In Use stage including the potential disassembly of the building. Monitor the performance of standardised components including maintenance and replacement and provide Feedback.	Consider any Feedback during the In Use stage necessary to inform future projects. Monitor the performance of standardised components including maintenance and replacement and provide Feedback. Monitor disassembly or potential reuse of materials during demolition at the end of the stage and provide Feedback.
Designing and	Use BIM to train site operatives. Use digital technologies to track each step of the manufacturing, packing, logistics and delivery process.	Ensure any relevant documentation relating to DfMA components is linked to BIM components for Feedback, including lessons learned and potential reupposing.	Consider configuration management techniques to maintain an up-to-date record (BIM model) of the building.
Designing and	Consider recording the complete history and location of every component for Feedback, future use and learning.	Link components to assembly manuals, method statements and quality records including identifying any aspects of the design which may be reused in the future.	
Designing and	Capture Feedback including lessons learned from site installation to inform the Procurement Strategy of future projects.	Ensure that 'As-Constructed' Information relating to DfMA elements has been delivered including Feedback on information to be incorporated into the client's in-house BIM object library. Provide Feedback on the capability and performance of specialist subcontractors who delivered DfMA aspects.	



www.offsiteschool.com/DfMA

© RIBA



Need to Embrace Insurance Products, Integration & Value Based Thinking To Drive Better Outcomes

Prospectus

Insurance Backed Alliancing

A game-changing journey on the first project using the IPI model at Dudley College



IPIInitiatives



Innovate UK

Web-Based Tool

Proof of Concept User Journey

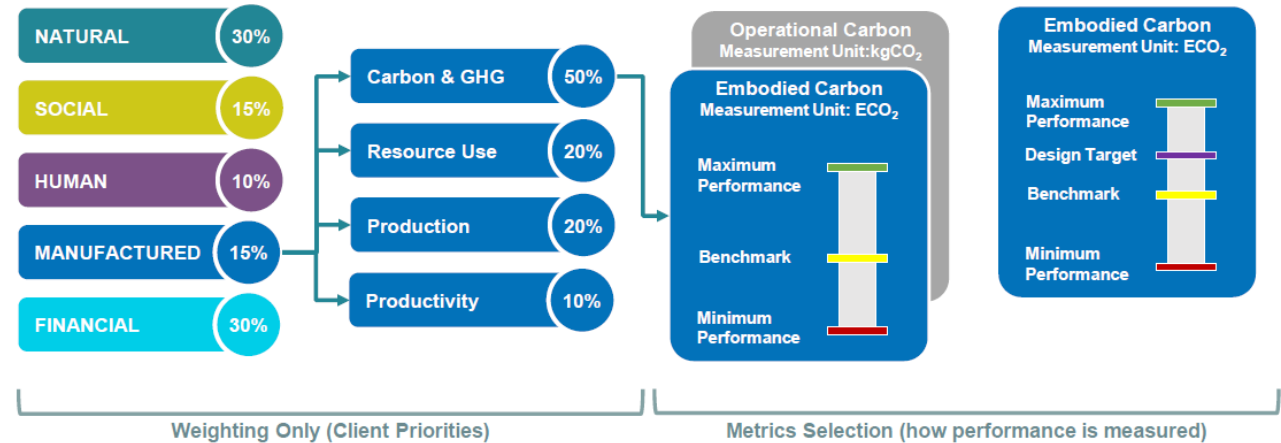


Project Name*

Project Location*

Asset Class*

Sub-Asset Class*



5. Lack of Data & Evidence

A Lack Of Evidence & Data - Traditional v MMC



A Lack Of Evidence & Data - Traditional v MMC

Press release

Homes England commissions MMC research study to drive construction innovation

Homes England has commissioned its own research study into modern methods of construction (MMC) to drive innovation in the construction industry.

Published 20 May 2020

From: [Homes England](#)



- As part of the agency's strategic objective to improve construction productivity and encourage the uptake of MMC in housing delivery, a series of Homes England's own sites will participate in the study.
- Monitoring the construction of around 1,500 homes at sites across country over several years, the study will test the performance of different types of MMC.
- The research will explore a range of themes and seek to learn lessons about how MMC technologies might be improved upon in future.

Related content

[Homes England register of interests](#)

[Shared Ownership and Affordable Homes Programme 2016 to 2021: qualification](#)

[Compliance audit breach severity list](#)

[Statistics at Homes England](#)

[Compliance Audit](#)

- pace
- cost
- labour productivity
- town planning
- pre-manufactured value
- safety
- waste
- delivery logistics
- delivery performance (defects/snagging)
- energy efficiency
- sales
- life cycle (i.e. post occupation)
- economic rationale costs v monetised benefits

A Lack Of Evidence & Data - Traditional v MMC

buildoffsite

ciria

Methodology for quantifying the benefits of offsite construction



UNIVERSITY OF CAMBRIDGE

LAING O'Rourke CENTRE for CONSTRUCTION ENGINEERING and TECHNOLOGY

12) and of the projects that reported on construction site energy use, half-used kWh (13 no) as the metric while the other half used kgCO₂e (14 no). As the breakdown of contribution to energy use from different sources such as fuel, gas and electricity is not known, it is not possible to convert between the units without much more detailed information.

For construction waste, 38 of the projects (83 per cent) provided information on total waste generated with 35 of these noting the proportion of this waste sent to landfill. Where the information was provided in m³, this was converted into tonnes using the conversion factor for general construction waste (0.87 tonnes/m³). Figures 6.14a and b suggests that there is a correlation between higher PMV and a reduction in the construction waste generated. However, the PMV does not appear to affect the percentage of waste sent to landfill, as seen in Figures 6.14c and d.

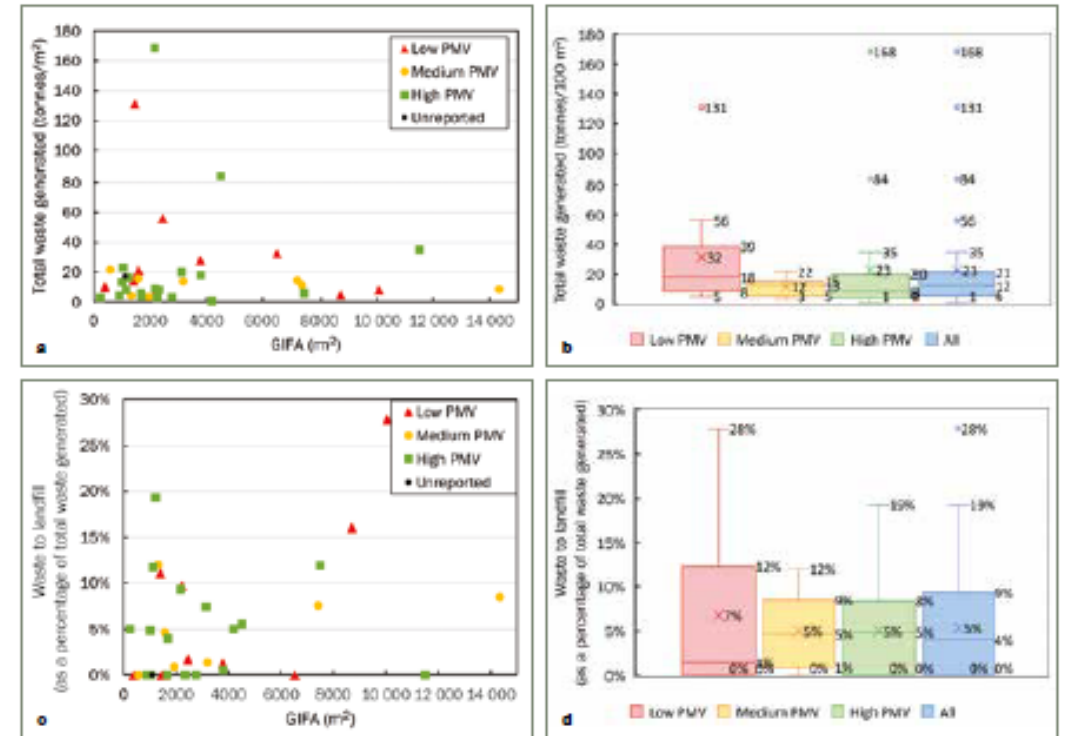


Figure 6.14 Construction waste

6. Skills, Training & Qualifications

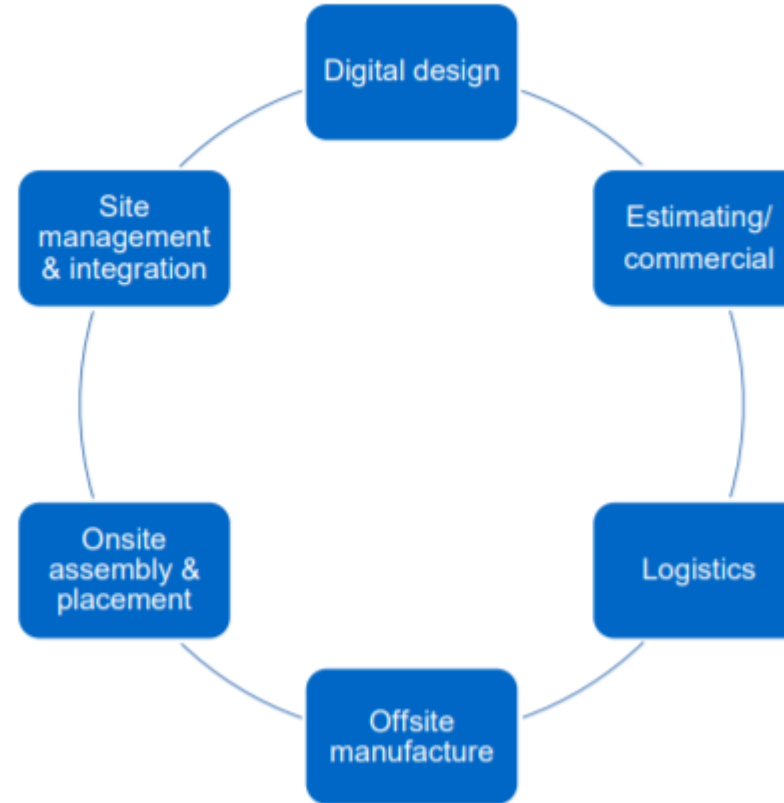
Make Up of Built Environment Workforce Has To Urgently Change - New Career Families

citb.co.uk



Faster, Smarter, More Efficient: Building Skills for Offsite Construction

April 2017



We Urgently Need New Qualifications & Training Standards

CONSTRUCTION ASSEMBLY AND INSTALLATION OPERATIVE

Overview of the role

Assembling and installing manufactured components to agreed design specification and tolerance

Details of standard

This occupation is found in the construction sector. On site assembly of manufactured components is a rapidly growing part of the construction sector, representing 15% of the market in 2018. Projects include; infrastructure, residential, commercial, retail, healthcare, education, rail, prisons and leisure. Structures and components are manufactured in factories and then transported to the construction site, ready for location, connection and finishing. Materials can include concrete, timber, modular and portable buildings and can include plastic and steel components. Projects can be small local ones such as a bespoke house or nationwide

Status: Approved for delivery 

Level: 2

Reference: ST0265

Version: 1

Date updated: 03/07/2019


Approved for delivery: 3 July 2019

Route: Construction


Typical duration to gateway: 18 months months (this does not include EPA period)

Maximum funding: £13000

Trailblazer contact(s):

 alomplough@laingorourke.com

Offsite Housing Construction

MSc Full time Distance Learning 1 year, Part-time Distance Learning 2 years  [Register your Interest](#)

[Apply now](#)

[Already Applied? Login Now](#)

This innovative programme offers a multi-disciplinary, practice-based approach toward offsite housing construction.

Institute Code	W75
UCAS Code	
Entry Requirements	View
Fees	View

7. Fit For Purpose Building Regulations & Accreditations

Barriers : Funding & Mortgage availability – UK’s (Slow!) Journey Towards Collaboration



A Singapore Government Agency Website

Building and Construction Authority

BuildSG ▾ Regulatory Info ▾ Procurement ▾ Public ▾ About Us

PPVC Manufacturer Accreditation Scheme

Home > Build SG > Productivity > Design for Manufacturing and Assembly (DfMA)
> [PPVC Manufacturer Accreditation Scheme](#)

It is mandatory to use [Prefabricated Pre-finished Volumetric Construction \(PPVC\)](#) in selected non-landed residential sites which are sold under the Government Land Sales (GLS) Programme.

The Building and Construction Authority (BCA) has set up an acceptance framework to ensure that the different PPVC systems being used at the mandated sites are reliable, robust and meet minimum standards. The PPVC acceptance framework consists of two parts - acceptance by the [Building Innovation Panel \(BIP\)](#), followed by accreditation under the PPVC Manufacturer Accreditation Scheme.

The PPVC Manufacturer Accreditation Scheme aims to:

- Ensure quality assurance and control in the production of PPVC.
- Set the process for manufacturers to produce high quality PPVC systems.

Quality Planning Needs To Be Led By The Lending & Insurance Underwriting World & Become A Proxy For Better Outcomes



Construction Quality Planning Guide Draft for Consultation

Construction Innovation Hub

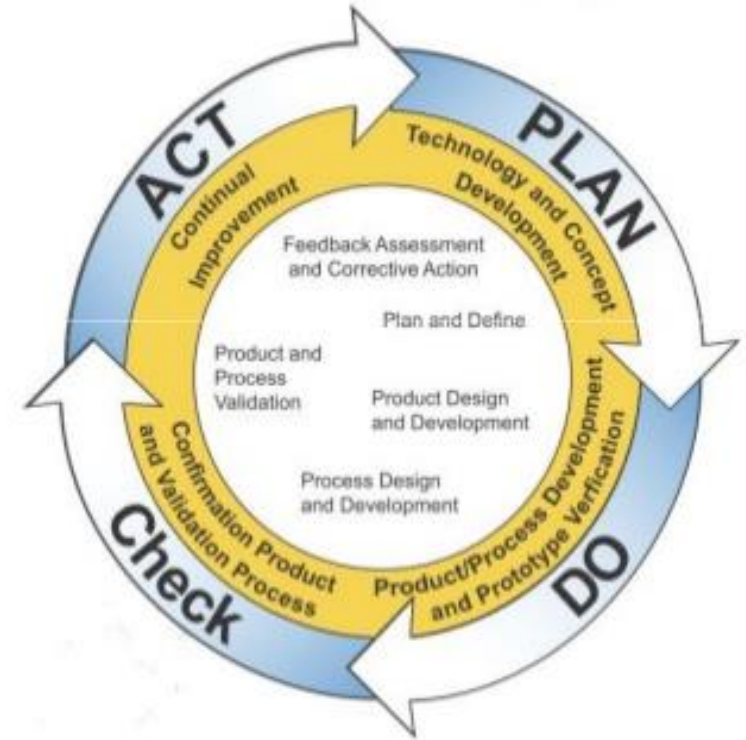
May 2020

www.constructioninnovationhub.org.uk

Quality Assurance Planning (or APQP) is a proven framework of procedures and techniques developed by the “Big Three” (Ford, GM, Chrysler) and Deming in the 1980s to address the increasing threat from Japanese product.

APQP methodology reduces cost and waste and improves quality and lead times. It is used throughout the supply chain in automotive, aerospace and defence - but has also been successfully applied to bio-medical, food and drink, and energy sector.

APQP is suitable for use on both high volume and bespoke product and services.



We Also Need a Building Regulation Framework That Properly Controls & Incentivises A Manufacturing Approach to Construction



Building (Building Products and Methods, Modular Components, and Other Matters) Amendment Bill - First Reading - Video 1

A screenshot of the Buildings Department website. The header includes the logo and "Buildings Department, The Government of the Hong Kong Special Administrative Region". Navigation links include "What's new", "Building works", "Safety and inspection", and "Resources". The main content area is titled "Modular Integrated Construction" under "Codes and references". A table of contents on the left lists sections 1 through 15, with 9A and 9B highlighted. A photograph of a building under construction with a crane is shown on the right. The text "Pre-acceptance Mechanism" is visible at the bottom of the page.

Buildings Department
The Government of the Hong Kong Special Administrative Region

What's new Building works Safety and inspection Resources

Codes and references

Modular Integrated Construction

Home > Resources > Codes and references > Modular Integrated Construction

1	Explanatory Title
2	Commencement
3	Amendments
4	Section 4 amended
5	Section 5 amended
6	Section 7 amended
7	New sections
	9A
	9B
8	Section 11 amended
9	Section 14 amended
10	Section 14E amended
11	Section 14G amended
12	Section 15 amended
13	Section 19 amended
14	Section 20 amended
15	Section 26 amended

Pre-acceptance Mechanism

8. Diversified Development & Asset Finance Players

Securitisation of Manufactured Goods Is Different To Real Estate Assets

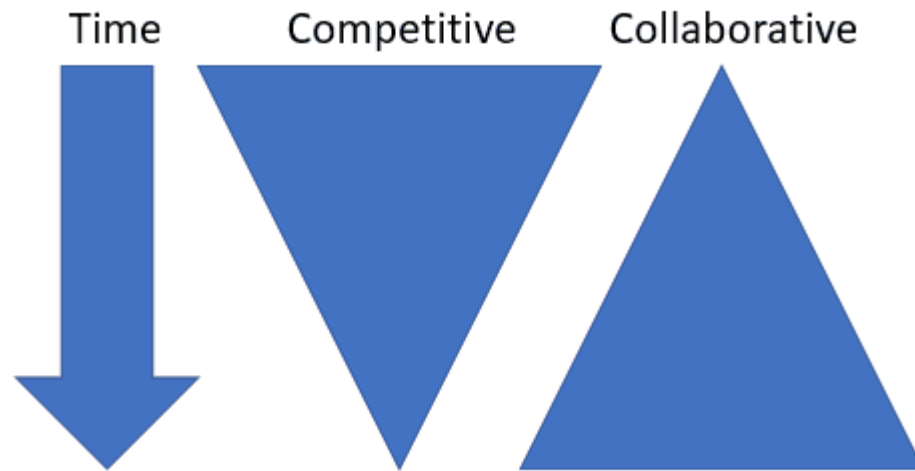


V



9. Lack of System Interoperability

Pre-Competitive Collaboration - 'Growing The Size of The Cake'



‘Open’ Platforms Versus ‘Proprietary Systems’

Offsite manufacturing – building better homes faster

A Kāinga Ora redevelopment project at Busby Street, Blockhouse Bay project is being delivered using tested state-of-the-art building technologies.

Deploying the “platform based approach” to offsite manufacturing, the project combines cross-laminated timber (CLT) panels, engineered light timber frame panels and pod bathrooms/laundries.

Busby is the first of a four-project programme that will combine these technologies to enable the delivery of homes manufactured to a factory level quality which are assembled safely and with pace on site.

This initiative forms part of a research and development programme that could further advance the capabilities of Kāinga Ora as New Zealand’s largest residential builder, meaning more people in the homes they need.

“Kāinga Ora is responsible for the delivery of a very large build programme in a highly competitive and congested construction sector,” says Tim Campbell, Kāinga Ora Business Innovation, Research and Design Director.

“We are working closely with industry to grow our offsite manufacturing capability because we believe that OSM has a really important role to play in improving productivity across the industry.”

The purposeful use of offsite manufacturing methodologies and sustainable materials will deliver a quality product to our customers with a lower impact on the environment.

The CLT is from Xlam, the engineered panels and pods from Concision, and the building is being assembled by Miles Construction. RM Design is the architect.



Progress at Busby Street on 3 June 2020, 18 of June then 26 of June.

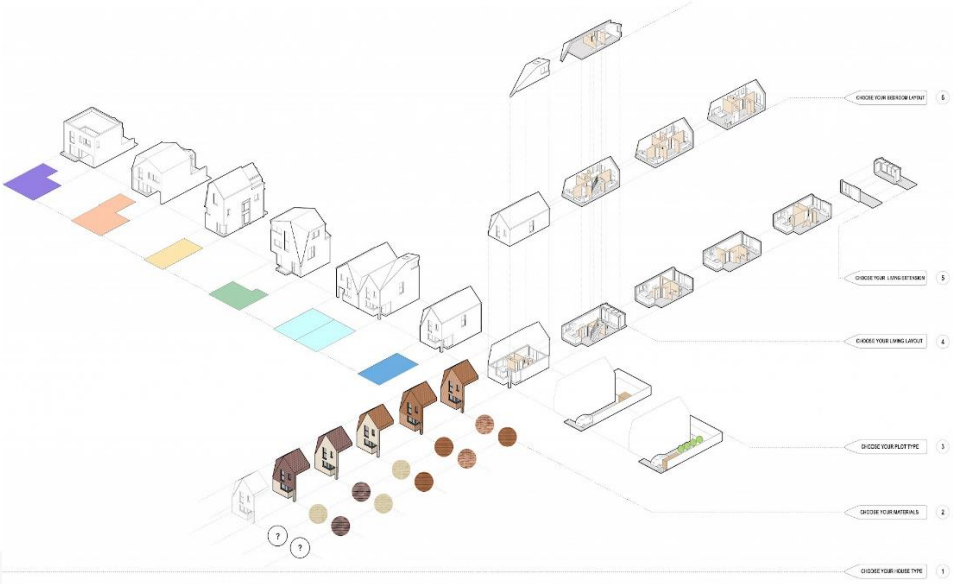


10. Educating Planners & Reforming Planning Process

Overcoming Aesthetic Stigma & Unlocking 'Type Approval' Accelerated Planning & Customisation Potential



V



IN CONCLUSION.....

ALL WITHIN THE CONTEXT OF A
DEMAND STIMULUS STRATEGY TO
PUMP PRIME MMC ADOPTION

Joined Up Policy & Strategic Market Interventions Are Critical To A Successful Construction & Homebuilding Transformation - The Market Can't Get There On Its Own



