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Can Modular Construction Deliver Better Homes?

CIBSE Homes for the Future seminar

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Can Modular Construction Deliver Better Homes?

Agenda

- Choice of Primary Structure
- The Need to Drive Improvement in Build Quality
- General Benefits of Modular Construction
- A Change of Emphasis in Design
- The Berkeley View on Modular Construction
- The Challenge in Defining What Makes A Better Home
- Conclusions

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Choice of Primary Structure

Cross Laminated Timber

Steel Framed

Timber Framed

- Significant capital investment in new UK manufacturing capacity is evident
- Variety of options being considered in respect of primary structure
- Concerted effort being directed towards securing relevant product assurance credentials
- Key drivers for new entrants the supply-demand imbalance, productivity and build quality

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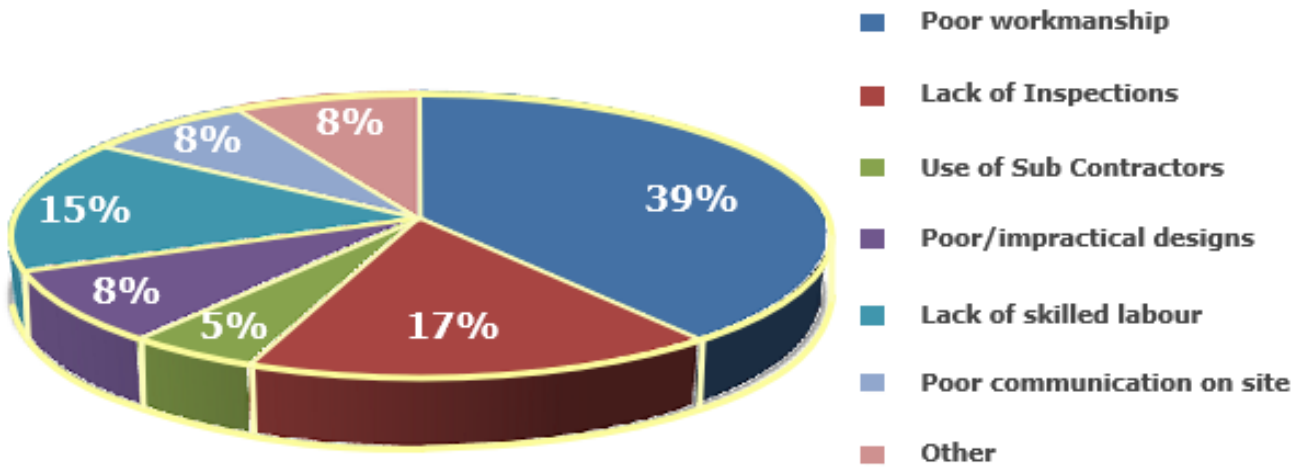
The Need to Drive improvement in Build Quality

Data from research has revealed the principal reasons why new homes have so many recorded defects:

- A lack of continuity in terms of supervisory / management personnel during construction
- A lack of investment in new talent
- An over emphasis placed on project profit



Source: T Williams (Coventry University)

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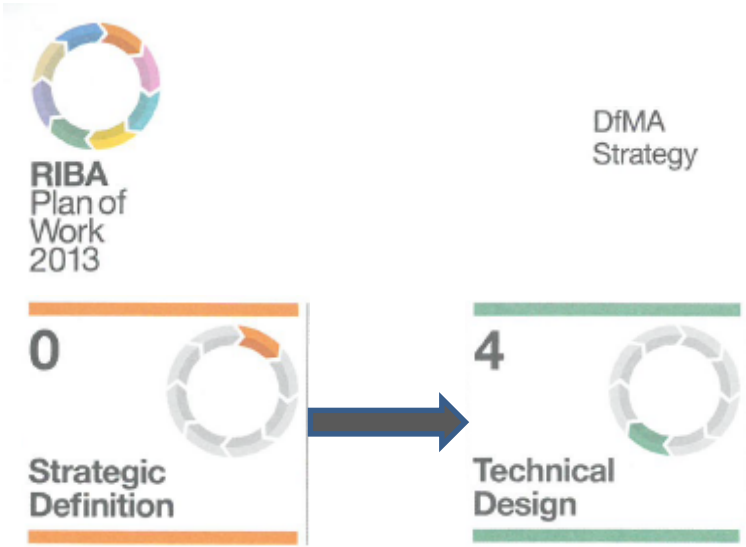
General Benefits of Modular Construction

Managing supply chain	• Full-time employment of permanent workforce facilitating control of labour • Scope to strategically invest in apprenticeships / skills development of full-time employees • Opportunity to directly engage with key providers of materials / components / equipment
Quality	• Scope to drive design and build efficiency through rationalisation / standardisation • Opportunity to embed factory inspection and acceptance testing • Scope to deliver higher levels of occupancy comfort and through-life performance of finished product
Programme	• Improved programme surety • Reduction in time required to build • Improvement in planning / milestone adherence / reporting disciplines
Cost	• Reduction in cost to build by embracing design for manufacture / assembly / installation to leverage productivity • Efficient conversion of development finance
Environment	• Scope to optimise use of materials, and fully re-use / re-cycle any waste generated through manufacturing • Opportunity to reduce energy usage to build
Health and Safety	• Transfer of operative activity to a controlled manufacturing environment • Scope to reduce risk of construction and maximise use of mechanical handling / semi-automated process technologies
Innovation	• Scope for production scalability • Improved potential to control fabric and services build quality • Opportunity to embed continuous improvement via lessons learned
Logistics	• Reduction in on-site activities • Reduction in material deliveries to site and personnel traffic to / from site

A Change of Emphasis in Design

Construction industrialisation is a process that starts in virtual space:

- Building Information Modelling can help facilitate an improved culture of innovation and collaboration
- Stage 2 Concept Design activity must cover the issue of buildability (i.e. how to build as well as what to build)
- The aim has to be better correlation between design intent and actual building performance



Consider opportunities for applying DfMA across portfolios or programmes of projects. Consider how DfMA might impact on the **Business Case** or **Strategic Brief**. Consider whole life issues in the **Strategic Brief** including options for reuse or repurposing and recycling of components at the end of the building's life. Consider **Research and Development** that might assist **Feasibility Studies** or the **Concept Design** including intellectual property issues.	Initiate DfMA thinking and incorporate client requirements into the **Initial Project Brief**. This should include high-level targets for the extent of DfMA adoption and time/cost/waste savings against traditional benchmarks. Consider opportunities for 'repeatability', site/logistical constraints, **Research and Development** and early input required from specialist subcontractors. Consider best practice DfMA exemplars for comparable projects. Test the feasibility of high-level DfMA objectives included in the **Initial Project Brief** using the **Site Information** and **Feasibility Studies**.	Test initial **Concept Design** options against the DfMA aspirations set out in the **Initial Project Brief**. Identify opportunities for the greatest impact and initiate any **Research and Development** required to integrate DfMA into the **Concept Design**. Prepare the **Construction Strategy** considering high-level DfMA benefits including safety, productivity, quality and sustainability, considering topics such as eliminating scaffolding, wet or hot works, the delivery methodology and the suitability of proposed systems. Consider DfMA aspects in **Risk Assessments** and the **Health and Safety** and **Maintenance and Operational Strategies**. Ensure that the **Cost Information** takes account of the DfMA methodologies set out in the **Construction Strategy**.	Update the **Construction Strategy** taking into account DfMA opportunities appropriate to the **Developed Design** and coordination activities. Prepare a schedule of DfMA components and consider national (or other) standards appropriate for DfMA. Consider buildability, including how the erection sequence, fabrication or manufacturing techniques and tolerances impact on interfaces. Update **Cost Information** taking into account discussions with potential contractors, specialist subcontractors and suppliers. Update **Risk Assessments** and the **Health and Safety** and **Maintenance and Operational Strategies** taking into account DfMA considerations.	Develop the DfMA components more accurately considering the implications of the possible methods of manufacturing or fabrication. Develop the interfaces and specifications including structural, water/moisture/vapour penetration and acoustic issues. Update the **Construction Strategy** considering the lifting, handling and transportation strategy for each component and sub-assembly. Consider manufacturing and assembly risks in the updated **Risk Assessment** and **Health and Safety Strategy**. Develop a commissioning plan optimising the use of factory acceptance testing.

Source: RIBA Plan of Work 2013)

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The Berkeley View on Modular Construction

Potential for offsite to help solve the housing crisis:

- Speed of construction
- Lower cost to build
- Helps to address the skills shortage challenge
- More sustainable approach to construction
- Improved quality of finish and through-life performance

Factors affecting the take-up of offsite:

- Restricts architectural creativity
- Expertise and experience of professional teams in offsite
- Limited number of supply chain options
- Logistical constraints
- Impact on conventional procurement routes

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The Challenge in Defining What Makes A Better Home

The Green Building Council is promoting the case for improved health and wellbeing of occupants of new build homes:

- Provision of natural daylight / sunlight
- Indoor air quality
- Acoustic performance of building structures

CIBSE has produced a Technical Memorandum for improved health and wellbeing of occupants of new build homes:

- Thermal comfort and avoiding over-heating

Berkeley Group aims to build individually designed homes with low environmental impact. For modular construction to ensure this it is imperative that we deliver:

- Quality of workmanship and product fit-out / finish is industry leading and we want to maintain our standards
- Offsite for those projects which are suited to modular construction (i.e. very high rise solutions will remain traditional)
- Tenure blindness (i.e. the customer is not able to discern how something has been built)

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Conclusions

There is no doubt that opportunity exists to transform the process of housebuilding in the UK and we are looking to other sectors, such as automotive, to help gauge the potential

The challenge in addressing the overly risk-averse, non-productive and innovation wary culture that typifies housebuilding in the UK could be considered significant

Lessons can be learned from other sectors as to how to leverage productivity, competitiveness and build quality, so as to directly benefit the potential end-customer with better quality housing stock

Having an understanding of what constitutes quality is key to designing and manufacturing product that will perform and yield improved customer satisfaction

UK automotive market in 1970s dominated by Ford, Chrysler, British Leyland and Vauxhall

Mid-1970s saw first Datsun product being exported into the UK to challenge incumbents

In 1986, Nissan had opened its first production facility in Sunderland, initially making100 cars per week

By 2015, the Nissan plant in Sunderland was manufacturing 10,000 cars per week