

THE ECONOMICS OF MODULAR CONSTRUCTION

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INTRODUCTION

- MD of MMC Quantity Surveyors
- Director of The Offsite Group
- Involved in modular & offsite construction since 2006
- www.mmcqs.com
- www.theoffsitegroup.co

THE COST OF MODULAR

- Cost is a function of demand, supply, inputs & efficiencies

AGENDA

Current state of the industry

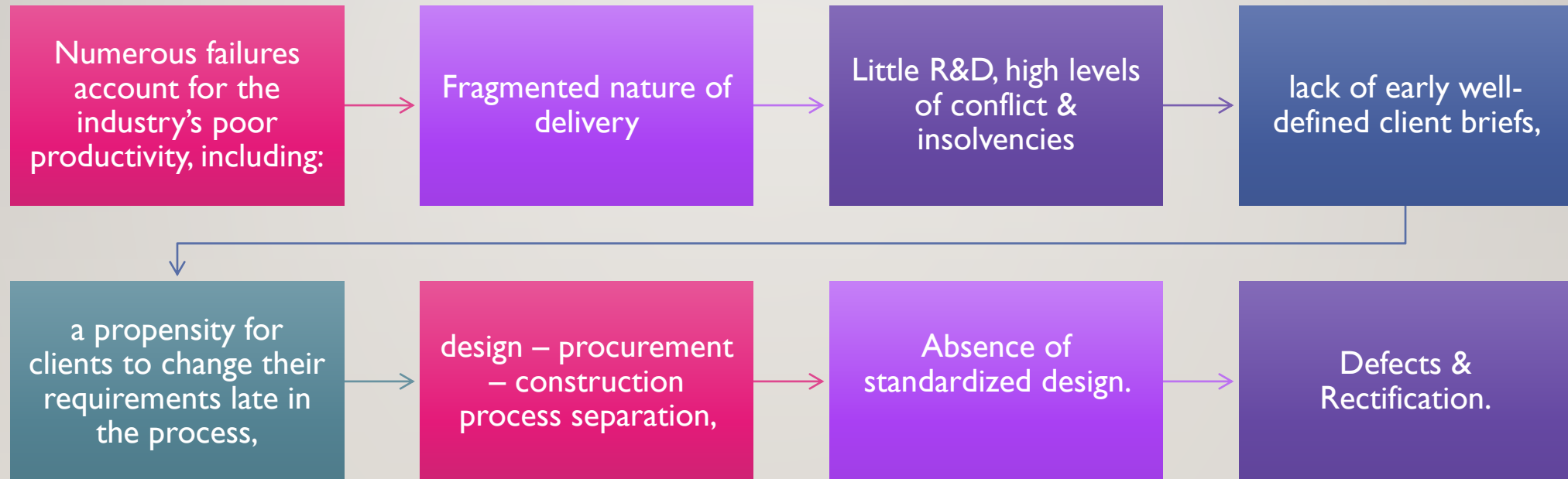
How modular & offsite can address this.

Why is modular not working?

Where modular works best

The winning formula

CURRENT STATE OF CONSTRUCTION INDUSTRY



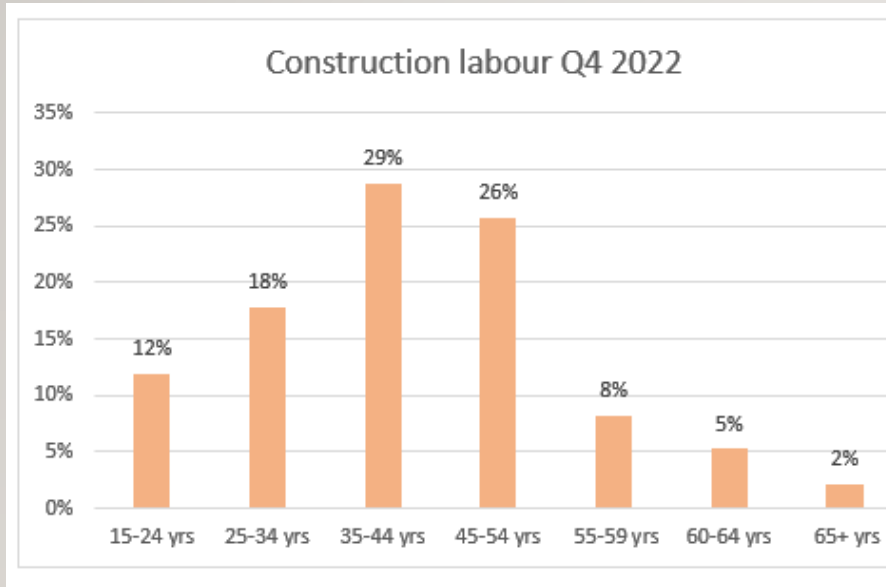
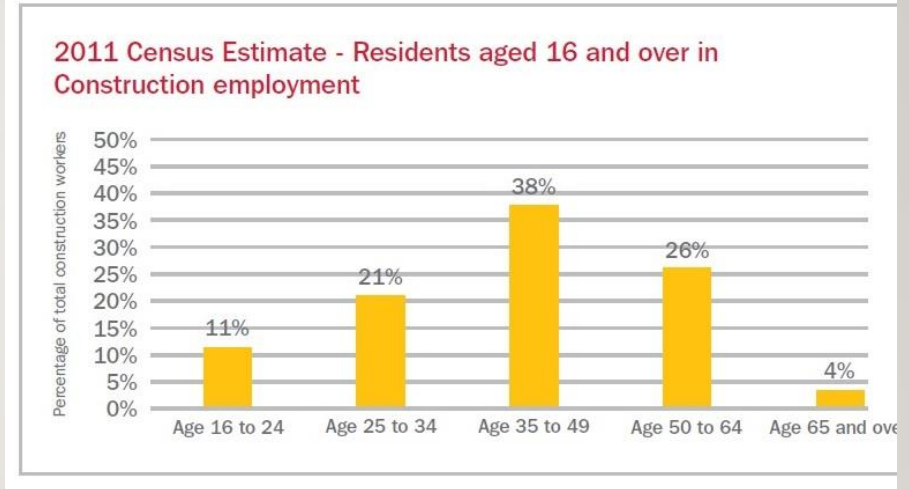


Figure 13: From Nomis, 2011 Census estimates, ONS Crown Copyright Reserved, Access April 2016



CHALLENGES ATTRACTING NEW APPRENTICES

CSO DATA OF 163,000 EMPLOYED AS OF Q4 2022

FUTURE LABOUR REQUIREMENTS

- Additional 107,000 people needed to meet 2030 targets
- Extra 51,000 people for housing and retrofit alone.



Rialtas na hÉireann
Government of Ireland

Report on the Analysis of Skills for Residential Construction & Retrofitting 2023-2030

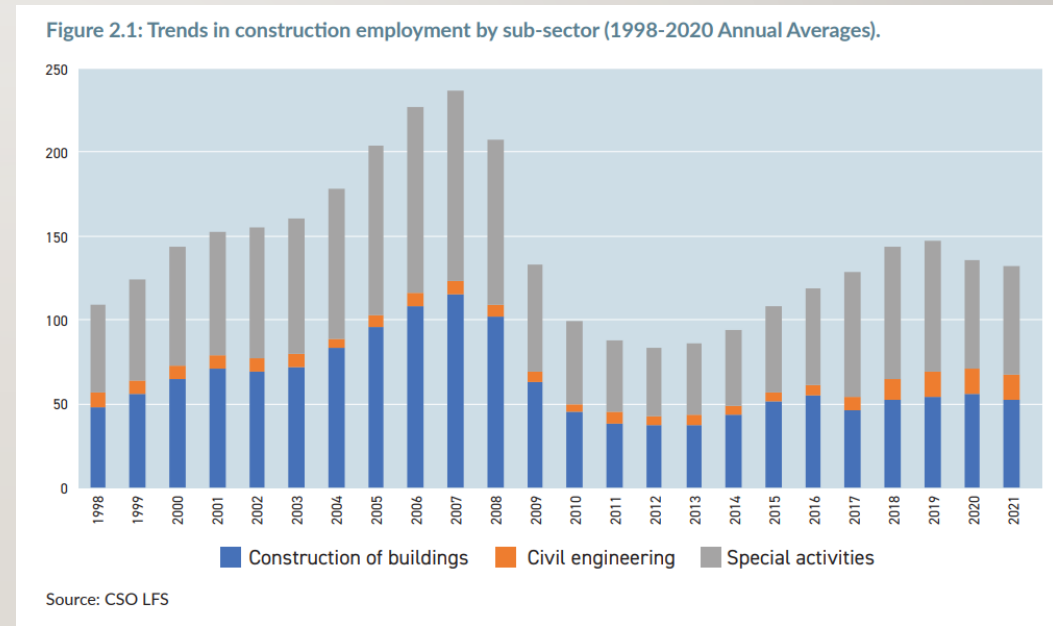
Table 1E: Estimated new entry requirements (2023-2030) to deliver the Government's targets on new housing and retrofitting.

Year	2019	2023-2030		
	Base year	Required recruitment (additional)		
All skills*	Employed	Expansion	Replacement	Recruitment
Building new houses	29,969	10,675	13,511	24,186
Retrofit scheme (B2)	3,870	18,180	4,598	22,779
Other RMI	13,916	0	3,866	3,866
Total	47,755	28,855	21,975	50,831

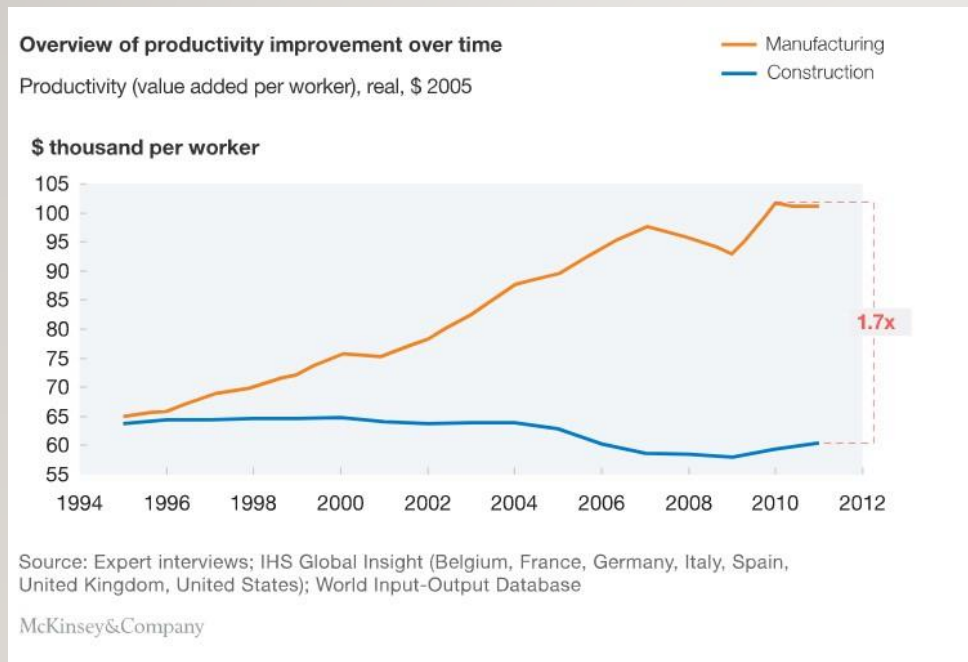
Source: Author's estimates. *Elementary workers are excluded as they are unskilled.

CONSTRUCTION EMPLOYMENT

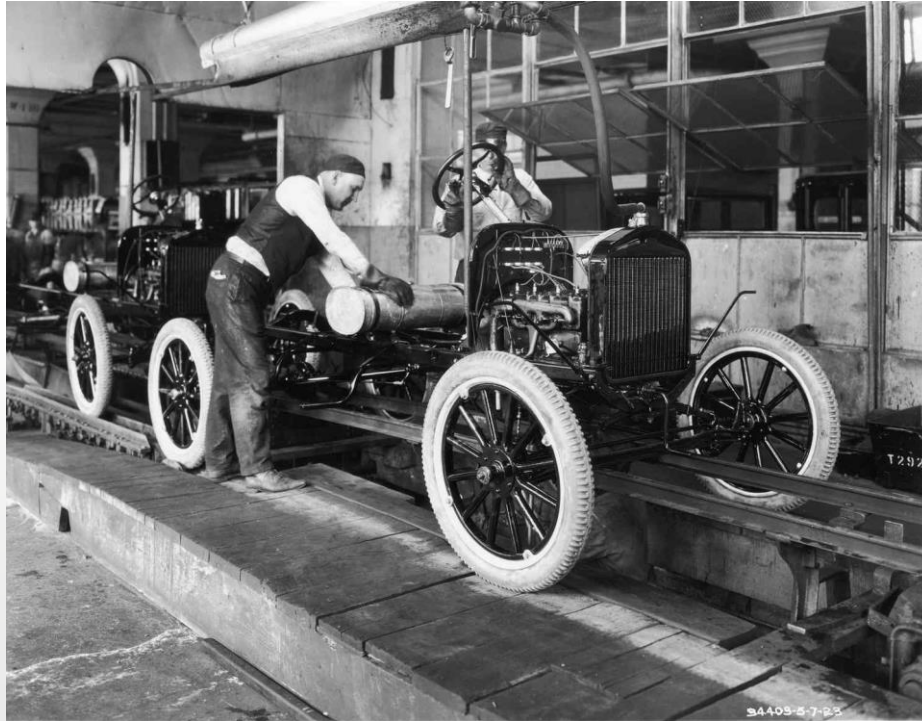
- 2016 ~120,000 employed
- 2022 Q4: ~163,000 employed
- 2030 ~270,000 required



CAN MODULAR HELP? LOW PRODUCTIVITY



- Manufacturing quality increase while prices fell & margins rose.
- Construction productivity decreased
- Can manufacturing efficiencies be applied to construction?



CAN MODULAR HELP? THE ASSEMBLY LINE

- Ford Model T Assembly line: 1913
- 12hrs/ car to 1.5hrs per car
- \$850 in 1908 to \$290 in 1925
- 65% reduction in costs
- The job comes to worker & materials
- 40k cars/ yr to 15m
- Standardised parts & supply chain



CAN MODULAR HELP? THE ASSEMBLY LINE

- Fast forward 100 years
- Ford Plant Michigan
- AI enabled robotics
- Further efficiencies
- Higher quality
- Lower costs

THE LATHAM REPORT: JULY 1994

The time to choose has arrived. The construction process cannot wait 30 years for another Banwell or 50 years for another Simon.



Michael Latham
July, 1994

Recommendation 24: Productivity Target

7.48 This target of 30 per cent real cost reduction by the year 2000 should be accepted by Ministers and the industry, and it should be the duty of the Implementation Forum to encourage, assist and monitor progress towards its achievement. This will involve early agreement on a benchmarking system. If a Construction Industry Development Agency (see Chapter 12) is set up, meeting this target should be its key task.

...SO CLOSE

LATHAM REPORT CHAPTER 7

TABLE 1: WHAT THE PRIVATE SECTOR CLIENT WANTS

Industry Performance Compared to Car Industry

Wants	Modern Motor Car	Modern Buildings		
		Domestic	Commercial	Industrial
Value-for-money	●●●●	●●●●●	●●●	●●●●
Pleasing to look at	●●●●	●●●●	●●●	●●●
(largely) Free from faults	●●●●●	●●●	●	●●
Timely Delivery	●●●●	●●●●	●●●●	●●●●
Fit-for-purpose	●●●●●	●●●●	●●	●●●
Guarantee	●●●●●	●●●●	●	●
Reasonable running costs	●●●●	●●●●	●●	●●●
Durability	●●●●	●●●	●●	●●
Customer delight	●●●●●	●●●	●●	●●

Source: Presentation by Dr Bernard Rimmer, Slough Estates plc, to a conference organised by "Contract Journal" & CASEC, the Barbican, London, 15th December 1993.

24. A productivity target of 30 per cent real cost reduction by the year 2000 should be launched (Chapter 7, paragraph 7.48).

3. McDonald's Restaurants Ltd has used a great deal of off-site prefabrication for its fast food outlets. It has reduced cost and time of construction in the UK over the last five years by 60%, and on-site construction times from 115 to 15 days. It uses modular techniques and treats production as an engineering exercise. It is looking for further improvements, including standardisation of foundations. It agrees on a yearly programme with producers so as to build up familiarity, team work and performance (source: McDonald's Restaurants Ltd).

HIGH PROFILE FAILURES



- £20m losses in 18 months
- 4 years of straight losses
- Material supply costs
- Legacy quality issues
- Very high cost

L&G

- The Great Hope
- 500,000 ft² factory
- 450 employees
- Plans for 3,000 modular homes / yr
- £5.5 Billion parent Co.
- £172m accumulated losses





WHY IS THIS HAPPENING?



ADVANTAGES & DISADVANTAGES OF MODULAR

- **Advantages**

- Controlled environment
- Efficient processes
- Specialisation in one type of building
- Unskilled / semi skilled labour

- **Disadvantages**

- High overhead costs
- Need continuous orders
- Specialisation in one type of building
- Cash flow

WHY MODULAR FAILS

- Projects not designed for modular
- Design not frozen early enough
- Issues between modular co & civils co.
- No single point of responsibility
- Inefficient factories
- Inefficient systems
- Cash flow problems

COMMON MISTAKES OF MODULAR MANUFACTURERS (I)

DESIGN

- Trying to modularise trad build designs
- Not designing for DfMA
- Designs too wide / heavy
- Absence of co-ordinated design
- Lack of commercial awareness of efficient modular design

DESIGN

- No DfMA wall elevations
- Lack of integrated M&E info
- Lack of vertical alignment

COMMON MISTAKES OF MODULAR MANUFACTURERS (2)

FACTORY PROCESS

- No programme contingency
- 'Just in time' delivery delays
- Inefficient factory layout and processes
- Poor accuracy of frames
- Not following QA process
- Facility wrong size & storage areas

SITE

- Over wide modules => logistic issues
- Higher foundation tolerances
- Co-ordination issues between factory & site programmes
- Storage, weathering and completeness issues

WHERE MODULAR WORKS BEST



Highly repetitive design

Hotels

Student accommodation

Apartments



Over 6 storeys height



Restricted site access or live environments



Where time & speed of construction is a value



Vertical integration



Where projects are designed specifically to the system of the modular co.

WHO'S DOING IT RIGHT?



- Specialist in one type of construction – v. high rise.
- Vertically integrated
- Efficient factory process
- Unchallenged in the market place

THE WINNING FORMULA



- John Blyde – former CEO Potton Group
- 173 Travel lodges – 1 every 14 weeks
- 6,000 houses
- Thousands of units for the RAF
- 25% below trad construction prices & profitable

JB PRINCIPLES

- Standard transport dimensions
- Multi-functional application
- Common frame system & dimensions
- No factory cladding
- No factory schedule gaps
- Lean production principles
- Control of on-site elements

