

A spotlight on

# The shift to off-site and modern methods of construction

A 2020 step-change in productivity?

## Why opt for MMC?



**Project programme savings**



**Early engagement**



**Collaboration**



**Innovation**



**Improved and more predictable outcomes**

Modern methods of construction (MMC) techniques are not new, but in the past few years the term has been rejuvenated and is widely used in the industry. However, the techniques that the industry can benefit from, particularly at the moment, are about so much more than off-site volumetric modular manufacturing practices that have grabbed industry attention.

Whilst we operate through unanticipated project delays and Health and Safety procedures are under increased scrutiny, now is the time for the industry to unlock the manifold aspects of MMC and prioritise investment to achieve better project outcomes. We surveyed the views of the contractor market in September 2020, and 65% of respondents said that they would look to incorporate MMC in their projects going forward as a result of the pandemic. Here we introduce the variety of types of MMC approaches and their benefits.

We evidence the savings achieved through adoption of MMC on a complex hospital build completed in 2020. A time and motion study has been conducted to produce valuable data, demonstrating to the industry the tangible savings that can be realised. We explain in this insight why MMC could accelerate productivity levels across the construction industry, providing lower cost and greater quality to deliver vital projects on time, particularly given the current socio-economic backdrop.



## Spotlight on the **Grange University Hospital**, Wales, UK

### Wales' largest health infrastructure project was planned from the outset to embrace industry collaboration and MMC:

- The design and construction teams were involved from an early stage, enabling everyone's perspectives to be understood; underpinning this was use of the NEC suite of contracts, which allowed early collaboration and the use of design for manufacture and assembly (DfMA)
- A streamlined, repetitive grid form was designed to simplify the components of the building, including a ward block for the inpatient care zone, with beds positioned in the same location on different floors to standardise engineering
- The team embraced building information modelling (BIM) and used the same platforms, enabling sharing of data and minimising errors.

### MMC elements in the scheme included:

- Reconstituted stone, insulation and load-bearing inner-skin sandwich panels incorporating pre-installed windows
- Precast elements including columns, shear walls, hollow core pre-stressed planks and staircases
- Bathroom pods manufactured from 3D models and vertical services riser modules.

### Project achievements:

- A programme saving of 23%; 137 weeks instead of 197 weeks for a traditional build
- The build programme was fast-tracked in response to COVID-19 and the health board took possession of 50% of the space in the hospital; this happened just four weeks after the request for beds to be brought forward was received in March, when planned completion of the project was 12 months away
- 70% of components were manufactured off-site in regional UK factories, increasing quality and predictability
- 60% increase in productivity.

“The Grange University Hospital demonstrates the change needed in our construction industry; a beacon for the future with innovation and collaboration at its heart. There’s no going back, we have to seize this opportunity now to make construction better.”

VICTORIA HEAD,  
PROJECT DIRECTOR



Grange University Hospital, Wales, UK

## What does MMC mean in 2020?

MMC has become an all-encompassing term, and the Ministry of Housing, Communities & Local Government (MHCLG) Joint Industry Working Group on MMC has created a definition framework to allow for better understanding with regularised terminology.

The definition framework shows that MMC encompasses a range of processes which can increase efficiency on a project, not just limited to off-site volumetric modular construction.

	Category	Category definition	Description	Example	Prevalence / Maturity
Off-site manufacture	1	Pre-manufacturing (3D primary structural systems)	Volumetric modular, building components manufactured off-site in 3D and assembled onsite, can be structure only or with all finishes and services installed	Hotel rooms, student accommodation modules, apartments, corridor racks, bathroom pods etc.	Medium
	2	Pre-manufacturing (2D primary structural systems)	Panelised - panel units for floor, wall and roof structures produced in a factory environment and assembled on-site to form 3D structure	Basic framing for walls, floors, stairs and roof. Enhanced panels (closed panels) include insulation and lining materials. Further enhancements can include roofing, cladding, doors and windows etc.	Medium
	3	Pre-manufacturing components (non-systemised primary structure)	Pre-manufactured structural members made of framed or mass engineered timber, cold or hot rolled steel or pre-cast concrete	Pre-fabricated pile caps, floor slabs, staircases, roof structure etc.	High
	4	Additive manufacturing (structural and non-structural)	Printing of building components on or off-site through digital design	Structural elements / non-structural components	Low
	5	Pre-manufacturing (non-structural assemblies and sub-assemblies)	Non-structural components that are manufactured off-site	Unitised non-structural wall systems; roof finishes cassettes, small volumetric units, pods bathrooms, utility cupboards, risers, plant rooms, prefabricated MEP assemblies / composites	Medium
Site based improvements	6	Traditional building product-led site labour reduction / productivity improvements	Reduction of onsite labour with modifications to traditional building products e.g. pre-cut, large format, easy jointing	Large format wall products / systems, systemised traditional materials, easy site installation, jointing, interfacing systems e.g. brick slips, modular wiring, flexible pipework	Medium
	7	Site process-led site labour reduction / productivity / assurance improvements	Innovative site-based construction techniques which generate outcome improvements	BIM enabled lean delivery and workflow planning, digital augmentation; digital productivity measurement devices; trade and process robotics; digital site validation devices	Low

## The opportunity to increase efficiency

Pre-manufactured value (PMV) measures the proportion of a project made up of on-site labour, supervision, plant and temporary works. By improving PMV, through increasing manufacturing and / or reducing site labour, greater efficiencies can be achieved.

## Off-site / near-site manufacture approaches

(Categories 1-5).

Benefits include:

- Reduction in site labour
- Controlled manufacturing process increases predictability, quality and performance
- Quicker than traditional, bespoke solutions which give preliminaries cost benefits and allows facilities to be delivered sooner.

## On-site process improvements

(Categories 6 and 7).

Benefits include:

- Lower wastage
- Increased productivity Better planning, reduced need for supervision.



## Additional benefits of MMC

### Reduction in labour requirements:

This is important as the construction industry is already facing skills shortages. Office for National Statistics undertook analysis of the construction industry labour force and found that 2011 Census data indicated that an estimated one in every five UK-born construction workers were aged 55 and over, meaning by 2021 many will have nearly reached retirement age and be exiting the industry.

Offsite factories tend to have predictable employment levels, without the need for labour to move around to different sites and may encourage more diversity in the industry with standard hours and less travelling.

The increase of digital working may also attract new entrants to the industry and challenge traditional perceptions.

### Meeting of sustainability / net zero carbon targets:

Tighter tolerances can be achieved in controlled conditions, improving energy performance. A lower number of deliveries to site are required when MMC is adopted, and waste in the construction process is reduced.

### Innovative products can be used to generate smart buildings:

This allows monitoring of a building to understand how it is used and the subsequent data can be used to improve performance, for benchmarking and to inform the design of similar, future projects.

### Range of approaches:

There are opportunities to incorporate elements of MMC alongside traditional construction in a hybrid approach.

## MMC is suitable for any project or framework

There are opportunities on all projects for MMC approaches to be used. Whether off-site manufactured components, adaptations to traditional products leading to increased efficiencies on-site or innovative technology on-site, reducing labour requirements / improving productivity.

The UK Government is driving adoption of MMC by the construction industry. In order to meet housebuilding targets, the Government has recognised that MMC will make a vital contribution towards the target to deliver 300,000 new homes annually by the mid-2020s, and a report from Savills suggested that the proportion of homes built using MMC over the next 10 years will rise from roughly 8% today to around 20%.

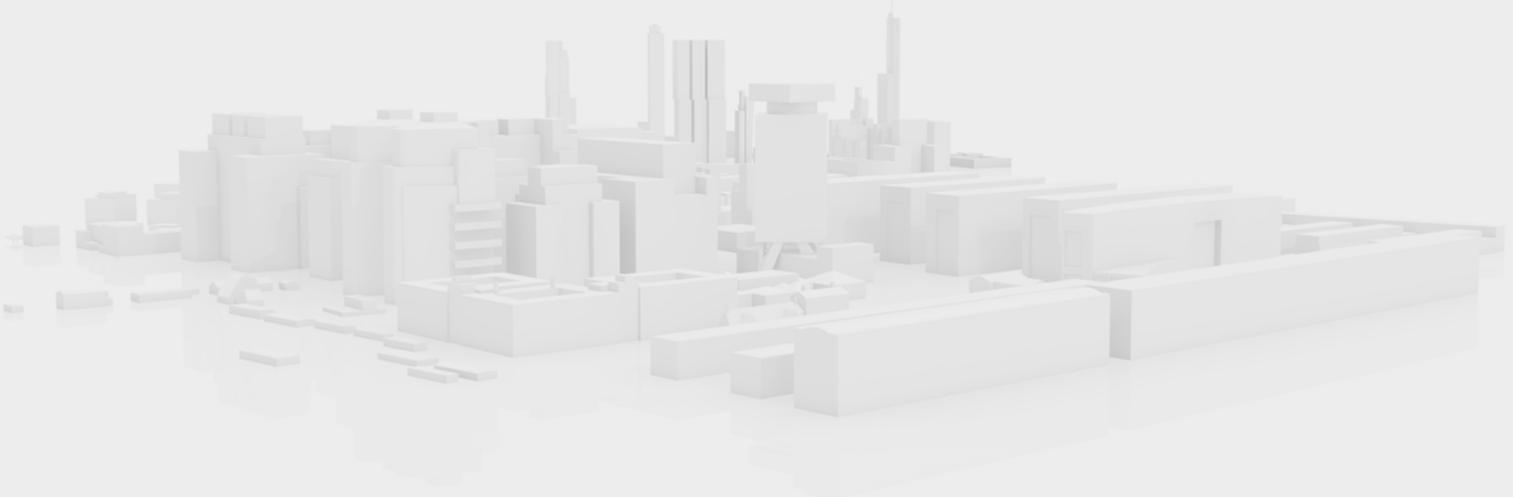
Public infrastructure projects are typically well-suited to embrace MMC, for example in the health, justice, education sectors creating hospitals / surgeries, prisons and schools, as they have:

- **Output specification / generic design brief:** Standardisation of layouts aligns with principles for volumetric modular / panelised systems to be used and pre-contract periods can be shortened due to the standardised approach across projects
- **Volume:** Strong pipeline of demand allows frameworks to be formed to collaborate with suppliers and to continuously improve.

In January 2020, the Department for Education announced the winners of the off-site schools' framework, expected to deliver 30 schools per year with a projected pipeline of £3bn over the next four years. £2bn of the projected spend is for secondary schools above 6,000m<sup>2</sup> with the remainder for primary and secondary schools 750 – 6,000m<sup>2</sup>.

The lessons learnt from recent school construction using MMC are being used to develop 10,000 more prison spaces. With the prison currently under construction in Wellingborough, UK using MMC and four new prisons planned to be constructed over the next six years.

The Government is also looking to construction to support the economic recovery from the effects of COVID-19, with Boris Johnson unveiling plans on 30<sup>th</sup> June 2020 with a promise to “build build build”, bringing forward £5bn of infrastructure projects and spending including £1.5bn for hospital maintenance amongst others. MMC will mean quicker delivery of projects enabling the benefits of the investment to be felt sooner – it will also drive modernisation of the industry.



## Is there a downside to MMC? (The threats to widespread adoption)

Threat	Mitigation
Construction industry is slow to change / significant investment required	The government is driving the MMC agenda in their projects and has a strong pipeline of work. Homes England has announced a research 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 to promote confidence. Lessons can also be learnt from other countries where MMC is used.
Negative perceptions of quality / longevity - previous high-profile failings of MMC residential developments has meant that the insurance industry has been cautious	The largest four housing warranty providers, National House Building Council (NHBC), BLP, Premier Guarantee and Local Authorities Building Control (LABC) Warranty have agreed a memorandum of understanding around assessing the reliability and durability of off-site built homes with an undertaking to use the same standards to assess homes so that insurers and mortgage lenders know what has been tested.
Lack of long-term data for MMC	Digital technology makes it possible to collect, store and share data about the construction, maintenance and materials used in MMC buildings - this data can then be used to analyse performance and inform stakeholders. A time and motion study has been undertaken at the Grange University Hospital so there is data available to verify and advise on what savings can be achieved using MMC.

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## Summing up

Whilst some threats to widespread adoption and uptake of MMC in the UK construction industry have been identified, there is active will to overcome these to reap the benefits and to contribute to overcoming industry issues with quality, output, carbon emissions, resource efficiency and skills shortages.

The Government's backing and assistance to overcome some of the challenges to MMC gives hope for widespread adoption. Technological advancement through 3D printing, robotics and other artificial intelligence will continue to develop and improve the effectiveness of MMC; reducing reliance on labour, changing the way the construction sector works and bringing increased transparency and predictability to projects.

Through early engagement of all partners on each construction project, a standardised approach using MMC can drive greater efficiencies in the construction industry, not only during a time of unanticipated delays, but also in the long-term, to develop an increasingly flexible and resilient built environment.

## Talk to an expert



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