

Summary Whitepaper  
**MODERN METHODS  
OF CONSTRUCTION**  
*2023*

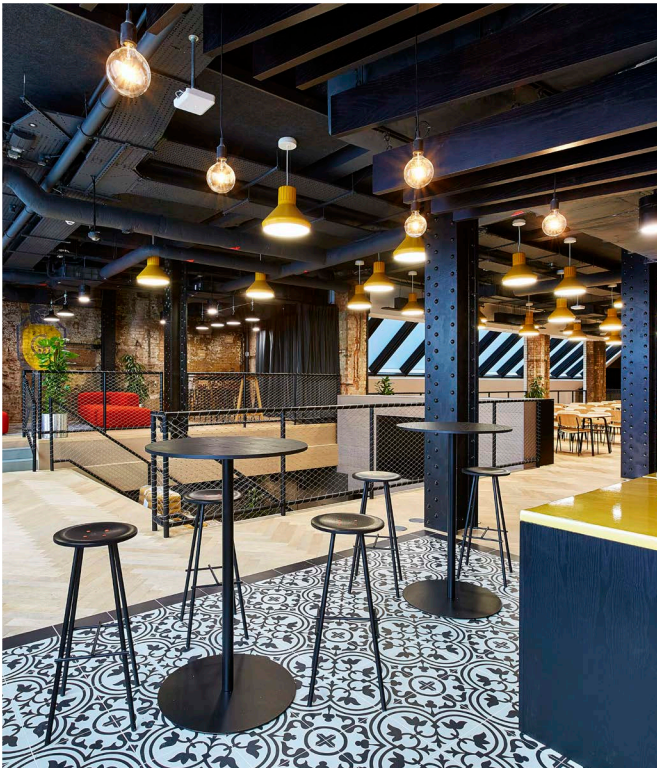


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*The term ‘modern methods of construction’ (MMC) has become synonymous with innovative ways of building – utilising a variety of processes and systems, often involving digital technology to maximise productivity and efficiency.*



## EXECUTIVE SUMMARY

MMC typically refers to non-traditional building methods or processes, often by creating structural elements of the building offsite and then putting them together onsite.

MMC uses a wide range of techniques and materials with the aim of minimising the amount of time required to construct a building, while maximising the efficiency of both material and human resources, therefore improving quality, health and safety and sustainability.

Some of the innovative practices employed by MMC include :

- Creating panelled units in factories, which can be quickly assembled onsite to create 3D structures
- Volumetric construction, which sees 3D (or pre-fabricated) units created under factory conditions
- Pre-cast concrete foundations and pre-formed wiring looms
- Pre-fabricated floor and roof panels
- Tunnel form or thin-joint blockwork

However, uptake of MMC has not been as widespread as originally predicted. A variety of possible factors that may have stalled its progress include a lack of skilled labour and training, to regulatory changes and inadequate certification.

Although its popularity is growing, there is uncertainty from some stakeholders about the future of these innovations and whether or not the current supply chain challenges can be overcome.

Using the wealth of experience and network of contacts from working at the forefront of this sector for a number of years, Gardiner & Theobald convened a series of panel discussions with experts from across the supply chain to discuss the barriers to greater uptake of MMC, help the industry better understand these innovative building techniques and unlock its potential.

These sessions focused on key considerations for offsite manufacture, the impact using MMC can have on procurement and the challenges faced onsite. Expert panels examined the project lifecycle, breaking down the myths and dispelling many preconceptions.

Insights drawn from these conversations included the need for greater engagement with the supply chain to help align design and delivery partners from the outset.

The discussions discovered the importance of understanding the manufacturing process of any chosen MMC solution when embarking on a new development, to help the project team respond to questions from independent parties such as a building control officer and the insurance industry.

The series noted key considerations for mitigating against onsite challenges and how to ensure maximum value when Designing for Manufacture and Assembly (DfMA), with the impact that taking an alternative procurement route can have on the programme of a development.

**This whitepaper brings together all the key points raised during our conversations with MMC experts and summarises them by topic. If you want to find out more about our MMC series, please visit [our website](#) where you can watch the recordings from each session.**

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# 1. OVERVIEW OF MODERN METHODS OF CONSTRUCTION (MMC)



## OVERVIEW OF MMC

### What is MMC?

MMC is ultimately about improving efficiency and productivity in both design and in construction. It is widely known that construction has a substantial productivity gap compared to many other sectors and MMC has been suggested as one of the methods to tackle this challenge.

Although described as a “product-led” type of construction, MMC is also about developing the manufacturing processes and how these processes are executed.

When implemented correctly it can enable a smarter, safer construction methodology. However, we need to become much more familiar with these new MMC processes and products, especially as we strive towards a net zero future and look to uncover efficiency gains in the construction process.

The broad spectrum of these innovative construction techniques can be categorised by:

**CATEGORY 1** – Pre-Manufacturing - 3D primary structural systems

**CATEGORY 2** – Pre-Manufacturing - 2D primary structural systems

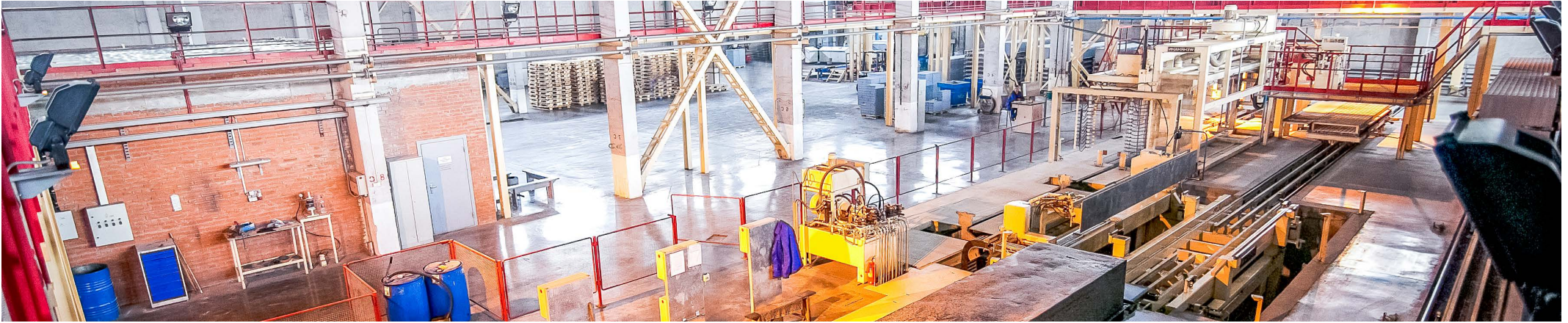
**CATEGORY 3** – Pre-Manufacturing - Non systematised structural components

**CATEGORY 4** – Pre-Manufacturing - Additive manufacturing

**CATEGORY 5** – Pre-Manufacturing - Non-structural assemblies and sub-assemblies

**CATEGORY 6** – Traditional building product-led site labour reduction/productivity improvements

**CATEGORY 7** – Site process-led labour reduction/productivity improvements



### MMC as a Mindset:

MMC has been described as a mindset. From the outset, it's crucial to think about the high-level outcomes you are looking to achieve from the project, whether they be speed, sustainability or financial improvement. Once established, you can then start to break down the project into individual goals. For example productivity, performance or ESG/ sustainability goals.

The panel in the first discussion noted as an industry we should stop talking about MMC in terms of the 'product'. Their belief being that the product should be a byproduct of what we want to achieve. There are lots of different products in the market, all of which have their own benefits. As an industry, we therefore need to look at what we are trying to achieve in terms of the outcomes.

Ultimately, the sector needs to showcase the benefits of MMC to stakeholders when it is correctly utilised. Once these benefits become more widely known, it'll become easier to embrace an 'MMC mindset'.

### What is the industry perception?

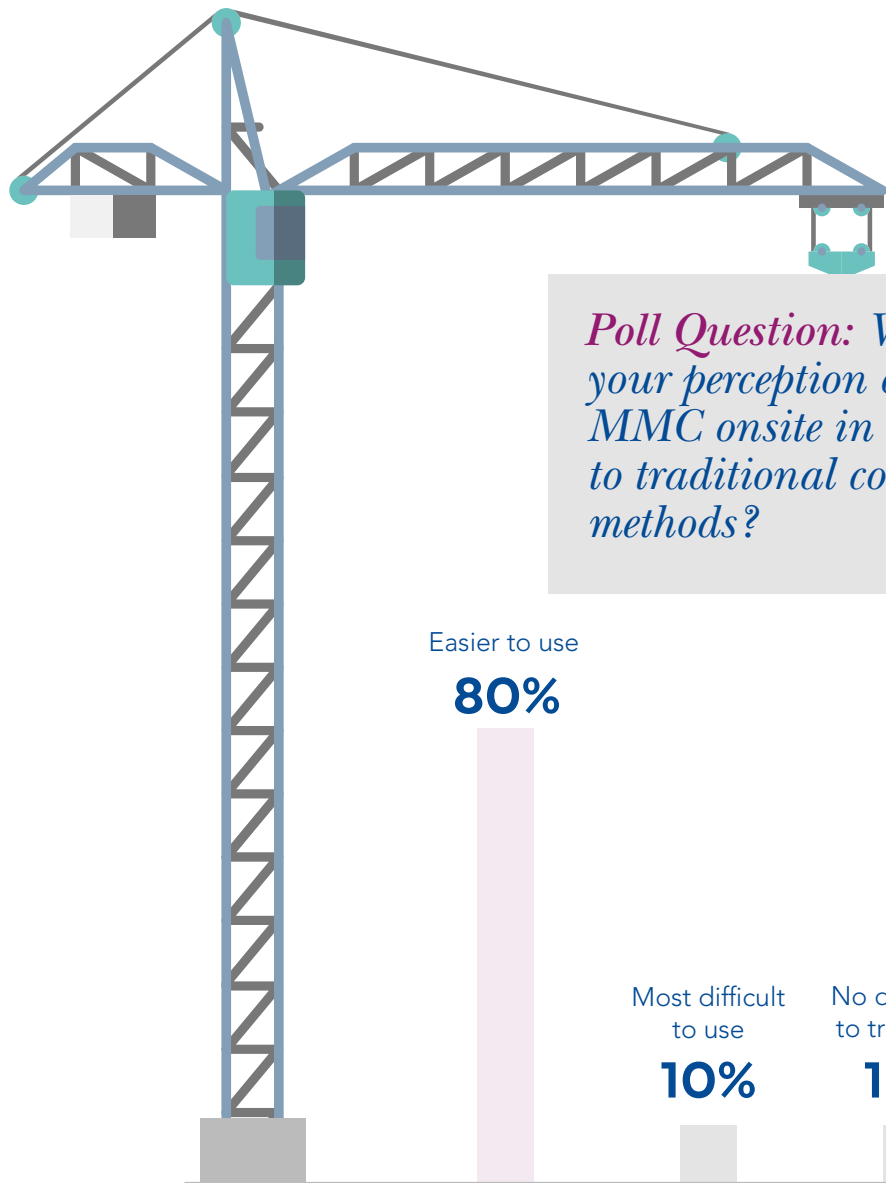
Everyone is at different stages of maturity in their understanding of MMC, but as explored in this paper MMC is much broader than just offsite construction. It is about introducing better products and processes that can ultimately deliver better outcomes.

The perception across the industry of MMC is mixed. Some consider the sector to have a limited supply chain and therefore can be a challenge to be cost competitive. There is also a belief that the manufacturing process leads to lack of flexibility when on site.

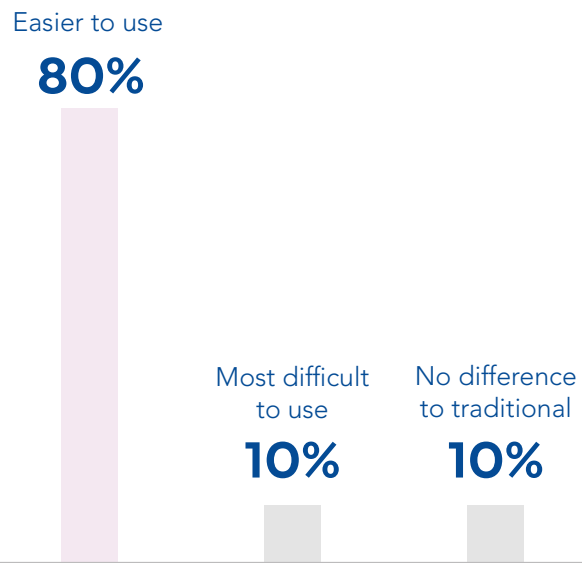
However in contrast to this perception, there are a variety of schemes (which we will discuss in this paper) that have been delivered successfully utilising MMC with strong long-term asset performances.



“*Everyone is at different stages of their MMC understanding.*”



*Poll Question: What is your perception of using MMC onsite in comparison to traditional construction methods?*



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## 2. BENEFITS



# WHAT ARE THE BENEFITS OF USING MMC?

**01** Programme savings through increased speed of construction onsite

**02** Greater cost certainty

**03** A better quality product due to production in a controlled environment

**04** More sustainable due to embodied carbon reductions\*

*\* NOTE: Tide Construction recently published findings from its academic research, indicating the organisation can deliver schemes with a 45% improvement in embodied carbon compared to traditional construction*



**05** Reduced waste and noise

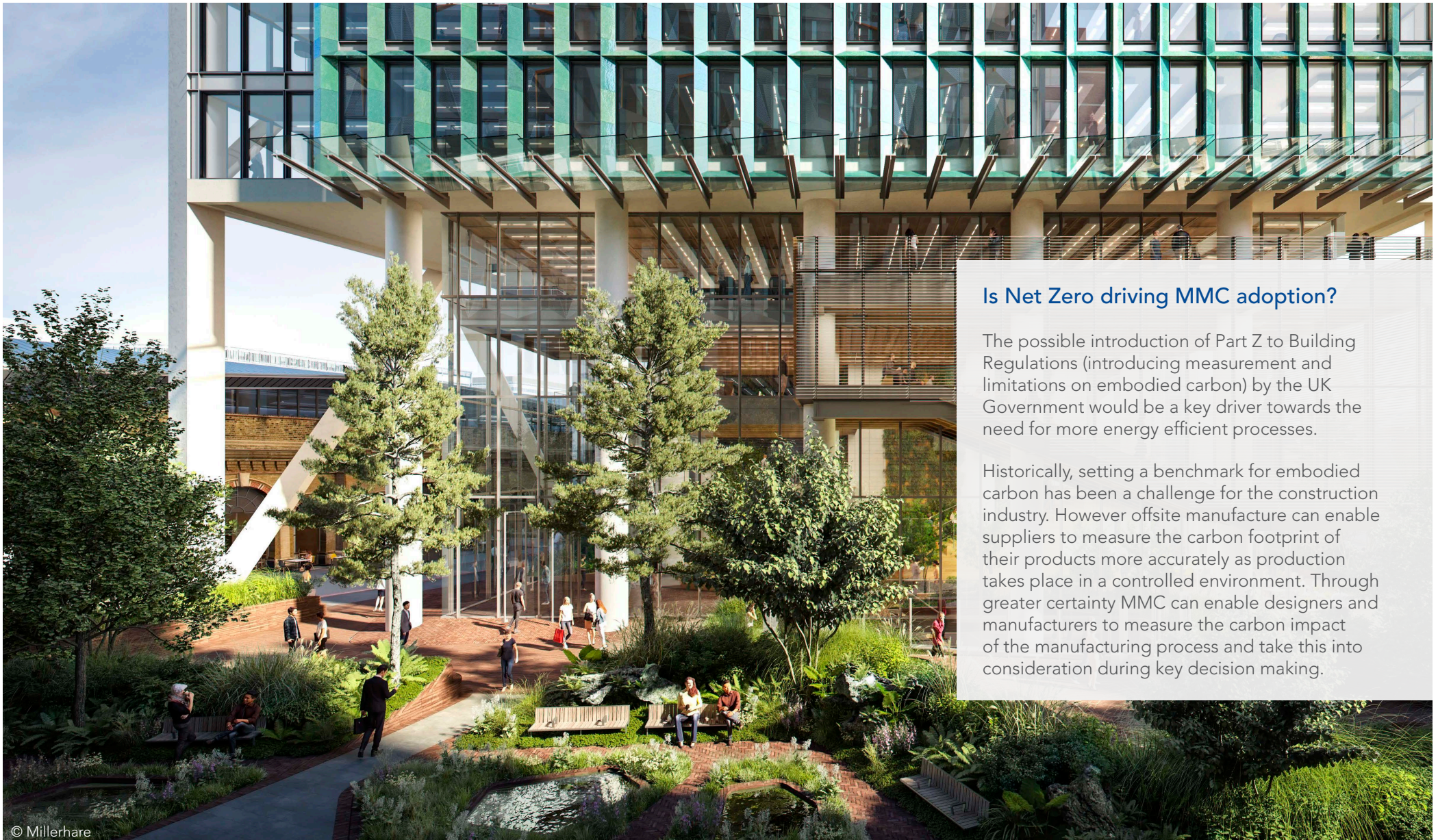
**08** Offsite delivery reduces activity onsite which can help alleviate accessibility challenges

**06** Better fabric performance

**09** Using tried and tested MMC systems can help ensure regulatory compliance

**07** Repeatable designs help develop continuous improvement processes

**10** Improved health and safety due to reduced activity onsite



### Is Net Zero driving MMC adoption?

The possible introduction of Part Z to Building Regulations (introducing measurement and limitations on embodied carbon) by the UK Government would be a key driver towards the need for more energy efficient processes.

Historically, setting a benchmark for embodied carbon has been a challenge for the construction industry. However offsite manufacture can enable suppliers to measure the carbon footprint of their products more accurately as production takes place in a controlled environment. Through greater certainty MMC can enable designers and manufacturers to measure the carbon impact of the manufacturing process and take this into consideration during key decision making.

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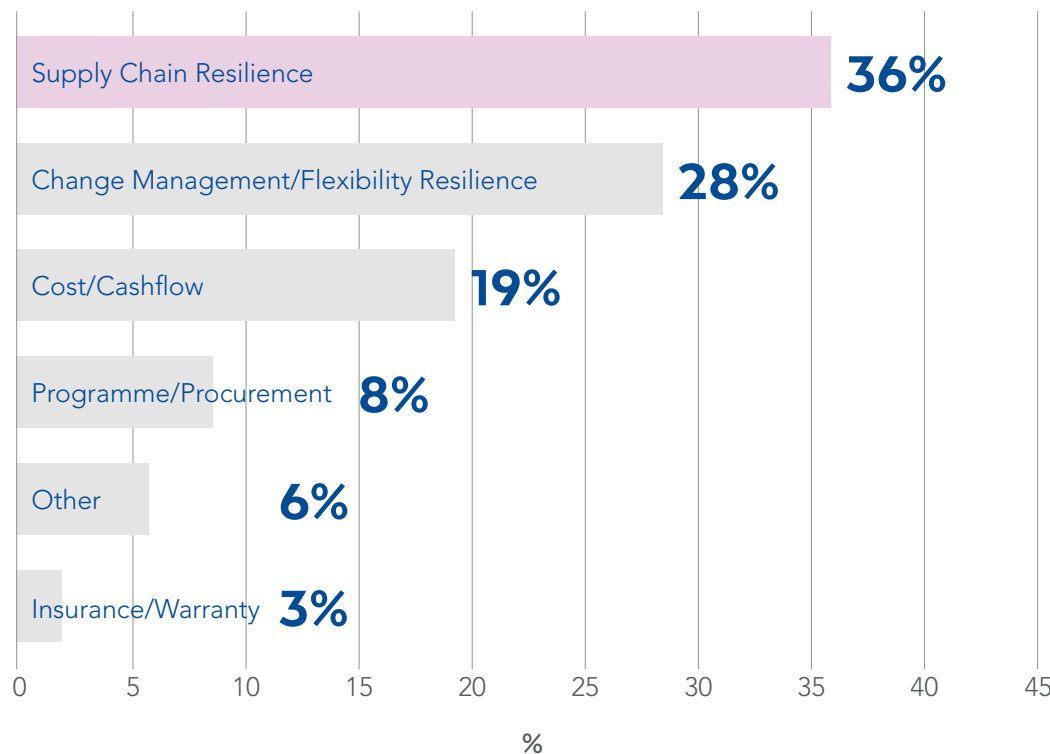
## 3. KEY CHALLENGES

# KEY CHALLENGES

## Audience Poll:



*In your opinion, what is the biggest challenge to adopting MMC?*



At the beginning of the MMC series, around 36% of our polled audience believed the biggest challenge to adopting MMC to be 'supply chain resilience'. The supply chain for many MMC technologies has yet to mature to a point at which it can meet the strong ambitions for the sector.

With 28% of the votes 'change management and flexibility' was another challenge to adoption noted by our webinar audience.

When discussed by the panel, it was highlighted that although this is a common perception, one of the objectives of MMC is for the majority of cost to be incurred offsite, in factories and at the design phase (ie a front-loaded cost curve). Consequently, the cost profile of MMC demands a 'right first time' ethos from initiation.

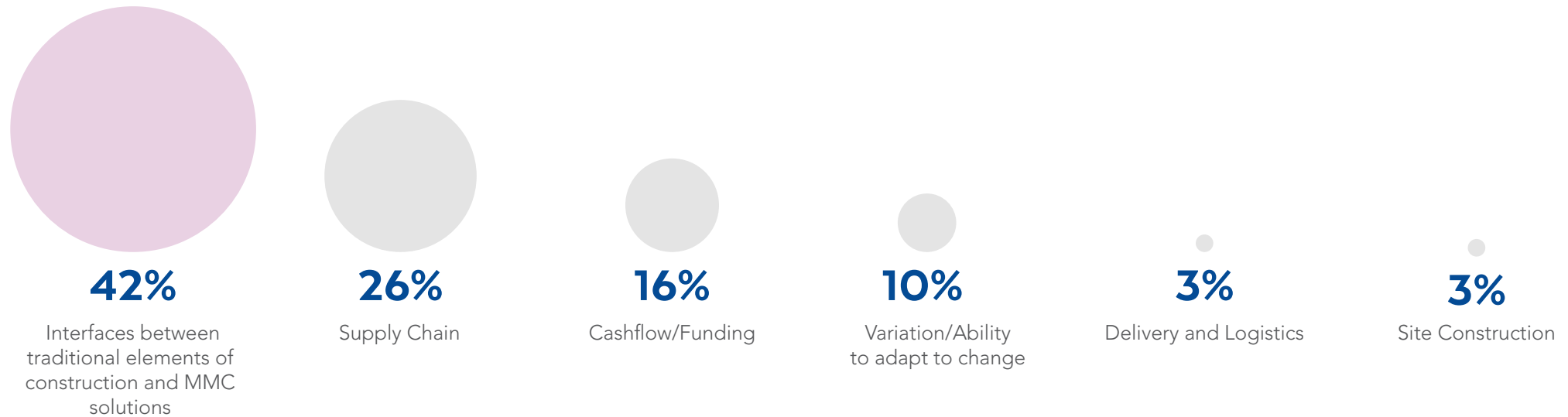
This inherently means there is less flexibility to change elements of the project later down the line.

However, if the project is approached as an MMC development from the outset, it is possible to overcome this challenge and overcoming this barrier will undoubtedly mean educating stakeholders about the MMC processes and what the limitations are.

Finally, another major barrier noted was 'cost/cashflow'. Polling at 19%, audience members thought that from a cost perspective, MMC is relatively untested and still in an evolutionary phase.

The perception was that cost data is not robust yet and as technologies improve, cost data becomes obsolete. This could make it more difficult for the industry to estimate costs, address the benefits of MMC and plan appropriately.

However, as MMC becomes more widely adopted, the subsequent costs will become more competitive as more MMC contractors enter the market.

***Audience Poll:******What do you perceive to be the biggest onsite challenge for MMC projects?***

In terms of the onsite challenges when using MMC 'interfaces between traditional elements of construction and MMC solutions' were perceived to be the biggest (42%). Similarly to those mentioned earlier, the 'supply chain' (26%), as well as 'cashflow/funding issues' (16%) and 'variation/ability to adapt to change' (10%) were also noted as significant challenges.

The interface between traditional and MMC solutions is indeed a significant challenge, but this can be mitigated against through early engagement at project conception. For the interface of the design, the supply

chain and the contractors need to work together closely. Onsite, what you see is the outcome from months of productive conversations. The panellists noted a red flag whenever the supply chain is brought onboard late to an MMC project.

With MMC the big advantage onsite is programme savings, but this also means that you don't have time for error. If you need to go back and redo works onsite, you risk the valuable time and cost savings you've already achieved in the factory. On any MMC or traditional project, you need to establish a continuous

improvement loop and make sure that any error onsite, however small, is fed straight back to the design team, digital model and the supply chain. There were examples given by panellists where the same interface issue was seen across several projects and it was noted that these could have been avoided with MMC.

There is a need to appreciate and trust the precision of these MMC systems. An experienced design and contractor team who are engaged early can overcome the perceived challenges regarding interfaces.

Throughout the sessions with our expert MMC panellists, the following were also identified as key challenges:

### MMC requires an earlier design freeze

With MMC there is the need for a much earlier design freeze. This requires a mind-shift that suppliers can manage by setting up a prototype that allows clients to come and see and touch their product. Any design changes can then be made before it goes into manufacture. The benefit of having the design freeze early is that all the decisions are then made, allowing the key benefits of modular delivery/the manufacturing process to be realised.

### The key issue of supply chain resilience

It makes good business sense for any industry to plan for shocks in the supply chain and the MMC sector is no different, but it is unlikely that anyone planned for the series of disruptive events that hit the supply chain over the past few years. The important thing is to know what you need to procure. Fortunately with an early design freeze you are designing earlier when using MMC, so you should know exactly what materials you'll need

and when you'll need to order them. Although this doesn't shield you entirely from supply chain challenges, it does help to identify the type and quantity of materials needed, alongside when they are required in the programme.

The important thing is having good relationships with your supply chain and keeping it under constant review.

### Is there a lack of supply competition?

This is not an entirely inaccurate perception, according to our panels. Peter Goring, technical director at Mace, explained that while Mace controls the assembly process, its methodology involves working within their existing supply chain, sourcing products from a range of suppliers. Mace is finding that a much wider range of companies are now able to manufacture within 'production to construction', rather than just going to a single source.

It was also highlighted by the experts that it's important to look carefully at the manufacturing and system type.

If you look at Category 1 volumetric, there are a relatively small number of manufacturers to choose from at the moment, but they are all fairly large organisations so it wouldn't be fair to compare them to small panel manufacturers that make up the majority of Category 2 providers. Category 1 manufacturers (ie manufacturers that deal with the entire MMC process), are similar in size to some national Design & Build (D&B) contractors – many of which may not be considered 'financially robust' in the current market.

To combat this challenge, there is a need to ask where the supply chain risks lie and conduct a thorough risk assessment.



Sam Hiller  
Gallaghers

### Higher Insurance Premiums

In our session on insurance Sam Hiller, partner at construction insurance broker Gallaghers, explained that obtaining property insurance with large-scale, volumetric modular buildings is possible but similarly to construction insurance, it can be more expensive. He said to expect a c.10-20% increase in insurance rates with MMC projects as there is a degree of uncertainty about how MMC buildings perform over time. This also factors in complexities such as the possibility for hidden water ingress or increased repairs due to the highly specialised nature of MMC buildings.

*Further information on insurance follows here.*

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## 4. DESIGNING FOR MANUFACTURE

# DESIGNING FOR MANUFACTURE

## Do we need to design for MMC?

The short answer is 'absolutely' but this isn't because MMC is any less flexible or that MMC has limitations. If you don't specifically design for MMC, the issues that have been systemic in the wider construction industry for many years are not going to be fixed and this will leave many of the opportunities that could be available with MMC unrealised.

MMC necessitates a different way of working and thinking, and this needs to be leveraged at the right stage to realise the desired outcomes. Clients are after certainty – certainty of programme, quality, budget, safety outcomes.

MMC requires you to think more upfront, so there needs to be a left-shift by design practices to achieve this. Ultimately this leads to more informed, better developed, and well-coordinated designs, which really helps in the final stages of the project.



*It's key to know your outcomes, engage with suppliers as early as possible and understand where its best to get that degree of fixity."*

## When is it too late to convert a traditional build to MMC?



Claire McAnallen  
Tide Construction & Vision Modular

### Focus on Tide Construction:

Claire McAnallen gave examples where at Tide they have taken Stage 3 and 4 building designs and transferred them to MMC. However the earlier the manufacturer can get involved in the design process, the better in terms of design efficiencies. Tide designs from first principles, looking at the site context, the area, the planning stipulations and then 'modularises' it. Because the building is created offsite, they do need to think about the logistics of getting the modules to site as well as the craning strategy and installation process. These need to be taken into consideration and so designing for MMC certainly helps with logistics planning and installation steps.

Whilst it is best to design for MMC, conversion of traditional schemes to MMC is possible, but it's certainly not the most efficient approach. To ensure you maximise the benefits, regardless of the stage of conversion, you should begin the project with MMC on the table.

If you have a standardised design that isn't too complex, it was suggested that it's possible to wait until the end of Stage 3 (and potentially Stage 4) before deciding to convert. The inclusion of transfers and overhangs, for example, would make conversions more challenging. It's important to ensure the wall thicknesses are correct because if you switch from a traditional to a modular approach, wall thickness will increase and there is a risk of going outside the approved planning envelope.

It was concluded that it's better to convert a traditional build to one that uses MMC as early as possible. This increases your chances of making it a success and securing the desired productivity gains. The longer you leave it, the more the opportunity for efficiency gains diminishes.

### Key Note

It's also important to understand the market and what the various MMC suppliers can realistically deliver in the timescales available. If pursuing a panelised solution for example, there may be more suppliers that can meet your requirements with the requisite design information. Many suppliers will work on the same wall thicknesses, with the same wall details and build-ups which gives you more flexibility.



## Are there key design considerations for certain sectors?

The considerations for design are no different to the ones for a traditional design. There are, however, certain sectors that lend themselves more readily to MMC. For example, prisons and schools lend themselves well to an MMC approach because they follow repeated designs. Prison cell sizes and even classroom sizes are standardised. As a result, the industry has been able to create sector-specific volumetric and panelised solutions. In reality, the same could apply to any sector.

Analysis has been done on hospitals and found that 60% of any hospital is standard. Similarly, parts of the residential sector are standard with many aspects being exactly the same for each building. Therefore, these sectors are particularly viable for MMC solutions. Examples were discussed where MMC is even being used on bridges. It was noted that it can take 45 minutes to design a parametrically designed MMC bridge – something which can take weeks with traditional design. The nuclear energy sector is another which is increasingly looking to MMC solutions.

The key thing to bear in mind is that the approach with MMC is different between sectors. You need to know what the key criteria and issues are in any given sector, and then you need to know enough about the products to understand how they can be deployed to deal with these sector-specific criteria. Certain products will not be viable for certain sectors. MMC can even be used on bespoke, one-off projects. However, when a project is bespoke it's important to think about the cost as writing off the cost of single-use moulds and other offsite tasks would need to be factored in.

Standard offsite solutions are more readily available for some sectors, but where these solutions are not as widely available there are small and medium sized enterprises (SMEs) within the industry who can determine what is possible.

## The differences between Design for Manufacture and Assembly (DfMA) and traditional approaches.

There is often similarities drawn between MMC and the car manufacturing industry and how they are striving to reach similar design goals. Where traditional approaches often involve getting to site, coordinating and then starting to build, DfMA uses systems and large-scale components assembled offsite utilising programmes such as BIM to provide models which enable increased information and data sharing. This cuts down the time it takes for interpretation and allows contractors to feed accurate drawings back to the design team resulting in much earlier coordination efforts.

The traditional design process using the RIBA stages is very sequential, for example the concept design is handed over to another party that does the documentation, who then hands over to another party to do the detailed design etc. Because the disciplines tend to work in sequence, there is a lack of integration in the construction process. However with DfMA the big difference from a traditional approach is thinking much earlier about the construction, bringing this forward into the design process and trying to resolve any interface issues between the manufactured products and the traditionally built elements.

The experts agreed - it's all about 'how you build and not what you build'. It's about thinking through the whole construction sequence, the systemisation of site, the componentisation and the assembly in order to gain the maximum speed benefit.

## How can designers increase the buildability of MMC projects and make designs more MMC-friendly?

In short, earlier engagement increases the buildability of MMC projects. Understanding which form of construction designers are designing to is key from the outset. However it was noted that repetition can be challenging. While welcome to a degree, designers and architects don't want the same design solutions for everything. There is the opportunity to be intelligent regarding replication, looking at what can be repeated in the details without impacting the aesthetic of the design. It may be that projects are custom built but incorporate a portion of, for example, volumetric cross laminated timber (CLT) where you use the same volumetric CLT base but allow for a variety of detailing options. We just need to be thoughtful about where we can repeat data, details, drawings and models.

Designing around a system would also increase buildability. Looking back to the early days of CLT in the UK, you would often see generic designs that would later be converted into a CLT design. However, taking this approach means you lose the efficiencies that can be gained through MMC.



*The nuclear energy sector is another which is increasingly looking to MMC solutions.*



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## 5. EARLY ENGAGEMENT

## EARLY ENGAGEMENT

Early engagement was a recurring theme throughout G&T's MMC series.

Its importance has already been emphasised with respect to engaging the supply chain in early design meetings so they can input into the programme to avoid errors and mistakes.

Earlier engagement was also thought to be the best way to overcome perceived challenges regarding interfaces.

### Some of the broad benefits associated with early engagement when using MMC include:

- Easier to mitigate later stage challenges
- Greater certainty of approach
- Earlier procurement of supply chain
- Programme efficiencies onsite
- Ability to anticipate peaks within the assembly programme and plan accordingly

The need for earlier engagement also brings with it certain challenges and requires getting all of the stakeholders (from contractors to insurers) on board and collaborating at an earlier phase of the construction process.

MMC projects will also need to engage with Building Control earlier in the process, particularly given that a high degree of certainty is needed before pressing 'go' on manufacture. It's key that fundamental design decisions are made early on. Clients need to be aware of this and able to make these design decisions at an earlier stage than they would for traditional builds.

With MMC, a large portion of labour and other costs are generated early and there may be a need to commit financially a little sooner without having achieved full cost certainty on other elements of the build. It's therefore important to consider what contractual mechanisms will allow for earlier engagement. For example, as explored later in this paper, single stage tendering doesn't allow you to fully realise the benefits of modular construction because you're starting from an almost resolved design too late in the construction process.



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## 6. PROCUREMENT

## PROCUREMENT

### MMC v. Traditional build: What are the differences in procurement?

Often the procurement routes are not too dissimilar to what most people expect, but there are some subtle nuances around sourcing and the opportunities. The reality of MMC is that construction is just being done away from site and being brought to the site, where procurement and tendering are largely the same, it's just a shift in mentality.

The experts elaborated, explaining that procurement does vary from traditional builds when you move up the categories. The sooner you find a partner to work with the better. Involving the manufacturer shouldn't be left until the end of Stage 3, when the design has already been completed. Difficulties tend to arise when new entrants into the market were unsure of the direction they wanted to go. Certainty of approach at an earlier stage is crucial to make a success of MMC.

With MMC, it can be easy to forget that there are in fact two sites. The reason there is less time onsite is that you are doing work offsite. It's important not to forget that the majority of work will take place within a manufacturing facility and therefore you need to be aware that the things that might impact a traditional programme (eg delayed planning or delayed piling due to weather) all have an impact on the second site.

Because you are producing quickly, efficiently and predictably, the integration between what happens on and off site is critical. The critical path is no longer a single path on site and so it's important to understand all the various knock-on effects, where they are, and what the impact is. Accordingly, the job of an MMC contractor is through leadership, being able to juggle all these different elements of the process. This can be difficult as everything about the MMC process is interlinked.

### *Knowledge Point: Capacity Mapping*



Graham Knight  
Gardiner & Theobald

From the perspective of applying MMC across programmes (rather than individual projects), G&T partner Graham Knight said in his work with the Ministry of Justice, they used a capacity mapping exercise. This exercise showed the availability of the raw materials that went into individual elements or pre-manufactured components that were subsequently assembled on site. Graham emphasised the need to factor in supply chain capacity assessments, especially when looking at the peak demand across multiple projects. This is an important consideration from a procurement standpoint.



## Procurement Routes

In the panel discussion, it was noted that the majority of MMC projects are delivered via a JCT D&B or an NEC3/4 type of contract. As such, the modular industry is well-versed in using these types of contracts. More bespoke contracts have been used for certain schemes, such as the 2012 London Olympics for example, but typically MMC can be delivered using the same procurement methodology.

However, it was explained that single stage tendering doesn't allow you to get the benefits out of modular construction because you're starting from an almost resolved design too late in the construction process. It's also possible to use PCSA contracts to engage modular contractors early on to design a concept.

### Audience Poll:

*Would you consider alternative procurement models for future projects?*

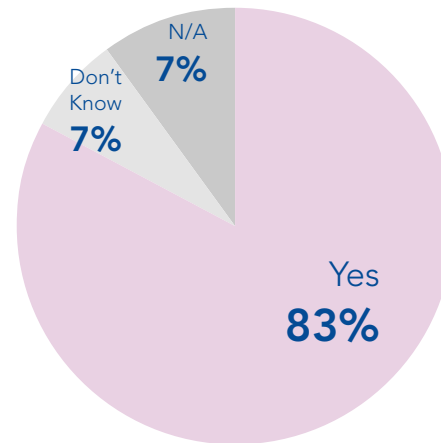
None of those polled said that they would not consider new procurement routes.

Yes
  No
  Don't Know
  N/A

## What are the benefits of taking an alternative procurement approach?

One of the key benefits of MMC is in improvements in programme duration. By using offsite manufacturing, it's possible to fit-out much closer to structure and install. As such, some of our panellists are seeing 10–18 week improvements in residential programmes.

There are also far fewer deliveries to site – about 40% fewer deliveries of heavy goods vehicles (HGVs) – but what wasn't entirely anticipated was the huge reduction in the volume of light commercial vehicles (LCVs) going to site. It was acknowledged there is still some work to do on waste from general activities, but this is an improvement on traditional construction methods.



## Case Study: The Ministry of Justice (MoJ)



Graham Knight  
Gardiner & Theobald

*“MMC opens up the possibility of different forms of contract to support earlier engagement.”*

Graham Knight noted that on the Prisoner State Transformation Programme with the MoJ, a PPC 2000 partnering agreement was used. At the time, this was seen as the most collaborative way of engaging the supply chain early.

More recently the FAC-1 alliancing form of contract has been used successfully as an umbrella contract on the New Prison Programme (NPP), where all members of a collaborative delivery team can be appointed on an even footing.

Underneath this, you can still deliver under an NEC or JCT D&B contract for each individual project. By doing this, you've procured early works orders from the supply chain as well as services.



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## 7. INSURANCE

## INSURANCE



Sam Hiller  
Gallaghers

Typically insurers tend to prefer underwriting new build developments of traditional frame, as this is where they hold the most data. The more challenging risks for insurers are developments that involve structural timber refurbishments and modular/MMC as the data available is not as substantial.

### Construction vs Property Insurance

#### Knowledge Point

Construction and property insurance are two separate markets. Construction insurance is obtained at the start of a project and covers constructional risk for the contract works as well as the various other insurances that flow down from it (eg third party liability, non-negligent indemnity, latent defects etc).

Property insurance follows and covers a development post practical completion and includes business interruption and loss of income etc.



“For the more complex projects such as large scale volumetric modular schemes, it is highly recommended you involve key construction and property insurers early in the design stage.

*Due to the separation between the construction and property insurance markets, encouraging greater synergy between the two sectors is essential for larger schemes, especially refurbishments. If you have an existing building and are performing low value, non-structural, touch-up type works, from a cost and efficiency point of view this is probably best covered by your existing property insurers.*

*However, when going north of £2.5-5 million of works, the property insurance market would step away. In which case, you would need to arrange a project insurance policy taken out by the developer or utilise the contractor’s policy.*

*As mentioned earlier getting property insurance is possible for MMC buildings but like construction insurance, it can be more expensive with a possible 10-20% increase on premiums.”*



## How easy is it to obtain insurance on MMC projects?

### Case Study - The Forge



Neil Pennell  
Landsec

Neil Pennell, head of design, innovation and property solutions at Landsec, said in his main experience of using MMC at scale from working on The Forge (a large-scale new build commercial office development that utilised a 2D panelised, kit-of-parts form of MMC) which used a steel and concrete structure, there weren't any problems obtaining construction insurance as these materials are considered as standard. Neil also noted that he doesn't anticipate there to be any issues once the building is completed and moved to a group insurance scheme.

Difficulties tend to arise if insurers perceive the building to be far from the norm, but most of the MMC Neil has been involved with has focused on using traditional materials albeit in innovative ways - adding processes, standardisation and creating reusable solutions. However, he did raise the point that because more work is being done offsite with MMC, there is a greater need to insure the materials offsite and at an earlier stage of the construction process.

Some early versions of MMC were a challenge for insurers because they were unfamiliar with the method of assembly. There were also potential

issues with things like hidden voids and gaps in the façade. Once these issues had been ironed out and the sector moved towards a more componentised approach MMC no longer raises issues for the insurance market, because even though the methodology is different, the end-product being insured is recognisable.

In fact, it was suggested that many insurers hold MMC in high regard. The repeatable processes involved reduce reliance on workmanship on site and can increase accuracy/consistency. Once insurers understand how MMC is being delivered, insurers feel that MMC is a less risky proposition and potentially more insurable.



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### What is the best way of procuring project insurance?

Many employers and developers opt to go down the 'owner controlled' route (ie an owner-controlled insurance programme or 'OCIP') as opposed to utilising the contractor's policy or letting the contractor lead the procurement. This is because an OCIP brings about coverage certainty and consistency, control of claims, avoidance of disputes, reduces issues in the event of contractor insolvency and the ability to protect the developers anticipated revenue.

An OCIP is a bespoke set of insurances designed to suit the needs of all parties involved in the project. It provides focus on the developer's insurable risks through conversations with their insurance advisors and brokers. It can also look at uninsurable and retained risks, and what contractual or onsite risk mitigation measures can be adopted. OCIP doesn't really change the contractor's responsibility for the site or meeting excesses, but a crucial point is that all sub-contractors and parties benefit from the same broad level of cover which does provide consistency. Investors, lenders, freeholders and tenants can all be specifically named under an OCIP which can be an advantage.

### Structural timber and insurance

Obtaining insurance is often impacted by the materials chosen. For developments using structural timber The Structural Timber Association's (STA) latest [guide](#) highlights key considerations when insuring mass timber buildings. You can find out more on this topic in [G&T's Mass Timber Forum](#).



## Underwriting considerations for MMC products when providing insurance

MMC technology can vary significantly between different manufacturers of volumetric/modular solutions. Long-term relationships are therefore key as switching providers can be complicated.



Some practical considerations that insurers like to see during the construction phase include:

- 01** An experienced main contractor who is Build Offsite Property Assurance Scheme (BOPAS) accredited
- 02** A clear understanding of the responsibilities during the factory stage and transit to site, and when the risk starts/ends
- 03** Details of onsite storage prior to use or installation (knowledge of length of storage time, measures for weather protection etc)
- 04** Consideration of the modular production facility (eg, where it is, whether there is more than one in case of an issue, the security of the facility)
- 05** Practical information and details about the modular unit's lifecycle
- 06** Where possible use an integrated supply chain, where the main contractor and supplier are related

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## 8. THE MANUFACTURING PROCESS

# THE MANUFACTURING PROCESS

## What is a MMC process?

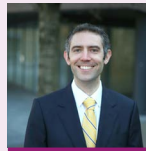
MMC is about both products and processes. Like with any industry, if you are going to manufacture something, you want to make sure its manufactured to a high standard.

MMC provokes a shift in the design process where a lot of what would traditionally happen at RIBA Stage 4 would need to be brought into Stage 3 when using MMC.

This is because you need to know, for example, what penetrations are going in walls, where valves need to be on riser systems etc. This then gets driven through a 3D-modelling or a 'common data' environment. These live models can be used to start manufacturing.

Lead times for standard/typical products can be around 12-16 weeks. This gives factories enough time complete their fabrication drawings, seek stakeholder approval and manufacture the product. This period can be shortened if the models are set up correctly at the front end, but it can also increase if buffer stock is required.

However, because MMC drives earlier coordination many of the challenges can be mitigated against further down the line towards the back end of delivery compared to traditional construction.



Andrew Shepherd  
TopHat

### Focus: TopHat's approach to new product development

Andrew Shepherd explained that TopHat, a UK leader in technology-driven modular housing, is different to most other manufacturers in the MMC world as they sell a product. TopHat have 22 different types of houses and seven different apartments that they sell, and customers are asked to pick from the product range they have in place. However, there is an infinite amount of choice within these product ranges and using 3D printing, they are able to create any type of external façade and change things like windows and general layouts etc.



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## 9. HEALTH & SAFETY

## HEALTH & SAFETY

### This issue of safety when using a performance-based design approach



Raj Kotecha  
Laing O'Rourke

MMC can give you an opportunity to engineer in better safety. Factors of safety have ended up in design codes to deal with onsite variability and variation. However, with MMC, because the processes are factory-controlled, it's possible to reduce those Factors of Safety.

Raj Kotecha gave the example of the design of precast products. If you can demonstrate the consistency of your mixes (eg what confidence intervals the strength falls into or that the placement of your rebar is within certain tolerances), you can reduce your material and partial safety factors in design. Raj said that precast columns, for example, generally yield about a c.20% reduction in the amount of steel required, also helping us move towards a net zero future.

“MMC isn't about eliminating Factors of Safety and making things less safe – its more about leveraging factory-controlled processes to make the design more performance-based.”

### MMC: A Building Control perspective

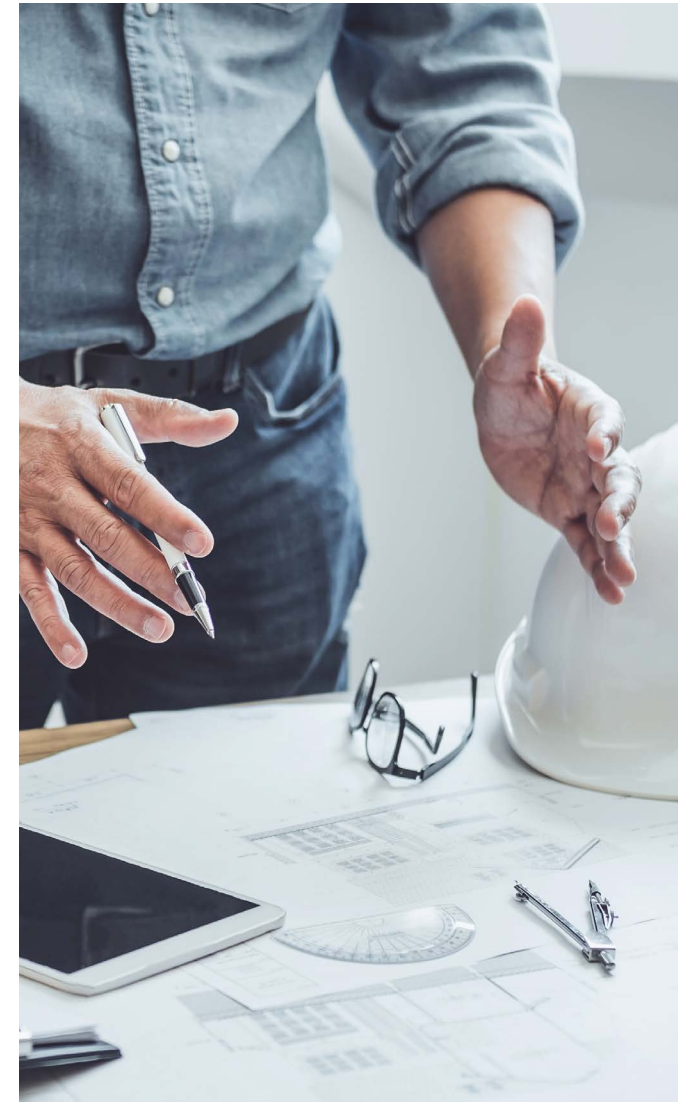


Mark Pundsack  
City of London,  
Building Control

Building Control is still learning how to deal with MMC, but the laws and regulations are no different for MMC products. It's not how you make the building but the outcome that is important.

The guidance that goes alongside this (ie the Approved Documents) are for common types of buildings, but if we're going to drastically change the way we build things, the guidance we have may not be appropriate. This would need further consideration. MMC projects need to think about the guidance they are using and whether it's appropriate for the methodology being used. As MMC starts to gain more traction, Building Control will need to ask this question and adapt as necessary.

Early engagement with Building Control is important. MMC projects often engage with Building Control too late in the process, particularly given that a high degree of certainty is needed before pressing 'go' on manufacture. If you take construction away from the site environment where Building Control would have looked at certain elements and move this to a factory environment, you need to consider that Building Control may need to visit the factory to inspect these bespoke building components. This has already been done to a certain extent on some projects, inspecting pre-cast works on fabrication yards in order to gain the confidence that what is going into the buildings will be compliant.



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# 10. LOGISTICS & TRANSPORT

## LOGISTICS & TRANSPORT

The aim of MMC is to build faster, better, cheaper, safer and greener buildings according to Neil Pennell. Despite the poll result (see section 2.2, above) which indicated that only 3% thought that delivery and logistics was the biggest challenge for MMC projects, if you're going to build faster you need to understand that materials and large components are going to be going to site in a shorter space of time. When managing this workflow process onsite and optimising it to maintain pace, careful consideration

needs to be given to things like the forklifts to unload the lorries, the tower cranes and the material hoists.

True logistics control and a real-time understanding of information underpins successful MMC projects. Many of our panellists noted that certain MMC projects failed because the logistics delivered manufactured items too early and the site simply wasn't ready. Subsequent exposure to the elements would then damage these items. Equally, if panels haven't been delivered to site in time for when workers are ready for them, the benefits of MMC can be diluted. In short, many panellists believed logistics to be the next important frontier - one that can glue together the onsite and offsite work.



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## 11. INCENTIVES, INVESTMENT AND THE ROLE OF GOVERNMENT

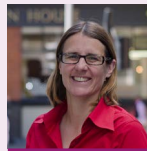
# INCENTIVES, INVESTMENT AND THE ROLE OF GOVERNMENT

## Current market incentives for adopting MMC

There are currently no tax reliefs for using MMC, however there is some encouragement in the market. Under the Government's Homes England development programme, there is a pre-manufactured value (PMV) component for bids in the current bidding round (with 55% PMV as the minimum threshold). This is driving the adoption of closed panel systems/pods in this market.

It was emphasised that the progress made in the MMC market so far hasn't come about from Government incentives or subsidies. It's been driven by market demand in key sectors including the hotel, student accommodation, private rental sector (PRS) and build to rent (BTR). Institutional investors operating in these sectors see all the benefits (such as greater certainty, improved sustainability) that can be realised through MMC.

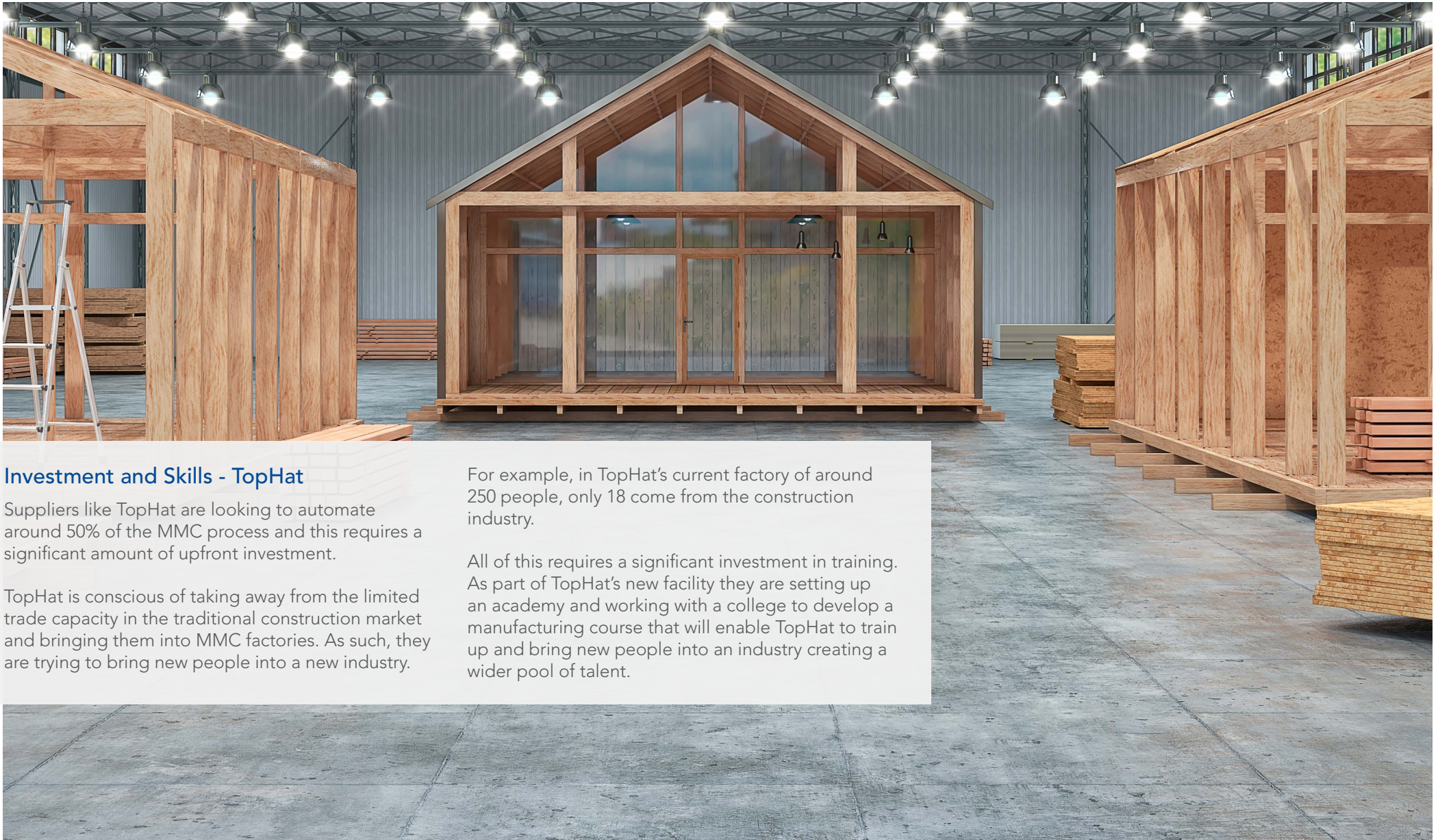
Introducing incentives for institutional investors would make it a little easier for these investors to adopt MMC, but that it was really their own ESG goals rather than Government policy that is encouraging MMC growth. In fact, many institutional investors believe we need to out-perform the Government's sustainability regulations and policy. The panellists agreed that the Government could be doing more to encourage the use of MMC in both frameworks and the development pipeline, and that this would ultimately support factories in their growth and development phase. Having a visible pipeline means that MMC manufacturers can then go to the investment market to secure finance for expansion.



Helen Cuthbert,  
Planning Potential

### Policy Focus:

Helen Cuthbert, managing director at Planning Potential, suggested the industry could do with the Government putting a focus on MMC through policy documents. Currently, the sector is waiting for a new National Planning Policy Framework (NPPF) that covers MMC. This would allow Local Authorities to point to policies that encourage MMC development. Furthermore, Helen added once the traditional housebuilders increase their MMC efforts and Local Authorities become more familiar with MMC, we'll see a big change in momentum.



### Investment and Skills - TopHat

Suppliers like TopHat are looking to automate around 50% of the MMC process and this requires a significant amount of upfront investment.

TopHat is conscious of taking away from the limited trade capacity in the traditional construction market and bringing them into MMC factories. As such, they are trying to bring new people into a new industry.

For example, in TopHat's current factory of around 250 people, only 18 come from the construction industry.

All of this requires a significant investment in training. As part of TopHat's new facility they are setting up an academy and working with a college to develop a manufacturing course that will enable TopHat to train up and bring new people into an industry creating a wider pool of talent.

### What skills are needed to build MMC?

With MMC, you cannot underestimate the people element. Well-trained, knowledgeable people make a big difference to any construction project and MMC is no different. You need people that are committed to innovation, but there is also a degree of re-skilling and training required in order to be able to use these automated processes and methods. However, panellists were optimistic that the workforce can pick up these digital competencies quickly.

One of the key drivers behind this shift towards a manufacturing-led approach is to offset endemic skill shortages in a growing industry. Enabling this, however, requires a whole new set of technical skills (eg digital literacy) for the factory floor as well as a host of softer skills (such as more collaborative behaviours). MMC will undoubtedly require a change in the requisite skill set and knowledge-base and this is something the sector will have to tackle as the adoption of MMC increases.

There is a need to educate the onsite team and trades in how to deal with the larger MMC components. It's very important that everyone onsite is in tune with what is going on. However, there is currently not enough investment to build the skills needed to deliver MMC. One reason for this is that the industry has historically had to deal with relatively small margins which left limited funds to train staff. Fortunately, there is a trend towards greater investment in MMC and there are several programmes in the pipeline to support companies looking to invest in staff training.

### Are Local Authorities talking about MMC at planning stage?

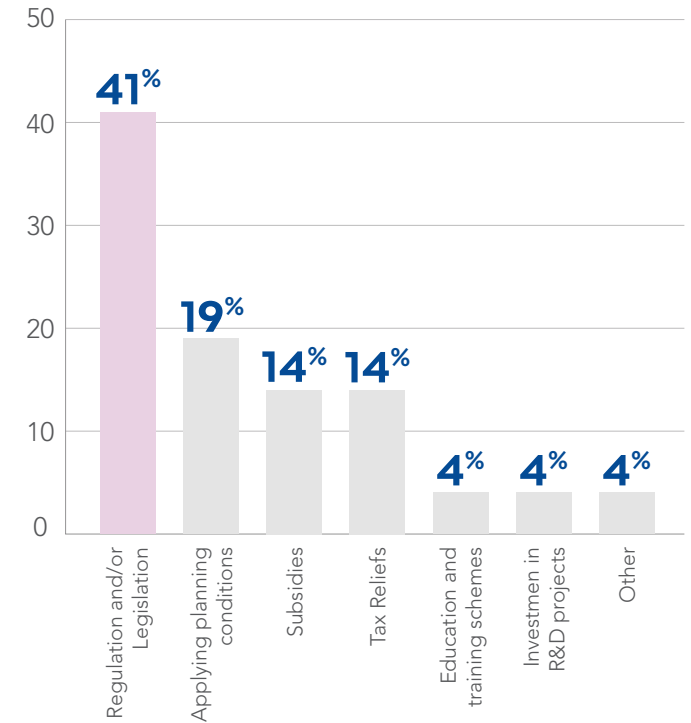
Local Authorities (LAs) are talking about MMC but not as much as they could be and this is mainly because the current guidance doesn't give LAs a clear steer on planning.

In the National Planning Policy Framework (NPPF) – no reference is made to MMC. MMC does feature very briefly in the National Design Guide with just a single reference, but it means stakeholders are working with LAs that may not know about MMC. With a lack of understanding and experience in dealing with this type of construction, LAs would be unable to confidently encourage it.

It was suggested that the best way to tackle the challenge of education is to take councillors to visit completed MMC projects – preferably ones that are similar in nature to the one being proposed. This helps reassure LAs because with many MMC projects, it's hard to tell whether they are manufactured offsite or not as they don't look like different buildings. MMC manufacturers go to a lot of trouble to ensure that this is the case. Once reassured, LAs become more welcoming of MMC and the benefits it can yield (such as quicker delivery, less local traffic, noise, pollution and disruption). These benefits are very positive from a LA perspective, but it's important that they are brought along the journey.

Another challenge is that LAs often require various local employment conditions to be met in order for planning to be granted. Meeting these social value responsibilities tend to necessitate the use of local apprentices and supply chains so that the benefits of the build are felt locally. These localised policies tend to challenge offsite construction systems, despite providing wider employment benefits nationally and assisting with the levelling-up agenda.

### Poll Question: How could the Government and other agencies best support the increased uptake of MMC?



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## 12. LESSONS LEARNT

## LESSONS LEARNT

### Other Industries



Jamie Hillier  
Akerlof

*“There is plenty we can learn from other industries (car manufacturing and aerospace), both good and bad. One of the key lessons is to ensure that organisations are clear on what they are trying to achieve and apply MMC as a strategic decision to do so. MMC needs to be recognised as an enabler, suitable in select contexts, not an outcome in itself.”*



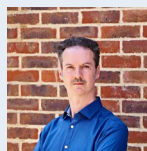
Gavin White  
Ramboll

*“Key takeaways from other industries are digitisation and automation. Standardisation allows us to do both these things and improve our productivity.”*



Chris Spiceley  
Modulous

*“We can learn a lot from the post war shipping container industry, and how it was revolutionised by the introduction of the standardised intermodal container (or ISO). ISOs took shipping from flat rates of productivity and fragmentation to new levels of efficiency. We can take this basic principle of standardisation as a way of informing wider thinking within the construction industry.”*



Rory Bergin  
HTA Design LLP

*“A lot of MMC is about logistics and getting products from one place to another. Take London as an example - instead of working out how to bring products into London from a factory possibly many miles away and then storing them, it makes more sense to create a buffer zone of materials close to a site in order to mitigate against traffic delays and maximising efficiencies in the logistics.”*



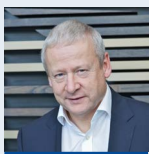
Peter Goring  
Mace

*“Mace’s MMC methodology is an “optimised logistical solution” focused on how you bring the components to site. Sometimes it costs nearly as much to deliver the components to site as it does to make them. Unlike car manufacturing, every building is almost like a prototype, and each is slightly different.”*



“

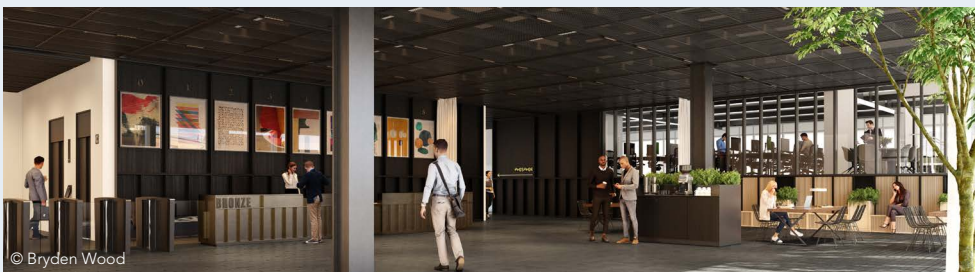
*On the ground...*



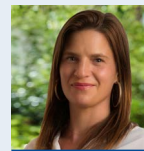
Neil Pennell  
Landsec

*“The Forge is a great example of a project that has successfully applied a DfMA approach. There are many others worth noting including infrastructure projects such as Crossrail, large residential projects delivered by Mace using their ‘rising factory’ concept (a six-storey ‘jump factory’ built around a tower to create an indoor construction site) and Laing O’Rourke has implemented a Platform Approach to Design for Manufacture and Assembly (P-DfMA) on some of its projects such as Everton Football Club’s new stadium.*

*It’s time for the principal contractor’s role to change and evolve in light of MMC. Logistics will be a big part of this.”*



© Bryden Wood



Emily King  
ESS

*“Best practice is collaboration and communication, including all stakeholders and ensuring you’ve got all the right people around the table from the outset. This is how you deliver an MMC project that works and realises all the inherent benefits from adopting this methodology.”*



Craig Liddell  
Binderholtz

*“Successful MMC projects include Murray Grove (a nine-storey CLT project) and Dalston Works (the largest CLT project globally on completion) – but North America and the Nordic countries are still leading the way. I’m having more conversations about building repeatable MMC components and would expect to see more of this in the future.”*

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## 13. SUMMARY AND CONCLUSION



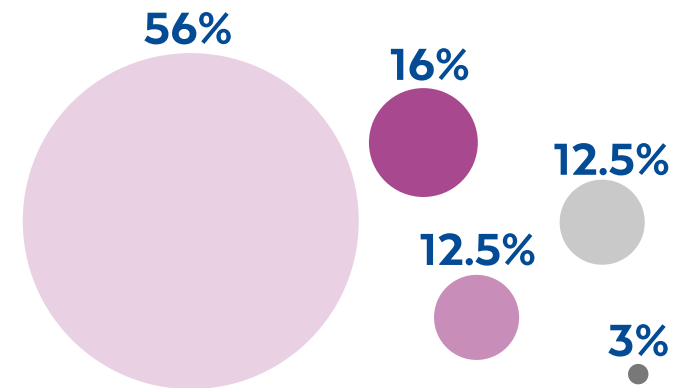


## SUMMARY

Overall both the audience and panellists believe MMC brings significant opportunities for the future of the industry, through increased efficiencies which can help to speed up the production of complex structures.

*Audience Poll: What is the prime opportunity when using MMC?*

- Efficiency in Programme
- Carbon Reduction
- Quality Control
- Waste Reduction
- Health and Safety





## KEY CONSIDERATIONS

What advice would our panellists give to those looking to build using MMC?

**01** Early engagement

**02** Communicate and collaborate

**03** When considering cost think about the whole system

**04** Work with people who demonstrate a vision to lead the process

**05** Be involved in the design process

**06** Understand the different types of MMC available early on

**07** Allow insurance underwriters time to consider the risks

**08** MMC can provide greater cost certainty over traditional building techniques



## CONCLUSION

At the end of our three-part series we concluded that early engagement with the supply chain and wider project team was vital for success, helping to align both design and delivery as well as maximising efficiencies within the programme.

The chosen procurement route can also have an impact on the success of MMC developments and considering an alternative approach to support early engagement can help alleviate challenges faced at the later stages of a project.

Finally, education for all project team members can mitigate against key issues in the factory and onsite, with greater investment in R&D and Government incentives needed to encourage greater uptake across the industry.

*“ We would like to thank everyone who has supported this series including all of our panellists and contributors who have helped to make it so successful.”*



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# APPENDICES



## APPENDIX

14.1



MMC Team Overview

14.2



Panel Overview

14.3



Glossary of Terms

14.4



Useful Resources

## G&T MMC TEAM OVERVIEW



MATT HOLMAN  
HOST



OLIVER BOOTH  
HOST



JESS PENNELL  
SERIES COORDINATOR



JACK LEWIS  
SERIES COORDINATOR



DANNY DAVIES  
SERIES COORDINATOR



LAURA LE BOUTILLIER  
COMMUNICATIONS



MICHAEL URIE  
MARKET ANALYST

# DESIGN AND OFFSITE MANUFACTURE PANEL OVERVIEW



ANDREW SHEPHERD  
TOPHAT



CLAIRE MCANALLEN  
TIDE CONSTRUCTION



GAVIN WHITE  
RAMBOLL



JAMIE HILLIER  
AKERLOF



RAJ KOTECHA  
LAING O'ROURKE



CHRIS SPICELEY  
MODULOUS

# PLANNING AND PROCUREMENT PANEL OVERVIEW



MARK PUNDSACK  
CITY OF LONDON/  
BUILDING CONTROL



PETER GORING  
MACE



RORY BERGIN  
HTA DESIGN LLP



TIM UTTLEY  
JRL CALEDONIAN  
MODULAR



HELEN CUTHBERT  
PLANNING POTENTIAL



GRAHAM KNIGHT  
GARDINER & THEOBALD



## ONSITE CHALLENGES AND BUILDABILITY PANEL OVERVIEW



CRAIG LIDDELL  
BINDERHOLZ



EMILY KING  
ESS



NEIL PENNELL  
LANDSEC



SAM HILLER  
GALLAGHER



KOTEY NIKOI  
POLLARD THOMAS  
EDWARDS



JAIMIE JOHNSTON  
BRYDEN WOOD

## 14.3 Glossary of Terms

**Build to Rent (BTR)** - specifically designed privately rented residential properties

**Building Information Modelling (BIM)** - a process that uses technology to generate digital representations of a construction project

**Cross Laminated Timber (CLT)** - a product that uses planks of sawn, glued and layered wood, with each layer perpendicular to the previous

**Design and Build (D&B)** - a procurement route where the main contractor is appointed to both design and then construct the project

**Design for Manufacture and Assembly (DfMA)** - a design approach that focuses on assembly, optimising the design to achieve efficiencies onsite

**Digital Twin** - a digital representation of the built asset

**Environment, Social and Governance (ESG)** - a framework designed to consider ways that value can be created on behalf of all stakeholders

**FAC-1 Contract** - a new type of contract that connects and integrates multiple two-part contracts

**Glue Laminated Lumbar (Glulam)** - an engineered product where a number of wood laminates glued together

**Heavy Goods Vehicles (HGVs)** - lorries with a gross combination mass of over 3,500kg

**Internet of Things (IoT)** - physical objects with sensors, processing ability, software and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks.

**JCT Contract** - standard forms of building contracts relating to all procurement routes that parties can use to document their construction projects.

**Key Performance Indicator (KPI)** - a quantifiable measure of performance over time for a specific objective

**Kits of Parts** - a set of pre-engineered components, assemblies and/or products design via DfMA principles

**Laminated Veneer Lumbar (LVL)** - an engineered wood product that uses multiple layers of thin wood assembled with adhesives

**Light Commercial Vehicles (LCVs)** - a commercial carrier vehicle with a gross vehicle weight of no more than 3.5 tons

**Local Authorities (LAs)** - governing bodies responsible for a range of vital services for people and businesses in defined areas

**Modern Methods of Construction (MMC)** - also known as Smart Construction and often used to describe innovative approaches to building

**National Planning Policy Framework (NPPF)** - sets out the Government's planning policies for England and how they are expected to be applied

**Net Zero Carbon (NZC)** - refers to the balance between the amount of greenhouse gas produced and the amount removed from the atmosphere

**NEC 3/4 Contract** - contract types where under the NEC3, the contractor had the option of submitting a payment application, with no penalty if they chose not to do so. The NEC4 places a positive obligation on the contractor to submit a payment application to the client

## 14.3 Glossary of Terms

New Prison Programme (NPP) - a scheme where the Government has committed over £4 billion to make significant progress in creating 18,000 additional prison places across the prison estate by the mid-2020s, through a combination of new builds, as well as extending, refurbishing and maintaining other prisons

Offsite Manufacturing (OFM) - the design, planning, manufacture and pre-assembly of construction elements or components in a factory environment

Owner Controlled Insurance Programme (OCIP) - is a business practice that consolidates insurance liability for construction projects, where an insurance policy held by a property owner during the construction or renovation of a property

Platform approach to Design for Manufacture and Assembly (P-DfMA) - a rules based approach to design that uses standardised components and process to maximise efficiencies

PPC 2000 - a pathway for the partnering process. It creates a single contractual hub that allows all team members to contract on the same terms

Pre-Construction Services Agreement (PCSA) - contracts that enable clients to employ contractors before the main contract for the construction of the works has been awarded

Pre-Manufactured Value (PMV) - the financial proportion of a construction project's Gross Construction Cost derived through pre-manufacturing

Private Rented Sector (PRS) - a classification of housing in the UK. The basic Private Rented Sector definition is property owned by a landlord and leased to a tenant

Research and Development (R&D) - is the set of innovative activities undertaken by corporations or governments in developing new services or products, and improving existing ones

Royal Institute of British Architects (RIBA) - a professional body for architects founded for the advancement of architecture under its royal charter granted in 1837

Small and Medium Sized Enterprises (SMEs) - any organisation that has fewer than 250 employees and a turnover of less than €50 million

Structural Timber Association (STA) - an organisation that aims to enhance quality and drive product innovation through technical guidance and research, together with growing the market for structural engineered timber systems.

Volumetric - large building elements linked together to form complete buildings without the need for additional superstructure

## 14.4 Further Reading

### MMC Webinar Recordings

Session 1, Design and Offsite Manufacture:  
<https://www.youtube.com/watch?v=IQqQk4Crag0&list=PLrFwHvNZGKkEP6s-YVK8znYc2bD4mobn5>

Session 2, Planning and Procurement:  
<https://www.youtube.com/watch?v=wZHtrAzsGqU&list=PLrFwHvNZGKkEP6s-YVK8znYc2bD4mobn5&index=2>

Session 3, Insurance Onsite Challenges and Buildability:  
<https://www.youtube.com/watch?v=gofHOY9w24c&list=PLrFwHvNZGKkEP6s-YVK8znYc2bD4mobn5&index=3>

### MMC Discussion References

Session 1, Design and Offsite Manufacture:  
<https://marketintel.gardiner.com/g-t-launches-modern-methods-of-construction-webinar-series>

Session 2, Procurement, Planning and the Role of Government:  
<https://marketintel.gardiner.com/mmc-series-procurement>

Session 3, Insurance, Onsite Challenges and Buildability:  
<https://marketintel.gardiner.com/modern-methods-of-construction-series-insurance-onsite-challenges-and-buildability>

### Reports

Mass Timber Office Forum - Summary Whitepaper:  
<https://marketintel.gardiner.com/mass-timber-commercial-developments-what-do-you-need-to-know>

MMC and Social Value Guide:  
<https://www.architecture.com/knowledge-and-resources/resources-landing-page/dfma-overlay-to-the-riba-plan-of-work#:~:text=The%20dfMA%20Overlay%20to%20the,new%20build%20sectoral%20building%20types>

Structural Timber Association's Insurer's Guide to Mass Timber - <https://timefortimber.org/wp-content/uploads/2021/01/STA-Insurers-Guide-to-Mass-Timber-FINAL-2.pdf>

The Platform Rule Book -  
[https://constructioninnovationhub.org.uk/media/rp2i3lfb/the-product-platform-rulebook\\_edition-1.pdf](https://constructioninnovationhub.org.uk/media/rp2i3lfb/the-product-platform-rulebook_edition-1.pdf)

The Private Sector Construction Playbook -  
[https://media.bethebusiness.com/documents/5195\\_Construction\\_Brochure\\_SinglePgs.pdf](https://media.bethebusiness.com/documents/5195_Construction_Brochure_SinglePgs.pdf)

Further Glossary of Terms -  
<https://akerlof.co.uk/glossary>



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