

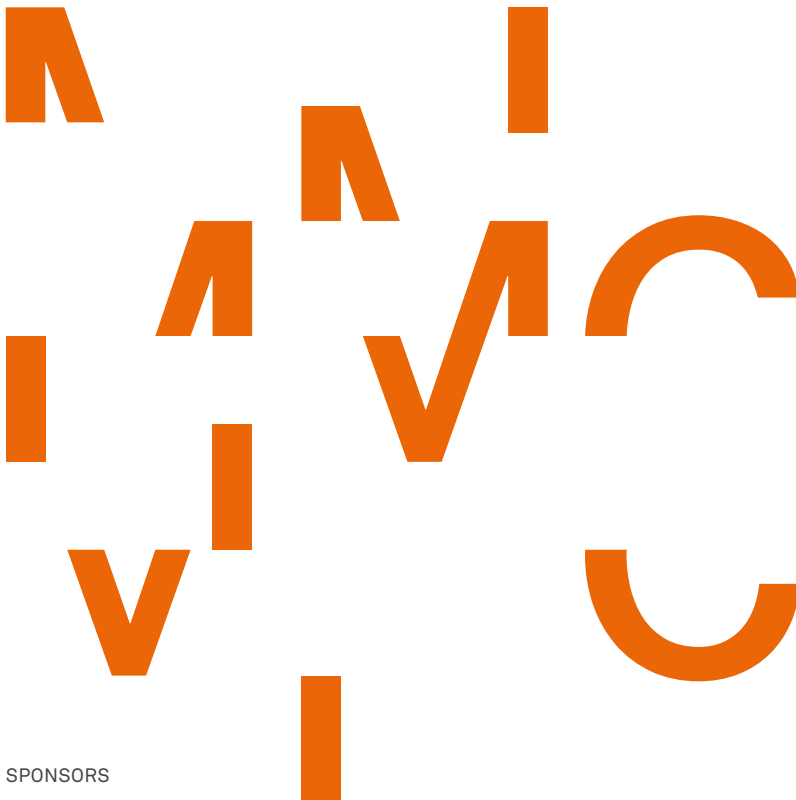


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MMC for affordable housing developers

A Housing Forum guide to overcoming challenges and barriers

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If you are interested in joining The Housing Forum, please contact the Chief Executive:

shelagh.grant@housingforum.org.uk
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The views in this report are the views of The Housing Forum and have been contributed from working group discussions.



FOREWORD

Mike Fairey, Director, Fusion Building Systems and Board Member, The Housing Forum

For those of us who have been involved in manufacturing off-site solutions for a number of years, the renewed interest in modern methods of construction (MMC) for residential development is to be welcomed. The Housing Forum's MMC Working Group brought together experts from all areas of the supply chain - architects, manufacturers, contractors, consultants, housing associations, trade bodies, and government - to examine the challenges affordable developers face when adopting new methods.

The result of our work is this guide, which aims to encourage and provide practical advice to clients considering adopting an off-site approach to delivery, and to affordable housing providers in particular. It proposes a set of principles to help overcome some of the basic hurdles around procurement, design and delivery and provides examples of good practice.

I'd like to thank all who contributed to the report, in particular those who provided case studies and the sponsors who contributed financial support for the publication.



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Introduction

Why a Housing Forum guide to modern methods of construction?

If ever there was a time and a need to embrace more productive construction methods, that time is now.

Modern methods of construction (MMC), the catch-all phrase for non-traditional means of building, including major housing elements produced off site in factories, is not a new concept. As well as being associated with post-war housing development it was strongly advocated by Sir John Egan in his 1998 report *Rethinking Construction*, which suggested that the industry as a whole is under-achieving, and called for “dramatic improvements”.

Some of the key drivers for the adoption of MMC have converged in recent years and they now make MMC a feasible, attractive and efficient option for the residential sector.

The main factors and drivers are:

Political and regulatory

- A greater onus on building safety and accountability in the new regulatory regime being introduced by government following the review from Dame Judith Hackitt of the Grenfell fire: MMC can provide both.
- Government’s commitment to 300,000 homes a year: MMC offers speed and efficiency in a time of labour shortages.
- Renewed political focus on the quality of new build homes following an outcry from the public and MPs about shoddy workmanship: quality and precision can be higher in factory-built homes.

“ Last year, housing associations spent £10.7 billion on new build. The construction industry is atomised, with an over-dependence on trade skills, under-capitalisation and poor productivity growth compared to other industries. With this level of investment in affordable housing there must be more that could be done to improve efficiency, quality and value for money. ”

Economic and social pressures

- The need for greater productivity in construction.
- An ageing, shrinking construction workforce, exacerbated by the impact of Brexit and the drift to other markets of labour from Eastern Europe.
- The arrival of new institutional investor entrants into the residential market who are typically private landlords in the sector for the long term, looking to build out developments in single phases, rather than phased over time. This trend plays to the strengths of MMC.

Technological advances

- Advances in digital technologies, such as building information modelling (BIM), are delivering increasing efficiency and flexibility, creating manufacturing blueprints from architects' designs.

Many of these technological advances were highlighted in *Modernise or Die*, Mark Farmer's 2016 review of the UK construction industry, which among other things presented MMC as one of the key solutions to dealing with a construction sector heading into the 'perfect storm' of challenges and problems.

What has always been important to most clients is the end product of a building which meets employers' requirements and building regulations, and is delivered at the right time and the right price. The actual construction method is often of less concern as long as the end product comes with a warranty and can be used as loan security.

There are now very good reasons why this client mind-set is changing. Effective use of MMC offers the following additional benefits to the client:

- It can be delivered more quickly than traditional construction, sometimes removing as much as 12 months from a build programme. This allows rents and sales to be collected earlier and has a positive impact on cashflow.
- Disruption to local residents is minimised, thanks to fewer deliveries on site over a shorter period of time.
- More of the build than with traditional methods is carried out under factory conditions so quality is consistent and defects can be minimised. This reduces the building's maintenance costs.
- As-built thermal performance is improved, producing more sustainable buildings and lower energy bills for residents.

John Synnuck,
Chief Executive,
Swan Housing Group

“ We believe that off-site construction methods will enable us to deliver these much needed homes quickly, designed to a high specification and with reduced impact on both local residents and the environment. ”

Whatever route an organisation chooses, in order to get the benefits of MMC, it has to be prepared to do things differently. This means change and that can be daunting.

This guide will help with that change.

Organisations are adopting different strategies to realise these benefits. Swan Housing Group and Accord have developed their own manufacturing facilities. Home Group has created an Innovation Village in Gateshead with a range of different technologies. Network Homes has partnered with Laing O'Rourke and Stanhope. Others are looking to procure as consortia and through the NHF the Building Better initiative is looking to both agree standard products and consolidate demand.

And it's not just large housing associations adopting MMC: Raven Housing Association in Surrey and RHP (formerly Richmond Housing Partnership) in west London, have also started to develop off-site schemes.

As we will explore in this guide, despite MMC's growing acceptance there are still challenges to surmount. It is vital to choose a system and a manufacturer with care, to adopt the right procurement approach and to ensure that the whole organisation has bought into the potential advantages. Additionally, it is essential that mortgages are available for MMC homes, that finance can be secured against an MMC portfolio and that ongoing maintenance requirements have been taken into account.

The basics

What MMC involves, and what developers need to think about

There is a wide variety of epithets for MMC: they include off-site manufacture, smart construction and precision-manufactured homes. When government uses the term, it refers to a combination of factory-built elements and digital processes.

The categories set out by The Housing Forum's working group to frame the spectrum of MMC are divided into seven categories, and have been taken from those adopted by the Ministry of Housing, Communities & Local Government (*for more information see page 7*). This is a range of approaches that encompasses off-site, near-site and on-site pre-manufacturing, process improvements and technology applications.

Categories one to five define the off-site and near-site pre-manufacturing processes, while categories six and seven cover traditional site-based construction.

Category 1. Pre-manufacturing [3D primary structural systems] (components entirely factory produced and assembled).

Category 2. Pre-manufacturing [2D primary structural systems] (generally panelling, walls, floors, stairs and roofs as basic frames).

Category 3. Pre-manufacturing components [non-systemised primary structure] (components manufactured but not assembled off site, eg, floor slabs, columns and beams).

Category 4. Additive manufacturing [structural and non-structural] (including 3D printing).

Category 5. Pre-manufacturing [non-structural assemblies and sub-assemblies] (eg, volumetric podded assemblies and bathroom pods).

Category 6. Traditional building product-led site labour reduction/productivity improvements (traditional products cut to size, eg, walls, brick slips and pipework).

Category 7. Site-process-led, site-labour reduction/productivity/assurance improvements (robots and drones used on site).

McKinsey & Company
Capital Projects &
Infrastructure
Modular construction:
From projects to products

“ Our analysis suggests that leading real estate players that are prepared to make the shift and optimize for scale will be able to realize more than 20 percent in construction cost savings, particularly as everyone involved moves up the learning curve. ”

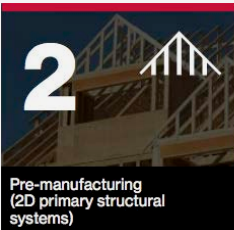
In the popular psyche, homes manufactured off site call to mind the post-war ‘prefabs’. However, there is no comparison between those and the products on offer today, which are often better quality than contemporary traditional build, can be covered by warranty and are expected to have a similar lifecycle.

One of the main reasons affordable housing developers have been slow to adopt MMC is not to do with style, quality or longevity, but rather their ‘if it ain’t broke’ approach to traditional construction methods. There has also been a reluctance to change the design and build contracts by which most homes are procured, and these are not compatible with MMC. There is concern, too, about the availability of mortgages for MMC and the willingness of landlords’ lenders to accept the properties as security against development finance

These impediments are now being re-evaluated in the face of the diminishing capacity of the construction sector to deliver a quality product using the traditional model, as highlighted in recent reports from The Housing Forum.

The pioneers of MMC see two main benefits to its adoption - quality and speed. But they recognise that no one element of the MMC mix will be uniformly appropriate for all sites, geographies and building types. Acknowledging this, in London the GLA has commissioned an online tool called Prism which will help with identifying what methods are most appropriate for any particular project.

We believe effective deployment of MMC is a way to future-proof housing supply, speed up delivery, reduce defects, improve as-built performance and reduce maintenance costs. And as the industry matures, there is a good chance build costs will come down significantly.



At the end of 2017, the UK government launched a cross industry working group tasked with supporting the mortgage finance, insurance and valuation communities in better understanding and supporting the greater use of MMC across residential development.

That working group has been developing various outputs, one of which is a new categorised definition framework for different forms of innovative construction methodologies. The intention is for this framework to regularise and refine the term 'MMC' by defining the broad spectrum of innovative construction techniques being applied in the residential market, both now and in the future.

For more information visit:
www.cast-consultancy.com

Exploding the myths

Public procurement, contractual structures and MMC

With thanks to Katie Saunders, David Cordery and Rebecca Rees, Trowers & Hamlins

Where to start

Ensuring compliance with the public procurement regime is one of the recurring concerns raised as a reason preventing public sector bodies from embracing the use of MMC. Primarily this is because it can be confusing to understand how the Public Contracts Regulations 2015 apply to what is actually being procured. There are a number of routes to consider before settling on a procurement method.

Supplies-only contract

Where the client has the resources and experience (either in-house or via existing third-party contractors and consultants) to manage the logistical and technical complexity of the modular build on site, then it can use a supply-only route to procure. If the total contract value exceeds £181,302 it must be publically advertised.

Procure a main contractor

Alternatively, if a client wishes to procure a contractor to take responsibility for the design, manufacture, delivery and installation of the units, then it is more likely this would be classed as a public works contract. If the works value exceeds the defined financial threshold of £4,551,413 exclusive of VAT, it should be publically advertised.

Procure a manufacturer and trade contractor

As another option, the client could procure a manufacturer direct and select trade contractors to undertake the groundworks and installation and use a construction manager/project manager to provide advice and monitoring assistance to deliver the project. This is likely to involve a combination of supplies, works and services contracts, and the correct classification will depend on the primary purpose of works, services and supplies. It may also require a number of linked procurements.

Once the client has decided what they need from the market, the public procurement regime can be harnessed to deliver its requirements in a cost-efficient, quality-driven manner.

The confusion over whether MMC can be adopted without legal challenge has also spawned a series of myths which have become accepted wisdom in certain quarters. The main myths, which have no foundation in reality, include the following assertions:

Myth 1: All MMC products are bespoke so cannot be compared

Many public sector client groups, including the GLA, are working on models to standardise design so that manufacturers can work to agreed design standards. This approach simplifies the route-to-market competitive comparison through a faster public procurement exercise via the Open or Restricted Procedures. Alternatively, more flexible procedures under the Public Contracts Regulations 2015, such as the Competitive Dialogue and Innovation Partnership procedures, as well as design competitions, will allow clients to work with a number of tenderers bidding on an output specification. This flexibility allows the collaborative development of a bespoke product.

The *Official Journal of the European Union* (OJEU)-compliant framework agreements can also be used for early engagement with framework members (contractors and/or suppliers and/or manufacturers) in order to develop an outline design for the project, which can then be market tested through mini-competitions run in accordance with that framework.

Myth 2: Public procurement is all about lowest price selection so if MMC is the more expensive option this is a barrier

There is evidence to suggest that in some instances the cost of an off-site method of construction (modular or panelised) will initially be higher than with traditional build methods. Nevertheless, overall feasibility studies carried out on schemes to ascertain viability have highlighted MMC benefits over traditional build such as:

- Lower lifecycle costs.
- Earlier revenue from rents and sales.
- The financial benefits of a higher-quality product and digital record, leading to reduced maintenance costs over the life of the asset.

It's clear from the Public Contracts Regulations 2015 that these benefits can be evaluated as part of a procurement process, which requires clients to select a quality/price evaluation that anticipates these non-price elements (eg ongoing maintenance costs).

Myth 3: The constraints of the public procurement regime mean you cannot create the sustainable long-term relationships which are needed to provide a consistent pipeline for the manufacturing industry

It is accepted best practice in the construction sector that creating collaborative relationships helps capture lessons learned on one project that are then taken forward by the team to the benefit of the next project. The same is true for those clients establishing their own manufacturing base, so that it can deliver off-site manufactured products with a consistent supply-chain and make efficiencies and improvements through iterative design development and manufacturing practice.

Public procurement is not a barrier to the creation and development of long-term relationships. Framework agreements and longer-term contracts set up by clients enable relationships to be developed over a longer-term period, thereby streamlining the requirements for full procurement exercises undertaken on individual projects.

One way to enable better collaborative working between the different parts of the project team is to use the Framework Alliance Contract (FAC 1). This creates relationships between clients and a series of manufacturers and suppliers and provides for an integrated supply chain. FAC 1 is recommended by the Construction Leadership Council as a model form for long-term strategic relationships for MMC and has been adopted by the Crown Commercial Services as its form of contract for its MMC framework.

A number of housing providers have also set up contractual and corporate joint venture arrangements with manufacturers to guarantee a sustainable pipeline and achieve the benefits of a collaborative approach to design and product development.

Myth 4: MMC may require forward funding and the public procurement regime is a barrier as clients cannot engage with the market at a sufficiently early stage

The Public Contracts Regulations allow and encourage early market engagement prior to commencing any formal procurement process. In fact, the regulations consider prior market engagement as an essential ingredient to a successful procurement. Clients are encouraged to approach and hold conversations and consultations with any operator ahead of a contract notice being published in the OJEU, provided that such conversations do not subsequently discriminate in favour of a particular

bidder or class of bidder. Such engagement can be used by the client to establish its procurement option, its route to market and detailed specification/approach to risk/contract terms etc.

Used properly and in a commercially sensitive manner, it can give the client useful access to the key market players/likely bidders, which can help shape the procurement and address any outstanding questions and concerns they may have.

Myth 5: MMC cuts across the social value agenda and its encouragement of using SMEs by re-locating construction jobs away from the local area

The Social Value Act encourages public sector housing providers to consider the social value to be delivered by tenderers but the social value deliverables/outcomes can be measured on a national basis, not just locally. Nevertheless, for a client who requires a locally-based social value offer, it is important to consider what locally-based social value outcomes it wishes to secure through its MMC procurement, and then use its ability to engage pre-procurement with its potential market in order to scope a set of social value requirements that are likely to be deliverable.

Despite this perceived difficulty, many MMC manufacturers and contractors are embracing the requirement for the provision of training, apprenticeships and employment proposals within their tenders. Under the Public Contracts Regulations, a client is able to take social value proposals into account in its overall evaluation model, although a more local provision cannot be preferred over a wider national offer.

Tension can be caused if the client requires local delivery of social value requirements when the

manufacturer is not based in the locality. Here, clients must decide if key outcomes in line with their community investment plan are achievable or not through the on-site part of the contract. If not, they can look to other contracts to deliver the required outcomes. Thus, a holistic approach to community investment and procurement can satisfy all parties.

The inclusion of MMC solutions as part of a development programme should encourage clients to take a strategic view of their social value requirements, which can encourage an organisation-wide, holistic and outcome-driven approach to social value, rather than a project-by-project assessment, which can limit the impact of the contract spend.

Myth 6: There is no standard form of construction contract which can be used for MMC projects

It is true that there is currently no standard form of building contract which has been specifically drafted with the intention to be used for MMC projects. JCT, NEC and FIDIC, for example, are generally aimed at procuring construction projects in a traditional way; there is an early design or specification and the design concept and other high-level decisions about procurement are often taken by the client before it goes out to tender.

That is not to say, however, that these standard form contracts cannot be adapted fairly easily for use on a project where the majority of the works are constructed off site. All the major standard forms are capable of incorporating bespoke amendments to suit a particular project.

Below are some of the areas that should be dealt with by specific drafting:

- Early contractor/manufacturer involvement in the design process.
- Securing a production slot in the factory - one of the biggest risk factors concerning developers and funders is the failure of the factory to deliver off site items to programme.
- Ensuring quality.
- Rethinking payment.
- Logistics, transport and home warranty schemes.
- Collaboration.

Procurement and contracts – what to look out for

- How to ensure early contractor/manufacturer involvement in the design process.
- How to secure a production slot in the factory.
- What the contract says about quality.
- Payment terms.
- Logistics and transport.
- Home warranty schemes.
- How collaboration is encouraged.

Building Better - a project which aims to accelerate the use of MMC in the housing association sector.



Where to find help

Building Better is a project backed by the National Housing Federation, RHP (formerly Richmond Housing Partnership), Raven Housing Trust and Metropolitan Thames Valley which aims to accelerate the use of MMC in the housing association sector. By collaborating, the group is aiming to create scale and help smaller associations through some of the challenges.

The project was developed in the National Housing Federation's Greenhouse innovation programme in the summer of 2018. The Building Better team spent four months exploring the causes of the chronic shortage of affordable homes and the quality issues that plague many new build homes

The aim of the project is to:

- Standardise typologies/employer requirements across a number of housing associations.
- Work with the MMC market to deliver these homes (aggregating pipeline).
- Collectively navigate the procurement challenges.
- Implement an iterative improvement process involving architects, tenants and asset managers.



The Building Better team speaking to PM Theresa May at the National Housing Federation's Summit ahead of presenting to 800 housing association chief executives.

Planning and design

The smart way to ensure speedy delivery

Selecting systems

A question regularly posed is whether clients prescribe MMC to designers or vice versa.

The degree of MMC employed on a project will depend on the collaboration between the designer and client organisation. In some circumstances, an architect will propose a modular or panellised system as a solution to the challenge set for the site by the client. Where the client already has preferred systems, the designer's role will be to assess their suitability for the site and deliver plans accordingly.

Client organisations should have a detailed knowledge of their future programme, the type and number of homes required, the nature of the likely sites and the tenure mix. With this information, it should be possible to identify potential systems and supply chain partners. These might include manufacturers, architects, specialist consultants and contractors. It is quite likely that there are two or three potential solutions, each of which will have advantages in different scenarios.

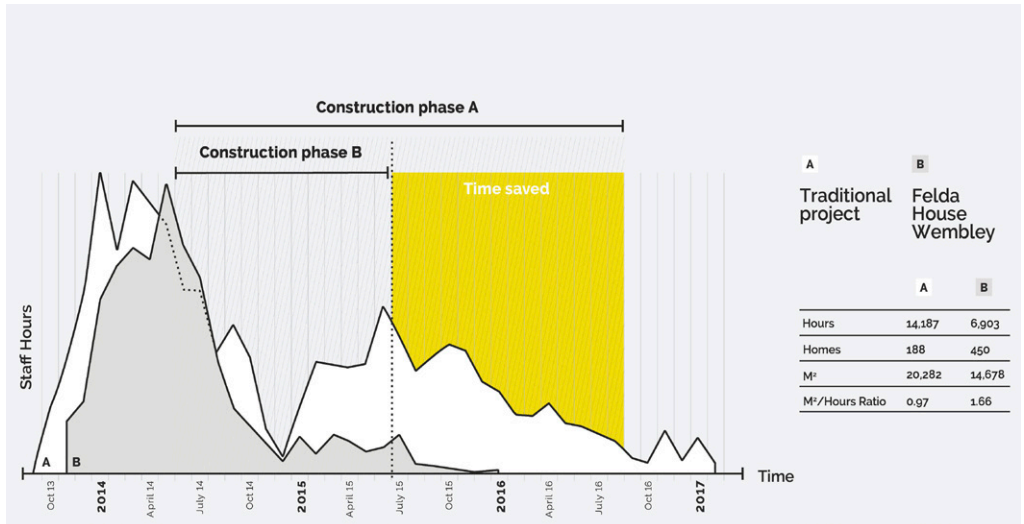
Defining these scenarios and the likely volume that will flow from each can form the basis for a procurement process. It's preferable to engage some expertise here as metrics for selecting the most suitable system need to be based on an

in-depth understanding of many things. They include: the various nuances of each system and provider; structural capabilities; price points; supplier capabilities; factory volume requirements; financial stability; transport restrictions; and an understanding of how they fit within the parameters and constraints set by the project or client. Any system should be covered by accreditation such as BOPAS and/or a warranty from a reputable provider.

Many client organisations will also have in-house asset management teams, long-term maintenance contracts and preferred components and materials, with prescribed maintenance cycles. To maintain the 'golden thread' of design intent with the requirements of end users it is essential that those responsible for maintaining an asset should be involved in early-stage design discussions, system selection and sign off on whatever category of MMC is implemented.

Where organisations are looking to aggregate demand by joining a consortium or wish to take part in a co-ordinated approach to MMC such as the NHF Building Better initiative (see page 12), this can require a joint design standard and for client organisations to be open to a change from their 'own' product to something co-created.

Image courtesy of HTA Design LLP:
 Measurable benefits of off-site design.
 Comparison between a traditional project
 and Felda House, Wembley.



Standardising manufacture

There are a number of initiatives aimed at encouraging manufacturers to provide their systems to common or publicly accessible standards (PAS). The more the sector can work towards common dimensions, the lower the risks involved with committing to an individual manufacturer.

BRE has produced a draft standard for modular systems for dwellings. There is also a proposed project to develop a PAS for off site, which would provide a methodology for design teams to design with MMC in mind. It would set the rules of engagement and advise clients on how to instruct their design teams and how to approach procurement for off site.

Agreeing the design

The role of the designer once a site is identified for development is to optimise the pre-manufactured element of the scheme. Designing homes using MMC forces project teams into good habits. There is a need to think hard and clearly about what the end goal is. This contrasts with the traditional methods and design and build contracting which tend to involve a design phase that extends into the construction phase, as in the diagram above.

When you are designing with manufacturing processes in mind, a significant element of the end product has to be agreed and fixed before the ground is broken. If the client organisation has already settled on some specific off site options as described above, then part of the work is already done. But once a design is agreed with the manufacturer there is little room to make the changes which often occur after start on site under design and build.

However, there is still likely to be some up-front investment involved, which is often eschewed in the traditional approach when planning is secured through an outline design without thought to buildability.

At planning stage it is vital that the scheme be designed with MMC in mind. There are different room heights, wall thicknesses and other configurations associated with manufactured homes. It is usually possible to convert a scheme designed for MMC to a traditional build method. It is usually impractical and costly to try to do the opposite.

Off-site construction delivers greater benefits to some site opportunities more than others. For example, the sweet spot for modular-based apartment blocks is a constricted site with good access. This harnesses the benefits of not storing materials on site and the significantly shorter build time, which reduces disturbance to those around. Where access to a site is more difficult, panel systems come into their own.

As mentioned previously, the GLA has sponsored the development of Prism, an online tool which provides guidance around appropriate off-site methods based on the size, location and topography of sites. The Housing Forum believes that a case for off-site methods can be made in most cases, but the tool is most useful when used by those with experience in scheme design.

The design team and MMC

Appointing an effective design team **is crucial.**

It is helpful to select architects, structural engineers, M&E consultants and other specialists who have a track record in off-site manufacture. There are significant benefits to be gained from using the team on a number of projects in conjunction with the chosen manufacturer(s) and contractor(s).

While procurement legislation and organisational financial standing orders need to be complied with, continuity allows the process to become more efficient. If professional teams are drawn from existing open frameworks which allow direct call off, then teams can be kept together and re-procured within procurement requirements.

A new mind-set

MMC requires from the client organisation a change of mind-set. This entails new approaches: for example, understanding that more will be spent up front at risk; and preparedness to work differently and to manage risk in a more sophisticated way. Under design and build contracts, design risk is passed to the main contractor. With MMC, more risk and cost need to be absorbed in the pre-construction phase. While this is unfamiliar to most, the recommendations of the Hackitt Review encourage this way of working. It is how some of the most successful build-to-rent developers deliver great buildings quickly and profitably.

MMC also creates a very collaborative approach to design and delivery, and over time the supply chain management becomes more effective and customer-focused than is often the case with traditional methods of construction.

MMC and the planning process

Planners and elected members of planning committees may need some educating as to the benefits of using off-site methods for both the development of place and for the local community. These groups may harbour concerns based on prejudice about historical experience of non-traditionally built homes. However, there are real benefits with MMC in terms of lack of disruption to neighbours, improved quality and accelerated supply.

Local communities, too, may have preconceived ideas of the homes they want in their backyard. They need to be persuaded that new MMC homes will be well designed and built to a good standard in keeping with the area, and delivered more quickly with less site traffic, noise and waste.

Planning and design – what to look out for

- The design which forms the planning application should be created with MMC in mind.
- Site access and ground conditions will determine the optimum types of MMC.
- Make sure all internal clients are consulted in the design phase – variations are costly.
- Capture learning from previous projects to drive efficiency.
- Use specialists early to establish the optimum solution.

Where to find help: The GLA Prism tool

As part of the Mayor's commitment to supporting and modernising the construction sector in London, the GLA has commissioned residential consultancy Cast and tech-led design practice Bryden Wood to develop a design tool to support the delivery of precision manufactured homes in London.

PRISM

MAYOR OF LONDON

www.prism-app.io

The app called Prism was launched at the end of June 2019. It is co-funded by TfL, L&Q, Legal and General and Greystar. The app is browser based, free to use, user friendly and is intended to be utilised by a range of organisations (from housing associations, developers and architects) and by a wide range of people. Users won't need to be design experts or have technical expertise.

Prism responds to a need in the sector for a practical resource which can help test the feasibility of, and plan for, MMC in the delivery of new homes from as early as site selection.

In practical terms, the tool allows the user to plot a building outline on a map, and input information such as desired number of different sized units, floor height etc. The tool logic then optimises the layout of units and internal apartment layouts for precision manufactured methods (eg by standardising room sizes and aligning wall partitions which play a significant role in optimally designing for volumetric or panellised systems).

Getting homes built and into the market

Delivery

From a client's perspective the delivery phase of a scheme delivered using MMC should be:

- **Quicker** – any manufactured element should be installable far quicker than if it was built on site.
- **Easier** – there will be fewer variations and less post-contract value engineering.
- **Less disruptive** – fewer site staff and fewer deliveries over a shorter timescale. This also means that it is far more energy efficient.

However, a key factor in the success of an off-site project and therefore of reaping these benefits is the programming of the manufacturing and site delivery. The off-site elements need to arrive in good order with assemblers ready to receive and fix in a just-in-time process.

Applied correctly, MMC should **simplify the logistics chain.**

MMC naturally consolidates components, and it reduces the support footprint of on-site accommodation and associated facilities. Additionally, production schedules provide the kind of transparency that logisticians dream of and only the required number of components are bought, not 15% more provisionally, in case they get lost or damaged.

Effective logistics are key. Many construction schemes are held up by the slow pace of utility companies. Initial site investigation processes and preparation need to be completed in time for the delivery of manufactured elements. Developer clients should ensure their project teams have the right competences in this area.

It is important to recognise that delays can easily occur in construction due to weather, unforeseen ground conditions, available labour and transport. Provision should be made for storage of manufactured systems and to align manufacturing output with site progress.



Image courtesy of Hawkins\Brown:
Model for East Village, Stratford
for Qatari Diar Delancey

Special equipment may be needed on site to lift panels and modules into place and new skills may be required to make connections between units and to ensure that issues such as fire-stopping have been properly looked after. Accordingly, it is essential that construction/erection teams are fully trained and supervised. Close attention to the detailing between units is essential.

BIM and MMC

Building information modelling (BIM) is in itself a modern method of construction: it builds computerised 3D models of buildings. Rather than relying on 2D drawings and printouts, team members use a single digital model for design and construction. The models are not just representations of a building's spatial form; they are also shared, centralised repositories of data on every aspect of its fabric and features.

So, by sharing this information, changes are more easily made, and design clashes are detected. While BIM is becoming more common in traditional construction it has a central role in the design, manufacture and delivery of off-site construction.

The use of digital design in MMC may well mean that asset management teams may be presented with a BIM asset information model (AIM) which will contain all the relevant data about the materials and components used. As these type of outputs become more common, asset management teams and their systems will need to adapt to receive them. A team engaged with an MMC project may be a useful catalyst.

Warranties and quality assurance

Homeowners, and their lenders and insurers, need reassurance that a home built using MMC satisfies all the criteria of a traditionally built dwelling.

The attitude of lenders, both corporate and mortgage providers, is one of the issues that concerns prospective developers. The lenders will require that the homes built possess sufficient quality and longevity to justify borrowing against the asset, either for mortgage purposes or to raise finance.

When considering an MMC system it is important to establish the attitude of warranty providers like NHBC and assurance schemes such as BOPAS towards it.

Because there is insufficient historical data on in-use performance and failure rates, the finance and insurance world perceive the risk of using off site as higher than traditional build and often require a higher level of assurance. Therefore, the NHBC suggests developers using MMC focus on the following:

Factory production controls: In order to manage the risk of systemic defects, warranty providers will require an audited, approved quality management system. This helps to ensure that the materials and manufacturing are of consistent quality.

Early design freeze: Because the system is being evaluated, the specification of components and proof of their performance needs to be fully demonstrated before manufacture begins. This is different to the procurement of materials for traditional housebuilding where products can be substituted for alternatives much later during design and construction.

A full home warranty: Homes need to be built to a finished standard that enables the issuing of a warranty for each home, such that homes are mortgageable and insurable under normal terms. Housing associations need to be sure that warranty and insurance is available on any MMC approach they are considering.

Currently there is an opportunity to improve the integration and interface between BOPAS accreditation and warrantors' required quality standards. This is being addressed through a group set up by MHCLG and chaired by Mark Farmer. It is seeking to agree protocols which will make these elements work better together and hopes to finalise its work during 2019. The aim is to provide a scheme capable of immediate deployment in the market as a framework for underwriting mortgage lending, building insurance and for cultivating improved industry and consumer confidence in MMC.

Lenders and insurers

Ensuring the system adopted is covered by warranty is an important step. But to an affordable provider there are still challenges, particularly where the business model is based on securing future finance against all completed homes. At the moment not all lenders will accept homes built off site as appropriate security, so organisations either need to accept that some MMC schemes may not be charged immediately, or will need to identify those lenders more willing to charge.

Asset-owning landlords will also need to ensure that the rates at which their building insurers provide cover is not affected.

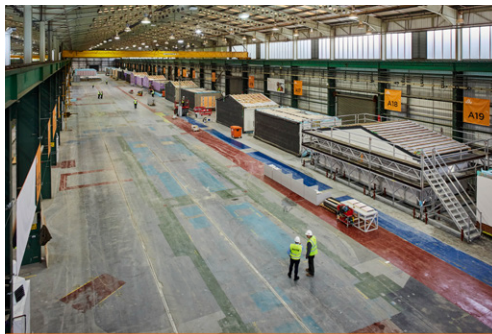


Top 10 takeaways for affordable housing developers considering MMC

- 1 Be ready to do things (eg, procure, design, pay, manage) differently to get benefits.
- 2 Use specialist designers or consultants to advise on what, when and where to adopt as this can help avoid costly mistakes.
- 3 Plan and design for MMC – it's easier to convert to traditional than vice versa.
- 4 There are MMC solutions for almost every type of project and a number of different procurement routes to get there.
- 5 Efficiencies can be gained by clients working together to standardise home designs and aggregate demand.
- 6 Design is crucial. Standard designs don't have to equate to aesthetic uniformity.
- 7 Early engagement with the design team, manufacturer and delivery partner is essential.
- 8 Organisations are most likely to get financial benefits if they work with partners over a number of schemes.
- 9 More commitment up front on design and planning means quicker deployment and delivery.
- 10 There is great momentum in favour of MMC, many resources to help with the journey and more and more examples of organisations making it work.

Case Studies

Homes delivered through MMC



Case Study 1: Creating lasting partnerships unlocks future capacity

ilke Homes has tied up with Places for People to leverage benefits of scale.

At the end of May 2019, ilke Homes signed off on a joint venture with Places for People, one of the UK's leading property management and placemaking organisations. The deal will see 750 precision-engineered homes created in ilke's North Yorkshire factory, which will then be transported to sites across the UK, providing Places for People with quality housing that is both aspirational and affordable.

Not only was this one of the largest deals to date in the UK off-site manufacturing space, it is also being seen as an exemplar of how the sector can continue to grow through the creation of lasting, dynamic and strategic partnerships, which provide stability and a steady pipeline.

Places for People's project pipeline creates the certainty of demand that ilke Homes' manufacturing facility needs.

ilke Homes is one of a variety of MMC partners that Places for People uses. These multiple strategic partnerships are needed to create the confidence, capacity and certainty of demand that are crucial to scaling up off-site manufacturing in the UK.



Case Study 2: Taking a strategic approach to modern construction methods

The Walsall-based housing association whg is one organisation taking a holistic approach to advances in construction methods, materials and components.

whg sees off site as a solution to the challenges it faces in building quality homes for affordable rent. It has been exploring the method in one specific project - 200-plus infill and garage sites it's inherited from a stock transfer which it is keen to develop.

To this end, whg has worked with architects Northmill Associates and manufacturers to develop a standard design that, as well as utilising panels and pods to maximise manufactured value, also meets lifetime homes space sizes, takes a fabric-first approach to improve energy efficiency and can provide a digital asset with which the organisation can start to manage its newer stock.

The plan is to deliver the homes in partnership with a contractor which provides site preparation and finishing, while directly commissioned specialist manufacturers supply the off-site elements. The homes will be designed, manufactured and built to meet BRE's new standard for off-site construction, BPS 7014. This will ensure they meet the requirements of warranty providers, insurers and lenders. It also provides a quality assurance benchmark that partners would have to meet when working with whg.



Case Study 3: Small site, big benefits

The housing association RHP is planning to commission ilke Homes to deliver 10 affordable homes on a small strip of land adjacent to one of its larger housing estates.

Social homes provider RHP sees multiple benefits in using modular on a small site in south west London. Disruption to local people is reduced thanks to the shorter build time and less construction traffic going to site. A speedier build time means it receives rental income sooner, helping project viability. Additionally, operating as it does in this part of London, the high property values make smaller/infill sites unviable when using traditional building methods – even when sites are packaged up. Modular, in contrast, offers cost benefits, although the timing of payments is slightly different.

The biggest benefit of going modular, however, says RHP is quality. It's convinced that the quality of many modular/MMC products is at least on par with traditional build and will only get better. As a result, it has pledged to use modular and MMC wherever possible in meeting its target of delivering 1,000 homes over the next five years. Consultations with residents on the plans are ongoing and a planning application was expected to have been submitted by late summer 2019.

Image courtesy of ilke Homes



Case Study 4: Light gauge steel provides solution for Barratt

Over four years ago Barratt Developments set itself a strategic goal of producing at least 20% of its output using off-site methods by 2020.

In order to achieve this, it evaluated 150 different off-site businesses over a two-year period and as part of the process ran a trial project to see how this approach could potentially scale up for volume housebuilding.

In 2015 Barratt asked the building systems manufacturer Fusion to design, manufacture and erect light gauge steel superstructures for domestic properties at Barratt's Swanbourne Park development in West Sussex.

Fusion responded by adapting Barratt's existing housing designs to incorporate its light gauge steel superstructure. In late 2015, the project was ready to start on site, and with just five personnel employed, nine properties were erected in nine days.

Successful delivery of 200 units on three different types of project is proof positive for these supply chain participants that off-site manufacturing is part of the future for volume housebuilding.

Following the trial, Fusion secured further contracts with Barratt, including St Mary's Place in Felpham, West Sussex, New Quarter in Bordon, Surrey and Cane Hill Park development in Coulsdon, Surrey.

The three sites were very different in their requirements, from two, -three and four-bedroom standard house types, to non-standard designs, with challenging ground conditions and four-storey apartment buildings.

Working on almost 200 different units, Fusion again adapted existing Barratt house types and developed bespoke multi-storey designs which would be suitable for use with its light gauge steel panelised system.

Barratt says it has seen a real improvement in speed, as it expected, and is continuing to work closely with the Fusion team to roll this technology out further.



Case Study 5: Off site reaches for the skies

A 28-storey building with 558 rooms for student accommodation was delivered speedily thanks to adopting a modular approach.

The architect HTA Design has worked alongside Tide Developments for a number of modular housing projects and delivered them using Tide's sister company, Vision Modular Systems. The same design team for most disciplines has been used on seven projects which have been built or are under construction and is working on others still in early design stages. This approach has led to significant speeding up of project delivery, particularly in locations where there is a sympathetic planning authority.

The quickest project to date, at Apex House in Wembley, saw a 28-storey building with 558 rooms for student accommodation - the tallest modular building in Europe - being delivered two years and four months after the start of the design phase. To achieve this speed, Vision Modular Structures manufactured fully furnished modules from steel frames and craned them into position on a slip-formed concrete floor.

The building has a variety of room types and shapes suitable for different students, including wheelchair units, and a variety of shared social spaces including a café and a ground level courtyard to allow for relaxation, social interaction and group study.

HTA Design also worked successfully with Vision Modular Systems on another modular student residence in Wembley, Felda House, a 19-storey, 450-room residence in Wembley. Constructed entirely from modular elements manufactured in the Vision Modular Structures factory, the rooms arrived on site fully finished internally and were installed at a rate of eight units per day. The aluminium cladding system was installed on site. The building achieved BREEAM Excellent



Case Study 6: Locals benefit from off-site approach to housebuilding

Applying best practice manufacturing principles achieved time and cost benefits on this Northampton housing project.

In March 2018, Fusion Building Systems started on site at two locations in the Spring Boroughs area of Northampton. Contracted by developer Willmott Dixon on behalf of Northampton Partnership Homes (NPH), Fusion's brief was to design and install the superstructures for 18 units - apartments and maisonettes to be built on Little Cross Street.

The completed accommodation was to be allocated to local families through Northampton Borough Council. NPH's chief executive Mike Kay had previous knowledge of off-site methods of construction and was keen to engage a local supply chain. Willmott Dixon had worked with Fusion for many years, and it being a Northampton-based business, was keen for Fusion to be the off-site provider.

All supply chain partners were engaged at the outset, MMC was designated as the procurement route and Fusion's 2D panelised system was agreed as the best solution for the site. Applying best practice manufacturing principles, a standardised pattern book design was used for all units which delivered significant advantages in terms of both time and cost through design, engineering and production.

Fusion's work scope consisted of insulated external walls, internal load-bearing walls, cassette floors and flat roof cassettes, parapet panels, and supplying the crane. It started work on site in March 2018 and the superstructure was complete within six weeks, just as planned.

NPH says that the delivery partnership with Willmott Dixon and Fusion Building Systems embraced the advantages which modern methods of construction presents and delivered what the community needed.



Case Study 7: Student accommodation supplied on time thanks to precision off-site engineering

The University of Manchester employed off-site methods for a 1,222 bedroom development on its Fallowfield Campus at Unsworth Park.

As it was replacing existing accommodation, Manchester University's new student accommodation buildings at Unsworth Park had to be delivered to schedule, in time for occupation by September 2019, and without compromising on quality or cost-efficiency.

To deliver this, VINCI Construction UK selected the Kingspan KingBuild System (KBS). With its 2D panelised off-site construction, the KingBuild Solution kept the project on track to complete in time.

To achieve this, Kingspan Steel Building Solutions worked closely with the project team from the initial design phase right through to construction. BIM models of the proposed structures were generated, detailing all sections and connections in accordance with Kingspan's Steel Construction Institute certified system. This allowed potential clashes to be identified and addressed. Once approved, the models were used to create the computer numerical control data for the steel rolling mills, ensuring extremely accurate production.

The entire KBS, which included Kingspan's composite metal-deck floor trays, in situ poured concrete floors, joisted cassette roofs, pre-cast concrete stairs and timber trussed roofs, was then precisely engineered to these requirements to an arranged build sequence delivery schedule.

The systems' panels are formed from light gauge steel and are supplied pre-fitted with elements such as insulation, membranes, brackets for floor and brickwork support and external façade systems, with pre-formed apertures for windows and doors as required.

The external walls of the KBS were supplied with Kingspan Thermawall TW55 and supplied with brickwork support systems and stainless-steel brick tie channels to allow the outer façade to be rapidly installed. In addition to the enhanced speed and predictability of the build programme, the off-site construction approach also allowed bespoke design features to be easily incorporated.

The component units were craned into position and fixed by site operatives, reducing on-site labour and costs. Once erected, the KBS panels formed a weather-tight shell, allowing internal fit-out to begin much sooner than would have been possible with traditional on-site construction processes. In addition, the dry construction method achieves zero shrinkage and, through advanced, patented connection technology, provides almost zero settlement in the frame.



Homes England

Case Study 8: Prefabricated pods save time in Stratford

524 apartments are streamlined down to just 15 unit types on former Olympics site.

At East Village in Stratford, East London, architect Hawkins\Brown has designed and is delivering the final piece of the East Village masterplan at the former 2012 Olympics Athletes Village, which is due to open in 2021.

The design is for two towers of 31 and 26 storeys linked to 'tails' of 10 storeys, providing 524 build to rent apartments.

The project has made extensive use of modern methods of construction. To enable economical off-site manufacture, ease of installation and consistency of maintenance across all units, the 524 apartments are streamlined down to just 15 unit types, with three specification levels for finishes and fittings. Bathroom pods are standardised to six types and utility cupboards to just two types.

Using pre-fabricated bathroom and utilities pods offers savings in construction time and cost, and ease of future maintenance. The unitised façade is being manufactured off site, with the large wall panels pre-fixed to equally-sized floor panels before delivery to site and craning into position, thus reducing time on site while improving quality.

Homes England's supporting role

Homes England is playing a vital role in creating momentum behind MMC and helping forge partnerships.

Through the Government's £450m Accelerated Construction Programme, Homes England supports organisations that utilise MMC to deliver affordable housing throughout the UK, such as Places for People, to accelerate the housebuilding process and bring forward more land for development.

Acknowledgements

MMC Working Group - members and contributors

Jon Wardle	AMCM
Chris Spiceley	AMCM
John Milner	Baily Garner
Jeff Maxted	BLP Insurance
Tim Hall	Build Offsite
Jamie Parr	Build Offsite
Timothy Porter	Catalyst Housing Group
Nigel Tenwick	Clarion Housing Group
Ernie Bardrick	Clarion Housing Group
Mike Fairey	Fusion Building Systems
Drew O'Mahony	Fusion Building Systems
Francesca Lewis	Greater London Authority
Louise McGough	Greater London Authority
Nigel Ostime	Hawkins\Brown
Paul McGivern	Homes England
Rory Bergin	HTA Design
John Gray	HTA Design
Craig Liddell	ilke Homes
Paul Inch	Innovare
Shaun Sheldrake	J. Murphy & Sons Limited
Said Hajjmaili	J. Murphy & Sons Limited
Michael Wright	J. Murphy & Sons Limited

Robert Jones	Kingspan
Jason Kennie	Metropolitan Thames Valley
Mohied Miah	MHCLG
Adetokonbo Okunlola	MHCLG
Will Jeffwitz	National Housing Federation
Trina Chakravarti	National Housing Federation
Richard Lankshear	NHBC
Graham Sibley	NHBC
Mike Kay	Northampton Partnership Homes
Paul Satchwell	Northampton Partnership Homes
Gary Owens	Northampton Partnership Homes
Carl Vann	Pollard Thomas Edwards
Chris Duckworth	SIP Build
Andrew Ferguson	Skanska
Louise Free	Southeast Consortium
Sanjiv Sangha	Southern Housing Group
Michael Cleaver	The Housing Forum
Katie Saunders	Trowers & Hamlins
David Cordery	Trowers & Hamlins
Simon Leadbeater	Willmot Dixon
Paul Nicol	whg
Dave Sheridan	ilke Homes

The Housing Forum champions collaboration and innovation in construction to improve productivity, design, build quality and the maintenance of existing housing.

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If you are interested in learning more about membership of The Housing Forum, please contact the Membership Marketing Manager:

callum.riley@housingforum.org.uk
020 7648 4067
07572 015 529

Twitter:
[@thehousingforum](https://twitter.com/thehousingforum)

LinkedIn:
[@thehousingforum](https://www.linkedin.com/company/thehousingforum)

THE HOUSING FORUM TEAM

Shelagh Grant

Chief Executive
shelagh.grant@housingforum.org.uk
020 7648 4070

Callum Riley

Membership Marketing Manager
callum.riley@housingforum.org.uk
020 7648 4067

Sandra Manning

Member Events Executive
sandra.manning@housingforum.org.uk
020 7648 4065

Mateja Pirc

Corporate Services Executive
mateja.pirc@housingforum.org.uk
020 7648 4069

Editor / Graphic Design:
Denise Chevin / Lester Clark



INTERACT
INFORM
INFLUENCE

020 7648 4070
info@
housingforum.org.uk

The Housing Forum
6 Floor, 1 Minster Court
Mincing Lane
London EC3R 7AA