

Modern methods of construction

Views from the industry



Primary research

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The NHBC Foundation

The **NHBC Foundation**, established in 2006, provides high-quality research and practical guidance to support the house-building industry as it addresses the challenges of delivering 21st-century new homes. To date, it has published 70 reports on a wide variety of topics, including the sustainability agenda, homeowner issues and risk management.

The NHBC Foundation is also involved in a programme of positive engagement with the government, academics and other key stakeholders, focusing on the current and pressing issues relevant to house building.

To find out more about the NHBC Foundation, please visit www.nhbcfoundation.org. If you have feedback or suggestions for new areas of research, please contact info@nhbcfoundation.org.

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Foreword

The very mention of the phrase ‘modern methods of construction’ (MMC) has tended, for more than half a century, to generate heated debate and conflicting reactions from those involved in the building industry.

In the aftermath of the Second World War the need for a rapid expansion of housing output provided a strong impetus for innovation, and this led to extensive applications of new systems and technologies. However, a preoccupation with quantity rather than quality, coupled with a failure to think through the full implications of some of the new approaches, contributed to a number of highly publicised failures, which in turn prompted a reversion to more traditional house-building techniques.

More recently, around the turn of the new millennium, and partly inspired by the Egan Report *Rethinking construction*^[1], interest revived in the potential of new methods, including the wider use of off-site prefabrication, to deliver efficiency gains and improve quality. But once again the high hopes invested in MMC, as a means of delivering transformational change to the house-building industry, have not been realised on the scale anticipated by their champions.

Yet for all the reservations expressed by the sceptics, and the clear lack of enthusiasm in the bulk of the industry for the more radical and far-reaching manifestations of MMC, house builders have been making extensive use of a variety of innovative approaches, including components assembled off-site. Indeed in a context where once again a rapid expansion of output is required, but where the industry is facing severe skills shortages, it would be surprising if there was not a keen interest in exploring new methods with the capacity to improve both quality and efficiency.

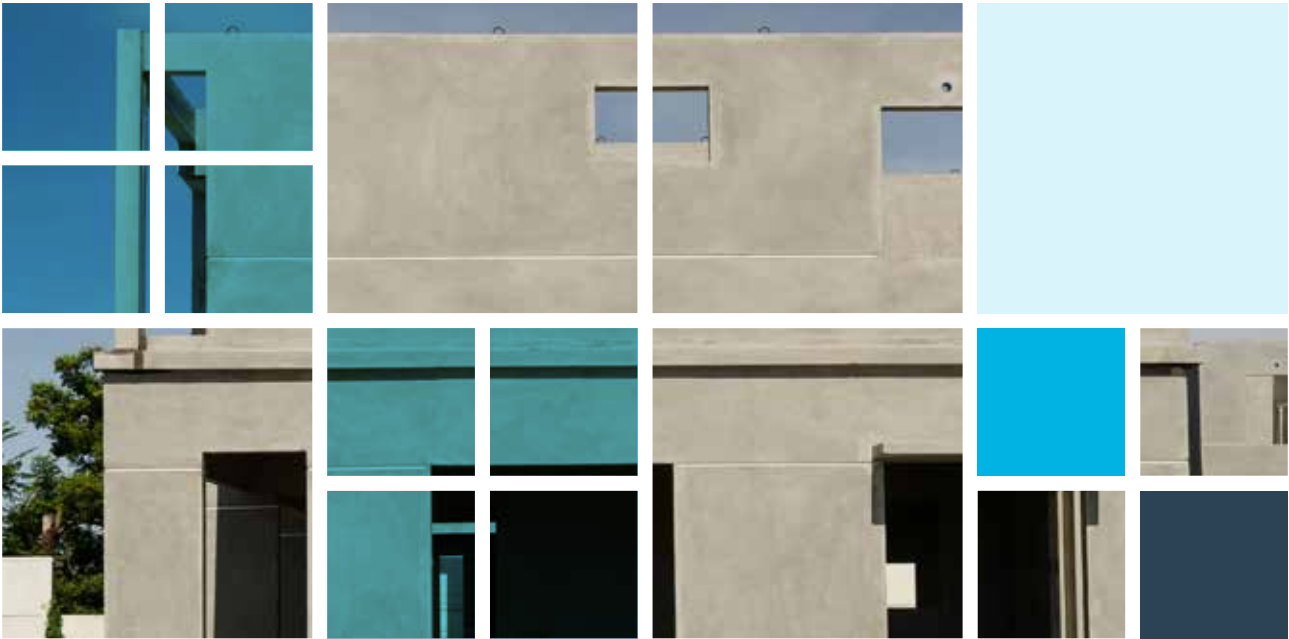
This new research from the NHBC Foundation explores attitudes towards MMC across the industry. It records the degree to which different methods and systems have been adopted and assesses the appetite for more extensive application of specific approaches. It finds an industry, which, while cautious about over-commitment, is nevertheless embracing MMC in many guises, and remains ready to explore new options and innovations.

The research has depended on the participation of a number of house builders and housing associations whose contributions are gratefully acknowledged.

I hope that the findings will be of interest and use to many organisations and people involved in house building, and will stimulate discussion on the scope for more effective innovation across the industry.

Rt. Hon. Nick Raynsford
Chairman, NHBC Foundation

1 Key findings



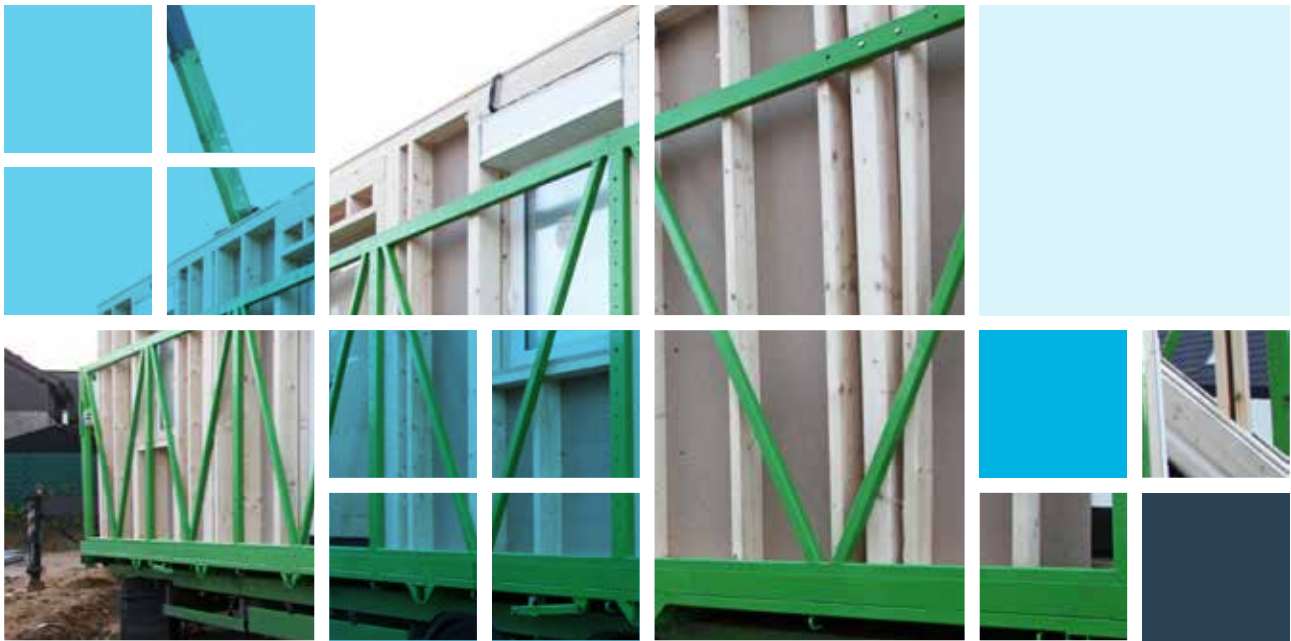
Alternative forms or modern methods of construction (MMC) have a long history in the UK. In the post-war period much use was made of a variety of innovative house-building systems and from time-to-time since then, there have been surges in interest. An industry survey, reported in this publication, was carried out at the end of 2015. It aimed to establish current attitudes to MMC amongst the larger house builders and housing associations.

Key findings were as follows:

1. The majority of the organisations surveyed have made use of MMC: 98% of large and medium-sized house builders and housing associations have used or considered at least one form of MMC in the last 3 years.
2. The most widely-adopted form of MMC is sub-assemblies and components with two-thirds having used them for at least one home during 2015. This category includes items such as door sets, timber I-beams, prefabricated chimneys and prefabricated dormers.
3. The second most popular form of MMC is panelised systems (eg timber and steel frame), which was used by 42% of respondents during 2015 for at least one home. In the lead was timber frame which, according to NHBC registration statistics for 2015, accounts for 15% of UK housing output. In Scotland, where timber frame is used for three-quarters of new homes, it is not regarded as a modern method.
4. Only limited use is being made of volumetric construction (large modules fully fitted out on-site) and pods (room-sized modules normally bathrooms or kitchens) with 6% and 7% of organisations having used these methods respectively one or more times in 2015. Use tends to be concentrated in apartment buildings in London and the South East.

5. The majority of organisations surveyed consider themselves to be 'late adopters' or 'followers' of volumetric construction, pod and panelised forms of MMC, watching the success of others before making the decision to move away from conventional cavity masonry construction. Only 10% of house builders considered themselves to be 'market leaders', leading innovation.
6. One of the key attractions driving the use of MMC is the perceived ability to build more quickly. While house builders reported that faster construction is being realised in practice, housing associations were less convinced; they did, however, believe that a weathertight envelope was achieved quicker with the use of MMC.
7. It was also felt widely that MMC would have a role to play in improving the quality of construction and overcoming current shortages in the availability of skilled labour. For those already using MMC these perceived advantages were being realised in practice.
8. There is some evidence of MMC leading to a reduction in costs and improved profitability, with 44% of house builders and 27% of housing associations pointing to benefits such as reduced preliminary costs, improved cash flow and faster sales revenues.
9. Most participants expect the role of MMC to grow or remain static over the next 3 years; only 3% expected it to decline. Over half expected the use of panelised systems, in particular, to increase during that period. Drivers to increased use include overcoming skills shortages, faster build, increasing output and improving build quality.
10. If there is to be greater use of pods and full volumetric construction, risks within the supply chain need to be addressed. There are concerns about the size, quality and capacity of suppliers and their ability to sustain high volume output. Other issues include a need to build-in the ability to provide bespoke designs and interiors and overcome the constraints of standardisation, the need for an early design freeze and transport logistics.

2 Background and introduction



The history of innovation in construction in the UK is long, dating back to before the Second World War, but comparisons with the current housing market challenges are striking. In the post-war period, there was a housing crisis with over 200,000 homes estimated to be required quickly; Prime Ministers were heavily involved setting up cross-party committees to examine solutions and Government programmes were being rolled out to build 'new technology' homes. In 1944 this was known as the EFM (emergency factory made) programme which, despite a good start, eventually delivered 153,000 'temporary' prefabricated homes. Alongside these were 'permanent' non-traditional homes of which almost 450,000 were built in the decade following the war.

More recently the need to increase off-site construction in the housing sector, and the construction industry generally, was discussed in the Latham Report, *Constructing the team*^[2], *Joint review of procurement and contractual arrangements in the United Kingdom construction industry* published in 1994, and the Egan Report *Rethinking construction*^[1] published in 1998. By drawing on experiences of other industries such as manufacturing, these reports sought to identify how to improve efficiency, reduce waste and make the industry more responsive to customer needs.

Currently we still see an industry that has largely continued to use masonry cavity wall construction for low-rise residential new build. The success of off-site manufactured homes seen in other parts of the world, such as Scandinavia and Japan, has not generally been replicated in volume in the UK.

The pressures in today's housing market are:

- high customer demand with shortfalls in supply
- shortages of skilled labour and materials
- a drive for construction speed
- achieving high quality and energy performance
- the elimination of waste.

These pressures have echoes of past challenges which could be expected to encourage use of off-site methods, now referred to as MMC. So how is the industry responding?

To examine current attitudes, policies and use of MMC and its prospects for the future, the NHBC Foundation commissioned research amongst large and medium-sized house builders and large and medium-sized housing associations in the private and social residential sectors.

The research set out to answer the following questions:

- the extent to which organisations are embracing or considering MMC
- factors which are driving their interest
- reasons for using or rejecting MMC
- benefits and drawbacks experienced in use
- views on the extent to which MMC will contribute to a significant increase in build volumes to meet demand
- expectations for future use of MMC and factors which could lead to an increase in use.

The intention of this report is to help understand current attitudes towards MMC amongst those responsible for delivering new homes and to understand whether it is being adopted to the benefit of the industry.

3 Methodology



The research focused on large and medium-sized house builders and housing associations. Those participating accounted for just over 45,000 homes or 30% of NHBC new home registrations in 2015.

The research was conducted in two phases, involving both qualitative and quantitative methodologies.

3.1 Stages

Stage 1

Focus groups, each lasting 2½ hours, were held in London, Glasgow and Birmingham. These were attended by 29 people in total, representing a mix of house-building companies and housing associations. Attendees are listed in Appendix A.

Stage 2

Stage 1 results informed the questionnaire design for stage 2, the quantitative stage, which involved 135 interviews by telephone (Table 1). Three-quarters were with regional and head offices of large and medium-sized house builders and one-quarter with housing associations.

Interviews, lasting an average of 24 minutes each, were conducted with a variety of senior people, including house builders' technical directors, technical managers, construction directors, construction managers and housing association development directors and managers.

Table 1 Telephone interview programme

	No. interviews
House builders	
– Large national house builders*	61
– Medium, regional house builders†	39
Housing associations	35
Total	135
London and the South East	49
Rest of England and Wales	73
Scotland	13

* Building over 1,000 units a year nationally.

† Building 200 to 1,000 units a year nationally.

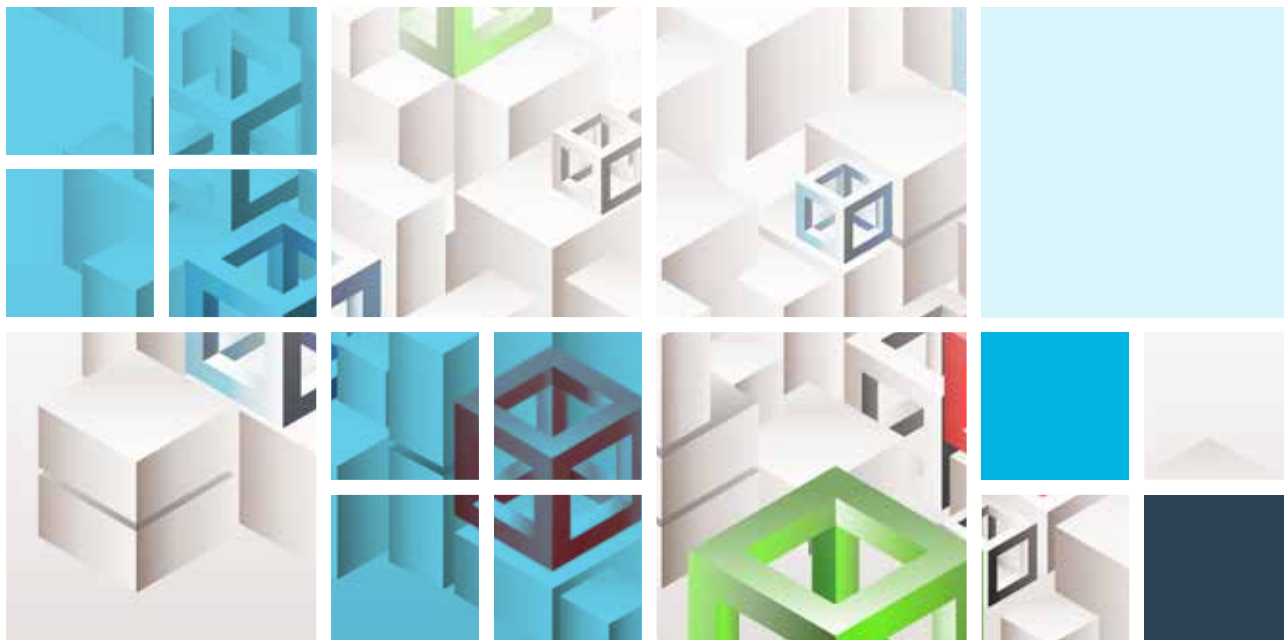
Interviews were spread geographically and some results have been analysed in accordance with the geographical classification shown in Table 1.

3.2 Weighting of data

This survey was conducted to be as representative as possible of the large and medium-sized house builders building 200 or more homes a year, and large and medium-sized housing associations that have a new homes development programme.

In aggregating data from these groups, to arrive at an 'all' figure for some of the results quoted in this report, a weighting factor has been applied to each group. This ensures that their answers are reflected in the all or total figures in proportion to the number of new homes each group built in 2015. More details are provided in Appendix B.

4 Definition of modern methods of construction



The term modern methods of construction (MMC) embraces a number of approaches involving off-site manufacture or assembly. The definitions of MMC have varied over the years but for the purposes of this research for the purposes of this research, the following types of MMC were used (illustrated further in Figure 1):

- volumetric construction
- pods
- panelised systems
- sub-assemblies and components
- site-based MMC.

The types of MMC used in the research are based on those used by BRE in the NHBC Foundation report *A guide to modern methods of construction*^[3]. This classification also includes innovative on-site methods designed to improve efficiency and/or reduce waste, such as thin joint blockwork.

The definitions and appropriate images were shown to participants as the basis for questions about approaches they had used, and the extent of their use.

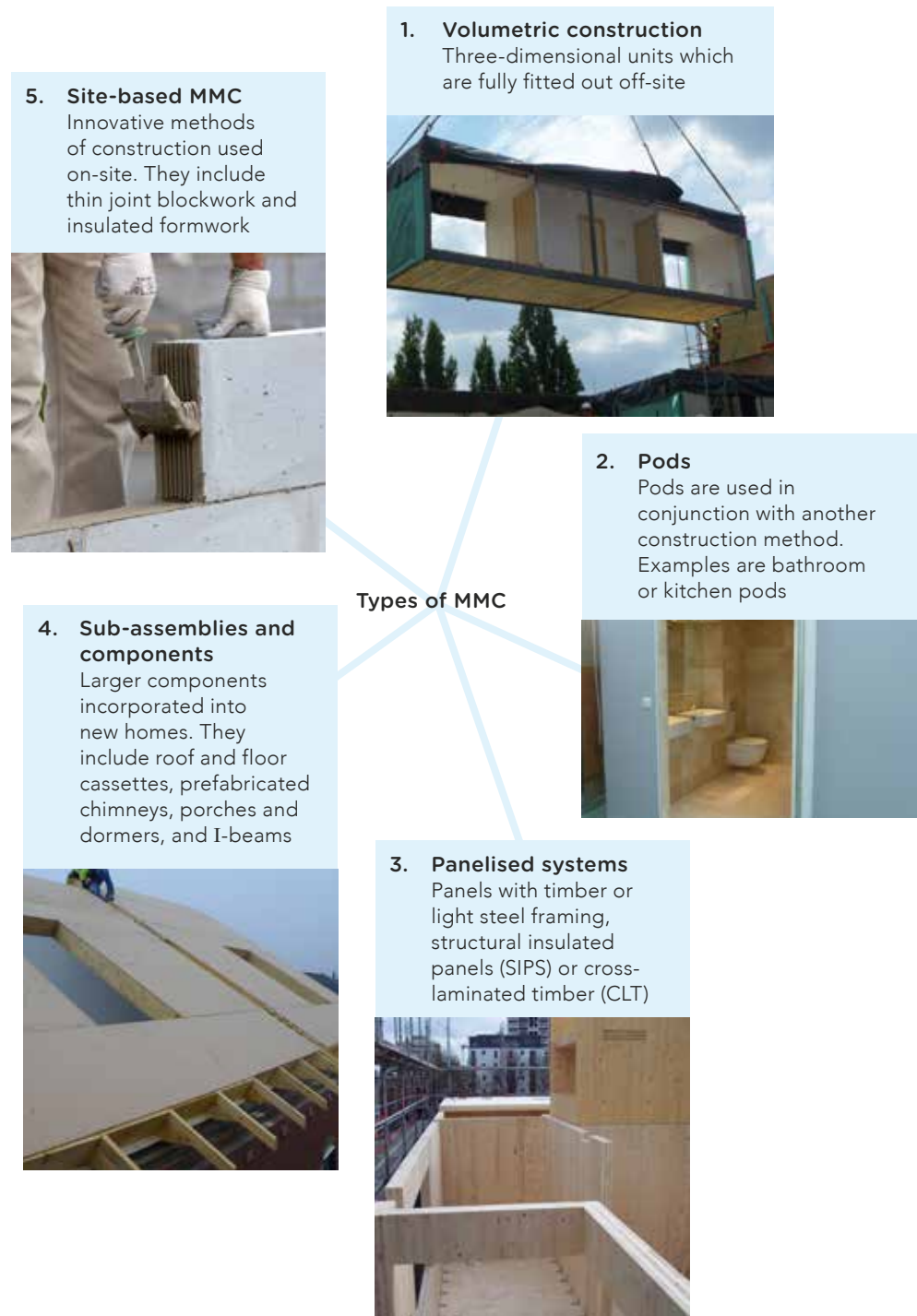
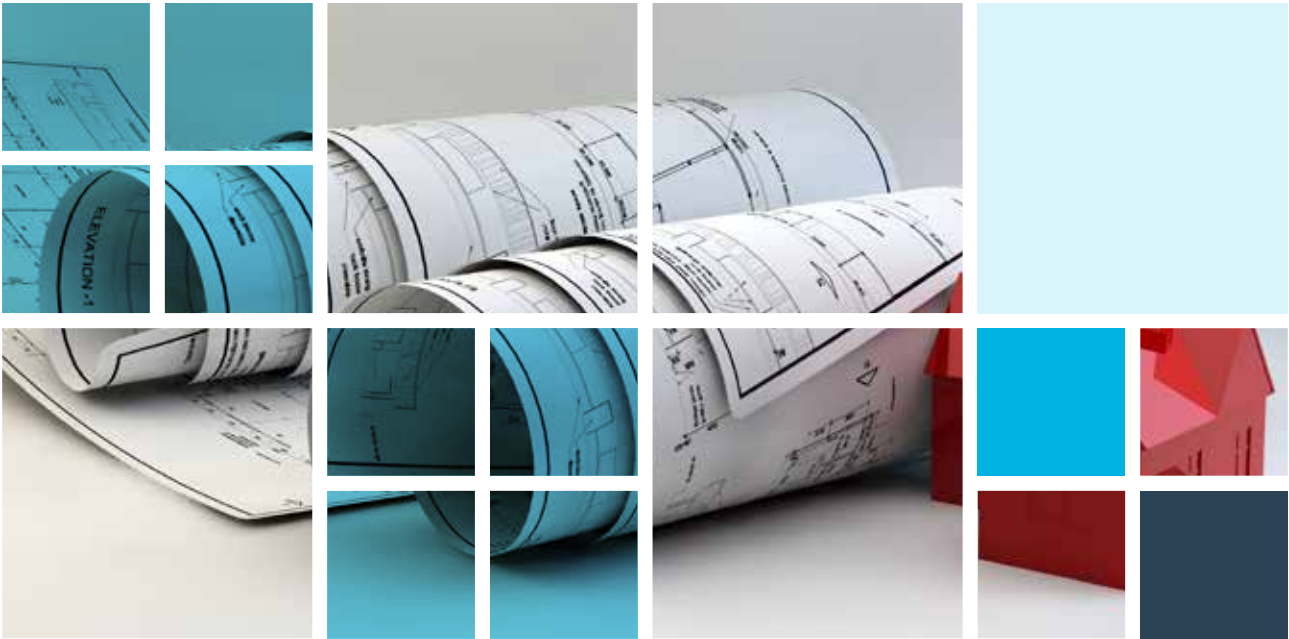


Figure 1 Types of MMC

There was some discussion in the focus groups about use of the term MMC and its application to approaches which have been in use for some time. For example, Scotland has a long tradition of building in timber frame, where it accounts for the majority of residential new build; those in the focus group did not feel that timber frame should therefore be described as a ‘modern’ method.

5 Use and consideration of MMC



This section examines the use of construction methodologies in residential new build as recorded by NHBC. It breaks down the use of MMC by type and geography, and looks in detail at the use of panelised systems and off-site manufactured components. It indicates where decisions on construction methodology are being made and the willingness to innovate amongst those building new homes.

5.1 NHBC statistics on construction type

NHBC records statistics on construction type on the new homes it registers, representing about 80% of new homes built in the UK. The figures show that masonry construction continues to account for the majority of new residential build and the proportion has remained fairly constant over the last 8 years (Figure 2).



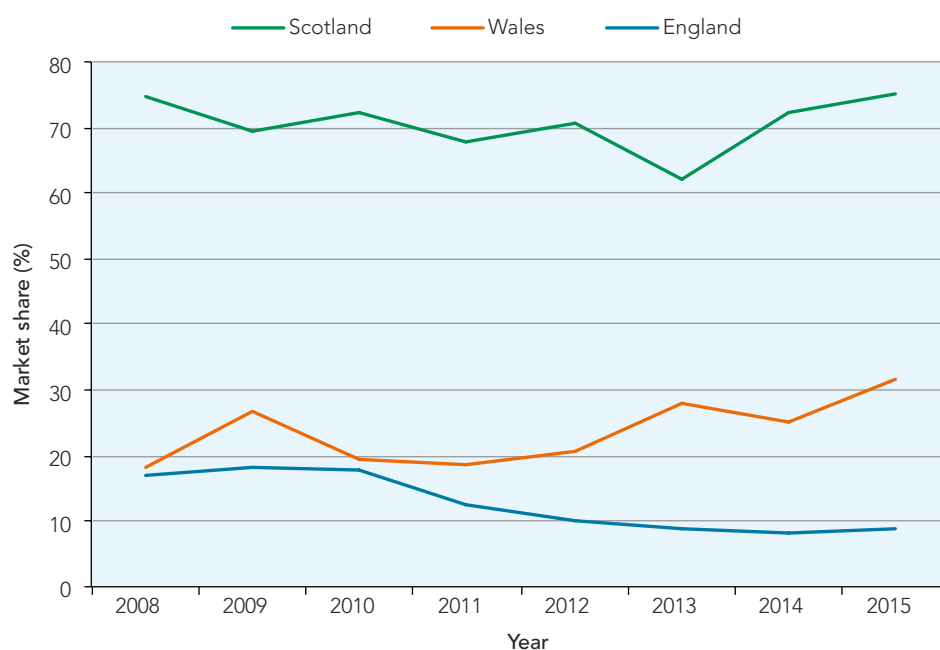
Source: NHBC, based on registrations.

Figure 2 New build, share by construction type in the UK (2008 to 2015)

The use of timber-framing or light steel-framing methods for the structure of homes represented about 16% of the new build market in 2015, having declined from a high of 24% in 2008 (Figure 3).

NHBC's statistics do not, however, record the extent of use of sub-assemblies and components, which are used by more organisations involved in new build than structural forms of MMC.

The UK figure masks differences in construction method between countries. In Scotland, timber frame is the conventional approach, where it accounted for 75% of construction methods amongst NHBC-registered new build homes in 2015. In Wales timber frame has experienced a higher share than in England, where market share is at its lowest.



Source: NHBC, based on registrations.

Figure 3 Timber frame market share in the UK, by country

5.2 Use and consideration of different types of MMC

The majority of house builders and housing associations are using, or have considered, at least one MMC approach within their recent build programmes. Of the large and medium-sized house builders and housing associations surveyed, only two said they had not used or considered at least one form of MMC in the last 3 years.

The most used are sub-assemblies and components, installed by about three-quarters of the house builders and just under half of the housing associations in 2015. Panelised systems are the next most used MMC type (Figure 4).

Very few have used full volumetric construction or pods in the 3-year period 2013 to 2015 (Figure 5). However, these are being considered for future use by over a third of organisations: 37% are considering, or may consider, volumetric construction and 28% are considering, or may consider, using pods (sometimes known as semi-volumetric). But opinion remains split with over half in each case having already rejected or unlikely to consider use at all.

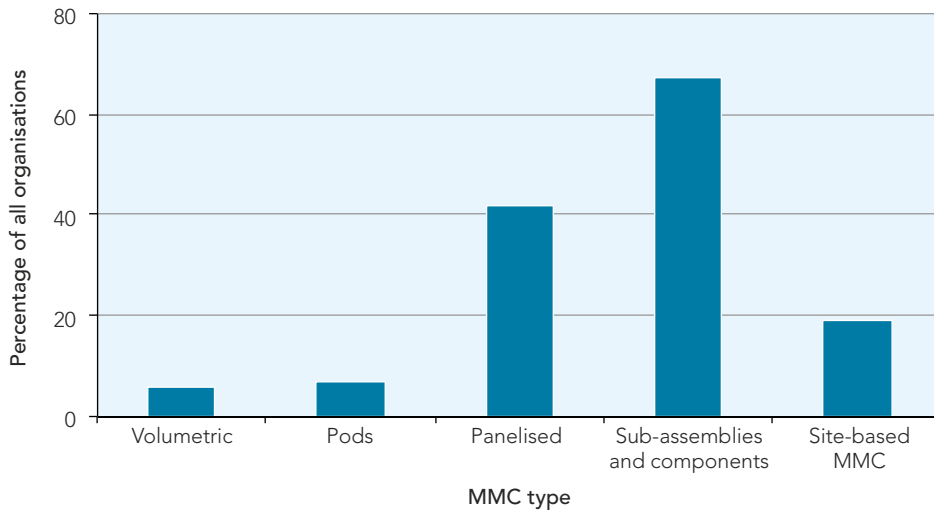


Figure 4 Percentage of all organisations using different types of MMC for new homes in 2015

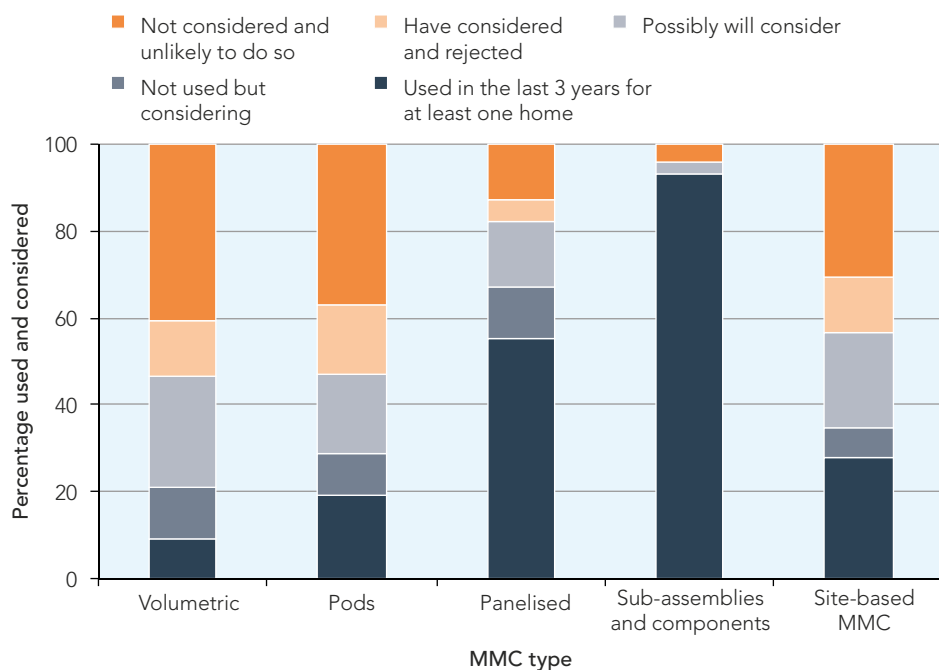
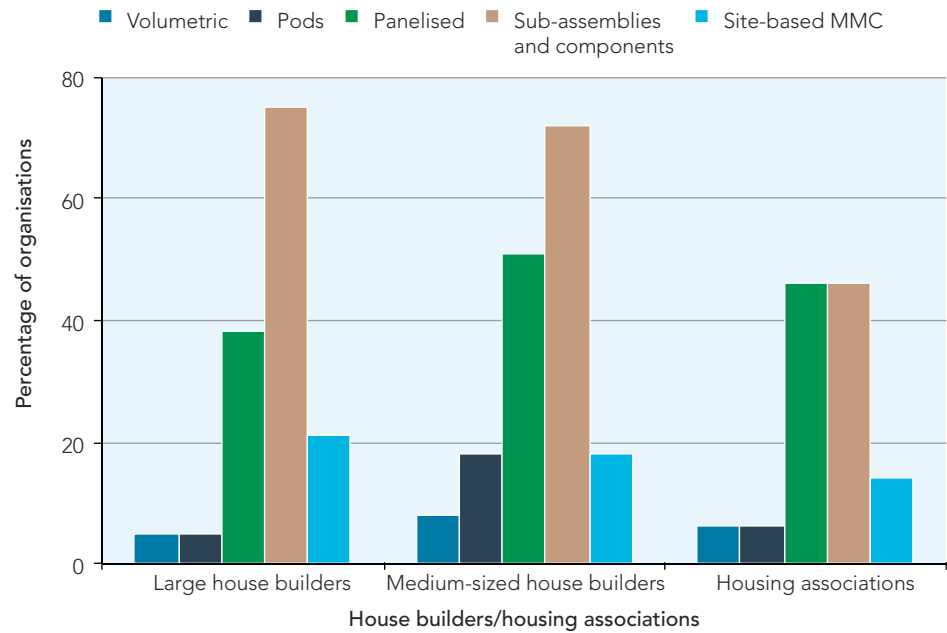


Figure 5 Percentage used and considered in the last 3 years

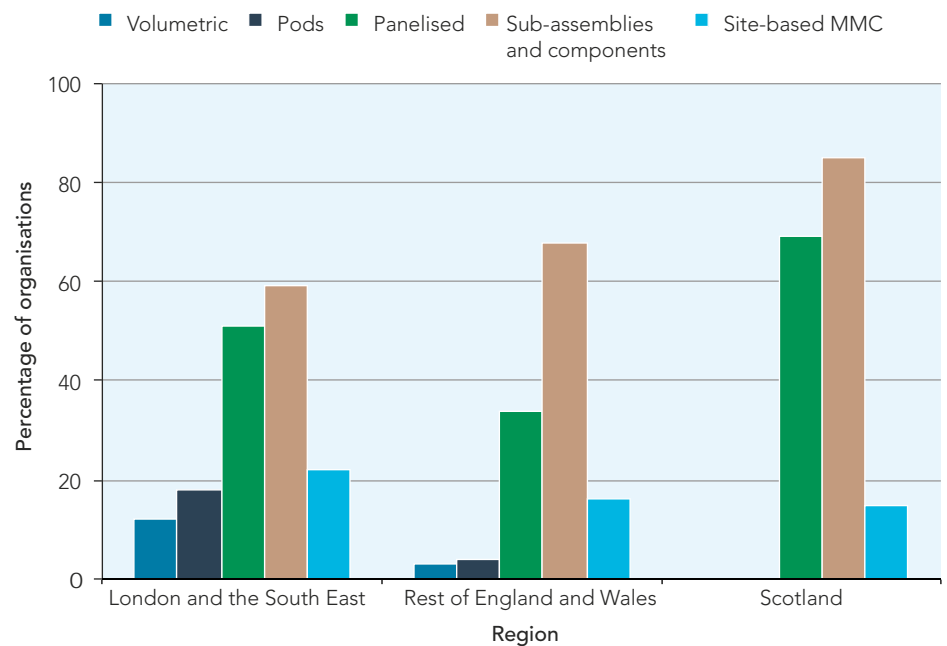
Encouraged by historical Government funding conditions, housing associations might be expected to have the most experience of MMC; but it appears that more private sector house builders have been using pods, sub-assemblies and components (Figures 6 and 7). The apparent lower use by housing associations may be due to their procurement of new homes through Section 106 agreements or through design and build contracts, meaning that they may not always select the method of construction used.

By region, use of volumetric construction and pods has been almost entirely in London and the South East. Use of panelised system MMC is higher in Scotland than elsewhere due to the well-established tradition of building with timber frame. Use of off-site manufactured sub-assemblies and components is also highest in Scotland.



Base: Large house builders (61), medium-sized house builders (39), housing associations (35).

Figure 6 Percentage of organisations using MMC at least once in 2015, by house builder and housing association



Base: London and the South East (49), Rest of England and Wales (73), Scotland (13).

Figure 7 Percentage of organisations using MMC at least once in 2015, by region

Other findings from the survey about the application of MMC show that:

- MMC has been used for both apartments and houses, although pods have been mainly used for apartments; 97% of those using pods have installed them in apartments in the last 3 years. By comparison, two-thirds of users of panelised systems have used this approach for apartments and three-quarters for houses.

- The average number of storeys for which pods have been used is 14, and for volumetric construction, 9.
- MMC is not used as a blanket approach – a standard specification adopted across all sites; its use varies from site to site and suitability will often be judged for each individual project. This explains why market share for the MMC systems is lower than the proportion of organisations with experience of their use.
- Almost all of those regarding themselves as MMC ‘market leaders’, representing 10% of those interviewed, have used panelised systems and sub-assemblies and components. Of the market leaders 3 in 10 have also used or have tried volumetric construction in the last 3 years and 2 in 10 have used pods, ie above the market average.

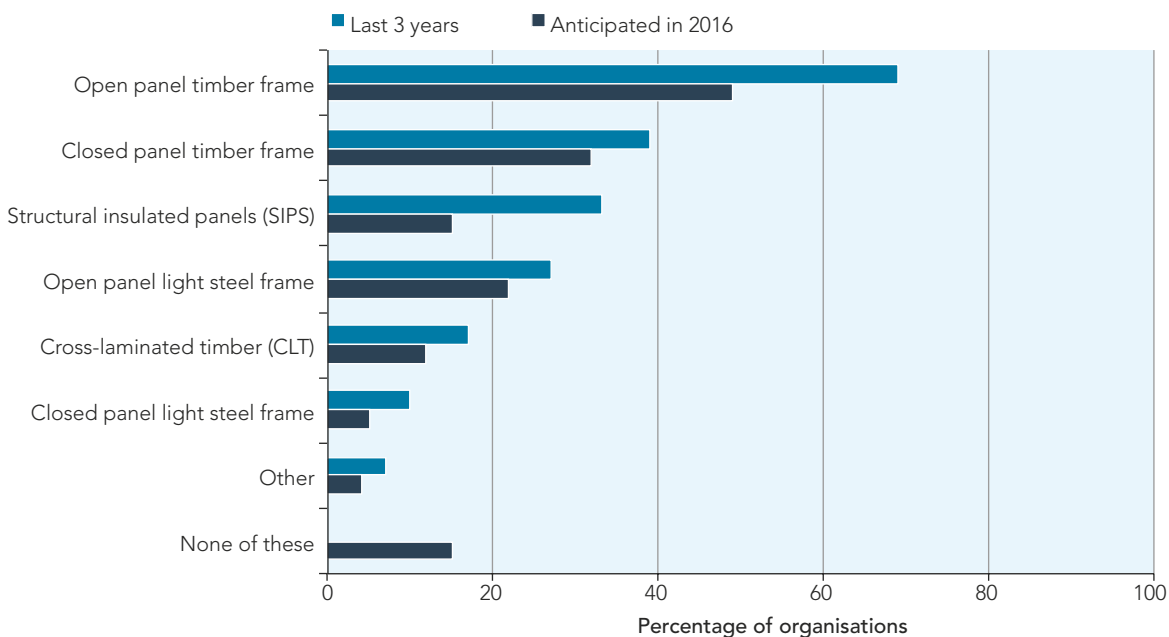
5.3 Types of panelised systems used

Panelised systems in use include ‘open panels’ (ie without plasterboard linings factory fixed) and ‘closed panels’ (ie plasterboard fixed in the factory) in both timber and light steel framing. In addition, this category includes structural systems such as SIPs and CLT. 42% of the organisations interviewed used panelised systems in 2015.

The main type used is open panel timber frame, installed by just over two-thirds of panel system users in the last 3 years (Figure 8). 39% of organisations have used closed panel timber frame and 33% have used SIPs over the same period.

This use of panelised systems is set to continue in 2016 with 49% expecting to use open panel timber frame, 32% closed panel timber frame and 22% open panel light steel frame.

32% said they are likely to use closed panel timber frame in 2016.



Base: House builders and housing associations (77) as a percentage of those who have used panelised systems in the last 3 years.

Figure 8 Types of panelised system used in the last 3 years and anticipated use in 2016 (based on percentage of organisations who have used panelised systems in the last 3 years)

Those who have used open panel systems cited several reasons for not moving to closed panels:

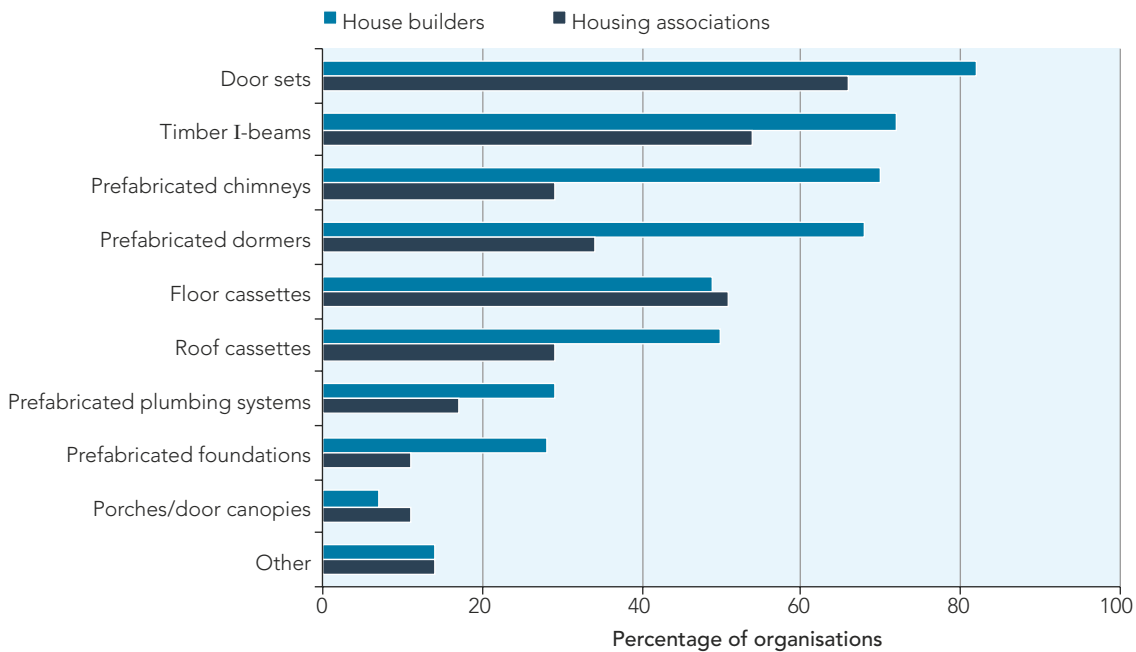
- perceptions of capital cost and 'up-front' expenditure
- being 'not suitable' for the specific project or site
- reduced flexibility on-site, open panel is 'tried and tested'
- risk of damage in transport.

5.4 Types of off-site manufactured sub-assemblies and components used

The survey revealed that the industry is currently making more use of sub-assemblies and components than it is off-site manufactured systems (volumetric construction, pods and panelised systems). Focus group comments showed that components which have been manufactured or constructed off-site require less on-site labour, are seen as efficient, improve build quality, have health and safety advantages and do not attract some of the concerns associated with other types of MMC.

The types of off-site manufactured components used by the highest proportion of companies are door sets, timber I-beams, prefabricated chimneys and prefabricated dormers (Figure 9).

Housing associations' stated use of these components is lower than that of house builders. This could be because they are less aware of what is used on-site when they acquire homes through Section 106 arrangements or through design and build contracts.

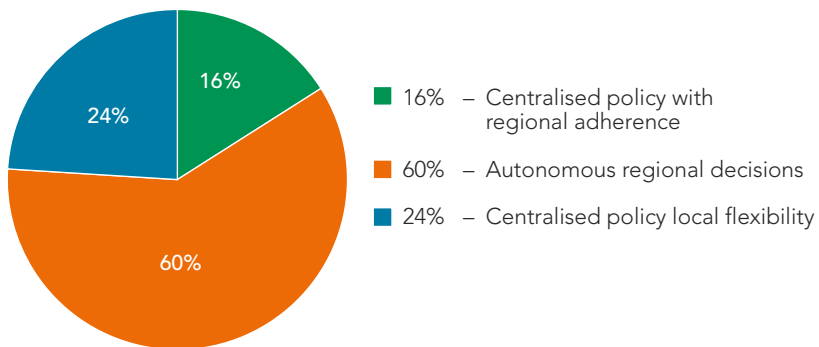


Base: House builders (100) and housing associations (35).

Figure 9 Types of off-site manufactured components used in the last 3 years

5.5 Where are decisions made about the construction method?

Decisions about the type of construction method on a new development, in most house builders and housing associations, are made at the regional office level rather than at head office (Figure 10).



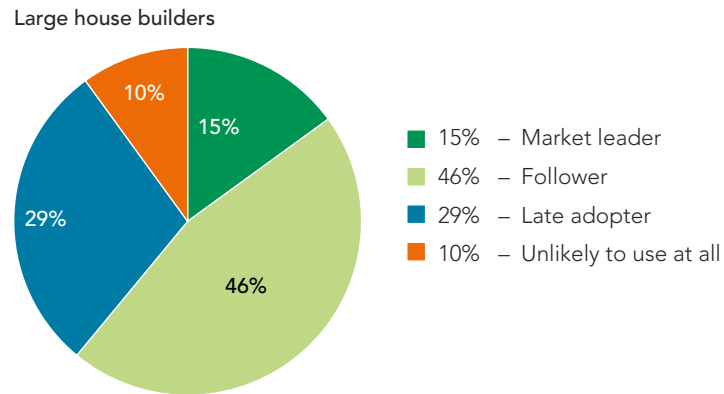
Base: House builders and housing associations (135).

Figure 10 Where decisions are made about the construction method

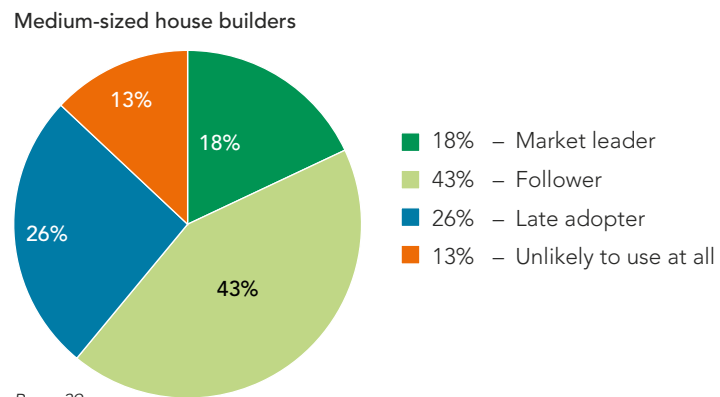
5.6 Willingness to innovate

The majority of those interviewed regard themselves as 'followers' or 'late adopters' of volumetric construction, pods and panelised systems, rather than 'market leaders' in using these forms of MMC (Figure 11).

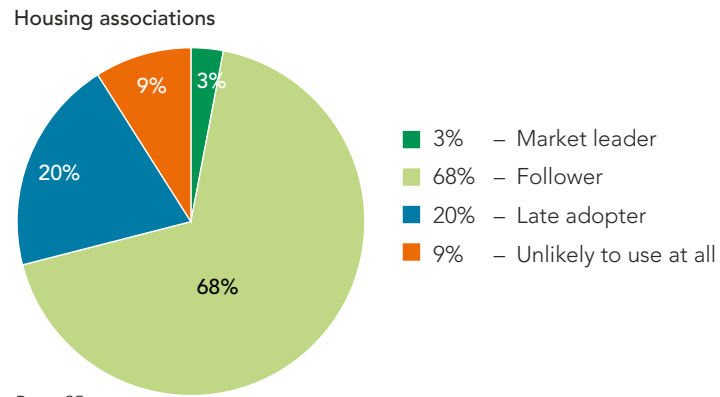
10% of the organisations surveyed described themselves as market leaders, mostly the large and medium-sized house builders rather than the housing associations. Subsequent answers confirm, as expected, that the market leaders are using all the different forms of MMC to a greater extent than the majority of the market.



Base: 61.



Base: 39.



Base: 35.

Figure 11 Which best describes your company's attitude towards the use of volumetric construction, pods and panelised systems?

6 Factors driving consideration of MMC and experiences in practice



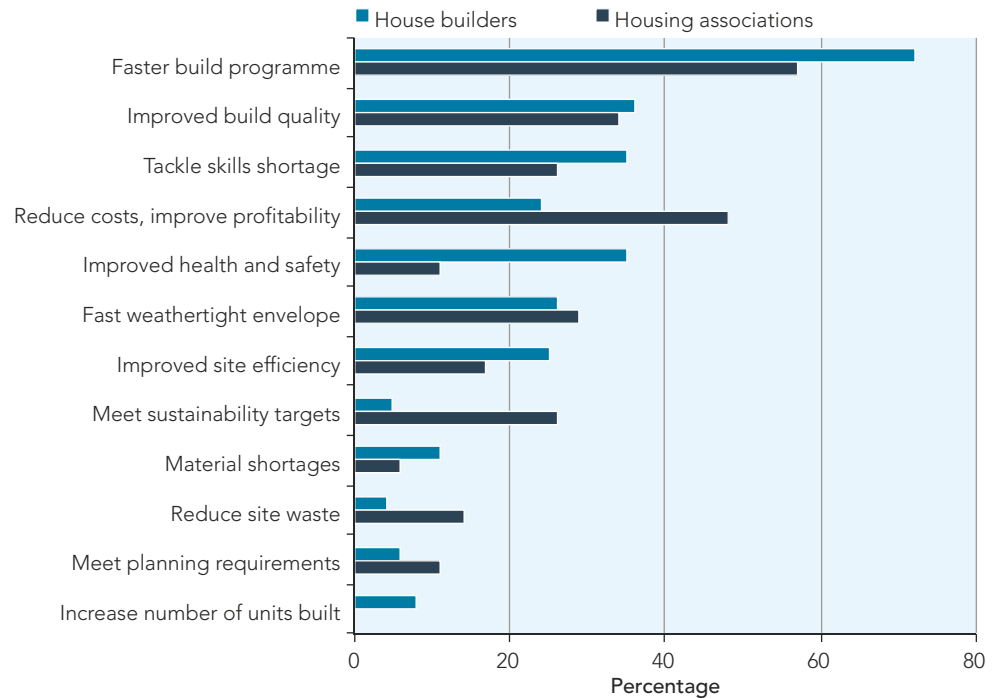
In this section the main reasons for considering the use of MMC amongst house builders and housing associations are described, together with the benefits which have been realised in practice. Experiences with volumetric construction and pods used for apartments or houses are examined in detail together with the likelihood for use again in the future.

6.1 Main reasons for considering MMC

The main reason for considering use of MMC is to achieve a faster build programme (Figure 12). The majority of house builders and housing associations identified this as their main driver and overall two-thirds gave this as one of their top three factors.

Other reasons for considering MMC include improving build quality, tackling the skills shortage, and improving health and safety. Achieving a fast weathertight envelope, reducing costs and improving site efficiencies were also mentioned. Housing associations are motivated by the need to deliver homes quickly, and cost effectively, and the results suggest they believe MMC will help them achieve this objective.

There is an undisputed need for more new homes and the house-building industry is steadily increasing its output. However, only 8% of house builders described a need to increase the number of units they build as a top three driver for considering MMC, although 35% included it in a list of drivers which have influenced them to some extent (not shown).



Base: House builders and housing associations (133, weighted) prompted response from those using, have used or have considered MMC.

Figure 12 Main reasons for using or considering MMC. Percentage stating as a top three driver

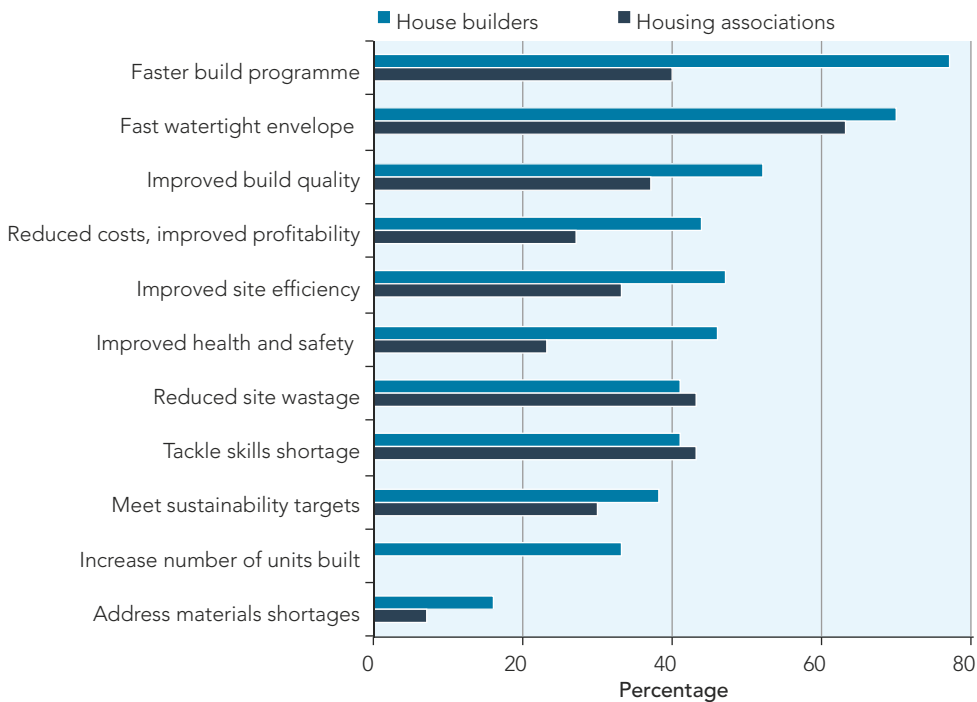
6.2 Benefits of MMC in practice

Section 6.1 showed that achieving a faster build programme was the main motivation to use MMC; this section explores what was encountered in reality.

For the house builders using MMC, speed of construction had proved to be the main benefit experienced in practice. Housing associations were less convinced of this benefit; this may be explained by their lack of direct control over the building programme, being reliant on their contractors/house builders.

Whereas the ability to achieve a fast weathertight envelope did not rank highly in the drivers to using MMC, it was commonly reported as a main benefit realised in practice. Other benefits include improved build quality, site efficiency and health and safety, and a reduction in labour and site waste (Figure 13).

33% of house builders (36% of the large and 20% of the medium-sized companies) have found that MMC has helped towards increasing the number of units they build. However, none of the housing associations has found this; achieving a faster watertight envelope has been the main benefit reported by respondents in this group.



Base: House builders and housing associations using MMC in the last 3 years (120), prompted.

Figure 13 Main benefits of MMC experienced in practice, percentage stating it as a benefit

Fewer than half (44% of house builders and 27% of housing associations) reported that they had experienced reduced costs/improved profitability despite the potential for MMC to offer reduced preliminary costs, improved cash flow and lead to faster sales revenues. The focus groups emphasised that these benefits will only be available in a strong sales market; some contributors had not found that the preliminary costs could be reduced in practice.

MMC is not considered to have made a useful contribution towards reducing reliance on specific building materials that have been in short supply as house-building output rose following the recession. Materials such as facing bricks are likely to still be required regardless of whether or not the underlying structure is of MMC.

6.3 Experiences of volumetric construction and pods

6.3.1 Volumetric construction

34% of those interviewed have used, considered or are considering using full volumetric construction for apartments and/or houses. Most of these organisations are in London and the South East, a small number elsewhere in England and Wales and none in Scotland.

12 organisations have used volumetric construction at least once in the last 3 years and their mixed experiences are summarised in Figure 14.

One-third of the organisations had a positive experience, but the remainder were less positive as they have not encountered the expected benefits. Their experience has also highlighted the importance of paying detailed attention to co-ordination and planning well in advance of construction starting on-site and during construction as well. Feedback from the survey highlights the following issues:

- There is the need to take design decisions and 'freeze' the design at an earlier stage; this reduces flexibility on-site, particularly for any last-minute changes.
- More comprehensive procurement planning of the whole development is required at the outset.
- Despite the planning, more work has been found to be required on-site when the off-site units are delivered, than was anticipated within the programme.
- Cost benefits are not fulfilled in practice; logistics, weather delays and so on, quickly erode savings.
- Low capacity exists within the supply chain, which constrains procurement choice with some having encountered disappointment with delivery performance and product quality.

In spite of these issues, the majority of respondents said that they would be likely to consider using volumetric construction again.

Amongst the 17 organisations who had considered volumetric construction, but not yet used it, 7 thought they might use it in future. Specific drivers for future use included where there is a need for speed, to overcome labour or material shortages, and to help drive up quality or build volumes.

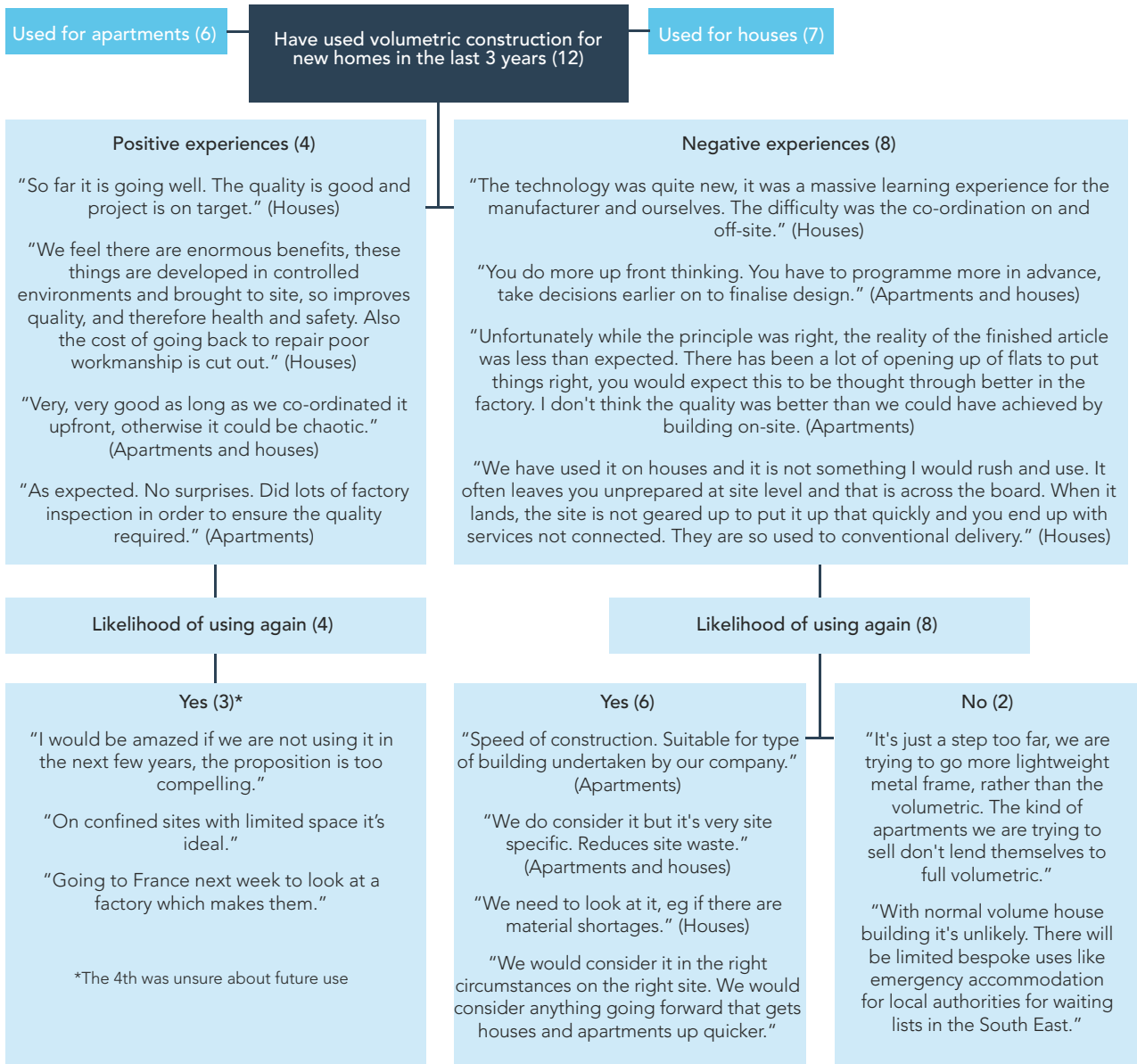


Figure 14 Full volumetric users' experiences

6.3.2 Pods

45% of organisations have used, considered or are considering pods in their new residential build.

Of the 28 organisations which have used pods at least once in the last 3 years most have had largely positive experiences (Figure 15). Amongst the main reasons for using them and the benefits experienced, they highlighted the improved build quality and reduced levels of snagging, reductions in site labour and a faster build, with improved programming and greater overall construction efficiency.

Almost all of those who have used pods would do so again, and most of those considering them expect to use this approach in future.

The main problem experienced by both those who have used and those who have rejected pods was the higher capital cost. Other drawbacks related to capacity within the supply chain, with a lack of choice of suppliers who are able to meet the needs of house builders. There have also been experiences of problems with suppliers being unable to meet the delivery programme as well as companies going out of business. The logistics of transporting pods to site have also proved challenging due to the size of each pod.

Other participants raised concerns about adverse customer reaction, particularly at the luxury end of the market. Concerns were also expressed about where responsibility lies if there are problems during installation.

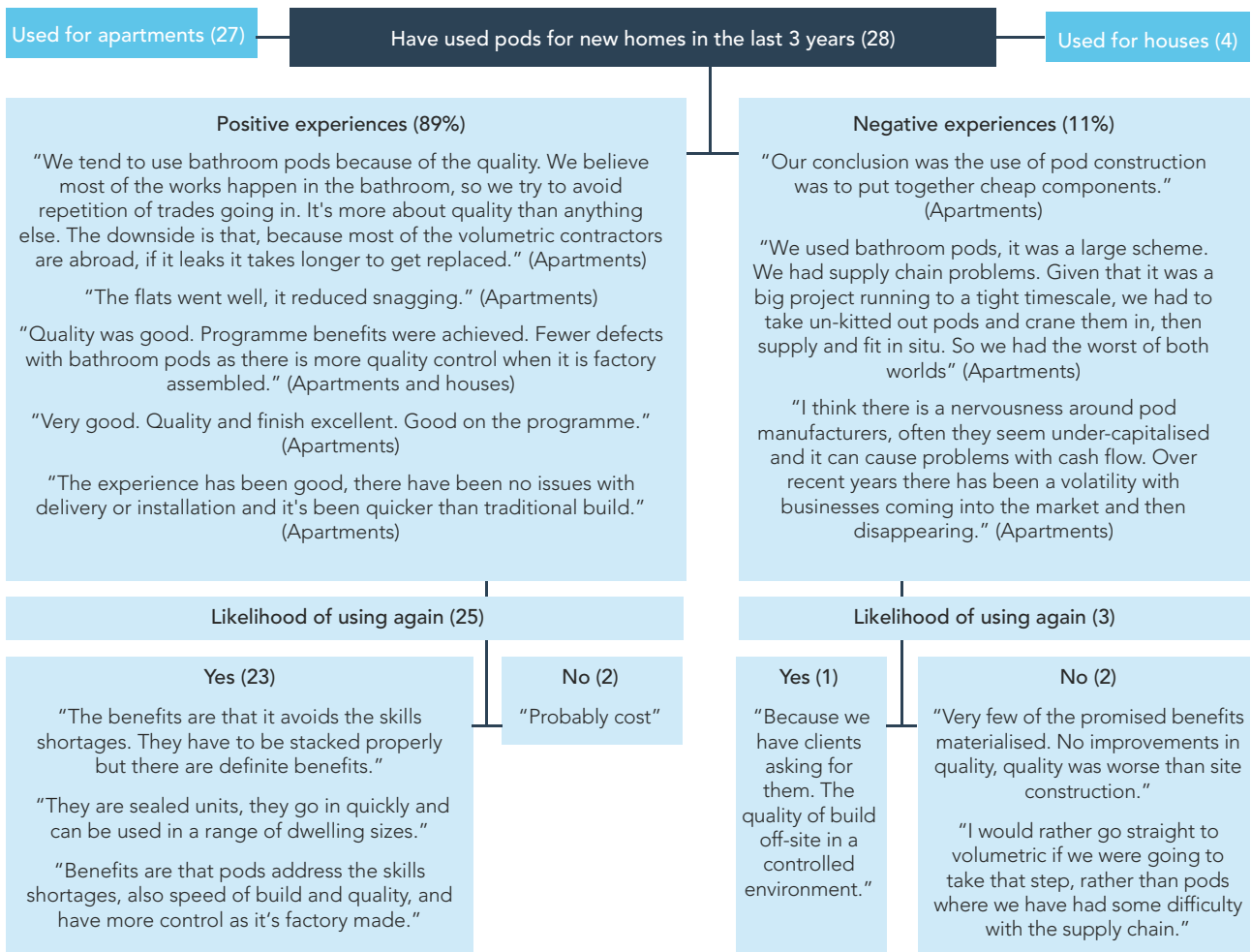


Figure 15 Pod users' experiences

7 Concerns and barriers to using volumetric construction



Concerns about the use of 'whole home' volumetric construction were first expressed in the focus groups and the results on drivers and use in Section 6 corroborate that initial feedback. To assess the concerns in more detail and understand the extent to which these were barriers to future use, questions were asked of the wider audience in stage 2 of the research programme.

The initial observations in the focus groups were confirmed with the main concerns and barriers to use being the higher capital cost and the lack of suppliers. When asked how they perceive the costs associated with the use of volumetric construction in comparison with other approaches, two-thirds said they expect it to cost more.

Other concerns raised in the wider telephone survey, not considered major barriers but nevertheless needing to be addressed, include reactions from potential buyers, the availability of the right labour skills for installation, the need for an early design freeze, a lack of flexibility on-site, transport logistics and reactions from potential buyers.

Respondents were asked to name two main barriers to using full volumetric or modular construction (Table 2) from the list shown in Figure 16.

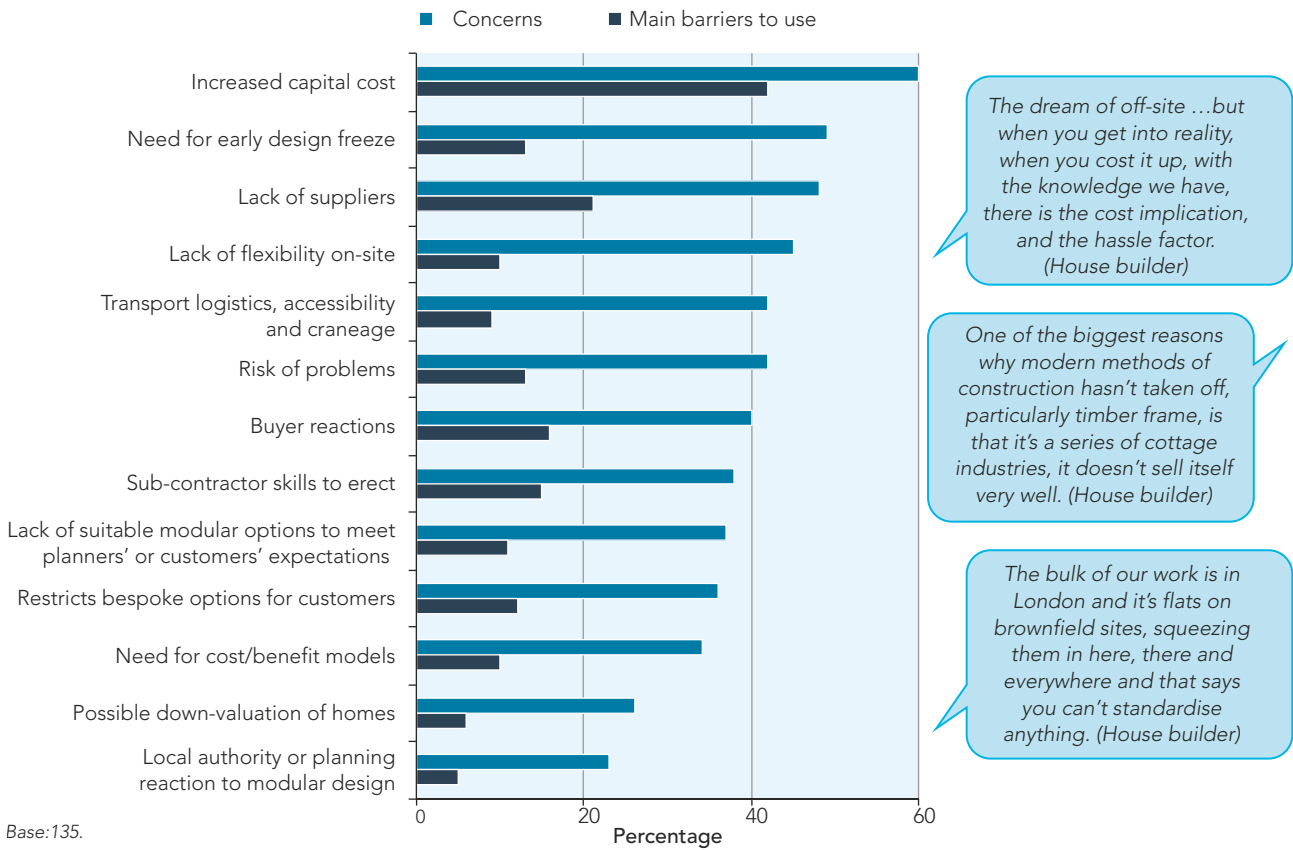
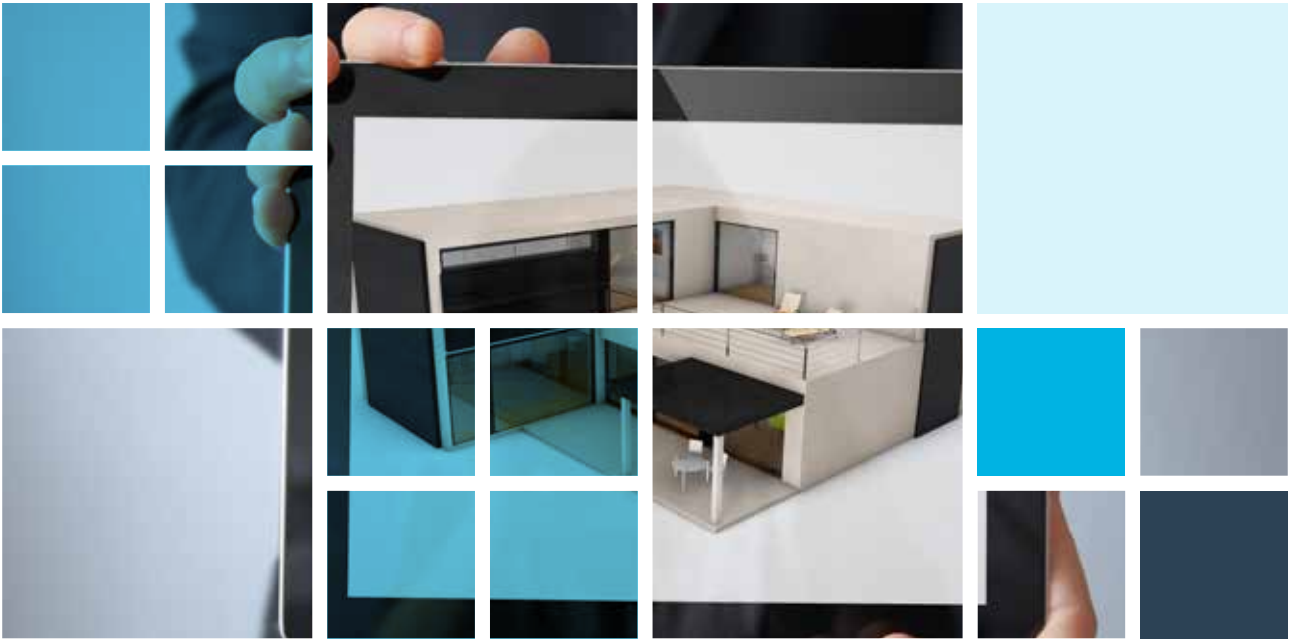


Figure 16 Concerns and barriers to use of full volumetric or modular construction (prompted)

Table 2 Top barriers by type of organisation

Large house builders	Capital cost Buyer reactions Lack of suppliers
Medium-sized house builders	Capital cost Lack of suppliers Lack of flexibility on-site Need for early design freeze
Housing associations	Capital cost Lack of sub-contractor skills Lack of suppliers

8 The future for MMC



With a somewhat mixed picture emerging of both use and experiences to date, the research sought to gain insight into industry views about the future for MMC.

Respondents were asked for their views on the potential contribution of MMC in the construction of new homes in the UK and the expected role it will play within their own organisations. They were also questioned about MMC, in the context of increasing housing output generally, over the next 3 years.

By far the main contribution is considered to be the ability to build homes faster, again corroborating the main benefit experienced in practice. But MMC is also expected to help house builders improve build quality and will be adopted by some to help address skills shortages (Figure 17).

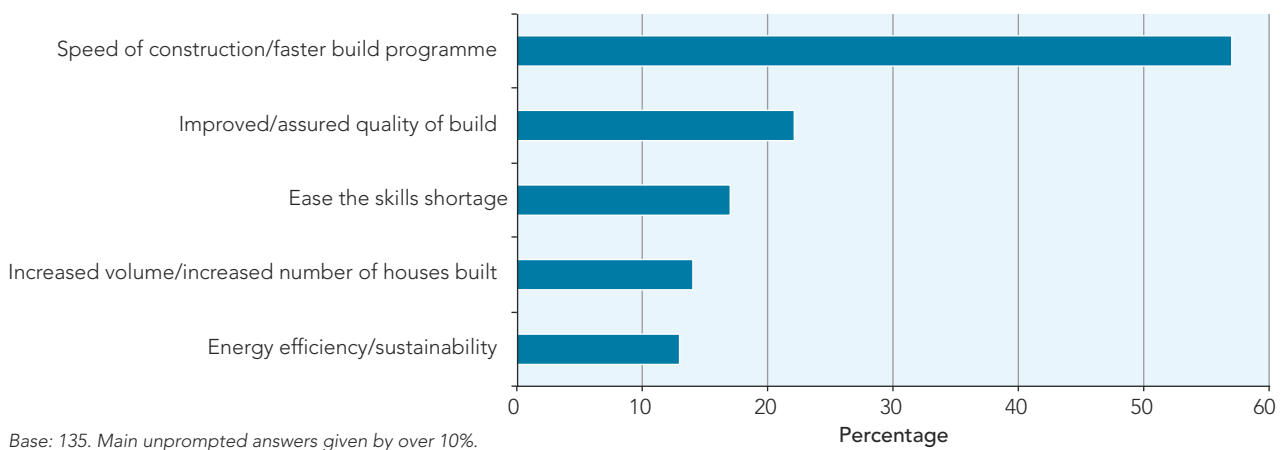
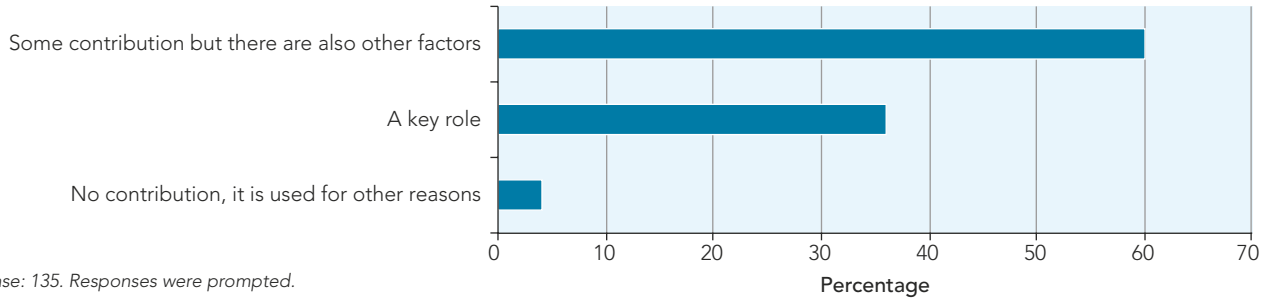


Figure 17 Views on MMC's main future contribution to new build

The majority of house builders and housing associations interviewed feel that MMC has some role to play in the delivery of large volumes of new homes (Figure 18), but identified other factors which need to be addressed. These are examined in more detail in Section 9.



Base: 135. Responses were prompted.

Figure 18 Expected role of MMC in significantly increasing UK housing input

In spite of these factors, 78% of house builders and 46% of housing associations expect to increase the number of new homes they build over the next 3 years and MMC is expected to make some contribution in achieving this by the majority (Figure 19).

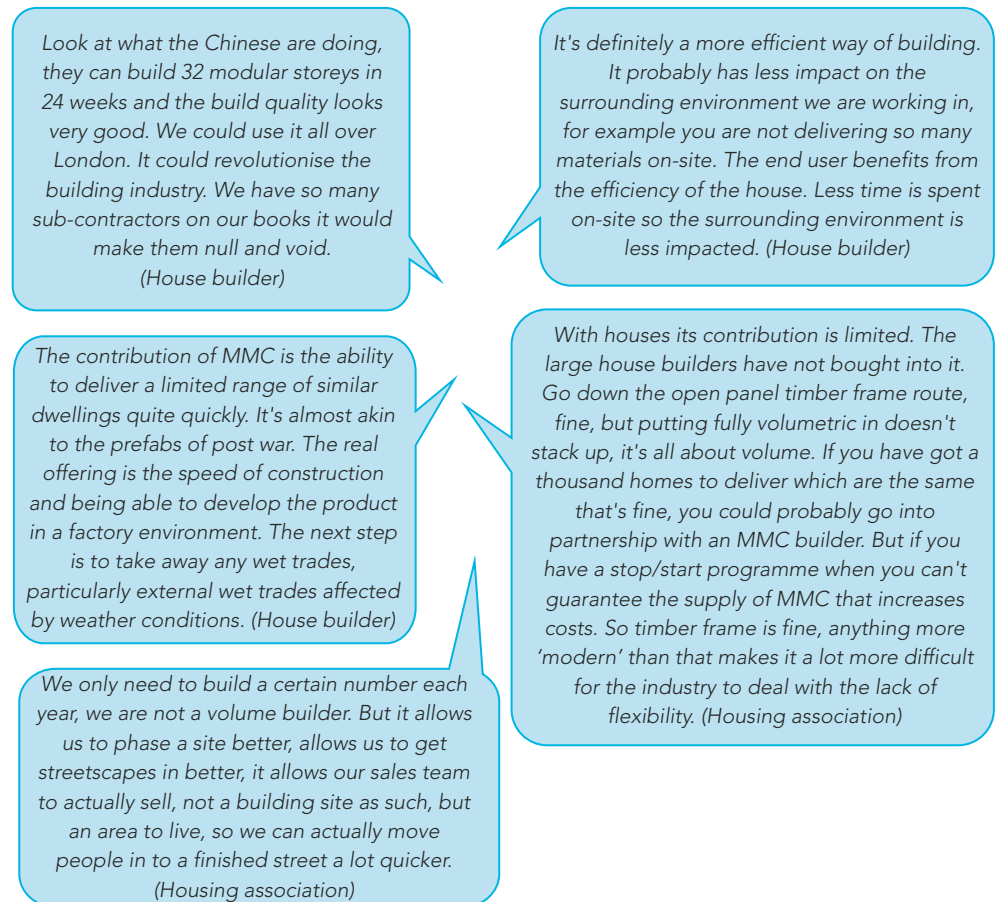


Figure 19 Some comments about the contribution of MMC to the new build sector

It is expected that the use of MMC is likely to grow over the next 3 years; 45% anticipate that it will play a greater role in their organisation's construction processes. Only 3% of those surveyed expect the role of MMC to decline (Figure 20).

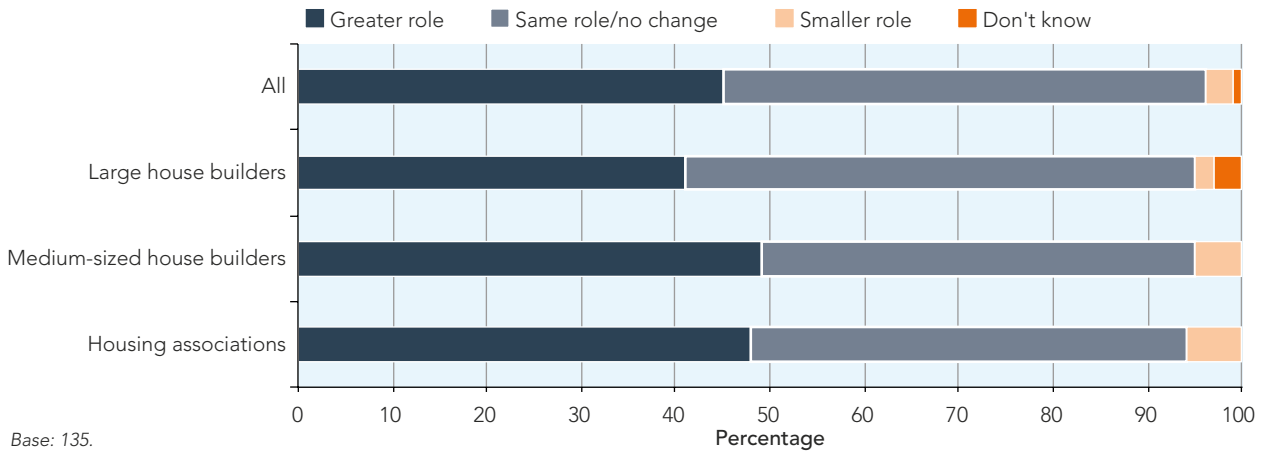


Figure 20 Anticipated role of MMC in organisations' construction processes over the next 3 years

Concerns over skills shortages, which are expected to continue over the next 3 years, were given as the main reason encouraging the use of MMC. Other reasons are a wish to increase build speed and housing output and to improve quality (Figure 21).

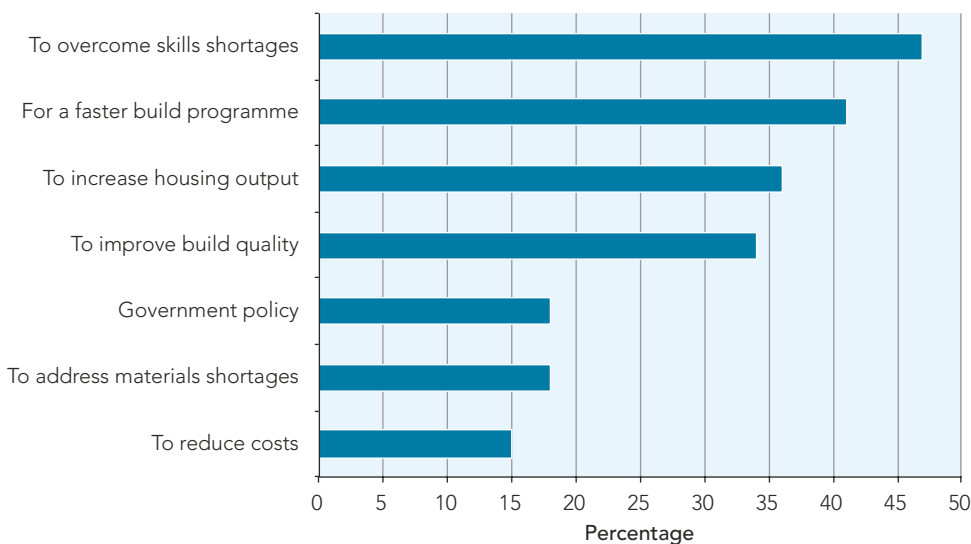
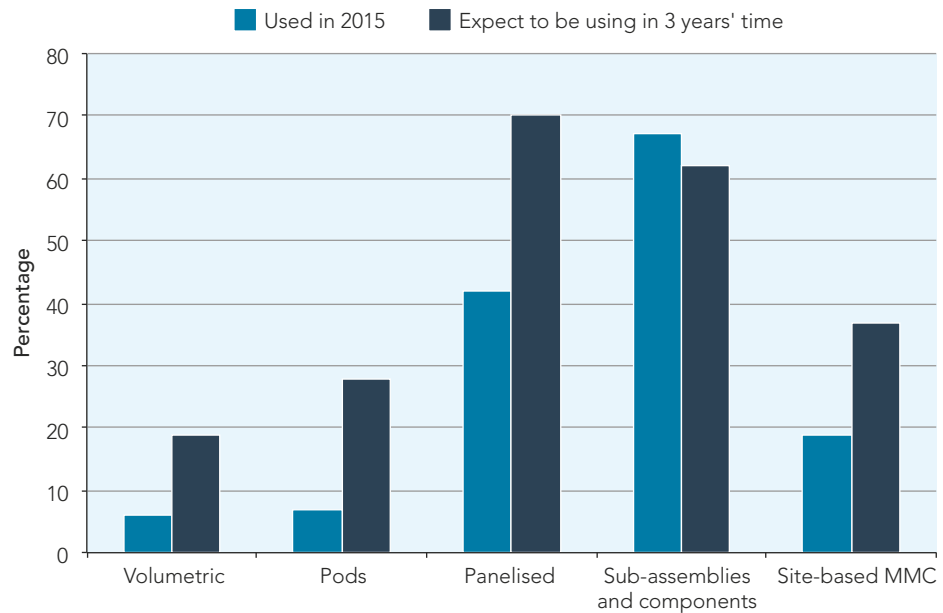


Figure 21 Main reasons why MMC is expected to play a greater role

Panelised systems and sub-assemblies and components are expected to continue to be the most used type of MMC over the next 3 years (Figure 22).

The use of ‘whole home’ volumetric construction and pods is expected to increase over the next 3 years. 19% think they will be using volumetric construction and 28% pods in that timeframe, significant increases compared to 6 to 7% who said they used each approach in 2015.



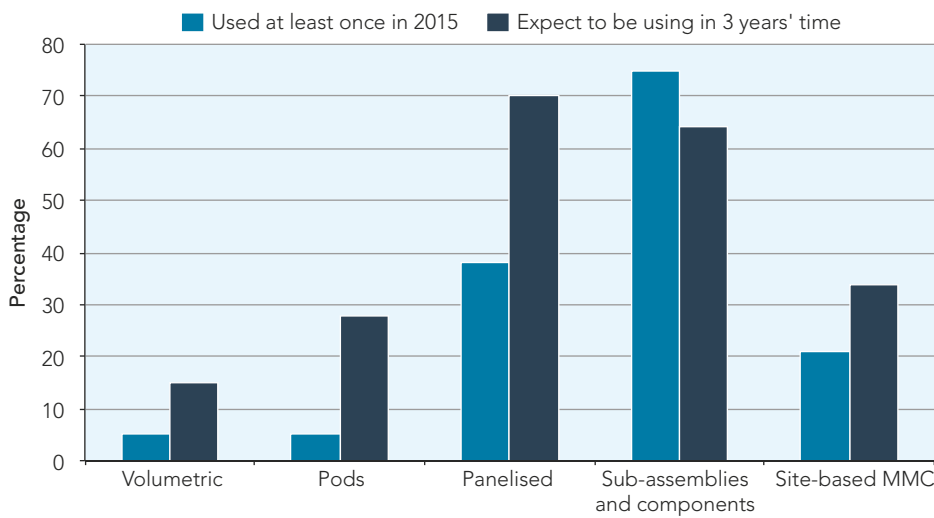
Base:135.

Figure 22 Types of MMC used in 2015 and expected to be used in 3 years' time

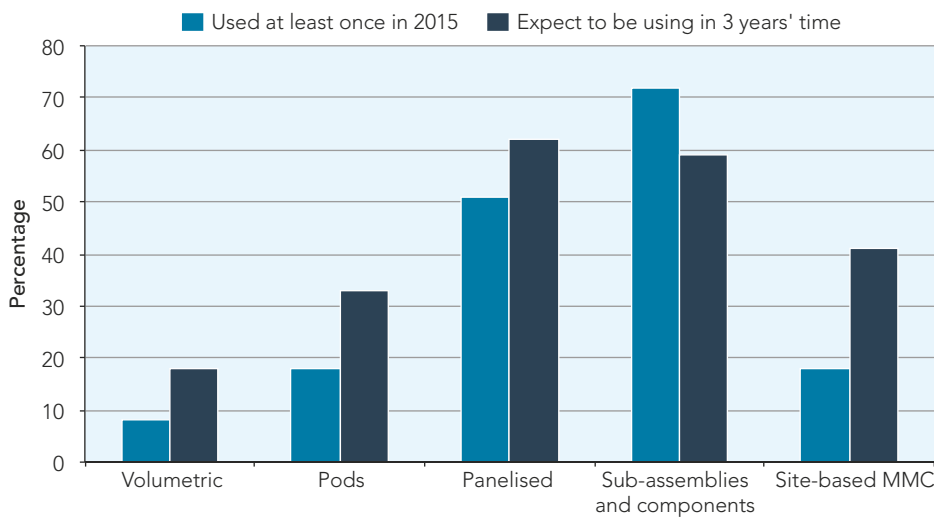
There are differences by type of organisation (Figure 23); twice as many housing associations than house builders think they will be using volumetric construction in 3 years' time. Also, the proportions of large house builders and housing associations using panelised systems to some extent is anticipated to increase significantly.

Significant differences are expected to continue by region (Figure 24), with anticipated use of volumetric construction and pods increasing predominantly in London/the South East and high levels of panelised system construction continuing in Scotland, but also increasing in the rest of the UK.

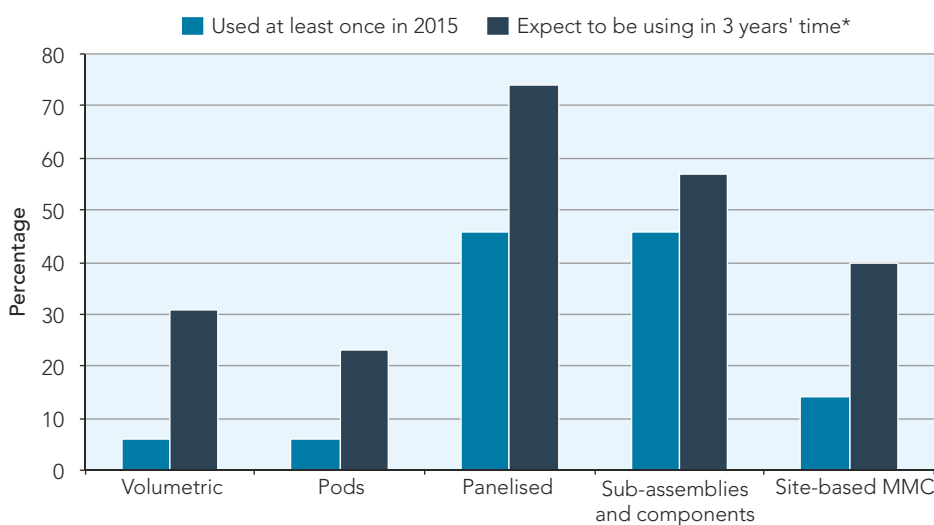
Large house builders



Medium-sized house builders



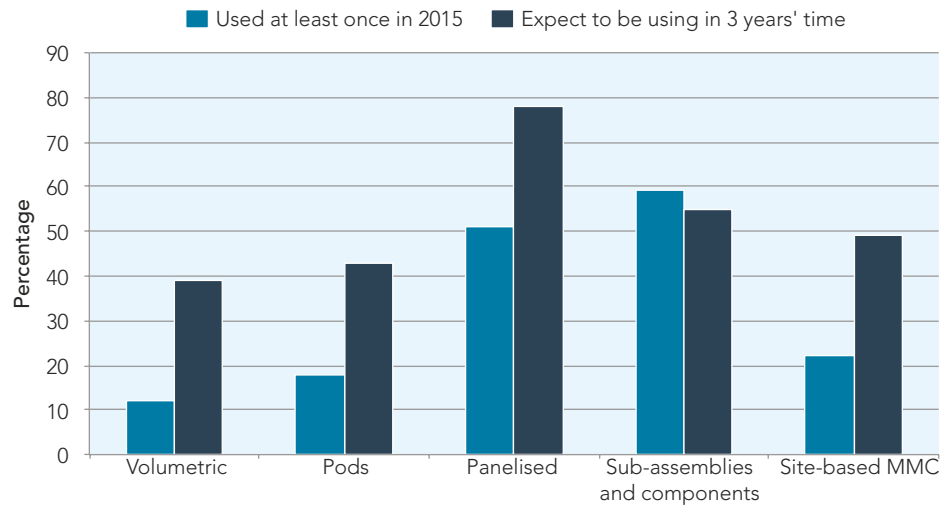
Housing associations



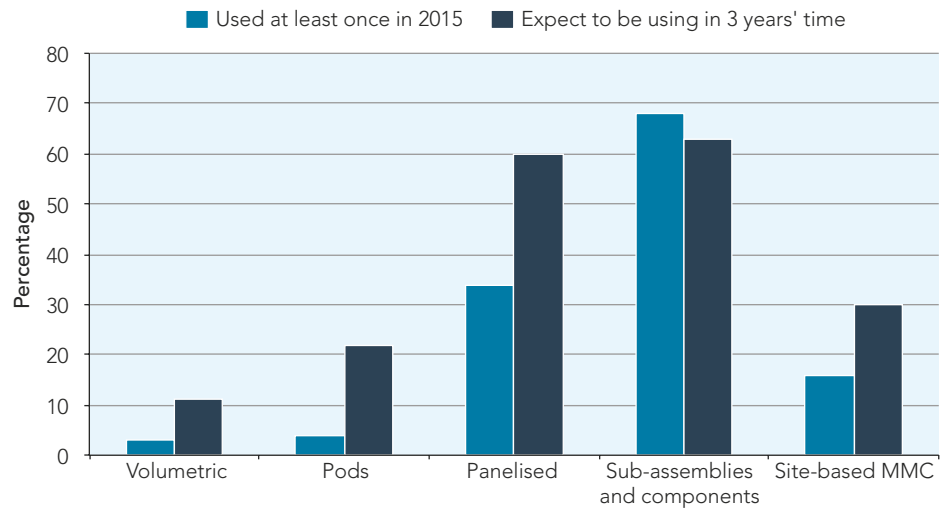
*7% said they do not expect to be using any of these in 3 years' time.

Figure 23 Types of MMC organisations expect to be using in 3 years' time, by type of organisation

London and the South East



Rest of England and Wales



Scotland

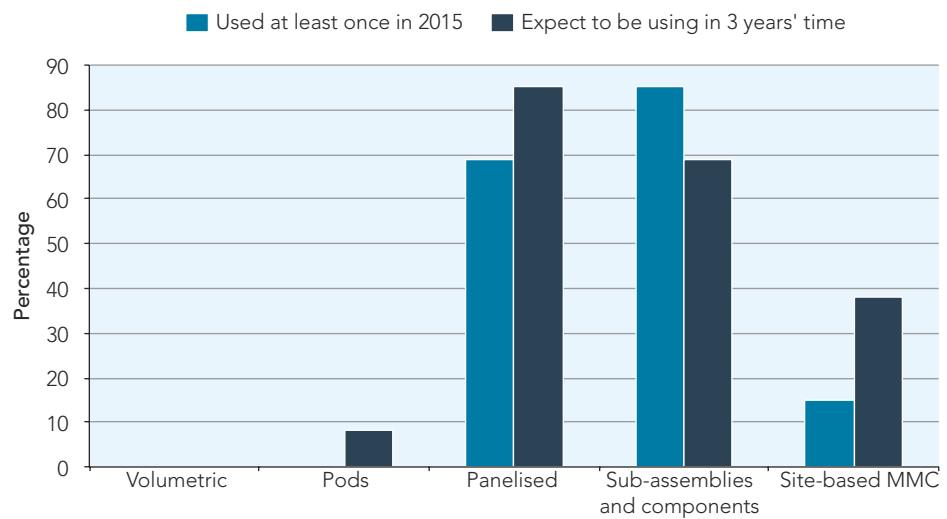
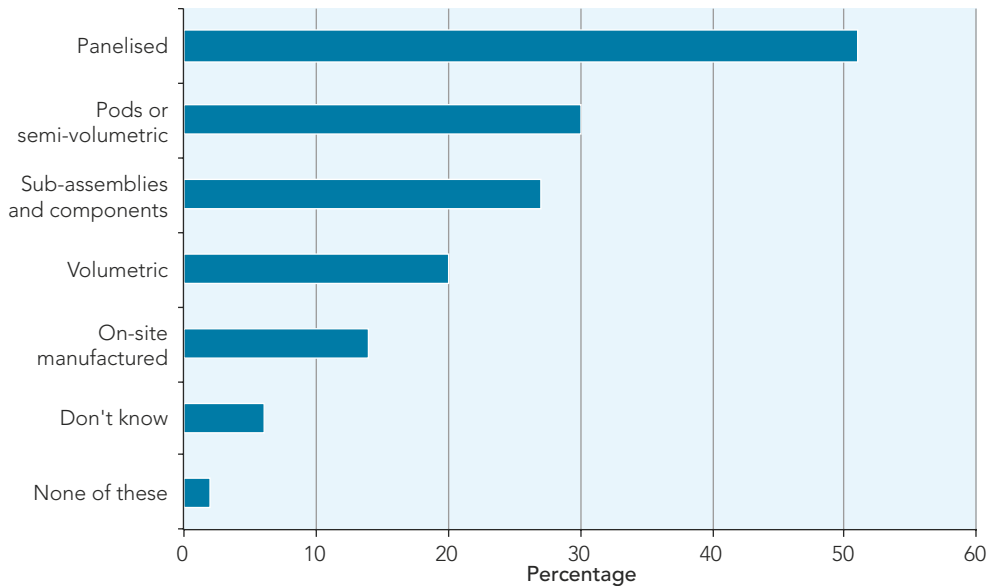


Figure 24 Types of MMC organisations expect to be using in 3 years' time, by region

When asked for views on where the industry is most likely to see growth in MMC over the next 3 years, the most common answer was panelised systems (Figure 25).



Base: 135.

Figure 25 MMC approaches considered most likely to grow in use in new build over the next 3 years

Amongst those who feel that their use of volumetric construction and/or pods will grow, their reasons are similar to those given for encouraging greater use of MMC generally, ie faster build time, addressing skills shortages and helping to meet demand (Figure 26).

Those not anticipating increased use consider that these methods remain unfamiliar and therefore carry some risk which they are not willing to take.

- For speed/faster build time (32%)
- Help address skills shortage (30%)
- Help meet demand (23%)

- Risk of unfamiliar systems and public perception (41%)
- Expensive (26%)
- Insufficient capacity in supply chain (12%)
- Market prefers traditional buildings and methods (12%)

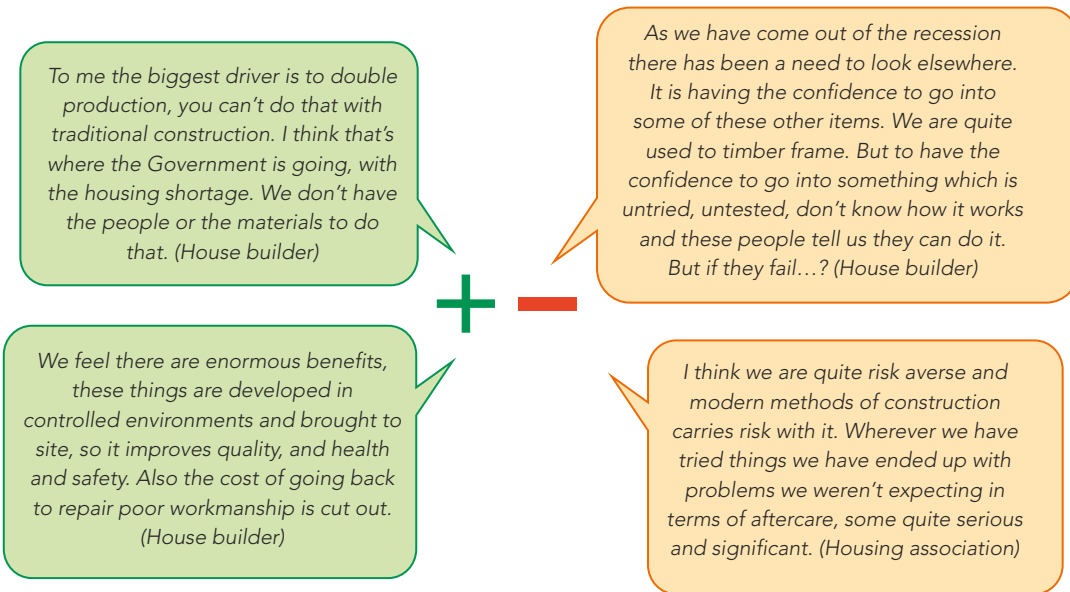
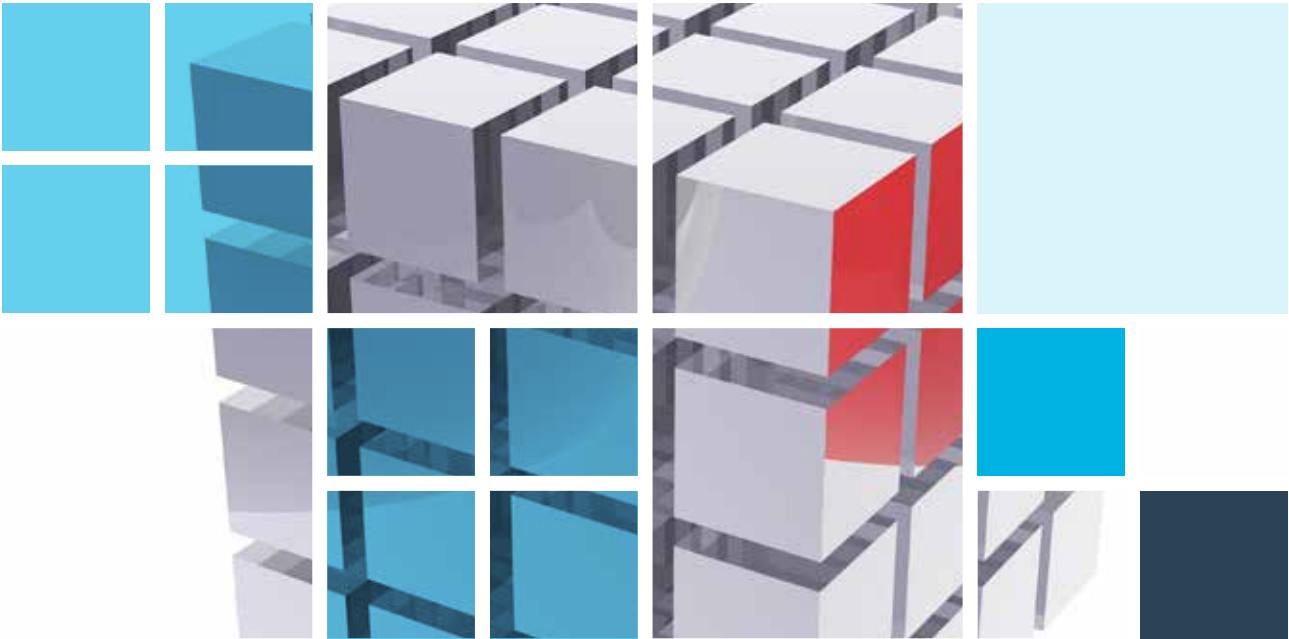


Figure 26 Reasons for and against use of volumetric construction and/or pods in future (unprompted)

9 Factors to be addressed for increased use of MMC



It is clear from the research that the use of components and sub-assemblies is very well established. The use of panelised systems, already standard in Scotland, is developing and is clearly expected to continue. However, to progress the move towards greater use of pods and whole home volumetric construction, the perceived barriers need to be overcome, and the benefits delivered such that they outweigh the drawbacks, reinforcing the case for greater use.

This issue was debated amongst the focus group participants who identified the following list of key issues preventing or restricting greater use of full volumetric construction. The main issues are shown in blue shading in Table 3.

Table 3 Key issues identified for preventing or restricting greater use of full volumetric construction

Risk, including lack of suppliers	<p>The risk factor was raised unprompted at both stages of the research; use of an unknown or unfamiliar approach, and the effect on costs, site issues, labour requirements and importantly customer attitudes. Also the risk of using what are often small suppliers who were described as not understanding the house-building industry.</p> <p>Analogies were drawn with countries like Japan where there are several large and experienced companies successfully supplying high volumes of modular homes – a more developed supply chain, delivering more confidence.</p>
Increased cost	<p>Described as a main barrier to use, some companies find that savings on-site, for example, resulting from shorter construction duration and health and safety benefits are not taken into account in financial models. Others had been unable to achieve significant site savings to counter the higher capital cost, in preliminaries for example.</p>

<p>Buyer reactions and restriction on bespoke customer options</p>	<p>There is concern about buyer reactions to volumetric construction – it may be seen as a ‘cheap’ approach with association with ‘prefabs’, although some house builders are describing off-site as providing better quality of construction.</p> <p>The opportunity to offer bespoke options to customers is more limited and decisions need to be made earlier on – restricting buyer options if an off-plan buyer withdraws from purchase or the home is sold post construction.</p>
<p>Requirement for standardisation</p>	<p>The view was expressed that house types need to be varied to suit local requirements for planning and marketing purposes, but an expectation that volumetric construction is suited to standardised or repetitive designs. There is thought to be a lack of suitable modular options which meet planners’ and customers’ expectations.</p>
<p>Need for early design freeze</p>	<p>Designs may need to be changed slightly for a number of reasons; the industry is accustomed to working with some flexibility in design – that volumetric designs must be fixed at an earlier stage is considered by some to be an unwelcome and impractical way of working.</p>
<p>Transport logistics</p>	<p>Transporting large units to sites which may be restricted in size and difficult to access, and requiring hoisting, is seen as adding cost and limiting use.</p>
<p>Lack of sub-contractor skills</p>	<p>A lack of skills to install volumetric units and a lack of understanding about working with them.</p>

Suggestions made during the course of the research to encourage use of volumetric construction include:

- dissemination by MMC manufacturers of cost/benefit models and best practice case studies
- encouraging suppliers to enter the market (some have in fact left it in the last 3 years) and improving their understanding of the house-building sector
- finding ways of working with suppliers to overcome industry concerns
- grant or subsidy-funded development
- improving awareness and understanding of what volumetric construction is amongst potential homebuyers.

To be adopted by the industry on a widespread basis, volumetric construction needs to be seen to be providing benefits for house builders. At present other MMC approaches, such as panelised systems and sub-assemblies, are seen to be enhancing the build process by increasing the speed of construction and improving quality; given the concerns about full volumetric construction, these alternatives are providing solutions sufficient for many house builders’ and housing associations’ needs at present.

Appendix A: Focus group attendees

Organisation	Name	Job title
Aster Group	Tony Clifford	Development Director
Avant Homes	Stuart Rowlands	Development Director
Barratt	Oliver Novakovic	Technical and Innovation Director
Barratt East Scotland	Andrew Rule	Design Manager
Barratt East Scotland	Martin Eaglesham	Senior Architectural Technician
Bellway	John Kerr	Managing Director
Cala	Marc Coulon	Group Construction and Technical Director
CCG Homes	Daniel McGann	Partnership and Innovation Manager
Churchill	Hacon Edgley	Sustainability Consultant
Clyde Valley Housing Association	Gerard Eardley	Technical Inspector
Cruden Estates	David McEvoy	Construction Director
Guinness Trust	Michael Watts	Head of Partnerships Design and Quality
Hanover	Martin Whale	Quality and Programme Manager
Housing 21	Steve Hogben	National Construction Manager
Keepmoat	Peter Hindley	Managing Director: Homes
Kier	Jim Collins	General Manager
Link Group	George Andrew	Clerk of Works
Mactaggart and Mickel	Ross Mickel	Director
Network	David Foster	Head of Construction
Notting Hill Housing Association	Ed Badke	Development Director
Octavia Housing Association	Dave Woods	Development Director
Riverside Group	Geoff Fogden	Director
Springfield Properties	James Johnstone	Timber Frame Design Manager
Springfield Properties	Raymond Stevenson	Timber Frame Design Manager
Swan Housing	Deane Rosewell	Commercial Director
Taylor Wimpey	John Gainham	Divisional Managing Director
Thenue Housing Association	Beth Reilly	Head of Property Services
Waterloo Housing	Neil Adie	Group Head of Development

Appendix B: Weighting of results

Where 'all' results are given in this report, weighting factors have been applied to ensure each segment interviewed, ie large and medium-sized house builders and housing associations, has a 'share of voice' of the 'all' figures which is in proportion to the number of new homes each group developed in the total market in 2015.

To arrive at this, the number of homes developed in 2015 by each office interviewed was recorded (within bands). This was then compared with the proportion of homes each group built in the total market by the groups included in the survey (ie excluding those building under 200 homes).

For example, of the total number of homes built in 2015 in the sample, 26% were built by medium-sized house builders. However, medium-sized house builders accounted for 15% of all new homes built in 2015 by the groups included in this research. Hence a weighting factor of 0.15 has been applied to results from this group to arrive at the aggregated or 'all' results, to ensure their views are representative in proportion to the number of homes this group actually built.

This ensures that, if any group holds a very different view to other groups, their answers are not over- or under-represented in the total.

Weighting factors are given in Table B1.

Table B1: Application of weighting factors to ensure aggregated or 'all' answers are representative

	Homes built as a percentage of total in sample	Homes built as a percentage of actuals in 2015*	Weighting factor†
Large house builders Over 1,000 homes per annum nationally	55%	60%	0.60
Medium-sized house builders 200 to 1,000 units per annum nationally	26%	15%	0.15
Housing associations	19%	25%	0.25
* Note that the sample in the research did not include those building fewer than 200 homes a year. † Each group's answers to individual questions has been weighted by these factors to ensure their 'voice' is in proportion to their share of new homes built.			

References

- 1 Department of Trade and Industry. Rethinking construction (The Egan Report). London, Department of Trade and Industry, 1998.
- 2 Department of the Environment. Constructing the team. Joint review of procurement and contractual arrangements in the United Kingdom construction industry (The Latham Report). London, Department of the Environment, 1994.
- 3 NHBC Foundation. A guide to modern methods of construction. NF 1. Milton Keynes, NHBC Foundation, 2006.

Further reading

UK House builders directory 2015.
www.propertydata.com.

Construction Products Association. Construction industry forecasts 2015–2019.
London, Construction Products Association, 2015.
www.constructionproducts.org.uk.

Modern methods of construction

Views from the industry

The UK has a long history of using modern methods of construction (MMC), with many systems being introduced since the Second World War, to increase housing output in the UK.

Based on an extensive survey of house builders and housing associations, this report explores current industry attitudes towards MMC. It records the degree to which different methods and systems have been adopted and assesses the appetite for more extensive application of specific approaches.

The research finds an industry, which, while cautious in its approach, is nevertheless embracing MMC in its many forms, and remains ready to explore new options and innovations.



The NHBC Foundation, established in 2006, provides high quality research and practical guidance to support the house-building industry as it addresses the challenges of delivering 21st century new homes. Visit www.nhbcfoundation.org to find out more about the NHBC Foundation research programme.

