

CITB ANALYSIS

THE IMPACT OF MODERN METHODS OF CONSTRUCTION ON SKILLS REQUIREMENTS FOR HOUSING



A report on the skills implications for both panelised and volumetric housing construction.

April 2019





The 2017 Housing White Paper set out the ambition to deliver **250,000** homes a year by 2022, which has been extended to **300,000** homes by the mid-2020s.

Various research studies have indicated that modern methods of construction (MMC) require less on-site labour to assemble homes than brick and block construction methods and potentially require a smaller workforce with different skill sets from those currently being used. However, limited information is available on the impact of MMC on the overall workforce skills requirements.

This commission by the Ministry of Housing, Communities and Local Government (MHCLG) was to consider the contribution that increased MMC uptake in home building could make to the workforce requirements for delivering new homes. As there are a range of MMC types, the study focused on the changes to the workforce profile for panelised and volumetric offsite home building.

Using the definition and categorisation of MMC developed by the MHCLG working group on MMC assurance, insurance and mortgages, volumetric construction is the production of three-dimensional units in controlled factory conditions which are then assembled together on site.

Panelised construction on the other hand is an approach where panels units are produced in a factory environment and come to the site 'flatpack', typically a series of floor, wall, or roof panels, which are then assembled on-site to produce a three-dimensional structure.

Opinions from industry experts who are involved in the use of MMC for home building were used to quantify the impact on labour demand of constructing a typical house using MMC, and the results used to calculate the change in labour demand arising from different levels of MMC uptake of MMC.

Five different MMC scenarios were considered, as outlined below. For example, in Scenario 1, we are assuming that **50%** of homes built in 2025-26 will be based on the mix of types currently being built and the other **50%** being built with equal shares of panelised and volumetric MMC types.

	PANELISED	VOLUMETRIC	CURRENT (BRICK AND BLOCK)
Baseline	n/a	n/a	100%
Scenario 1	25%	25%	50%
Scenario 2	15%	35%	50%
Scenario 3	12.5%	12.5%	75%
Scenario 4	17.5%	7.5%	75%
Scenario 5	7.5%	17.5%	75%

For home building to reach the Government housing ambition by mid-2020s without increased levels of MMC-use (Baseline), a **40%** increase in the home building workforce would be required, which represents an overall increase of **195,000** workers over the next seven years.

Scenarios 1-5 show that increasing uptake of MMC can reduce the additional workforce requirement, especially when there is increased adoption of volumetric MMC, such as in Scenarios 1 and 2. The details are shown in the following table.

		EMPLOYMENT	CHANGE FROM STARTING WORKFORCE	% CHANGE FROM STARTING WORKFORCE	CHANGE FROM BASELINE	% CHANGE FROM BASELINE	CHANGE AS A % OF THE BASELINE CHANGE FROM STARTING WORKFORCE
2017-18 Workforce		493,000	n/a	n/a	n/a	n/a	n/a
2025-26 workforce	Baseline	688,000	195,000	40%	n/a	n/a	n/a
	Scenario 1	658,000	165,000	33%	-30,000	-4%	-15%
	Scenario 2	651,000	158,000	32%	-37,000	-5%	-22%
	Scenario 3	673,000	180,000	37%	-15,000	-2%	-9%
	Scenario 4	676,000	183,000	37%	-12,000	-2%	-6%
	Scenario 5	670,000	177,000	36%	-18,000	-3%	-10%

While this shows the overall workforce impact, looking within the broad occupational groups highlights some notable differences.

There is no change in the professional and non-manual workforce between the baseline and each of the scenarios. This is a constant requirement across all, irrespective of the build type adopted and is more a measure of the supporting workforce required to deliver the volume of homes being built. However, the scenarios do show an impact on the workforce estimates for skilled trades and manual workers required, and a shift between onsite and offsite shown on table below.

The baseline shows the skilled trade and manual workforce increasing from **266,000** up to **372,000** by 2025-26, all of which is assumed to be onsite. Scenarios 1 and 2 indicate that the level of onsite skilled trades and manual workers would be very similar to the current workforce as MMC uptake results in an additional workforce of **80,000** skilled trade and manual workers based offsite. Scenarios 3, 4 and 5 model increased MMC take up of **25%**, which is half of what is used in Scenarios 1 and 2, therefore their workforce demand impact is around half the value, although all three scenarios still require an increase in the onsite skilled trades and manual workers.

		PROFESSIONAL AND NON-MANUAL	SKILLED TRADES & MANUAL				INCREASE IN OFFSITE
		WORKFORCE	CHANGE FROM BASELINE	CHANGE FROM BASELINE (%)	% CHANGE IN ADDITIONAL WORKFORCE FROM STARTING POINT COMPARED TO BASELINE	WORKFORCE	
2017-18 workforce		227,000	266,000	n/a	n/a	n/a	n/a
2025-26 workforce	Baseline	316,000	372,000	n/a	n/a	n/a	n/a
	Scenario 1	316,000	262,000	-110,000	-30%	-104%	80,000
	Scenario 2	316,000	254,000	-118,000	-32%	-112%	81,000
	Scenario 3	316,000	317,000	-55,000	-15%	-52%	40,000
	Scenario 4	316,000	321,000	-51,000	-14%	-48%	39,000
	Scenario 5	316,000	313,000	-59,000	-16%	-56%	41,000

The main impact for the scenarios modelled was on the skilled trades and manual workforce:

- **Scenario 1** (25% Panelised; 25% Volumetric; 50% current build): the number of workers in 2025-26 is just under current estimates of around **266,000**, with an additional **80,000** jobs created offsite.
- **Scenario 2** (15% Panelised; 35% Volumetric and 50% current build): the number of site-based workers decreases to **254,000** by 2025-26 with an additional **81,000** workers employed offsite.
- **Scenarios 3, 4 & 5**, with lower levels of Panelised and Volumetric construction: all show the site-based workforce increasing to around **317,000 – 320,000** workers, with around **40,000** jobs being created offsite.

Current levels of panelised and volumetric construction techniques used in home building are estimated to be at relatively low levels (circa 6%). The scenarios show that ramping up volumes of panelised and volumetric construction to just over **50%** of total build (Scenarios 1 & 2) might help mitigate some of the longer-term pressure on skilled trade and manual workers.

However, there would still be a requirement for:

- An increase in the number of skilled trades and manual workers to support homes being constructed with current build methods from 2018-2021.
- After 2021, the emphasis shifts to maintaining employment levels of site based skilled trades and manual workers to support current build methods while concurrently developing skills for offsite workers.
- Development of non-manual workers to support both onsite and offsite work.

The analysis allows occupational details to be drawn out for the skilled trades and manual workforce in each scenario, highlighting that:

- Labourers; Construction Trades Supervisors; Wood trades and interior fit out – all have more than a **10%** reduction in workforce for these occupations when compared to the baseline projection of current workforce for both Scenarios 1 or 2.
- Bricklayers and Glaziers show more than a **10%** reduction in workforce for these occupations in Scenario 1, however this is around a **7%-8%** reduction under Scenario 2.
- Scenarios 3, 4 and 5 all have lower levels of MMC uptake and show less impact for those occupations mentioned above, with workforce reductions ranging between **5%-9%** for most, and only labourers giving a reduction of **10%** under Scenario 3.
- All other occupations modelled under each scenario show either a slight or no variation when compared to baseline estimates.

Although the scenario analysis shows that MMC for home building can influence future workforce requirements, helping to mitigate some of the occupational demand pressure, it also highlights that widespread adoption of offsite construction would be needed to have a significant impact on future productivity.

The analysis also highlights that in the short term to 2021, an increase in the number of homes being built is likely to result in an increased demand for a workforce that supports the existing mix of build types, unless there is a rapid increase in MMC.

This means that the home building sector faces a series of challenges:

- In the short term it will need to grow and develop skilled trades and manual workers to support an increase in the number of homes built using the current construction methods,
- In the medium to longer term it will be necessary to maintain the onsite skilled trades and manual workers at the same time as developing the offsite workforce to deliver MMC builds.
- There is also the need to up-skill existing workers to cover the site management, integration, onsite placement and assembly that will be increasingly required for MMC, and to.
- Ensure that the professional, management, technical and non-manual workforce develops the digital skills that will be an increasing part of construction work in the future.

Helping industry respond to and embrace the challenges associated with delivering an increasing number of homes using the current build mix, while also promoting and developing adoption of MMC and offsite construction has already been recognised by Government and CITB. However, for this to result in noticeable productivity improvements, further actions are likely to be needed.

It is therefore recommended that:

For Government:

- Public sector home building along with support for the development of affordable housing may provide opportunities to showcase and develop use of MMC. As a client for home building, Government has an opportunity to consider how MMC types can support innovation to deliver better value for public sector home building.
- One of the challenges in producing this report was the lack of available evidence around the impact of MMC for home building on the workforce. There is an opportunity for Government to help promote a forum for sharing information, such as real data on workforce requirements and best practice information on MMC techniques, which could help stimulate further adoption by industry.
- Government could help to promote conditions for sustained, long term market investment in home building by helping to create a future, visible pipeline for housing development.

For CITB:

The main recommendations are to continue working with employers and recognised bodies such as the Construction Leadership Council, HBF, NHBC, etc to:

- Establish a baseline for development of future skills and training by examining how the skills for future onsite home building will need to respond to the uptake of MMC. As understanding of the impact on the workforce improves;
- Continue to develop the training and qualifications for skills that would support increased take-up of offsite home building, while also supporting skills related to current methods of construction.
- Share details of sector insight to support workforce development that promote home building as a career within the construction sector; ensuring that there are training standards and qualifications that cover the full range of skills that home building will require in the future; and help employers to understand and access the range of training opportunities that they will need.

CONTENTS

1.	INTRODUCTION	1
2.	LITERATURE REVIEW	1
3.	UNDERSTANDING THE CHANGES IN LABOUR DEMAND	2
	3.1. Approach	2
	3.2. Survey design & issue	3
	3.3. Survey results	3
	3.4. Validation	7
4.	MODIFYING THE LABOUR COEFFICIENTS	8
	4.1. Approach	8
	4.2. Modified coefficients	9
5.	FUTURE SCENARIOS OF MMC	10
	5.1. Housing building plans	10
	5.2. Baseline scenario	11
	5.3. MMC Scenarios	12
	5.4. Impact on Employment demand	13
	5.4.1. Overall	13
	5.4.2. Net addition housing scenarios for constant rate increase to reach 300k in 2025-26	15
	5.5. Impact on skills and training	18
	5.5.1. Baseline impact on skills and training	18
	5.5.2. Scenario 1 impact on skills and training	20
	5.5.3. Scenario 2 impact on skills and training	22
	5.5.4. Scenarios 3, 4 and 5 impact on skills and training	24
6.	CONCLUSIONS	26
7.	RECOMMENDATIONS	28

APPENDIX CONTENTS

APPENDIX A.	33
<hr/>	
OCCUPATIONAL DEFINITIONS	
APPENDIX B.	37
<hr/>	
QUESTIONNAIRE-Evaluating the impact of mmc on labour demand for home building	

LIST OF FIGURES

Figure 1: Baseline construction labour demand forecast for net additions housing scenarios for constant rate increase to reach 300k in 2025-26	11
Figure 2: Comparison of baseline and scenarios for construction labour demand forecast for net addition housing assuming constant rate increase to reach 300k in 2025-26	15

LIST OF TABLES

Table 1: Trades & manual occupational changes for panelised construction	5
Table 2: Trades & manual occupational changes for volumetric construction	6
Table 3: Ratio of net to gross additions housing	10
Table 4: Scenarios of MMC take up in 2025-26	13
Table 5: Comparison of baseline and scenarios for construction labour demand forecast for an increase to reach 300k in 2025-26	14
Table 6: Comparison of baseline and scenarios for construction labour demand forecast for an increase to reach 300k in 2025-26 by broad occupational group	15

Table 7:	
Total workforce demand	16
Table 8:	
Workforce demand for onsite skilled trades and manual workforce	17
Table 9:	
Workforce demand for offsite skilled trades and manual workforce	17
Table 10:	
Summary of scenarios 3, 4 and 5 build profile and employment growth	24

1. INTRODUCTION

In England, the 2017 Housing White Paper set a target to deliver **250,000** homes a year by 2022 (since extended to 300,000 homes by the mid-2020s). Various research studies have also indicated that modern methods of construction (MMC) require less on-site labour to assemble homes than brick construction methods and potentially requires a smaller workforce with different skill sets from those currently being used.

This study was carried out by CITB and WLC Ltd and commissioned by the Ministry of Housing, Communities & Local Government (MHCLG). It relates only to housing in England.

The objective agreed with MHCLG is to estimate the change in labour skills and quantities on and offsite as home builders increase the use of MMC through offsite manufacture. As there is range of MMC types, to achieve the aim of the study we considered the changes to the workforce profile for panelised and volumetric offsite home building.

Ultimately, this research is intended to answer the question: what contribution can MMC make to reducing the workforce requirements for delivering new homes? To deliver an answer we have conducted a survey which gathered expert opinion to quantify the impact on labour demand of constructing a typical house using MMC.

The results have been used to calculate the change in labour demand arising from different levels of uptake of MMC.

2. LITERATURE REVIEW

Various supply chain members within the construction industry use the term MMC interchangeably with offsite construction, offsite manufacturing, design for manufacturing, smart construction etc. It was therefore necessary for the research to agree on,

- a) a working definition of MMC, and
- b) the type of MMC to be considered in this study.

In January 2018 an extensive literature review concluded that although there is no universally agreed definition of MMC, the importance of the National Audit Office (NAO) definition is recognised¹. This definition advocates a move from the view of MMC in terms of particular construction technologies to 'one based on performance and outputs regardless of construction technique chosen.' Although the report redefines MMC in terms of a set of performance outputs, none were relevant to the explicit aim of this study.

We therefore proposed for the purposes of this study to measure the performance of MMC in terms of the change in skills and size of the labour force needed to build an agreed number of housing units compared with the skills and size currently required. This is in effect a measure of change in labour productivity.

The literature review also concluded that that the two modern methods of construction should be used for the study were:

- 1) volumetric and
- 2) panelised offsite construction.

3. UNDERSTANDING THE CHANGES IN LABOUR DEMAND

3.1. APPROACH

Fundamental to our approach is the use of the Labour Forecasting Tool (LFT) developed by WLC Ltd on behalf of CITB. The tool can predict the labour demand, broken down for **28** occupational groups², which are shown in Appendix A. Models of several different types of project are embedded within the tool, but for the purposes of this commission, only the model relating to residential construction was used. The tool uses labour coefficients (person years input per £m of output) to convert the value of a project into the number of person years required for its construction in each of the **28** occupational groups.

Our review of the literature concluded that there was insufficient data available to allow an empirical analysis of the impacts of modern methods of construction on labour demand. We therefore adopted a subjective approach, gathering expert opinion on the likely impacts of volumetric and panelised construction on labour demand, and using that to inform the labour coefficients in the LFT. This allowed us to determine the changes in demand for each occupational group arising from the implementation of MMC.

We were conscious that within the current mix of housebuilding there will be a degree of MMC including both panelised and volumetric. Most of the studies which have been carried out have considered how many people have used a particular build method rather than the number of dwellings which have been constructed using that approach. We have been able to establish from a NHBC Foundation report that around **15%** of the dwellings in the UK are timber framed. Given that timber frame is only one panelised method, although arguably the largest used, the total amount of panelised construction is likely to be larger than **15%**.

¹National Audit Office (2007),
Homebuilding: Measuring
Construction Performance

²The 28 occupational groups are used
by CITB as part of their forecasting
methodology and cover construction
occupations, including trades,
manual, managerial, professional and
support staff.

3.2. SURVEY DESIGN & ISSUE

The paucity of data regarding current levels of offsite construction meant that we are unable to assess the current likely size of the offsite workforce. However, we could find no robust information to indicate that it would amount to a notable proportion of current housing output.

To gather the necessary expert opinions we developed, in conjunction with CITB and MHCLG a web-based survey, reference Appendix B, which was issued to those with a knowledge of MMC.

The survey was designed to elicit the views of respondents on:

- their level of knowledge of MMC;
- in which UK nation(s) their experience principally lies;
- the percentage change in the labour required to construct a typical dwelling for each of **28** occupational groups, for both panelised and volumetric construction; and
- the proportion of each occupation which is offsite.

The survey was issued to a group of around **80** MMC professionals. Recipients were invited to pass the link to colleagues who might be able to contribute. Additionally, the Royal Institution of Chartered Surveyors have shared the survey link with their members. Individual follow up of non-responses was undertaken by CITB.

3.3. SURVEY RESULTS

The survey was accessible electronically during April and May 2018. There were **17** respondents who self-identified as having an 'expert' or 'intermediate' level of knowledge of MMC. Those who self-identified as having a basic level of knowledge were not included in the analysis as their returns were incomplete. All the respondents had experience of working in England and around half of working in Scotland and Wales as well.

In considering the response to the question concerning the % change in the labour requirement in each occupation, respondents were offered the opportunity to respond with a maximum and minimum percentage increase or decrease. The mid-point of the range of each response was used to define the percentage change in each case and the median of all respondents' percentage change was calculated.

There was wide variation between individual responses but there was no noticeable difference between those who identified as having 'expert' and those who identified as having 'intermediate' knowledge. We have therefore combined all responses.

The total change in labour calculated from the survey results was as follows:

- Panelised: **4%** reduction in total labour with **44%** shift in skilled trades and manual occupations to working offsite
- Volumetric: **14%** reduction in total labour with **60%** shift in skilled trades and manual occupations to working offsite.

Table 1 and Table 2 show the overall occupational changes from the survey results for trades and manual occupations for panelised and volumetric construction. The results are shown separately because each method has a different impact on the workforce demand.

The tables show for each method:

- i. the percentage increase/decrease in labour from current methods; and
- ii. the percentage of each occupation working offsite.

Survey respondents were also asked the same questions for non-manual and professional occupations. There was significantly less variation within the responses for those occupations and the median of each occupation indicated that there was no change in the labour demand per dwelling constructed. However, since the overall labour demand per dwelling has reduced this does mean that professionals and management occupations represent a higher proportion of labour demand on a typical dwelling.

We have maintained a distinction between trades and manual and non-manual and professional occupations. This distinction is used in the application of the results in the different scenarios of MMC reported in section 5. Non-manual and professional occupations are shown separately because they are not necessarily assigned to an offsite manufacturing or onsite construction location as they may be employed remote from both.

Table 1: Trades & manual occupational changes for panelised construction

OCCUPATION	PANELISED	
	% CHANGE IN LABOUR	% OF WORK OFFSITE
Labourers nec*	-30%	45%
Construction Trades Supervisors	-25%	23%
Bricklayers	-10%	50%
Wood trades and interior fit-out	-9%	50%
Scaffolders	-8%	0%
Building envelope specialists	0%	50%
Painters and decorators	0%	33%
Plasterers and dry Liners	0%	60%
Roofers	0%	30%
Floorers	0%	50%
Glaziers	0%	85%
Specialist building operatives nec*	0%	28%
Plant operatives	0%	30%
Plant mechanics/fitters	0%	13%
Steel erectors/structural	0%	38%
Electrical trades and installation	0%	40%
Plumbing and HVAC Trades	0%	55%
Civil engineering operatives nec*	0%	5%
Non-construction operatives	0%	15%
Logistics	1%	55%

Table 2: Trades & manual occupational changes for volumetric construction

OCCUPATION	VOLUMETRIC	
	% CHANGE IN LABOUR	% OF WORK OFFSITE
Labourers nec*	-53%	65%
Wood trades and interior fit-out	-50%	75%
Glaziers	-50%	85%
Construction Trades Supervisors	-40%	25%
Plasterers and dry Liners	-40%	65%
Roofers	-33%	70%
Bricklayers	-31%	50%
Floorers	-27%	75%
Plant operatives	-25%	40%
Building envelope specialists	-18%	63%
Plant mechanics/fitters	-13%	43%
Scaffolders	-11%	8%
Plumbing and HVAC Trades	-8%	78%
Electrical trades and installation	-5%	70%
Painters and decorators	0%	65%
Steel erectors/structural	0%	58%
Civil engineering operatives nec*	0%	8%
Non-construction operatives	0%	15%
Logistics	3%	60%
Specialist building operatives nec*	4%	25%

3.4. VALIDATION

A key part of the research has been establishing – through the survey – the change from the current number of person-hours to construct an average dwelling including all on- and offsite labour if the average home was built using panelised or volumetric construction.

Even though the survey results aggregate the views of respondents, the resulting average response may not be commonly accepted. We therefore undertook consultation to validate the results. All the survey respondents and other key relevant parties such as the Home Builders Federation (HBF) and the National House Building Council (NHBC) were initially invited to a workshop to discuss the results. This proved infeasible due to conflicting diary commitments. It was therefore agreed to circulate a results report eliciting feedback on the aggregated results. Consultees were asked to sense check the changes in labour demand for a typical dwelling.

They were asked the following questions:

- Do the results seem logical?
- Do the individual occupational changes reflect the overall changes in the use of MMC?
- Are there any important workforce changes that aren't being picked up?
- How well does this provides a starting point to estimate future workforce requirements of housing labour demand?

There was only one response to the consultation. The response did not raise any significant concerns about the results of the analysis. Although not necessarily the case, we take the view that if non-respondents did have serious concerns about the results they would have responded to the consultation.

4. MODIFYING THE LABOUR COEFFICIENTS

4.1. APPROACH

The results of the survey have been applied to the re-calibration of the labour coefficients in the residential model of the LFT.

Analysis has shown that the construction value per dwelling varies considerably from region to region. This may be a result of numerous factors including the geography of the region, the build mix in the region (flats, houses), and the size of the properties in each region. To compensate for this variation, we have re-calibrated the labour coefficients separately for each region.

We have used historic data to:

- i. estimate the total workforce in the region by applying the labour coefficients to the total value of housing work;
- ii. Calculate the person years per dwelling by dividing by the total number of dwellings constructed.

The total value of housing work is the sum of public and private housing output taken from the Monthly Business Survey. Output is defined as the amount chargeable to customers for building and civil engineering work done in the relevant period excluding VAT and payments to subcontractors (to avoid double counting) Following discussion with MHCLG, the number of dwellings constructed is taken from MHCLG's net additions housing statistics.

Net additions are the sum of:

- new build completions;
- net conversions;
- net change of use; and
- net other gains
- all less demolitions.

To ensure that the number of dwellings and the value of residential construction output are truly comparable, we removed the number of demolitions from the number of additions to create a measure that we have termed 'gross additions.' Even so, we have been obliged to assume that the number of conversions and changes of use from residential to other types of use is a negligible proportion of the total value of residential construction output.

The other important consideration is the timeframe that is used for the historic data in analysis. We have used a five-year set of historic data because this is consistent with CITB's standard five-year forecasting methodology. Our approach also assumes that UK-wide labour coefficients can be applied at the regional level. Consequently, any regional variations in productivity or the skills mix between occupations will not be entirely reflected in the results.

4.2. MODIFIED COEFFICIENTS

Using the approach outlined above we have derived housing labour coefficients for each of the nine English regions in terms of person-years per dwelling. These have been produced for each of the **28** occupational groups.

Using the responses from the survey we have then sought to do two things with the data:

- Firstly, we have applied the percentage increase or decrease to the labour coefficient.
- Secondly, we have split the labour coefficients into the proportion of the workforce onsite and offsite.

On the second point, although we have asked survey respondents to indicate the proportion of the onsite/offsite workforce for all **28** occupational groups, in the scenarios which follow we have treated and shown separately those occupations which are non-manual and professional. We have assumed that any changes in labour demand per dwelling are reflected in the forecast of labour demand but have not indicated whether these occupations are based on or offsite.

Given that there will be an existing workforce (presently undeterminable) in the current mix which is working offsite we have referred in latter sections of this report to an 'increase in offsite.' This recognises that there is no change to the offsite workforce involved in current build, especially those that are skilled trades and manual workers, and that the demand in future is for new roles that are created offsite.

5. FUTURE SCENARIOS OF MMC

The modified labour coefficients have been incorporated in the LFT which has then been applied to future projections of housing in England to estimate the labour demand. Furthermore, we have considered four different scenarios representing different levels of uptake of both panelised and volumetric construction.

5.1. HOUSING BUILDING PLANS

We have produced our results using an assumed constant trajectory for the growth in housing net additions to reach the target of **300,000** new dwellings in England by 2025-26. A split by each region has been assumed.

As outlined in section 4, our labour coefficients have been derived in terms of the gross additions and we assumed that the number of demolitions in each region remains constant over time. Table 3 presents the ratio of net to gross conversion factors for each of the regions based on the total number of net additions to gross additions over the last five years.

Table 3: Ratio of net to gross additions housing

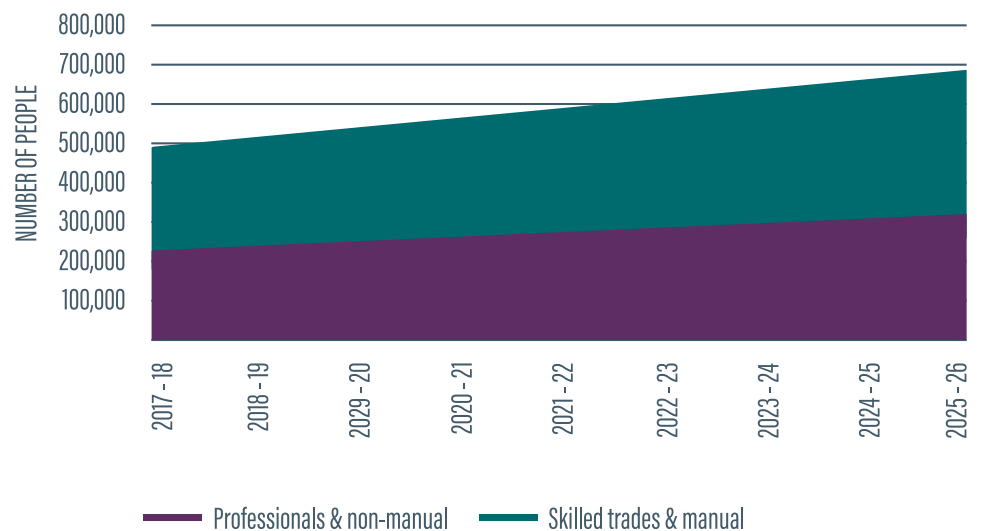
REGION	NET TO GROSS FACTOR
East Midlands	104%
East of England	104%
Greater London	107%
North East	118%
North West	110%
South East	107%
South West	103%
West Midlands	106%
Yorkshire & the Humber	106%
England	107%

Using the appropriate regional factor, we have adjusted the net housing addition forecast to produce an estimate of the gross housing additions.

5.2. BASELINE SCENARIO

The gross housing addition numbers have been used to estimate the future demand for housing construction labour and skills. This is shown in Figure 1. The baseline scenario presents the current mix of housing construction and is based on the existing labour coefficients within the Labour Forecasting Tool. It should be noted that this will include a component of MMC and therefore an offsite workforce but for the purposes of this analysis we have assumed these are included in the onsite workforce. The figures also show the professional and non-manual workforce separately. Some of these will be onsite and some will be offsite, either in a manufacturing facility supporting offsite work or elsewhere.

Figure 1: Baseline construction labour demand forecast for net additions housing scenarios for constant rate increase to reach 300k in 2025-26



5.3. MMC SCENARIOS

In conjunction with MHCLG we have modelled five scenarios of the future uptake of MMC.

There are several dimensions which can be modelled in developing scenarios including:

- the growth rate of housing net additions;
- the mix of volumetric, panelised & current build types;
- the growth rate in the take up of volumetric and panelised construction; and
- how the mix varies in each region.

We have developed scenarios for different volumes of panelised and volumetric construction and Table 4: Scenarios of MMC take up in 2025-26 Table 4 shows the shares assumed to apply in 2025-26. This is based on a non-linear, increasing rate of MMC use between now and 2025-26. We assumed that the use of MMC is the same across all regions and that the rate of growth is the same for all regions.

Finally, it should be observed that the volumes of MMC shown in the scenarios for 2025-26 are in addition to MMC that is currently being delivered in 2017-18.

Previous work carried out by the National House Building Council (NHBC) looking at new home registrations showed although home builders were increasingly looking at MMC approaches, levels of uptake remained flat, with just over **70%** UK builds being cavity masonry type. Timber framed and light steel framed structures were the alternative approaches that were more likely to be used, however their share had dropped as home building levels increased after the 2008/09 recession.

More recent data from NHBC indicates that these trends have continued with cavity masonry construction accounting for nearly three quarters of UK new registrations in 2017.

Using the NHBC data the baseline for current MMC take up is that:

- Panelised MMC accounts for around **10%-15%** of builds. (Note: there is a very significant difference between England and Scotland on the use of timber framed construction. In Scotland it is the main approach used, whereas in England it accounts for less than 10% of builds)
- Volumetric MMC accounts less than **2%** of current builds.

The percentages shown on Table 4 are therefore increases in addition to the current build profile and not the overall level of MMC uptake. For example, in Scenario 1, we are assuming that **50%** of homes built in 2025-26 will be based on the mix of types currently being built and the other 50% will be built with equal shares of panelised and volumetric MMC types.

Table 4: Scenarios of MMC take up in 2025-26

PANELISED		VOLUMETRIC	CURRENT
Baseline	n/a	n/a	100%
Scenario 1	25%	25%	50%
Scenario 2	15%	35%	50%
Scenario 3	12.5%	12.5%	75%
Scenario 4	17.5%	7.5%	75%
Scenario 5	7.5%	17.5%	75%

5.4. IMPACT ON EMPLOYMENT DEMAND

5.4.1. Overall

Table 5 shows the impact on total employment (skilled trades and manual plus professionals and non-manual) by the end of 2025-26 for each of the scenarios. For home building to reach Government housing ambition by mid-2020s without increased levels of MMC use (Baseline scenario), a **40%** increase in the home building workforce would be required, which represents an overall increase of **195,000** workers over the next seven years.

Scenarios 1-5 show that increasing uptake of MMC build types, can to varying extents, reduce the additional workforce requirement, especially when there is increased adoption of volumetric MMC, such as in Scenario 2. However, the headline workforce reduction of **37,000** shown by Scenario 2, which has volumetric MMC making up **35%** of home building by 2025-26 represents an overall workforce demand that would be **5%** lower than the baseline.

Although Scenario 1 also has a **50%** increase to MMC types, the balanced adoption between panelised and volumetric types gives a slightly higher workforce requirement when compared to Scenario 2.

As Scenarios 3, 4 and 5 all model a lower level of MMC uptake, with an increase of **25%**, the reduction in workforce demand when compared to baseline is lower at around **2%-3%**.

Table 5: Comparison of baseline and scenarios for construction labour demand forecast for an increase to reach 300k in 2025-26

		EMPLOYMENT	CHANGE FROM STARTING WORKFORCE	% CHANGE FROM STARTING WORKFORCE	CHANGE FROM BASELINE	% CHANGE FROM BASELINE	CHANGE AS A % CHANGE FROM THE BASELINE ADDITIONAL WORKFORCE
2017-18 workforce		493,000	n/a	n/a	n/a	n/a	n/a
2025-26 workforce	Baseline	688,000	195,000	40%	n/a	n/a	n/a
	Scenario 1	658,000	165,000	33%	-30,000	-4%	-15%
	Scenario 2	651,000	158,000	32%	-37,000	-5%	-22%
	Scenario 3	673,000	180,000	37%	-15,000	-2%	-9%
	Scenario 4	676,000	183,000	37%	-12,000	-2%	-6%
	Scenario 5	670,000	177,000	36%	-18,000	-3%	-10%

While Table 5 outlines the overall workforce demand, Table 6 breaks the workforce down into the broad occupational groups.

It can be seen that there is no change in the professional and non-manual workforce between the baseline and each of the scenarios. This is in effect a constant requirement across all, irrespective of the build type adopted and is more a measure of the supporting workforce required to deliver the overall volume of homes being built.

The scenarios do show an impact on the workforce estimates for skilled trades and manual workers required, as well as a shift in where they would be located, i.e. onsite or offsite. The baseline shows the skilled trade and manual workforce increasing from **266,000** up to **372,000** by 2025-26, with this being all onsite.

With scenarios 1 and 2 the level of onsite skilled trades and manual workers would be very similar to the current workforce as the level of MMC uptake results in an additional workforce of **80,000** skilled trade and manual workers based offsite. Under these two scenarios the onsite skilled trades and manual workforce is comparable in size to the current workforce with the increased offsite workforce essentially addressing the increase in the numbers of home being constructed.

As scenarios 3, 4 and 5 model increased MMC uptake of **25%**, which is half of what is used in scenarios 1 and 2, the corresponding workforce demand impact is around half of the value.

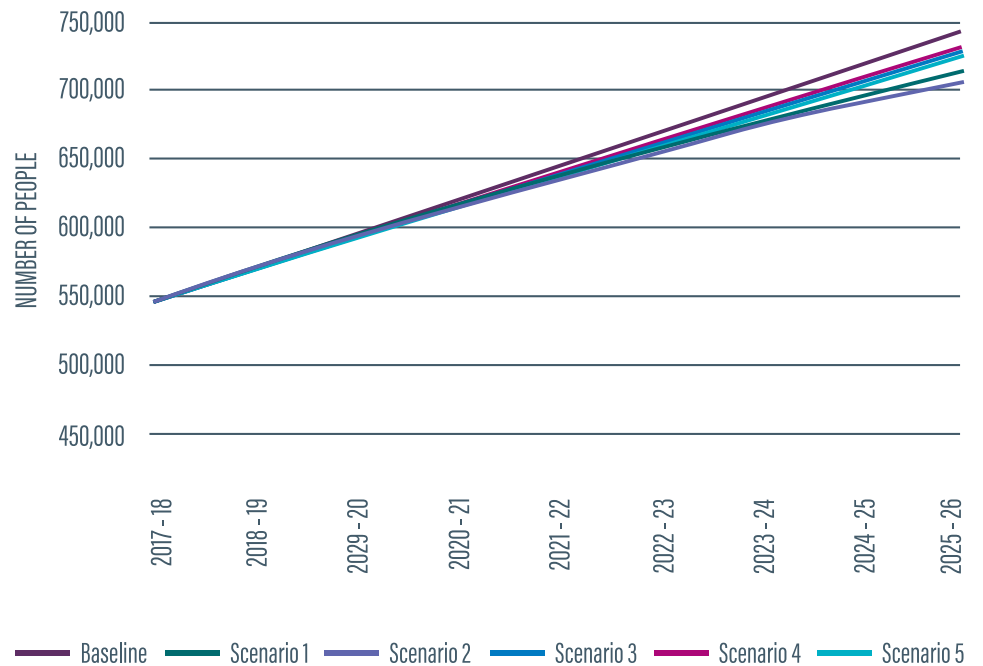
Scenarios 3, 4 and 5 would all require an increase in the onsite skilled trades and manual workers, which varies from an additional **47,000 – 55,000** workers by 2025-26, plus an additional offsite based skilled trade and manual workforce of between **39,000 – 41,000** for home building to match Government ambition.

Table 6: Comparison of baseline and scenarios for construction labour demand forecast for an increase to reach 300k in 2025-26 by broad occupational group

		PROFESSIONAL AND NON-MANUAL WORKFORCE	SKILLED TRADES & MANUAL			INCREASE IN OFFSITE
			WORKFORCE	CHANGE FROM BASELINE	% CHANGE FROM BASELINE	WORKFORCE
2017-18 workforce		227,000	266,000	n/a	n/a	n/a
2025-26 workforce	Baseline	316,000	372,000	n/a	n/a	n/a
	Scenario 1	316,000	262,000	-110,000	-30%	80,000
	Scenario 2	316,000	254,000	-118,000	-32%	81,000
	Scenario 3	316,000	317,000	-55,000	-15%	40,000
	Scenario 4	316,000	321,000	-51,000	-14%	39,000
	Scenario 5	316,000	313,000	-59,000	-16%	41,000

5.4.2. Net addition housing scenarios for constant rate increase to reach 300k in 2025-26

Figure 2: Comparison of baseline and scenarios for construction labour demand forecast for net addition housing assuming constant rate increase to reach 300k in 2025-26



Note: the details for the offsite workforce shows growth from 2017-18, as the scale of offsite construction increases.

Table 7 below show overall employment numbers for each scenario using the constant rate increase, then Tables 8 and 9 show the headline numbers for onsite and offsite skilled trades and manual workers, as this is the group most influenced by adoption of MMC types over current build.

The baseline and scenarios all show an overall workforce growth profile, although there is some variance in the skilled trades and manual workforce for scenarios 1 and 2 when it comes to proportions of onsite and offsite workers. Both scenarios show the onsite skilled trades and manual workforce increasing to a peak of around **290,000** in 2021-22, before reducing to the levels shown in 2025-26. In these scenarios, as the number of homes increases, the take up rates for more MMC on either panelised and volumetric builds, still leads to a growth in the number of homes being delivered using current methods of construction. It is not until after 2021-22 that the increasing take-up of MMC results in a decline in the reliance on current methods of construction and a corresponding decrease in levels of onsite skilled trades and manual workers.

Under scenarios 3, 4 and 5, the lower overall level of MMC take-up results in the onsite skilled trade and manual workforce continuing to increase in numbers across the period modelled, although the rate of increase does slowdown in the later years.

Table 7: Total workforce demand

	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26
Baseline	493,000	517,000	542,000	566,000	590,000	615,000	639,000	664,000	688,000
Scenario 1	493,000	516,000	539,000	561,000	583,000	603,000	622,000	641,000	658,000
Scenario 2	493,000	516,000	539,000	560,000	581,000	600,000	619,000	636,000	651,000
Scenario 3	493,000	517,000	540,000	564,000	587,000	609,000	631,000	652,000	673,000
Scenario 4	493,000	517,000	541,000	564,000	587,000	610,000	633,000	655,000	676,000
Scenario 5	493,000	517,000	540,000	563,000	586,000	608,000	629,000	650,000	670,000

Table 8: Workforce demand for onsite skilled trades and manual workforce

		2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26
Baseline	Onsite	266,000	280,000	293,000	306,000	319,000	332,000	345,000	359,000	372,000
Scenario 1	Onsite	266,000	276,000	284,000	289,000	290,000	289,000	284,000	275,000	262,000
Scenario 2	Onsite	266,000	276,000	283,000	287,000	288,000	286,000	279,000	269,000	254,000
Scenario 3	Onsite	266,000	278,000	288,000	297,000	305,000	311,000	315,000	317,000	317,000
Scenario 4	Onsite	266,000	278,000	288,000	298,000	306,000	312,000	317,000	320,000	321,000
Scenario 5	Onsite	266,000	278,000	288,000	297,000	304,000	309,000	312,000	314,000	313,000

Note: 2017-18 is taken as the starting point and figures are new offsite jobs created for each scenario

Table 9: Workforce demand for offsite skilled trades and manual workforce

		2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26
Baseline	Offsite	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Scenario1	Offsite	n/a	3,000	7,000	13,000	21,000	31,000	45,000	61,000	80,000
Scenario2	Offsite	n/a	3,000	7,000	13,000	21,000	32,000	45,000	62,000	81,000
Scenario3	Offsite	n/a	1,000	3,000	6,000	10,000	16,000	22,000	30,000	40,000
Scenario4	Offsite	n/a	1,000	3,000	6,000	10,000	15,000	22,000	30,000	39,000
Scenario5	Offsite	n/a	1,000	3,000	6,000	11,000	16,000	23,000	31,000	41,000

5.5. IMPACT ON SKILLS AND TRAINING

While section 5.4 outlined the impact of the baseline and scenarios on employment demand, this section takes a closer look at the occupational detail for each and discusses the potential impact on skills and training.

³CITB (2017); Faster, Smarter, More Efficient: Building Skills for Offsite Construction

Before covering this section, there are some points to note:

- Firstly, although the survey asked respondents for views on potential new skills required for the MMC types, the feedback did not identify new skills as being an issue. Recent research undertaken by CITB³, along with the wider literature review undertaken as part of this study has therefore been used to inform views on possible MMC skills shifts.
- Secondly, while the workforce demand estimates made in section 5.4 allow us to compare future demand with current supply, there is no exclusive home building workforce. Workers with skills such as carpentry, bricklaying, roofing and the like will be required to build homes, however they can work in other construction sectors, and potentially, in other industries outside of construction.
- Linking into the previous point, it is possible that employment demand could be met by attracting workers in from other sectors who may already have similar skills. This means that additional employment may not always have a direct link to demand for skills and training. For example, introduction of new regulations for electricians tends to lead to a training uptake from existing workers looking to maintain occupational competence, whereas apprenticeship training will be helping to meet future employment growth and replace workers who would naturally be looking to leave the sector through retirement or for other reasons.
- This section focuses on the skilled trades and manual workers as the requirement for managerial, professional, technical and office support staff is consistent across all scenarios.

Taking these points into account, the details covered in this section should be seen as indicative of the skills and training impact rather than a quantifiable view.

5.5.1. Baseline impact on skills and training

As the baseline is ramping up the current build profile with no additional uptake of MMC, this produces the highest demand for overall employment, which would increase from the current estimate of **493,000** to **688,000** workers by 2025-26. This is an average annual increase of over **24,000** new workers each year, which is constant across the years, and would be an annual average employment growth rate of **4.3%** based on current workforce. With **11,000** of the new worker demand being for managerial, professional, technical and office-based jobs each year and just over **13,000** being skilled trades and manual workers, this points towards a general requirement for skills and training over the full range of construction occupations.

To put this into context, CITB's current industry forecasts estimates an average housing output growth of just over **2%** per year for the next five years, whereas meeting Government ambition would increase this to an average of around **4%** per year for the next eight years. An increase of this level would influence the estimate of the number of new workers that the construction industry needs to attract.

CITB's current estimate of the number of extra workers that the construction industry as a whole needs to attract each year is around **32,000** per year⁴. Although this estimate will include some additional employment related to home building, it wouldn't be at the level of matching Government ambition, therefore the majority of the **24,000** new workers each year to support home building identified in this work could be considered as additional growth in employment.

Of the skilled trades and manual workers, the main occupations that would see employment demand growth are:

- Bricklayers (2,000 average per year)
- Labourers (1,700 average per year)
- Wood trades (1,600 average per year)
- Building envelope specialists (1,400 average per year)
- Plumbers and HVAC (1,400 average per year).

As a group, these five occupations account for over **60%** of annual demand growth for skilled trades and manual workers.

The recently published Independent Review of Build Out Rates⁵ looked at the extent to which availability of skilled labour was a constraint on current home building. While the 'availability and price of labour was a significant concern for the major house builders⁶, the review concluded that the interchangeable nature of the work meant that labour could be drawn from other construction sectors and potentially other industries to meet demand for a range of occupations. The exception to this was bricklaying, which was in demand for home building and where there were fewer options to meet this from workers in other construction sectors.

The review estimated that meeting Government ambition using existing construction methods would require an additional **15,000** bricklayers and the details modelled in the baseline scenario support this with a total of just over **16,000** bricklayers required by 2025-26 to meet demand.

Although full training data in England for the 2017-18 academic year will not be available until early 2019, analysis of recent data shows that bricklaying qualifications for occupational competence in England (construction qualifications that have retained NVQ in their titles at either Level 2 or Level 3), over the last three years (2014–2017).

There has been an average of:

- around **2,000** bricklaying completions per year supported by an apprenticeship programme
- around **1,000** bricklaying completions per year supported by wider training in Further Education.

With this level of training being relatively stable in recent years and home builders having difficulty in sourcing bricklayers, it would be safe to assume that demand for an extra **2,000** bricklayers per year would put additional pressure on training for both apprenticeships and other training supporting people to get competence qualifications. Both aspects would need a significant increase in numbers to meet the demand and to ensure that the construction sector is replacing the number of bricklayers who would retire or stop working for other reasons each year.

It should also be noted that there will be a time period for learners to start and complete their training. Further Education courses typically last for 12–24 months while a Trade Apprenticeship at Level 2 can take around 18–24 months to complete, with a further 12 months to progress on to a Level 3 Apprenticeship. Higher Education courses can take 3–4 years, which can be followed by periods of professional accreditation for the likes of Civil Engineers, Architects or Chartered Surveyors.

The baseline would therefore result in the largest need for additional employment growth if Government's housing ambition is to be met and the strain on bricklaying skills and training would continue to escalate unless there was a significant intervention which had an immediate impact.

5.5.2. Scenario 1 impact on skills and training

Scenario 1 anticipates 2025-26 homes delivered with:

- **25%** panelised MMC
- **25%** volumetric MMC
- **50%** current construction methods.

⁴CITB (2018 & 2019); Construction Skills Network Forecasts 2018-2022 & 2019-2023, UK

⁵Ministry of Housing, Communities and Local Government (2018); Independent Review of Build Out Rates

⁶Ministry of Housing, Communities and Local Government (2018); Independent Review of Build Out Rates, page 19

By 2025-26 this gives:

- total employment increase of **165,000**
- average total employment growth of nearly **21,000** new workers per year
- average employment growth rate of **3.7%**.

If uptake of MMC increases to account for **50%** of homes built by 2025-26 there is lower workforce demand relative to the baseline scenario. Although overall employment is only **4%** lower than the baseline, it is the skilled trade and manual workforce where the impact is greatest, with an overall **8%** reduction when compared to the baseline. As the skilled trade and manual workforce would be split between onsite and offsite work, the actual estimate for onsite skilled trade and manual workers by 2025-26 would be a **30%** reduction in numbers when compared to baseline.

However, the scenario also shows that it will take time for MMC take-up to impact on employment. In the short term (2018-2021), the mix of homebuilding type modelled results in an increased number of homes constructed using the current construction methods and it is not until around 2021 that the increase in MMC starts to take effect and is reflected in the employment estimates.

For example, in scenario 1 the requirement for bricklayers is an average of:

- **1,700** per year from 2018-2021, which then reduces to,
- **1,000** per year from 2022-2026.

This results in two slightly different views on skills and training with the short term (2018–2021) impact likely to be similar to the baseline, while the longer-term view (2022 onwards) increasingly reflects the potential impact that MMC could have as the offsite workforce builds up from an estimated **13,000** in 2020-21 to over **80,000** by 2025-26.

⁷CITB (2017); Faster, Smarter, More Efficient: Building Skills for Offsite Construction

CITB's recent work⁷ highlighted six key functions associated with the adoption of offsite construction, which were:

- Digital design
- Estimating/commercial
- Offsite manufacturing
- Logistics
- Site management and integration
- Onsite placement and assembly.

While these functions were considered key to capitalising on the potential of offsite construction techniques with a requirement for training for each function in both technical aspects and underpinning softer skills, there was some variance when it came to employer's views on the proportion of the existing workforce that would require training in offsite construction. This ranged from **16%** of respondents who saw it having an impact on more than **50%** of their workforce, as opposed to **43%** of employers who saw it as impacting less than **10%** of their workforce. This view, from companies that were expecting to use offsite construction over the next 3-5 years, indicates that while there is a broad understanding around role functions, there is also some understanding to be developed around the level of impact this might have within companies.

Scenario 1 would see a reduction in overall workforce demand by 2025-26, however the increasing uptake of MMC points towards a more noticeable impact on employment from 2021.

The implications for skills and training are that:

- between 2018-2021: continued pressure on existing skills and training, slightly lower than the baseline,
- from 2022 onwards: pressure on existing skills and training to reduce for skilled trade and manual occupations, however demand for professional, managerial, technical and office-based roles continues,
- between 2018-2026: development of MMC related training and support required for existing workers to develop their skills and for new workers attracted into employment opportunities.

5.5.3. Scenario 2 impact on skills and training

Scenario 2 has 2025-26 home build being delivered with:

- **15%** panelised MMC
- **35%** volumetric MMC
- **50%** current construction methods.

By 2025-26 this gives:

- a total employment increase of **158,000**
- an average total employment growth of nearly **20,000** new workers per year
- and an average employment growth rate of **3.5%**.

As with scenario 1 uptake of MMC increases to **50%** of homes built by 2025-26, however as there is more volumetric MMC in this scenario, it results in the largest reduction in workforce demand when compared to the baseline.

Overall employment would be **5%** lower than the baseline, with the overall skilled trade and manual workforce reducing by an estimate of **10%**. The higher level of volumetric MMC results in the estimate for onsite skilled trade and manual workers by 2025-26 being **32%** lower in numbers when compared to baseline.

Again, scenario 2 also shows that it will take time for MMC take-up to impact on employment, in the same way as outlined in scenario 1, although the higher level of volumetric MMC take-up in scenario 2 has slightly more impact on the skilled trade and manual workforce.

For example, in scenario 2 the requirement for bricklayers is an average of:

- **1,600** per year from 2018-2021, which reduces to,
- **800** per year from 2022-2026.

The skills and training view is therefore consistent with that outlined for scenario 1, with a short term (2018–2021) impact likely to be similar to the baseline. The longer-term view (2022 onwards) indicates the potential that MMC could have as the offsite skilled trade and manual workforce increases from an estimated **13,000** in 2020-21 to over **81,000** by 2025-26.

The offsite workforce requirement under scenario 2 is likely to be like scenario 1 for functions such as:

- Digital design
- Estimating/commercial
- Offsite manufacturing.

However, increasing use of volumetric MMC could result in greater demand for functions involved in the on-site assembly of units such as:

- Logistics
- Site management and integration
- Onsite placement and assembly.

Scenario 2 would see the largest reduction in overall workforce demand by 2025-26 out of all the modelled scenarios, however the increasing uptake of MMC still points towards a noticeable impact on employment from 2021.

The implications for skills and training are consistent with scenario 1 in that:

- between 2018-2021: continued pressure on existing skills and training, though slightly lower than the baseline,
- from 2022 onwards: pressure on existing skills and training to reduce for skilled trade and manual occupations, however demand for professional, managerial, technical and office-based roles continues,
- between 2018-2026: development of MMC related training and support, for existing workers to develop their skills and for new workers attracted into new employment opportunities,
- between 2018-2026: with more use of volumetric MMC, potentially more demand for skills related to co-ordination of onsite activity and assembly of homes.

5.5.4. Scenarios 3, 4 and 5 impact on skills and training

Scenario 3, 4 and 5 are variations on different MMC uptake to account for 2025-26 homes build being delivered by:

- **25%** MMC
- **75%** current construction methods

Although the modelled scenarios have different levels of MMC uptake, the overall employment demand figures vary only slightly variation, as shown below in Table 10.

This slight variation means that the skills and training impact from these scenarios can be discussed as a group rather than individually.

Table 10: Summary of scenarios 3, 4 and 5 build profile and employment growth

	SCENARIO 3	SCENARIO 4	SCENARIO 5
Panelised MMC	12.5%	17.5%	7.5%
Volumetric MMC	12.5%	7.5%	17.5%
Current build	75%	75%	75%
Total employment increase	180,000	183,000	177,000
Average employment growth per year	23,000	23,000	22,000
Average annual employment growth rate	4.0%	4.0%	3.9%

With the level of MMC uptake at **25%**, compared to the **50%** outlined in scenarios 1 and 2, the corresponding impact on employment is proportionately lower. Scenarios 3, 4 and 5 reduce the employment demand by an overall figure of around **2%-3%** and by around **3%-5%** for the skilled trade and manual workforce relative to the baseline.

Scenarios 3, 4 and 5 generate an offsite skilled trades and manual workforce of around **40,000** by 2025-26 (half of what is seen in scenarios 1 and 2) and the onsite skilled trade and manual workforce is around **310,000 to 320,000**.

Unlike scenarios 1 and 2 which show a reduction in the onsite skilled trades and manual workforce requirement after 2021, scenarios 3, 4 and 5 all show the onsite workforce continuing to grow before levelling off towards 2025-26, at around **17%-20%** more than the current onsite workforce. This also indicates that increased MMC uptake could result in a stable level of onsite workforce demand by 2025-26, almost independent of the level of panelised or volumetric build.

In terms of impact upon skills and training scenarios 3, 4 and 5 all point towards similar short-term pressures as the baseline, although the medium to longer term pressures ease slightly.

For example, the requirement for bricklayers in each scenario is around:

- around **1,900** per year from 2018-2021, which then reduces to,
- around **1,600** per year from 2022-2026.

Scenarios 3, 4 and 5 give two less distinct views on skills and training. The short-term view is very similar to the baseline, while the longer-term view combines the requirement to deliver MMC skills and training alongside existing training. In that respect scenarios 3, 4 and 5 are more likely to reflect the pressures that would be seen in the mid- years for scenarios 1 and 2 in which MMC skills need to be developed and embedded concurrent with growth in the skills that support current construction methods, which would continue to be in demand until 2025-26.

Scenarios 3, 4, and 5 are similar in their overall workforce demand by 2025-26, although the lower level of MMC uptake modelled shows that the requirement for site based skilled trades and manual workers will continue to grow through to 2025-26.

The lower level of MMC take-up means that the implications for skills and training:

- for 2018-2021 are only slightly less than the baseline, and,
- from 2022 onwards, pressure on existing skills will only ease slightly while there will be a requirement to develop MMC related training and support.

6. CONCLUSIONS

⁸Ministry of Housing, Communities and Local Government (2018), Housing Statistical Release: Housing supply; net additional dwellings, England: 2017-18

With **222,000** net additions in England reported for 2017/18⁸, increasing home building to reach Government ambition of **300,000** dwellings in England by mid 2020s represents an overall volume increase of **38%**. This could be achieved by an annual average growth rate of around **4%** per year, which is within previous levels of housing growth; however, it would require relatively stable market and could be influenced by macro-economic conditions.

The survey findings support the view that increasing use of panelised and volumetric methods of construction would reduce the overall workforce requirement relative to increasing use of current construction methods. In particular, some of the skilled trades and manual occupations that are mainly site-based such as carpenters, bricklayers, glaziers and labourers. As expected, volumetric construction is likely to lead to a lower overall workforce requirement than panelised build techniques with more of the current site-based workforce moving to work offsite.

When the survey findings are modelled, the scale of impact upon the overall workforce is relatively low. Table 5 shows a **4%** reduction in overall numbers when there is a **50%** point increase in the number of homes that are built with panelised and volumetric construction techniques by 2025-26 (Scenarios 1 & 2). If the future level of MMC uptake was to be lower, at a **25%-point** increase in MMC volume, then the level of overall workforce reduction is likely to be around **2%** relative to current construction (Scenarios 3, 4 & 5). However, there are increases in the volume of the workforce that will be offsite.

The following notable points were also drawn from the analysis:

- While some workforce estimates focus only on the manual and skilled trades that tend to be construction site based, there is an almost equal requirement for non-site-based workers. Our current estimate of the home building workforce would be **266,000** site-based workers (manual and skilled trades) with nearly **227,000** non-site based, such as office staff, technicians and professionals such as architects and surveyors. The non-manual workforce requirement is consistent across the baseline and MMC scenarios and increasing levels of home building, regardless of construction technique used, is likely to lead to an increased demand for technical, professional and office-based support roles of nearly **90,000** workers by 2025-26.
- The baseline scenario shows a total demand of **688,000** workers if home building is to reach Government ambition, which is a **40%** increase in the current workforce.

The workforce would be:

- **372,000** skilled trades and manual workers
- **316,000** professional, managerial, technical and non-manual workers.
- For each of the scenarios modelled, there was no change to the workforce requirement for professional, managerial, technical and non-manual workforce. This is a constant requirement across the baseline and all MMC scenarios.

- **The main effect for the scenarios modelled was on the skilled trades and manual workforce:**

- Scenario 1 (25% panelised; 25% volumetric; 50% current build) sees the number of workers in 2025-26 being just under current estimates of around **266,000**, with an additional **80,000** jobs created offsite.

Scenario 2 (15% panelised; 35% volumetric and 50% current build) shows the number of site-based workers decreasing to **254,000** by 2025-26 with an additional **81,000** workers employed offsite.

Scenarios 3, 4 & 5, with lower levels of panelised and volumetric construction, all show the site-based workforce increasing to around **317,000** – **320,000** workers, with around **40,000** jobs being created offsite.

- With the current level of panelised and volumetric construction techniques used in home building estimated to be at relatively low levels, the scenarios indicate that increasing MMC to just over **50%** of total build (scenarios 1 and 2) helps to mitigate some of the longer-term pressure on skilled trades and manual workers.

However, there would still be a requirement for:

- skilled trades and manual workers to support homes being constructed with current build methods from 2018-2021.
- after 2021, the emphasis shifts to maintaining employment levels of site based skilled trades and manual workers to support current build methods
- the development of skills for offsite workers
- development of non-manual workers to support both on and offsite manual and skilled trade workers.

At an occupational level, increasing uptake of either panelised or volumetric MMC reduces the long-term requirement for some manual and skilled trades:

- In scenarios 1 and 2, labourers; construction trades supervisors; wood trades and interior fit out, all have more than a **10%** workforce reduction relative the baseline projection.
- Bricklayers and Glaziers show more than a **10%** reduction in workforce for these occupations in scenario 1, however this reduces to around **7%-8%** under scenario 2.
- As scenarios 3, 4 and 5 all have lower levels of MMC uptake, they show less impact for the occupations mentioned above, with workforce reductions ranging between **5%-9%** for most. The only exception is labourers with an estimated reduction of **10%** under Scenario 3.
- All other occupations modelled under each scenario show either a slight or no variation when compared to baseline estimates.

Overall there is potential for increased uptake of MMC to enable more homes to be built and productivity to be improved. The biggest impact would be if significant and rapid progress was made in the adoption of volumetric construction techniques, however NHBC data on new homes registered over the last ten years shows that over 70% of homes are being built with cavity brick techniques. The absence of change in the share of homes being built with cavity brick techniques as home building has emerged from the economic recession indicates a significant challenge for the home building sector if it is to increase MMC uptake in future years.

7. RECOMMENDATIONS

There is a growing recognition on the importance of modern methods of construction, in particular, the role that offsite construction could have on improving construction sector productivity. With future growth forecasted for home building and infrastructure work, the uptake of MMC within these sectors will shape the resulting workforce and skills requirements^{9,10}.

For home building, the literature review carried out for this work highlighted the wide range of options that are currently available, from different panelised approaches through to hybrid and full volumetric construction techniques. It also highlighted that MMC, when used in reference to home building, isn't the same as MMC when used to define work in other sectors, such as infrastructure, commercial buildings, offices, schools or hospitals. There may be some common workforce and skills requirements around the office based, technical and professional support roles, however the construction techniques are likely to be different in practice when building a home, school or large-scale infrastructure project.

Increased levels of home building based on scaling up of existing build types, with no shift to increased shares of MMC build is shown to generate a significant demand for additional workforce, with an overall increase estimated at **195,000** extra workers. This represents a **40%** increase on current workforce estimates and an annual average increase of over **24,000** new workers per year through to 2025-26. One of the main occupations in demand would be bricklayers, whose availability is already a concern for the sector. An increase in homes built based on scaling up of existing build types would exacerbate those concerns.

The training rate of around **3,000** learners per year achieving bricklaying competence qualifications in England, appears to be insufficient at the moment, and demand for an extra **2,000** bricklayers per year would require training rates to possibly double in volume to bridge the gap between demand and supply.

Although the scenario analysis shows that MMC for home building can influence future workforce requirements, helping to mitigate some of the occupational demand pressure, it also highlights that it would have to be widespread adoption to have the maximum impact on future productivity.

The scenarios show that even with adoption of MMC towards 2025-26, in the short term it is likely that there will be increased demand for a workforce that supports the existing mix of build types, unless there is very rapid uptake of MMC.

As a result, the home building sector is facing series of challenges:

- In the short term it will need to grow and develop skilled trades and manual workers to support increased number of homes built using the current methods of construction
- In the medium to longer term there is a need to maintain the training and provision of onsite skilled trades and manual workers at the same time as developing the offsite workforce required for MMC
- There is also the need to up-skill existing workers to cover the site management, integration, onsite placement and assembly that will be increasingly required for MMC
- Finally, it will be necessary to ensure that the professional, management, technical and non-manual workforce develops the digital skills that will be an increasing part of construction work in the future.

The level or scale of industry adoption of MMC is possibly the main challenge for home building given that the sector does not appear to have a strong track record of innovation and productivity improvements for new build homes in England.

Helping industry respond and embrace the challenges associated with delivering an increasing number of homes using current construction methods, while also promoting and developing adoption of MMC and offsite construction has already been recognised by Government and CITB.

However, the results from this research suggest that for a noticeable productivity improvement, further actions are likely to be needed. We therefore make the following recommendations:

For Government:

- Public sector home building along with support for the development of affordable housing may provide opportunities to showcase and develop use of MMC build methods. As a client for home building, Government has an opportunity to look at how home building using MMC types can support innovation to deliver better value for public sector home building. This should in turn act as a catalyst for more widespread adoption on innovate home building in the private sector if it can be shown to deliver productivity/cost improvements
- One of the challenges in producing this report was the lack of available evidence around the impact of MMC for home building upon the workforce. There is also an opportunity for Government in helping to promote a forum for sharing information, such as real data on workforce requirements and best practice information on MMC build techniques, which could help stimulate further industry adoption. This recognises that Government has a dual role as client for home building, along with an enabler of wider conditions for home building such as planning policies, skills development and the like
- While the level of home building can be influenced by general economic conditions, the underlying demand for more homes can be influenced factors related to population growth and lifestyle changes that result in more households being formed. Actions to help to promote conditions for sustained, long term market investment in home building would be welcome and one action for Government could be helping to create a future, visible pipeline for housing development. This approach could be like the approach to infrastructure work, where the Infrastructure and Projects Authority (IPA) publish the National Infrastructure Delivery Plan and Pipeline, to give that long-term view to support infrastructure investments.

For CITB:

The main recommendations are to continue working with employers and recognised bodies such as the Construction Leadership Council, HBF, NHBC, etc to help:

- Examine how the skills for future onsite home building will have to respond to uptake of MMC. As noted earlier, there is a lack of current robust, quantifiable evidence on the impact that building homes with different MMC types of construction would have on the home building workforce. In part this is linked to the current level of MMC adoption and assumptions on future uptake, however improved understanding of workforce impact would help establish a baseline for development of future skills and training
- Continue to understand and develop the training and qualifications for skills that would support increased take-up of offsite home building, while also supporting skills related to current build types. Even with increased levels of future MMC use, there will be a significant level of housing stock that will be maintained and improved, which is based on brick/cavity construction types. It isn't a case that skills to support existing construction techniques will be immediately replaced, more that there will be a longer-term shift in the balance of training as levels of MMC build types increase
- Linking into the Government action for a forum that promotes and shares information, CITB will also have a role in sharing details that form sector insight to support workforce development, by promoting home building as a career within the construction sector; by ensuring that there are training standards and qualifications that cover the full range of skills that home building will require in the future; and by helping employers to understand and access the range of training opportunities that they will need.



APPENDIX A. OCCUPATIONAL DEFINITIONS

Appendix Table 1: Occupation definitions

Occupations included within construction occupational aggregates (Four-digit codes refer to Office for National Statistics Standard Occupational Classification Codes).	
1 Senior, executive, and business process managersⁱⁱ	
(1115) Chief executives and senior officials	(1162) Managers and directors in storage and warehousing
(1131) Financial managers and directors	(1259) Managers and proprietors in other services nec
(1132) Marketing and sales directors	(1139) Functional managers and directors nec
(1133) Purchasing managers and directors	(2133) IT specialist managers
(1135) Human resource managers and directors	(2134) IT project and programme managers
(1251) Property, housing and estate managers	(3538) Financial accounts managers
(1136) Information technology and telecommunications directors	(3545) Sales accounts and business development managers
(2150) Research and development managers	
2 Construction project managersⁱⁱ	
(2436) Construction project managers and related professionals	
3 Other construction process managersⁱⁱ	
(1121) Production managers and directors in manufacturing	(1255) Waste disposal and environmental services managers
(1122) Production managers and directors in construction	(3567) Health and safety officers
(1161) Managers and directors in transport and distribution	(3550) Conservation and environmental associate professionals
4 Non-construction professional, technical, IT, and other office-based staff (excl. managers)ⁱⁱ	
(3131) IT operations technicians	(3541) Buyers and procurement officers
(3132) IT user support technicians	(3562) Human resources and industrial relations officers
(3534) Finance and investment analysts and advisers	(4121) Credit controllers
(3535) Taxation experts	(4214) Company secretaries
(3537) Financial and accounting technicians	(7129) Sales related occupations nec
(3563) Vocational and industrial trainers and instructors	(7211) Call and contact centre occupations
(3539) Business and related associate professionals nec	(7219) Customer service occupations nec
(3520) Legal associate professionals	(9219) Elementary administration occupations nec
(3565) Inspectors of standards and regulations	(2111) Chemical scientists
(2136) Programmers and software development professionals	(2112) Biological scientists and biochemists
(2139) Information technology and telecommunications professionals nec	(2113) Physical scientists
(3544) Estate agents and auctioneers	(3111) Laboratory technicians
(2413) Solicitors	(3421) Graphic designers
(2419) Legal professionals nec	(2463) Environmental health professionals
(2421) Chartered and certified accountants	(2135) IT business analysts, architects and systems designers

(2424) Business and financial project management professionals	(2141) Conservation professionals
(2423) Management consultants and business analysts	(2142) Environment professionals
(4216) Receptionists	(2425) Actuaries, economists and statisticians
(4217) Typists and related keyboard occupations	(2426) Business and related research professionals
(3542) Business sales executives	(4124) Finance officers
(4122) Book-keepers, payroll managers and wages clerks	(4129) Financial administrative occupations nec
(4131) Records clerks and assistants	(4138) Human resources administrative occupations
(4133) Stock control clerks and assistants	(4151) Sales administrators
(7213) Telephonists	(4159) Other administrative occupations nec
(7214) Communication operators	(4162) Office supervisors
(4215) Personal assistants and other secretaries	(7130) Sales supervisors
(7111) Sales and retail assistants	(7220) Customer service managers and supervisors
(7113) Telephone salespersons	(4161) Office managers
5 Construction trades supervisors¹²	
(5250) Skilled metal, electrical and electronic trades supervisors	(5330) Construction and building trades supervisors
6 Wood trades and interior fit-out¹²	
(5315) Carpenters and joiners	(5319) Construction and building trades nec (25%)
(8121) Paper and wood machine operatives	(5442) Furniture makers and other craft woodworkers
7 Bricklayers¹²	
(5312) Bricklayers and masons	
8 Building envelope specialists¹²	
(5319) Construction and building trades nec (50%)	
9 Painters and decorators¹²	
(5323) Painters and decorators	(5319) Construction and building trades nec (5%)
10 Plasterers¹²	
(5321) Plasterers	
11 Roofers¹²	
(5313) Roofers, roof tilers and slaters	
12 Floorers¹²	
(5322) Floorers and wall tillers	
13 Glaziers¹²	
(5316) Glaziers, window fabricators and fitters	(5319) Construction and building trades nec (5%)
14 Specialist building operatives not elsewhere classified (nec)¹²	
(8149) Construction operatives nec (100%)	
(5319) Construction and building trades nec (5%)	(9132) Industrial cleaning process occupations
(5449) Other skilled trades nec	

¹²Managerial, professional & office based staff

15 Scaffolders¹²	
(8141) Scaffolders, staggers and riggers	
16 Plant operatives¹²	
(8221) Crane drivers	(8229) Mobile machine drivers and operatives nec
(8129) Plant and machine operatives nec	(8222) Fork-lift truck drivers
17 Plant mechanics/fitters¹²	
(5223) Metal working production and maintenance fitters	(5222) Tool makers, tool fitters and markers-out
(5224) Precision instrument makers and repairers	(5232) Vehicle body builders and repairers
(5231) Vehicle technicians, mechanics and electricians	(9139) Elementary process plant occupations nec
18 Steel erectors/structural fabrication¹²	
(5311) Steel erectors	(5211) Smiths and forge workers
(5215) Welding trades	(5221) Metal machining setters and setter-operators
(5214) Metal plate workers, and riveters	(5319) Construction and building trades nec (5%)
19 Labourers nec¹²	
(9120) Elementary construction occupations (100%)	
20 Electrical trades and installation¹²	
(5241) Electricians and electrical fitters	(5242) Telecommunications engineers
(5249) Electrical and electronic trades nec	
21 Plumbing and heating, ventilation, and air conditioning trades¹²	
(5314) Plumbers and heating and ventilating engineers	(5225) Air-conditioning and refrigeration engineers
(5216) Pipe fitters	(5319) Construction and building trades nec (5%)
22 Logistics¹²	
(8211) Large goods vehicle drivers	(4134) Transport and distribution clerks and assistants
(8212) Van drivers	(3541) Buyers and purchasing officers (50%)
(9260) Elementary storage occupations	
23 Civil engineering operatives not elsewhere classified (nec)¹²	
(8142) Road construction operatives	(8123) Quarry workers and related operatives
(8143) Rail construction and maintenance operatives	
24 Non-construction operatives¹²	
(8117) Metal making and treating process operatives	(9249) Elementary security occupations nec
(8119) Process operatives nec	(9233) Cleaners and domestics
(8125) Metal working machine operatives	(9232) Street cleaners
(8126) Water and sewerage plant operatives	(5113) Gardeners and landscape gardeners
(8132) Assemblers (vehicles and metal goods)	(6232) Caretakers
(8133) Routine inspectors and testers	(9241) Security guards and related occupations
(8139) Assemblers and routine operatives nec	(3319) Protective service associate professionals nec

¹²Skilled trades & operatives

25 Civil engineers¹¹	
(2121) Civil engineers	
26 Other construction professionals and technical staff¹¹	
(2122) Mechanical engineers	(3119) Science, engineering and production technicians nec
(2123) Electrical engineers	(3121) Architectural and town planning technicians
(2126) Design and development engineers	(3122) Draughtspersons
(2127) Production and process engineers	(3115) Quality assurance technicians
(2461) Quality control and planning engineers	(2432) Town planning officers
(2129) Engineering professionals nec	(2124) Electronics engineers
(3112) Electrical and electronics technicians	(2435) Chartered architectural technologists
(3113) Engineering technicians	(3531) Estimators, valuers and assessors
(3114) Building and civil engineering technicians	(3116) Planning, process and production technicians
27 Architects¹¹	
(2431) Architects	
28 Surveyors¹¹	
(2433) Quantity surveyors	(2434) Chartered surveyors

¹¹Managerial, professional & office based staff

APPENDIX B. QUESTIONNAIRE-EVALUATING THE IMPACT OF MMC ON LABOUR DEMAND FOR HOME BUILDING

Aim and Background

The aim of this study is to determine the impact on employment and skills of meeting the Government Housing Ambition target using modern methods of construction in the homebuilding sector.

The 2017 housing White Paper set a target to deliver **250,000** homes a year by 2022 (since extended to 300,000 homes by the mid-2020s) and the reforms to deliver this. These include measures to ensure that homes are built using modern methods of construction (MMC) which have the potential to speed up the supply of high-quality, high-performance homes. Various research studies have indicated that MMC requires less on-site manpower to assemble homes than current construction methods and potentially requires a smaller workforce with different skill sets to those currently being used.

The study is carried out by CITB and WLC Ltd and commissioned by the Ministry of Housing, Communities & Local Government (MHCLG). It relates only to housing.

Objective of this questionnaire

The objective agreed with MHCLG is to estimate the change in labour skills and quantities on- and off-site as home builders increase the use of panelised and volumetric off-site manufacture. To achieve this, we are looking to understand changes to the workforce profile for panelised and volumetric off-site home building.

Definitions

MODERN METHODS OF CONSTRUCTION

For the purpose of this questionnaire, MMC is defined as ‘an approach to construction process where the construction value added offsite is more than **60%** of the final construction value at completion.’

We recognise that definitions of MMC can vary, however this study recognises the importance of the NAO (2007) definition which advocates a move from the current definition of MMC in terms of particular construction technologies to one based on performance and outputs regardless of construction technique chosen.

PANELISED CONSTRUCTION

Panelised systems are units which are produced in a factory and assembled on-site to produce a three-dimensional structure or to fit within an existing structure.

VOLUMETRIC CONSTRUCTION

Volumetric construction involves the production of three-dimensional modular units in controlled factory conditions. The units are then transported to site and assembled together.

Questionnaire

Section 1 – General Information

1.1 Respondent's Name:			
1.2 Job Title:			
1.3 Email address:			
1.4 Name of Organisation:			
1.5 Organisation type: (Drop down menu includes: Client, Manufacturer, Designer, Contractor and Other, please specify)			
Does your organisation have experiences of using panelised construction methods for housing?		Yes	No
Does your organisation have experiences of using volumetric construction methods for housing?		Yes	No
Please rate your level of knowledge of MMC:			
Basic		Intermediate	Expert

Section 2 – Impact of MMC on labour demand

Please use the table below to provide details of the percentage change from the current number of person hours to construct an average dwelling including all on and offsite labour if the average home was built using panelised or volumetric construction. The table includes all the occupations that are both used in the Construction Skills Network forecasts and that are in the CITB footprint.

Please first specify whether you think there would be an increase or decrease in labour demand. Secondly, please specify the range of that percentage change. Finally, please specify what proportion of the labour in each occupation would be offsite or onsite for both panelised and volumetric construction.

[Once the questionnaire is finalised, a sample occupation will be provided as an example].

	Occupational group	Panelised construction		Volumetric construction	
		% change in the current number of person hours per dwelling [Dropdown for a) no change; b) increase; c) decrease followed by two text boxes which allow % to be input with logic that second number must be >= first number]	Mix of on site to offsite labour [This will be a slider from 0 (all offsite) to 100 (all onsite)]	% change in the current number of person hours per dwelling [Dropdown for a) no change; b) increase; c) decrease followed by two text boxes which allow % to be input with logic that second number must be >= first number]	Mix of on site to offsite labour [This will be a slider from 0 (all offsite) to 100 (all onsite)]
Management & backoffice	Senior, executive, and business process managers				
	Construction project managers				
	Other construction process managers				
	Non-construction professional, technical, IT, and other office-based staff (excl. managers)				
	Construction trades supervisors				

Trades	Wood trades and interior fit-out				
	Bricklayers				
	Building envelope specialists ¹³				
	Painters and decorators				
	Plasterers				
	Roofers				
	Floorers				
	Glaziers				
	Specialist building operatives ¹⁴				
	Scaffolders				
	Plant operatives				
	Plant mechanics/fitters				
	Steel erectors/structural fabrication				
	Labourers				
	Electrical trades and installation				
	Plumbing and heating, ventilation, and air conditioning trades				
	Logistics				
	Civil engineering operatives ¹⁵				
Non-construction operatives ¹⁶					
Designers	Civil engineers				
	Other construction professionals and technical staff				
	Architects				
	Surveyors				

Are there any other construction occupations which will be affected by a move to volumetric and panelised construction? If so, which ones and in what way.

Please use the box below to provide any additional comments.

Consent

Responses are confidential and individual respondents will not be identified by name in research outputs and reports without prior consent. The only people to analyse the questionnaire will be members of the team at Whole Life Consultants.

By completing and returning this questionnaire I understand that I am giving consent for my responses to be used for the purposes of this research project.

Thank you for your time.

Would you be willing to talk to us further about this project?	Yes	No
Would you like to receive the results of this survey?	Yes	No

¹³Building envelope specialists: trades involved with the external structure of a building other than bricklaying, for example curtain walling or external wall insulation

¹⁴Specialist building operatives: covers the range of trades that are not picked up by the other identified occupational groups. Examples would be maintenance operatives, multi-skilled trades, heritage skills and the like

¹⁵Civil engineering operatives: covers the likes of ground workers, road builders and demolition workers.

¹⁶Non-construction operatives: examples here would be workers for site security, cleaning, fencing and landscaping

The findings and conclusions set forth in this report represent the best professional judgment of CITB and Whole Life Consultants based on information made available to it at a point in time. The authors have relied on, and not independently verified, data provided to it by independent sources and sources of information cited in the report. We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above. We accept no responsibility to third parties to whom this report, or any part, thereof is made available. Any such party relies upon the report at their own risk.

About the Construction Industry Training Board (CITB)

CITB is the Industrial Training Board (ITB) for the construction industry in Great Britain (England, Scotland and Wales). CITB ensures employers can access the high quality training their workforce needs and supports industry to attract new recruits into successful careers in construction. Using its evidence base on skills requirements, CITB works with employers to develop standards and qualifications for the skills industry needs now, and in the future. CITB is improving its employer funding to invest in the most needed skills and by making it easier for companies of all sizes to claim grants and support.



CITB ANALYSIS

CITB, Bircham Newton, Norfolk, PE31 6RH
+44 (0)344 994 4400

Whole Life Consultants Limited, Dundee University Incubator,
James Lindsay Place, Dundee, DD1 5JJ
+44 (0)1382 224 304
enquiries@wlcuk.com

For further information contact:

Ian Hill, Senior Research Analyst
07909 906364
ian.hill@citb.co.uk
www.citb.co.uk

