

OCTOBER 2022

Future Homes Appendix I: MMC Definitions

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Defining MMC and AMC

What is the MMC Framework?

The MMC definition framework is a seven category definition framework that enables a full and future-proofed range of 'Modern Methods of Construction' used in homebuilding to be better understood with regularised terminology.

The definition framework spans all types of pre-manufacturing, site-based materials and process innovation. This definition framework is an output of the MHCLG Joint Industry Working Group on MMC which is tasked with improving stakeholder education and understanding of MMC with particular reference to enabling better access to mortgage finance, insurance and assurance. Particular thanks go to the Working Group members, Buildoffsite, Homes England, NHBC and RICS who all provided input to this definition framework.



1
Pre-manufacturing
(3D primary structural systems)



2
Pre-manufacturing
(2D primary structural systems)



3
Pre-manufacturing components (non-systemised primary structure)



4
Additive manufacturing
(structural and non-structural)



5
Pre-manufacturing
(non structural assemblies & sub-assemblies)



6
Traditional building product led site labour reduction / productivity improvements



7
Site process led site labour reduction / productivity / assurance improvements

The term 'pre-manufacturing' encompasses processes executed away from final workforce, including in remote factories, near site or on-site 'pop up' factories. The pass test is the application of a manufactured led fabrication or consolidation process in controlled conditions prior to final assembly / install. On-site 'workforce factories' are included in Category 7).

Advanced Manufacture in Construction (AMC)

A term which covers a sub-set of the technologies described as MMC. AMC techniques are typified by the fundamental use of digital technology throughout the process, from design through to component manufacture and assembly, and the use of automation and high-performance materials where appropriate to drive quality, performance and mass-customisation through standardised processes. AMC techniques will also learn from, adopt and evolve manufacturing processes already established in other sectors.

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Pre-Manufactured Value (PMV)

What is PMV?

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

Pre-manufacturing includes all costs incurred prior to the final installation at the construction workforce, including all materials, the total labour applied in pre-manufacturing processes, fixed and variable manufacturing overheads and associated plant, logistics and transportation costs.

Gross Construction Costs include all pre-manufactured costs, on-site labour costs, all preliminaries costs, overhead, profit and risk.

The PMV formula is a simple equation, it translates the **Pre-Manufactured Value** of a project into a percentage of the overall **Gross Construction Cost**.



Pre-manufactured value (£)



Gross Construction Cost (£)

x 100

Benefits for optimised PMV

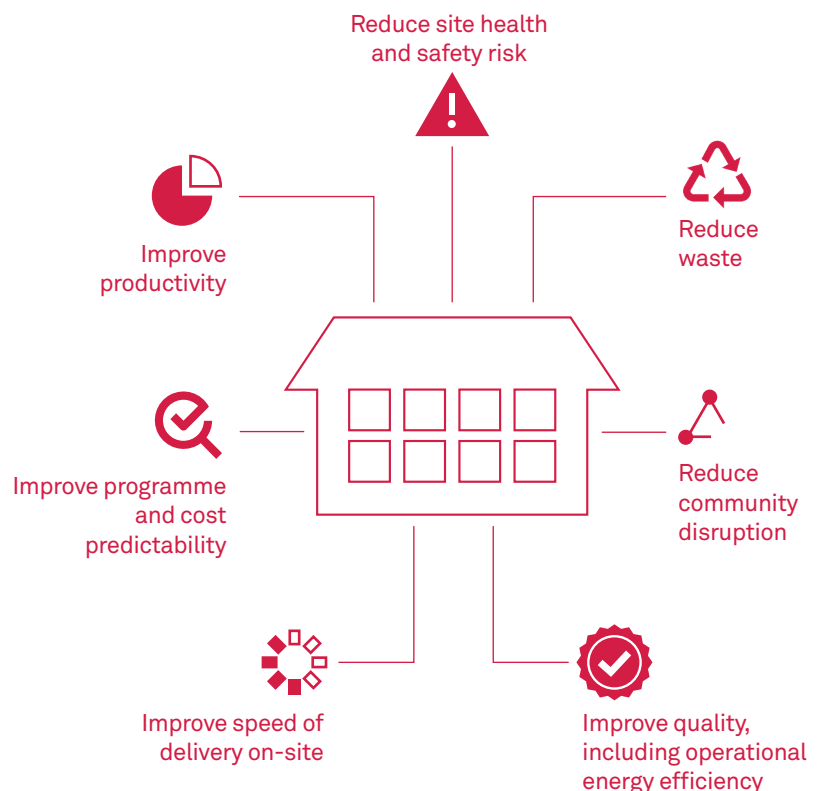
Targeting an optimised PMV will ensure that a higher proportion of project building materials, components and consolidated assemblies or modules are produced within a controlled factory environment.

A factory based approach of all building elements will help:

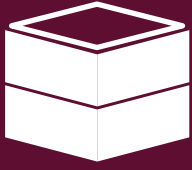
- Reduce site and factory waste with controls in place to use less material
- Improve quality with construction taking place in controlled environments and quality control through checks
- Improve predictability with more certain outcomes.

Moving away from traditional construction techniques and implementing a more componentised construction will further provide on-site benefits including:

- Improved speed of construction across all building elements
- Increased productivity with the on-site labour force working across more houses over the same man days
- Reducing community disruption with fewer transport movements and less construction duration.



MMC assessment by category



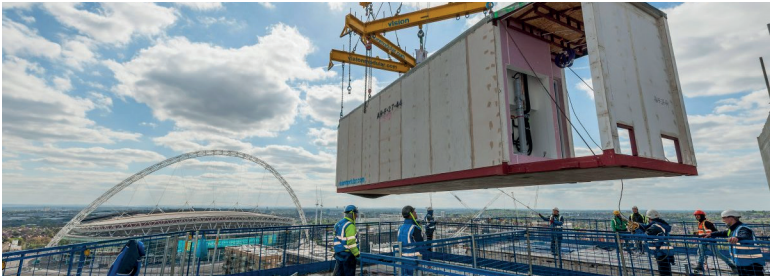
Category 1

PRE-MANUFACTURING
(3D PRIMARY STRUCTURAL SYSTEMS)

- a. Structural chassis only – not fitted out
- b. Structural chassis and internal fit out
- c. Structural chassis, fit out and external cladding / roofing complete
- d. Structural chassis and internal fit out – ‘podded’ room assemblies – bathrooms / kitchens etc

Any of the above variants can be used in the following 3 configurations:

- i. Whole building systemised
- ii. Hybrid construction – part systemised, part traditional (ie traditional core / ground floor podium)
- iii. Hybrid construction – secondary structure to enhance system performance (ie build at height)



Product options	Examples of in the market
A: Structural chassis fitted out	Tempo Housing
B: Structural chassis fitted out with cladding	Boutique Modern
i: Whole building systemised	TopHat
ii: Hybrid traditional core with volumetric modules	Tide/Vision, Elements Europe, Caledonian

Category 1: Impact on PMV

Traditionally constructed house

PMV = c40%

PMV uplift
→
UPTO
40%

House utilising Cat 1 MMC

PMV = c70-80%

Note: Cat 1 MMC can also be combined with elements of categories 3 and 7 to drive further PMV improvement

WMCA MMC Supply Chain: Category 1

Supplier	Location	Description
 <p>Actavo</p>	Birmingham	Strategic operations partner offering multiple services, including the design, construction, manufacture and maintenance of modular buildings for multiple sectors
 <p>Algeco</p>	Branches in Cannock, Nuneaton and Wolverhampton	Supplier of turnkey portable and modular, permanent or temporary, buildings
 <p>Elements Europe</p>	Telford	Manufacturer of volumetric modular, bathroom pod, and lightweight steel frame solutions
 <p>ModPods International Limited</p>	Kenilworth	Designer and builder of modular housing for the private and public sector

MMC assessment by category



Category 2

PRE-MANUFACTURING
(2D PRIMARY STRUCTURAL SYSTEMS)

- a. Basic framing only including walls, floors, stairs & roof
- b. Enhanced consolidation – insulation, internal linings etc
- c. Further enhanced consolidation – insulation, linings, external cladding, roofing, doors, windows



Product options	Suppliers in the market
Cross Laminated Timber	
Light-gauge Steel Frame	Fusion, Metsec, Orca, Parabuild
Pre-Cast	FP McCann, Laing O'Rourke, MACE Tech
Structurally Insulated Panels	SIP Build, SIP Co

Category 2: Impact on PMV

Traditionally constructed house

PMV = c40%

PMV uplift
→
UPTO
14%

House utilising Cat 2 MMC

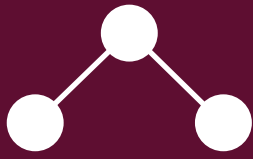
PMV = c45-54%

Note: Cat 2 MMC can also be combined with elements of categories 3, 5, 6 and 7 to drive further PMV improvement

WMCA MMC Supply Chain: Category 2

Supplier	Location	Description
 Accord / LoCal Homes	West Bromwich	Not-for-profit advanced housing manufacturer, offering high performance, low carbon housing solutions across the UK, providing both traditional and closed panel timber-frame systems
 Albion Section	West Bromwich	Manufacturer of cold rolled steel sections, producing bespoke kit-form roof and floor cassettes
 Ayrshire Metals Limited	Smethwick	Manufacturer of cold rolled steel
 FrameClad	Dudley	Designer, manufacturer of steel frame solutions for traditional and MMC construction
 Hadley Group	Smethwick	Manufacturer of volumetric modular builds, panels and cassettes, and pods
 Innovare Systems	Coventry	Specialist manufacturer of high performance SIPs
 Metstructure	Halesowen	Offsite construction contractor - light gauge steel frame, design, manufacture and installation
 Midland Structures	Brierley Hill	Structural steel contractor
 Roofspace Solutions	Alcester	Award winning offsite manufacturer of roof and frame solutions
 Skyline Timber Systems	Cannock	Supplier of timber frames and structures, panels and roof trusses
 Space4 (persimmon)	Birmingham	Manufacturing subsidiary of Persimmon producing timber frames, insulated wall panels and roof cassettes
 TG Escapes	Coventry	Construction company specialising in timber frame
 WB Timber Innovations Ltd / Timber Innovations	Solihull	Specialist Timber Frame design, manufacture and installation
 Wyckham Blackwell (Group)	Solihull	Specialist manufacturer of timber products including roof and floor cassettes

MMC assessment by category



Category 3

PRE-MANUFACTURING COMPONENTS
(NON-SYSTEMISED PRIMARY STRUCTURE)

- a. Driven / screw piling
- b. Pre-fabricated pile caps / ring beams
- c. Columns / shear walls / beams
- d. Floor slabs
- e. Integrated columns, beams and floor slabs
- f. Staircases
- g. Pre-assembled roof structure – trusses / spandrels



Building elements	Specific systems
Substructure - Pile - Pile Caps	Roger Bullivan, FP McCann Laing O'Rourke
Frame - Beams - Columns - Slab - Twin Wall	Expanded Byldis O'Reilly Bison
Stairs	Stairmaster, Precast stairs by various suppliers. Selection to be contractor led
Roof	Ruukki or MODURoof systems

Category 3: Impact on PMV

Traditionally constructed house

PMV = c40%

PMV uplift
→
UP TO
5%




House utilising Cat 3 MMC

PMV = c41-45%

Note: Cat 3 MMC can also be combined with elements of all other categories to drive further PMV improvement

Increases efficiency given the volume of repetitive components, reduces reliance on on-site labour and increases quality.

WMCA MMC Supply Chain: Category 3

Supplier	Location	Description
 <p>FP McCann</p>	Nuneaton	Precast concrete manufacturer and supplier
 <p>FrameClad</p>	Dudley	Designer, manufacturer of steel frame solutions for traditional and MMC construction
 <p>Metstructures</p>	Halesowen	Offsite construction contractor - light gauge steel frame, design, manufacture and installation
 <p>WB Timber Innovations Ltd / Timber Innovations</p>	Solihull	Specialist Timber Frame design, manufacture and installation

MMC assessment by category



Category 5

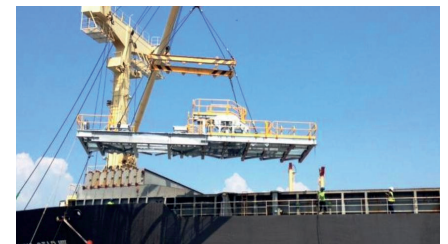
PRE-MANUFACTURING
(NON STRUCTURAL ASSEMBLIES AND SUB-ASSEMBLIES)

Volumetric podded assemblies

- Whole bathroom assemblies (including enclosing structure)
- Kitchen assemblies (including enclosing / supporting structure)
- Bathroom / kitchen combined assemblies (including enclosing / supporting structure)
- In unit M&E central equipment assemblies (utility cupboards etc)

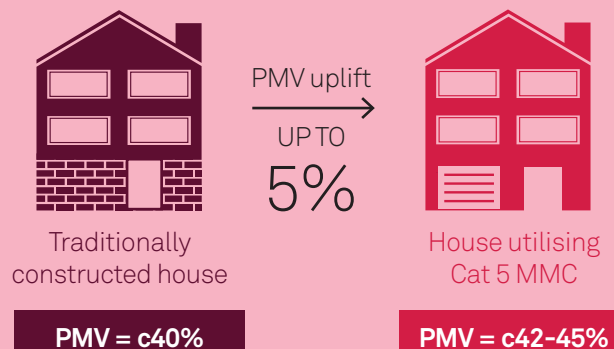
Panelised / linear assemblies

- Façade assemblies (non structural) including glazing, solid cladding, metalwork
- Roof assemblies / cassettes – pre-finished roof sections (including structure to support own weight)
- In unit M&E distribution assemblies
- Infrastructure M&E assemblies – vertical risers / main distribution
- Infrastructure M&E assemblies – central plant & equipment
- Floor cassettes with horizontal services / finishes added
- Partition cassettes – with horizontal & vertical services / finishes added
- Doorsets (pre-hung, finished with ironmongery)









Product options	Suppliers
Bathroom pods	Deba, Elements Europe, Forta, Off Site Solutions, Walkers
Utility pods	Borough Engineering Services, Modular Engineering, Alternative Heating, YGHP, Rhico
Kitchen pods	Elements Europa, B&B Italia, MaceTech
Doorsets	UK Door Sets, Shadbolts, Door Concept
Risers	Pipetech, Modular Engineering, Balfour Beatty, DST Group
Wall Cassettes	Kingspan, Fasthouse, Stewart Milne Timber systems
Floor Cassettes	Fusion, Monarfloor

Category 5: Impact on PMV

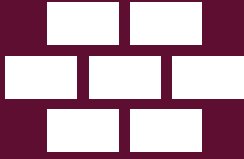


Note: Cat 5 MMC can also be combined with elements of categories 2, 3, 6 and 7 to drive further PMV improvement. i.e. Cat 2c frame and Cat 5a bathroom pod creates an 18% uplift to 58% PMV

WMCA MMC Supply Chain: Category 5

Supplier	Location	Description
 Elements Europe	Telford	Manufacturer of volumetric modular, bathroom pod, and lightweight steel frame solutions
 FrameClad	Dudley	Designer, manufacturer of steel frame solutions for traditional and MMC construction
 Hadley Group	Smethwick	Manufacturer of volumetric modular builds, panels and cassettes, and pods
 Prism	Coventry	Specialist manufacturer of utility pods, service and prefabricated risers and multiservice modules
 Roofspace Solutions	Alcester	Award winning offsite manufacturer of roof and frame solutions
 Superior Insulated Panels Ltd	Coventry	Supplier of of insulated aluminium architectural panels for facade glazing and cladding

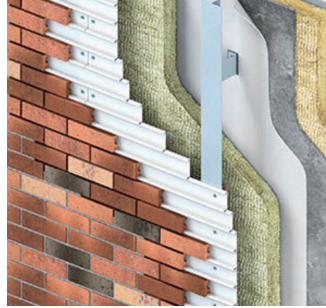
MMC assessment by category



Category 6

TRADITIONAL BUILDING PRODUCT SITE LED
LABOUR REDUCTION / PRODUCTIVITY IMPROVEMENTS

- a. Large format walling products – external walls
- b. Large format walling products – internal walls
- c. Large format roofing finishes
- d. Pre-sized and cut to measure traditional materials – component level systemisation
- e. Easy site install / jointing / interfacing features – brick slips, modular wiring, flexible pipework



Product options	Suppliers
Large format blockwork	Masonry Frame Systems,
Large format brick slips	Wetherby
Unitized systems	Rehau
Modular Wiring	Wetherby

Category 6: Impact on PMV

Traditionally constructed house

PMV = c40%


PMV uplift
→
of
1-2%
For every Cat 6 system used

House utilising 3 x Cat 6 solutions

PMV = c43-46%

Note: Cat 6 MMC can also be combined with elements of every other category to drive further PMV improvement

WMCA MMC Supply Chain: Category 6

Supplier	Location	Description
 Ash and Lacy	West Bromwich	Manufacturer of engineered façade and roofing systems. Specialists in cold rolled steel frame systems and brick cladding
 Just Walls UK	Warwick	Supplier of brick, brick slips, and stone
 Kettle Brick Company	Brierley Hill	Manufacturer of bricks and brick slips

Contact us

Cast is a specialist construction consultancy providing solutions for developers, investors, policymakers and the supply chain. We are focused on helping deliver great homes and places viably whilst also addressing bigger economic, societal and environmental challenges.



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