

PAS 8700:2025

Modern methods of construction for new-build residential properties – Specification



Ministry of Housing,
Communities &
Local Government



Publishing and copyright information

The BSI copyright notice displayed in this document indicates when the document was last issued.

© The British Standards Institution 2025
Published by BSI Standards Limited 2025

ISBN 978 0 539 23292 9

ICS 01.040.13; 91.010.01; 91.040.30

No copying without BSI permission except as permitted by copyright law.

Publication history

First published April 2025

Contents

Foreword	iv
0 Introduction	vi
0.1 Aims of PAS 8700	vi
0.2 Background	vi
0.3 Insurance, warranties and third-party requirements	x
0.4 Manufacturing funding	xi
0.5 RIBA plan of work	xi
0.6 Realizing the benefits of MMC and DfMA	xiii
0.7 Collaboration	xiii
1 Scope	1
2 Normative references	2
3 Terms, definitions and abbreviated terms	3
3.1 Terms and definitions	3
3.2 Abbreviated terms	4
4 Establishing the delivery team	5
4.1 Competence	5
4.2 Roles and appointments	5
4.3 Supply chain input	10
4.4 Stakeholder consultation	11
5 Integrating MMC into project design	12
5.1 Risk register	12
5.2 Preparation and briefing	13
5.3 Optioneering	15
5.4 Design responsibility	17
5.5 System selection	18
5.6 Sustainability targets and embodied carbon	19
5.7 Future adaptation	20
5.8 Design freeze	20
5.9 Standardization	23
5.10 Technical design information	23
5.11 Information management	24
5.12 Future inspection requirements	26

6 Systems, assemblies and components	28
6.1 System description	28
6.2 Design life, repair and replacement	29
6.3 Resilience and insurability	29
6.4 Structural design	30
6.5 Fire protection and safety	33
6.6 Factory installed cladding	37
6.7 Design for transport and handling	38
6.8 Design for assembly, buildability and lifting	38
7 Deployment and delivery	40
7.1 Factory output and site readiness	40
7.2 Transport planning	41
7.3 Deployment plan and logistics information	41
7.4 Labelling, protection and support	42
7.5 Delivery and safe handling	43
7.6 Off-site storage	44
8 Site construction and assembly	46
8.1 On-site temporary storage and protection	48
8.2 Substructure	48
8.3 Site assembly	48
8.4 Competence requirements for installation and site personnel	50
8.5 Connections	50
8.6 Building envelope	52
8.7 Building services	53
8.8 Identifying and remedying problems and defects	53
9 Testing and inspection	54
9.1 Factory production control	54
9.2 Factory inspections and testing	54
9.3 Site tests and records	56
9.4 Operational checks and testing	57
9.5 Recording information	58
9.6 Commissioning and completion	58
10 Quality and compliance recording	59
11 Completion information	60
11.1 Health and safety information	60
11.2 Home user guide	61

Annexes

Annex A (informative)

Insurance considerations	63
---------------------------------------	----

A.1 Latent defects insurance	63
------------------------------------	----

A.2 Buildings/property insurance (annual building insurance)	64
--	----

Annex B (informative)

Briefing checklist for MMC projects	65
--	----

Annex C (informative)

Setting up a project: MMC roles and appointments	72
---	----

Annex D (normative)

Structural MMC design for consequence class 2b and 3 buildings and buildings with alternative structural failure mechanisms	75
--	----

D.1 Design responsibilities	75
-----------------------------------	----

D.2 Design reports	75
--------------------------	----

D.3 Specific conditions	76
-------------------------------	----

Bibliography	79
---------------------------	----

List of figures

Figure 1 – Positioning industrialized construction	ix
--	----

Figure 2 – DfMA process through the RIBA Plan of Work	xii
---	-----

Figure 3 – Timing and duration of key delivery team appointments	6
--	---

Figure 4 – MMC technical design activities and interfaces (pre-manufacture, low-rise housing layout)	22
--	----

Figure 5 – Chart of MMC handover points and interfaces (low-rise housing layout post manufacture)	47
---	----

List of tables

Table 1 – Approaches to fire safety	34
---	----

Table B.1 – Briefing checklist	65
--------------------------------------	----

Table C.1 – MMC roles and appointments	72
--	----

Foreword

This PAS was sponsored by the Ministry of Housing, Communities and Local Government (MHCLG). Its development was facilitated by BSI Standards Limited and it was published under licence from The British Standards Institution. It came into effect on 30 April 2025.

Acknowledgement is given to Suzanne Davenport and Richard Partington, Studio Partington, as the technical authors, and the following organizations that were involved in the development of this PAS as members of the steering group.

- Akerlof
- Association of British Insurers (ABI)
- Buildoffsite (BOS)
- Buildoffsite Property Assurance Scheme (BOPAS)
- Building Safety Regulator (BSR)
- Built Environment-Smarter Transformation (BE-ST)
- Cast Consultancy
- Cooper Reed
- Egan Bennet Architects
- Frontier Insurance Solutions Ltd
- Health and Safety Executive (HSE)
- Institution of Structural Engineers (IStructE)
- LRQA Group
- Ministry of Defence (MoD)
- Ministry of Housing, Communities and Local Government (MHCLG)
- Mott Macdonald
- National Fire Chiefs Council (NFCC)
- National House Building Control (NHBC)
- National Housing Federation
- Offsite Alliance
- Osco Homes
- Royal Institute of British Architects (RIBA)
- Royal Institution of Chartered Surveyors (RICS)
- Steel Construction Institute
- Structural Timber Association (STA)
- Studio Partington
- Trowers and Hamlins
- Turner & Townsend
- University of Salford
- Vision Modular Systems

Acknowledgement is given to Clare Vokes, Harlow Consulting, for her contribution to the initial scoping and drafting activities, and the members of the advisory groups and the wider review panel who were consulted in the development of this PAS.

Acknowledgement is also given to Trudi Sully, Mott MacDonald, for her contribution to the development of Figure 1, and Matthew Egan, Egan Bennet Architects, and Nigel Ostime, Ostime Consulting, for their contribution to the development of Figure 2.

The British Standards Institution retains ownership and copyright of this PAS. BSI Standards Limited as the publisher of the PAS reserves the right to withdraw or amend this PAS on receipt of authoritative advice that it is appropriate to do so. This PAS will be reviewed at intervals not exceeding two years.

This PAS is not to be regarded as a British Standard. It will be withdrawn in the event it is superseded by a British Standard.

The PAS process enables a specification to be rapidly developed in order to fulfil an immediate stakeholder need. A PAS can be considered for further development as a British Standard, or constitute part of the UK input into the development of a European or International Standard.

Information about this document

Copyright is claimed in Figure 3 which is reproduced by kind permission of the Royal Institute of British Architects (RIBA). Copyright holders are RIBA, 66 Portland Place, London, W1B 1AD.

This publication can be withdrawn, revised, partially superseded or superseded. Information regarding the status of this publication can be found in the Standards Catalogue on the BSI website at knowledge.bsigroup.com, or by contacting the Customer Services team.

Where websites and webpages have been cited, they are provided for ease of reference and are correct at the time of publication. The location of a webpage or website, or its contents, cannot be guaranteed.

Use of this document

It has been assumed in the preparation of this PAS that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this document are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. "organization" rather than "organisation").

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

Compliance with a PAS cannot confer immunity from legal obligations.

0 Introduction

0.1 Aims of PAS 8700

This PAS sets out the process for the effective deployment of modern methods of construction (MMC) in residential development to improve stakeholder understanding and realize the benefits of MMC. As the sector has significantly evolved and matured, there is a need for greater consistency and comparability to increase the use of MMC. This PAS has therefore been developed to provide a unified specification, which is material and technology agnostic, and to act as a coordinating document that directs readers to other technical requirements. The aim is to support the procurement, design, manufacture, construction and use of safe, resilient and repairable residential buildings that use MMC.

This PAS primarily covers pre-manufactured or off-site constructed forms of MMC and includes:

- entire buildings;
- consolidated systems and assemblies; and
- components and elements.

MMC items can also be two-or three-dimensional (panels or volumes) and primary structural or non-structural elements.

Annexes are provided covering insurance considerations (Annex A), a briefing checklist (Annex B) project set-up (Annex C) and structural MMC design (Annex D).

0.2 Background

0.2.1 Building legislation

This PAS is being introduced at a time of fundamental reform of building legislation throughout the UK, particularly through the Building Safety Act 2022 (BSA 2022) [1], the Fire Safety Act 2021 [2] and associated regulations. These create significant new duties and accountabilities for all those involved in procurement, design, manufacture, construction, installation and in some instances the operation of buildings. While some elements of the BSA 2022 [1] apply across the UK, most aspects of building safety are devolved, with specific building regulations and guidance in place in each UK nation. Scotland, Wales and Northern Ireland are also making significant changes to legislation.

NOTE 1 For all users of this PAS, attention is drawn to this regulatory landscape and associated duties as MMC projects progress.

NOTE 2 In addition to the Building Regulations 2010 (as amended) [3] and equivalent national variations [4] to [6], guidance is also available from:

- GOV.UK (England)¹⁾;
- the Welsh Government (Wales)²⁾
- the Scottish Government (Scotland)³⁾; and
- the Department of Finance (Northern Ireland)⁴⁾.

¹⁾ Available at <https://www.gov.uk/government/collections/approved-documents>.

²⁾ Available at <https://www.gov.wales/building-regulations-approved-documents>.

³⁾ Available at <https://www.gov.scot/collections/building-standards/>.

⁴⁾ Available at <https://www.finance-ni.gov.uk/articles/building-regulations-technical-booklets>.

The dutyholder roles of “client”, “principal designer”, “designer”, “principal contractor” and “contractor” are legally defined under both the Construction (Design and Management) Regulations 2015 (CDM 2015)⁵⁾ [7] and the Building Regulations 2010 (as amended) [3]. Under these regulations, roles with the same name (e.g. principal designer) have separate and distinct duties. Those involved in new residential buildings using this PAS might have one or more roles and associated legal duties under either or both regulations.

NOTE 3 For clarity in this PAS, a role is prefaced when attention is being drawn to specific requirements under the respective legislation, e.g. CDM 2015 [7] principal designer (CDMPD) and Building Regulations 2010 (as amended) [3] principal designer (BRPD).

The BSA 2022 [1], together with supporting secondary legislation, has also introduced a new regulatory regime for higher-risk buildings (HRBs) in England. This PAS does not focus on how to comply with this regime but does touch upon relevant aspects.

NOTE 4 Whilst this PAS refers to the legislation it neither duplicates nor provides guidance on the Acts or associated regulations.

0.2.2 Off-site construction and modern methods of construction (MMC)

Off-site construction is the practice of manufacturing and/or consolidating buildings, assemblies or components in a location other than their final installation site. In other words, moving operations that are traditionally completed on site to a manufacturing environment. With the right conditions, this method can add value and allows for better control over the production process, leading to improved efficiency, quality, safety and reduced on-site disruption.

MMC is an umbrella term that describes innovative building methods designed to improve productivity and safety or reduce the need for labour, with the specific objective of improving efficiency compared to traditional techniques. Whilst the term is most associated with off-site construction, it includes a range of construction approaches which spans off-site and on-site pre-manufacturing, site-based process improvements and technology applications. The practice of manufacturing components and assembling them off-site is not new (notwithstanding the widely accepted prefix “modern”, some systems have been around for over 100 years) but house building is becoming increasingly technologically driven.

The MHCLG Joint Industry Working Group’s *Modern methods of construction: Introducing the MMC definition framework* [9] describes seven categories of MMC used in the residential sector and uses regularized terminology to improve stakeholder understanding of MMC with reference to the mortgage, finance, insurance and valuation communities. This PAS predominantly covers pre-manufacturing MMC categories 1 to 3 and 5.

0.2.3 Design for manufacture and assembly

Design for manufacture and assembly (DfMA) is a design approach that focuses on the ease and efficiency of manufacture and assembly, which is an important enabler for off-site construction and pre-manufactured forms of MMC. DfMA emphasizes two considerations: how a component is manufactured and how it is assembled into a product that can be tailored to varying degrees in a process known as mass customization. DfMA can be seen as an extension or evolution of a designer’s ordinary ways of working, as part of a broad design focus on aspects such as safety, quality, design for place and community and inclusion.

⁵⁾ The CDM 2015 [7] applies in England, Scotland and Wales. Northern Ireland has its own regulator, the Health and Safety Executive for Northern Ireland (HSENI), and health and safety legislation under the Construction (Design and Management) Regulations (Northern Ireland) 2016 [8].

DfMA is often linked to digitization, automation and earlier engagement between disciplines, and requires a good knowledge of manufacturing processes and logistics to succeed. Delivery teams with sufficient experience and knowledge of DfMA can embed a manufacturing mindset early in the project and, wherever possible, translate this into a programme-wide approach (see 0.6 for realizing the benefits of MMC and DfMA).

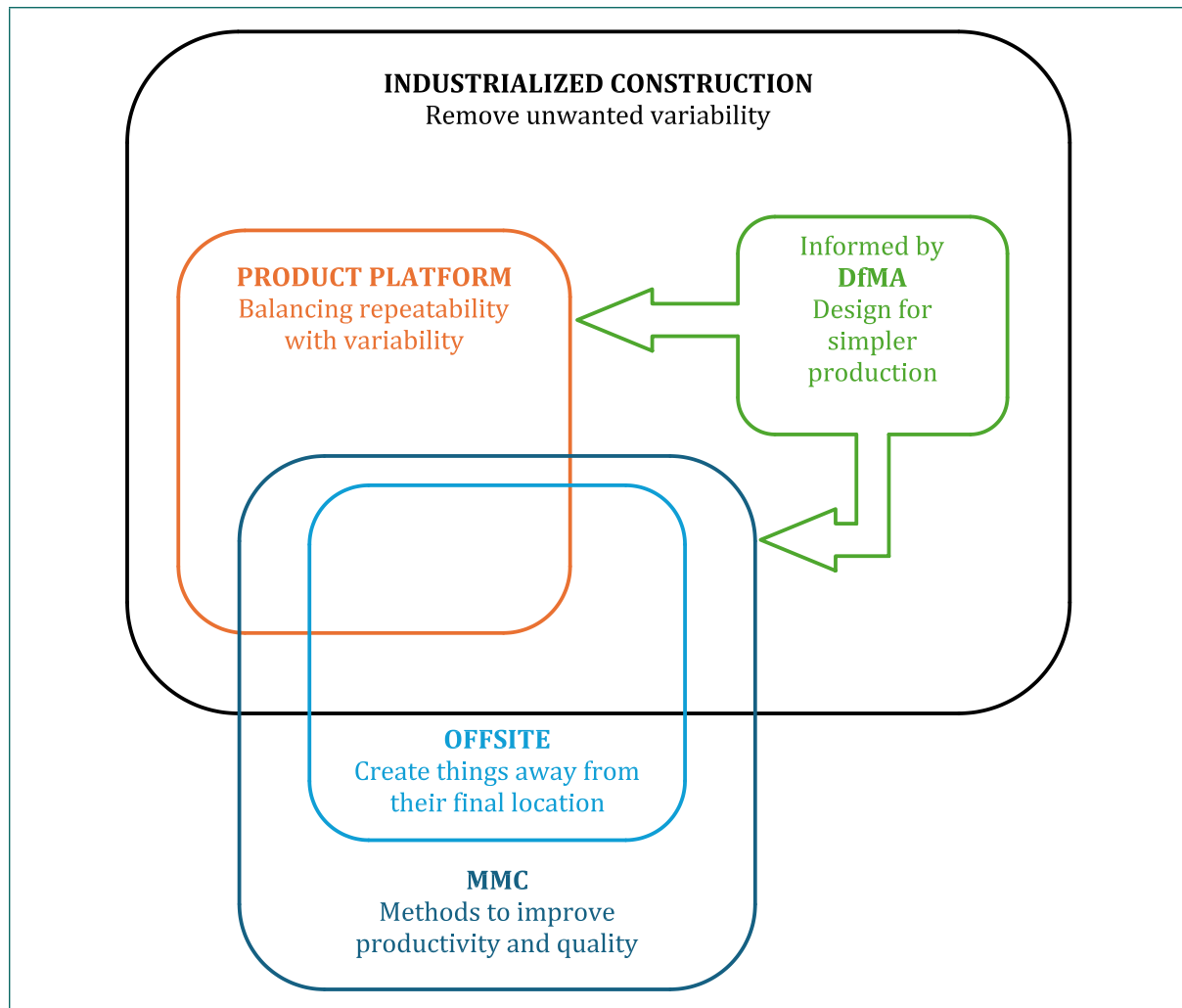
In the context of DfMA, standardization involves quality-assured systems and processes that govern design, manufacturing and assembly inputs with the objective of improving the reliability, speed, consistency and efficiency of digital and physical outputs, making it possible to achieve economies of scale. With continuous improvement the extent of benefits is refined over time.

Construction Product Quality Planning (CPQP) is a quality management framework for developing manufactured construction products and requires that records about product development, manufacturing and production monitoring are kept and made accessible, so that information persists throughout the whole building life cycle as per the requirements of the golden thread. The CIH's *CPQP toolset: Design for manufacture and assembly guideline* [10] provides guidance for carrying out DfMA analysis.

0.2.4 Industrialized construction (or delivery)

Advanced industrialized methods have been supported by successive governments and are embraced by other building sectors. The processes, systems and terminology developed in these sectors are now being adopted to deliver homes. Industrialized construction or delivery employs standardized systems, processes, mechanized production and advanced technology that can be repeatedly deployed across many projects through stable relationships. As industrialized construction matures, process standardization and automation are extending to costing, procurement, logistics, maintenance and beyond (see Figure 1 for positioning of industrialization).

Figure 1 – Positioning industrialized construction



In the context of industrialization, a “product platform” approach (which is derived from manufacturing practice and an emerging approach within construction) is an integrated systems approach that balances variability with repeatability. A product platform can include a “kit-of-parts” (KOP) and the associated production processes, knowledge, people and relationships required to deliver all or part of the construction project.

A KOP is composed of standardized pre-manufactured building components that can be produced at scale and configured for easy construction and flexible arrangement to suit the needs of a given project. A KOP is underpinned by a set of rationalized design rules and parameters that reflect the range of projects they intend to serve. The rationale for keeping the parts separate is to allow more efficient and safer handling/transportation, and to allow flexibility (within certain constraints) in their final configuration.

The core principle of a product platform is to maximize the use of repeatability where it is most beneficial, whilst ensuring variability where it is most valuable; for more information see CIH’s *The product platform rulebook* [11].

0.2.5 Value-based decisions

Informed, value-based decisions can support better outcomes from the investment made in the built environment. Such decisions go beyond simply controlling cost during construction or ensuring that projects are completed on time. Value also encapsulates wider, whole-life considerations, including:

- experience of residents;
- health and safety;
- durability and longevity;
- net zero ambitions;
- resilience to climate change impacts;
- social impact;
- biodiversity; and
- productivity of the sector.

HM Government's *The construction playbook* [12] sets out key policies and guidance for how public works, projects and programmes are assessed, procured and delivered. The CIH's *Value toolkit overview* [13] and Value Toolkit online resource⁶⁾ were developed with experts from across the sector and government, and aim to facilitate informed, value-based decisions, driving better social, economic and environmental outcomes.

Figure 2 in the *Value toolkit overview* [13] uses the "Four Capitals Approach" familiar to a corporate audience and aligned with HM Treasury's *The green book* [14] as a way of defining value. The "Four Capitals Approach" includes "Natural Capital", "Social Capital", "Human Capital" and "Produced Capital".

The value definition and measurement process is intended to help clients to articulate what is important to them to produce a unique value profile for a project or programme and the asset life cycle. This high-level value-based methodology has been published as BSI Flex 390.

0.3 Insurance, warranties and third-party requirements

The assistance of the development funder, system accreditation bodies, insurance and warranty provider/s and other stakeholders can be sought to identify and address:

- any requirements to meet the future insurability of homes;
- the likelihood of and reasons that mortgage lenders might limit access to lending; and
- any perceived risks that could influence the future valuation of a home.

NOTE 1 *Early engagement can assist in understanding specific requirements of funders, system accreditation bodies, insurance or warranty providers and highlight fundamental issues in the design or supporting evidence that might have wide ranging consequences for both the system and building design. Attention is drawn to the likely need to consult with a range of insurance providers, agents and brokers.*

In writing a brief for and selecting a system, there are insurance considerations beyond the time-limited period during which latent defects are insured. The scope and terms of latent defects warranties might be limited to specific defects, such as structural failure or water ingress, but might exclude events such as property loss through fire.

NOTE 2 *See Annex A for more information on insurance considerations.*

In addition, whilst the Building Regulations 2010 (as amended) [3] and equivalent national variations [4] to [6], make provision to inhibit the spread of fire and premature collapse of buildings, the primary purpose of these regulations is to ensure the safety of people, not the preservation of property itself. Design for asset protection might entail higher standards of property protection than are required by the regulations or standards.

⁶⁾ Available at <https://constructingexcellence.org.uk/value-toolkit/>.

0.4 Manufacturing funding

MMC manufacturing processes might require higher financial investment during the early stages of a project to enable, for example, raw materials required for manufacturing to be procured in advance of factory production works commencing. The system manufacturer often seeks a guarantee of cash-flow, whilst the client is likely to want to mitigate their exposure and limit or impose conditions on any advance payments or deposited funds. It can be beneficial to consider, at an early stage, financial instruments, such as escrow accounts, insurance bonds, letters of credit or advanced payment guarantees, which could be used to help secure the financial viability of the project for all involved. Understanding these different options can help to facilitate the selection of the most appropriate MMC solution provider for a particular project.

0.5 RIBA plan of work

0.5.1 General

In certain clauses, this PAS maps activities against the RIBA Plan of Work⁷⁾. This is to illustrate how and when MMC activities might be coordinated. It is not to be inferred that compliance with this PAS requires the adoption of the RIBA plan, nor that the stages are to be rigidly applied.

The RIBA Plan of Work organizes the process of briefing, designing, constructing and operating building projects into eight stages as follows:

- Stage 0: Strategic Definition;
- Stage 1: Preparation and Briefing;
- Stage 2: Concept Design;
- Stage 3: Spatial Coordination;
- Stage 4: Technical Design;
- Stage 5: Manufacturing and Construction;
- Stage 6: Handover; and
- Stage 7: Use.

The *RIBA plan of work 2020 overview* [15] provides further guidance and details of the work stages and project strategies.

MMC projects do not always follow the linear sequence anticipated by the RIBA Plan of Work. Deployment of a system or product platform on a project (with a library of technical design level information) can streamline optioneering and RIBA Stages 1 to 4 (briefing to technical design). Activities might run concurrently or in a different order, for example some technical design (RIBA Stage 4) might need to be brought forward as early as concept design (RIBA Stage 2).

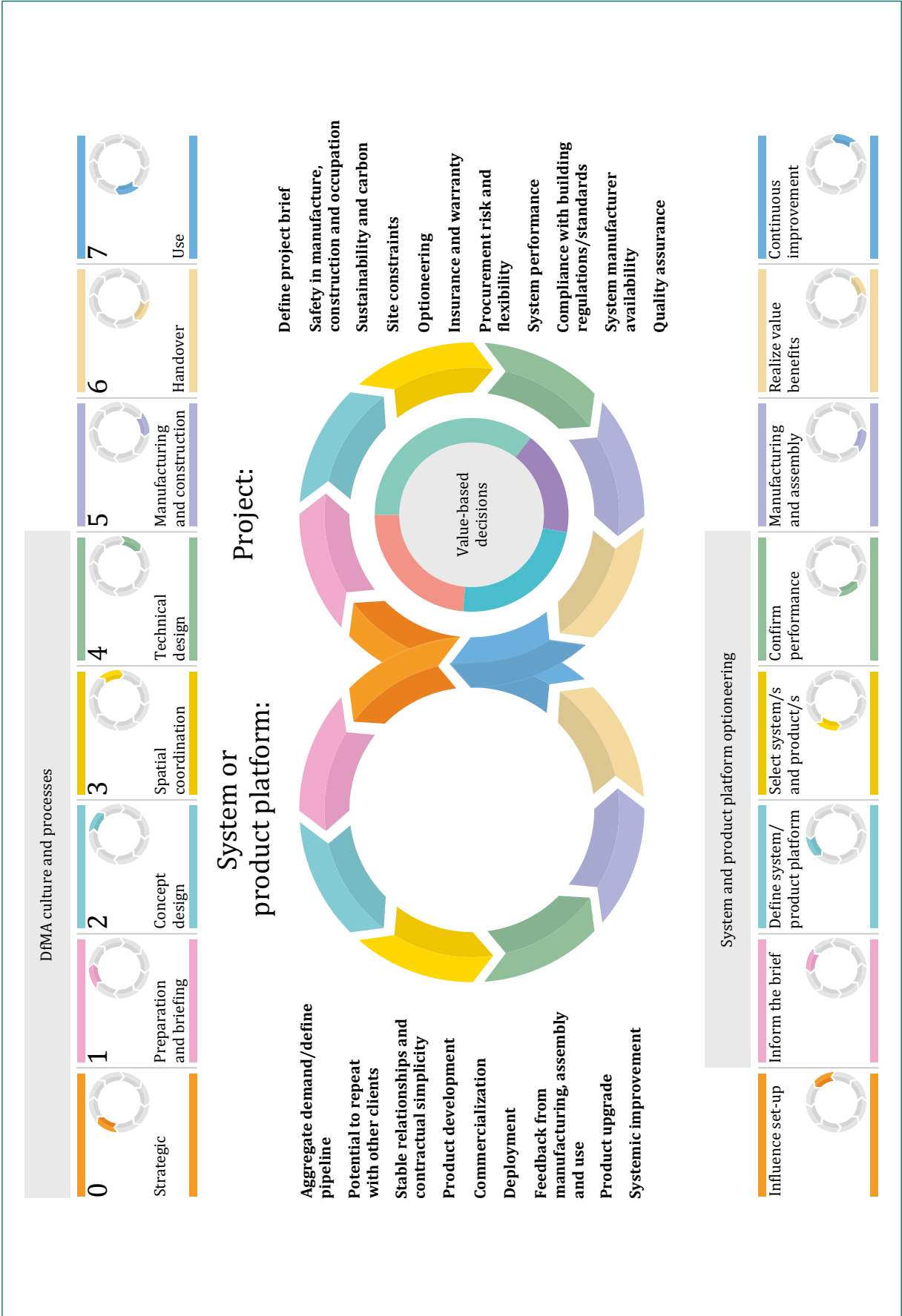
0.5.2 DfMA overlay to the RIBA plan of work and system deployment

The *DfMA overlay to the RIBA plan of work* [16] is a project management guide for implementing MMC and explains how a DfMA approach can maximize the potential of MMC solutions and produce good architecture.

Figure 2 illustrates the relationship between the development of an MMC system or product platform (product development process) on the left and the deployment of a system or product platform on a project on the right. The infinity loop diagram describes the potential to aggregate demand, how available systems or product platforms influence project set-up and the design process and how, in turn, feedback from product manufacture, assembly and use informs cyclical product upgrades leading to systemic improvement. The project process of briefing, designing, constructing and operating buildings (the eight stages of the RIBA Plan of Work) on the right is centred on value-based decisions (see 0.2.5). This is provided to illustrate how MMC activities might be coordinated.

⁷⁾ Available at <https://www.architecture.com/knowledge-and-resources/resources-landing-page/riba-plan-of-work>.

Figure 2 – DfMA process through the RIBA Plan of Work



0.6 Realizing the benefits of MMC and DfMA

MMC and DfMA are often linked to digitization, automation and earlier engagement between disciplines, and require good knowledge of manufacturing processes and logistics to succeed.

Successful integration of MMC and DfMA in project delivery depends on:

- timely engagement of stakeholders with the right knowledge;
- choosing the most appropriate form of construction and predominant material to meet project goals and site constraints;
- understanding the limits of the chosen system; and
- managing interfaces and tolerances between pre-manufactured and on-site elements.

The effective deployment of MMC and DfMA can bring benefits to clients and residents, including:

- unlocking previously inaccessible and small infill sites;
- earlier cost and timescale certainty;
- improved productivity and delivery speed;
- reduction in labour and overcoming skills shortages;
- safety in occupation;
- improved health and safety;
- better planning, monitoring and management of projects;
- improved collaboration;
- better build quality and quality control;
- solutions tailored to places and communities;
- provision of inclusive, accessible and adaptable homes;
- less carbon (operational and embodied) and the use of sustainable materials;
- efficient use of materials and reduced on-site waste;
- lower energy bills and maintenance costs;
- improved thermal and acoustic performance, airtightness and indoor air quality;
- superior disassembly and recyclability; and
- product feedback, innovation and systemic improvement.

This PAS reflects the principles of DfMA and focuses on the culture and processes that can realize the potential benefits of MMC through doing more design and planning work early and using more standardized solutions and supply chain engagement. How clients and their teams set their projects up from strategic definition stage onwards has a massive impact on the success or otherwise of adopting manufacturing principles and effectively deploying MMC.

0.7 Collaboration

Realizing the benefits of MMC hinges on consultation and collaboration between clients, designers, contractors, manufacturers and suppliers, and on having the time and opportunity to resolve and coordinate various design inputs to a high level of detail comparatively early. This contrasts with more traditional projects, where contractors and their supply chain are involved later, and designs can continue to evolve right up until the part of the design in question is being built.

NOTE 1 Under the CDM 2015 [7] and the Building Regulations 2010 (as amended) [3], there are legal duties to cooperate on specific areas.

This PAS stipulates information needed at various stages of the typical MMC project journey to help effective communication and collaboration, for example, when:

- educating project stakeholders on the benefits of off-site construction and MMC (see 0.2.2 and 0.6);
- defining the business case and brief and how MMC can achieve those outcomes, including consultation with the end user where possible (see 0.2.5 and 5.2);
- bringing the delivery team together, including the client, developer, designer, principal designer, system manufacturer, contractor and principal contractor (see 4.1 to 4.3);
- consulting with the insurance and warranty provider(s), the system accreditation body, the building control body and other stakeholders (see 0.3 and 4.4);

***NOTE 2** Building control bodies include the Building Safety Regulator (BSR), local authorities and registered building control approvers. In Scotland, the building control body is the local authority.*

- providing information for designers and architects to identify opportunities for pre-manufacture, standardization and repeatable designs (see 4.3, 5.3 and 5.9);
- understanding what information needs to be shared and the interfaces between the system manufacturer and principal contractor (see 5.5 and 6.1);
- understanding what information needs to be provided to regulators and other statutory consultees as part of the approval process (see 6.1); and
- understanding what information needs to be provided to regulators, to the client and to other parties on completion (see Clause 11).

In projects where a client organization is taking a strategic approach, there are opportunities to involve system manufacturers and technical advisers (e.g. a fire engineer) from the outset and investigate alternative delivery models that can provide better value from MMC based on scale, standardization, common technical solutions and collaboration.

***NOTE 3** Housing associations and local authorities are already working together to aggregate demand and create opportunities to maximize production output, which would enable a manufacturing-led approach; for more information see the Housing Festival's Social rent housing at pace: The MMC playbook [17].*

1 Scope

This PAS specifies requirements for modern methods of construction (MMC) in new-build residential properties, including processes and activities.

This PAS is applicable to most build types and materials and covers:

- project set-up and appointments;
- design;
- risk, safety and skills;
- information management and systems manuals;
- delivery and assembly; and
- maintenance, repair, adaptation, disassembly and end-of-life.

This PAS does not cover industrial and commercial buildings.

NOTE Other building types that include some form of residential accommodation, such as mixed-use buildings, hostels, care homes and specialized housing, hotels, prisons and student housing, might benefit from the use of this PAS, but their specific management, fire safety and occupancy characteristics are outside the scope of this PAS.

This PAS is intended for those involved in the procurement, design, manufacture, assembly, use or management of new-build residential MMC buildings.

This PAS is of interest to regulators, building insurance providers, mortgage lenders, building managers and occupiers.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions, or limits the application, of this document⁸⁾. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Standards publications

BS 5250, *Management of moisture in buildings – Code of practice*

BS 7593, *Code of practice for the preparation, commissioning and maintenance of domestic central heating and cooling water systems*

BS 7671, *Requirements for Electrical Installations – IET Wiring Regulations*

BS EN 1264-4, *Water based surface embedded heating and cooling systems – Part 4: Installation*

BS EN 1990:2002+A1:2005, *Eurocode – Basis of structural design*

BS EN 1991-1-2, *Eurocode 1 – Actions on structures – Part 1-2: Actions on structures exposed to fire*

BS EN 1991-1-7:2006+A1:2014, *Eurocode 1 – Actions on structures – Part 1-7: General actions – Accidental actions*

BS EN 1992-1-1:2023, *Eurocode 2 – Design of concrete structures – Part 1-1: General rules and rules for buildings, bridges and civil engineering structures*

BS EN 1993-1-1:2022, *Eurocode 3 – Design of steel structures – Part 1-1: General rules and rules for buildings*

BS EN 1995-1-1:2004+A2:2014, *Eurocode 5 – Design of timber structures – Part 1-1: General – Common rules and rules for buildings*

Other publications

[N1] CHARTERED INSTITUTION OF BUILDING SERVICES ENGINEERS (CIBSE). *CCM commissioning code M: Commissioning management*. London: CIBSE, 2022.

[N2] BUILDING ENGINEERING SERVICES ASSOCIATION (BESA). *DW/144: Specification for sheet metal ductwork*. Third edition. London: BESA, 2016.

[N3] BUILDING ENGINEERING SERVICES ASSOCIATION (BESA). *DW/154: Specification for plastics ductwork*. London: BESA, 2000.

[N4] BUILDING ENGINEERING SERVICES ASSOCIATION (BESA). *DW/143: Guide to good practice: Ductwork leakage testing*. Sixth edition. London: BESA, 2013.

⁸⁾ Documents that are referred to solely in an informative manner are listed in the Bibliography.

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1 assembly

building elements that are manufactured or consolidated in controlled factory conditions prior to final assembly or installation on-site

3.1.2 design freeze

one or more points in a project where elements of the design become fixed so that the next level of detailed design and/or manufacture can commence

***NOTE** The number, timing and purpose of design freezes in an MMC project can vary and depends on many factors, including the choice of MMC category and the scope of the MMC works; for more information see 5.8.*

3.1.3 dutyholder

person or organization with legally defined responsibilities

3.1.4 interface

shared boundary between two systems, components, elements or organizations

3.1.5 MMC adviser

person or organization with the necessary knowledge of the MMC systems and the manufacturing industry to assist in assessing which construction method or system suits the desired outcomes for the project and to provide guidance in the procurement and delivery process

***NOTE** The MMC adviser might be a member of the delivery team, a separate consultant or the system manufacturer. Those undertaking the MMC adviser role might change through the life of the project depending on the need at that stage (see 4.2.2).*

[SOURCE: *DfMA overlay to the RIBA plan of work* [16], modified – “an individual” amended to “person”, “client and design team” removed and “delivery” added before “process”]

3.1.6 standardization

quality-assured systems and processes that govern design, manufacturing and assembly inputs

3.1.7 system manufacturer

person or organization making off-site components, elements or systems which form an MMC solution

***NOTE** Pre-manufacturing encompasses a manufacture led fabrication or consolidation process in controlled conditions prior to final assembly or installation.*

3.1.8 warranty provider

organization which provides or arranges latent defects insurance policies

NOTE 1 Latent defects policies usually cover physical damage caused by incorrect design, engineering, specification or inadequate quality materials and/or poor workmanship and should meet the requirements of development funders, residential mortgage lenders and other financial institutions who take security of the complete asset. These insurance policies usually have a minimum term of 10 years.

NOTE 2 There are principally three different types of business in this definition: insurance companies, managing general agents and insurance brokers. There are also many different types of insurance policy, varying in cover, geographical jurisdiction, regulatory context and financial security ratings. It is important to ascertain if the cover offered meets the requirements of the project.

3.2 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

BSA 2022	Building Safety Act 2022
BRPD	Building Regulations 2010 (as amended) principal designer (England)
CDM 2015	Construction (Design and Management) Regulations 2015
CDMPD	Construction (Design and Management) Regulations 2015 principal designer
CPQP	Construction Product Quality Planning
DfMA	design for manufacture and assembly
HRBs	higher-risk buildings
MMC	modern methods of construction
PMV	pre-manufactured value
SKEB	skills, knowledge, experience and behaviours

4 Establishing the delivery team

4.1 Competence

COMMENTARY ON 4.1

Although the disciplines involved in MMC are similar to those of traditional projects, the knowledge needed within that discipline, the extent of collaboration and the timing of that collaboration are different.

Members of the delivery team shall:

- a) have individual and organizational competence with a combination of appropriate skills, knowledge, experience and behaviours (SKEB); and
- b) demonstrate to the client and dutyholders that they are able to undertake the work for which they are being appointed.

NOTE 1 PAS 8671 establishes the competence requirements for the role of principal designer. PAS 8672 establishes the competence requirements for the role of principal contractor. Both standards follow the framework set out in BS 8670-1 and are part of BSI's Built Environment Competence Standards (BECS) programme.

NOTE 2 Organizations or individuals carrying out the CDMPD and the CDM 2015 [7] principal contractor roles are also required to have the skills, knowledge, experience and (if an organization) the organizational capability necessary to fulfil the role in a manner that secures the health and safety of any person affected by the project.

Competence shall include an understanding of MMC that is appropriate for the scope and complexity of the project or programme.

NOTE 3 Factors specific to MMC that influence project complexity and individual/organizational competency requirements include:

- housing typology, height, scale and layout;
- planning use class, accessibility, occupancy and occupiers' requirements and capabilities;
- MMC category;
- unusual or innovative structural design approaches or structural failure mechanisms;
- combustible structure;
- disproportionate collapse due to fire;
- construction method with potential for concealed fire or smoke spread;
- programme and phasing constraints;
- proximity of neighbouring buildings;
- ongoing inspection and maintenance requirements;
- choice and combination of materials; and
- site and logistics constraints which impact on the construction method.

4.2 Roles and appointments

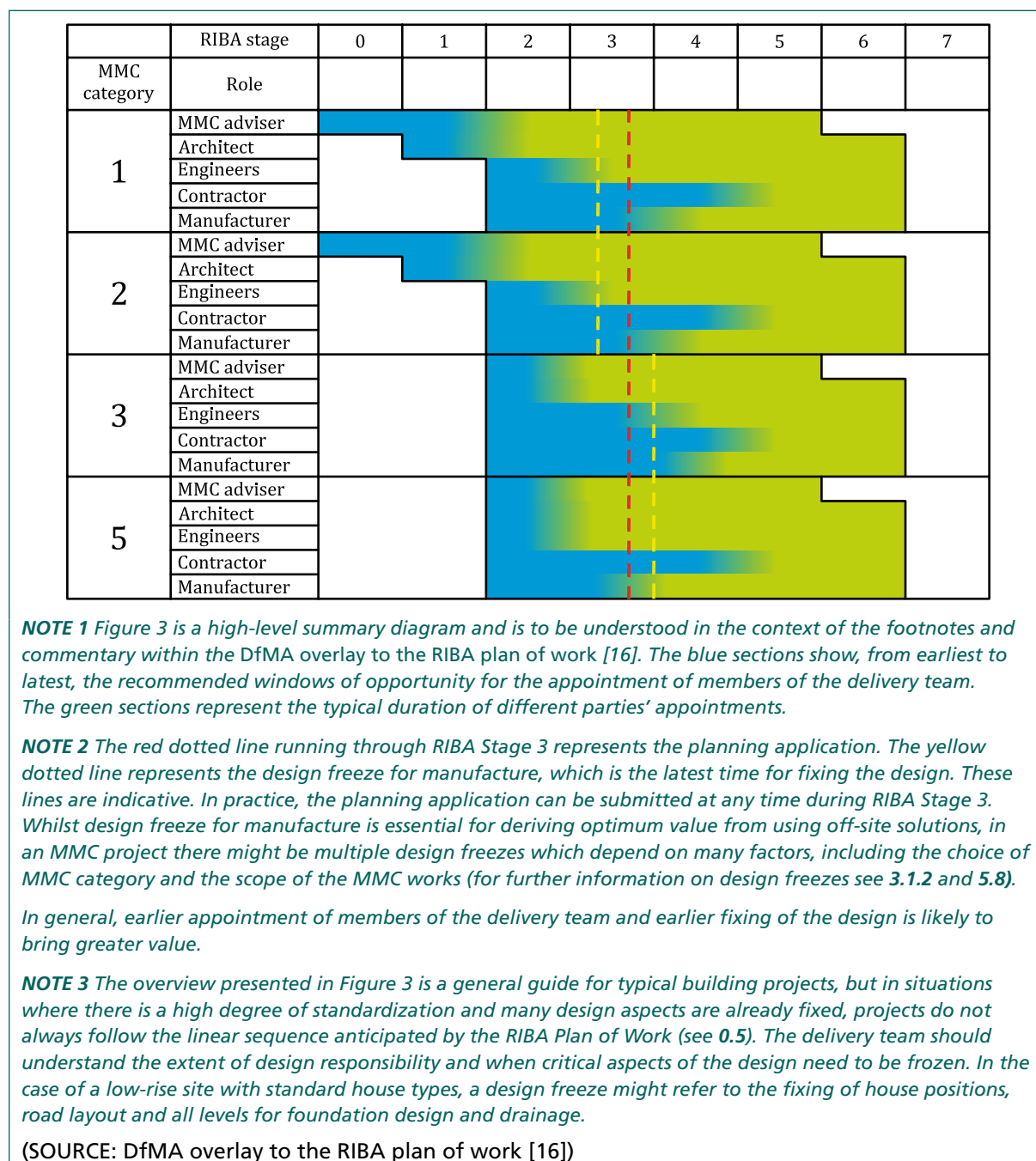
COMMENTARY ON 4.2

MMC and the underpinning DfMA can promote a collaborative approach where the delivery team is engaged from the outset. This differs significantly from traditional procurement models, where the contractors and their supply chain are involved only after the design is completed. How DfMA might impact on the business case or client requirements, and how different MMC strategies might impact the set-up of the delivery team, should be taken into account. The inclusion of an MMC adviser in the delivery team can enable the client team to have the requisite knowledge of MMC and DfMA to deliver the best solution.

The process through which MMC is optimized relies on the correct approach to client project management, from setting initial client requirements, integrating the team with the appropriate procurement mechanism and front-loading key decision making in avoiding unnecessary client change. BS ISO 22058 provides guidance on the construction procurement strategy and tactics, and is applicable to the private sector, public sector or community organizations. HM Government's The construction playbook [12] provides guidance on sourcing and contracting public works projects and programmes.

Figure 3, reproduced from the DfMA overlay to the RIBA plan of work [16], outlines the timing and duration of appointments in a typical MMC process.

Figure 3 – Timing and duration of key delivery team appointments



Annex C indicates the likely appointments and competencies required for specialists involved in an MMC project, where the roles should be clearly defined and the degree of cooperation and coordination between roles should be established. Fire engineering and structural engineering appointments should be made earlier than in traditional construction, as they might influence strategic decisions such as category or system selection or the route to demonstrating regulatory compliance. Other specialist consultants' expertise might be needed with specific knowledge of the MMC system, for example, acoustics, environmental, access and inclusion, energy and sustainability.

4.2.1 General

The client shall:

- a) select designers, other team members and potential supply chain partners to meet the strategic objectives of the project and align with value-based decisions; and
- b) appoint designers and relevant delivery team members and define their scope of work and responsibilities.

All appointments of individuals or organizations shall take into account and align with the particular circumstances of the programme or individual project and requirements for manufactured elements.

NOTE 1 *Attention is drawn to the client's duties under both the CDM 2015 [7] and the Building Regulations 2010 (as amended) [3].*

NOTE 2 *A responsibilities matrix that is reviewed and updated during the project can help to clarify roles and responsibilities (see 5.4).*

Communication protocols and mechanisms shall be established and agreed between the client and delivery team.

Roles and responsibilities shall be agreed and documented for the following:

- 1) client;
- 2) MMC adviser;
- 3) principal designer;
- 4) architect, designer or lead designer;
- 5) engineers (including structural, building services, ground works, façade, lift and other engineers);
- 6) fire engineer;
- 7) other specialist consultants;
- 8) system manufacturer;
- 9) principal contractor; and
- 10) contractors.

NOTE 3 *Depending on the category of MMC, the principal contractor might be a main contractor or an integrator. An integrator is a consultant or contractor coordinating the various manufacturing supply packages and other supply chain agreements. For platform approaches, the client might benefit from direct relationships with manufacturers, led by an integrator. The integrator could be an overall project or programme manager or the lead manufacturer (with careful consideration of the lead manufacturer's competence as a combination of SKEB and capacity); see HM Government's Modern methods of construction: Guidance note [18] for potential procurement models.*

4.2.2 MMC adviser

COMMENTARY ON 4.2.2

The skills and knowledge for early optioneering processes and using tools for selecting MMC options are not generally acquired during professional or construction training. The DfMA overlay to the RIBA plan of work [16] identifies the new role of an MMC adviser who can be involved in all RIBA stages but has a strategic role in the early stages prior to the appointment of a manufacturer or contractor to challenge, provide support and experience. In the later stages (from RIBA Stage 3) more technical expertise is required and a different member of the team might be appointed or take on the role.

The role of MMC adviser can be undertaken by:

- *a member of the design team, if they have appropriate knowledge;*
- *a project manager, or an in-house function of the client if they have the capability;*
- *a separate MMC consultant; or*
- *the system manufacturer, if the MMC system is simple and/or has been used before on a previous project.*

The MMC adviser might also bring expertise in procurement, including advanced payment mechanisms, bonds and vesting processes, and advise on the need for and help in defining the roles of other collaborators.

An MMC adviser, with the SKEB appropriate to the complexity of the MMC project/programme, shall be appointed.

NOTE 1 *The MMC adviser may be nominated from within the delivery team, or an external specialist appointed to the delivery team.*

The MMC adviser's responsibilities shall include:

- a) supporting with the establishment of project aims, the project brief and defining a procurement strategy;
- b) defining the level of competence (in relevant MMC categories) needed from design team partners before they are appointed, and incorporating this advice into the appointment criteria;
- c) assessing how different MMC categories impact the setup of the delivery team, the responsibilities matrix and professional services contracts, including intellectual property issues, during briefing (RIBA Stage 1 if used);
- d) advising on the relative merits and risks of possible construction methods and recording the optioneering process and outcomes in a summary report (see 5.3);
- e) advising on the future maintenance, inspection and management requirements that influence the MMC category and system selection;
- f) assisting with early engagement of stakeholders to establish strategies and project requirements that influence the MMC category and system selection;
- g) advising on the most appropriate supply chain for the project;
- h) advising on available procurement routes;
- i) advising the client regarding the impact on cash flow of different forms of MMC; and
- j) confirming the intended procurement strategy during concept design (RIBA Stage 2 if used).

NOTE 2 *In a complex single project, for example, the MMC adviser role might be one of design leader, coordinating inputs from other consultants and participating in consultations, submissions and gaining approvals from external organizations (including a planning or building control body). This might be an architect, who is also likely to be the BRPD, or a project manager.*

NOTE 3 In a turnkey or programmed role out, different skills might be required to monitor the quality and production from the factory, the coordination of site activities (programme, completions and handover) and to manage payments, certifications and insurances. This role would be more aligned with the skills of a project manager or employer's agent but technical knowledge would be essential, including an awareness of the interfaces and coordination between suppliers and sub-contractors.

In the technical design, manufacture and assembly stages of the project, the MMC adviser's responsibilities shall include:

- 1) advising on the requirements of insurance and warranty providers;
- 2) organizing design services agreements with system providers and manufacturers;
- 3) organizing pre-tender activities and coordinating tender information;
- 4) advising on the selection of a system provider;
- 5) defining the scope and responsibilities of specialist consultants;

NOTE 4 For example, a fire engineer or MMC structural designer.

- 6) monitoring the progress of technical design and production/manufacturing information;
- 7) coordinating technical submissions for approvals;
- 8) contributing to deployment and logistics strategies;
- 9) making factory, site quality and progress inspections;

NOTE 5 Depending on the project's scale, site inspections/clerk of work roles might be a separate appointment.

- 10) monitoring handovers and final inspections and certifying payments; and
- 11) helping to improve processes and products by implementing feedback and learning.

NOTE 6 Depending on the capability of the early project stage MMC adviser and the complexity of the project/programme, the MMC adviser might continue in their role for the technical design, manufacture and assembly stages of the project, or another person or organization might be nominated from within the delivery team or appointed to it.

4.2.3 Fire engineer

The need for and role of fire engineer shall be assessed during briefing (RIBA Stage 1 if used) and:

- a) if not required, the reasons for not appointing a fire engineer shall be recorded in the project brief and responsibilities matrix; or

NOTE 1 A fire engineer might not be required for projects that follow a basic approach to fire safety design; for example, low-rise category 2 where statutory guidance is applicable (see 0.2.1 for statutory guidance in devolved nations and also the summary of approaches to fire strategy based on complexity in 6.5.1).

- b) if required, a competent fire engineer with knowledge of MMC shall be appointed no later than the end of concept design (RIBA Stage 2 if used) and shall be retained and regularly consulted until project completion, when the building fire safety systems have been verified and the handover procedures and information have been delivered to the building owner or manager.

NOTE 2 Attention is drawn to responsible persons in the Regulatory Reform (Fire Safety) Order 2005 [19].

Where appointed, the fire engineer shall demonstrate the training and SKED relevant to the complexity of the project and type of MMC and recognize and accept that ongoing assessment and certification of their competence for their role is necessary and that independent bodies exist for this purpose.

4.2.4 Structural engineer and system structural engineer

COMMENTARY ON 4.2.4

The clarity of roles, responsibilities and the accountability of engineers in an MMC project is essential, as there are often several specialists involved. A suitably competent project structural engineer might be appointed to advise in the early stages on the extent and characteristics of MMC systems and their selection. The project structural engineer might also have specific sections of the building to design and extended responsibility for the complete building.

It is also common to have a separate specialist MMC structural designer who is not engaged until RIBA Stage 2 or 3 and whose appointment might be limited, excluding specific aspects that are covered by other specialists. Examples of different engineering specialists that the MMC structural engineer might liaise and coordinate with are:

- *foundation and geotechnical engineer;*
- *civil engineer;*
- *structural engineer for a transfer slab/support structure for the MMC element;*
- *façade engineer (cladding and fenestration);*
- *specialist engineer (e.g. canopies, plant room assembly, stair flights, lift shafts); and*
- *roof engineer if not part of the MMC package.*

A project structural engineer shall be appointed with responsibility for liaising, coordinating and exchanging information with other engineers in the project.

The project structural engineer shall coordinate and cross-check the interfaces between MMC engineering elements and the interfaces with the whole building structure.

The project structural engineer shall demonstrate the training and SKEB relevant to the complexity of the project and type of MMC and recognize and accept that ongoing assessment and certification of their competence for their role is necessary and that independent bodies exist for this purpose.

4.3 Supply chain input

The supply chain shall be consulted during briefing and concept design (RIBA Stages 1 to 2 if used) to identify:

- a) opportunities for pre-manufacture and MMC elements;
- b) the likely predominant material;
- c) potential systems for shortlisting/selection;
- d) opportunities for standardization and repeatable designs;
- e) supply chain capability, capacity, availability and lead times; and
- f) the collaboration and design freezes required.

This information shall be documented and fed into the MMC optioneering process (see 5.3).

NOTE 1 *Much knowledge is held within manufacturers. Early engagement is recommended so that buildability of the design can be established and any necessity for changes after the design freeze avoided. The positive impact of early contractor involvement does not stop with the design, it continues in the manufacturing and on-site construction stages by ensuring that the development can be built in accordance with the timescales and cost plan. This differs significantly from the traditional procurement model, where the contractors and their supply chain are often involved only after the design is completed.*

NOTE 2 *Industrialized construction systems, centred around aggregated demand, standardized technical solutions and a collaborative supply chain, can be manufactured at scale and deployed across many projects. Moving away from project-by-project delivery to industrialized construction can increase productivity and predictability and address skills shortages.*

The level of pre-manufactured value (PMV) shall be determined with input from the system manufacturer and supply chain.

NOTE 3 *PMV is a proxy measure of project efficiency. The DfMA overlay to the RIBA plan of work [16] defines PMV as the project's gross capital cost less the cost of prelims (site overheads) and site labour, divided by the gross capital cost, expressed as a percentage. The benchmark is 40%; anything higher has more of its operations conducted off-site. Used judiciously in combination with other tools, for example, the Value Toolkit online resource⁹⁾, the measure can be a useful way of framing project ambitions and monitoring progress. The level of PMV might be set by funding requirements or in the project brief.*

4.4 Stakeholder consultation

COMMENTARY ON 4.4

Early engagement and decisions can have a positive impact on the success criteria for each MMC project. Project stakeholders are any party outside the delivery team who might influence the direction of the design, the selection of MMC or influence a project outcome. They generally have no contractual relationships with the delivery team. Their specific requirements might have an impact on the overall design specification and the testing and inspection process to demonstrate the product meets the specification.

The MMC adviser, with support from specialist consultants, shall consult relevant stakeholders during briefing and concept design (RIBA Stages 1 to 2 if used) and agree the strategies and site/project specific requirements.

The agreed strategies and site/project specific requirements shall be used to:

- a) refine the project brief;
- b) identify any constraints/opportunities; and
- c) evaluate and select the potential MMC solution (see 5.2, 5.3 and 5.5).

NOTE 1 *A review of legislation is undertaken (during RIBA Stage 3) with input from the building control body and fire rescue authority where appropriate.*

NOTE 2 *Stakeholders might include:*

- environmental bodies;
- insurance and warranty providers;
- planning departments;
- building control bodies;
- utility companies; and
- community/specialist interest groups.

⁹⁾ Available at <https://constructingexcellence.org.uk/value-toolkit/>.

5 Integrating MMC into project design

COMMENTARY ON CLAUSE 5

MMC components or assemblies can be for just a single project or, more usually with mass customization, many different projects. Therefore, the design process generally begins, not from scratch, but from optioneering to assess which pre-designed construction method or system suits the desired outcomes for the project and a specific site. Some areas for consideration include production of the technical design stage deliverables, which might need to be brought forward to as early as concept design (RIBA Stage 2). Attention is also drawn to the requirement for the project specific design to comply with legal, insurance and safety requirements, specifically from briefing (RIBA Stage 1).

5.1 Risk register

COMMENTARY ON 5.1

BS 7000-4:2024, 5.12, provides guidance on managing design in construction and covers risk management protocols. Guidance on risk management is also given in BS ISO 31000 and RICS' Management of risk [20].

A risk register shall be created from strategic definition (RIBA Stage 0 if used) and shall form part of the early project management processes. Different risks associated with various MMC categories shall be identified together with a methodology for managing them.

NOTE 1 The risk register might be differently impacted and evolve as alternative forms of MMC are proposed. This could include different risks at each significant stage of MMC deployment from procurement to design, manufacture and installation.

Significant potential risks shall be identified in the risk register (at RIBA Stages 1 and 2 if used). A risk study shall be undertaken into these identified areas and the findings documented. These findings shall be used to update the risk register or project brief as appropriate. Fire risk management, mitigation and protection shall be included in the risk register from the outset.

As the design progresses, a risk assessment process shall be used to determine all the design and associated risks on a project. The risk assessments produced shall be specific to the project, site and use of MMC. Risks associated with the construction method, MMC category and selected system/s shall be identified.

Identified risks shall:

- a) be categorized according to their likelihood, impact and severity;
- b) clearly identify those responsible, accountable, consulted and informed (RACI); and
- c) have mitigating actions identified.

NOTE 2 Risks relevant to MMC might include the following:

- design risks associated with:
 - coordination;
 - selection of design or product solutions;
 - statutory compliance;
 - planning and meeting project outcomes; and
 - achieving key strategies such as sustainability, environmental and safety protection systems;
- information risks, such as accuracy or dependency concerns;
- cost risk associated with change or delays;

- fire and health and safety risks associated with the design solutions in construction and occupation;
- procurement risk associated with interface and responsibility;
- logistics risk associated with readiness, transport, lifting and storage;
- assembly risk, such as delay, incorrect installation, damage and tolerance error;
- programme risk and achieving outcomes within required time parameters; and
- operation and maintenance risk.

NOTE 3 Risks might be identified using team coordination and design workshops.

NOTE 4 The NBS Uniclass RK Risk table¹⁰⁾ classifies a broad range of project-related risks. Capturing risk information in a consistent and repeatable way can limit the potential for risks to be missed and enables the transfer of knowledge and experience between similar projects.

NOTE 5 The CPQP Framework¹¹⁾ for developing manufactured construction products includes the creation of a live control document which provides a digital audit trail according to the requirements of the golden thread. Design failure mode and effect analysis (DFMEA) is a structured approach used by engineers to identify potential failures that can occur in the design of a product.

NOTE 6 The CDMPD plans, manages, monitors and coordinates health and safety in the pre-construction phase. Depending on the procurement route and the choice of MMC category, the CDMPD appointment might change during the project.

Information shall be provided to allow other delivery team members to design and implement the appropriate mitigation as the design progresses. Each designer shall undertake risk assessments on the area of the design for which they are directly responsible.

Risk assessments shall include wider project input and identify interfaces with the design of others so that the risks can be reviewed, managed and mitigated by the delivery team collaboratively.

NOTE 7 BS EN ISO 19650-6 specifies the concepts and principles for classifying, sharing and delivering health and safety information collaboratively.

The risk assessment shall be reviewed at each key stage of the project, confirming that the delivery team understands those risks that still require attention and those that have been eliminated or mitigated. The risk assessment shall be maintained until manufacturing, construction and commissioning are completed to support ongoing assessment, elimination or mitigation of risks.

NOTE 8 See Clause 11 for information requirements at handover.

5.2 Preparation and briefing

COMMENTARY ON 5.2

Client requirements should be taken into account in detail in connection with the value profile for:

- a project or programme of repeated projects – see the CIH's Value toolkit overview [13] for value definition and measurement;
- a specific site/s' constraints/opportunities; and
- optioneering.

A key task in the briefing stage is to understand and capture any relevant regulations.

¹⁰⁾ Available at <https://uniclass.thenbs.com/taxon/rk>.

¹¹⁾ Available at <https://constructioninnovationhub.org.uk/our-projects-and-impact/platform-programme/assurance/cpqp-quality/>.

The client's requirements shall be captured in a project brief, which shall include:

- a) desired long-term social and environmental outcomes;
 - b) the client's high-level key performance indicators (KPIs) and project goals;
 - c) level of PMV (if required);
 - d) financial risk mitigations or appetite and procurement/contract terms (if known);
 - e) financial, funding, insurance, warranty, organizational, legal and market requirements;
 - f) estimated project budget and contingency;
 - g) project timescale and programme, including timing of engagement with insurance providers, fire and safety consultants, approving authorities, statutory consultees and the supply chain;
 - h) intended long-term use and occupation and means of escape strategy (see 6.5.1);
 - i) suitable arrangements for managing the project so that health, safety and welfare are secured;
 - j) access, adaptation and inclusion;
 - k) energy efficiency, performance standards and the post-occupancy evaluation (POE);
 - l) site constraints and opportunities, including:
 - 1) logistics and access, to cover:
 - i) sufficient access for fire appliances and firefighting personnel; and
 - ii) recommendations of a "last mile" logistics survey;
 - 2) services and utilities;
 - 3) local planning requirements;
 - 4) historical and cultural contexts;
 - 5) environmental factors;
 - 6) noise limitations;
 - 7) risk of external fire spread;
 - 8) risk to structure from an external event;
 - 9) the use of the building and its position in relation to adjacent buildings and the site boundary; and
 - 10) the appropriate provision of pre-construction health and safety information;
 - m) MMC categories, materials, systems, assemblies or components that are available and appropriate for the proposed development;
 - n) architectural expression, quality and external material;
 - o) design service life of the system, assembly or components;
 - p) repairability and future adaptability or extendibility, including whether assemblies can be repaired, altered or upgraded (see 5.7);
- NOTE 1 Future adaptability requirements might include service zones with spare capacity or additional penetrations for future services.*
- q) evidence-based end-of-life considerations such as disassembly, reconfiguration and reuse;
 - r) expectations and implications on clients in terms of future maintenance and inspection of fire protection systems; and

- s) expected inspection, testing and maintenance requirements of the systems and assemblies for the proposed service life of the building.

NOTE 2 *In writing a brief and selecting a system, there might be considerations for differing types of insurance from warranty providers to on-going buildings insurance. The scope and terms of such cover might have a material impact on product selection and should be understood; for example, latent defects warranties might be limited to specific defects, such as structural failure or water ingress, and exclude events such as property loss through fire.*

NOTE 3 *See Annex B for a briefing checklist for MMC projects. Further good practice relating to the production of a brief is available in BS 7000-4 and BS 8536.*

The project brief shall be approved by the client and confirmed that it can be accommodated on-site.

5.3 Optioneering

COMMENTARY ON 5.3

Identifying factors that can impact on the project informs the selection of appropriate MMC system/s. Whilst many of these factors are also relevant when considering design solutions for traditional construction, the challenges they present to MMC can be more pronounced and should be factored into the system selection at an early stage. For more information see HM Government's The construction playbook [12] and Modern methods of construction: Guidance note [18].

Site-specific differences in local planning constraints, historical and cultural contexts and environmental factors all mean that each site is unique. Bespoke solutions can be avoided by applying mass customization concepts, which allow tailored solutions using a palette of standardized components, assemblies and façade materials without affecting the cost or time savings associated with off-site manufacturing.

Where systems are redeployed, optioneering is required to ensure systems are suitable for or tailored to the site, client and project requirements. However, the optioneering process and project progress through the RIBA Plan of Work stages can be boosted or streamlined, a benefit of aggregation of demand, standardization and industrialization; see the DfMA overlay to the RIBA plan of work [16].

A robust and agnostic MMC optioneering process shall be conducted during briefing and concept design (RIBA Stages 1 and 2 if used) to identify which MMC systems are:

- a) available and appropriate for the proposed development; and
- b) able to meet the clearly defined environmental, social and corporate governance and other project goals.

NOTE 1 *Where necessary, optioneering can continue into RIBA Stages 3 and 4 (spatial coordination and technical design).*

The MMC adviser shall record the potential supply chain for the project and available procurement routes during briefing and concept design (RIBA Stages 1 and 2 if used).

The risk register shall identify any potential issues, and these shall be researched thoroughly before committing to a particular method of construction.

NOTE 2 *For example, a logistics survey can identify any site access and "last mile" logistics issues.*

Results of research or survey recommendations shall be recorded in the risk register or project brief, where appropriate. The design team and client shall review options and sign off the intended construction method/s or system/s and preferred procurement route.