



Infrastructure
and Projects
Authority



Proposal for a New Approach to Building: Call for Evidence

Summary of responses

Infrastructure and Projects Authority

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Executive Summary

The construction industry plays a vital role in delivering the economic and social infrastructure that underpins UK economic activity and public services. However, the longstanding challenges the sector faces are well known and have been exacerbated by Covid-19. Productivity growth in the UK construction industry is stagnant; since 1997 the annual rate of productivity improvement has been 21% lower than the wider economy, undermining the value of investments made by public and private sector clients. The industry faces further challenges with comparatively low levels of capital investment, limited innovation and increasing workforce pressures.

Government is committed to using its position as the single largest construction client to support the adoption of a more productive and sustainable business model within the UK construction Sector. At Autumn Budget 2017 the government announced its commitment to Modern Methods of Construction through the adoption of a presumption in favour of offsite construction for relevant departments from 2019. This was followed in December 2017 by the publication of Transforming Infrastructure Performance, setting out a long term programme to improve the performance and delivery of infrastructure assets.

The government took this commitment a step further, by setting out specific proposals for how this approach could be developed over time and used to deliver its capital investment programmes. This is called 'A Platform approach to Design for Manufacture and Assembly (P-DfMA)', which was described in a Call for Evidence in November 2018. P-DfMA is an innovative approach to leveraging the government's collective buying power to aggregate demand for platforms made up of digitally designed components, that can be used across different built assets, for instance schools, clinics, hospitals or offices. The aim is to drive a new market for manufacturing in construction, and to provide a stable pipeline of demand to give industry the confidence to invest in new products and manufacturing technologies. This will deliver greater efficiency through economies of scale and add value by providing businesses and public services with infrastructure that performs better over its life cycle.

The government accepts it will take industry time to develop and implement this approach, but is determined to set the strategic direction now, to give industry the confidence and time to invest and innovate. The government recognises that a number of commercial, technical, process and cultural changes will be required to embed such an approach, and it will work with industry to take these forward.

In June 2019, the government set its target to reduce carbon emissions to net zero by 2050. The government is increasing the use of modern methods of construction such as offsite and P-DfMA to create infrastructure and built assets that are higher quality, more sustainable and a better fit for future users.

The publication of this response to the Call for Evidence comes at a critical time, following the publication of the National Infrastructure Strategy in November 2020 and alongside the launch of the Construction Playbook. The Playbook is a transformational next step in the



P-DfMA journey, and a powerful example of ambitious, pragmatic and effective collaboration between government and industry. There is a clear line of sight from the presumption in favour of offsite construction, through the responses we received to the Call for Evidence, to the policies included in the Construction Playbook, including: harmonising, digitising and rationalising government specifications and standards; adopting portfolio approaches to delivery where possible; and ensuring whole life performance and value is embedded across the project lifecycle and a critical success factor at procurement. Significant progress has been made, and the emphasis is now on translating policy into practice and ensuring the construction industry, and our vital economic and social infrastructure assets, emerge stronger, more sustainable and more resilient over the coming years and decades.

In responding to the Covid-19 pandemic, government and industry have forged new collaborative relationships, working in partnership to develop guidance for site operating procedures and responsible contractual behaviours, and most recently the Construction Playbook. This constructive approach has demonstrated what can be achieved when necessity requires truly outcome-focused partnership working. Government welcomed the publication of the Construction Leadership Council's Roadmap to Recovery in June 2020 and is committed to working together with all partners to deliver our shared objectives.



1. Introduction

Context for the call for evidence

On 26 November 2018, the Infrastructure and Projects Authority (IPA), in conjunction with the Department for Business, Energy & Industrial Strategy (BEIS), launched a Call for Evidence seeking views on a new approach to building. It proposes that government uses standardised and inter-operable components from a wide base of suppliers, across a range of different buildings, as one way to drive efficiencies, innovation and productivity in the sector. This approach is called a 'Platform approach to Design and Manufacture for Assembly (P-DfMA).'

The call for evidence set out to understand:

- how the government can best adopt and embed a P-DfMA approach in its capital programmes
- how prepared the sector is to adapt to this change and support the delivery of this approach
- what changes the government would need to make to support such an approach

Whilst the government is committed to a P-DfMA approach and to implementing enablers for this, it recognises that a P-DfMA approach forms one part of a wider strategy, which is required to transform construction and infrastructure performance. Through the implementation of the Construction Playbook it will continue to work with industry and other stakeholders to deliver this strategic objective.

Engagement with the call for evidence

The government is grateful to all those who took the time and effort to respond to the call for evidence. The IPA received 62 written responses to the consultation from the following categories of stakeholder:

- individuals
- professional representative bodies
- manufacturers
- contractors
- technology companies
- consultants
- academia

In addition to this, the government hosted a workshop with a wide group of industry stakeholders. A full summary of respondents to the call for evidence can be found in Annex A.



Some of the respondents held their own workshops with other organisations and submitted responses that captured a broader range of views.

Responses to the call for evidence questions

Respondents addressed some or all of the questions, and this document sets out a summary of the main findings made to each part of the call for evidence. Some of the same points were made in response to multiple questions so these have been grouped under the most suitable question where appropriate.

The responses were not exclusively limited to a P-DfMA approach and some respondents were more focused on Design for Manufacture and Assembly (DfMA), modular, offsite, or other Modern Methods of Construction (MMC). Some responses were not specifically attributed to a question, or other relevant points outside the scope of the questions were raised - in these cases the responses have been summarised alongside the questions.



2. Responses

Overview

The majority of respondents were supportive of the government's approach and agreed that MMC and P-DfMA will drive productivity, innovation, efficiency and quality. The common themes identified in responses were:

- together with the opportunity to improve productivity, the UK's leading international position in relation to BIM demonstrates the advantage in moving early; whilst conversely, there is a risk that if the UK lags behind it will become difficult to compete, and an opportunity for UK industry will be lost
- it is important there is a strong, committed and visible pipeline of projects; some responses specifically referred to a pipeline of projects using a defined set of standardised and interoperable components, whereas others referred to a more general pipeline of projects that could be constructed using a range of MMC
- the government needs to standardise and rationalise the designs and components for built assets that it wishes to procure using P-DfMA
- procurement approaches will need to better support a P-DfMA or similar approach; a specific example given was the opportunity associated with greater weighting of whole life value relative to capital cost in the procurement process
- respondents stated there should be further encouragement of investment in innovation and R&D to support MMC and P-DfMA approaches
- industry would benefit from a clearer definition of P-DfMA, and how and in what circumstances the government intends to use this approach
- cultural change within both clients and the industry is required for such an approach to be a success
- to enable a move towards a manufactured approach to construction the industry needs to adopt different commercial models
- some potential concerns were raised around standards and that a manufacturing approach may drive offshoring due to lower costs

General

Question 1: How can the government best encourage the adoption and implementation of this approach in its capital programmes?

There was a consensus among respondents that having a strong, committed and visible pipeline of projects that will use MMC and a P-DfMA approach is key to adoption and implementation. Some respondents specifically suggested that there should be a forward look for the next decade, and the government should seek to gain cross party support, to provide industry with certainty and confidence of long-term commitment. Without a strong



pipeline, there will be limited incentives for industry to invest in the manufacturing processes and skills required to support such an approach.

The majority of respondents stated in order to implement a P-DfMA approach, the government needs to adopt new ways of working. This includes taking a different approach to procurement by using a value-based approach to bid assessment and evaluation, focusing on delivering value over the life of an asset and its overall contribution to the UK. Some respondents said that whole life value should be considered using a range of metrics (which are discussed in more detail in question 4).

The majority of respondents also stated that there needs to be earlier engagement with the supply chain and more collaborative working. These respondents said that the P-DfMA process would require more effort from a larger team in the design and planning phases of a project, which would likely take longer, as the design requirements need to be finalised before manufacturing can begin. Some respondents also said that the government will need to be an active, capable client and should encourage uptake by harmonising, rationalising and digitising requirements across departments for spaces, assemblies and components - including technical specifications.

Many respondents referenced the approach the government had taken implementing BIM i.e. announcing it would be introduced in 2011 and then giving industry 5 years to develop its capability before mandating in 2016. They felt a similar approach should be taken when adopting P-DfMA and that the government should set a clear framework and then embed this within its procurement processes.

In order to be successful, some respondents stated that both government and the wider public sector, including local authorities, need to support this approach. Some respondents referenced the MMC work underway in the housing sector.

A few respondents felt that offsite construction was appropriate in some scenarios, but should be market led. There was support for government to take on an enabling approach, e.g. progressing further through design in advance of starting the works, so that components could be looked at holistically. Some thought that such an enabling approach would facilitate more standardisation.

Question 2: Within your organisation or sector what changes are needed, including in relation to technologies, skills and commercial models, for this approach to succeed?

Respondents' answers to this question largely fell into the following categories:

Collaboration

There was a consensus from respondents that there will need to be much greater levels of collaboration across the industry. They stated that manufacturers, contractors, suppliers and stakeholders must all be prepared to partner with the supply chain to create a DfMA/P-DfMA environment.



Respondents said that as products become standardised, there will be changes to traditional supply chain models, and potentially a move towards integrators providing the focus for the on-site/assembly phase of the works.

Some respondents stated there needs to be more 'open source capture' of lessons learned and best practice. They said that knowledge management of these lessons should be collaboratively and transparently delivered across government, industry and academia. It was also felt that this should be shared within industry to support this approach.

Some respondents stated that industry needs product databases and enabling product data to be accessible through other platforms and tools.

Commercial and Procurement

Some respondents suggested the current contractual and procurement models drive poor behaviours. They said that these need to adapt and change in order for this approach to be a success.

Some respondents stated that there may be a need for an industry shift to different contractual terms and commercial models, rather than using the current models of delivery. They felt that the current models are sub-optimal for the level of risk associated with investment in MMC, and that there is a need to establish with industry the right commercial environment that enables flexible, but optimal commercial arrangements to be utilised, based on the appetite for risk and reward. Respondents said that these may include different reimbursement models and/or a greater proportion of funding released earlier in the lifecycle of the project, or before components are manufactured. In future, this could be combined with a risk/reward structure that is based over the life cycle of a built asset. Refurbishment and running costs in relation to energy use should be included and monitored.

Skills

The majority of respondents said the industry needs to inspire, attract and retain new talent. Using P-DfMA or other methods of MMC will require different skill sets, such as digital, logistics management and onsite assembly and manufacturing. Several respondents suggested industry should work with government to encourage changes in further and higher education to develop offsite, manufacturing and digital construction courses to ensure these skills exist.

Planning and Design

The Royal Institute of British Architects (RIBA) created a [DfMA Overlay for their Plan of Work¹](http://consig.org/wp-content/uploads/2018/10/RIBAPlanofWorkDfMAOverlaypdf.pdf), which has been welcomed by industry. However, some respondents felt that there is no other comprehensive guidance that tells clients, professionals or business what should be expected at each and every stage of the lifecycle of an asset. Several respondents indicated

¹ <http://consig.org/wp-content/uploads/2018/10/RIBAPlanofWorkDfMAOverlaypdf.pdf>



a requirement for RIBA stages to be considered differently, and that completely new standards should be created for offsite projects.

Many respondents stated projects will need to have finalised design before construction starts, as changes cannot be made as easily in a P-DfMA approach. Some said this would have benefits in reducing costs by finalising designs up front, compared to a traditional approach where changes are often made once construction is underway, at additional cost.

Respondents stated the industry needs to work from standardised baseline designs rather than starting from scratch each time, and this would lead to efficiencies. Some respondents felt there should be more focus on standardisation, rather than offsite construction.

Technology

Many respondents said there needs to be more digital design and manufacture including utilisation of digital twins, building on BIM.

Question 3: How should government engage with industry to make sure this approach succeeds?

The majority of respondents recognised the importance of government commitment to the approach. They highlighted that a collaborative approach involving all levels of the supply chain would be most effective for the approach to be successful.

Several respondents suggested that it would be beneficial for the government to carry out an assessment of the current capabilities and capacity within the industry to deliver offsite construction. They stated the government should then work with industry to find ways to fill these gaps and incentivise investment.

Many respondents suggested that the government should work with industry to pilot a small number of projects using this approach, and benefits should then be communicated to the wider industry to generate buy in. Similarly, many respondents also suggested that the government should undertake research, in collaboration with the supply chain, to design and implement standard but flexible interfaces and joints between building components and building systems. Several respondents felt that government should ensure that the approach is flexible and adaptable as new technologies, materials and techniques are developed, and could potentially be based on a framework of principles which suppliers can innovate around.

Respondents suggested that the government should use the first set of projects to inform benchmarking analysis which can be built on (more detail can be found in question 4), and the evidence of the benefits can then be publicised and communicated within the public sector and industry. They felt this would not only illustrate the shorter-term delivery benefits, but also the longer-term operational benefits, consequently allowing departments to choose/compare suppliers and allow procurement directly from suppliers (instead of going through technical advisers/architects, saving cost and time).



Several respondents said that while pursuing this approach, the government should remain open to other modern methods of construction that could also drive wider benefits.

A few respondents said that the government needs to define long-term outcomes, devise rules and incentives to achieve them and communicate these to industry. Similarly, some felt that government should think about how it signals demand to the market. One specific suggestion was that government should think about how to link payment to performance over periods of occupation, to incentivise the supply side to focus on quality and value for money.

Question 4: How can the benefits of this approach best be measured?

There is currently no standard methodology for assessing and measuring the benefits of off-site construction. There was a consensus among respondents that it is essential to have a holistic, whole-life perspective across a wide range of factors to determine the value and quantify the benefits of this approach.

Many respondents felt a robust, common approach and method should be developed and adopted. The following key points should be considered as part of this:

Metrics

Many respondents stated that a set of multi-tiered KPIs/metrics, which capture the whole project life-cycle from design, through construction and operation, should be defined to assess this approach. They said these should be used to compare benefits against traditional methods of construction.

It was felt that these KPIs/metrics should assess performance against benchmarks for different categories of built assets. As no common approach currently exists, respondents suggested that the government should work with the public and private sectors to develop a set of metrics and an initial database, which can be developed as more projects using P-DfMA or other MMC are completed.

A variety of suggestions for possible metrics were put forward by respondents:

- focus on residual asset value/conversion cost
- source of products and materials used (tracking material & sources digitally)
- number of sales/uptake within value
- critical timing parameters (design time, construction time, lead times, adherence to original plan)
- costs of contracts let (in offsite this can be closer to outturn cost unlike traditional methods)
- health & safety impacts
- social (community) impacts



- environmental impacts (including CO2 reduction)
- productivity (value per hour)
- in use performance of new buildings
- actual trades workforces of firms contracted (not subcontracted), including value of training provision and trades apprenticeships
- simple business metrics (e.g. an introduction of new classifications in business codes associated with construction enterprises)

It was suggested that initially KPIs/metrics should be set out by government, rooted in a definition of value and that local authorities and the wider public sector should be encouraged to adopt the same metrics.

Case studies

A large proportion of respondents thought case studies should be presented to illustrate practical benefits, and data from these collated to give a baseline or benchmark to the measurements. They stated that these should assess savings in programme, capital cost, running costs, delivery on time and on budget, and time for the design to be moved from outline design to final construction information. One suggestion was these case studies could include the 'Smart Construction Metrics' being promoted by the Construction Leadership Council Innovation in Buildings Group and Constructing Excellence's KPIs.

Evidence based research is required for how off-site manufacturing, or standardisation of component parts for construction projects that are repeatable and scalable, ensures value for money over the life of the built asset and programme.

Question 5: What risks and costs (including hidden and associated costs) would this approach create for your organisation or sector?

The main risks raised by respondents were:

- misalignment of payments: manufacturing has more upfront costs and overheads, if there is not an appropriate change in payment schedules this could lead to a cashflow risk
- a manufacturing approach could drive offshoring due to cost benefits and the risk this would then present to the UK supply chain
- the full benefits of this approach will not be realised if architects and engineers are not fully engaged
- the approach could become too prescriptive and stifle creativity and innovation, platforms should be as flexible and 'agnostic' as possible to maximise their attractiveness to use
- associated processes (planning, building control, insurance etc) may not keep pace with a P-DfMA approach



- disruption to the traditional supply chain and routes to market, there will likely be winners and losers and it will take time for the industry to build up capability and capacity
- legal liability for built asset performance and safety: it was felt there should be contractual allocation of liability risk for design, assembly and fitness for purpose across the firms delivering the project, as this will no longer lie with the manufacturer only
- some of the materials interactions and uses could impact building safety, a suggestion to mitigate this was rigorous testing of platforms, and maintaining building data to ensure contractors (including maintenance contractors) have an awareness of the complexities and limitations of the building
- the willingness of the financial services sector to invest in construction and offsite manufacturing is uncertain, adopting P-DfMA in the construction industry could provide new investment models to give more certainty and security
- a manufacturing approach needs certainty of volume to ensure continuity of production and drive investment - without it, there would be a risk of lower investment in improving manufacturing techniques to deliver further productivity and efficiency gains.
- The main costs identified by respondents were:
 - training and upskilling staff
 - transition costs from a traditional construction to a manufacturing approach will be large and smaller firms will be hit harder to gain entry to the market - costs may be too high for the sector to bear
 - even with current funding, lack of R&D investment in infrastructure is a barrier to change
 - there will likely be an initial higher cost, until economies of scale are realised
 - if the supply side takes on more responsibility for what they are producing, then the client should expect an increase in initial capital expenditure, with this delivering value over the life of the investment programme
 - data, benefits realisation and associated initial IT investment costs to adopt new technologies

Question 6: How can this approach best be used to support the economy on a local and a national level?

On a local level the majority of respondents stated this approach would allow construction to grow in geographically diverse areas. Many respondents said local and regional assembly hubs could stimulate local jobs. A specific point made was local authorities have common needs and demand could be aggregated across local government. It was also said that this approach will benefit existing local value initiatives and boost local employment, while other manufacturing sectors are experiencing challenging circumstances. One respondent made the point there is a need for data about geographical based demand patterns to make manufacturing investment decisions.



Fewer respondents made points about national benefits. Of those that did, they stated the new approach will help develop and embed supply chains in the UK, and the UK being an early adopter would give firms a competitive advantage, which would then drive exports. It was felt that it will increase productivity in the design and procurement of construction projects, and encourage greater efficiency in the economy as a whole. One respondent suggested this should be seen as a national approach that delivers local benefits.

Technical and commercial

Question 7: How would current contracting models and building requirements need to change, in order to best facilitate procurement from a product platform?

There was a broad consensus amongst respondents that current contracting models will not be effective in facilitating a P-DfMA approach, and that new models of contracting are required.

Many respondents addressed the need to involve different parties at an early stage in the process. Most respondents specifically referred to involving contractors and suppliers early on to avoid issues with specification and integration. Others felt that a more radical shift towards procuring products and services, instead of splitting design and build stages, needs to occur. One respondent advocated the use of a design sold “on licence” model, as used by the automotive industry. Standardised central design components are developed, from which a customer segment design is created through the application of a smaller percentage of bespoke parts and it was suggested this would work for the construction sector as well.

Many respondents referred to ICE’s Project 13 as a good example of rethinking the business model for infrastructure delivery. It was felt that the initiative encompassed many of the requirements that would underpin the successful delivery of a P-DfMA approach, and the government should look to work with industry to adopt Project 13 approaches where possible. In particular, the role of an integrator as set out in Project 13 was highlighted by a number of respondents as having the potential to actively engage and integrate all tiers of the supply chain.

Incentives to encourage the uptake of a P-DfMA approach were highlighted by a number of respondents as a consideration for the government. There was a general view that the value of new digital or manufacturing designs must be made a key requirement for a contract if the government is to achieve its goal.

A number of respondents referred to managing risk and liability. It was widely felt that a platform approach would have a significant impact on risk transfer. Some respondents said that this change in risk transfer should be managed in an explicit way in the contract, instead of implied, to ensure it does not lead to poor adoption rates.

Responses to the building requirements question were varied. Some respondents expressed concern over the perception that building standards would be simplified, particularly in



relation to fire safety. Other respondents felt that buildings would need fewer specific requirements to utilise standard components as widely as possible.

Question 8: What unique requirements, including security, do different government departments currently specify that could (not) be rationalised or simplified?

Only about half of the respondents answered this question. It was generally felt that there is scope for rationalisation and simplification in any process, which would lead to efficiencies. Even with some unique requirements, respondents said a degree of standardisation would be possible. Several respondents thought an executive body or custodian commissioning body should be responsible for this.

Respondents highlighted data security as a risk. They stated that if the government will be digitising buildings, due consideration also needs to be given as to how this data and information is generated, processed, stored and shared, as well as who has access to it.

Question 9: How and by whom should product, process and interoperability standards be set, validated and maintained over time?

More respondents felt that the government, in some form, should have this function. However, some felt it would be more appropriate to be overseen by an independent body or for the market to decide. It was suggested that all aspects of interoperability should be covered by whoever has responsibility.

Many respondents felt that collaboration between different parts of the sector and government on this matter will be key.

Other specific points made were that while government sets the standards, there should still be room for individual companies to innovate.

Question 10: What should the balance be between the core Intellectual Property (IP) which is retained and available to companies in the sector, and the proprietary IP that should be owned by individual firms?

Respondents generally agreed that this was a complex balance to strike and that any changes would not be quickly implemented.

Many respondents were concerned about the stifling of innovation and recognised that suppliers will struggle to deliver standardised products with no opportunity to differentiate and add value. Some felt that a clear boundary between core IP and proprietary IP must exist, in order to incentivise R&D and design innovation without compromising the openness of the platform. Similarly, some said that to avoid stifling innovation there was a benefit to allowing some proprietary IP to reside with individual firms.

Respondents stated that organisations in the supply chain must be committed to sharing best practice and collaborating for a P-DfMA approach to work. It was felt that sharing data played a big part of this and data owners need to be incentivised or required to share data.



Some respondents advocated an approach of minimal or no intellectual property being retained. A number of responses pointed to an open sourced platform (that a company developed) and components, allowing them to retain some competitive advantage as the original developers, but also enabling others to learn, adopt and adapt.

Although there was not a clear consensus amongst respondents, a significant number of responses advocated for the following balance:

Core IP - should be concerned with a set of parameters that assure functionality and performance of an asset whilst ensuring adherence to product standards that drive performance. This should cover aspects such as the interoperability between components, performance requirements and quality targets. The IP for this should be held by the government as the customer and should be open source to ensure widespread adoption.

Proprietary IP - should cover specific products developed by firms within the parameters set by the core IP. This would allow product developers to work within defined parameters and a managed platform but with the ability to differentiate themselves from competitors. This would help encourage and justify investment in R&D to improve performance.

Question 11: Are there any other issues that you believe need to be considered if this approach is to be successfully implemented?

Responses to this question were varied, but were largely grouped around three broad themes. Below is a summary of the main issues raised:

Culture

- many of the respondents highlighted the importance of changing the culture and behaviours of the industry and its clients
- some respondents stated that there is a need to challenge the perception that standard components lack quality compared to bespoke solutions
- some responses recognised that there will continue to be cases where a bespoke, in-situ solution will offer the best outcome for the customer
- the government needs to show commitment to changing the approach towards capital investment, and to seek to secure cross-party support for this approach, which is necessary for stakeholders to consider long-term investments

Integration and alignment with other issues

- integration of future technology needs to be properly considered as advances in technology in manufacturing and other sectors will help to unlock further efficiencies e.g. Internet of Things, automation and 3D printing
- government should ensure data-related strategies are coordinated and aligned



- alignment with the planning regime - revisions to the National Planning Policy Framework need to facilitate the adoption of P-DfMA and other innovative methods of construction
- there should be further alignment with the housing sector, for the approach to be successful it needs to be incorporated in all buildings

Points for further consideration

- consideration needs to be given as to how best to apply this approach to the hire and refurbishment market as they make up a significant proportion of government's portfolio
- some felt P-DfMA as a term is not easily understood by industry and government should set out clearly how and in what circumstances it intend to use this approach



3. Departmental progress

The government has made significant strides in recent years to increase the adoption of MMC, with a particular focus on:

Social Infrastructure - using significant investment in long term social infrastructure programmes, such as hospitals, schools and prisons, to drive the adoption of digital and manufacturing techniques wherever appropriate. IPA has been leading this work via Pathfinders for the TIP Programme, and in partnership with HM Treasury, Cabinet Office and No10 as part of Project Speed.

Transport - Digital and construction techniques that exploit the benefits of manufacturing processes to plan, design, construct, maintain and operate assets faster, cheaper and more sustainably. This work is led by the Transport Infrastructure Efficiency Strategy (TIES) programme, a collaboration between the Department for Transport, East-West Rail, High Speed 2 Ltd, Highways England, Network Rail and Transport for London. .

Housing - MHCLG is delivering interventions to positively disrupt the housing market and support the growth of MMC in housebuilding by creating the right conditions for a diverse, well-functioning market which innovates to accelerate supply, improves products, techniques, productivity and efficiencies, whilst offering a competitive and safe product for consumers.

The departments that have adopted the presumption in favour of offsite construction each have their own strategies and programmes to further this shared agenda.

Department for Education

The Department for Education (DfE) are continuing to advance their offsite schools programme, delivering projects to their GEN 4, 5, 6 and 7 standardised modular designs through existing MOD A, B & C frameworks and the newly procured MMC1 and offsite framework. The offsite programme will shortly incorporate the new Carbon Zero school design currently under development.

The MMC1 framework went live in January 2020, valued at up to £3bn it incorporates the next generation of standardised designs and methods of delivery, including panelised and component systems. The DfE see this as a vital next step towards delivery of DfMA school projects in the future. The framework has broadened the typology of businesses working with the department, with integrators of offsite systems now involved alongside manufacturers.

MMC1 requires incorporation of BIM models that includes a 3D design and a highly standardised and componentised solution suitable for efficient manufacture. This framework will ensure a step change in offsite school delivery, targeting better outcomes when measured against quality, cost and speed of delivery.



The Ministry of Justice

The Ministry of Justice (MoJ) has led some of the early research informing the P-DfMA approach to building within its Prison Estates Transformation Programme. The current prison build has targeted 70% to be delivered through offsite construction, this builds on previous offsite work delivered in constructing HMP Berwyn and is evident in the current construction of HMP Five Wells. The department will utilise category management of products, such as new window designs, to improve the value delivered by aligning to key outcomes, such as prisoner rehabilitation. These knowledge assets have been shared with the Construction Innovation Hub to inform the development of the platforms that could deliver greater value for money in both future prison builds and wider industry use.

The Ministry of Justice has developed a Modern Methods of Construction strategy that establishes a vision and structure for unlocking the delivery of better social, economic and environmental outcomes across the MoJ estate.

The Department for Health and Social Care

DHSC and NHSE/I are developing, refreshing and updating the Technical Standards to be set as guidance for the planning, design, configuration and delivery of healthcare buildings in the NHS in England. This work has taken on additional prominence as the NHS embarks on a major hospital building programme through the Health Infrastructure Plan (HIP) and all new schemes within the plan will be required to adopt the new guidance.

The Technical Standards will include guidance on 'Intelligent Hospitals delivered through standardisation,' building on the repeatable designs for rooms that was developed via the Procure framework, and also including clusters and zones that can be configured to develop whole hospital designs in a consistent format that takes account of both the digital agenda (technology, medical equipment and smart buildings) and a requirement to hit net zero carbon targets.

The development of MMC as a delivery method for the HIP Projects will therefore form part of the 'Intelligent Hospital' workstream within the Technical Guidance programme. This will ensure that there is a linkage between all the guidance being released to NHS Trusts and allow for standardisation to be delivered through MMC. To that end, NHSE/I and DHSC have appointed a leading MMC specialist to bring practical experience of advising on adopting MMC for major building programmes as well as operating frameworks that are designed to bring supply chains together to deliver projects.

The Intelligent Hospital project will produce initial recommendations on the planning, adoption and 'Road Map' for MMC in the NHS building programme. This will include how the use of MMC can be accelerated and identifying opportunities for the use of common platforms to drive efficiencies, including application to broader NHS estate investment.



The Ministry of Defence

The Ministry of Defence (MoD) utilises Modern Methods of Construction (MMC) in its infrastructure and housing delivery, including modular and component-led approaches. A commitment to MMC is driving the development of MoD Construction Standards policy, both in design and in the use of standardised components. An Interim Policy has been issued to reinforce the use of off-site construction on all new builds and major refurbishments. The Defence Estates Optimisation Portfolio is the most significant capital investment by the MoD in its infrastructure, with circa £1.5bn to be invested into the Defence Estate over the next 5 years. The Defence Infrastructure Organisation (DIO) Procurement Pipeline will deliver Service Families' Accommodation and Single Living Accommodation for military personnel, alongside technical facilities to support Defence capability. This will offer a significant future pipeline for platform solutions.

MMC is being used in the build of the DIO headquarters at Whittington and in-Service Single Living Accommodation at Bovington. Several pilot projects are being conducted to ensure the 'whole life performance' of buildings is managed, including the drive to Net Zero carbon emissions. The DIO's Commercial Strategy outlines the need for industry designs to utilise MMC when a value for money case can be made. The MoD has an MMC Champion to lead the wider implementation of MMC across the Defence Estate and to support Defence's commitment to a sustainable estate. Collaboration and learning are on-going alongside other Government departments and sponsored research, such as the Construction Innovation Hub, to ensure innovation and learning are embedded into MoD policy and standards.

The Department for Transport

The Transport Infrastructure Efficiency Strategy (TIES) is a collaboration between the Department (DfT) and its client bodies that aims to deliver a step-change in the efficiency of transport infrastructure projects by:

- Increasing understanding of critical data, measures and metrics
- Applying this intelligence to select Modern Methods of Construction
- Evolving business, commercial and decision-making processes to embed new models in operations

TIES is being operationalised through the TIES Living Lab, which aims to be a catalyst for driving even greater efficiency savings through three key themes: better use of data, measures, and metrics; adopting modern methods of construction and digital technology; and evolving business processes. Alongside this the Department's client bodies will continue to share best practice with each other and across government. DfT is committed to collaborating with partners, such as the Construction Innovation Hub, who share their objective of transforming the construction sector to enable 'better, faster and greener' delivery of infrastructure. The Department expects initiatives such as TIES, and the work of the Transport Research and Innovation Board (TRIB), to accelerate the adoption of MMC in the coming years.



Ministry of Housing, Communities & Local Government

The Housing White Paper focuses on tackling the barriers to increasing use of MMC and working with the sector to deliver more homes using these methods. Since its publication in 2017, MHCLG has established a housing specific MMC Working Group to address barriers to assurance, insurance and finance for MMC homes and earlier this year members of the group signed a Memorandum of Understanding to work towards a shared minimum standard.

The Department has also delivered a standardised definition framework for MMC classification; explored how the planning system works for MMC through a cross sector roundtable; encouraged the use of MMC through the Affordable Homes Programme; invested over £298m in MMC developments from the £4.5bn Home Building Fund; used its commissioning power through the Accelerated Construction (AC) programme to showcase MMC as a way to drive build out pace and strengthen the supply chain on local authority owned land and is considering options for further interventions.

Crown Commercial Service

The Crown Commercial Service (CCS) "asset to operate" offering has a major focus on MMC. Working with government departments and the supply chain, CCS is driving the use of MMC by defining requirements and influencing the design stages of construction projects. This is facilitated by the use of alliance ways of working using Framework Alliance Contract 1 (FAC-1), and with policy embedded throughout its commercial agreements.

CCS is working with MoD and MoJ as strategic customers, supporting their procurement and design strategies for programmes of work relevant to the presumption in favour of offsite construction. CCS are supporting delivery of MMC through its Construction Professional Services, Modular Building Services and Construction Works commercial agreements, with the ability to coordinate centrally and share best practice and innovation across government departments.



4. Conclusions and Next Steps

The government is committed to driving better infrastructure performance and whole life value from taxpayer-funded investments, for the benefit of the UK. This includes the commitment to reduce emissions and carbon in construction, implementing reforms to support the faster delivery of high quality projects and supporting wider outcomes such as the development of more sustainable, resilient and efficient business models in the UK construction industry, and more employment in a disaggregated manufacturing base. The government thanks all those who have taken the time to respond to its call for evidence and for the positive engagement and outlook of respondents. The government recognises that there are challenges associated with embedding large scale adoption of MMC, and a P-DfMA approach specifically, and respondents have corroborated this whilst indicating ways in which the challenges can be addressed.

MMC is a broad term, encompassing a number of different methods in building projects to drive a range of outcomes, including more productive delivery and smarter operation. P-DfMA is one of the methods the government will use to deliver its agenda. The government will continue to work with industry to put in place the enablers and to promote the adoption of MMC and a P-DfMA approach as a means of enabling improved productivity, innovation and efficiency and to reduce carbon emissions in the construction and infrastructure sectors. This work will primarily be taken forward via the Transforming Infrastructure Performance Programme, the Transforming Construction Challenge (as part of the Construction Sector Deal) and through the implementation of the Construction Playbook.

This is a transformation that will require changes in the business models, current skill sets, and the culture of the UK construction industry. It will take time for both government and industry to adopt new methods of working in order to achieve success. The government sees this as a programme of work that will be developed over the next 10 years. All will have a role to play; government, industry and academia. Setting the strategic direction now gives the industry time to prepare, to invest, and adapt in the medium term.



Next steps

To enable greater and more consistent insight into productivity and progress relating to offsite construction, government has accelerated work to agree consistent metrics for government construction projects. In the first instance this will be focused on the delivery phase, but there is a clear ambition to develop the work further to include metrics which robustly capture whole life performance of built assets. The metrics will be grouped into four themes which reflect government policy: productivity, sustainability, levelling up and innovation.

The government appreciates and welcomes continued input from all stakeholders and recognises that collaboration across the supply chain is important for a P-DfMA approach to be successful. This has been powerfully demonstrated by the speed with which government and industry have collaborated to create the Construction Playbook. The vision is for government to 'design once and use many times' by the adoption of configurable interoperable components, manufactured and applying a quality process from the outset.

We each have a role to play, and the government will continue to work with industry in addressing the challenges and implementing the policies in the Construction Playbook. The government has committed to a multi-year implementation programme for the Construction Playbook to drive improvement and transform how we deliver projects and programmes. To enable the implementation of this approach the IPA will focus in particular on the following three areas:

Enable insight

As set out in the National Infrastructure Strategy, the government will continue to support initiatives that enable better use of high quality data. It will allocate funding for the Digital Framework Task Group to develop an information management framework, and will fund the Geospatial Commission's continuing work on a National Underground Assets Register.

During summer 2020 the IPA secured approval to develop and build a benchmarking hub for government. The benchmarking hub will collect project data from completed projects and provide access to this data to project leaders across government to support project investment decisions, helping to leverage the UK Government's project portfolio data to support and shape future investment decisions. The platform will collect data on previously completed projects and future projects, and will go live in 2021.

Transform Demand

To enable increased use of P-DfMA government will address its requirements such that the components and spaces that underpin demand can be manufactured efficiently and used interoperably, by adhering to standardised interfaces (encompassing aspects such as performance, quality and tolerance). This interoperability should ultimately extend across different categories of assets and different sectors. The Government recognises that some types of assets will include specialised requirements (security for example) and these



requirements may be distinct to specific sectors, albeit P-DfMA approaches can still be applied within these typologies.

Harmonise, digitise and rationalise:

- Government will develop common sets of rules that it will apply in describing its requirements, such that the standards and specifications (both written and drawn) across different types of construction (e.g. schools, hospitals) follow a consistent approach.
- Government will facilitate the creation of a digital environment to support P-DfMA approaches. This will include digitising the standards, specifications and design content for government construction. It will also mean embedding digital solutions, including the UK BIM Framework, to enable the effective digital management of government requirements.
- Government will leverage its digital requirements and associated ability to compare demand across sectors to drive increased rationalisation and adoption of shared P-DfMA solutions.

This work builds on the excellent progress made by some public sector clients to date, such as Highways England's work on the Design Manual for Roads and Bridges, Ministry of Justice Digital Estates Object Library and the Department for Health and Social Care's Procure 22 Repeatable Rooms programme.

The IPA will lead this work across government, providing good practice guidance, coordination and ensuring lessons learned are shared between departments.

The government recognises that a committed and transparent pipeline of demand is necessary to give industry the confidence it needs to invest in new ways of working. The creation and publication of such pipelines is a key policy in the Construction Playbook. The IPA and BEIS will work with departments to establish a committed, identified pipeline of projects to enable modern methods of construction, including P-DfMA. The IPA will explore how to capture and share information relating to the take-up of MMC and incorporate this into future iterations of the National Infrastructure and Construction Pipeline.

Support innovative supply

The government will continue to work with industry, including via the Construction Innovation Hub, to support the development and piloting of product platforms based on components and assemblies which can be configured interoperably as kits of parts that can be used to address demand across multiple building typologies and different sectors.

This will include industry-Government collaborations to support the design and construction of demonstration buildings assembled using a platform-based approach, so we can learn from what works before scaling up.



Milestones

- December 2020 - scoping and development of a multi-year implementation programme for the Construction Playbook begins
- Spring 2021 - Departments start collecting and reporting on Construction Metrics and IPA Procurement Pipeline published
- Summer 2021 - TIP 2021 published
- During 2021 - IPA benchmarking hub goes live



Annex A

The following organisations responded in writing to the consultation:

- AECOM
- Anglian Water
- Arcadis
- Association for Consultancy and Engineering
- Autodesk
- BIMobject
- blacc ltd
- British Standards Institution
- Bryden Wood
- BSRIA
- Building Alliance
- Buildoffsite
- CECA
- Cobuilder
- Constructing Excellence
- Construction Innovation Hub
- Construction Scotland Innovation Centre
- DDA Engineers Ltd
- Electrical Contractors' Association
- Environment Agency
- Finishes and Interiors Sector Ltd
- Heathrow Airport
- Innovaré Systems Limited
- Institution of Civil Engineers
- Interior Services Group
- Joint response from Modern Masonry, The Concrete Centre and the Mineral Products Association
- Kier Construction Limited in collaboration with Procure22
- Laing O'Rourke
- Laing O'Rourke Centre for Construction Engineering and Technology at the University of Cambridge
- Loughborough University
- Mace
- Mid Group
- Mineral Wool Insulation Manufacturers' Association
- Modular & Portable Building Association Limited
- National Building Specification
- Ordnance Survey
- Pinsent Masons / London First
- Portakabin Limited
- Premier Modular Limited



- RIBA
- Skanska
- SNC-Lavalin Atkins
- Tata Steel
- The British Constructional Steelwork Association Limited
- The McAvoy Group
- The University of Sheffield Advanced Manufacturing Research Centre
- Trimble Solutions
- Turner & Townsend
- Wieland Electric
- Wood Panel Industries Federation
- WSP
- Zurich Insurance

In addition to this, IPA and BEIS hosted a technical workshop with experts from industry, academia and government, where the details of the proposal were discussed in detail.



Annex B

Lines of Enquiry

General

Q1: How can the government best encourage the adoption and implementation of this approach in its capital programmes?

Q2: Within your organisation or sector what changes are needed, including in relation to technologies, skills and commercial models, for this approach to succeed?

Q3: How should government engage with industry to make sure this approach succeeds?

Q4: How can the benefits of this approach best be measured?

Q5: What risks and costs (including hidden and associated costs) would this approach create for your organisation or sector?

Q6: How can this approach best be used to support the economy on a local and a national level?

Technical and commercial

Q7: How would current contracting models and building requirements need to change, in order to best facilitate procurement from a product platform?

Q8: What unique requirements, including security, do different government departments currently specify that could (not) be rationalised or simplified?

Q9: How and by whom should product, process and interoperability standards be set, validated and maintained over time?

Q10: What should the balance be between the core Intellectual Property (IP) which is retained and available to companies in the sector, and the proprietary IP that should be owned by individual firms?

Q11: Are there any other issues that you believe need to be considered if this approach is to be successfully implemented?





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