

A Proposal for a New Approach to Building: A Call for Evidence

ACE consultation response

13 February 2019

Summary

Background to Opportunity

ACE welcomes the opportunity to engage with the Infrastructure and Projects Authority (IPA) on the potential for the adoption of digital and manufacturing techniques in government-led building projects to help drive better performance in the construction sector.

Construction underpins our economy and society and affects the lives of every person in our country. It is one of our truly nationwide industries that links individual homes in remote areas to some of the greatest infrastructure projects of in Europe. It is one of our major employers, with around 3.1 million people working in the sector, most of whom are outside London and the South East.¹ It encompasses contracting, product manufacturing and professional services, with a turnover of in excess of £370 billion, adding £138 billion in value to the UK economy² or 9% of the total and exporting over £8 billion of products and services.³

However, the potential of the sector has been held back by productivity that is historically below than the wider economy – an average of 21% lower since 1997.⁴ The Farmer Review,⁵ published in 2016, highlighted a combination of factors behind this problem, including the cyclical nature of the sector, the unpredictability of future work and a lack of collaboration across the sector. It concluded that transforming the industry would require shared leadership by the industry, its clients and the government.

The Construction Sector Deal launched in 2018 sets out how the construction industry will contribute to this, with a £420 million joint investment from the sector and the government in new technology and techniques. This will build on existing initiatives such as the Centre for Digital Built Britain; the technology roadmap developed by the Infrastructure Industry Innovation Platform (i3P) consortium; and work with construction clients to drive demand for innovative construction materials, technologies and techniques.

ACE and its members support the government's ambitions to modernise construction, including offsite manufacturing and principles emanating from the circular economy across the built environment, and are facilitating a dialogue across the industry to achieve this. ACE's Future of Consultancy campaign bring together our members ensure the UK's engineering and environmental consultancies are able to seize these opportunities. Details can be found at <https://www.acenet.co.uk/campaigns/future-of-consultancy>.

We are also supportive of the objectives of Government's Transforming Infrastructure Performance (TIP) programme, Transport Infrastructure Efficiency Strategy (TIES), the Construction Sector Deal and Industrial Strategy and are working with the government to help achieve these objectives. Many of our

¹ Office for National Statistics (ONS), '[Annual Business Survey](#)', (October 2017) and [Labour Market Statistics](#), (October 2017) (self-employed construction contractors)

² Office for National Statistics (ONS), '[Annual Business Survey](#)' (2017) – analysis of GVA share adjusted to reflect ABS measurement of approximate GVA.

³ Office for National Statistics (ONS), '[UK Balance of Payments Pink Book](#)' (2017). Table 9.11 and Table 3.8 for data construction contracting and services exports.

⁴ Office for National Statistics (ONS), '[Employment and Labour Market](#)' (2018)

⁵ Construction Leadership Council (CLC), '[Farmer Review of the UK Construction Labour Model](#)' (2016)

largest members such as AEACOM, ARUP, Arcadis, Mott Macdonald, WYG and WSP are pioneers in this space.

A Vision for the Future

We, therefore, recognise that more needs to be done to improve the industries low productivity, poor predictability, skills shortage and low levels of investment in innovation that have plagued the industry for decades. We feel that adopting modern digital and manufacturing techniques could form part of the solution to this problem, but it will not be a silver bullet and will take time to implement.

ACE feels that the model used by the automotive industry where standardised central design components are developed from which a customer segment design is created through the application of a smaller percentage of bespoke parts would work for the construction sector as well. What is important from a technical perspective is that the overarching design is developed as a system and signed off by a design authority. This is then reviewed and finally signed off once the customer configuration has happened.

To enable industry to deploy this capability, ACE is advocating public and private clients implement a commercial strategy around “customer segmented design”, similar to that deployed in the car manufacturing industry. Put simply the car manufacturers identify the segment of their target market they are aiming a design at (luxury 4x4s for high net worth individuals or reliable practical cars for families). For buildings, for instance, this might require segments for a particular customer base such as affordable social housing or schools for disabled children. While for major infrastructure segments a similar approach could be taken, albeit these will be determined by defining segments around an existing network such as footbridges for a one, two or three carriage way road.

The impact of this strategy could be further enhanced by making the segment solutions available on the open market on long term regulated agreements/contracts; aggregating Government demand across the many public sector clients and allowing private sector clients access to purchase too. Industry will respond to this by experts emerging with an innate understanding of their specific needs, an incentive to continuously improve on the design over the term of the contract and the opportunity to follow the designs into operation to learn and adapt from how they perform.

As designers, we will need to adapt our mindset to develop quality and user-experience over the current asks on us to quickly deliver a pipeline of fully bespoke work, but this movement to offsite and manufacturing processes presents an opportunity to seize and reinforce our sector’s value across the supply chain. There will be challenges in evolving business models, but also positive impacts on skills. This new way of working is likely to be more attractive, rewarding and creative, enabling the emergence of experts across new areas – far more interesting work than drifting between lowest-cost bespoke design projects. After all, most engineers are problem solvers and harnessing expertise in this way will unlock a lot of frustrated creativity and potential supported by the digital tools now at our disposal.

Risks and Challenges

ACE believes that platform design can only go so far as there will always be a need for variation of any structural design due to the unique features of the project or the site of occupation. Because of this it

will be impossible to eliminate the need for either bespoke components or individual design work. There is also a significant danger that standardisation, while achieving efficiency's in the short term, may well limit innovation in the long term leading to declining levels of productivity and efficacy, compromise on whole life performance, and reduced customer experience.

We must also stress that the issues around productivity, predictability, skills and low levels of investment are symptoms of a governmental procurement practice that priorities lowest cost bidding under the guise of value for money that has led to a profitability crisis in the sector that prevents high levels of investment in new techniques, greater collaboration or innovation- all of which the government states it supports. Governmental clients and HM Treasury need to understand that good design costs money and is often more expensive in the upfront cost but does lead to greater cost efficiencies and user experience and performance over the whole life of the project.

Finally, we feel that government should not become too committed to the concepts outlined in design for manufacture and assembly (DfMA) as outlined in the consultation as the the way in which we build things is changing due to the wider technical revolution we are in the midst of. So, although there are undoubted efficiencies to be seen from standardised components in manufacturing, the way we construct items is moving away from mass assembly to a much greater use of bespoke design and build though Additive Manufacturing (AM) and 3D printing solutions.⁶

AM as a process allows for the building up of products layer by layer, offering an unprecedented freedom of form, resulting in endless possibilities in mass customisation, weight reduction, product integration and more. Mass customisation allows each product to be different, supporting overall flexibility in the shape of a building and the design of products that do exactly what they are supposed to do as part of the design parameters.

The IPA should not, therefore, become too wedded to any particular technology or solution in achieving its goals. ACE suggests that IPA should move away from standardised design thinking towards a conceptual design thinking that would allow a governmental client to express a desired design outcome while leaving the industry free to innovate within set standards. This would move standardisation away from components towards conceptual designs that have the potential to be used in a myriad of projects with modifications made to meet environmental and technical requirements. The result would be a more efficient and productive building model.

Next Steps

ACE's Future of Consultancy campaign will be investigating the issues raised by this consultation in further detail by focusing on four work streams. These are:

- **Domestic Opportunities**- identifying opportunities for applying technology to develop new products and services in strategic planning and placemaking, delivering integrated projects, or data driven asset performance.
- **Export Opportunities**- identifying global opportunities for where UK consultancy and engineering expertise can add the most value and the routes to those markets.
- **Skills and Capacity**- identifying what the businesses of the future will look like in terms of people, the planet and profit so as to attract the best talent.

⁶ <https://www.arup.com/projects/additive-manufacturing>

- **Business Models and Contracts-** identifying the ownership structures and business models of the consultancy businesses of the future?

ACE looks forwards to working with IPA on this campaign and discussing our findings with you in greater detail.

Response to Questions

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

The key to any move towards a new technical approach in construction will be the commercial strategy employed by the procuring authority. If government procurement practices do not incentivise the use of new technology than the market will respond by using older established techniques. The value of new digital or manufacturing designs must be placed at the highest level of requirement for a contract if the government is to achieve its goal.

Alongside this, there needs to be a large, well-developed and constituent pipeline of work that will justify the tooling cost that the industry will need to absorb to improve the availability of new components as envisaged in the consultation. Government will need to ensure that pipeline and continue with projects regardless of the economic environment of a particular time if it wishes to see the benefits envisioned.

The creation of a visible pipeline of work is a helpful contribution from Government but what is clear to our members is that radical change in the way we build in this country is not going to change over-night. ACE calls on government departments to create 10-year plans for change that would embed this new approach in their procurement strategies prioritising aggregation of demand across government departments.

ACE feels that is important to recognise the differences between building and infrastructure when considering implementing new approaches. Building projects such as schools and custodial buildings lend themselves more obviously to modularised solutions. Linear infrastructure such as road and rail schemes offer more limited opportunities in this regard. Where there are options for standardisation, such as in steel beams and deck, these are already commonly standardised.

For infrastructure projects far more of any work relates to activity in the ground, where the variation in conditions means that standardised approaches may prove challenging, particularly where there are interfaces with existing assets. It is also the case that much new infrastructure is delivered alongside existing networks, providing further constraints that make standard solutions more difficulty to implement.

Notwithstanding the above concerns, it was recognised that there is considerable appetite from the UK Government and major infrastructure clients to adopt new approaches to construction.

In this regard, it was felt that the single biggest intervention that the UK Government could make to make adoption of new approaches to construction more widespread would be to ensure that such approaches are properly considered from the earliest stages of projects and at a programme level. If it

is left to tender or post-tender stage to implement offsite, there will be too many constraints already in place that will limit the value of such activity. Whereas if it is considered right from the start of projects, all opportunities can be adopted, and this will also allow much greater scope for planning of the investment required in production.

Other key areas which need consideration now are the overhaul of technical standards so that they are appropriate for off-site techniques. Government should also consider standardising technical standards across government departments so that off-site techniques can be used more readily. Finally, we believe that there is merit in undertaking a capacity study for the availability of off-site options and work with suppliers to incentivise gap-filling.

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

The government needs to recognise the importance and value of good design at the very earliest stages of a project and the cost this entails if the sector is to meet these requirements. There needs to be a much greater emphasise of thinking about what a client needs and how this can be produced. If this design time is allowed properly at the start, then it would be possible to ensure that components are produced to exacting specifications that will allow for a more speedy and seamless construction.

There is scope for a new delivery model that encourages off-site opportunities, and the need for industry to consider the RIBA stages differently and standardise these for off-site projects. This is something that government and industry should work together on developing perhaps by modifying ICE's Project 13 proposals.

For the industries part, more investment in training in digital technology and automation in design will be required. This will become more feasible if the pipeline of work exists to support this investment. The industry would need to establish the proposed 'platform' with all of the agreed components. All parts of the supply chain, including designers, contractors and suppliers would need to understand and agree to the standards that would underpin components being added to the platform. This will be a considerable undertaking and will likely prove to be challenging for many businesses to migrate to this new model. This challenge is likely to also affect clients, with a need to be more flexible about their current standards to allow them to align with those of other customers using the platform.

A platform-based approach to the delivery of infrastructure projects would require a very different commercial model to that which currently exists for most existing projects and programmes. This new model would demand early engagement of the relevant suppliers (including those designing and manufacturing components). In the early years of any new approach this may mean a model where payment is on a cost-reimbursable basis, reflecting the uncertainty that the change will create for all parts of the supply chain.

This new approach will require significant work by tier 1 suppliers to work with their supply chain to help them with development, ensuring that all parts of the supply chain are ready to deliver in this environment. It will also require tier 1s to have longer-term relationships with suppliers, genuinely bringing them in from the earliest stages of projects. This may require an alternative supply chain commercial model, to ensure that suppliers are adequately rewarded for their input at this stage.

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

Although consultation with the industry is useful and welcome, what is of more use is certainty over project requirements that will allow the industry to meet the government's needs. If the government is truly committed to this approach it will begin to be seen in successful bids as part of the procurement process which will lead to a more rapid industrial shift. Offsite work, if it is to be effective, will require repetition if the hoped-for efficiencies are to be realised and this can only be achieved with policy certainty and continuity.

A demonstrable pipeline of work will be required if companies are to make the commitment required to this new approach. Unfortunately, UK construction project history does not bode well for this being achievable littered, as it is, with planned schemes to deliver real volume that are not delivered due to endless cuts such as PSBP, PF2, MOJ etc. Industry will struggle to make the required investment unless it is clear that there is a clear, consistent and long-term programme that shifts the industry towards a platform model.

The UK Government has significant influence as a major buyer of infrastructure. It can use this buying power to influence the supply chain to move to this model. This can be further strengthened if the Government also collaborates with major private sector infrastructure clients to provide consistency. There is scope for the government to work with industrial trade bodies to collaborate on the delivery of potential construction methods and improved business models that will sustain them.

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

Effective measuring of success will be key to delivery and must be established that the very start. Agreeing a set of benchmarks and KPIs will be a beneficial step change for both clients and the industry and should be prioritised by the government. Potential markers for success could be assessed by rating accuracy on delivery, or the number of new entrants in the market. The volume of private projects that adopt the same approach is also an interesting measure, in part because it is a good determinant of the appetite for future schemes. ACE's Benchmarking series can assist with this.

See <https://www.acenet.co.uk/resources/benchmarking/>

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

ACE has discussed this issue with its members and has found that companies such as ARUP, AECOM and WSP have given it a great deal of thought in their future business strategies. They highlight that the risks and costs associated with a transition to such an approach are numerous and arise at numerous levels of the supply chain. One of them is the transition cost. As an example, the cost of becoming a brick layer is a few hundred pounds, and the cost of becoming a manufacturer of DfMA brick walls is tens if not hundreds of thousands of pounds. For this reason, while as it stands small firms have no incentive to enter this market but the risks to their future are absolute.

Another risk is lack of strategic patience. Indeed, the industry will not be able to change overnight. For this reason, we need to make the changes are sustainable – reinforcing our points about the importance of pipeline, lessons learnt, incentives, pilots etc- but we feel that on the long run the benefits far outweigh these initial risks.

Finally, ACE feels that there is a real danger that any moves by government to a standardised approach for all government projects could lead to a long-term stifling of innovation within the sector as it would not reward the adoption of pioneering new techniques outside of agreed standards that could deliver greater productivity and efficiency.

If you add to this a system that prioritises the lowest price for a project rather than according to increased profit margins within the supply chain gained by great productivity, certainty and technical innovation it creates and unprofitable industry. The result is a system that cannot translate productivity increases into higher value added and reduces incentives to adopt or invent better technology or management practices that could lower production costs. On the contrary, enterprises that adopted new technologies and increased outputs are often at a disadvantage in bidding for government contracts that prioritise the lowest price next to competitors who do not innovate due to a high upfront cost of their services.

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

At a national level, there is a major opportunity for exports. Indeed, while the UK is not yet a leader in offsite, it is not alone in its lack of adoption of offsite, and there is still a real benefit to be the first mover at scale. Indeed, there are markets beyond the UK that appropriate manufacturers can target thus increasing exports.

At the local level, such methods provide an opportunity to increase the local benefits associated with major schemes. Indeed, schemes of volume can invest directly or with manufacturing partners in local delivery “pop up factories”, creating local employment possibilities, and legacy infrastructure.

One of the most significant benefits of a new approach to construction is the opportunity that it affords for revitalising economically stagnant parts of the UK, spreading the benefits of investment in infrastructure far beyond the locations where it is delivered.

There are a number of locations across the UK that have seen the decline in traditional industries such as shipbuilding and steelmaking. Such areas typically have good transport links and an engineering workforce to support these former industries, making them ideal to host clusters of offsite manufacturing capability, creating new industrial heartlands across the country.

There is also the potential to use large infrastructure projects or regeneration schemes to create sustainable new industries – initially to provide components for the project delivery, but with a longer-term legacy value – i.e. manufacturing of off-site assemblies for residential buildings (kitchen pods/panellised systems).

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

ACE would support a move towards a design sold “on licence” model as used by the automotive industry where standardised central design components are developed from which a customer segment design is created through the application of a smaller percentage of bespoke parts would work for the construction sector as well. What is important from a technical perspective is that the

overarching design is developed as a system and signed off by a design authority. This is then reviewed and finally signed off once the customer configuration has happened.

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

NA

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

ACE believes that a single central organisation that draws from clients, Government, and suppliers should own and operate the platform.

We see the open source software operating system Linux as an example of how such a collaboration can be managed, with intelligent users all contributing to the platform's development. Engagement in the development of the platform will be beneficial to individual organisations as it will allow them to benefit from its use, helping to provide the resource that will be required to develop the platform. In the initial stages this may also require some upfront Government funding to develop the basic information management architecture for the platform.

To avoid early challenges, it is suggested that there should be initial trials of the platform for specific products or components, allowing industry to familiarise itself with the platform before its use becomes widespread.

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?

ACE feels that the right balance would be the concept design IP being retained by the consultant but allowing for reconfiguration at a lower licence cost. This is something we would be happy to discuss at greater length with the IPA as a follow-up to this consultation response.

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

While our responses above have largely focussed on the opportunities that open up where there is a widespread adoption of common components and products through a platform, there are also benefits associated with offsite construction of individual items where doing so removes constraints that would occur with in-situ construction. It must also be recognised that there will continue to be many cases where a bespoke, in-situ solution will still offer the best outcome for the customer.

The government needs to give greater consideration to how it engages with the industry and in particular Trade Associations to determine how it can be achieve its aims.

About ACE

As the leading business association in the sector, ACE represents the interests of professional consultancy and engineering companies large and small in the UK. Many of our member companies have gained international recognition and acclaim and employ over 250,000 staff worldwide.

ACE members are at the heart of delivering, maintaining and upgrading our buildings, structures and infrastructure. They provide specialist services to a diverse range of sectors including water, transportation, housing and energy.

The ACE membership acts as the bridge between consultants, engineers and the wider construction sector who make an estimated contribution of £15bn to the nation's economy with the wider construction market contributing a further £90bn.

ACE's powerful representation and lobbying to government, major clients, the media and other key stakeholders, enables it to promote the critical contribution that engineers and consultants make to the nation's developing infrastructure.

Through our publications, market intelligence, events and networking, business guidance and personal contact, we provide a cohesive approach and direction for our members and the wider industry. In recognising the dynamics of our industry, we support and encourage our members in all aspects of their business, helping them to optimise performance and embrace opportunity.

Our fundamental purposes are to promote the worth of our industry and to give voice to our members. We do so with passion and vision, support and commitment, integrity and professionalism.

Further information

For further details about this consultation response, please contact:

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