

Not your average prefab

Bill Healy makes the case for the increased use of off-site manufacture (OSM) and provides some advice on how to make it a success on projects

The industry is facing a number of tough challenges: money for investment is tight, buildings are becoming more complicated, the heat is on to reduce carbon emissions and clients are challenging the industry to come up with ways of delivering better value for their investments.

In an environment such as this, it is hardly a surprise that a growing number of clients, designers and constructors are looking at alternatives to traditional construction methods to deliver the buildings they want at a price they are willing to pay. Indeed, for many clients, the construction site has already become the place where factory-made components are merely assembled – as the value

Modular service runs are precision engineered and tested in the factory before delivery to site on a just-in-time basis

adding processes have already taken place in the factory rather than on site. Some professional and construction teams are in the vanguard of this new off-site way of working but the implications are likely to impact the industry as a whole.

The use of factory-made material components to assemble buildings on site can be an attractive commercial and project proposition because of the potential benefits of faster construction on site, predictable project time and cost, assured quality and accuracy, minimisation of waste, etc. Specific benefits include:

- services that have been designed for simplicity and speed of installation and which have been tested in the factory
- a level of manufacturing accuracy and fit on site that cannot be matched by traditional construction methods
- simplification of the project's critical path
- increases in levels of productivity on site
- fewer trades on site
- reduced waste of materials, manpower and capital
- improved health and safety
- maximising returns on investment.

Factory-made components are also becoming ever more sophisticated as innovative manufacturers and designers identify ways to incorporate additional structural or service features with high accuracy and quality. However, these developments are possible only if there is a very close and sustained working relationship between the client, their consultants and manufacturers. For much of the industry, this represents a substantially new way of working with increased collaboration across the construction team becoming a necessary reality rather than simply an aspiration.

Regulatory drivers

The case for non-traditional construction methods is also being driven by changes in UK legislation. In particular, new regulations to support the UK government's targets for carbon reduction will have an increasing impact on design and construction practices to deliver buildings with the required level of performance. The pressure is on to create buildings that use substantially less energy and the way to achieve this will be through better design and specification, new construction products and, critically, substantially higher standards of workmanship. No sector of the industry is exempt from these new requirements and the Code for Sustainable Homes and changes to Building Regulations will specifically drive this requirement in new-build housing.



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» **Impact on the industry**

But it is going to be very difficult, if not impossible, for the industry to meet these new challenges by tinkering with current site-based construction methods.

We know that in the UK the history of prefabrication has had some serious ups and downs and many in the industry may have substantial reservations about the use of off-site solutions based on their past experiences or possibly their perceptions of the sector. Some will conclude that although a strong case for the use of off-site solutions might exist in the new build sector, the industry does not as yet have the product offerings to compete effectively in the repair and refurbishment markets. At present, this may well be the case.

Many will also have concerns relating to potential restrictions on design flair, on the flexibility of solutions, site handling and the challenges of incorporating off-site solutions into construction projects that are still substantially dominated by on-site construction methods. There will, of course, also be concerns over the price of off-site solutions when compared to the price of traditional construction methods.

These are legitimate concerns for the industry just as much as they are for clients and contractors.

However, the reality is that the industry has to change the way in which it delivers buildings to meet the volume and quality required. The challenge is to engage with the off-site industry, to learn the lessons from serial clients and to begin to think of off-site solutions as a radical opportunity for the industry to adopt the practices that other manufacturing industries have been embracing for decades.

Practical guidance for clients and their advisors

Crucial to the successful use of off-site solutions is ensuring that the design process and the issue of tender documentation allows effective input from off-site manufacturers.

Our consultations with clients, designers, contractors and manufacturers who have experience of using off-site solutions have come up with the following basic prerequisites for off-site success:

- the initial design should be kept outline and flexible with basic layouts, plans and elevations with accompanying performance specifications
- introducing a 'design freeze' as early as possible in the programme to avoid the effects of any late changes which may give rise to particular difficulties for off-site suppliers. It is surprising how many clients will delay their design freeze without appreciating that this will inevitably delay and increase the cost of their project
- the importance of involving off-site suppliers during the design stage to work with the main design team
- ensuring that off-site suppliers have the appropriate level of competence.

Our discussions with the off-site supply side have also identified some factors which may impact the successful use of OSM. These include:

- practicality of build ignored – is it suitable for OSM?

- client standards (especially M&E) which are not compatible
- over-design by consultants
- over-prescription in non-essential areas
- lack of clarity in required performance standards
- specifications for services which are inappropriate
- consultants designing for manufacture without the necessary experience or specialist skills
- lack of understanding of the structure of the off-site supply chain.

The use of OSM is likely to be difficult for:

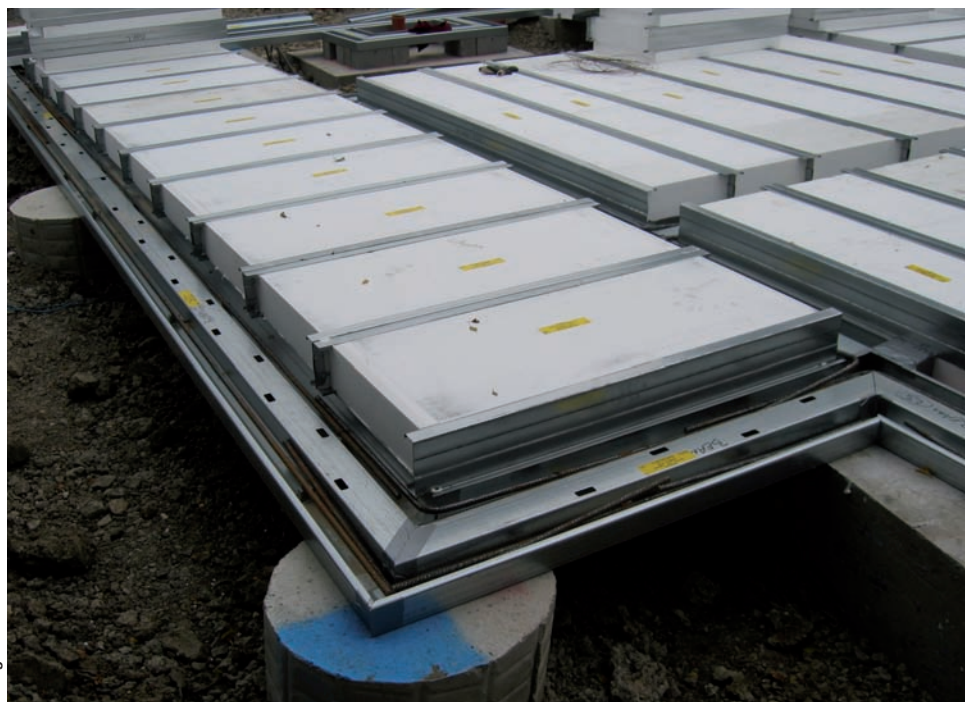
- small-scale refurbishment projects
- repairs and maintenance
- extension of service runs
- drainage and sewerage installations
- domestic extensions and conversions
- any project where the client is unwilling or unable to freeze the design
- projects where site access is severely restricted.

Early involvement of off-site suppliers

As with most collaboration, it is important to have early involvement with potential off-site suppliers before final decisions on the form of construction are taken. These suppliers will have knowledge in the project and commercial aspects of off-site solutions and how they can be integrated into the project. Early involvement can begin with a review of the strategic brief. However, if in the circumstances this is not a practical proposition, off-site suppliers will be able to advise on issues such as:

- manufacturing concerns
- costing considerations
- ensuring that the initial design is kept as simple and as flexible as possible
- that the whole life costs of the building are taken into account when considering construction solutions.

It is going to be very difficult, if not impossible, for the industry to meet these new challenges by tinkering with current site-based construction methods



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Prefabricated foundation solutions in association with piles can achieve a horizontal accuracy of +/-1mm and so eliminate the need for shimming

Design and specification

Also, to help increase the chance of success of OSM, it is important to ensure that the design and specification approach is integrated.

So, do:

- share project ambitions with off-site suppliers
- keep specifications simple
- be receptive to supplier ideas
- understand factors such as speed, quality, waste reduction and predictability.

And don't:

- be over-prescriptive too early in the process
- allow consultants to over-design
- design for manufacture without understanding capabilities and cost drivers
- select the off-site supplier on the basis of cost alone without understanding their critical capabilities and competences.

Performance specifications

I would also stress the importance of appropriate performance specifications and the need for programming to be realistic, given that off-site solutions tend to require longer preparation time while work on site is invariably much shorter than traditional methods. Requirements for future flexibility need to be realistic and specific and consideration should be given to the need for future adaptability, extension or modification in order to avoid unnecessary costs.

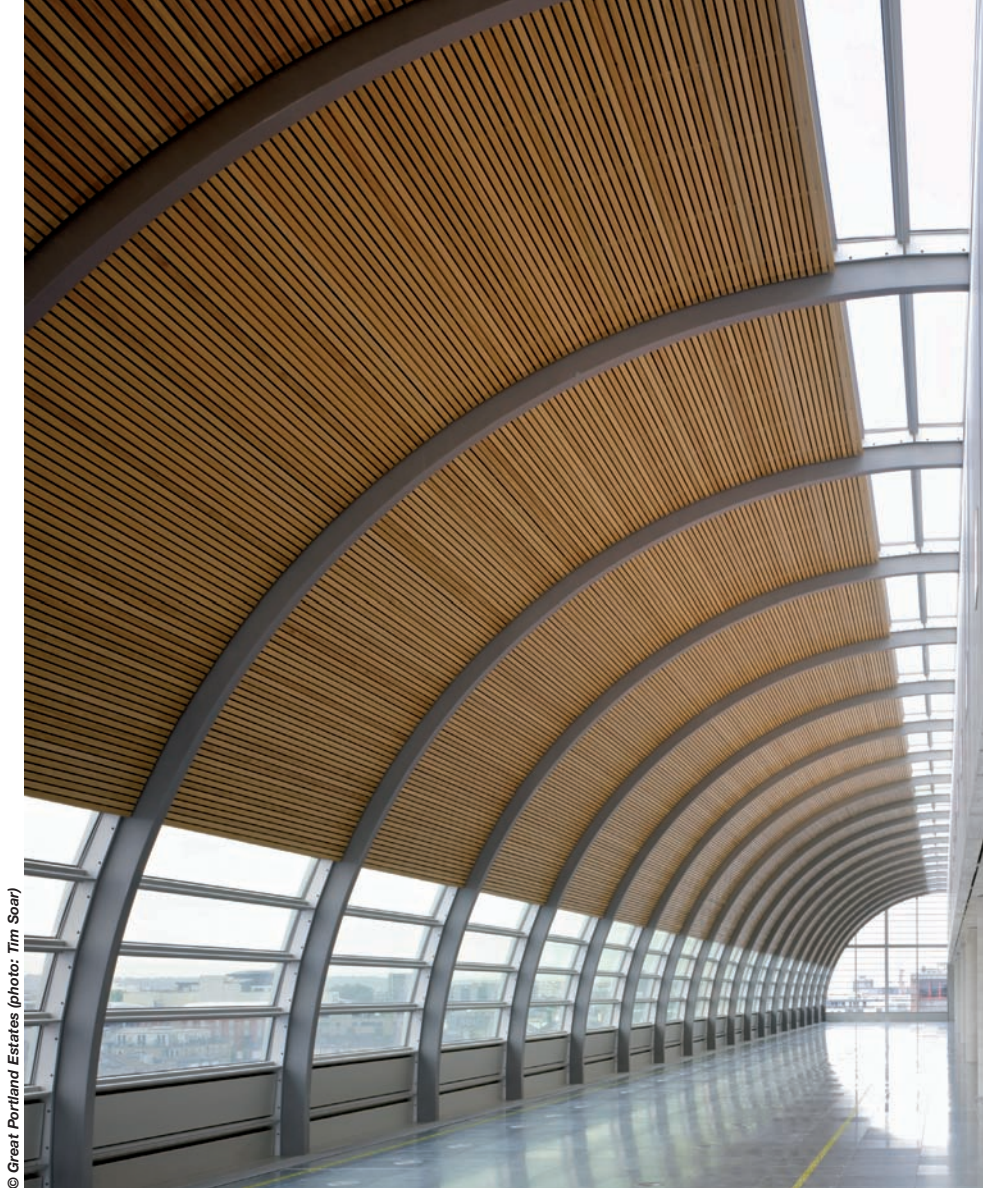
Typically, these specifications should include:

- limiting dimensions and volumes
- critical functional relationships
- service requirements
- cladding preference and thermal performance
- fire and acoustic performance
- logistic requirements
- requirements for finishes
- sustainability
- maintainability requirements
- relocatability.

The challenge for the industry

It is inevitable that the increased use of off-site solutions will provide additional challenges for construction professionals, particularly in those cases where off-site methods might be perceived to be competing directly with well-understood traditional construction methods. Techniques for measuring the cost of traditional construction methods are well understood, whereas it may well be that the cost and the project value of the corresponding off-site method may not be directly comparable. For example, what price do you put on a 'right first time' installation method, enhanced accuracy, a predictable construction programme, greater predictability of cost, simplified construction programme, etc?

Measuring comparative value is a big challenge and we are currently working with a number of industry organisations (such as BAA, Terrapin and Crown House Technologies) to consider developing



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80% of Tooley Street was fabricated off site. Right-first-time quality and integrated design and construction brought the project in at 20% below cost estimates

a tool to support a fair comparison between off-site solutions and traditional construction methods.

Getting the most value out of the off-site industry requires fresh thinking to deal with some of the barriers to innovative ways of working. For example, it is not helpful that there is often a substantial practical and contractual divide between the traditional processes of design and construction. Issues relating to accuracy, tolerances and technical detail may well be left to be sorted out on site, but these can lead to confusion and disruption with inevitable impacts on project programme and cost. It is also not very helpful that the supply side tends to operate as a strict hierarchy with the manufacturer or supplier at the bottom of the pile. That many clients are still content to accept the above as normal practice is an oddity that you would probably not find in any other industry.

Making a success of off-site construction is dependent on acquiring the necessary knowledge and skills, and developing the working relationships and mindsets that at this point in time are perhaps more familiar in the automotive or aerospace industries. This is clearly a big 'ask' for our industry but one that it must rise to if client and regulatory expectations are to be met.

Further information

Buildoffsite's *Your guide to specifying off-site manufacture: maximising value and minimising risk* is available for free from www.buildoffsite.com

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