access Construction

MODULAR AND OFF-SITE CONSTRUCTION

BUILDING THE FUTURE

PART 2

NEXT

LET'S TALK

REVIEW AND PREVIEW

Construction in general – housebuilding in particular – is in the middle of a major crisis.

The UK needs 300,000 new homes a year to begin to address its shortfall in housing but it is currently nowhere near.

The historically high demand for housing has pushed prices up to record levels, in terms of multiples of income. This has enabled housebuilders to paper over cracks in the system and continue to operate in traditional ways that are wasteful, inefficient and compromise quality and effectiveness.

As well as meeting demand for housing, the industry has to build in a different way. Regulatory requirements for high energy performance and the likely outlawing of conventional, fossil fuel powered boilers and central heating systems, mean that all sorts of buildings will have to be extremely energy efficient and capable of being comfortable while being heated by technology such as ground source and air source heat pumps.

Delivering such products at commercial scale and profitably will require a different way of building. Conventional methods will struggle to achieve it.

Off-site construction, manufactured housing or modular construction is the means to deliver the consistency, quality and performance required for the future, on commercial scale and profitably for companies involved.

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MODULAR CONSTRUCTION: WHAT IS IT?

Modular Construction, offsite construction, factory-built or modular building – it all means the same: construction carried out largely away from the site, in dedicated factories.

Part-built or fully-built homes, offices, factories, leisure, sporting and commercial premises are manufactured in factory environments and are then transported to site.

Bricks, concrete or breeze blocks, timber, roofing material, electrical, plumbing, heating and ventilation materials are all brought to the factory. They are assembled, in a scheduled order, in an environment that is much cleaner than a conventional building site. Scheduled construction and assembly means that it is never necessary to dig holes in completed walls to install HVAC or M&E.

Factory building is not new. The immediate aftermath of World War 2 saw a desperate need for homes to replace those destroyed; 'prefab homes' supplied the need for housing, quickly and efficiently. Their original life was set at 10 years but many lasted a lot longer. Their quality was not the best; a lot of lessons were learned at the time but it was to be a few decades before they could be applied, in volume.

Today's modular construction is a different game entirely. It is becoming synonymous with quality, highly energy efficient housing, and with buildings generally that move quickly from design to installation and occupation.

Modular construction has attracted some significant participants, including Ideal Homes and Premier Modular, which was originally established in 1956.

Homes England, the UK Government's housing delivery agency, has invested £30 million in Yorkshire-based startup company Ilke Homes, which is intended to be a step in the development of a new northern "Construction Corridor" Hub. Newcomer Legal & General Modular Homes, established by the financial services company of the same name in 2015, has a factory in Selby, N Yorkshire, that produces homes that exceed current Part L regulations by 70%, using air source heat pumps to achieve A-rated energy efficiency.

Catfoss and Premier Modular, which are based in East Yorkshire, offer a wide range of solutions, including modular wards for hospitals; commercial buildings; schools; and homes. Fast food restaurants are nearly all use offsite construction.

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Project Etopia, headquartered in London and with factories in Ellesmere Port, Cheshire, and Tiverton, Devon, produces houses that are capable of producing more energy than they consume. It has developments in Corby, Northants, and Wilburton, Cambridgeshire.

ModuleK Ltd makes modular buildings for customers in commercial, education, health, military and leisure sectors. The new Sir Jack Heyward Training Pavilion for Wolverhampton Wanderers FC, made up of 15 modules, was timed to mark its promotion to the English Premier League. The pavilion was delivered in time for the new season in August 2018. The cost of £1.7 million included groundworks, design, manufacture, delivery, installation, internal fit-out and service connections.

Yorkon Ltd, a subsidiary of Portakabin, has supplied a modular-built supermarket for Tesco on the Orkney Islands. The regular design of large retail facilities makes them ideal for modular construction. They require sophisticated heating and cooling; the essential infrastructure can be installed at the factory before delivery.

South East Water used precast concrete panels in its £22 million project to expand the Bray Keleher Water Treatment Works, near Maidenhead, Berkshire. Around 350 specially designed precast concrete panels were manufactured by Dutch company Kijlstra and imported from the Netherlands. They were brought to the site 'just in time' for installation, avoiding the need to provide space for storage – an important consideration, as access to the site was restricted and through a residential area. On-site construction time was cut dramatically; tanks that would require eight or nine weeks to build using conventional methods, including in-situ concrete mixing and pouring, were assembled in less than 10 days.

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MODULAR CONSTRUCTION: ADVANTAGES

The factory environment enables high quality and for building to tighter tolerances.

Materials, production time and build standards can all be monitored closely, which will lead to less rework and snagging. The need for better energy performance is driving innovations like intelligent homes, advanced insulation and alternative sources of energy for heating, lighting, ventilation and appliances. Novel ideas can be incorporated more quickly in the factory environment than in conventional building.

Industry surveys conducted or monitored by Grand View Research have found that modular construction offers savings in production time of 30% to 50%, compared with traditional models. Cost control and, consequently, profitability are greatly enhanced.

Modular construction makes commercial sense. As well as economies of scale, faster speed and improved quality control, rising level of interest is also being driven by concerns about workplace safety and the need for lower environment impacts. While the rate of fatal accidents on building sites has remained pretty much constant over recent decades, according to research organisation Markets & Markets, that failure to improve is itself unacceptable. The indoor production environment of modular construction is lower risk and can help to bring the industry in line with other sectors.

Bringing construction into a factory environment opens up opportunities to automate a range of activities, from bricklaying to roofing and including mechanical, electrical and plumbing.

Large companies not traditionally associated with construction, such as Legal & General, have been attracted to modular construction because of the more controllable production environment. The factory setting enables better management of product quality and cost of manufacture, as well as faster build times and better environmental performance. Companies are focusing on R&D initiatives related to the use of raw material, supply chain management, transportation and innovation.

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Factory construction takes place away from the building site. It reduces noise, dirt, pollution and traffic movements, which helps to take the aim of 'good neighbourliness' from aspiration to reality. It is a better way of constructing on restricted sites, greatly reducing the need for storage of materials and cutting the number of vehicles that need access.

Materials stored remotely, in permanent sites, can be stored more securely.

Factory-based construction enables the application of lessons from engineering and volume manufacturing. Advances in productivity based on Lean manufacturing ideas, bearing down on wasteful activities and implementing continuous improvement (kaizen), have re-energised sectors such as the auto industry and food and beverage, for example.

The factory environment facilitates the most effective application of Building Information Modelling, which uses IT in the design, construction, operation and maintenance of the built environment. Industries such as aerospace use "Digital Twins" to collect data that enables rapid improvement in design evolution. In the fulness of time, techniques such as generative design and artificial intelligence could be used to speed up design development and improvement.

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THE IT FACTOR

The old saying goes that "If you can't measure it, you can't manage it".

That is true but even more true is that "if you can't see it, how do you know what is going on?". Traditional building sites are, by definition, remote from centres of management. There is devolution of day-to-day control to the site manager but that devolution carries with it the reality that standard operating procedures are unlikely to be closely followed – where they are in place at all. Site operations are still dominated by paper-based systems, from spreadsheets to delivery notes.

Construction in the factory can extend the reach of IT into all aspects of construction, improving visibility and transparency across the supply chain. It is fair to talk of it as a production process because that is what modular construction becomes: a managed and controlled environment.

"You move from a site activity to a factory or warehouse to do that the actual construction work so the estimating tool plays a key part," says Carol Massay, Head of Construction at Access and previously CEO of ERP (enterprise resource planning IT program) specialist EasyBuild, which was acquired by Access Group in December 2020.

"The EasyBuild solution, the ERP, that brings the budget value of that piece of work into the system. Spending – labour costs, materials, subcontractors, overheads and plant – everything associated with the work, to building the modular components, is tracked within it," she explains. Financial reporting is also controlled and monitored by ERP, which makes management of profitability more visible and, thus, easier to maintain.

"Around the EasyBuild ERP are the mobile apps for recording when the goods turn up at the requested location, with the requisition app tracking order to delivery; the timesheet app recording work; all the key information is available, enabling you to maintain costs within the projected budget, the invoices are collected and billed electronically."

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The ERP graphical dashboard enables the capture of any point in time, live, which simplifies monitoring and management of project performance. They can be accessed via the Web so they can be seen from anywhere in the world. Directors hundreds of miles away can see if anything is going off-piste in terms of cost or value.

"When goods arrive on site, information can be readily captured and sent back to the Head Office system immediately," she continues. "It's streamlined, it ensures delivery of goods when they're needed."

In the modular environment, storage may be at a premium but reducing the inventory means less capital tied up in the warehouse. It enables better sequencing, so finished walls don't have to be taken out to fit M&E, for example.

Paperwork doesn't get lost because it's eliminated. Bills are more likely to be paid on time, which helps credit rating, and invoices issued more effectively and tracked more clearly. Building Information Modelling (BIM) gives architecture, engineering and construction functions the insight and tools to more efficiently plan, design, construct, and manage buildings and infrastructure, and to learn from the performance of assets in use.

IT makes the process visible from end to end.

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CHALLENGES

Modular construction is a great idea and clearly one whose time has come but building remains a traditional industry, especially further up the supply chain, in the smaller companies and sub-contractors. The culture is often based on connections and personal relationships.

These concerns are not unique to construction; every industry has gone through similar experiences, even theoretically advanced activities like nuclear power and aerospace; where is the room for the 'human touch'?

In fact, relationships can survive and flourish in the technological era. With less room for misunderstanding, connections become more robust and trust is strengthened.

There is also a fear of the cost of IT; how much will be needed to go from paper-based to computer-based working. The reality is that clearer billing and elimination of paper in favour of computerised records improves record-keeping and clarifies invoicing and payments.

The biggest cultural shift is a physical one: from the building site to the factory. Automation will inevitably lead to a degree of deskilling in some routine tasks – but it will also raise quality standards in bricklaying, roofing, M&E, plumbing and fit and finish. Factory-based construction enables skills in short supply to be concentrated and maintained where they are most needed.

Clients will, increasingly, demand evidence of more efficient ways of working from the contractor, during the estimating and prequalification process. The biggest challenge will be to those who will not embrace change.

Even the specialist subcontractors stand to gain from modularisation. They can shift emphasis, to become more component suppliers in the automotive industry, with clearer schedules of demand, more standardisation and greater understanding of need, as well as lower costs in always delivering to one place – the factory – rather than a disparate range of building sites.

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SUMMARY AND CONCLUSION

Whatever the circumstances, from infill and brownfield building in the UK's older cities to rapid corporate and commercial construction, conventional building methods are no longer up to it.

They are wasteful of materials, slow, difficult to supply in inner-city areas and have long-established and too easily accepted quality issues.

Modular construction is the future because it embraces technology to deliver both the core products and the ancillary services and reassurances that clients of all sizes require.

Factory-based construction companies better demonstrate that they:

- Have adopted and are meeting ISO/BS standards;
- Have effective 'track & trace' of materials – of particular concern in light of the Grenfell Tower disaster and subsequent scandal;
- Are working smarter, greener, more efficiently and faster;
- Deliver contracts on time, with either less involvement of 'variations' or clearer audit trail to support submissions – on both sides;
- Can deliver faster and more reliably, strengthening their case for 'preferred supplier' status, as well as improved credit terms.
- Have sound financial status, are profitable and thus reliable.

A 21st Century supply chain may make it easier for subcontractors to move further down the value chain and commission modular supplies direct from factories – as the rest of UK manufacturing already does.

Those companies prepared to embrace modern technologies and working methods will be those best placed to win work and market share.

They will embrace established information technology to monitor & manage better building, with proper sequencing, improved control of materials and supply, and more effective deployment and management of human resources.

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Access Construction adds up to a full service, comprehensive solution that will take your construction firm to the next level and help you better navigate the challenges facing your business today and tomorrow.

Why not see for yourself? Simply get in touch to book a demo or request a call from one of our construction software experts. We'd be delighted to discuss the best options for your business.

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