Offsite Construction

The offsite solution in the housebuilding offers a different approach to the traditional construction methods. Offsite prefabrication allows for more efficient project management and reduced project delivery times. Modular structures of buildings are built offsite in the factory what allows for better waste management, standard control and reduced site constraints.

The combination of modular construction with on-site construction work is a common approach for large buildings with repetitive structural elements. Offsite construction method can be used in projects with tight deadlines, on restricted site conditions or in projects that might be impacted by the adverse weather conditions or with repetitive structure's elements. Builders can increase the profitability of the project by choosing the appropriate construction method.

Evaluate the opportunities for offsite techniques in the construction project by analysing significant factors, drivers and constraints adequate for that particular project, for example:

- Cost certainty at an early stage
- Construction costs
- Costs of the construction process including design, procurement, construction, etc.
- More certain completion date
- Reduced time of design phase
- Reduced time of works on site
- Reduced overall time of the project realisation
- Quality of finish
- Procurement rules
- Site Restrictions- transport, materials handling, size, external parties, etc.
- Labour costs- availability and cost
- Level of quality and performance ability

What is the systematic approach to construction?

A systematic approach is the combination of traditional methods of building with offsite solutions. This approach optimises the building process and can be applied to whole buildings or elements only. The systematic approach offers advantages in terms of efficiency, cost and sustainability.

It allows for the quicker design process, less time on site and faster project commencement with more predictable completion dates. This is effective for buildings with repetitive structures like for instance

dormitories, barracks, hotels, offices. Modular elements are produced in a factory while constructions works on site allow for non-repetitive elements like stairways, electricity, lifts, etc.

When combining the two types of construction, the permanent modular portion consists of repeatable modules that are similar in design and layout. This is an effective method of construction to use for dormitories, barracks, hotel rooms, classrooms and offices, for example, because the rooms are very repeatable and they can be built in a factory one after the other with a lot of quality control. Site construction, on the other hand, allows for large open areas such as lobbies, gathering areas and common spaces. Within site built areas are elevators, mechanical rooms, electrical rooms, communication rooms, and stairways. These are spaces that are singular to the building and do not lend themselves as well to modular construction. By using the most suitable construction type for each application, builders can increase the economy of each type.

Advantages of systematic approach include:

- Quicker design process
- Faster realisation and earlier occupation
- Predictable completion dates - e.g. not weather dependent
- Easier to meet restricted availability of site - e.g. school holidays
- Cost certainty at an early stage
- Reduced abortive work and defects
- Reduced prelims and site overheads
- Better quality resulting in reduced maintenance costs
- Reduced construction time enabling earlier occupation

Offsite technologies

Offsite technologies widely used in the business include precast concrete, steel frame, timber, volumetric modular, PODs, MEP and modular, fitting components.

Precast concrete units including structural frame, columns, panels, beams, flat slabs, etc. can be manufactured at factory and pre-finished including services, windows, doors, etc. These units can also be finished externally to match the designed building external finish. Precast concrete gives guaranteed finish and may be used with in-situ concrete or structural steel as part of the building frame and is often used to build foundations.

The steel frame is particularly widely used in the range of buildings types including hybrid constructions. Structural panels are assembled from steel sections, and light steel framing is ideal for low and medium rise buildings. It can also be used in the range

of applications like roofing or walling. The alternative to steel or concrete is glulam. Glulam consists of glued layers of parallel timber laminates. It is widely used in the construction of supermarkets and swimming pools.

Another example of offsite technologies is structural insulated panels (SIPS) that are timber based with two layers - one of OSB or cement board and the second core of polyurethane PU or expanded polystyrene EPS. SIPS are commonly used in the variety of applications because they offer the high level of insulation.Timber studs, beams, walls and floors panels can be used for the timber frame of the building prefabricated offsite. Ready made panels can include windows, openings, service routes. Such panels are often called timber cassettes and are finished with OSB and plasterboard. Walls, floors and roofing can be constructed with the cross-laminated timber- CLT panels. CLT panels are timber boards glued together, prefabricated offsite to accurate dimensions.

Prefabricated modular units can be assembled or linked together on site to complete the building structure. All interior finishes and building services are pre-installed while the external façade, claddings and roofs are usually installed onsite. Bathrooms, shower rooms, kitchens, utility cupboards, wet rooms can be mounted as pods during the building assembly on site. Prefabricated panels have all services like plumbing or electricity installed in the ceiling, walls, under the floor or in service risers. These are ready for connection onsite. All fasteners, fixtures, adhesives, seals, etc. are used to finish the assembly of panels. Volumetric modular units are used for commercial offices, public buildings, hotels, airports, sports stadiums, hospitals, universities and schools.

Skills required for offsite construction

Offsite construction techniques like offsite prefabrication and pre-assembly techniques has increased in recent years, however still accounts for only 10% of industry output. The report "Faster, Smarter, More Efficient Skills for Offsite Construction" by Construction Industry Training Board (CITB) has shown that the offsite construction could change the construction industry and provide a solution to the UK housing shortage. According to the report 42% of construction industry employers with over 100 staff expect to use offsite methods in five years' time.The offsite-specific construction materials and products, 100% said they expected the use of precast concrete panels to increase; 91% anticipated the use of precast concrete frame to rise.

The industry expert Mark Farmer's recommended in the government-backed review of UK construction and reveals that nearly 50% of construction industry clients expect the use of offsite construction to increase over the next five years.

Offsite processes save time and money and can improve quality through pre-fabrication of components – from panels to fully fitted rooms.

Mark Farmer said about the report: "This report comes at a crucial time for the construction industry. The urgency for modernisation has never been greater, set against an insidious backdrop of an ageing workforce and increasing concerns about the impact of Brexit. "Any strategic shift towards pre-manufacturing and offsite construction creates an immediate requirement to define our future skills needs through collaboration between industry, educators, training providers and government.

"This is crucial to ensuring we can transition to a higher productivity, digitally enabled industry which inherently attracts more of the young talent we so desperately need. It should also set out clear opportunities for the existing construction workforce and indeed workers from other industries to reskill through a new family of career pathways.

"I welcome this report from the CITB and hope it adds to the current growing momentum for industry change."

Steve Radley, Director of Policy at CITB, said: "There is massive potential for offsite construction. The Government recently announced an additional £1.4bn of funding for affordable homes, with an increase in offsite construction set as an objective, representing a clear opportunity for growth in this area. That's why CITB has set out a clear strategy within this report to show how we're going to work closely with industry over the next five years to push the offsite agenda forward.

"The greatest potential currently lies within the housing and commercial sectors, where mass customisation can create the buildings we need more quickly and to higher standards. There are also opportunities to bring the benefits of offsite to large-scale infrastructure projects – some high profile examples include HS2 and Hinkley Point, which are already using offsite techniques."

The report outlines six key skills areas related to offsite construction: digital design, estimating, offsite manufacturing, logistics, site management and onsite assembly.

Steve Radley added: "Successful offsite management hinges on the effective integration of both onsite and offsite functions – and this requires a comprehensive understanding of both aspects. Our next steps will focus on the delivery of the required employer training, knowledge and soft skills, tailored specifically to the six key areas identified in the report. This will also include a review of the available training and qualifications to make sure we address any gaps and issues. "We will also work with other stakeholders – such as in design and manufacturing – to apply existing training in a construction context. We will step up our promotion of the career opportunities offsite can offer, emphasising digital skills, to attract a wider pool of people into these key roles."

To read the full report and CITB recommendations for the delivery of offsite training visit: https://www.citb.co.uk/research/research-reports/offsite-construction-report