Off-Site Production

Who should read this fact sheet?

This fact sheet is designed to provide construction clients and designers with an awareness of the benefits of using off-site production more widely in construction. It outlines the different levels of approach to each technique and details where to obtain more comprehensive guidance.

What is off-site production?

Off-site production is not a new concept. Both techniques have been used increasingly in construction, as a means of improving quality and increasing efficiency. Despite this trend there are still many construction projects which fail to benefit because neither the client nor the design team consider the techniques at an early enough stage.

The Reading Construction Forum's report *Value for Money - helping the UK afford the buildings it likes* identified the following findings in a survey of the construction industry:

- a high incidence of one-off component use within the construction industry,
- with at least half of all components being unique,
- and the remaining components repeatedly used only between two and six times on average.

Why off-site production?

There is a recognised desire for creativity and uniqueness in UK construction, a desire that need not be jeopardised in the pursuit of increased value for money. Off-site production and uniqueness in construction are not incompatible and the use of standard products does not limit the scope for design innovation.

The main benefits from using more off-site production on a project are:

- improved predictability resulting from more reliable call-off of products and components, and shorter lead times
- improved product reliability
- improved quality
- increased efficiency
- improvements to systems/processes
- lower costs
- increased social and environmental benefits (reduced waste, more scope for recycling materials)
- ease of maintenance

Off-site production is by no means appropriate across the whole of the industry, for all elements of a particular construction, or for all projects. Both the nature of the work, the size of the project and individual elements, will dictate whether preassembly is appropriate. Off-site production requires more time and effort to be applied at the beginning of a project but can help ensure higher quality standards and reduced on site construction time.

The main benefits from preassembly are:

- enhanced quality
- lower costs
- increased efficiency and speed
- improved predictability
- increased social and environmental benefits (safer and healthier working environment)
- ease of maintenance and replacement

The maximum benefits arise when standardisation and preassembly techniques are applied together.

When and how to use off-site production?

Both the client and the project team should systematically examine the opportunities for introducing more off-site production into a project in the very early stages (inception, concept design and scheme design). Once scheme designs have been completed, there is limited value in investigating new options since this is likely to cause disruption and have limited benefit.

In the early stages each of the following aspects should be considered:

- Standard frameworks or conventions for geometric fit
- Standard solutions or methods (details, forms of construction or process)
- Standard components
- Project-specific standard
- Preassembled components or modules whether on or off-site preassembly

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What forms do off-site production take?

Standardisation is the extensive use of components, methods or processes in which there is regularity, repetition and a background of successful practice. There are different levels of and types of standardisation:

- **Generic standardisation** - where an element or process is by its nature standard and is usually recognised as such worldwide. E.g. steel, concrete, cement or plaster. International standards (ISO etc.) seek to rationalise standards internationally.
- **National standardisation** - where some items are standard for a country or group of countries, such as the European Union. The dimensions of a household brick would be an example of national standardisation. National standards (BSI etc) seek to rationalise such items or processes into standards that are practices throughout the country.
- **Client standardisation** - where a particular client defines certain elements, processes or procedures in their business.
- **Supplier standardisation** - where a supplier, or in some cases a whole product or materials sector, stipulates that certain components, sub-assemblies, or even whole products are standard.
- **Project standardisation** - where a project team will decide to standardise certain procedures or building elements. For example, Quality Assurance procedures, column sizes, dimensional grids or module sizes.

Preassembly is the manufacture and assembly of buildings or parts of a construction ahead of the time that they would traditionally be constructed on site. There are different types of preassembly:

- **Preassembled components and sub-assemblies** - items in every-day use such as windows are actually preassembled components which in turn are installed on-site into other elements that may, or may not, include their own sub-assemblies.
- **Non-volumetric preassembly** - Non-volumetric preassembly includes cladding panels, building services ductwork, precast concrete bridge sections, structural steelwork trusses etc. They are all preassembled, but non-volumetric, in that they do not enclose usable space. They are also all items that the project team must choose to preassemble in preference to in situ construction.
- **Volumetric preassembly/modularisation** - This is a particular form of preassembly, which produces a complete volumetric unit, usually fully fitted out before it is placed in its final position in the building. Often units such as bathrooms, plant rooms, lift shafts or services risers are installed within buildings, but do not themselves form the building structure or fabric.
- **Modular building** - This is when the whole building comprises a number of volumetric units, although there may be additional on-site works (such as an external brick skin, or tiled roof).

Case Study 1: Second Severn Crossing

The Second Severn Crossing is a good example of both preassembly and standardisation. the project team made decisions to standardise precast elements and spans and to design some elements to optimise the use of some of the heavy lifting equipment that had already been procured for other lifts on the project.

As part of the debrief of the project the Laing team considered that even more standardisation would have benefited the project. For example, the wall thicknesses and dimensions of some of the support piers were different, due to the different loading conditions. Whilst the decision to make some piers smaller may have seemed logical from the engineering design view, the team consider that in practice the savings that would have accrued from using the same formwork, moulds etc. would have outweighed the costs of the extra concrete and reinforcement.

Case Study 2: Product Standardisation Reduces Client Costs

Waterloo Air Management, manufacturer of ventilating and air conditioning products made a strategic decision to invest in the development and production of a range of standard injection moulded grilles and diffusers.

When these were installed as part of a major British Telecom construction project in Leeds the installed costs were calculated to be 30% lower than the equivalent range of aluminium grills and diffusers. Both the lower product cost and the ease of installation contributed to this major customer benefit.

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