Glossary of Terms

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**Introduction to offsite**

Offsite is a term used to describe the spectrum of applications where buildings, structures or parts thereof are manufactured and assembled remote from the building site prior to installation in their final position. In other words, moving operations that are traditionally done on site into a manufacturing environment. The offsite spectrum is extensive and, currently, the sector is diverse and fragmented.

Various reports have been produced for the different sectors, in particular residential. However, when considered across all construction sectors, many different terms are used to describe the offsite process or offsite applications – hence the need for this glossary.

To maximise the benefits from offsite it is essential to adopt a manufacturing rather than a construction process. Ad hoc application of offsite technologies will only bring limited benefits.

**Benefits of Offsite**

**Time**
Time is the ‘big-win’ for offsite. Benefits include:
- Shorter time on site
- Predictable completion dates because not weather dependant
- Easier to meet restricted access time to site: e.g. school holidays, airport “closed” time

**Cost**
Cost is often seen as the down-side of offsite. Initial elemental costs may be more expensive, but savings from offsite benefits should be considered, such as:
- Cost certainty and reduced risk
- Reduced abortive work and defects
- Reduced prelims and site overheads
- Better quality therefore reduced maintainence etc.
- Reduced construction time can also result in cost benefit from earlier occupation
- Minimising overall life cycle costs

**Quality**
Offsite will not magically transform poor design. But, if designed and executed correctly, it will:
- Consistently achieve predetermined quality in a factory controlled environment
- Reduce damage from handling and storage on site
- Ensure no damage from follow on trades by using sealed volumetric and modular units

**Health and Safety**
By moving the work offsite, you are removing or reducing many of the hazards:
- Fewer personnel on site reduces H&S risk
- Offsite reduces work at height
- H&S is easier to control in a factory
- Manufacturing sector is six times safer than construction

**Sustainability**
Quite simply, it is easier to reduce the environmental impact of work in a factory than it is on a construction site:
- Less waste
- Less packaging
- Reduced environmental impact during the construction process
- Less impact on surrounding area
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Site Issues
These will play a part in all construction projects:

- Less work on site with offsite equals less noise, dust, mud and disruption
- Offsite limits site operation in live working environments
- Offsite needs less site storage space
- Offsite requires fewer deliveries

Offsite Categories

Offsite applications can be categorised in a number of different ways, for example:

- Materials
- Technologies
- Market sector
- Extent of preassembly

A useful generic categorisation\(^1\) considers the spectrum in terms of the following:

1. **Component subassembly**
   - Relatively small scale items that are invariably assembled offsite
     - e.g. light fittings, windows, door furniture

2. **Non-volumetric preassembly**
   - A large category covering items where the designer has chosen to assemble in a factory prior to installation
   - Units do not enclose usable space
   - Applications may be skeletal, planar or complex
     - e.g. panel systems, cladding panels; above ceiling service modules

3. **Volumetric preassembly**
   - Units that enclose usable space and are then installed within or onto a building or structure
   - Typically fully finished internally
     - e.g. toilet/bathroom pods; plantrooms

4. **Complete buildings**
   - Units that enclose usable space and actually form part of the completed building or structure (units may or may not incorporate modular coordinated dimensions)
   - Typically fully factory finished internally (and possibly also externally)
     - e.g. edge of town hotel or restaurant facilities, multi-residence housing

This spectrum is useful in identifying the increasing impact of the chosen solution on the project process.

It is important to recognise that offsite applications should be considered for each project. It is simplistic to assume that level 4 will always be the best solution for all projects, although it clearly offers the greatest extent of offsite.

Currently the offsite sector is both disparate and diverse, some technologies are considerably mature (e.g. structural steelwork or precast concrete) and some technologies are only suitable for certain application sectors (e.g. SIPs panels are designed for low-medium rise residential applications.

Also, a particular project may benefit from a number of different offsite applications (e.g. structural frame, cladding units, multi-service modules and volumetric toilet pods. The key issue in this case is the design and management of the interfaces between systems.

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\(^1\) Gibb, Loughborough University
As mentioned earlier, offsite is applied across all construction sectors and both terminology and categorisation will vary between sectors. The diagram on page 5 shows how the categories used in different sectors compare. Examples are given for illustration only. Precise allocation of systems and technologies into the different sector specific categories should be checked with the appropriate organisation (eg the Housing Corporation for residential MMC categories).

**Extent of Offsite**

Further to the preassembly categorisation, it is helpful to delineate the extent of offsite completion within each category in addition to the basic structure of the unit itself. This can be done using a star system\(^2\) as follows:

- ⭐ One star – no significant internal or external finishes applied in the factory
- ⭐⭐ Two stars – either internal or external finishes applied in the factory
- ⭐⭐⭐ Three stars – both internal and external finishes applied in the factory

The extent of offsite on a particular project can be measured in a number of ways, for example by establishing the out-turn cost of the work completed offsite compared to the work completed onsite, or by comparing the extent of offsite and on-site labour. This will then show the three star applications as having significantly greater extent of offsite than the one star. Buildoffsite encourages the maximum completion of finishes in a factory environment that is appropriate given the application.

\(^2\) Gibb, Loughborough University
Introduction to buildoffsite

What is buildoffsite?

An industry-wide campaigning organisation that promotes greater uptake of offsite techniques by UK construction.

Buildoffsite is an alliance of clients, developers, contractors, manufacturers, suppliers, government, advisors and researchers.

Who are buildoffsite?

Organisations already committed to buildoffsite cover the full industry spectrum.

They are successful now but see the benefits that can come from a much wider application of offsite throughout the UK construction industry.

Why does buildoffsite exist?

The challenges facing UK construction are well known. A combination of growing demand with poor quality and low productivity has created a dilemma that will not be resolved without a ‘step change’ in construction techniques and processes and, in particular, the use of offsite.

What does buildoffsite want?

Offsite has long been seen as a potential solution to the challenges facing construction but, to date, the uptake has been limited. Exemplars exist but critical mass for offsite has not been achieved.

What is needed is a step-increase in offsite, leading to tangible increased quality and productivity with a consequent reduction in true unit cost.

For the benefits of offsite to be more widely understood and applied, the challenge is to create the mechanism to enable the offsite industry to make its case more effectively by building awareness, informing, enthusing, and setting standards.

The DTI is supporting this first phase of the project to deliver the critical mass of stakeholders in offsite – clients, manufacturers, contractors, constructors – to identify and initiate priority actions. This is the first step in bringing offsite into the mainstream.

Buildoffsite’s ambition is to achieve a ten-fold increase in the uptake of offsite.

What does buildoffsite do?

Buildoffsite champions better construction by acting as a catalyst to the use of offsite.

It is the authoritative voice of the offsite industry.
It will carry out a number of specific activities for offsite:

- speak for the industry to all stakeholders
- demonstrate the business case
- set standards for the design, manufacture, and construction process
- resolving interfaces
- provide an independent, authoritative source of data
- provide a forum for discussion of the benefits and challenges
- inform and educate construction industry professionals

For more information on buildoffsite:
e-mail info@buildoffsite.co.uk

Introduction to the offsite glossary

This glossary describes commonly used terms for various offsite applications to aid understanding of those who wish to use offsite applications. These have been listed in alphabetical order along with a brief description. Where a number of terms relate to a generic item they have been grouped together (e.g. pods). Some terms relate to offsite as a whole and some to particular applications with different materials, technologies or market sectors.

The reader should note that, unfortunately, many people use these terms outside of their precise definition. Therefore, it is essential that a full understanding is gained prior to making assumptions on what people call particular products, systems or approaches.

Certain sectors require a particularly precise use of these terms, for instance, social housing applications must comply with the Housing Corporation's definitions (See 'M' – Modern Methods of Construction).

Whilst Buildoffsite is promoting a step increase in the uptake of offsite, they do not recommend any particular technology or approach in preference to any other. The editors and buildoffsite do not imply any approval of products, systems or processes described in this glossary.

Sources for glossary terms and acknowledgements are listed at the end of this document.
A

Advanced Panel Timber Frame
See ‘Frames’

Aesthetics
Offsite has historically been accused of producing poor aesthetic design. However, there are many examples that belie that accusation.

Delight from an aesthetic and performance perspective is a matter of design quality. Using an offsite process facilitates making an excellent design into an excellent end-product.
Air Handling Unit (Pre-wired) (AHU)
Packaged air handling unit fully tested, pre-wired packaged unit complete with integral refrigeration components and controls.

Bathroom Pod
See Pod

Beam and Block Floor
Extruded or wetcast prestressed beams between 150 and 225mm deep, spaced to suit the applied loading and spans, together with blocks of various types. These may be purpose-made blocks with rebates to suit the shape of the beams (‘tray blocks’) or may be standard concrete masonry blocks which have been tested and certified for use in floors. Also commonly used are specially shaped extruded or expanded polystyrene blocks which provide a high degree of insulation for ground floors.

Beam and Column Frame
See Frame

Brick Slips
Commonly used on offsite manufactured external walls to replicate the appearance of conventional brickwork. Brick slips are generally 20mm thick compared to a 100mm standard brick. The slips are generally glue fixed to the metal or plastic frame of an external wall panel.
Building Module
Self-contained volumetric element of building, typically room-sized, that has its own superstructure and is manufactured offsite. It is attached to or placed inside the main building structure and is typically used to house plant and services, washrooms and for similar relatively complex purposes. Alternative term for ‘pod’ but also sometimes used to describe units that make up the whole building. See also: Box Construction, Jack Leg Buildings, Modular Construction, Modular Volumetric Systems, Portable Buildings, Portable Accommodation, Prefabricated Buildings and Volumetric Building Modules.

Buildoffsite
An alliance of clients, developers, contractors, manufacturers, suppliers, government, advisors and researchers forming an industry-wide campaigning organisation that promotes greater uptake of offsite techniques by UK construction.

Building Services Offsite Applications
The use of offsite for Building Services is currently one of the under-used applications. For more information see: Air Handling Unit; Cable Containment; Ceiling Void Module; Chiller Beam Assembly; Combined and Single Service Horizontal Rack; Condensing Unit; Dressed Product; Heating Pod; Heavy-Duty Services Module; Integrated Plumbing System IPS; Light and Air Diffuser; Modular Wiring; Multi-Purpose Riser; Plant Room Module; Pod; Skids; Valve Assembly; Wiring Loom.

Building System
Any pre-engineered method of building that has a pre-defined scope and configuration limits. Building systems can be volumetric, panel, stick build or hybrid. Also see System
Cable Containment (Preassembled)
Cable system incorporating preassembled bracketry. Brackets supplied complete with preassembled spring nuts and bolts. Systems vary and can include:
- both bolted and welded forms
- trapezes and other non-standard bracketry
- fixing rails, cantilever arms and various accessories.

Ceiling Void Modules
See ‘Combined and Single Service Horizontal Racks’

Chiller Beam Assembly
The ventilated cooled beam is a complete cooling, heating and ventilation system in one monoblock unit. It is suitable for many types of applications design but is most commonly used for offices.

Chimney (Prefabricated)
The factory production of chimneys (mainly for residential projects). Insitu chimneys are particular problem areas for consistency of quality for example in terms of insulation.

Closed Panel Systems
See System or Panel

Combined Pod
Follows a typical bathroom pod technique, but combines a factory-finished bathroom with a pre-serviced kitchen, airing cupboard/hot water cylinder or boiler plant with BMS etc. This is not a well known or well used option but there are some examples where approach has been considered at the design stage.
Also see Pods

Combined and Single Service Horizontal Rack (also called Ceiling Void Module)
Integrated ductwork with pipe work and cable management support trays into a multi-services module mounted in the ceiling or under the floor. Usually constructed as an open frame structure, which reduces the overall weight of each section. Horizontal distribution has been in use for a number of years, but more recently mechanical ducting or pipework systems / modules are often combined with electrical service distribution. Often ‘supply and fit’, these systems are fully manufactured offsite in factory conditions. Whilst the pipework or ducting can be tested in the factory the system once connected must be system-tested and commissioned on-site. Modules should be constructed to give ease of access in the long term. Examples have shown that two operatives can install over 90m of pipework and over 45m of cabling support in one day.
Component
A term used loosely for items that are manufactured offsite and then assembled together with other components. If this is done offsite then the product is defined as a whole. If this is done on site then it falls into Loughborough's Level 1. Careful design of components and their interfaces is crucial for effective manufacture and assembly.

Composite Construction
A generic term covering a wide variety of construction techniques, particularly where two different materials are used in combination to fulfil a specific function. For example: composite floor slabs can comprise insitu concrete with profiled metal decking, which acts as structural reinforcement. These slabs are supported on hot-rolled steel beams. The beams are also often composite themselves, using shear connectors (normally welded headed studs) to achieve structural interaction with the slab. This form of construction is extremely structurally efficient with good spanning capability. Composite construction can also use precast concrete slabs with a composite structural screed.

Composite construction is sometimes called ‘Hybrid Construction’.

Concrete Tunnel Form
Tunnel Form is a on-site construction method utilising insitu concrete poured into two half-tunnel forms that together form the walls and ceiling of a room producing a monolithic structure. When this process is repeated, generally on a 24hr cycle, residential units can be created with great rapidity. This fast-track method of construction is suitable for repetitive cellular projects, such as hotels, apartment blocks and student accommodation. It is not part of the offsite spectrum, but it is classified as a Modern Method of Construction (MMC).

Condensing Unit (Preassembled)
Part of a refrigerating mechanism which pumps vaporized refrigerant from the evaporator, compresses it, liquefies it in the condenser and returns it to the refrigerant control. Preassembled condensing units have components factory mounted to ensure minimum on-site installation. Units leave the factory with lines pre-charged ready to install with quick connect fittings. Control panels are factory pre-wired with a single connection point.

Configuration
Interrelated functional and physical characteristics of a product defined in product configuration information.

Configuration Item
An entity within a configuration

Configuration Management
Coordinated activities to direct and control a configuration (see BSI/ISO 10007 Quality Management Systems – Guidelines for configuration management).

Cross Wall Construction
Multi-storey structure where the walls are designed as the means of primary support. Longitudinal stability is achieved by external wall panels and/or diaphragm action involving the floors and roof, connected back to lift cores or staircases, which may also be formed by precast wall panels or shaft units.
**Domestic Energy Centre**
modular unit to satisfy the complete hot and cold water and electrical requirements for an apartment; gas or electrical heating

**Dressed Product (Preassembled)**
A generic term applying to factory preassembled products (usually building services) that would otherwise be assembled on site. A typical example is a hand basin fitted with taps and waste.

**DFMA / DFM / DFA**
Abbreviations for:
Design for Manufacture and Assembly
Design for Manufacture – tends to simplify components
Design for Assembly – tends to reduce the number of components (as risks increase in complexity)

**Element**
Part of a building or structure which could be considered for standardisation and offsite production such as foundations, structural frame, envelope, services, internals and modular units.

**Elemental Cost Evaluation**
Elemental cost evaluation or analysis (as typically used in construction via Standard Methods of Measurement) will tend to overlook many of the benefits available from offsite.
Envelope

The external walls and roof that form the perimeter or enclosure of a building. Walling may include: lightweight curtain walling, in aluminium, steel or glass, or heavyweight components in concrete, brick or stone. Roofing includes flat or pitched roofs. The extent of offsite manufacture will vary between systems: e.g. for curtain walls:

- Stick system – components all assembled on site
- Unitised – components preassembled offsite into storey height, ~1m wide panels
- Panellised - components preassembled offsite into storey height, bay-width panels

Factory – Engineered Concrete (FEC)

Applies to precast concrete elements of a structure. This includes wall and floor elements, ceilings, staircases. Columns and beams. FEC elements can also include building service containment routes, window and door openings and possibly thermal insulation.

Fast Build Concrete Retaining Wall

Freestanding units of pre-cast reinforced concrete, designed to provide efficient and versatile bulk storage and temporary or permanent earth retaining.
Field Factory
A factory facility set up adjacent to the construction site, usually to reduce the need for long-distance transportation of preassembled products – particularly relevant for large scale, often civil engineering or infrastructure projects such as airports or bridges.

FMEA (Failure Modes and Effect Analysis)
Failure Modes and Effect Analysis – a design tool used in product development and therefore sometimes in offsite. Similar to project risk management but applied to products.

Flat Pack
Prefabricated elements or systems that are transported to site as 2D elements, rather than in 3D ‘volumetric’ form (see definition of volumetric in the introduction to this glossary). These can be used where volumetric options are not feasible.

Floor Cassette
A factory-manufactured panel comprising a series of floor joists joined together with trimmers or end-joists to form a load-bearing element of floor construction. Generally used for residential or low to medium-rise buildings. Generally steel or timber.

Flat Slab
Whilst not part of the offsite spectrum, flat slabs are included in the Concrete Centre’s definition of ‘Modern Methods’ (MMC). Flat slabs are built quicker than traditional methods due to modern formwork being simplified and minimised and a combination of early striking and flying formwork systems. Use of prefabricated services can be maximised because of the uninterrupted service zones beneath the floor slab and there are no restrictions on the positioning of horizontal services and partitions.
Foundation (Fast Track)
Precast concrete systems can be used to rapidly construct foundations. The elements are usually to a bespoke design and cast in a factory environment. The foundations are often supported by concrete piles and connected together. These systems improve productivity, especially in adverse weather conditions, and reduce the amount of excavation required – particularly advantageous when dealing with contaminated ground.

Offsite foundation techniques also include steel mini piles and helical screw piles

Frame and Framing Systems
The term frame typically refers to the structure of a building and may be constructed from a number of different materials. The term may also be used to describe the supporting structure for a pod or other volumetric unit.

This section includes descriptions for a number of terms related to frames and framing

Light Gauge Steel Frame (LGSF)
Light Steel Frame (LSF)
Structural panels assembled from cold formed galvanised steel sections. They are normally factory assembled but field factories can be utilised. Light steel framing is typically used for the primary structure of housing and low to medium rise buildings of 2 to 4 storeys. For taller buildings it can be complemented by the use of hot-rolled members at key locations.
Open (Cell) Panel Timber Frame
Structural timber panels forming the inner load-bearing leaf of the cavity wall which are manufactured in factory conditions and brought to site and fixed together to form a rigid load-bearing superstructure. These consist of timber studs and beams, stiffened on one side with wood-based panels, such as oriented strand board, or plasterboard. The lining of the second side of the building component, and the application of insulation and other features, usually happens on site. Open cell timber frame is currently the conventional form of timber frame in the UK and is often just referred to as ‘timber frame’.

Advanced Panel Timber Frame
This generic term covers the latest developments in conventional panellised timber frame. Advanced panel timber frame is a factory-manufactured timber-stud-constructed frame with sheathing in the conventional timber-frame manner. Manufacturers are now beginning to fit rigid insulation between the studs and pre-finished windows and external doors in the panel prior to dispatch to site.

Frame mounted
Term used to describe units mounted on a frame or other supporting structure, used either for transportation, final support or both.
**Glossary of Terms**

**Precast Concrete Frame**
Structural frame using precast concrete columns and beams, and/or panels. These may be factory finished internally or externally and may remain exposed in the final building. The extent of on-site work may vary significantly between projects. Members may be single columns or beams with factory-made connections, or the members may be preassembled into larger sections, either offsite or at low level adjacent to the works. Precast concrete may be used together with insitu concrete or structural steel as part of a hybrid frame.

**Steel Frame Building Systems**
Building systems that use steel as the primary structural material. In domestic scale construction they are generally formed from light steel framing.

For larger buildings hot rolled sections are used in pre-engineered buildings. Typically, such frames need site-applied finishes although fire protection may be applied in the factory and in certain circumstances exposed columns may appear in the final building. Members may be single columns or beams with factory-made connections, or the members may be preassembled into larger sections, either offsite or at low level adjacent to the works. Structural steel may be used together with insitu or precast concrete as part of a hybrid frame.

**Glued Masonry Panels**
Currently rarely used technique comprising panels of lightweight concrete blocks with glued joints fabricated offsite and crane lifted into position on site.

**Heating Pod**
A “mini-plant room”, typically fully commissioned and “ready to go”, with modular boiler plant. The smaller units can be wall mounted, whereas the larger units are rig or floor mounted.
*Also see Pod*
**Heavy Duty Services Module**
Volumetric services preassembly for vertical risers or horizontal distribution. They may contain pipework, ductwork and electrical elements.

**Hollowcore Floor**
Prestressed, precast concrete slab units that derive their name from the voids or cores which run through the units. The cores can function as service ducts and significantly reduce the self-weight of the slabs, maximising structural efficiency. Units are generally available in standard 1200mm widths and in depths from 110 to 400mm.

**Hot Rolled Steel**
Hot rolled steel is used in the form of I beams, channels, angles and plate. The elements are fabricated in the factory with attachments and connections for ease of site erection. Additionally offsite processes provide facilities for services and add fire protection.

**Hybrid**
A term describing something that is a combination of more than one discrete system or material. This term, in the context of offsite should not be confused with its use to describe the combination of structural steel and concrete in the frame of a building or structure.

**Hybrid Building System**
A combination of volumetric and panellised systems where the high value areas (kitchen and bathroom) are typically formed from volumetric units (sometimes referred to as pods) and the rest of the structure formed from some form of framing system (also known as ‘Semi-Volumetric’)

**Hybrid Concrete Construction (HCC)**
HCC combines precast and cast in-situ construction.

**Industrialised Building**
A lesser used term for offsite in the UK but which is more common internationally.

**Insulated Concrete Formwork (ICF)**
An onsite innovation, sometimes known as Permanent Insulated Concrete formwork (PIF), ICF is a building system made from inter-locking hollow polystyrene elements which act as permanent formwork as well as permanent insulation. In-situ concrete is then poured into the polystyrene formwork.
**Integrated Plumbing System - IPS**
Wash hand basins, urinals, lavatories assembled offsite into 'units' with range of backboards, taps etc. Most units would be designed to be removed and replaced with new units once they had reached the end of their serviceable life.

**Interchangeability**
The principle that, to be effective, a standard component must be able to be interchanged for another. This pre-supposes detailed understanding and rigorous control of the interfaces and connections between components. The interfaces must, above all, be predictable. This issue becomes even more important when these components are preassembled remote from the project-site.

**Interface**
Place of connection, or interrelationship, of components, elements or organisations.

**Jack Leg Building**
A volumetric building, with steel legs that can be adjusted to suit uneven ground. Lifted into place by crane, the cabins can be stacked on top of each other and are typically used for temporary site accommodation.
*See also Portable Buildings*

**Kitchen Pod**
*See 'Pod'*

**Lattice Girder Floor**
Sometimes referred to as 'plate flooring', lattice girder units are also intended to be used compositely with a structural topping. Units are 2400 wide and from 65 to 200 deep. The reinforcement lattices which project from the surface of the units as delivered are used to fix reinforcement for the insitu concrete topping which is generally between 75 and 100 deep.
Lift Shaft (Prefabricated)
Lift shafts, as containment for lifts and sometimes also bracing for structural frames, manufactured offsite, often in precast concrete but also in steel.

Costain

Light and Air Diffuser (Preassembled)
Multi-service luminaries’ section incorporating lighting, smoke detectors, sprinkler heads, PIR detectors, loud speakers and acoustic dampers.

Light Gauge Steel Frame (LGSF)
Light Steel Frame (LSF)
See Frame

Mass Customisation
The benefits of mass production are creatively combined with systems that offer greater choice for the individual customer, improved control of the total construction process, and flexibility of assembly options.

Mass Production
The production of a large number of identical or very similar components in order to realise the benefits of economies of scale. This term was used commonly in the 1950’s and ‘60’s but is rarely used now with respect to offsite.

Modern Methods of Construction (MMC)
Term recently adopted by the Housing Corporation and the ODPM (Office of the Deputy Prime Minister) as a collective description for both offsite-based construction technologies and innovative on-site technologies. The latter includes techniques such as thin-joint blockwork and tunnel-form construction. For further information see Housing Corporation MMC categories below. The term is also used more broadly outside social housing.

Because of the special nature of affordable housing it is important to note that the Housing Corporation definitions and categories should be used when working in this sector.

The House Builders Federation defines MMC as methods which provide an efficient product management process to provide more products of better quality in less time. It can be classified in various ways and may involve key services e.g. plumbing, key items e.g. foundations, inner shell, walls etc, external walls, or any combination of these elements. It can also be classified by material (timber, steel, concrete and masonry).
Housing Corporation MMC Categories

In order to record the homes that are produced using modern methods of construction, Housing associations are required to assign a “build category” to schemes at key stages in the processing route. For more information contact the Housing Corporation (HC). The following are the categories and their definitions.

**Modern Methods of Construction (MMC)**

MMC is a broad category that embraces a variety of build approaches including Off-Site Manufacturing (OSM). Whereas all OSM may be regarded as falling within a generic MMC heading, not all MMC may be regarded as OSM. To address this HC have set out a range of categories together with accompanying guidance.

**OSM – Volumetric**

Volumetric construction (also known as modular construction) involves the production of three-dimensional units in controlled factory conditions prior to transportation to site. Modules can be brought to site in a variety of forms ranging from a basic structure to one with all internal and external finishes and services installed, all ready for assembly. A family sized dwelling might typically be manufactured in four modules plus roof module(s).

**OSM – Panellised**

Flat panel units are produced in a factory and assembled on-site to produce a three dimensional structure. The most common approach is to use open panels, or frames, which consist of a skeletal structure only with services, insulation, external cladding and internal finishing occurring on-site. More complex panels – typically referred to as closed panels – involve more factory-based fabrication and may include lining materials and insulation. These may also involve include services, windows, doors, internal wall finishes and external claddings.

**OSM – Hybrid**

A method – also referred to as semi-volumetric – which combines both panellised and volumetric approaches. Typically, volumetric units (sometimes referred to as “Pods”) are used for the highly serviced and more repeatable areas such as kitchens and bathrooms, with the remainder of the dwelling or building constructed using panels. The hybrid approach is sometimes used to provide added flexibility on complex sites and those requiring additional communal areas. As with both volumetric and panellised approaches the degree of factory-based fabrication is variable.

*Continued*
### Housing Corporation MMC Categories continued

#### OSM – Sub-Assemblies and Components

This category is intended to cover approaches that fall short of being classified as systemic OSM but which utilise several factory fabricated innovative sub-assemblies or components in an otherwise traditionally built structural fabric. Typically, schemes incorporating the use of floor or roof cassettes, precast concrete foundation assemblies, pre-formed wiring looms, mechanical engineering composites, etc. would fall into this category. Traditional constructed schemes utilising manufactured units – such as windows, door-sets, roof trusses, etc., which might otherwise be part of the fabrication process in the other OSM categories – should not be included as sub-assemblies or components in this category.

#### Non-OSM Modern Methods of Construction

This category is intended to encompass schemes utilising innovative housing building techniques and structural systems that fall outside the OSM categories. The presence of innovation is an essential feature that might manifest itself through an innovative non-OSM building system, through a building technique familiar in other sectors but new to house building, or through traditional components being combined in innovative ways. Typically, “TunnelForm” or “Thin joint blocks” would fall within this category.

#### Non Applicable

This category is intended to encompass all “Traditional” site-based new build schemes and site-based rehabilitation, refurbishment and conversion.

### Modular Construction

- **Modular System**
- **Modular Volumetric System**
- **Modularisation**
- **Module**

These terms would imply a level of modular coordination (see modular coordination). However, more commonly, they refer to volumetric building modules where the units form the structure of the building as well as enclosing useable space. The terms are also sometimes used to describe room modules, which do not incorporate their own superstructure. They are particularly popular for hotels and student residences due to the economies of scale available from many similar sized modules and the particular benefit of reduced site construction time.
**Modular Coordination**
The discipline of designing buildings and structures using a specific module (for example 100mm) where all the elements and components are described as multiples of the module.

**Modular (Electrical) Wiring**
A preassembled electrical cabling system, using pre-terminated electrical cables usually made up into looms or wiring harnesses to provide the electrical distribution system for all mains small power, lighting and appliances (sometimes called wiring looms).

**Multi-Purpose Riser**
Multiple service vertical distribution module, constructed from primed or galvanised mild steel and incorporating appropriate building services which may or may not be lagged (insulated). These modules can be connected offsite, but are often transported in 7.5m lengths to avoid transportation problems. Modules can carry combined mechanical and electrical services but most manufacturers specialise in one or the other. The majority of the electrical risers are manufactured using a mesh or ladder system to allow easy distribution at floor levels in various directions. These systems are often bespoke in design and whilst the base structure may offer a level of standardisation the dimensions and carrying capacity will vary from project to project.

**Non-Volumetric Preassembly**
Items that are preassembled, but ‘non-volumetric’ in that they do not enclose usable space (Loughborough Level 2).

**Offsite Construction (OSC)**
**Offsite Manufacturing (OSM)**
**Offsite Production (OSP)**
Largely interchangeable terms that refer to that part of the construction process that is carried out away from the building site, such as in a factory or sometimes to specially created temporary production facilities close to the construction site - often referred to as ‘field factories’. Common alternative spellings for “offsite” are “off-site” or “off site”.

*Courtesy Yorkon*
**Offsite Process**

Offsite is a process rather than just a collection of technological solutions. The approach requires a change from a traditional building process towards a manufacturing process. This has implications for all parties involved in the process. The CIRIA offsite process is shown on page 26. An example of an offsite process based on structural steel is provided on page 27.

**Open (Cell) Panel Timber Frame**

*See Frame*

**Open Panel System**

*See system*

**Packaged Plant**

A generic term describing one or more items of mechanical and/or electrical plant that are combined (packaged) in the factory to form a transportable unit. *See also Plant Room Module (Preassembled)*

Courtesy Yorkon

Courtesy N.G.Bailey
STEP 1
Choose drivers and constraints
Choose your project drivers and constraints from a list of 19 drivers and 15 constraints that have been previously verified industry. View and save the driver or constraint example and related information.

STEP 2
Develop an Offsite strategy
Align the specific advice given for standard processes, standard components and pre-assembly with construction project phases to develop your Offsite implementation strategy.

STEP 3
Apply the strategy
Review the project to ensure that the strategy continues to address the drivers and constraints and maximise benefit from Offsite.

STEP 4
Measure the benefits
Measure the benefits derived from your Offsite strategy against the project drivers and constraints, or measure performance as an Offsite index.

The CIRIA Offsite Project Process

Review Project Phases

Develop S&P Implementation Strategy: aaa

This page will help you develop your Standardisation and Pre-assembly implementation strategy. Click on the appropriate phase or review in the process chart below. You will be asked to save a document listing specific advice for your chosen drivers and constraints at this phase or review point.

<table>
<thead>
<tr>
<th>S&amp;P category</th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Phase 4</th>
<th>Phase 5</th>
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<tbody>
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<td>Standard Processes</td>
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<td>Pre-assembly (Modular building)</td>
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Excerpt from the CIRIA Project Toolkit, showing best opportunity for action and full design freeze dates for different levels of offsite preassembly
Insert Landscape Optimised Steel Construction
Panel
A generic term describing a planar unit, typically manufactured offsite, which may, or may not have a structural as well as an enclosure function. Related terms are listed here:

Panel Building System
Comprising walls, floors and roofs in the form of flat pre-engineered panels that are erected on site to form the box-like elements of the structure that then require various levels of finishing. This term applies to all different material types.
Also see System

Precast Flat Panel System
Floor and wall units are produced offsite in a factory and erected on-site, ideal for all repetitive cellular projects. Panels can include services, windows, doors and finishes. Building envelope panels with factory fitted insulation and decorative cladding can also be used as load-bearing elements.
Also see System

Advanced Panel Timber Frame
This generic term covers the latest developments in conventional panellised timber frame. Advanced panel timber frame is a factory-manufactured timber-stud-constructed frame with sheathing in the conventional timber-frame manner. Manufacturers are now beginning to fit rigid insulation between the studs and pre-finished windows and external doors in the panel prior to dispatch to site.

Structurally Insulated Panels (SIPS)
This form of construction is used in panel building systems, typically in the residential sector. Structural sandwich panels typically comprise a core of foam with plywood, oriented strand board (OSB) or cement-bonded particleboard skins, bonded together to form a one-piece structural, load-bearing panel. The cores of SIPS can be made from a number of materials, including moulded expanded polystyrene (EPS), extruded polystyrene (XPS), and urethane foam. When engineered and assembled properly, a structure built with these panels needs no frame or skeleton to support it.

Panellised
For social housing this is a Housing Corporation MMC category where flat panel units are produced in a factory and assembled on-site to produce a three dimensional structure. The most common approach is to use open panels, or frames, which consist of a skeletal structure only with services, insulation, external cladding and internal finishing occurring on-site. More complex panels – typically referred to as closed panels – involve more factory-based fabrication and may include lining materials and insulation. These may also involve include services, windows, doors, internal wall finishes and external claddings. The term is also used more generally outside social housing (see envelope)

Permanent Insulated Concrete formwork (PIF)
See Insulated Concrete Formwork (ICF)
**Plant Room Module (Preassembled)**
Packaged or skid-mounted preassembled plant rooms pre-finished in the factory, ready for direct connection to mains services on site. Can include complete plant room areas including AHU’s, fans, chillers, boilers, pumps and pressurisation units, together with elements of the building envelope.

**Pod**
Prefabricated volumetric pod, fully factory finished internally complete with building services. Probably not completed externally, except for roof-mounted plantrooms which may include external cladding.

Types of pod include bathrooms, shower rooms, office washrooms, plant rooms, Kitchens

Applications for pods include commercial offices, public buildings, hotels, airports, sport stadiums, hospitals, universities and schools.

Pod framing or structure may be LSF (Light Steel Frame) or RHS (Rolled Hollow Section) steel, timber frame, precast concrete or GRP (mainly for smaller pods)

Floors are typically suspended timber or concrete, tiled or finished as appropriate.

Ceilings and wall covering are typically plasterboard, except for GRP/Precast concrete where that is the pod build material, tiled or finished as appropriate.

Occasionally pods may be delivered as a flat-pack assemblies.

**Portable Buildings and Portable Accommodation**
These are volumetric prefabricated buildings that are designed so that they can be moved and relocated. They are semi-permanent and have a relatively short life span of 20-30 years. Many are rented out to users.

*See also Jack-Leg Buildings*
**Preassembly**
The manufacture and assembly of a complex unit comprising several components prior to the unit’s installation on-site. “Offsite” is now the more commonly used term for construction of this type.

**Pre-engineered**
Standardisation of product allows the development of pre-engineering which is a term very loosely used in off-site manufacturing circles. Often it means no more than the production of the drawings before the product is made by adapting or modifying drawings from a previous application of the system. The correct use of the term is where a product is fully engineered and can be described in a technical manual or catalogue; where it is fully detailed and programmed for manufacture; where it is fully costed and the price is available; then it is pre-engineered.

For example, the manufacture of the room modules begins with a 3D CAD (computer aided design) model, which details each component and ascribes a unique part number. This detailed model provides the bill of materials for each module and is then converted into CAM (computer aided manufacture) files. The CAM files contain all of the data for the module, broken down into the sub-assemblies of walls, floor cassettes, ceiling cassettes etc.

The CAD files also contain all the machine codes that control the various stations on the automated assembly line. It is this linkage between the product and production equipment that provides the repeatable dimensional accuracy of a manufactured product when compared with other, more traditional methods of construction.

The term is also used to distinguish between bespoke, prototype building (traditional) and factory manufacture, which by its very nature requires pre-design and proving prior to being incorporated into the works on site.

**Prefabrication and Prefabricated Building**
This is a general term for the manufacture of entire buildings or parts of buildings offsite prior to their assembly on site. Prefabricated buildings include both portable buildings and the various types of permanent building systems. “Offsite” is now the more commonly used term for permanent buildings procured in this manner.

**Process for offsite manufacture**
*See offsite process*
Pump module (skid mounted)
Supplies pressurised water for heating and chilled water solutions

Risers (preassembled)
Preassembled electrical and/or mechanical vertical distribution modules designed either to be self-standing structures or fixed to walls.
See also Multi-Purpose Riser

Roof Cassettes
A factory-manufactured panel similar to floor cassettes. For pitched roofs in residential applications they will usually be timber or steel-based SIP panels, spanning from eaves to ridge. They are supplied insulated and require no additional truss style support making them ideal for providing additional roof space in housing applications. They are also used in commercial situations.
Sandwich Cladding Panel
Cladding unit incorporating internal and external finishes and integral insulation. Precast concrete and steel systems exist.

Serviced Building Modules (Prefabricated)
See Building Module.

Serviced Room Pods (Prefabricated)
See Pod.

Serviced Vertical Riser (Prefabricated)
See Multi Purpose Riser.

Skeletal Frame
Generic term describing frame systems, typically supplied without insulation or finished panels.

Skids
Transportable frames for carrying standardised preassembled products, mainly building services. For example pump skids, boiler skids etc. Term sometimes used as skid-mounted boiler etc.

S&P
Standardisation and Preassembly.

Standardisation
The extensive use of components, methods or processes in which there is regularity, repetition and a background of successful practice. This may include standard building products, standard forms of contract, standard details, design or specifications and standard processes, procedures or techniques. It can also mean generic, national, client, supplier or project standardisation.
Staircases (Preassembled)
Stairs and stair and landing units fabricated offsite – typically precast concrete or steel. Significant benefits from early access as well as no propping. May also be fully finished architectural staircases (see image).

Steel Frame Building System
See System & Frame

Steel Panellised System
See Panel

Stick Build Systems
See System

Structurally Insulated Panels (SIPS)
See Panels

Sub-Assemblies
Major building elements that are manufactured offsite but do not form the primary structure of the building. Foundation systems and cassette panels are typical examples.

System
Applied to offsite, a system is any pre-engineered method of building that has a pre-defined scope and configuration limits. Building systems can use a number of different materials, or combinations of materials and can be volumetric, panel, stick build or hybrid.

System Building
Internationally this term is typically used to describe open or closed building systems that invariably incorporate a significant amount of standardisation, either in components and/or dimensions. The term may also be used in a broader context -See System and Building System.

Open Panel System
The construction of the structural frame for the building using panels assembled in the factory. Open panel systems, of various materials, are typically delivered to the site purely as a structural element with services, insulation, cladding and internal finishes installed in situ.

Closed Panel System
Similar to ‘open panel systems’ in that the structural elements of the building are delivered to the site in flat panels. However closed panel systems typically include more factory based fabrication such as lining materials and insulation and may even include cladding, internal finishes, services, doors and windows.
Steel Frame Building System
Stick-build systems that use steel as the primary structural material. It is common to hear the term ‘light-steel frame’ (LSF) which, in this context, refers to thin-gauge steel sections supplied as components or panellised elements.

Stick Build System
These consist of pre-engineered frame elements in steel, pultrusions, and timber or precast concrete that are typically bolted together on site to erect a skeletal structure that is then enclosed and finished on site.

Thin Joint Masonry
Thin Joint Masonry is not part of the offsite spectrum but is included in the Housing Forum definition of Modern Methods. It allows the depth of the mortar to be reduced from 10mm to just 3mm or less, resulting in faster laying and improved productivity, particularly on long runs of walling. Construction speed can be further increased by some 13.5 per cent using large-format concrete blocks, which have a face size equivalent to two traditional concrete blocks. The mortar cures rapidly, achieving full bond strength within one to two hours, eliminating the problem of ‘floating’ therefore enabling more courses to be laid per day.

Thin Joint Masonry (preassembled)
The use of thin joint ‘glued’ blockwork preassembled offsite into panels that are then delivered to site and installed by crane in one operation. Panels may be single skin or cavity construction complete with insulation.

Tilt-up
Large precast concrete wall panels cast horizontally on-site, usually face down on a previously completed floor slab immediately adjacent to their final position. Once cured, panels are then tilted upright into position. Opportunities include cold stores; controlled environments; food, drug & clean rooms, firewalls, schools, prisons, warehouses and offices.

Timber Frame
See Frame

Timber Frame Building Systems
See Frame
**Trussed Rafters**
Typically used for pitched roofs on residential developments, trussed rafters, fabricated offsite from small section members have been in use for many years. Materials include timber and light-gauge steel.

**Valve Assemblies (Preassembled)**
Valve assemblies prefabricated to individual specification to reduce on-site installation time, site storage requirements and purchase orders.

**Volumetric Building Modules and Systems**

**Volumetric Modular Construction**

**Volumetric Unit**
These terms are usually used in one of two different ways, namely:

1. To describe volumetric units that enclose useable space but are installed inside or on top of a building (i.e. pods); or,
2. To describe volumetric units that enclose useable space and are joined together on site to form the whole building generally without the need for any additional support structure.

Units may be manufactured from a number of different materials including, steel, concrete and timber, with smaller pod units also available in GRP.
Units are invariably fully finished internally in the factory with external finishes, often brickwork, applied on site (2-star) or sometimes also externally factory-finished (3-star)
Washroom Pod
See pod

Wiring Loom
A preassembled collection of cables and connectors (sometimes called modular wiring)
Bibliography

This Glossary has been compiled using input from the buildoffsite direction group and the following references:

- Modern Methods of Construction - Realising Diverse Potential *The Concrete Centre website* (www.concretecentre.com)
- Notes supplied by Mtech Group on 16/2/05.
- Salford OSM Initiative, Report 1: Results from an initial scoping study into the use of OSM in house building, Salford Centre of Research and Innovation, 2004.
Acknowledgements

The editors acknowledge the input of many construction experts and practitioners in the development of this Glossary, in particular the following organisations and individuals:

- Acumen 7: Richard Ogden
- Arup: John Miles
- BAA: Nigel Fraser
- BRE: Ian Pannell
- British Precast Concrete Federation: Martin Clarke & Clive Budge
- BSRIA: Andrew Eastwell
- BURA: Paul Jess
- bwa - Brydon Wood Architects: Martin Wood
- CIRIA: Bill Healy, Anna Whiting & Chris Chiverell
- Concrete Society: Martin Powell
- Construction Products Association: John Tebbit
- Corus: Emily Davies
- Costain: Mark Gordon & Mike Amos
- Davis Langdon Consultancy: Adrian Jackson-Robbins
- DTI: Barry Blackwell
- English Partnerships: Penny Stern
- Housing Corporation: Clive Clowes
- Loughborough University: Chris Goodier & Wei Pan
- Mtech Group: Martin Goss, Darren Richards, Daniel Ashley & Mark Taylor
- N.G.Bailey: Cal Bailey
- OPDM: Canda Smith
- SCI (Steel Construction Institute): Graham Raven
- Terrapin: Nick Whitehouse
- The Concrete Centre: Richard Day
- TRADA: Andrew Abbott
- Yorkon: Keith Blanshard & Mike Sherwood