PRACTICE NOTE 4
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Offsite modular construction

INTRODUCTION

This practice note explains how the NEC4 suite of contracts can be used to support the use of offsite modular construction.

OFFSITE MODULAR CONSTRUCTION

Offsite construction is the manufacture of components required for the creation of a built asset that takes place remote from the site where the asset will be located.

Offsite manufacture has been a part of construction for many years with components such as windows, mechanical and electrical systems, precast concrete beams, staircases and cladding units all forming part of typical construction projects. However, these individual components are then installed into a structure which is built on site and whilst benefits can be achieved through this approach the majority of construction work stills takes place on site.

The greater the amount of prefabrication that takes place offsite the greater the potential benefits that can be realised, such as where three-dimensional units are manufactured for example an entire school room, prison cell or housing module for installation onto or into a building or structure. This is often referred to as modular construction and it to this level of offsite manufacture that the construction industry to being encouraged to move to and is the main focus of this practice note.

The benefits that offsite construction can bring are largely related to the creation of the components in a factory setting, protected from the weather and using manufacturing techniques such as assembly lines with dedicated and specialist equipment and the use of technology to

- increase the speed of construction by increasing the speed of manufacture of the component parts,
- reduce waste,
- increase economies of scale,
- improve quality leading to reduction in the whole life costs of assets,
- reduce environmental impact such as dust and noise and
- reduce accidents and ill health by reducing the amount of construction work taking place at site.

All of these should lead to greater efficiency and a reduction in the cost of construction.

Examples of offsite construction

There are a number of different sectors within the construction industry are embracing offsite construction such as.

- Housing where rooms or the component parts of a complete house, including all fixtures and fittings, can be fabricated offsite.
- Schools, hospital and prisons where complete rooms, wards, operating theatres or cells can be manufactured off site.
- Branded retail units such as fast food outlets where the component parts are fabricated offsite and fitted together on site.
- Oil and gas where modules of process plant are fabricated offsite in sections and connected together on site.

Industry and governmental support for offsite modular construction

Given the benefits of offsite modular construction there is widespread industry support for its use.

In the UK for example the Infrastructure and Projects Authority (IPA) launched the Transforming Infrastructure Performance (TIP) programme in December 2017. One of the key elements of TIP is improving productivity in delivery through smart construction which offers the opportunity to transition from traditional construction to manufacturing, and unlock the benefits from standard, repeatable processes with components manufactured offsite.

Similar initiatives are being pursed in locations such as New Zealand and also Singapore and the Hong Kong SAR where an aging workforce is another driver for its adoption.

NEC4 CONTRACTS FOR OFFSITE MODULAR CONSTRUCTION

One of the key principles of NEC contracts is their flexibility to be used across all sectors of the construction industry including building, infrastructure and process plant. They can be used to engage all the key members of the supply chain required for onsite and offsite construction on a consistent family of standard contracts at all stages in the design, construction and operation of an asset.

The starting point for any construction project will be the development of a procurement and contract strategy. As part of this the *Client* will need to consider how it will engage the supply chain and whether it will want to lead on the use of offsite modular construction or to leave it to the supply chain to decide whether or not to adopt it. The *Client* has the choice of directly engaging and managing the various members of the supply chain including designers, *Contractors* and offsite fabricators or to engages suppliers on a design and build or build only basis with the onsite construction and offsite fabrication forming part of the build element.

Single point responsibility for onsite and offsite construction

Where the *Client* wishes to have a single point responsibility with a *Contractor* undertaking the design, fabrication and installation of modular components manufactured offsite they can select the Engineering and Construction Contract (ECC), the Design Build Operate (DBO) contract or the Alliance Contract (ALC) depending on the nature of the work / service to be provided and the level of collaboration required.

The ECC can also be used by a *Client* on a build only basis where they want the *Contractor* to undertake both the onsite works and the offsite modular fabrication.

Where single point responsibility is required the *Client* can still require offsite fabrication by including this as a requirement in the Scope or it can be left to the decision of the supply chain to adopt offsite fabrication due to the benefits it can deliver.

Where a supplier undertakes modular construction they can use NEC4 contracts to engage the required members of their supply chain as Subcontractors in the same way as outlined for the *Client* in this practice note.

Multiparty contracts

Feasibility, design and management

The Professional Services Contract (PSC) and Professional Services Short Contract (PSSC) can be used to engage Consultants to undertake feasibility studies as to whether offsite fabrication is feasible and how it can be used most effectively. The same contracts can be used to engage the designers for items to be fabricated offsite and the works to be constructed onsite. They can also be used to engage the wider professional team to manage and supervise the offsite and onsite works and the interfaces between the two.

Fabrication, supply and related services

The Supply Contract (SC) and Short Supply Contract (SSC) can used to procure the design, fabrication and delivery of any type of offsite component including complete modular units. The contracts do not provide for any installation works, which will be undertaken under more appropriate contracts in the NEC4 suite but can include services related to the supply of the goods such as supervising installation, commissioning and on site testing.

The SC and SSC are designed to be used nationally and internationally and allow for the use of internationally recognised trade terms such as the International Chamber of Commerce (ICC) rules for the interpretation of trade terms (currently Incoterms 2010) which facilitate the conduct of international trade. This allows the contracts to be used to procure components manufactured in multiple different countries for assembly in another.

Onsite construction and installation of components manufactured off site

The Engineering and Construction Contract (ECC) and the Engineering and Construction Short Contract (ECSC) can be used for any onsite construction that is required prior to the arrival of the modular components manufactured offsite and also to undertake the installation and connection of the components.

NEC4 PROCESS TO SUPPORT OFFSITE MODULAR CONSTRUCTION

The NEC contracts provide a number of processes that be used to support the successful integration of offsite manufacturing into the creation and maintenance of assets.

Design

In all NEC4 contracts the supplier has to comply with the Scope and this allows the *Client* to determine what elements of the asset should be manufactured offsite and to ensure that the various components fit together onsite.

NEC4 also introduced specific provisions in the ECC and SC for the *Contractor* and *Supplier* to propose changes to the *Client's* Scope that would reduce the cost to the *Client* of the *Contractor* / Supplier Providing the Works / Providing the Goods and Services and if secondary Option X21 is selected the *Contractor* / Supplier can also propose changes to the *Client's* Scope to reduce the cost of operating and maintaining the asset. In both cases the changes may be necessary to remove any restrictions in the *Client's* Scope that would restrict the use of offsite modular construction.

The NEC4 contracts also allow the *Client* to determine ownership of the intellectual property rights of design and can, by using X9 transfer of rights, own the supplier's rights over the design prepared for the contract. Alternatively, the *Client* can choose to leave such rights with the supplier.

Quality

All contracts in the NEC suite contain provisions for quality management. For the manufacture of offsite modular components testing and inspection requirements can be included in the Scope and these can be required to take place prior to delivery of the components. This then avoids the abortive cost and delay that can occur if components are only discovered to be defective after delivery. Further tests on site can also be included as part of the Scope if required.

Payment

ECC payment for offsite fabrication

In Option A payment is made against completed activities. The fabrication of the offsite components can be identified as an activity by the *Contractor* and this can be further sub split into elements of the fabrication if the component is of high value or long duration so as to enable regular payment to be made to the *Contractor* to protects its cash flow.

In Option B payment will depend on the method of measurement used to create the Bill of Quantities, however, whichever method of measurement is selected it is possible to allow for the payment of offsite fabrication.

In Options C, D and E payment is made on the basis of forecast Defined Cost plus Fee. Defined Cost is the cost of components in the Schedule of Cost Components (SoCC). Payment for offsite fabrication will vary depending on who undertakes the work. If the offsite fabrication is undertaken by a Subcontractor then the costs incurred by the Subcontractor will be recovered by the *Contractor* under component 4 of the SoCC. The payment to the *Contractor* from the *Client* will be in line with payment from the *Contractor* to the Subcontractor.

If the *Contractor* undertakes the work directly then the *Contractor* will be able to recover payment in one of two ways. If there is a substantial amount of offsite fabrication the *Contractor* may choose to create a fabrication facility specifically for the contract. In this case the facility can be classed as part of the Working Areas and the people, Equipment, Plant and Materials etc. are paid for under the applicable components in the SoCC.

In some cases the *Contractor* may have already created a facility for manufacturing components offsite, in this case the costs of fabrication that takes place in this location can be recovered under component 6 of the SoCC manufacture and fabrication outside of the Working Areas. Component 6 of the SoCC allows the *Contractor* to recover the cost of offsite manufacture by multiplying rates, which it will have provided as part of Contract Data part two, for people by the time properly spent on work in the contract. The people rates will need to include the direct cost of the operatives undertaking the work as well as an allowance for the creation, maintenance and operational costs of the fabrication facility and the equipment and consumables used in the fabrication process. The cost of the Plant and Materials that forms part of the fabricated components will be recovered by the Contractor under component 3 of the SoCC.

In Option F payment is made on the basis of Defined Cost plus Fee and the cost of offsite fabrication will be recovered as payment to a Subcontractor as per Options C, D and E.

SC / SCC payment

Under the SC and the SCC, where all work will take place offsite, there is a single payment option which is based on a Price List. The Price List can contain lump sums and / or rated items and these will be used by the Supplier to recover the costs of fabrication and any related services.

Title

ECC

Under the ECC whatever title the *Contractor* has to Plant and Materials passes to *Client* when they are brought within the Working Areas. If they are outside the Working Areas title passes to the *Client* when the *Supervisor* has marked them as for the contract.

In the case of components fabricated outside the Working Area the *Client* will want to secure title to these as soon as possible and so will need to identify the requirements for marking in the Scope to pass title and to protect its position in line with its obligation to pay for the Plant and Materials.

SC

Under the SC the default position regarding title to *goods* is that it should pass when the *goods* are paid for as the contract requires, rather than on Delivery.

As an assurance for the *Client*, the *Supplier* is required to provide information to show that it is able to pass title before the payment is made.

Where payment is made for the *goods* before delivery the *Supplier* is required to mark the *goods* as the Scope requires in order to protect the *Client*.

Effective management of time, risk and interfaces

The NEC forms of contract are designed to stimulate effective project management, which is a key aspect of successfully delivering the benefits offered by offsite modular construction.

If a *Client* places separate contracts for the offsite and onsite works then the coordination of these works and, in particular ensuring that the components fabricated offsite are delivered to site at the correct time and in the correct sequence for assembly to take place, will be of criticial importance. All of the main NEC4 contracts contain extensive provisions for the management of time and programme and these can be used to effectively manage the interface between the different suppliers.

The early warning process in the NEC contracts can be used to help effectively manage the risk around the interfaces between the onsite activities and the delivery and coordination of offsite components.

A further way to encourage different suppliers to work together is the use of secondary Option X12 which incentivises multiple suppliers to collaborate to achieve a common set of objectives set by the Promotor (commonly the *Client*). These objectives can include the requirement for the suppliers to cooperate in the design and delivery of offsite fabricated modules and onsite works. A Core Group is created to take decision on behalf of the suppliers and led by the Promotor. The Partners collaborate as stated in the Partnering Information and in a spirit of mutual trust and cooperation. Under X12 the early warning process is also extended to require each Partner to give an early warning to the other Partners when it becomes aware of any matter that could affect the achievement of another Partner's objectives.

Information Modelling

Information Modelling (often referred to as Building Information Modelling (BIM)) can be a key enabler for the use of offsite modular construction as it supports the detailed integration of the component parts manufactured onsite and offsite and allows them to be designed and built to high levels of accuracy. Secondary Option X10 Information modelling can be selected for use with any of the main NEC4 contracts and is designed to be used with or without a formally published protocol. It covers the contractual matters related to the creation or updating of an Information Model and deals with ownership of Project Information and the Information Model and liability for faults and errors. It also requires the creation and regular update of an Information Execution Plan detailing how and when Project Information and Information from other Information Providers is issued to and from the suppliers.

SUMMARY

The move to offsite manufacturing coupled with other developing technologies has the potential to greatly increase productivity, efficiency and reduce cost in the creation and maintenance of assets as well delivering benefits in terms of safety and the environment. The NEC4 suite of contracts is uniquely placed to help *Clients* and their supply chain to deliver these benefits.