



# OFFSITE STRUCTURAL MODULAR SOLUTIONS



## Opportunities for living

VRC is a supplier of hybrid buildings to the self-build, Popup, social provision, developer and joint venture markets.

We partner with one of Europe's largest suppliers of modular buildings. The accredited facility supplies flat pack accommodation to 43 countries.

Regardless of the type of build, be it a bungalow, house or apartment, commercial or leisure project the structure will have BOPAS registration\*.

Our hybrid / volumetric modular construction system has many advantages. It offers a fast structural build, a flexible use of space, requires only a raft foundation and combines the best of offsite manufacturing with conventional build. We are able to construct up to five storeys high. There are no structural walls within the outer frame. It also has the added advantage of reduced dependency on the home supply chain.

What makes us different from many of our fellow structural suppliers is our simple approach to building design. We model all our builds on a multiple module layout of varying sizes, each storey being the same as the ground floor frame plan.

The look of the completed build can range from contemporary to traditional, offering two ceiling height's and allowing an uninterrupted internal width of up to eleven metres and the length being determined by the number of modules used.





# Overview

**Producing modular skeletons for use in the residential construction industry. Ideal for apartments, traditional houses, bungalows as well as roof top extensions. It is faster to build using this method than employing traditional techniques.**

Developed from decades of producing precision engineered accommodation for deployment around the world. The BOPAS accredited system is adaptable and enables semi-skilled staff to fit out.

Our target market include: councils (for their development companies), housing associations - both to use the system to teach skills via apprenticeships, commercial construction companies, private self-builders, housing developers and short term temporary accommodation providers.

The system is built around modules which are made from four core components. A bottom cassette, corner pillars, top cassette and exterior wall panels. These modules are then bolted together to form a skeleton structure. The steel work is galvanised prior to powder coating. The design of each module set is unique to each and every project.

As there is a void between floors, low level sound transmission is achievable. Coupled with good insulation values and by the nature of steel – low movement – the system is a first-class basis to use for a build.

Typical residential home on site erection time of a week, including the fitting of roof trusses and getting the structure weathertight, makes this system ideal where speed of build is an important factor. By having the structural part of the build up quickly, it allows both external and internal builds to start simultaneously.

Using clear span structures, internal walls can be moved without changing the structural integrity of the building. Room heights are not an issue as pillar and panel lengths can be to whatever client requirements need to be. Some heights will require on site assembly as UK road bridge heights are a limiting factor.



# The System

The modular system is designed for easy handling on site, allowing a safe working environment for on-trades. In the majority of cases, off site assembly will take place, but on sites with multiple units required, the solution would be to assemble on site. In either case the same care and attention to detail will be found.

Taking a typical three-bedroom house as an example, the modules are put together as follows: a bottom cassette is put down on a level floor. Within this cassette is an 80mm insulation layer encapsulated in a galvanised steel envelope. As the cassette is pre-fitted with a 16mm cement fibre board sheet, working on top of the cassette is safe and worker friendly. The four L shaped corner posts are fitted by 20mm bolts screwed into the corner eyelet socket. The top cassette is lifted into position and then bolted as before. Structurally, the module cannot come undone as any twisting action holds the bolts tight.

The exterior panels are fitted by slotting into place within a track on the bottom cassette and clipped into place into the top cassette. The side of the panel next to the pillar is fastened to the steel work by HEX screws, so stopping any sideways movement. On all exterior faces the joints between panel and frame / pillar are taped with a BLP approved jointing tape to stop water ingress.

The panels are designed as male and female joints so jointing compound is used to fill any joints. The openings are made in the panels for the windows and doors.

For the exterior walls a steel strap is fitted every 600mm and regardless of positioning, either side of any opening. This allows the brick ties or additional substrate to be tied to the structure. On the upper area of the top floor ceiling cassette, an OSB sheet covering is attached to help the truss fitters and provides the client a pre-boarded loft space.

At site the modules will sit on 10kN blocks, spaced to allow for under floor ventilation. Module attachment bolts are already inserted into the concrete, so they connect the structure to the ground.

On placing the units in final situ, the modules are bolted together either via the exterior eyelets or via the internal pillars. The vertical connecting bolts go eyelet to eyelet.

A thermal quilt is attached to the bottom cassette frame, as well as being fitted at subsequent levels covering the ceiling cassette and floor cassette.

Having fitted the truss runner (wall plate), the trusses are fitted using standard practice methods. The trusses are then ready to be covered with a breathable membrane.



Brick tie connection



Crane placement of modules



Module placement on 10kN blocks



Thermal quilt bottom and middle

# The Fit Out

As standard practice a floating floor is fitted to each bottom cassette. This helps to reduce noise, allows underfloor heating if required and counters any discrepancies in the level of the ring beam. The floating floor is based on either 38mm or 47mm deep 2" x 3" timber, with an 18mm tongue and groove, peel clean chipboard sheet glued and nailed into place. The ceiling joists are fitted into the steel grid at 600mm centres. This allows a clear space below the module frame. On the inner face of the exterior wall the gap between the two cassettes, is taped closed, thereby reducing air movement.



Insulation under floating floor

Insulation is fitted next to the steel work between the modules within the 300mm gap of the two cassettes. This is a combination of 75mm slab and 400mm roll insulation. Once the ceiling joists have been fitted, the studwork can be erected.



Showing first layer of insulation prior to the rolled insulation being fitted

One of the great advantages of the system is the space allowed for first fix layout. The pipe and cable runs can lay within the void of the ceiling area, allowing for a faster installation and enabling the services either to go down the stud wall or up the stud wall depending on the floor.



Space between modules

# Design and Specification

In many cases the modules can fit an existing design, especially apartments., but the main consideration must be the pillar position within the final layout. The external pillars are lost within the wall make up. But internal pillars – where four modules meet, giving a 350mm x 350mm foot

print – need to be carefully planned. As the modules can be up to 7.5m long in standard form (with the use of additional support to reduce deflection), most times a structure will have only one line of internal pillars.

The maximum module width is 2.3m. Corner room profiles, that is for glass either side is 285mm. Modules need to have 90 degrees corners. For off-site construction, the maximum module height is 3m, giving a 2.5m room height. For on-site construction this can be increased to 4m giving a room height of 3.5m.

If the build is in a flood prone area (for example within a catchment of a drainage board), a lower ground floor module can be provided to lift the ground floor up to the required planning consent level.

The cold rolled steel used is ST37 used in a combination of thicknesses of 3mm and 5mm. The steel is galvanised and for additional protection is factory powder coated and oven baked.

The exterior panels are filled with mineral wool fixed by a glue based bonding adhesive to the galvanised steel sheets.

In finished construction, the air test result has shown that below 3.5 is consistently achievable and the dwelling fabric energy efficiency is about 18% below the target requirement. For the fabric U-values, the targets achieved are: external walls 0.14, floor 0.14, roof 0.11. The dwelling carbon dioxide emission rate, is 40% below the target requirement when used alongside an air source heat pump.



Kitchen units are within pillar space

## Points to Consider

We have been asked previously to look at projects where the restrictive conditions on the site make it difficult for us to develop the project. As a rule, we need room for a crane and its stabiliser legs. We will not lift over power cables. This system needs large lorry access, so turning areas need to be considered.

## Customer support

Projects in early stage development may well benefit from advice from our structural engineer. We can supply other support professions if you need assistance.



Lloyd's  
Register



Working together  
for a safer world

## Lloyd's Register EMEA

### Buildoffsite Property Assurance Scheme (BOPAS)

This is to certify that

**VRC Homes**

has been awarded BOPAS Accreditation to the Hybrid Modular Construction technology

The scope of approval includes the assessment of the following, systems, processes and competencies:

Project Management Designer,  
Project Management Manufacturer,  
Constructor and  
60 year durability and maintenance assessment.

This Approval is subject to:  
Satisfactory Surveillance Assessments

Approval Number COV1624775/01

Date of Issue 03/11/2016

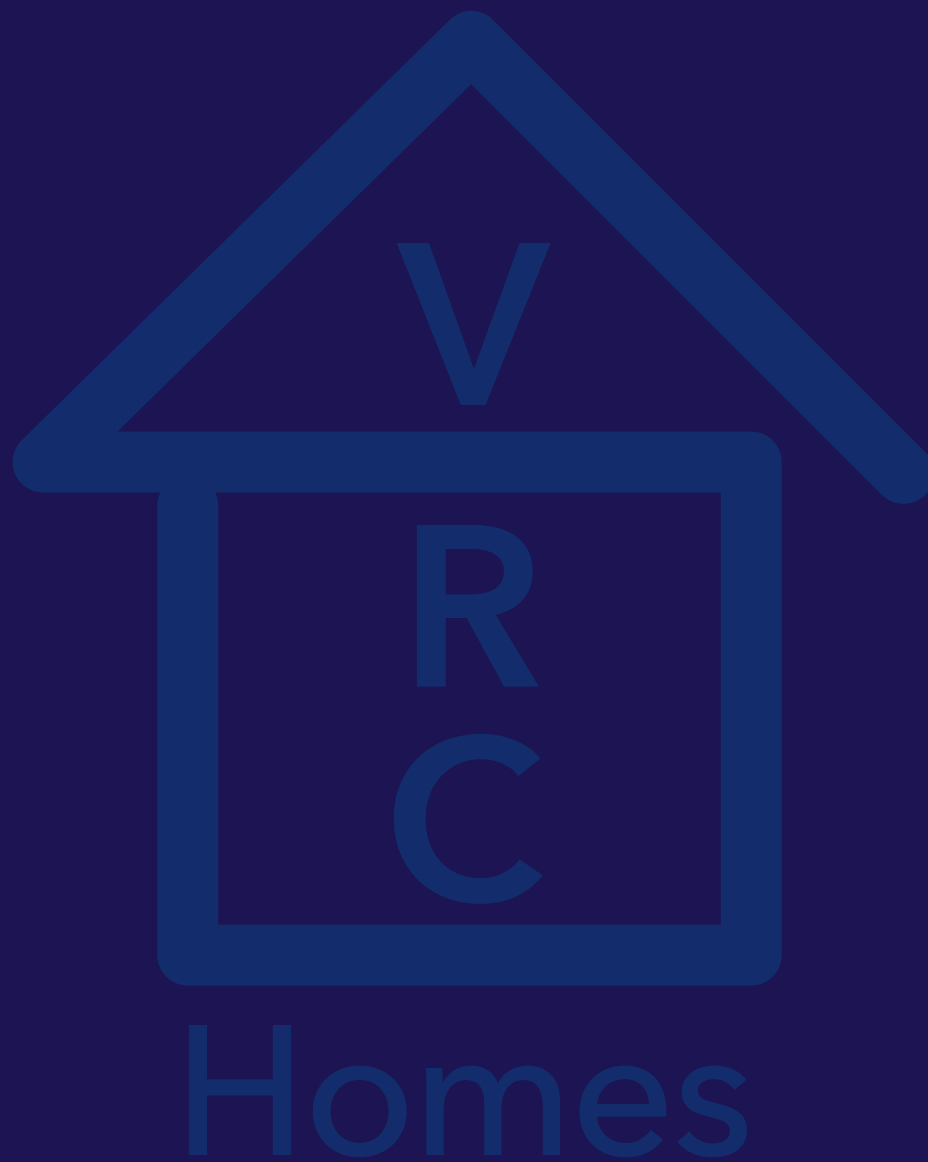
Date of Expiry 30/09/2019



Mike Cahill  
Sector Manager Utilities  
Lloyd's Register EMEA  
A subsidiary of Lloyd's Register Group Limited

Lloyd's Register Group Limited, its affiliates and subsidiaries and their respective officers, employees or agents are, individually and collectively, referred to in this clause as 'Lloyd's Register'. Lloyd's Register assumes no responsibility and shall not be liable to any person for any loss, damage or expense caused by reliance on the information or advice in this document or howsoever provided, unless that person has signed a contract with the relevant Lloyd's Register entity for the provision of this information or advice and in that case any responsibility or liability is exclusively on the terms and conditions set out in that contract.

This is a copy of an electronic document. In the event of any conflict or ambiguity between the copy and the electronic document, which is retained and published by Lloyd's Register, the original electronic and certified version shall always prevail.



VRC Homes Ltd  
Longthwaite House,  
Westley Waterless,  
Cambridgeshire CB8 0RQ

E [sales@vrchomes.co.uk](mailto:sales@vrchomes.co.uk)  
Tel 01223 459931  
[www.vrchomes.co.uk](http://www.vrchomes.co.uk)