

# PreFabhaus – MMC and low carbon housing

Modern methods appropriate for hybrid construction

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Quality control throughout the entire construction process is critical to the performance of properties seeking to achieve Passivhaus standard, particularly in regard to air tightness and the avoidance of thermal bridging. In practice, many errors arise from a misunderstanding of the entire building systems and the integrated nature of fabric performance with the optimization of services. As buildings get adapted and extended in response to changing uses and requirements, they also become more complex hybrid structures where standard solutions and products for typology based retrofitting are not always suitable. When these concerns are combined with the challenge to mainstream the Passivhaus concept for a diversity of both new and retrofitting projects, quality control has to be achieved quickly, easily and perhaps most importantly cost effectively.

One possible way of ensuring the appropriate levels of quality and reduction in errors due to on-site management, damage and control is the use of modern methods of construction (MMC). MMC is more than simply off-site manufacturing, it is a means to innovate within the design and construction process. As a process, it has the potential to deliver flexible specialization fabric elements as mass production components and provide possible responses for new built, retrofitting and hybrid structures in a continuum from new construction 'products' suitable for Passivhaus certification through to entire fabric 'systems' that can be utilized for one-off elements or larger new build and retrofitting developments. Where MMC has traditionally been thought of as suitable for whole and completed structure solutions, the authors suggest that when thinking of properties as evolving hybrid structures; particularly when you are also being asked to think about adaptation strategies for future climate change; this begins to significantly blur any distinction between new build and retrofit projects and the use of MMC elements.

In exploring the use of innovative process using modern methods of construction in the delivery of Passivhaus retrofit projects in Leicester and Newcastle (*figures 1-4*) together with proposals for new build CSH6 / Passivhaus projects in the East of England and the East Midlands, there are common lessons for innovation in the design process and working collaboratively with the extended supply and fabrication chain, the property owners and occupants. Using examples from a number of different 'proof of concept' projects, we will discuss the potential use of MMC to produce specific building components, such as modular roof pods, bay window frames and entrance pods as well as whole frame and structure systems. We will also highlight some of the potential concerns around professional trust and technical competencies within the construction industry that emerged in working with non-standard buildings methods and products. These examples will be set within a wider context of process innovation supported by procedural and management measures, where we have found that the use of modern methods of construction (both timber and metal frame products) can bring measurable benefits in speed of delivery, reduced disturbance to occupants and of impact and assurances on quality. These are included with our reflections on the motivations for housing associations and other large-scale housing developers currently considering responses to the provision for low carbon housing.

Comparison will be made between the predicted and actual performance of the individual building elements and the whole house performances from a mix of diagnostic testing, and monitored results. We will provide an analysis of the performance achieved and cost differences arising from the choice of different off-site MMC systems; for both proof-of-concept units and larger roll out programmes; compared with traditional build techniques. We will also review some of the practical issues around successfully linking capital and revenue costs for both development finance and on-going energy costs that could benefit the wider uptake of both MMC products and Passivhaus standards. This will discuss the concerns around trust and risks in the long-term technical performance of different MMC systems that result in fewer and less advantageous loan rates that can have the effect of canceling out the savings due to increased energy efficiency and lower bills.

In discussing the linked concerns around trust, cost, speed and quality, we will provide some current examples of projects in Corby, Derby, Leicester and Middlesbrough where developments are beginning to consider the issues of scale and co-design customization of MMC elements and the potential in moving from a 'proof of concept' to the benefits of a 'flying factory' approach for Passivhaus and low carbon housing. We will also make the case for integrated design, working closely with the supply chain, financial institutions and the end-users, as an essential means of achieving the technical performance required in practice and in a cost effective way that meets the lifestyle requirements of the occupants.



*Figures: (1) Bay Window Pod by Datum being installed at the YHN Greenford Road 'Retrofit for the Future' site in Newcastle with (2) completed semi detached properties. (3) Roof Pod by Envirohomes Ltd being installed at the East Midlands Housing Association terraced property at (4) Cottesmore Road, Leicester.*