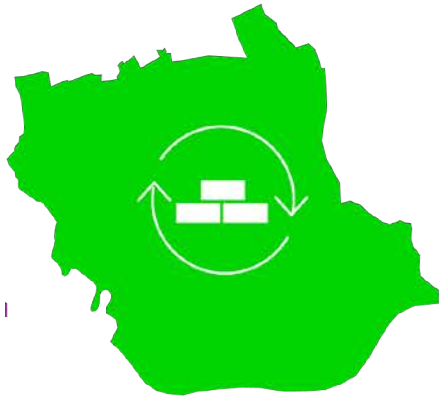
Newham London



NEW LOCAL PLAN | CLIMATE EMERGENCY

MMC and embodied carbon technical note

May 2022 | Rev C

Levitt Bernstein People.Design

ELEMENTA

Currie & Brown

Etude

Modern Methods of Construction (MMC) opportunities in Newham

Overview

Newham council intends to build more MMC housing across the borough. An in-house modular offsite construction programme with Populo Living has identified a potential 500 homes that can be delivered across the borough; creating rooftop extensions above council- owned blocks creating new homes and improving the existing housing stock.

Potential opportunities to improve environmental performance

- Opportunity to upgrade existing council housing at the same time.
- Retaining and extending life of existing structure.
- There are efficiencies of scale in delivering larger developments in MMC.
- Early engagement with contractor/supply chain is critical to deliver on net zero targets.
- Brief setting is the key – operational energy targets, airtightness, and embodied carbon KPIs could feature as part of the viability selection.
- Selection of MMC method should happen very early on (Stage 2) to allow greater input into the design.

December 14, 2020

Populo Living has been the given the green light to build 200 new social rent homes above existing council-owned blocks in Newham

MMC Definition Framework Categories

The MMC definition framework is an output from a government initiated cross industry working group, supported by NHBC and RICS among others. Further information can be found at www.gov.uk/publications.

Category 1. 3D primary structural systems- volumetric

3D units built in controlled factory conditions - they are brought to site with or without internal/external finishes and services.

Category 1

Category 2. 2D primary structural systems

Flat panel units used for floor, wall and roof structures. They can be simple open skeletal structures, where services insulation and finishes are installed onsite (2a). Or this can involve closed panels where insulation, finishes, windows etc are installed in the factory (2b).

Category 2a

Category 2b

Category 3. Structural components

Load bearing beams, walls, precast stairs and slabs.

Category 3

Category 5a. Volumetric podded assemblies- Non structural components

Bathroom pods, kitchen assemblies, utility cupboards, plant rooms

Category 5b. Panelised/linier assemblies- Non structural components

Vertical risers, partitions and floor cassettes (that include services and insulation), façade assemblies.

Category 5a

Category 5b

Why MMC does not directly reduce embodied carbon

Modern Methods of Construction do not directly reduce embodied carbon. The materials chosen in the construction attribute the most to its WLC impact. However, there are some benefits to MMC that could be utilised to address embodied carbon in a building's concept design, procurement and end of life considerations.

Procurement

If there is a strong client brief to reduce WLC early, contractor and supply chain involvement in the design process can inform material choices and collaborative work to provide solutions.

Facility energy usage

Appropriate MMC solutions could be selected to improve the speed of delivery reducing the energy used on site. To provide comparable savings the off-site manufacturing plant and facilities should be powered by renewable energy. Manufacturers with better green energy credentials would positively influence the embodied energy calculated in the material's cradle to gate assessment.

Waste

Off-site construction allows more efficient control, reuse, recycle and proper disposal of waste. However, increased material use in overengineering components to withstand increased stresses like transportation and installation are common in MMC. Transport links of materials from cradle to factory to site are increased, however individual labour transportation by employees is generally reduced.

Future consideration of materials at the end of their life can be better designed in in controlled environments. With elements being designed for disassembly for either reuse or effective recycling.

Watch points – Embodied carbon

High embodied carbon due to over-engineering

Whilst optimising/standardising the design with the contractor could reduce material waste. Watch out for overengineering of structure – particularly for Cat 1 volumetric which often requires strengthening of structure to withstand crane installation (20 min earthquake).

Ask for demonstration that MMC design will meet embodied carbon Net Zero KPIs targets through an embodied carbon assessment, and target figures in line with the LETI guidance. Refer to the 'Part 2: Embodied Carbon Topic Paper for further information.

Ask for demonstration of quantification of the amount of wastage (typical 5% should be lower than this but not necessarily significant).

Consider location of manufactory plant and storage

In terms of embodied carbon transportation is unlikely to be the highest contributing factor to embodied carbon - however you may wish to review this if components are transported overseas.

Avoid overseas manufacture. Local manufacture/storage is preferential but not a massive driver for embodied carbon.

Combustible materials (CLT, SIPs, timber frame)

Currently it not possible to use 'combustible' materials within the external envelope for **residential buildings over the 18m threshold (over 6 stories) but this could reduce to 11m threshold (over 4 stories)**

Whilst using timber/CLT structures has a lower embodied carbon. Avoid using combustibles in external façade/structure for residential buildings over an 18m threshold (more 6 stories).

Adaptability and Reuse

With Modern Methods of Construction there are opportunities to design for later adaptability without the need for extensive demolition. There is opportunity to design for end of life with components that can disassemble for reuse or recycling.

Ask the client and design team if they have a strategy for end of life stages as part of a whole Life Cycle Assessment. It is easier to implement into the brief from an early stage.

Watch points – Operational energy

- **Low U-values**

Net Zero homes require high performance system and thicker insulation - existing systems might not offer this level of performance or may not be compatible with the wall thickness requirements

Ask for demonstration that MMC design will meet Net Zero KPIs targets (i.e. space heating target). Ensure performance targets are a key criteria to inform decision of MMC method.

- **Compromised operational performance due to thermal bridging**

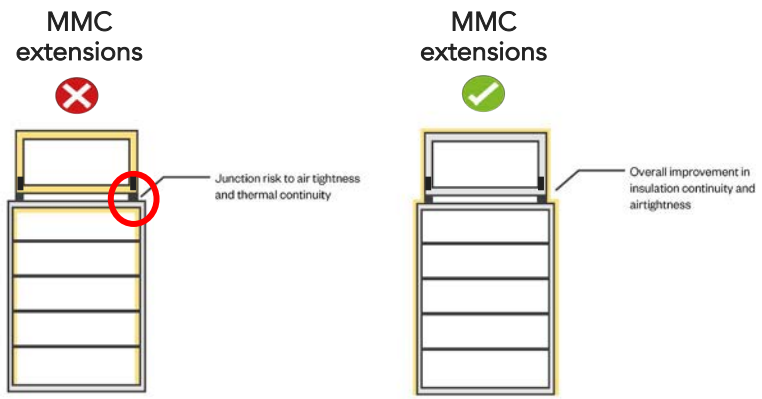
There are likely to be more joining edges and connections between components - this creates more potential for thermal bridging at these points.

Ask for demonstration that MMC design will meet Net Zero KPIs targets (i.e. space heating target). Ask for demonstration that thermal bridging and connection have been considered. MMC design which wrap the external envelope with insulation are more likely to avoid this issue.

- **Risk to airtightness**

Similarly more joining edges and connections - creates more potential weakness to airtightness, particularly if there are lots of penetrations through the airtightness layer

Ask for demonstration that MMC design will meet space heating target and airtightness requirement.



Life cycle stages: Carbon is emitted throughout a building's lifetime

What are Life Cycle Stages?

Whole life carbon 'life cycle modules' are set out by the BS EN 15978 and the RICS Professional Statement articulating the four stages in the life of a typical project.

- **Module A1 – A5** (Product sourcing and construction stage)
- **Module B1 – B7** (Use stage)
- **Module C1 – C4** (End of life stage)
- **Module D** (Benefits and loads beyond the system boundary)

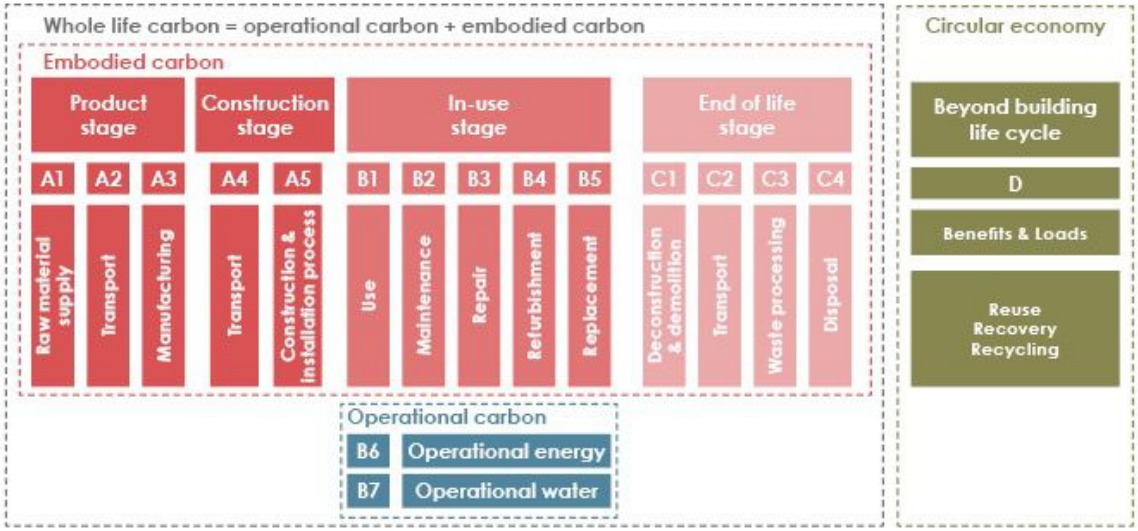


Image and data curtesy of LETI

Advantages and Disadvantages of MMC from Embodied Carbon Perspective - Summary

Conclusion

Modern Methods of Construction do not directly reduce embodied carbon. The materials chosen in the construction attribute the most to its WLC impact.

MMC could utilise opportunities to address embodied carbon in a building's concept design, procurement and end of life considerations.

Through early brief setting of embodied carbon KPIs and early engagement with contractor/supply chain are critical to deliver on net zero targets.

Selecting MMC method and materials early to inform the design process and using whole life carbon assessments to inform decisions and viability.

While issues of procurement, on-site energy usage and waste are key in designing low carbon buildings, current practices are not accountable in the design process. Only with early-stage policy and regulation will MMC be a better influencer of embodies carbon reduction.

cycle assessment (LCA) results across Elementa Consulting projects in the UK.

Advantages	How	Life Cycle Stage	Life cycle stage proportion of Whole Life Carbon*	Overall Whole Life Carbon Reduction %	Overall Impact
Reduces on-site **energy consumption**	• Due to reduced construction time • Off-site manufacturing plant may be powered by renewable energy	Construction (A5)	2-5%	<1%	Low
Reduces on-site **waste generation**	• Off-site construction allows more efficient control, reuse, recycle and proper disposal of waste	Construction (A5)	2-5%	<1%	Low
Reduces labour **transportation** emissions	• MMC workers are more likely to be geographically located around a MMC manufacturing plant • Reduced project time therefore reduced transportation	Construction (A5)	2-5%	<1%	Low
Easy to **disassemble** and relocate at end of life	• Materials can be easily separated and more readily re-used at end of life	End of Life Stage (C1,C2 & D)	1.5-2%	Not applicable (impacts building circularity, not EC)	Low

Disadvantages	How	Life Cycle Stage	Life cycle stage proportion of Whole Life Carbon	Overall Whole Life Carbon Reduction %	Overall Impact
Increased **materials** used	• When combining modular with panelised/on-site construction, temporary walls or framing is used to add extra structural support. • When two modules are joined together, the adjoining walls are double thick, which creates redundant materials • Some manufacturers estimate 10-25% more materials are used in modular homes in order to achieve the same structural benefits. • Modular units require more structural support to handle the stresses of transportation and lifting to site, and this structural support is often achieved using steel. Studies have shown a 20% increase in carbon impact for MMC.	Product Stage (A1-A3)	55-65%	Can be increase or decrease depending on MMC type.	High
Increased **transport** links	• Increased transportation stops from source to manufacturing plant to site	Product and Construction Stages (A2 / A4)	2-4%	<1%	Low