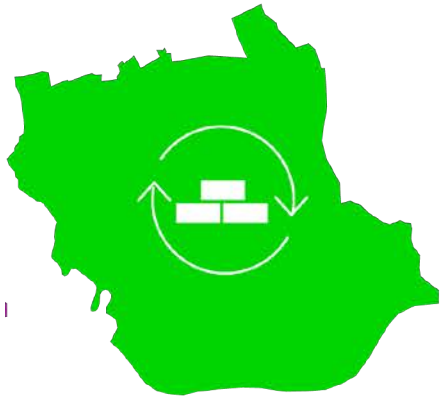
Newham London



NEW LOCAL PLAN | CLIMATE EMERGENCY

Embodied carbon topic paper

May 2022 | Rev D

Levitt Bernstein People.Design

ELEMENTA

Currie & Brown

Etude

Who prepared this topic paper?

The London Borough of Newham commissioned a multidisciplinary team of architects, engineers, cost consultants and energy specialists to develop this topic paper.

The work was directed by Ellie Kuper Thomas (Planning Policy Manager) and James Scantlebury (Senior Planner).

Levitt Bernstein is an award-winning architectural practice with a progressive and sustainable outlook.

Levitt Bernstein have specialised in the design of homes since 1968 and have a national reputation for our work in policy, standards and regulation. This includes work on the Nationally Described Space Standard and the three-tier standard for Approved Document M..

Elementa Consulting, a member of Integral Group, provide Mechanical, Electrical and Public Health (MEP) services design, fire and lighting design, resilience consultancy, strategic sustainability, wellness consultancy and advanced energy modelling for projects in the UK and abroad.

Elementa operate in all sectors of the built environment.

Currie & Brown has developed over the last 15 years specialist expertise in cost, technical and commercial advice on sustainability in construction, high performance and low carbon buildings. They provide specialist cost and techno-economic modelling to support the development of national policy and work with a range of private and public developers to maximise the benefits of their projects.

Etude is a SME of engineers specialising in energy and sustainability and dedicated to finding solutions to the climate crisis. One of our strengths is to combine building projects (which we work on at all phases) and strategic technical work on Net Zero carbon, including evidence bases and action plans. We regularly advise Local Authorities on carbon reduction, including Greater Cambridge, Cornwall Council, and many London boroughs.

What is Whole Life Carbon?

Whole Life Carbon

Whole life carbon brings together embodied carbon, operational carbon, as well as any benefits associated with recovery, reuse, or recycle beyond the system boundary.

Embodied Carbon

Embodied carbon refers to the greenhouse gas emissions associated with the manufacture, transport, construction, repair, maintenance, replacement and deconstruction of all building elements.

Operational Carbon

Carbon emissions associated with the energy and water use during a building lifetime. This can be affected by what heating system the building uses and the performance of the buildings fabric.

Current and future comparison of embodied & operational carbon in building projects.

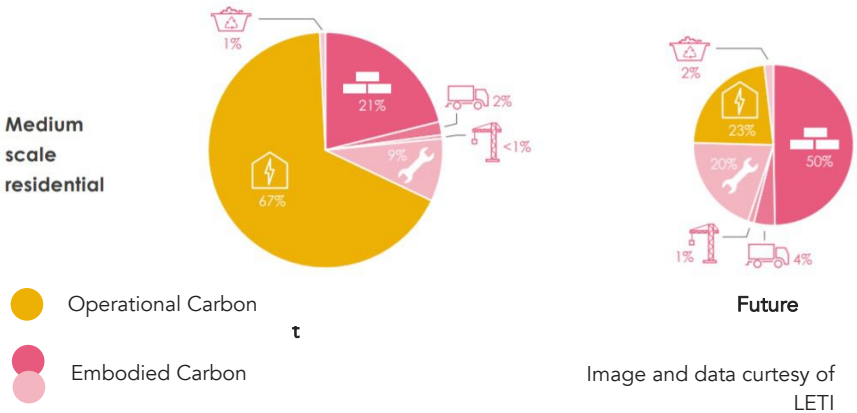
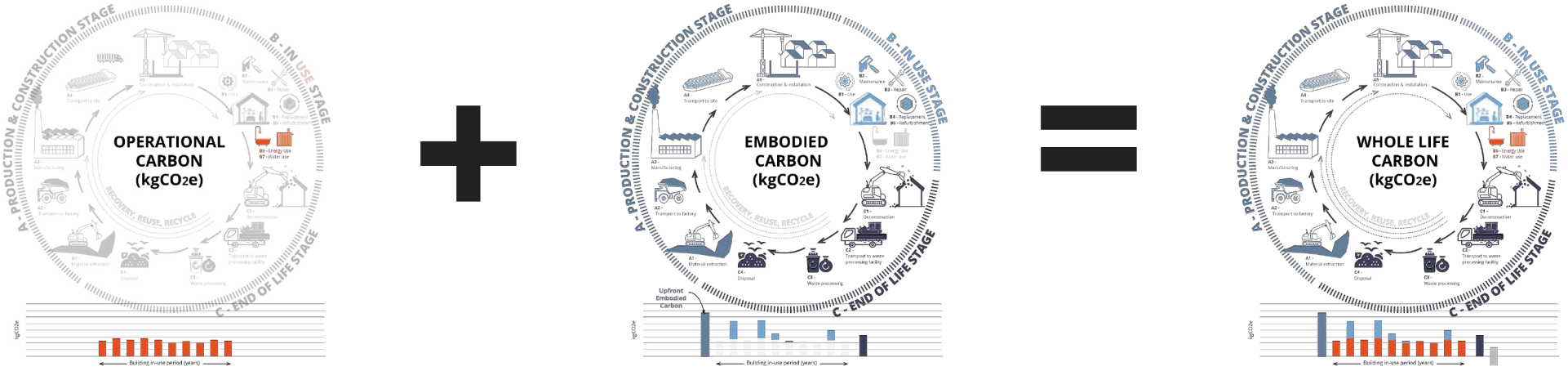


Image and data curtesy of LETI

Why is Embodied carbon important?

Both operational and embodied carbon must be reduced to address the climate crisis. Operational carbon is more closely monitored in current legislation and policy. Embodied carbon must be drastically curtailed throughout the building life cycle. Identify big ticket items early and target reductions during the design stage for largest impact.



Whole life carbon assessments

A life cycle assessment (LCA) is the process by which Whole Life Carbon is calculated.

Guidance

At the time of writing there are no universal standard targets for embodied carbon due to a limited evidence base across multiple typologies, however LETI and RIBA have set targets which provide a good baseline. The BS EN 15978 and the RICS Whole Life carbon assessment for the built environment set out the requirements for the assessment of embodied carbon and whole life carbon.

GLA policy requirements

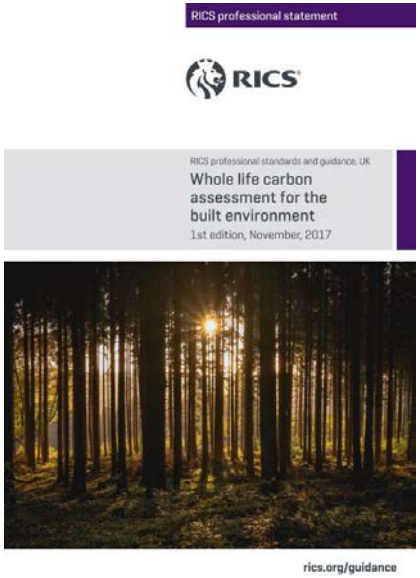
The London Plan Policy SI 2 sets out a requirement for developments to calculate and reduce Whole Life Carbon Emissions, currently this is only for projects referred to the Mayor. Applicants are required to use the Whole Life-Cycle Carbon Assessments London Plan Guidance published in March 2022.

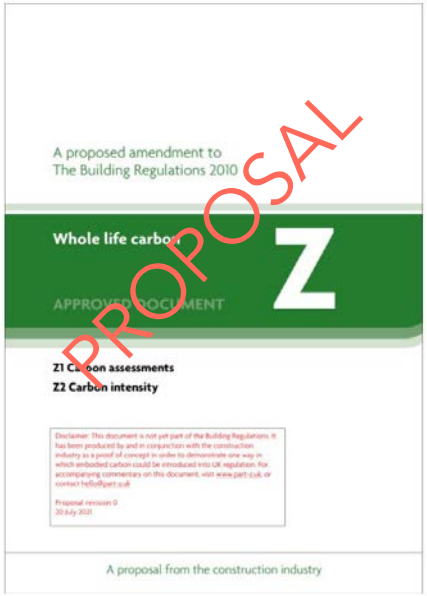
Proposed Regulation

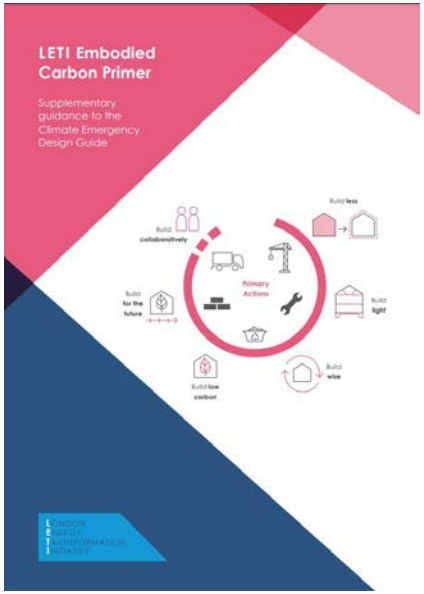
Whole life carbon assessments are being proposed by industry to be included as part of the building regulations; this movement has given the proposal the name 'Document Z'. The proposed 'Document Z' is in alignment with the RICS Professional Statement 'Whole Life Carbon Assessment for the Built Environment', and endorsed by the RIBA, IStructE, CIBSE, UKGBC and LETI. This is currently gathering support by industry leaders. It proposes that whole life carbon emissions are assessed for non domestic buildings from 2023, domestic buildings from 2025 and that targets are brought in for upfront carbon in 2027.

LETI Guidance

At the time of writing the current guidance is in the Carbon Alignment and Embodied Carbon Pages on the LETI website, which offers a wealth of information on embodied and whole life carbon, including proposed targets.







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.

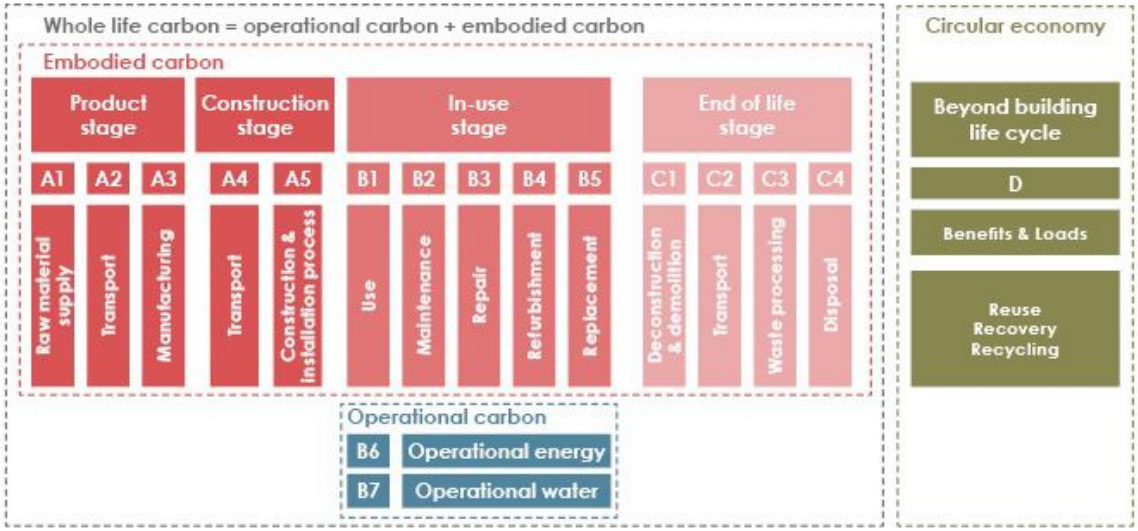
- **Module A1 – A5** (Product sourcing and construction stage)
- **Module B1 – B7** (Use stage)
- **Module C1 – C4** (End of life stage)
- **Module D** (Benefits and loads beyond the system boundary)

Upfront Embodied carbon (Module A1 – A5)

Upfront embodied carbon is the carbon emission up until the building is built. It contributes the largest proportion of embodied carbon across a building's life cycle and therefore it is important to set a target to significantly reduce this through early design consideration.

Life cycle Embodied carbon (Module A1 – C4)

Life cycle Embodied carbon is calculated by incorporating through modules A-1-5, B1-5, C1-4; this includes the whole life cycle of the building from construction, in-use, and end-of-life.



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Life cycle stages: Tackle Embodied Carbon Upfront

When is best to tackle Embodied Carbon?

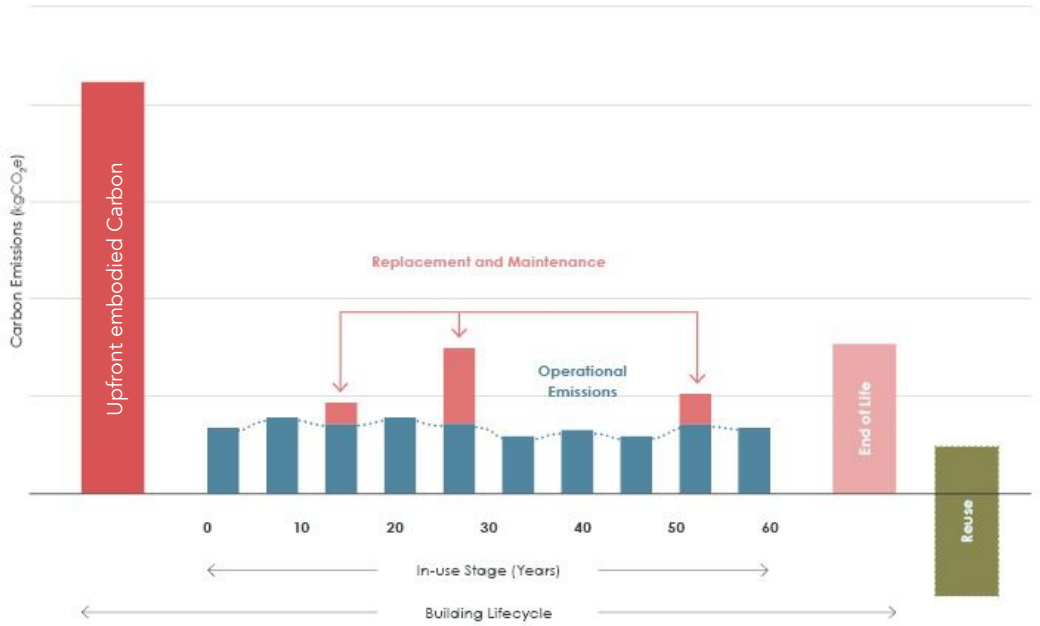
In tackling embodied carbon the best time to address the issues is;

- **Pre-application**
- **Planning application** (i.e. RIBA Stage 2/3)
- **Procurement Process**

In current Policy, the GLA requires planning applicants to submit a WLC assessment for referable schemes. However, it is encouraged that embodied carbon be addressed and discussed for all projects at pre-app stage to encourage early design stage analysis. The GLA uses the life-cycle modules as discussed on the previous page.

What to Include in Whole Life Carbon Assessments?

- Operational carbon emissions (both regulated and unregulated)
- Embodied carbon emissions
- Future potential carbon emissions 'benefits', post 'end of life', including benefits from reuse and recycling of building structure and materials.



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Embodied carbon targets

There are two methodologies for developing an embodied carbon target, either a percentage reduction from a baseline, or an absolute target. An absolute target is a much more robust approach, and is the approach taken by LETI and RIBA and the proposals in Part Z.

For embodied carbon there are two types of targets available, firstly just the upfront embodied carbon, and secondly lifecycle embodied carbon. Its important to note the sequestration* from timber and other natural materials are not included in upfront carbon.

It is important that buildings meet both the upfront embodied carbon and the life cycle embodied carbon targets. An upfront embodied carbon targets is relevant for policy and regulation as upfront carbon is this is in direct control of the developer and contractor.

How do we define good

There are currently no approved universal standard targets defined for embodied carbon however, LETI and RIBA targets have been aligned since May 2021, with best-practice performance for projects in the design phase considered to be a "C" rating, while a "B" and above is considered a robust stretch target for projects currently in the design phase.

** Sequestration is the amount of carbon absorbed by a material before it is used as a building product.*

Upfront Embodied Carbon, A1-5 (exc. sequestration)

Band	Office	Residential (6+ storeys)	Education	Retail
A++	<100	<100	<100	<100
A+	<225	<200	<200	<200
A	<350	<300	<300	<300
B	<475	<400	<400	<425
C	<600	<500	<500	<550
D	<775	<675	<625	<700
E	<950	<850	<750	<850
F	<1100	<1000	<875	<1000
G	<1300	<1200	<1100	<1200

Life Cycle Embodied Carbon, A1-5, B1-5, C1-4

Band	Office	Residential (6+ storeys)	Education	Retail
A++	<150	<150	<125	<125
A+	<345	<300	<260	<250
A	<530	<450	<400	<380
B	<750	<625	<540	<535
C	<970	<800	<675	<690
D	<1180	<1000	<835	<870
E	<1400	<1200	<1000	<1050
F	<1625	<1400	<1175	<1250
G	<1900	<1600	<1350	<1450

LETI targets

Building Target	Equivalent letter banding
LETI **Design** 2020 Target	C
LETI **Design** 2030 Target	A
RIBA **Built** 2030 Target	B

Ways to Reduce Embodied Carbon in Building Projects

There are key opportunities to reduce the embodied carbon in projects, from the concept design to in-use maintenance strategies.

What can you do?

Refurbishment over new build
Only build new when existing buildings cannot be reused or refurbished.

Lean design
Structural: Design structure for 100% utilisation. Use bespoke loading assumptions, avoid rules of thumb. Reduce spans and overhangs.
Architectural: Use self-finishing internal surfaces. Reduce the quantity of metal studs and frames.
Building services: Prioritise fabric performance to reduce services. Reduce duct runs, specify refrigerant with GWP<150, and ensure low leakage rate.

Material and product choice
Prioritise materials that are reused, reclaimed or natural from local areas and sustainable sources and that are durable. If not available use materials with a high recycled content. Use the following material hierarchy to inform material choice particularly for the building structure;

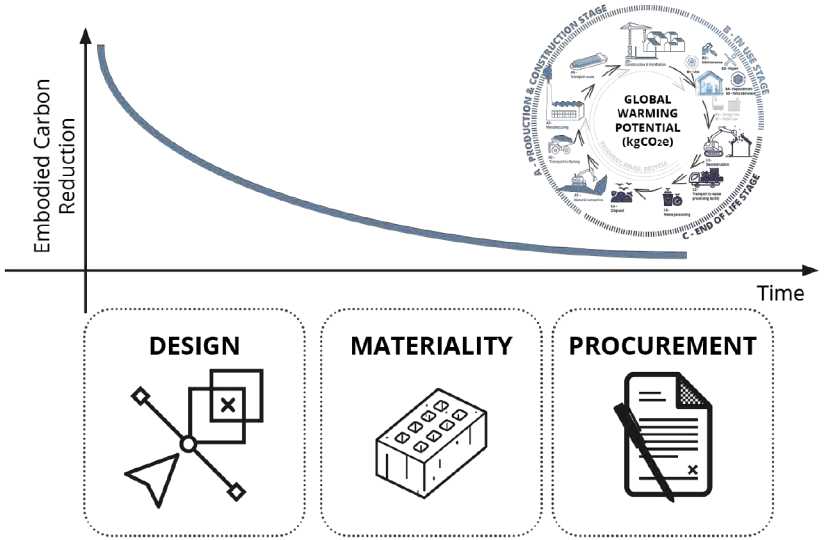
1. Natural materials e.g. timber
2. Concrete and masonry
3. Light gauge / Cold rolled steel
4. Hot rolled Steel

Ask manufacturers for Environmental Product Declarations (EPD) and compare the impacts between products in accordance with BS EN 15804

Housing adaptation & flexibility
Allow for flexibility and consider how a layout may be adapted.

Easy access for maintenance
Maintained equipment will last longer.

Design for disassembly
Consider disassembly to allow for reuse at the end of life of the building. Create material passports for elements of the building to improve the ability of disassembled elements to be reused. Material passports should be prioritised for high embodied carbon materials and products such as products made of metals.



Design
During the design process there are key opportunities to reduce the embodied carbon in projects. Early discussions about embodied carbon are key to identifying areas that could lead to carbon savings.

Procurement
Maintaining design elements related to embodied carbon can be difficult within the procurement process. Strength of brief is key in the continuation between building design and delivery. Early contractor appointment and involvement in the design process also helps maintain good energy standards.

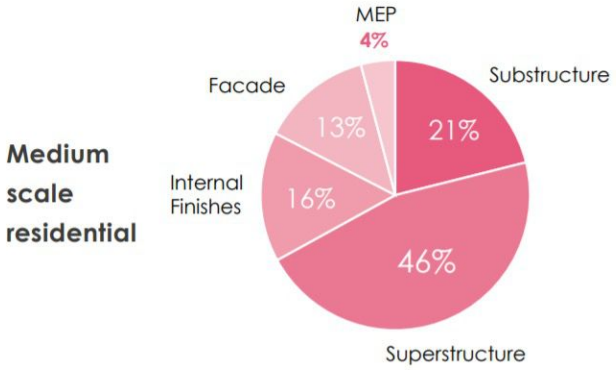
Low embodied carbon: structures can have the biggest carbon reduction

Structure

Embodied energy in the majority of construction projects can be attributed to the superstructure. In reducing this, a large percentage of the project's total embodied carbon can be reduced. It is therefore important to collaborate with the structural engineer early and considering how a building can be optimally designed can reduce more embodied carbon than the tinkering of finishing materials later down the line. For further information and guidance on Embodied carbon in structure see https://www.istructe.org/resources/climate-emergency/ https://www.istructe.org/resources/guidance/carbon-embodied-operational/

Restrictions due to fire regulations

At the time of writing, it not possible to use 'combustible' materials within the external envelope for residential buildings over the 18m threshold (over 6 stories). This could reduce to 11m threshold (over 4 stories) in future legislation. Check current Part B Building Regulations for accurate and up-to-date information.



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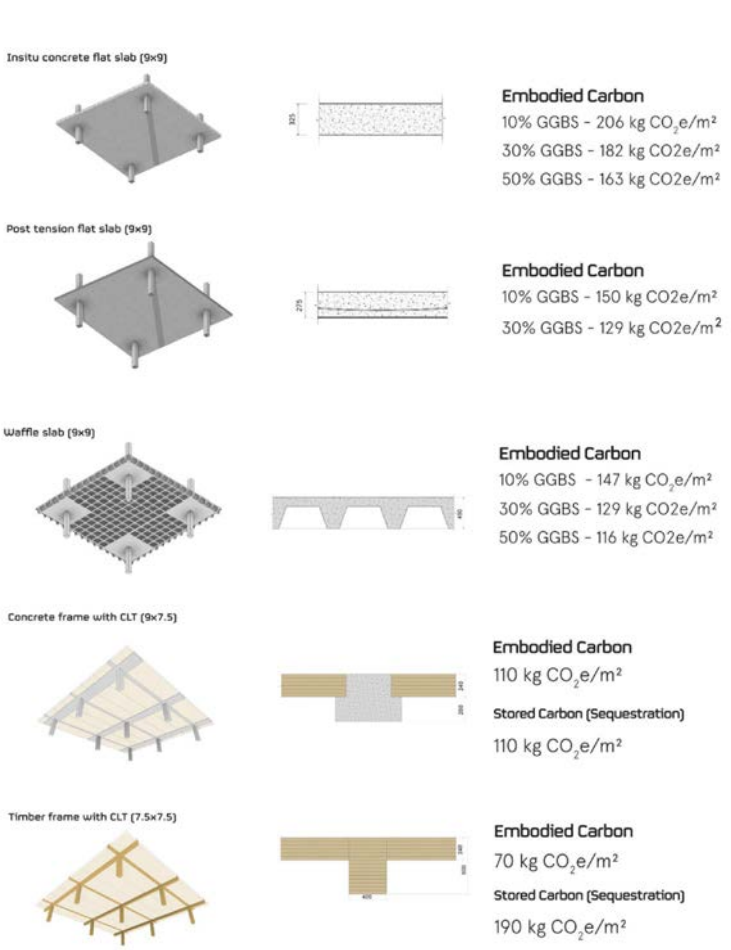

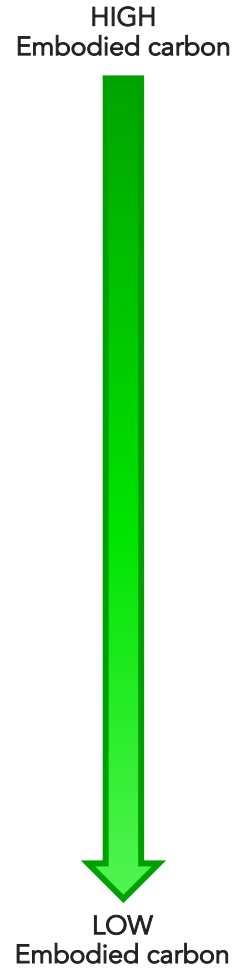

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Summary and recommendations for policy

Suggestions for Policy – WLC assessment for all major developments not just referable schemes

London Plan Policy SI 2 requires the calculation of embodied carbon and Whole Life Carbon. By requiring deign teams to calculate embodied carbon, this is a good first step to start to understand and then reduce embodied carbon. Current policy requirement is for 'Referable' schemes only. We would suggest that Newham extends this policy further and make it applicable for all major developments.

Upfront carbon limits for schemes

A more robust approach would be that the Newham policy be the first to introduce embodied carbon limits for schemes, as this requires embodied carbon to be reduced as well as calculated.

It is suggested that these limits are developed for upfront embodied carbon, as this is this is in direct control of the developer and contractor.

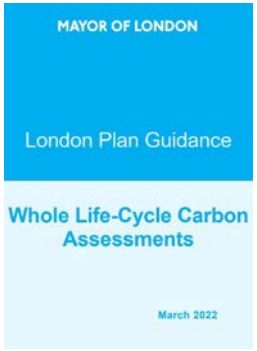
A report would be required as part of the planning submission that demonstrates the calculation of the expected upfront embodied carbon of buildings. Embodied carbon calculations should be reconfirmed post completion.

When to discuss embodied carbon

Encouraging design teams to start thinking about embodied carbon early in the process is key. Raising issues at Pre-Application planning meetings would encourage Whole Life Carbon decisions to be taken early in the process.

Further current guidance to be recommended

Steering applicants to relevant information is key in starting the conversation around embodied carbon. Further supplementary guidance can be found in the LETI Embodied Carbon Primer.



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WLC assessment for all major developments not just referable schemes

Introducing upfront embodied carbon targets

What upfront embodied carbon limits shall we set?

The LETI C rating is a good target to set initially, with the view to reduce this over time. LETI has targets for office, homes, retail and residential. It should be noted that the target for homes is for homes above 6 storeys. LETI, RIBA, CIBSE, UKGBC and others are collaborating this year to develop targets for further typologies.

Further areas of investigation

As this is an emerging area of policy there are some topics that require further investigation. A more robust evidence base with a wider range of typologies to inform the targets set is being developed and should be available summer 2022. From this viability assessments with deliverability and cost impacts can be undertaken. Another area that would benefit from investigation is an independent review of laminated timber and CLT construction materials in relation to UK fire regulations.