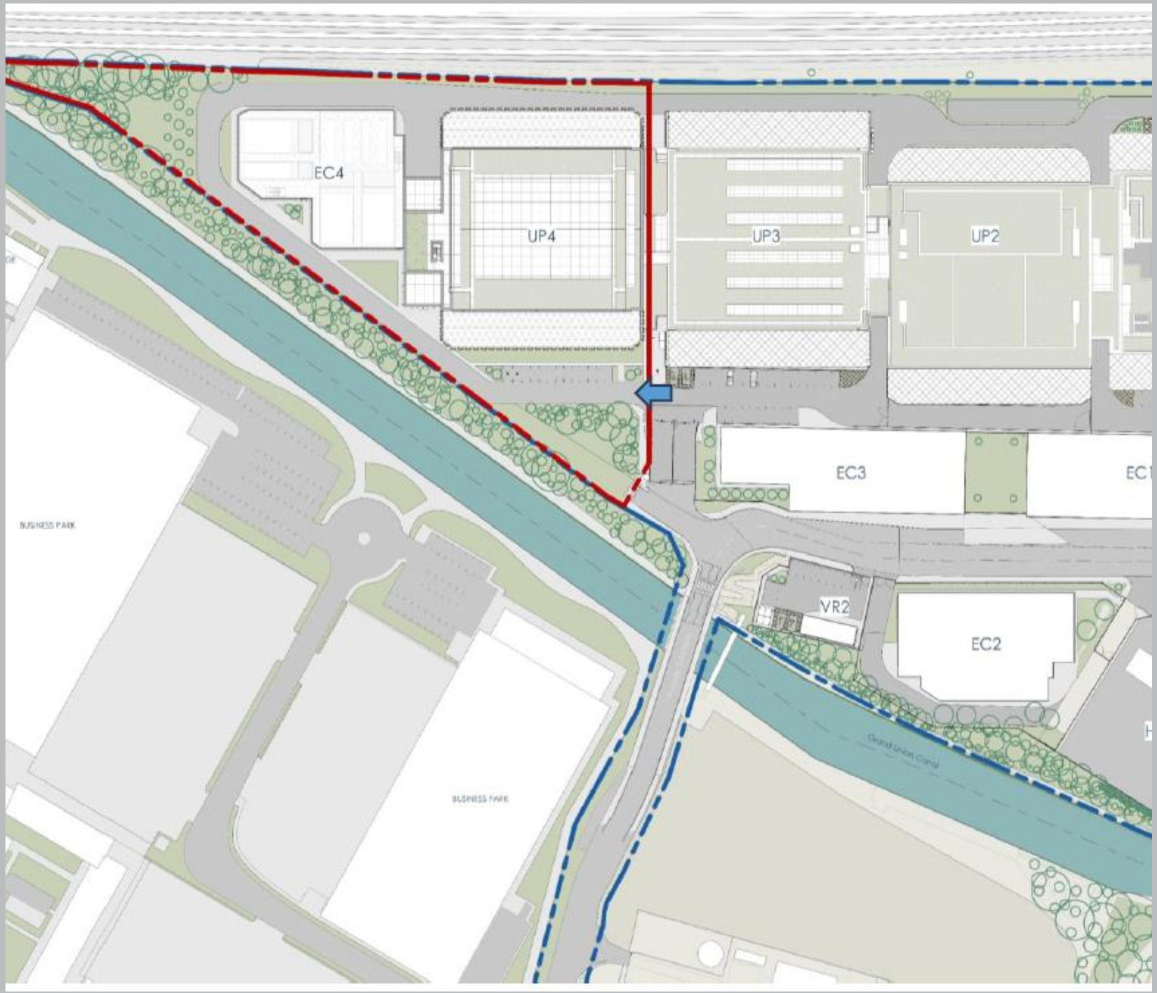
WLC and Circular Economy Workshop

18th November 2024



Agenda

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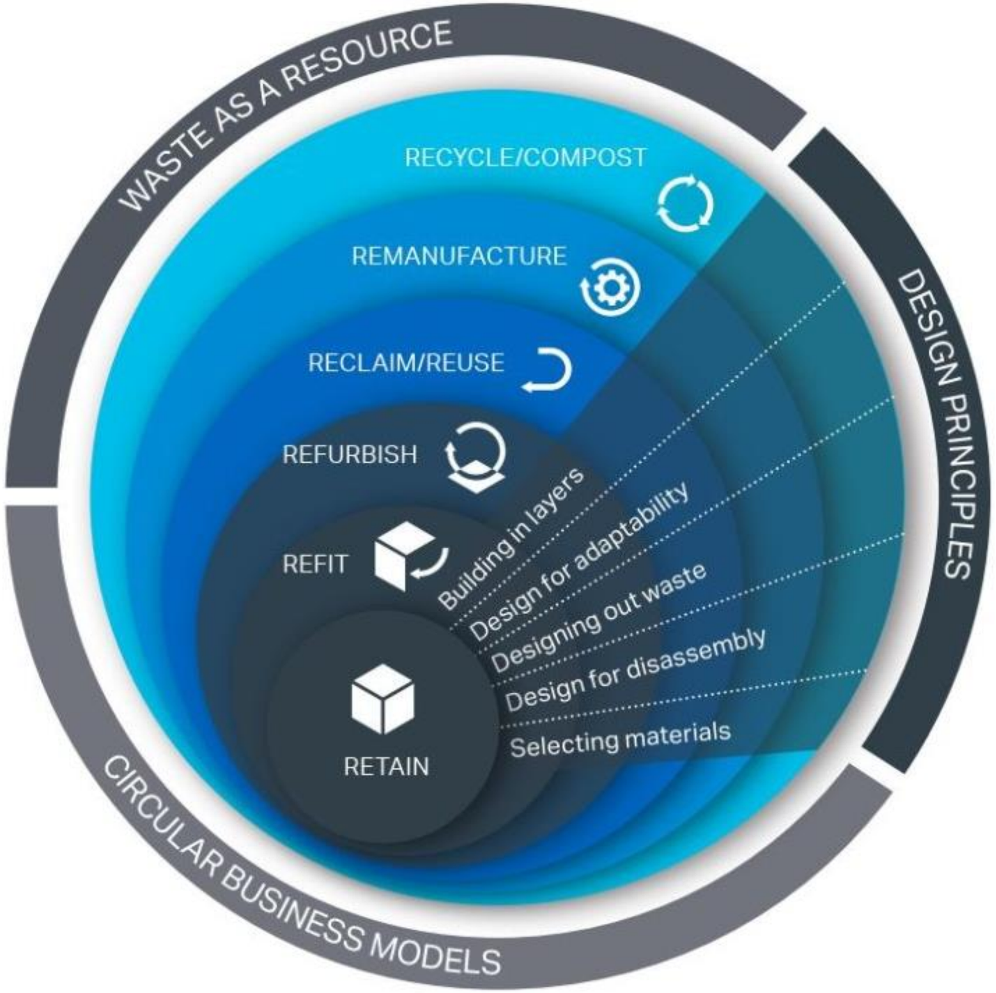


Purpose & Objectives

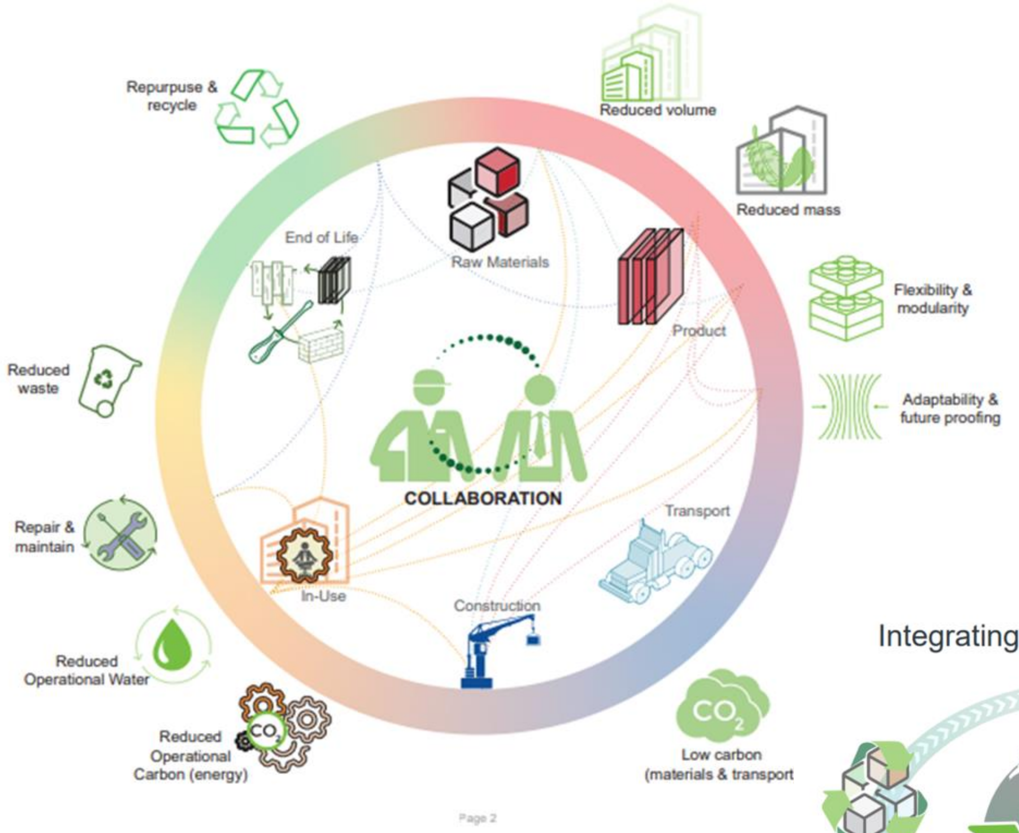
The aim is to facilitate conversations and collaboration across the design team in relation to whole life carbon and circular economy, with the aim of reducing the embodied and operational carbons impact of the development.

Establish the evidence level for the Circular Economy and Whole Life Carbon Statements (to be produced for Planning).

Support evidence base for BREEAM certification requirements.

Identify the opportunities that will help enable circularity and reduce embodied carbon within the project and beyond.

Identify key actions and next steps



Integrating Whole Life Carbon

GLA guidance and requirements WLCA

Policy SI 2 F of the London Plan 2021

- Ensure that a significant source of emissions from the built environment is accounted for.
- Achieve resource efficiency and cost savings, by encouraging refurbishment, and the retention and reuse of existing materials and structures, instead of new construction.
- Identify the carbon savings from using recycled material and the benefits of designing for future reuse and recycling, to reduce waste and support the circular economy.
- Encourage a ‘fabric first’ approach to building design, to minimise mechanical plant and services in favour of natural ventilation.

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- Ensure operational and embodied emissions are considered at the same time to find the best solutions for the development over its lifetime
- Identify the impact of maintenance, repair and replacement over a building’s life cycle which, by informing the building’s design and specification, improves lifetime resource efficiency and reduces lifecycle costs, contributing to the future proofing of asset value
- Encourage local sourcing of materials and short supply chains, with resulting carbon, social and economic benefits for the local economy
- Encourage durable construction and flexible design, both of which contribute to greater longevity and reduced obsolescence of buildings and avoid carbon emissions associated with demolition and new construction

GLA guidance and requirements WLCA

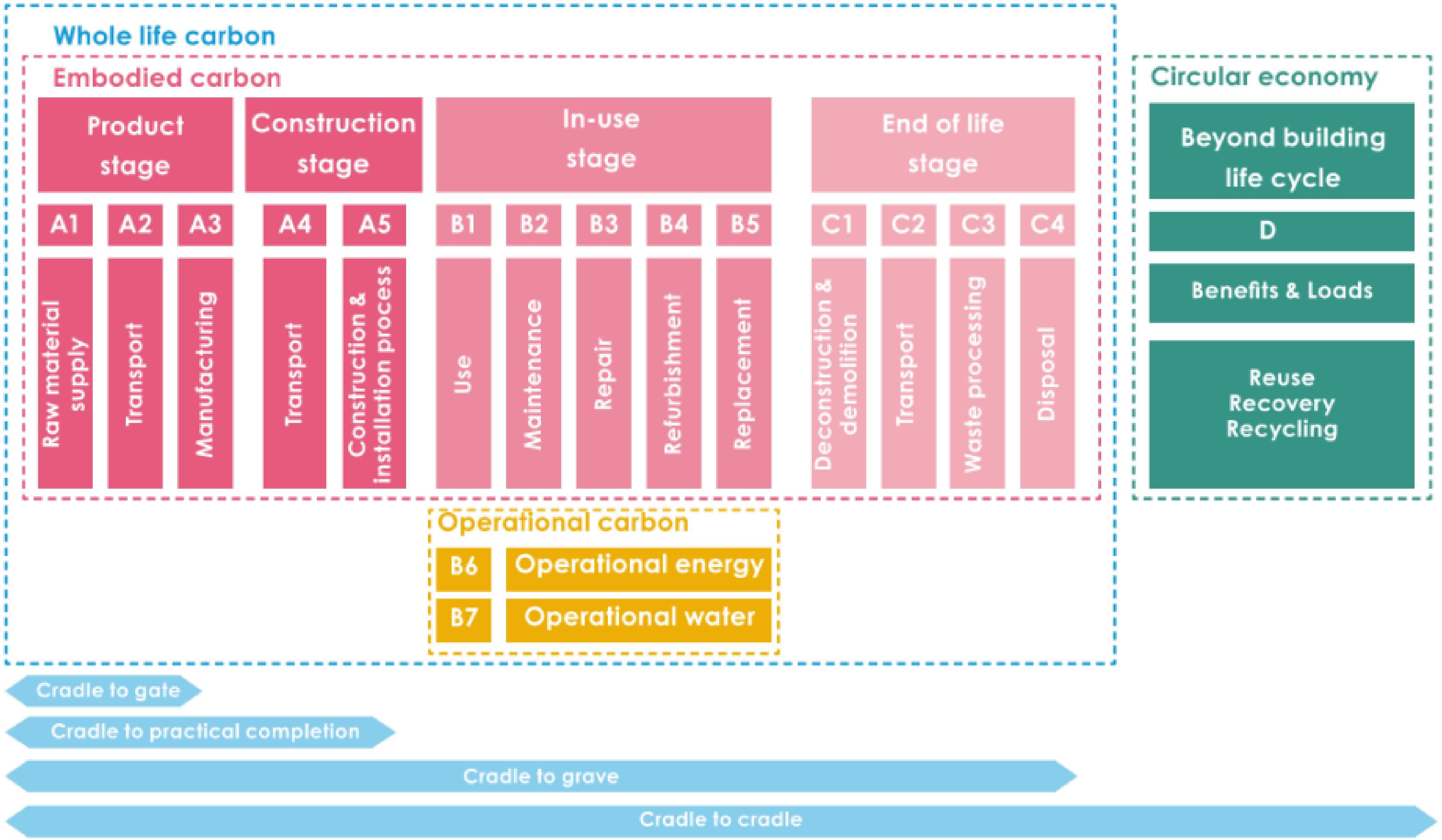


Figure A.3.2 - System Boundary: EN 15978:2011 Display of modular information for the different stages of the building assessment *(Source: LETI Embodied Carbon Primer, 2020)*

WLCA – Methodology

WLC assessments should demonstrate the actions that have and will be taken to reduce WLC emissions. The assessment should cover the development's carbon emissions over its lifetime, accounting for:

- any carbon emissions associated with pre-construction demolition
- any carbon savings associated with the retention, reuse and recycling of existing structures and materials that are already on-site
- its operational carbon emissions (both regulated and unregulated)
- its embodied carbon emissions
- any future potential carbon savings post end-of-life, including savings from reuse and recycling of building structure and materials.

WLCA – Information required

Key information required:

- Confirmation that options for retaining the building and structures have been fully explored before considering substantial demolition (link to pre-redevelopment audit in the Circular Economy).
- The percentage of the new build development that will be made up of existing facades, structures, buildings.
- Carbon emission associated with demolition (link to pre-demolition audit in the Circular Economy)
- Refrigerant types, GWP, initial charge, leakage rate, end-of-life recovery rate.
- Operational energy calculations
- Operational water consumption
- Key actions taken to reduce the developments whole life carbon emissions and the associated carbon savings
- Further opportunities to reduce the developments whole life carbon emissions
- Bill of materials (breakdown of materials used by building element, with associated quantities / volumes).

WLCA – Information requested by GLA

Building Element Group	Building Element (NRM level 2)	
Demolition	0.1 Toxic/hazardous/contaminated material treatment 0.2 Major demolition works	
0 Facilitating works	0.3 and 0.5 Temporary/enabling works	0.4 Specialist groundworks
1 Substructure	1.1 Substructure	
2 Superstructure	2.1 Frame 2.2 Upper floors incl. balconies 2.3 Roof 2.4 Stairs and ramps	2.5 External walls 2.6 Windows and external doors 2.7 Internal walls and partitions 2.8 Internal doors
3 Finishes	3.1 Wall finishes 3.2 Floor finishes 3.3 Ceiling finishes	
4 Fittings, furnishings and equipment (FFE)	4.1 FFE including building-related* and non-building-related**	
5 Building Services	5.1–5.14 Services including building-related* and non-building-related**	
6 Prefabricated buildings and building units	6.1 Prefabricated buildings and building units	
7 Work to existing building	7.1 Minor demolition and alteration works	
8 External works	8.1 Site preparation works 8.2 Roads, paths, paving and surfacing 8.3 Soft landscaping, planting and irrigation systems 8.4 Fencing, railings and walls	8.5 External fixtures 8.6 External drainage 8.7 External services 8.8 Minor building works and ancillary buildings

WLCA – GLA template (carbon emissions)

GWP POTENTIAL FOR ALL LIFE-CYCLE MODULES ($kgCO_2e$) (See Note 1 below if you entered a reference study period in cell C12)		Sequestered (or biogenic) carbon (negative value) ($kgCO_2e$)	Product stage ($kgCO_2e$)	Construction process stage ($kgCO_2e$)		
			Module A			
Building element category			[A1] to [A3]	[A4]	[A5]	[B1]
0.1	Demolition: Toxic/Hazardous/Contaminated Material Treatment					
0.2	Major Demolition Works					
0.3	Temporary Support to Adjacent Structures					
0.4	Specialist Ground Works					
0.5	Temporary Diversion Works					
1	**Substructure**					
2.1	Superstructure: Frame					
2.2	Superstructure: Upper Floors					
2.3	Superstructure: Roof					
2.4	Superstructure: Stairs and Ramps					
2.5	Superstructure: External Walls					
2.6	Superstructure: Windows and External Doors					
2.7	Superstructure: Internal Walls and Partitions					

WLCA – GLA template (targets)

	Module A1-A5 (excluding sequestered carbon)	Modules B-C (excl B6 & B7)	Modules A-C (excluding B6-B7; including sequestered carbon)
TOTAL kg CO_2e	2,759,612 kg CO2e	5,309,497 kg CO2e	4,885,485 kg CO2e
TOTAL kg CO_2e/m^2 GIA	261.6886984	503.489	463.281
enchmark from drop-down menu	Residential		
WLC Benchmark	*<850*	*<350*	*<1200*
Aspirational WLC Benchmark	*<500*	*<300*	*<800*

GLA WLC Assessment Template

WLCA – GLA template (Summary of key actions)

	Actions included in WLC assessment results reported	WLC reduction (kg CO_2e/m^2 GIA)
Summary of key actions to reduce whole life-cycle carbon emissions that have informed this assessment, including the WLC reductions	[This list does not need to be exhaustive but should identify the actions with the biggest impacts. Insert more lines if needed]	

	Further potential opportunities	WLC reduction potential (kg CO_2e/m^2 GIA)
Specify further opportunities to reduce the development's whole life-cycle carbon emissions. including the WLC reduction potential		

Example actions:

- GGBS in concrete
- Materials selection (High recycled content in materials, life expectancy of materials)
- Reuse of building structure / elements
- Designing for disassembly and reuse (reduces carbon emissions from maintenance and end-of-life phases. Increases potential for material reuse).
- Local sourcing of materials
- Lightweight construction
- Minimising waste (for example through use of standard sizes of components, using modern methods of construction (MMC), pre-cast / pre-fabricated materials, modular construction)

GLA guidance and requirements CES

<u>London Plan Policy SI 7 of the London Plan 2021</u>

'One where materials are retained in use at their highest value for as long as possible and are then reused or recycled, leaving a minimum of residual waste.'

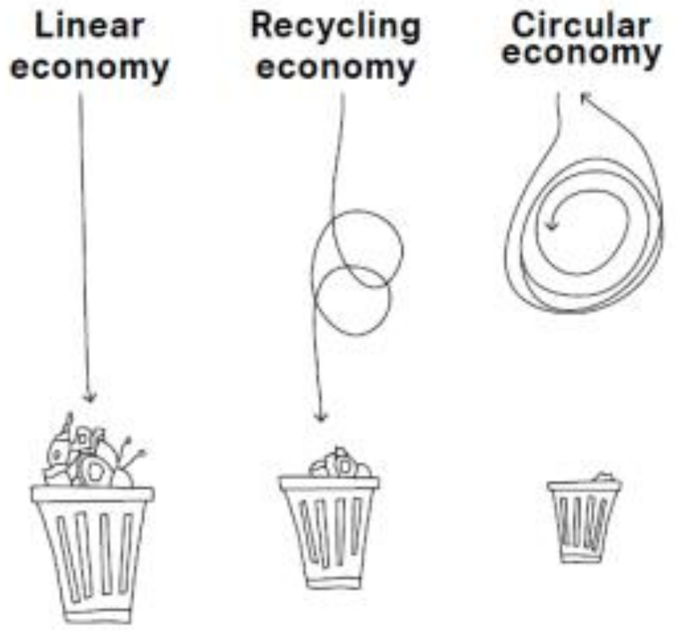
Retain material value for the longest possible time

Integrate new ways of designing, building, operating, and deconstructing the built environment

Efficient use of other resources like energy, wate and land

To support an economic transition with high level and long term thinking.

CE model, compared to the linear and recycling economies

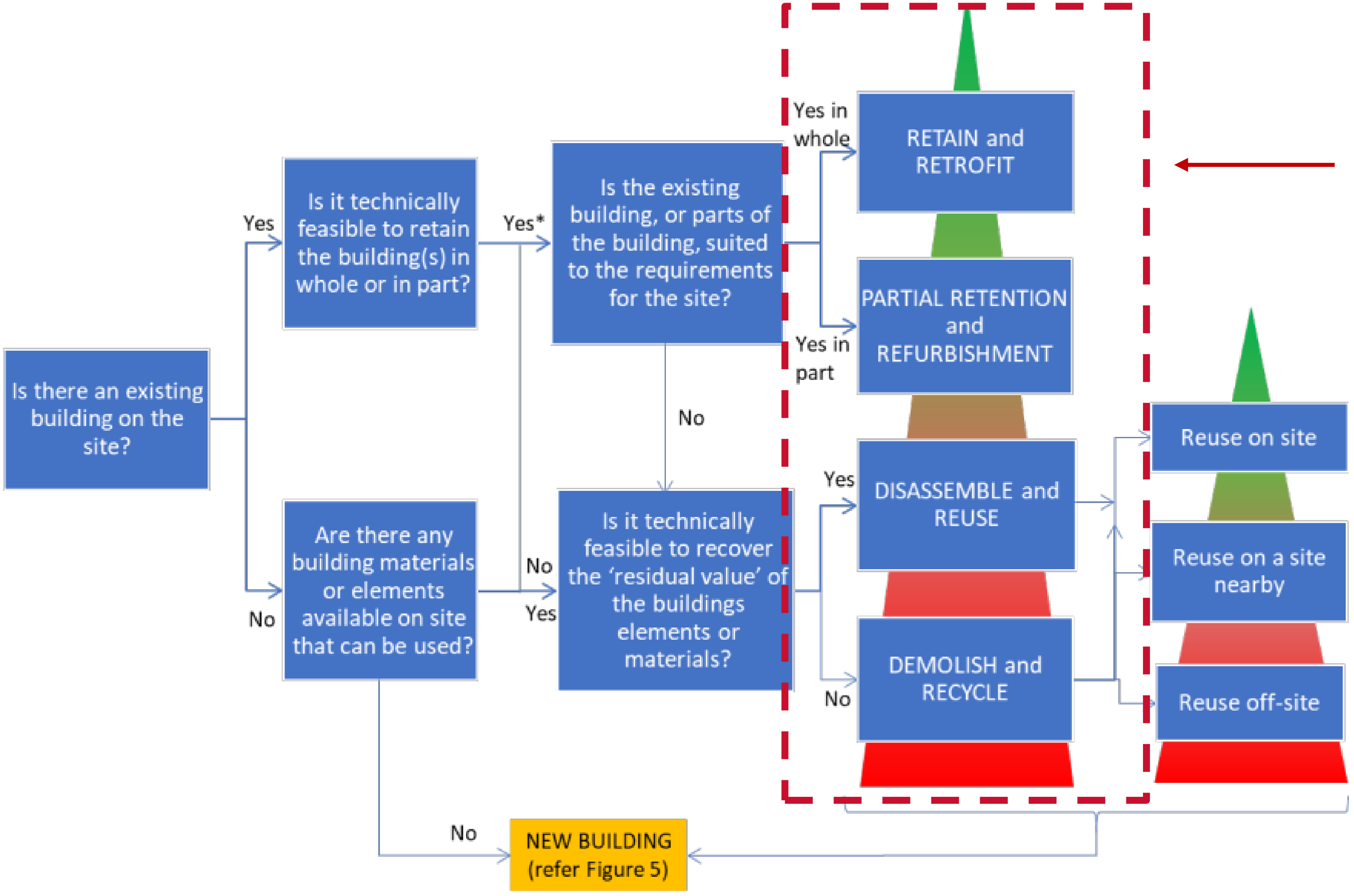


FROM TAKE • MAKE • USE • DISCARD TO RE-MAKE • USE-AGAIN

Diagram courtesy of Circular Flanders

WLCA and CES process

Decision tree for design approaches for existing structures/buildings



These are the CE Design approaches

Source: GLA's Circular Economy Guidance, March 2022

WLCA and CES process

Design approaches for existing structures/buildings

Circular Economy Design Approaches

Circular Economy Design Approaches for Existing Structures / Buildings	Applicant Response
Is there an existing building on the site?	Yes
Is it technically feasible to retain the building(s) in whole or in part?	Yes
Is the existing building, or parts of the building, suited to the requirements for the site?	No
Is it technically feasible to recover the 'residual value' of the buildings elements or materials?	No
The preferred strategy is:	**NEW BUILDING**
The preferred strategy is:	**DEMOLISH/DECONSTRUCT AND RECYCLE**

Circular Economy Design Approach	Phase/Building/Area/Layer	Strategic Response
Retain and Retrofit		
Partial Retention and Refurbishment		
Disassemble and Reuse		
Demolish and Recycle		

Justification is required for the reasons for adopting less preferred approaches or moving down the hierarchy of design approaches.

Source: GLA's Circular Economy Statements template, March 2022

WLCA and CES process

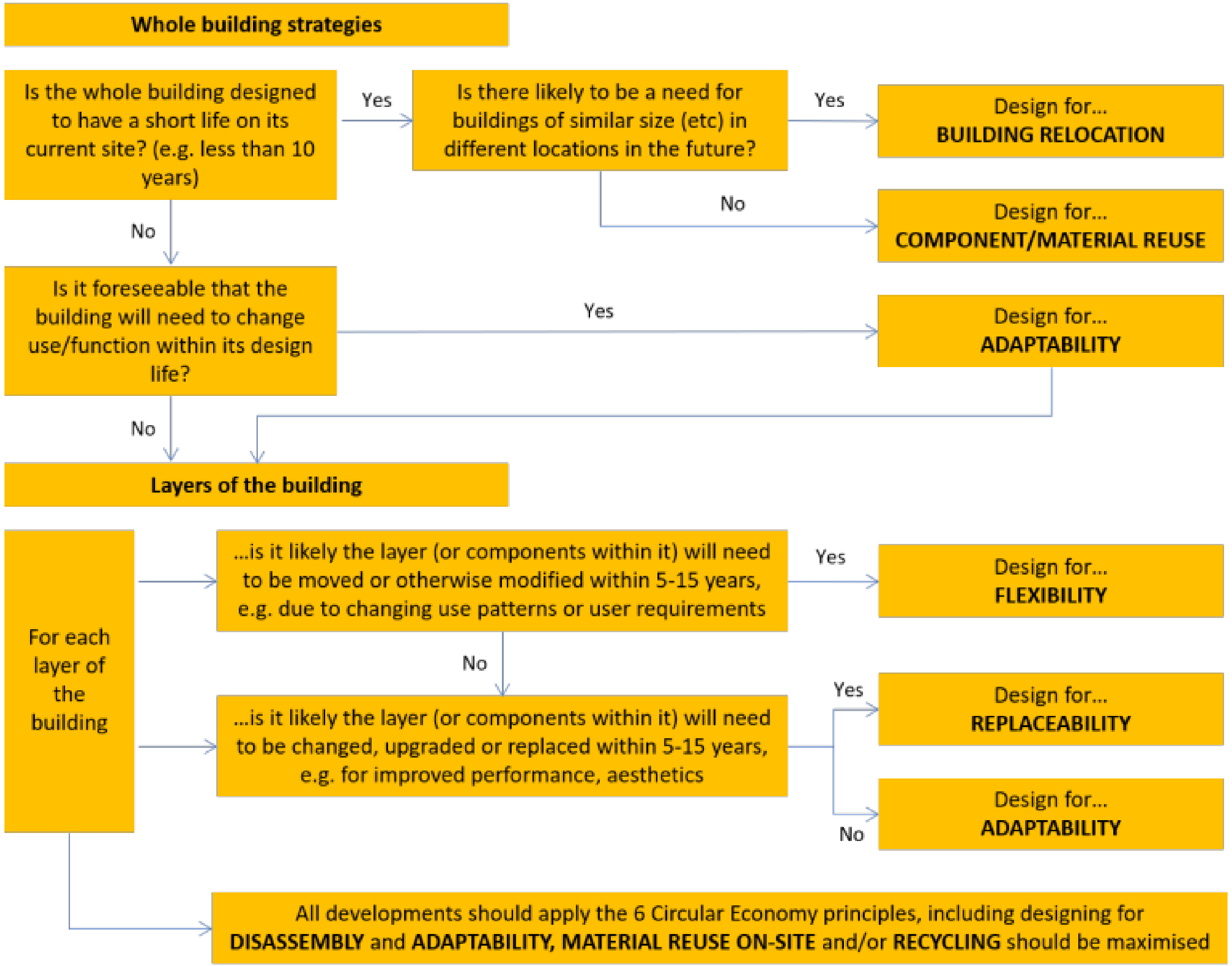
Circular Economy design approaches for new developments

All developments should be designed so that buildings can be adapted to extend their life. They should also be designed so they can be deconstructed and reconstructed to allow components and materials to be salvaged for reuse or recycling, whilst maintaining their economic and environmental value.

The appropriate design approach for new buildings and infrastructure, or new additions to existing buildings, should be informed by the decision tree and the seven CE design approaches. The decision tree should be applied for each aspect of a proposal

WLCA and CES process

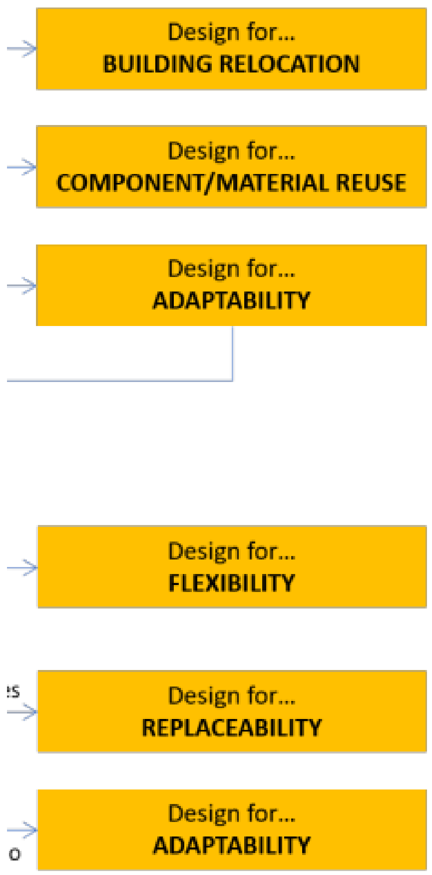
Decision tree for design approaches for new buildings



Source: GLA's Circular Economy Guidance, March 2022

WLCA and CES process

Design approaches for new buildings



New building CE design approaches	Definition
Building Relocation	Designing to allow the whole building to be used on a different site
Component or material reuse	The use of a product in its original form with minimal reprocessing. Materials can be reused as a whole; redeployed as modules; or reused as a kit of parts on one or more different sites.
Adaptability	Designing with thought of how it might be easily altered to prolong its life to suit new uses or patterns of use.
Flexibility	A building that has been designed to allow easy rearrangement of its internal fit-out and arrangement to suit the changing needs of its occupants.
Replaceability	Designing to facilitate easy removal and upgrade of components
Disassembly	Designing to allow the building and its components to be taken apart with minimal damage to facilitate reuse or recycling.
Longevity	Designing to avoid a premature end of life for all components through considering maintenance and durability.

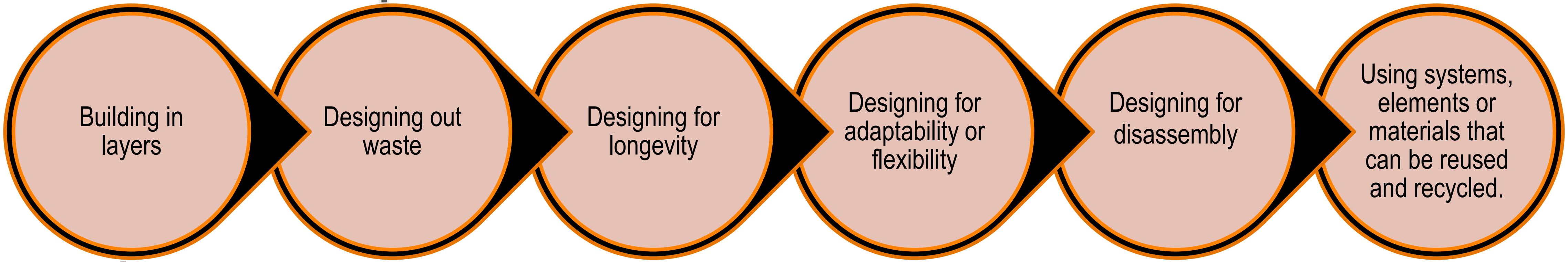
WLCA and CES process

Circular Economy Design Approaches for New Buildings, Infrastructure a		Applicant Response
Is the whole building designed to have a short life on its current site? (e.g. less than 10 yrs		No
Is it foreseeable that the building will need to change use/function within its design life?		Yes
The preferred strategy is:		**Design for ADAPTABILITY**
All developments should apply the 6 Circular Economy principles, including:		**Designing for DISASSEMBLY and ADAPTABILITY, MATERIAL REUSE ON-SITE and/or RECYCLING should be**
Circular Economy Design Approach	**Phase/Building/Area/Layer**	**Strategic Response**
Building relocation		
Component or material reuse		
Adaptability		
Flexibility		
Replaceability		
Disassembly		
Longevity		

All developments should apply the 6 circular economy principles including; designing for Disassembly and Adaptability. Materials re-use on site and/or recycling should be maximised.

WLCA and CES process

Ensuring that waste reduction is planned in from project inception to completion, including consideration of standardised components, modular build, and reuse of secondary products and materials



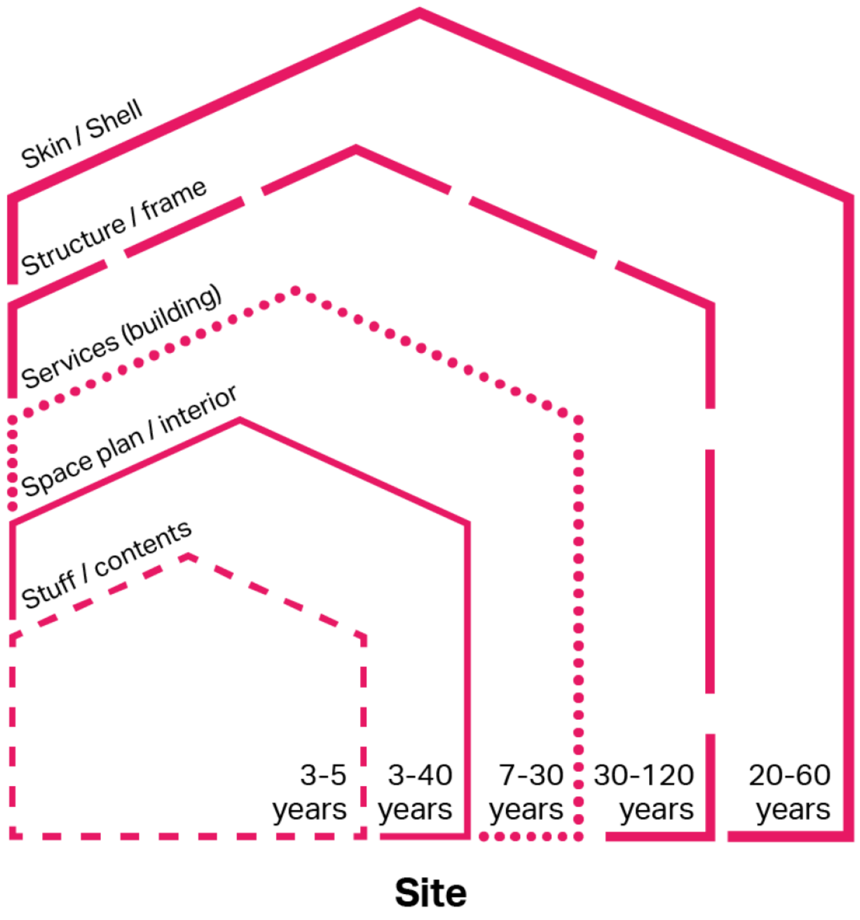
Ensuring that different parts of the building are accessible and can be maintained and replaced where necessary

The principles support the application of the waste hierarchy in that avoiding or reducing waste is prioritised.

WLCA and CES process

Building in layers includes:

- Site
- Substructure
- Superstructure
- Shell/skin
- Services
- Space
- Stuff
- Construction materials



Source: GLA's Circular Economy Guidance, March 2022

WLCA and CES process

Building "Layer"	Site	Substructure	Superstructure	Shell/Skin	Services	Space	Stuff	Construction stuff	Summary	Challenges	Counter actions + Who + When	Plan to prove and quantify
Is it likely the layer (or components within it) will need to be moved or otherwise modified within 5-15 years, e.g. due to changing use patterns or user requirements?	N/A	N	N	N	Y	N	Y	N/A				
Is it likely the layer (or components within it) will need to be changed, upgraded or replaced within 5-15 years, e.g. for improved performance, aesthetics	N/A	N	N	Y	Y	N	Y	N/A				
	Designing out Waste											
Module A - Product Sourcing and Construction Stage	brownfield site used - potential to re-use material. SWMP to be produced to minimise waste and increase recycling of construction waste. Pre-demolition audit to be considered.	25% GGBS content in concrete	25% Ggbs to be used in concrete. Off-site manufacturing reduces waste.	Use of companies with a commitment for recycling / reduction of carbon footprint / have EMS. Use of standardised materials with low environmental impact will be a priority.	Consider location of services to provide efficient building layout.	Standardised layouts for each floor to achieve efficiencies through standardised construction.	Consider products with recycled content. Efficient use of space.	SWMP to be provided. 'just in time' material delivery system would reduce the risk of wastage through damage.			Architects to consider specifications to meet environmental standards	Company Environmental Management Certificates / polices. BREEAM Assessment
Module B - In-Use Stage		n/a	n/a	Building envelope easily upgraded if required.	Water recycling.	Open plan space so easily re-arranged. Internal walls easily re-arranged by the use of standard wall panels.		as above for any fit-out work.			Maintenance policies to ensure longevity of all elements of the building	Maintenance strategy / BREEAM Assessment

Responsibilities	
Structural Engineer	
Architect	
M&E	
Client	

WLCA and CES process

Building "Layer"	Site	Substructure	Superstructure	Shell/Skin	Services	Space	Stuff	Construction stuff	Summary	Challenges	Counter actions + Who + When	Plan to prove and quantify
			reused upon demolition at end of building life. Steel can be recycled.			Materials designed for the life span of the building.	recoverable and recyclable				that design for disassembly measures are incorporated where feasible.	
Module D - Benefits and Loads Beyond the System Boundary	n/a	The majority of concrete can be crushed and re-used	The majority of concrete can be crushed and re-sued.		Metals within equipment is easily recoverable and recyclable.							
	Design Principles											
Designing for longevity	n/a		Concrete frame provides a long lifespan.	Target of 30 years +	Services designed to accommodate emerging technology where possible.	Materials designed for the life span of the building		n/a			Client to ensure that building services are regularly maintained to prolong lifespan.	Maintenance strategy / BREEAM Assessment
Designing for adaptability or flexibility	n/a	Foundations designed to hold a high structural load so alternative uses of the building could be considered.	Open plan layout provides flexibility in use.		Services designed to accommodate emerging technology where possible.	Open plan floors so easily adapted to alternative uses.		n/a				
Designing for disassembly	n/a	Concrete can be crushed and re-used.	Design for disassembly should be considered where possible.			Simple construction allows for ease of disassembly.	Equipment is provided in standard sizes so easily replaced.	n/a			The design team should ensure at an early stage that design for disassembly measures are incorporated where feasible.	BREEAM Assessment
Using systems, elements or materials that can be re-used and recycled	Brownfield site used gives potential to re-use materials.	Concrete can be crushed and re-used.	Concrete has the ability to be crushed and reused		Services can be striped down and materials such as metal recycled.	Specification of materials which can be recycled.	Metals within equipment is easily recoverable and recyclable	Consider companies that participate in packaging take-back schemes. Donation of excess materials to local community groups.			Review of disassembly during detailed design to increase the recovery / recyclability of elements.	BREEAM Assessment

Circular Economy Targets

Circular Economy Targets			
Circular economy targets for existing and new development	**Policy Requirement**	**Target Aiming For (%)**	**Policy Met?**
Demolition waste materials (non-hazardous)	Minimum of 95% diverted from landfill for reuse, recycling or recovery.		
Excavation waste materials	Minimum of 95% diverted from landfill for beneficial reuse.		
Construction waste materials	Minimum of 95% diverted from landfill for reuse, recycling or recovery.		
Municipal waste	Minimum 65% recycling rate by 2030.		
Recycled content	Minimum 20% of the building material elements to be comprised of recycled or reused content.		

CES – Information required

Building Element Group	Building Element (NRM level 2)	
1 Substructure	1.1 Substructure	
2 Superstructure	2.1 Frame 2.2 Upper floors incl. balconies 2.3 Roof 2.4 Stairs and ramps	2.5 External walls 2.6 Windows and external doors 2.7 Internal walls and partitions 2.8 Internal doors
3 Finishes	3.1 Wall finishes 3.2 Floor finishes 3.3 Ceiling finishes	
4 Fittings, furnishings and equipment (FFE)	4.1 FFE including building-related* and non-building-related**	
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CES – Information required

Building materials | ✔ Circularity score weighting factors | ✔ Calculation period | ✔ Building area

Clear	Material	Country	Data source	Type	Upstream	CO2e	Unit	Standard	
	Filter:	Filter:	Filter:	Filter:	Filter:	Filter:	Filter:	Filter:	Save

Foundation, sub-surface, basement and retaining walls ⇄ Compare answers ▾ Create a group ✥ Move materials Add to compare

Start typing or click the arrow

Resource	Quantity		Unit cost		Total cost	Comment	RICS category	Service life	Recyc
NEW Concrete piles ?	4226.0	m	140	£ / m	591,640 £	CFA piles	1.Substructure	Data by constituent	
Ready-mix concrete, normal strength ?	840.6	m3	250	£ / m3	210,150 £	Block B: CFA piles. Concrete	1.Substructure	Permanent	
Reinforcement steel (rebar), generi ?	105	ton	1650	£ / ton	173,250 £	Block B CFA piles. Rebar @	1.Substructure	Permanent	
Ready-mix concrete, normal strength ?	1632	m3	250	£ / m3	408,000 £	Block B. pile caps. 816m2 x	1.Substructure	Permanent	7
Ready-mix concrete, normal strength ?	202.38	m3	270	£ / m3	54,643 £	external Insitu RC wall (liner wall).	1.Substructure	Permanent	
Reinforcement steel (rebar), generi ?	244.8	ton	1650	£ / ton	403,920 £	Block B pile caps. Rebar @ 150	1.Substructure	Permanent	
Reinforcement steel (rebar), generi ?	30	ton	1650	£ / ton	49,500 £	Rebar for external insitu concrete	1.Substructure	Permanent	
Ready-mix concrete, normal strength ?	244.8	m3	270	£ / m3	66,096 £	Block B. ground floor slab. area	1.Substructure	Permanent	
Hydrophobic concrete admixture, CWP ?	506	kg	20	£ / kg	10,120 £	External Insitu RC wall to	1.Substructure	Permanent	None
Reinforcement steel (rebar), generi ?	42.84	ton	1650	£ / ton	70,686 £	Block B. Ground floor slab. Rebar	1.Substructure	Permanent	
Emulsion paint for allround inte ?	674.60	m2	0.2	£ / m2	135 £	External basement liner wall -	1.Substructure	Permanent	None

CES – Information required

	Building Element Category	Material Type	Material quantity (Module A) (kg)	Recycled content by value (%)
0.1	Demolition: Toxic/Hazardous/Contaminated Material Treatment	-	#REF	
0.2	Major Demolition Works	-	#REF	
0.3	Temporary Support to Adjacent Structures	-	#REF	
0.4	Specialist Ground Works	-	#REF	
1	Substructure	-	26,583,02	
1	Substructure	concrete blocks	1,942,200	0%
		insulation	7,665	1%
		Mortar	19,600	0%
		plastic membranes	7,867	0%
		ready mix concrete for external walls and floor	21,781,756	0%
		ready mix concrete for foundations and internal walls	841,368	1%
		ready mix concrete for lkightweight applications	46,860	0%
		Reinforcement for concrete	1,553,945	1%
		structiral concrete	28,800	0%
		structural steel	352,959	0%
2.1	Superstructure: Frame	-	2,900,45	
2.1	Superstructure: Frame	Paint	510	0%
		Ready-mix concrete for external walls and floors	157,464	1%
		Ready-mix concrete for structures	319,758	0%
		Reinforcement for concrete	375,19	0%
		Steel	2,047,529	0%
2.2	Superstructure: Upper Floors	-	9,845,800	
2.2	Superstructure: Upper Floors	concrete slabs	8,587,680	0%
		steel	127,144	1%
		Ready-mix concrete for external walls & floors	1,077,120	0%
		Reinforcement for concrete	53,856	0%

Costs not published to GLA, only %

CES – Information required

Bill of materials

- A draft bill of materials should be submitted at outline / full planning application stages
- Consistent information should be used for the CE and WLCA

- Opportunities for the use of reused or recycled materials should be identified. **Target = 20% recycled or reused content by value for the whole building.**

- End of life strategy:
- End of life assumptions should be made for each building element or material
- Details required on how this will be communicated to future building owners, managers & occupiers
- Details required on how the building information will be stored (e.g. by using Building Information Modelling or material passporting) to facilitate disassembly and support the recovery of components and materials at the end of the life of the building.

CES – Information required

Recycling and waste reporting

CE statements must demonstrate:

- how all materials arising from demolition and remediation works will be reused and/or recycled
- opportunities for managing as much waste as possible on site
- how much waste the proposal is expected to generate
- how and where the waste will be managed in accordance with the waste hierarchy.

Information required:

- Overall / total amount of non-hazardous / contaminated waste arising (tonnes) for excavation*, demolition and construction.
- Estimates of total waste arising for key waste streams
- % reuse on / off site
- % recycled / composted on / off site
- % to landfill
- % to recovery

*Excavation waste / cut and fill calculations should be provided.

CES – Information required

Pre-redevelopment audit:

- Can existing buildings, structures and materials be retained, refurbished, or incorporated into the new development?
- Outline details of existing buildings on site and their state of repair. Include buildings age, key materials, photos of typical internal spaces and facades, site plans.

Pre-demolition audit:

- Justification for demolition including how options for reusing, retaining and reconstructing have been explored
- Assessment of carbon impacts to show how negative impacts resulting from demolition, such as the loss of embodied carbon in existing buildings, would be mitigated and offset.
- Summary of key components present, estimation of quantity and associated embodied carbon, and whether they are suitable for reclamation
- Explanation and drawings showing extent of proposed demolition
- Opportunities for reuse and recycling either within the proposed development or offsite nearby

CES – Information required

Operational waste management plan

- Targets: 65% municipal waste recycling by 2023; 75% business waste recycling by 2030
- Quantity of waste expected
- How and where (on site v. off site) operational waste will be managed in line with the waste hierarchy
- Provision of adequate, flexible, easily accessible waste storage space and collection systems
- How the separate collection of dry recyclables (card, paper, mixed plastics, metal, glass), food waste and other waste will be supported
- How operational performance will be monitored and reported
- Explore measures such as consolidated, smart logistics and community-led waste minimisation schemes.

WLCA and CES information required

GLA Guidance March 2022 When reporting

Requirement by application stage	Pre-application	Outline application	Full application/ reserved Matters	Post-construction
RIBA stages	0 – 2	0-2	2- 3	4 – 7
CE targets	Encouraged	Yes	Yes	Yes (Performance reported)
CE design approaches	Yes	Yes	Yes	N/A
CE design principles	Yes	No	No	No
CE design principles by building layer	No	Yes	Yes	No
Pre-redevelopment audit	Encouraged	Yes	Yes	N/A
Pre-demolition audit	Encouraged	Yes	Yes	N/A
Bill of materials	No	Yes (Estimated)	Yes (Estimated)	Yes (Actual)
End of life strategy	No	No	Yes	Encouraged
Operational waste management plan	No	No	Yes	Encouraged
Recycling and waste reporting	No	Yes (Estimated)	Yes (Estimated)	Yes (Actual)
Lessons learnt and key achievements	N/A	N/A	N/A	Yes

Next Steps

Whole Life Carbon

- Bill of Materials to be issue to HDR;
- The above should includes quantities and costs;
- Any EPD available;
- Details of the materials for the foundations, structure and super structure
- Quantities and type of materials for external work
- Quantities and type of materials for finishes
- Decisions taken to reduce carbon emissions

Circular Economy

- Pre-redevelopment & Pre-demolition audit completed to be provided to HDR
- Operational waste strategy
- Site waste strategy during construction
- Opportunity to retain any material arising from demolition and site preparation
- End of life scenarios ie any aluminium cladding, insulation… to be recycled, reused..