

10 Carbon Analysis & Sustainability

10.5 Operational Carbon

10.5.1 Lean, Mean & Green

This page summarises the lean, mean & green measures applied into the design and taken into consideration for the Part L modelling.

Lean

The new build followed a fabric first approach and has an efficient form factor and high-performance façade. Glazing ratio were also carefully considered not to exceed an average of 35%. External shading responding to orientation avoids excessive solar gains.

Measures were taken for the existing building to reduce the energy use of the building as possible within the restraint of the heritage.

- L.1 Efficient form factor
- L.2 High performance facade - Uvalue and air tightness considerations
- L.3 Spatial arrangement responding to the site and orientation – wider windows located at amenity areas
- L.4 Glazing ratios – no more than 35% glazing on average over all façades
- L.5 Shading responding to orientation and balancing heat gains - denser fins on upper floors
- L.6 Envelope thermally enhanced
- L.7 Window replacement

Mean

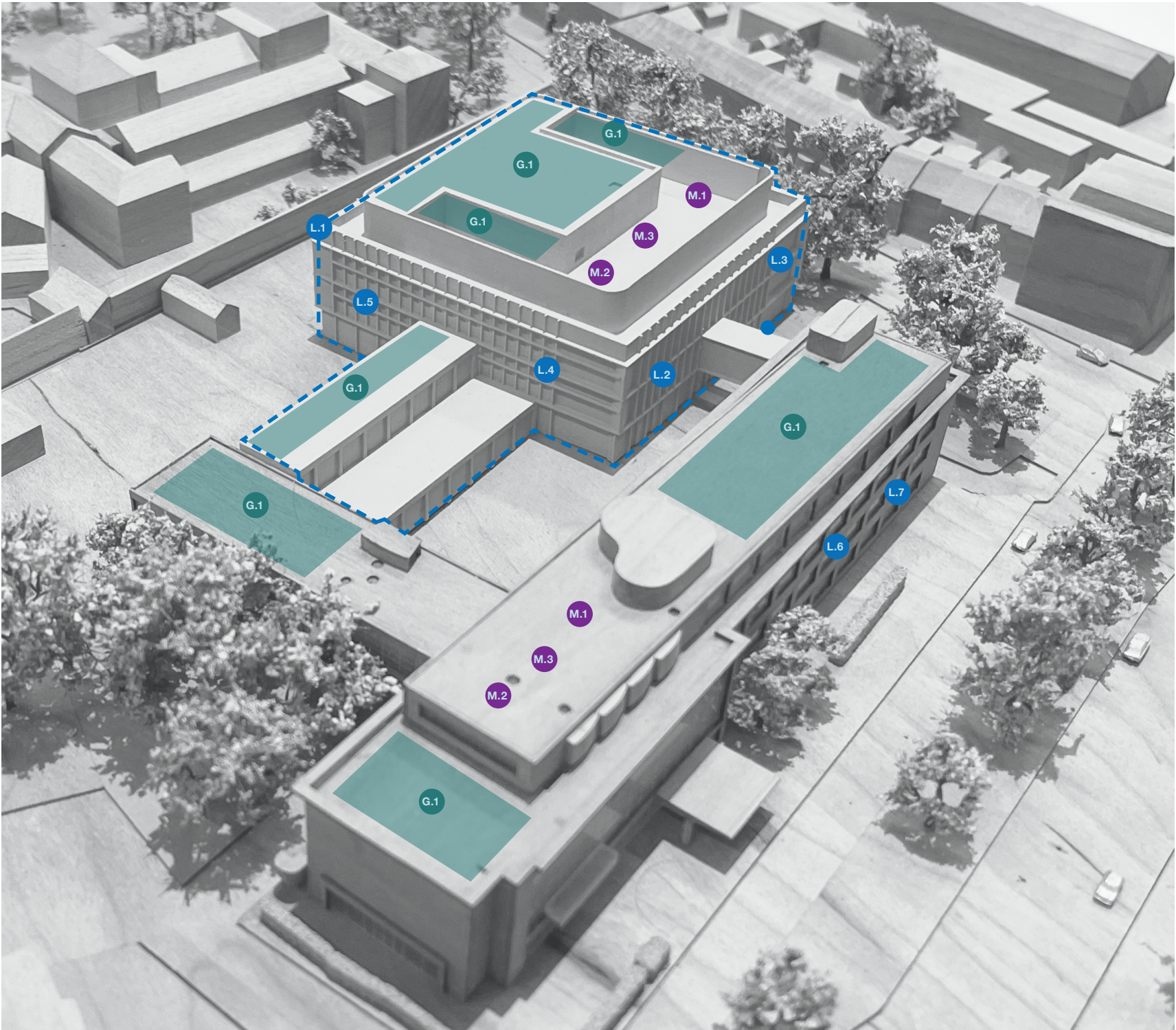
The HVAC system is fan coil units with air source heat pumps, and heat recovery. Summertime design temperature band is wider to avoid excessive cooling loads (23-27C). There is potential to open windows out of core hours.

- M.1 Mechanical ventilation with integrated heat recovery to enable low energy ventilation and good air quality
- M.2 All-electric MEP strategy to benefit from decarbonising national grid
- M.3 Installation of Air Source Heat Pumps for space heating, cooling and domestic hot water

Green

A minimum 20% of regulated campus wide energy demand shall be from on-site renewables, all roofs will have PV modules.

- G.1 Maximise renewables on site - PVs on roof



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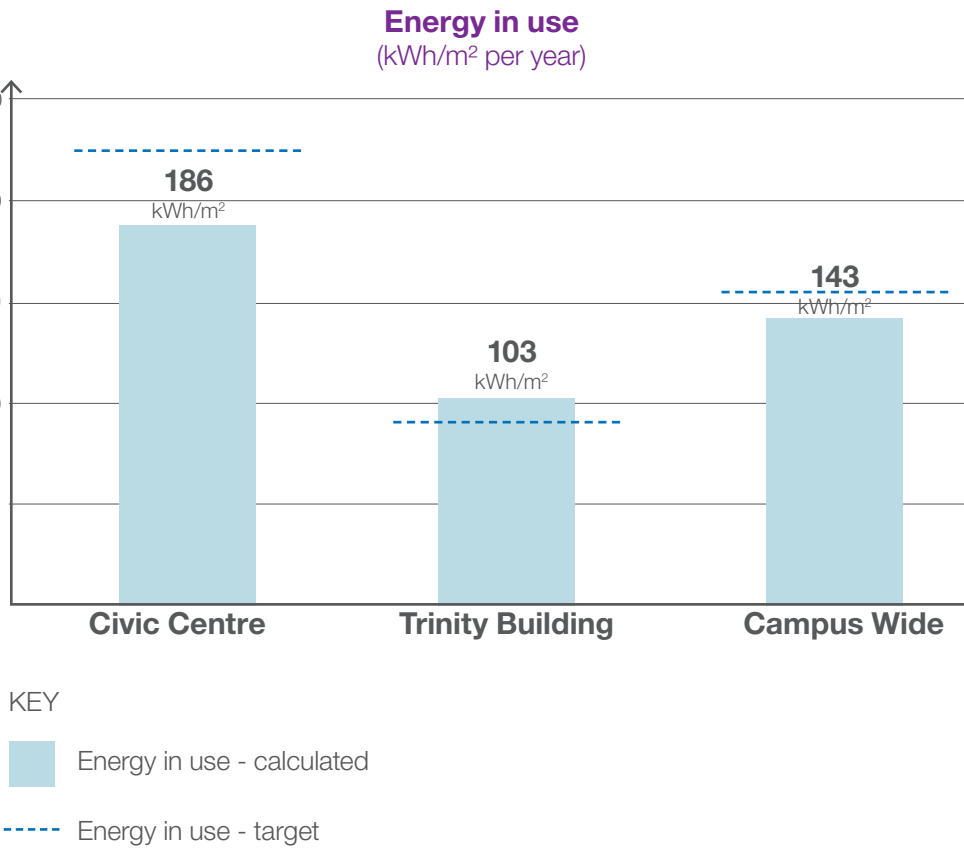
10.5.2 Results

Energy in use

It is good practice to define targets based on industry benchmarks. The targets were split between Civic centre (existing building) and Trinity building (new build), as it is expected that a refurb will not perform as well as a new build due to limitations in building fabric performance. A campus wide target was derived based on area weighted calculation from the new build and existing building targets.

Energy in use targets			
	Civic Centre	Trinity Building	Campus wide
target	225 kWh/m²/yr	90 kWh/m²/yr	155 kWh/m²/yr
source	RIBA 2030 Climate Challenge V1 2019 Target	UKGBC Energy performance targets for net zero carbon operational energy 2025-2030	Target is derived from the Civic Centre and Trinity targets area weighted

Below are the results of the TM54 model for both regulated and unregulated energy in use. This was calculated by Buro Happold.

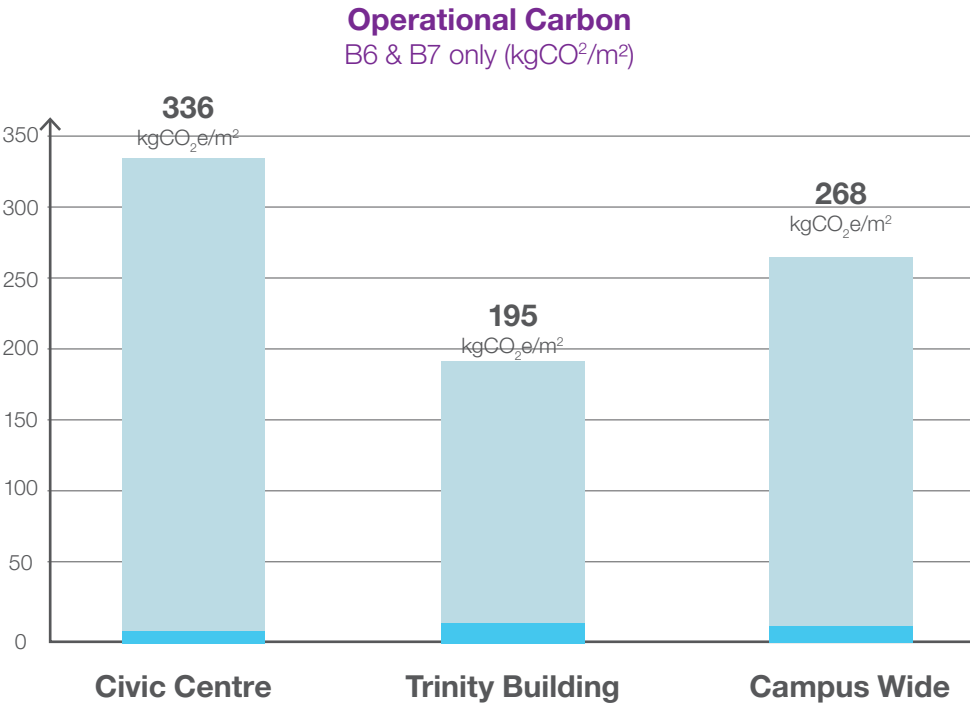


Operational carbon

The operational carbon emissions have been based on Buro Happold TM54 energy analysis.

The energy consumption of the development has been calculated for a life-cycle of 60 years based on the assumption that the annual operation energy consumption will remain the same throughout the life-cycle of the project. It was considered the UK average carbon intensity figure as produced by OneClickLCA 'Average future electricity, UK (2022-2082, for 60 years service life) based on Non-2050 compliant - Steady Progression 2050 scenario', which considers the decarbonisation of the grid by 2050. The factor is calculated based on RICS equation for future energy grid decarbonisation and data from Future Energy Scenarios, National Grid Electricity System Operator ESO 2020/2021.

The water use for all scenarios was based on the RIBA 2025 target benchmark of 13l/p/day. The information was input in OneClickLCA software and calculated both tap clean water and waste water.



	Overall Carbon (tonnesCO ₂ eq)		
	Civic Centre	Trinity Building	Campus wide
Operational Energy (B6)	1,807	922	2,729
Operational Water (B7)	44	66	110
Operational Carbon	1,851	989	2,839

	Carbon per m2 GIA (kgCO ₂ eq/m²)		
	Civic Centre 5,505m²	Trinity Building 5,075m²	Campus wide 10,580m²
Operational Energy (B6)	328	182	258
Operational Water (B7)	8	13	10
Operational Carbon	336	195	268

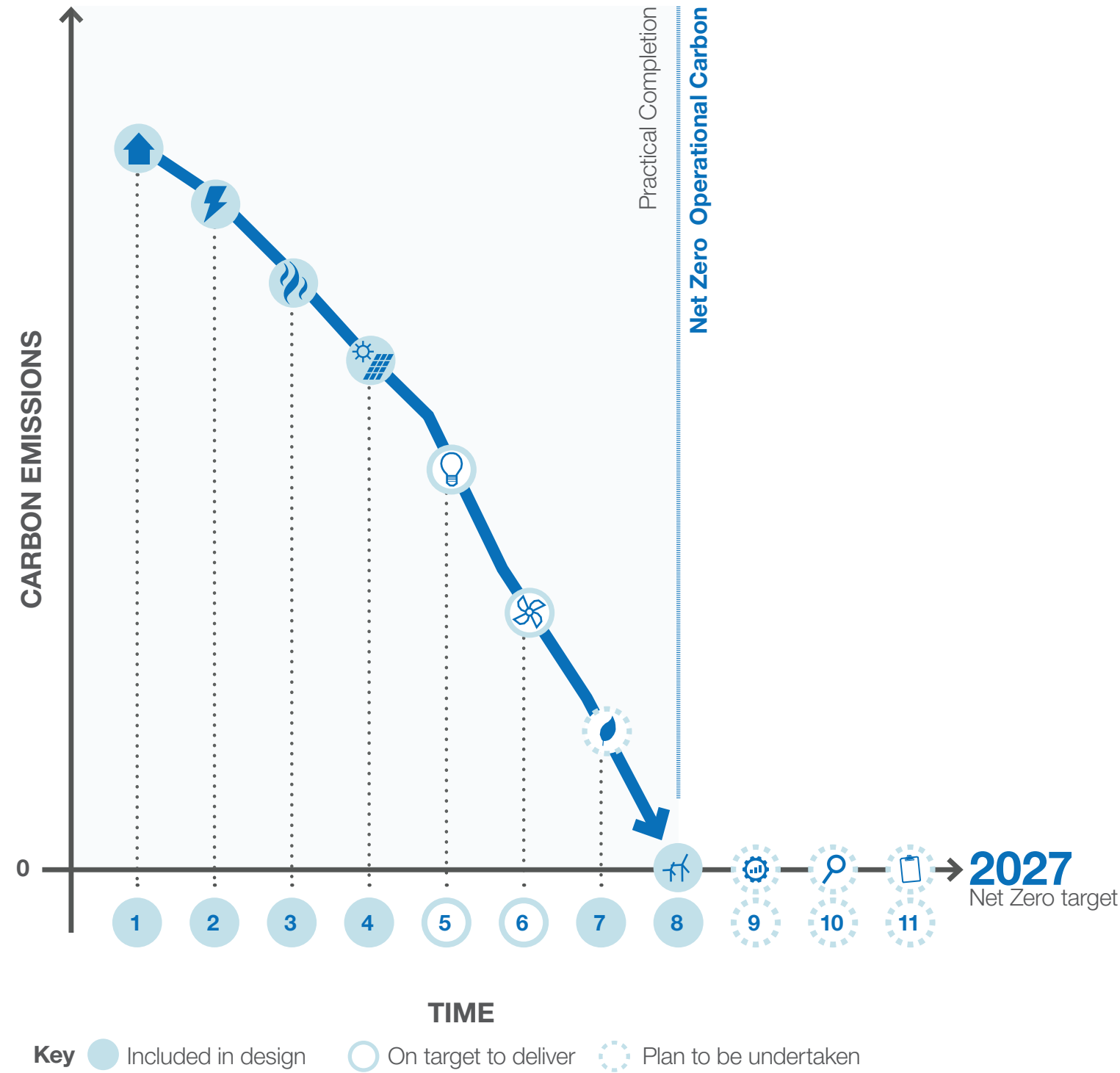
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10.5 Operational Carbon

10.5.3 Roadmap to net zero operational carbon

This graph is an illustrative roadmap showcasing the key steps needed for the project to reach Net Zero Operational Carbon by 2027 as per the London Borough of Haringey’s commitment to ensure all operational buildings become Net Zero Carbon by 2027.

Steps towards Net Zero Operational Carbon	
	1. Fabric first approach, targeting LETI standards for the New Annex
	2. Fossil fuel free through all electric systems
	3. Efficient MEP systems
	4. Maximise Solar PV where possible
	5. Meet industry energy use intensity targets
	6. Commission of building systems to ensure performance principles are met
	7. Responsible offsetting of carbon at practical completion
	8. Operational energy annually sourced from renewable energy sources
	9. Energy metering, monitoring, and optimisation
	10. Post occupancy evaluation
	11. Annual reporting



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10.6 Embodied Carbon

10.6.1 Assessment methodology

Scope of assessment

The Embodied Assessment has been conducted in accordance with BS EN 15978: 2011: (Sustainability of construction works - Assessment of environmental performance of buildings - Calculation method) using the RICS Professional Statement: Whole Life Carbon assessment for the built environment), over a 60-year study period, covering the modules A to C, excluding B6 & B7.

All the building elements listed in Table by the side have been included in the LCA Assessment, in line with the RICS Professional Statement.

LCA Software

The LCA Assessment has been conducted using the LCA software “One Click LCA” by Bionova.

“One Click LCA” is an industry recognised tool that produces results compliant with the international standards ISO 14044 and EN 159781 and it is certified with Quality System ISO 90012. “One Click LCA” has material life-cycle inventory carbon data that is compliant with EN15804.

The tool integrates data from nearly all of the available EPD platforms around the globe.

Building element group	Building element (NRM level 2)	Included in WLC?
Demolition	0.1 Toxic/hazardous/contaminated material treatment	N
	0.2 Major demolition works	N
0 Facilitating works	0.3 & 0.5 Temporary/enabling works	N
	0.4 Specialist groundworks	N
2 Superstructure	2.1 Frame	Y
	2.2 Upper floors incl. balconies	Y
	2.3 Roof	Y
	2.4 Stairs and ramps	Y
	2.5 External walls	Y
	2.6 Windows and external doors	Y
	2.7 Internal walls and partitions	Y
	2.8 Internal doors	Y
3 Finishes	3.1 Wall finishes	Y
	3.2 Floor finishes	Y
	3.3 Ceiling finishes	Y
4 Fittings, furnishings and equipment (FF&E)	4.1 Fittings, furnishings & equipment incl. building related and non-building-related	Y
5 Building services/ MEP	5.1–5.14 Services incl. building-related* and nonbuilding-related**	Y
6 Prefabricated Buildings and Building Units	6.1 Prefabricated buildings and building units	n/a
7 Work to Existing Building	7.1 Minor demolition and alteration works	N
8 External works	8.1 Site preparation works	Y
	8.2 Roads, paths, pavings and surfacing	
	8.3 Soft landscaping, planting and irrigation systems	
	8.4 Fencing, railings and walls	
	8.5-8.7 External fixtures, drainage, services	
	8.8 Minor building works and ancillary buildings	

Benchmarks

It is good practice to set targets for WLC emissions reductions and to track progress against them throughout the design development.

Currently, at the industry we have benchmark targets set by LETI, RIBA and GLA. Both LETI and RIBA targets have been aligned in the ‘Embodied Carbon Target Alignment’. GLA follows a similar target, with the current “aspirational benchmark” aligned with the RIBA 2025 targets.

For the campus wide, we are considering the following targets:

Upfront Embodied Carbon (A1-A5 exc. sequestration)

- Best Practice: LETI 2020 Design Target (Band C)
- Aspirational: LETI 2030 Design Target (Band A)

Life Cycle Embodied Carbon (A-C exc. B6&B7)

- Best Practice: RIBA 2025 Design Target (Band C)
- Aspirational: RIBA 2030 Design Target (Band B)



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10.6 Embodied Carbon

10.6.1 Assessment methodology

Methodology and assumptions

The calculation of the embodied carbon was based on the stage 3 design.

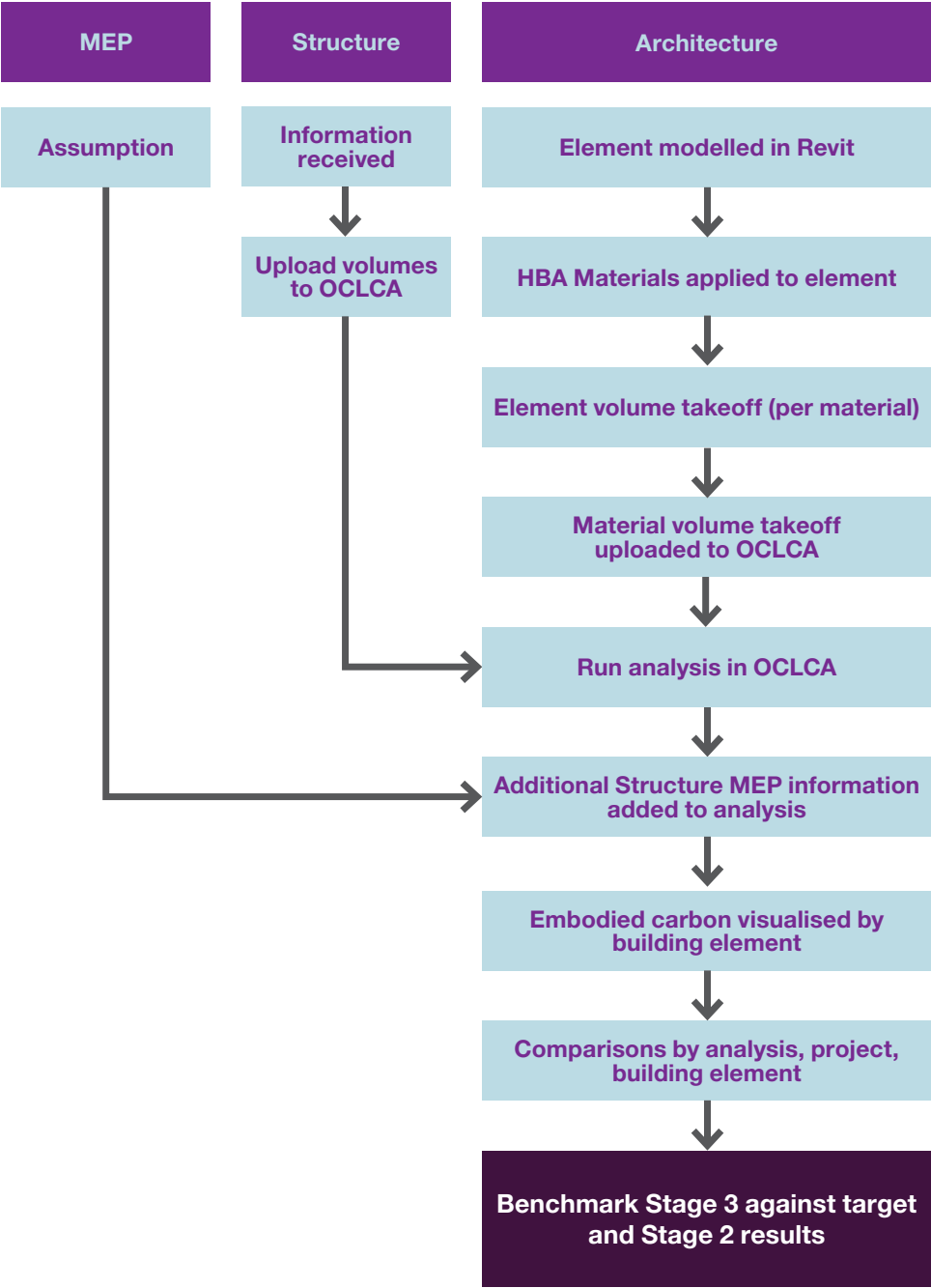
The data was then input into “One Click LCA” tool.

For MEP, the GLA breakdown (21%) for the business as usual benchmark (1400kgCO2/m2) was used, resulting in A-C exc B6/B7 of 292kgCO2/m2.

Information regarding the retained building components were added into the calculation, considering its impact in stages B & C.

The embodied carbon of the materials was calculated in OneClick LCA, in accordance to the RICS PS.

Considering that this is a Stage 3 and the materials specifications are yet to be defined, it was considered an extra contingency of 5%. This is to reflect possible carbon factor disparities due to the use of different EPD’s in later stages.



Main materials & components input

Structure

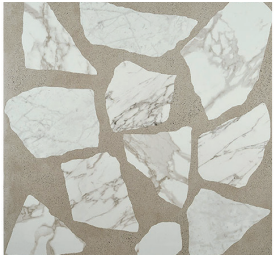
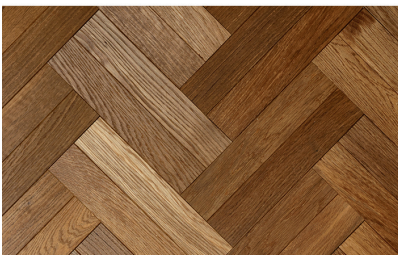
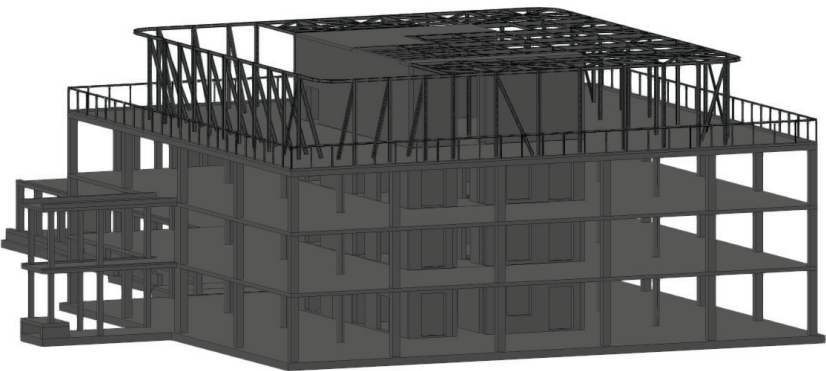
- Cement replacement is specified at 50% for all concrete elements
- PT slab (thinner slab than traditional RC flat slab)
- Optimised column grid
- Raft foundation
- Removal of the basement

Facade

- GRC facade with optimised modules to avoid excessive fixings points

Finishes

- Material efficiency: self-finishing and natural materials with long lifespan, robustness and low maintenance



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10.6 Embodied Carbon

10.6.2 Results

Embodied carbon comparison between stages

Analysis was undertaken using One Click LCA software and based on the Stage 3 design freeze for both the refurbishment and new build parts of the project to track the current design against the targets proposed.

The results of the embodied carbon for the Trinity and Civic Centre buildings are shown opposite alongside with the comparison between previous stage 2 and the benchmarks.

The Stage 3 design results show that the embodied carbon of both buildings remained similar to the Stage 2 design results Both Trinity building and Civic Centre are achieving the best practice embodied carbon ‘minimum’ target.

This shows the importance of the embodied carbon monitoring throughout design stages. To continue the aim to be an exemplary net zero carbon building, it would be important to continue this work of embodied carbon analysis in the next stage.

Life cycle embodied carbon (A-C exc B6&B7) (kgCO2/m2)				
	Targets		Results	
	Minimum	Aspirational	Stage 2	Stage 3
Civic Centre	500	350	453	446
Trinity Building	970	750	986	967
Campus Wide	428*	864*	710	712

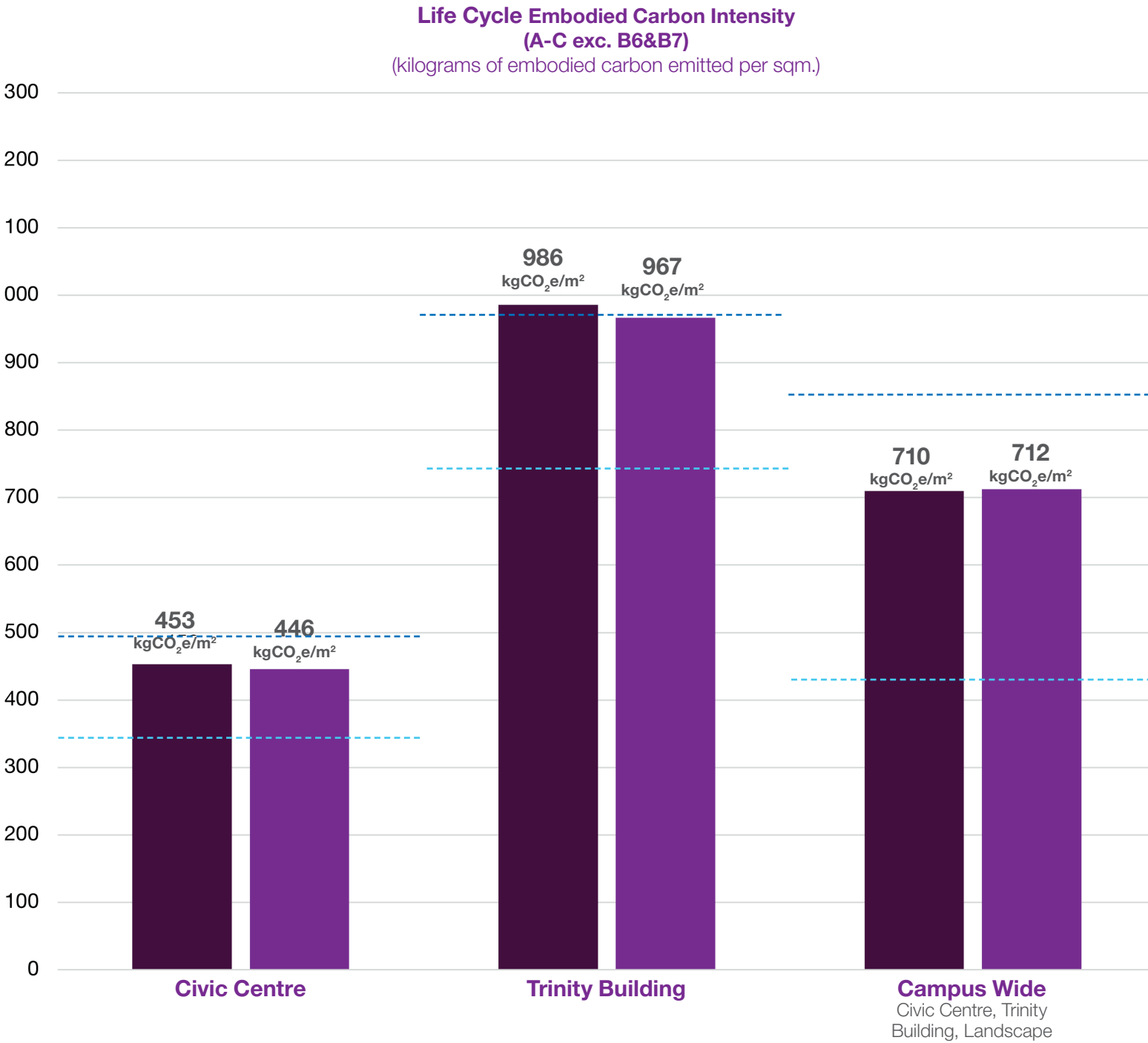
Key

Stage 2

Stage 3

Minimum target

Exemplary Target



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10.6 Embodied Carbon

10.6.2 Results

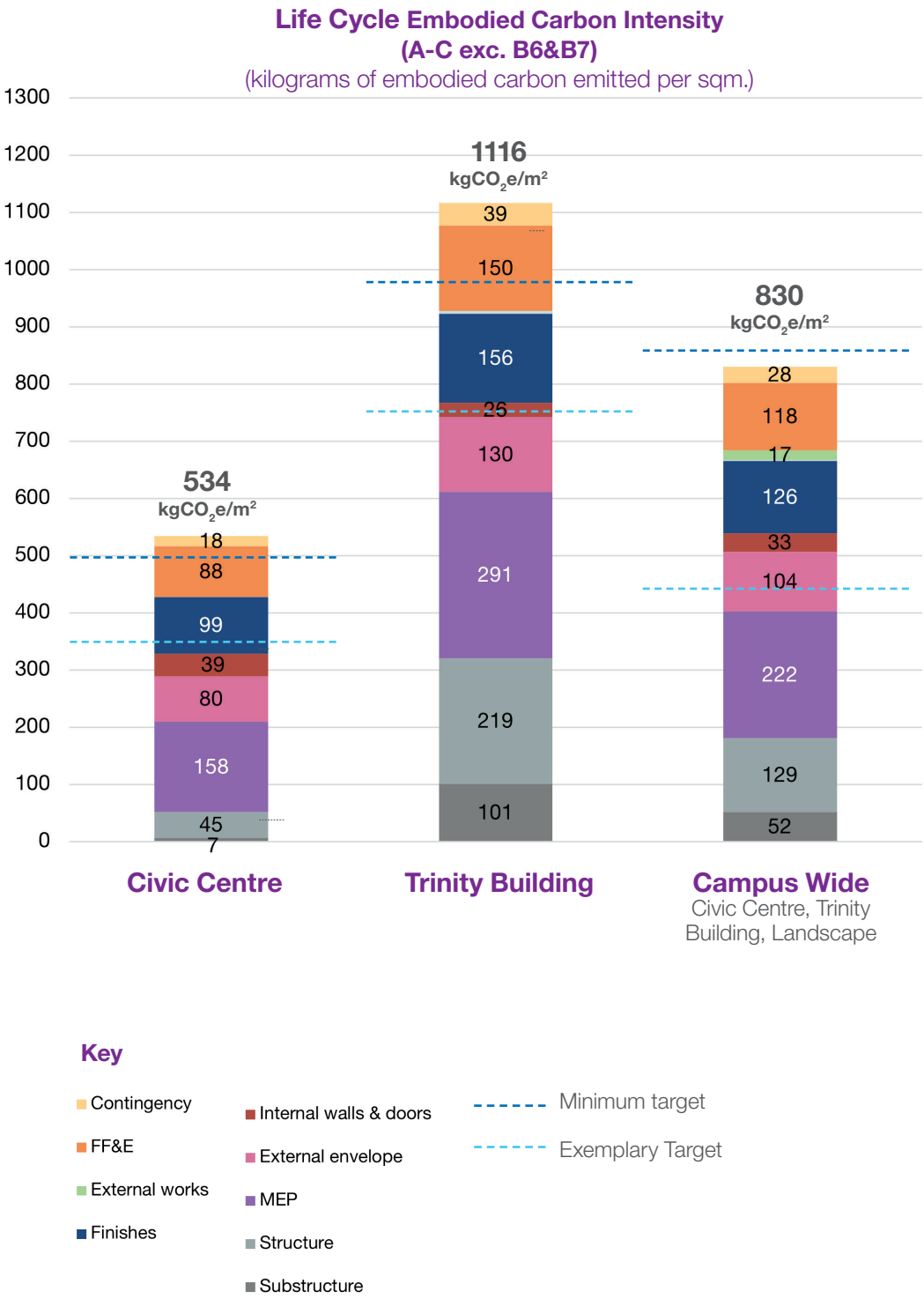
Embodied carbon results by building categories

The graph on this page shows the results of embodied carbon per building categories. It must be noted that in this analysis it was included the ‘FF&E’ (furniture, fixtures and equipment) carbon emissions, which was not included in the previous Stage 2 embodied carbon analysis. This element is reponsible for a considerable amount of the life cycle emissions because it was considered the RICS default replacement rate of 10 years.

The RICS with the indicative component lifespan considered in this study can be seen in this page.

Similar to the FF&E, the finishes embodied carbon have significant impact due to the replacement rate, which was considered the RICS default rates. As the client will be occupying the building, this mean there will be a higher level of control over the finishes replacement and maintenance. Assumptions can be updated in future embodied carbon analysis to reflect this, and should be liaised with the client.

In both buildings, the biggest contributor is MEP. As mentioned previously, this is an assumption based on GLA guidance breakdown for a business as usual office building. This assumption should be revised with the service engineer in the next design stage, and a TM65 analysis should be considered.



Building part	Building elements/components	Expected lifespan
Roof	Roof coverings	30 years
Superstructure	Internal partitioning and dry lining	30 years
Finishes	Wall finishes: Render/Paint	30/10 years respectively
	Floor finishes Raised Access Floor [RAF]/Finish layers	30/10 years respectively
	Ceiling finishes Substrate/Paint	20/10 years respectively
FF&E	Loose furniture and fittings	10 years
Services/MEP	Heat source, e.g. boilers, calorifiers	20 years
	Space heating and air treatment	20 years
	Ductwork	20 years
	Electrical installations	30 years
	Lighting fittings	15 years
	Communications installations and controls	15 years
	Water and disposal installations	25 years
	Sanitaryware	20 years
	Lift and conveyor installations	20 years
Facade	Opaque modular cladding e.g. rain screens, timber panels	30 years
	Glazed cladding/Curtain walling	35 years
	Windows and external doors	30 years

Table 9: Indicative component lifespans

Table 9 contains conservative generic assumptions for the lifespan of items based on information from BCIS Life expectancy of building components (2006); CIBSE Guide M; Scheuer, Keoleian, and Reppe (2003). Life cycle energy and environmental performance of a new university building: modelling challenges and design implications. Energy and Buildings, 35, pp.1049–1064.

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10.6.2 Results

Upfront embodied carbon emissions

The graph on this page shows the results of upfront embodied carbon total emissions per building categories.

If the development does aim to be Net Zero Carbon in Construction, then the upfront carbon should be responsibly offset at practical completion through recognised offsetting framework.

Key

- Contingency

FF&E

External works

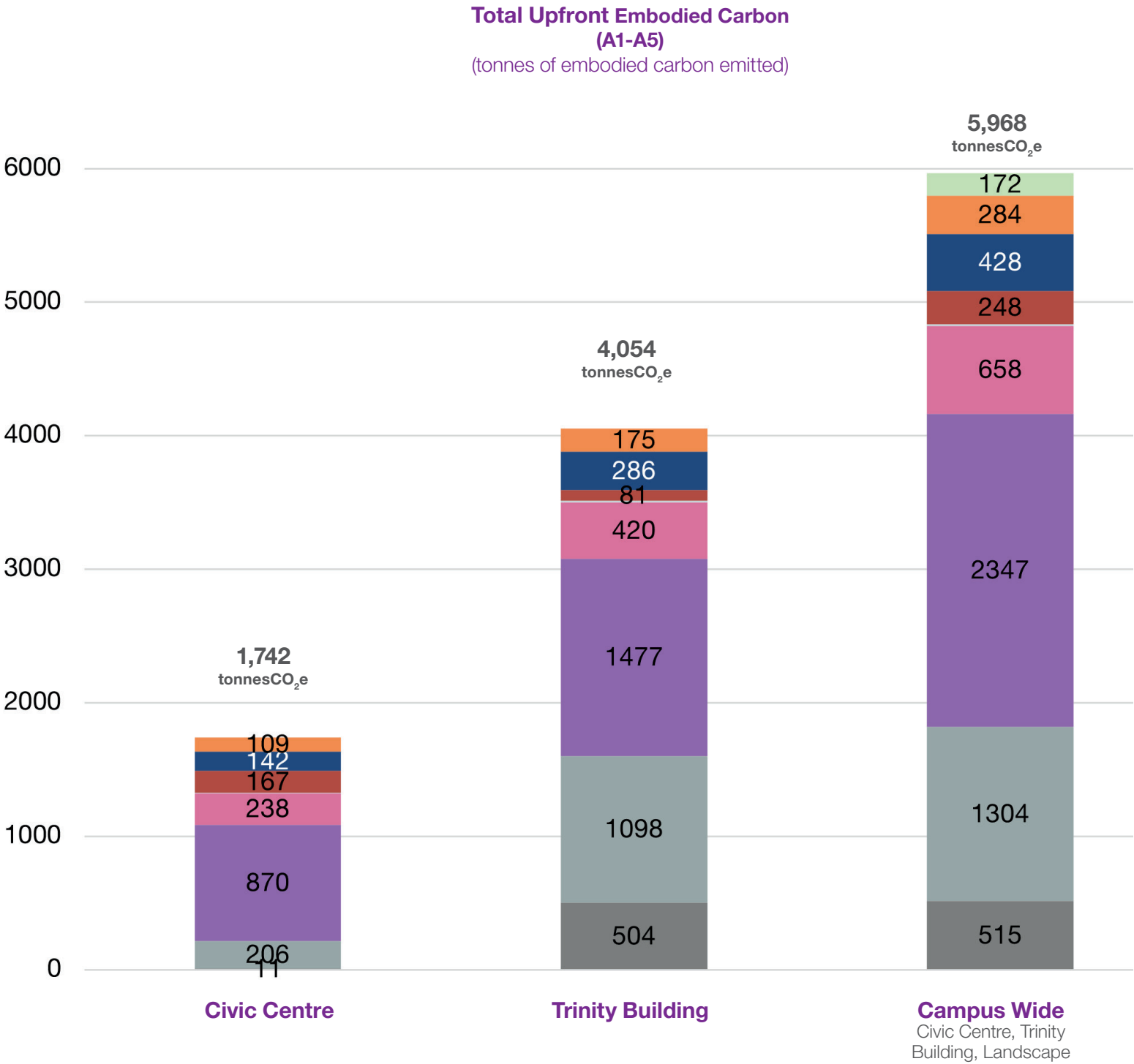
Finishes
- Internal walls & doors

External envelope

MEP

Structure

Substructure



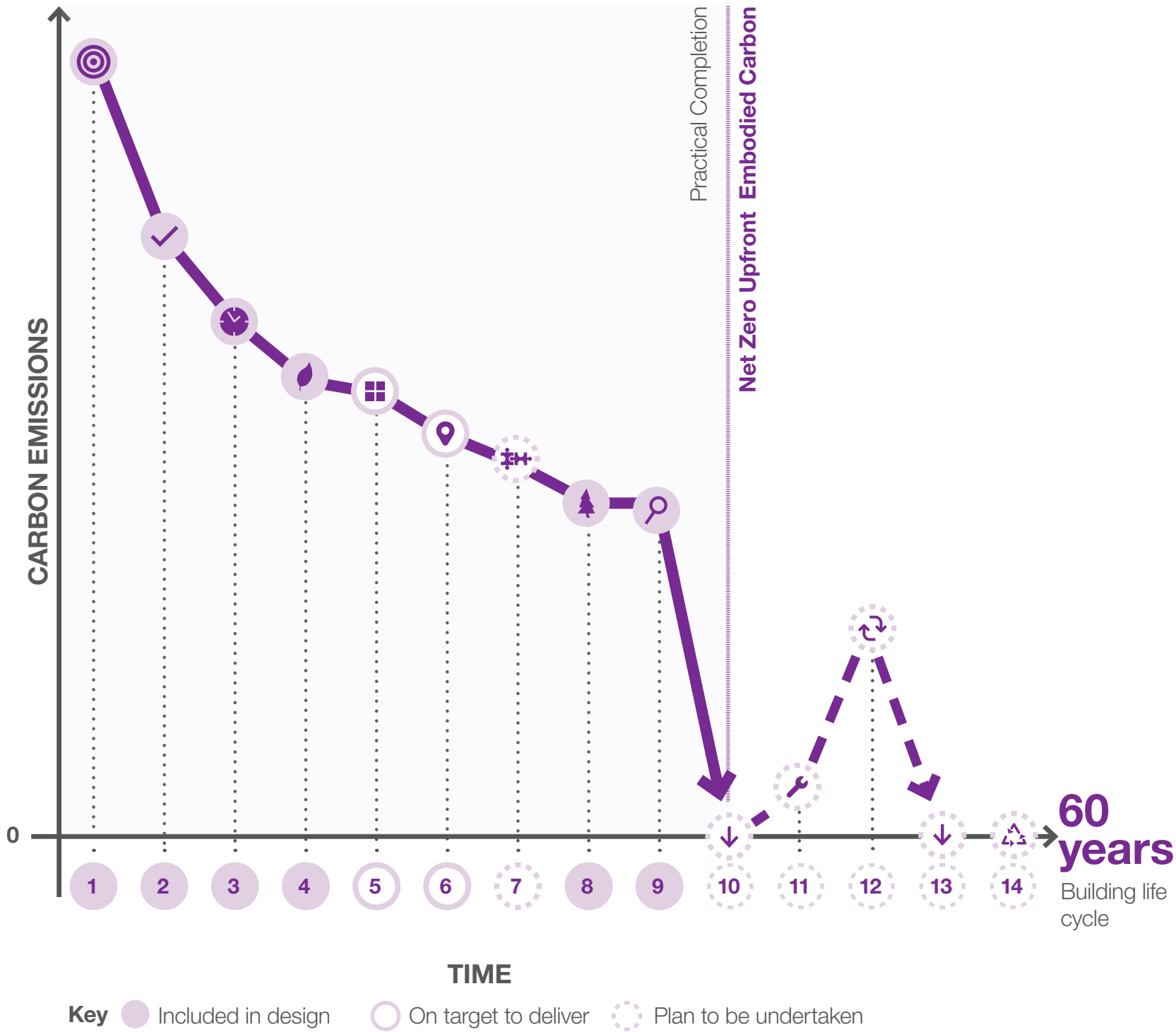
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10.6.3 Roadmap to net zero embodied carbon

This graph is an illustrative roadmap showcasing the key steps needed for the project to reach Net Zero Embodied Carbon. This extrapolates for a 60 years period as per LCA guidance.

Steps towards Net Zero Embodied Carbon	
	1. Define targets based on benchmarks
	2. Design efficiency
	3. Design for robustness and longevity
	4. Specify low-embodied carbon materials
	5. Specify self-finish materials
	6. Specify local materials
	7. Design for disassembly
	8. Maximise biogenic carbon storage
	9. Embodied carbon monitoring and optimisation throughout design stages
	10. Responsible off-setting of upfront carbon
	11. Maintenance to promote longevity
	12. Replacement of materials
	13. Responsible off-setting of carbon from replacement / refurb
	14. End of life: disassemble, reuse, recycle



10

Carbon Analysis & Sustainability

10.7

Whole Life Carbon

10.7.1

Results

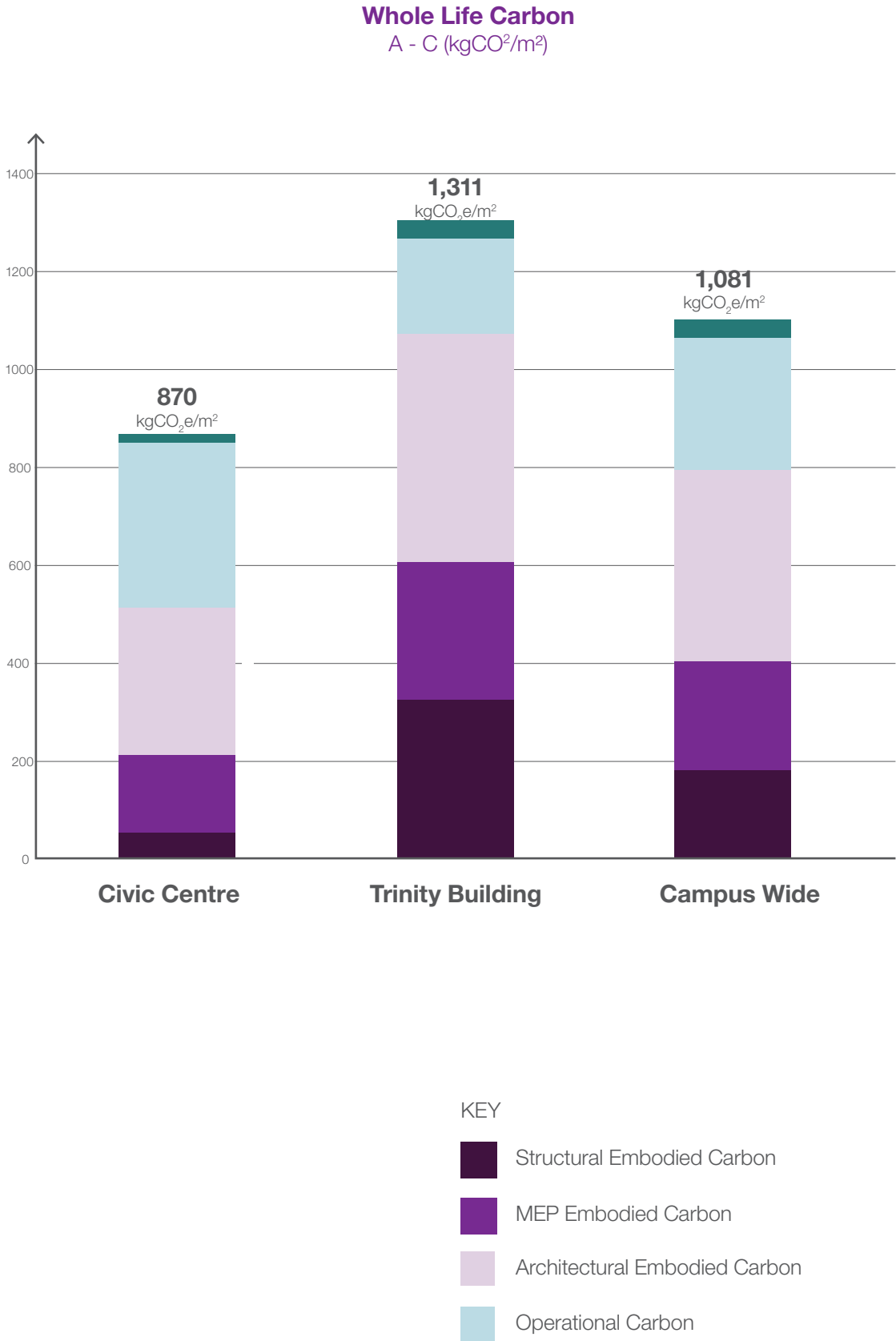
Whole Life Carbon

The results of the Whole Life Carbon analysis for the project are shown here, using the same conversion strategy of operational energy to carbon as earlier studies.

Civic Centre		
Area: 5,505m ²	Overall Carbon (tonnesCO ₂ eq)	Carbon per m2 GIA (kgCO ₂ eq/m ²)
Upfront Carbon (A1-A5)	1,742	316
Embodied Carbon (A-C exc. B6&B7)	2,840	516
Contingency (5%)	99	18
Operational Energy (B6)	1,807	328
Operational Water (B7)	44	8
WLC Carbon A-C	4,790	870

Trinity Building		
Area: 5,075m ²	Overall Carbon (tonnesCO ₂ eq)	Carbon per m2 GIA (kgCO ₂ eq/m ²)
Upfront Carbon (A1-A5)	4,054	799
Embodied Carbon (A-C exc. B6&B7)	5,465	1077
Contingency (5%)	199	39
Operational Energy (B6)	922	182
Operational Water (B7)	66	13
WLC Carbon A-C	6,653	1,311

Campus wide (Civic Centre, Trinity Building, Landscape)		
Area: 10,580m ²	Overall Carbon (tonnesCO ₂ eq)	Carbon per m2 GIA (kgCO ₂ eq/m ²)
Upfront Carbon (A1-A5)	5,796	548
Embodied Carbon (A-C exc. B6&B7)	8,305	785
Contingency (10%)	298	28
Operational Energy (B6)	2,729	258
Operational Water (B7)	110	10
WLC Carbon A-C	11,442	1,081



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10.8 Health & Wellbeing

Higher productivity, efficiency and running costs have always been the key focus in workplace design. However, the current biggest challenge being faced by the industry is firstly attracting and then retaining best in class people/global talent. This is where environmental design/sustainable design can make a big difference. Human beings by nature enjoy spending time in the outdoors with nature, daylight and sunlight. Recent studies show that people currently spend up to 80-90% of time indoors. This has huge impact on circadian rhythm, mental and physical health and well-being. Poor health increases absence due to sickness, further affecting productivity. To address these issues we believe it is essential to embed the following environmental design principles:

- Creating good indoor qualities by integrating biophilia, openable windows, good level of daylight

- Embedding climate resilience into the spatial layouts, MEP and external fabric design
- Ensuring workspaces can adjust longer term with minimal disruption (and embodied carbon) as their requirements change with time
- Creating environmental and spatial choices to enable people to control their immediate environment

To address wellbeing in buildings, one must understand the relationship between key factors that influence health and well-being and design strategies that shapes those healthy environments. We have listed the key factors below that have been considered while designing the internal spatial layout of the existing Civic Centre and the new build Trinity Building.



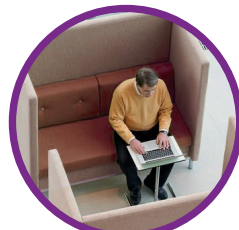
Biophilia



Openable windows for cross ventilation



Improved thermal performance of façades



Flexible working spaces



Views Out



Formal Meeting Room near core - less need of constant daylight



Openable windows for night purge ventilation



Biophilia



Informal working areas near larger windows