
Designing out waste

How to embed Circular Economy principles at the outset of building construction projects

18 August 2020

usefulprojects



About Us

What is our VALUE?

We
reinvest
our profits
into
education
+ research

We donate
our design
skills to
Projects
with a
high social
cause

We
design to
minimise
the use of
resource
and to
maximise
the ability
for re-use

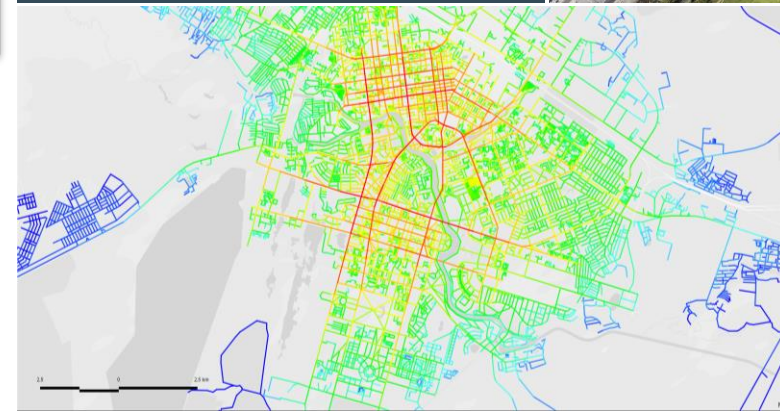
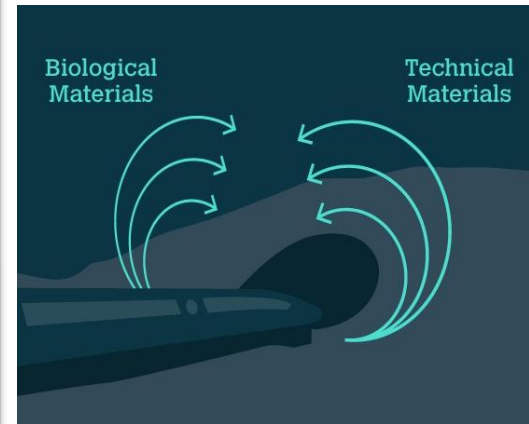
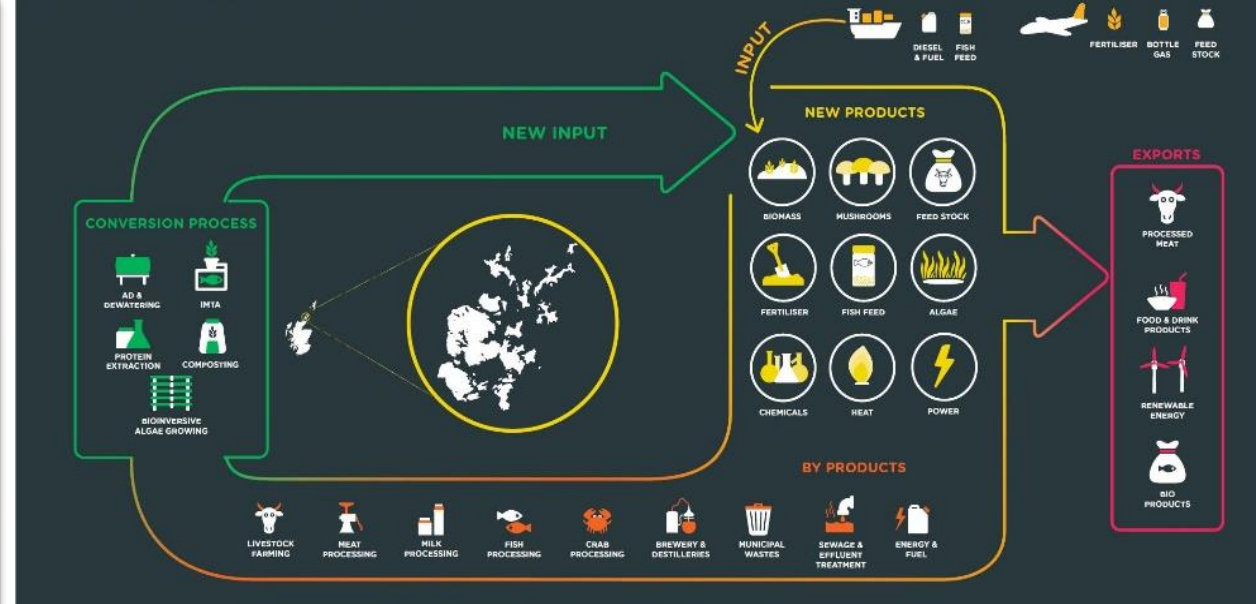
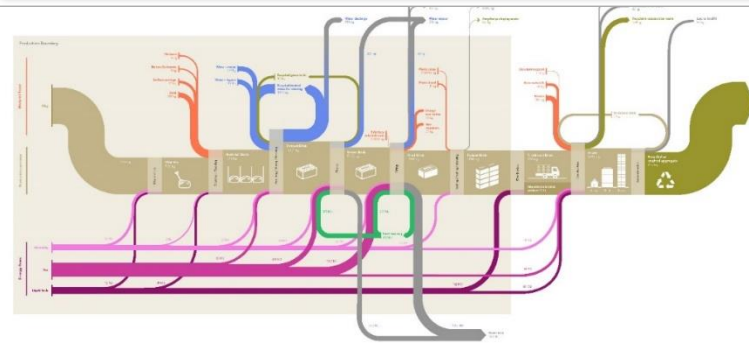


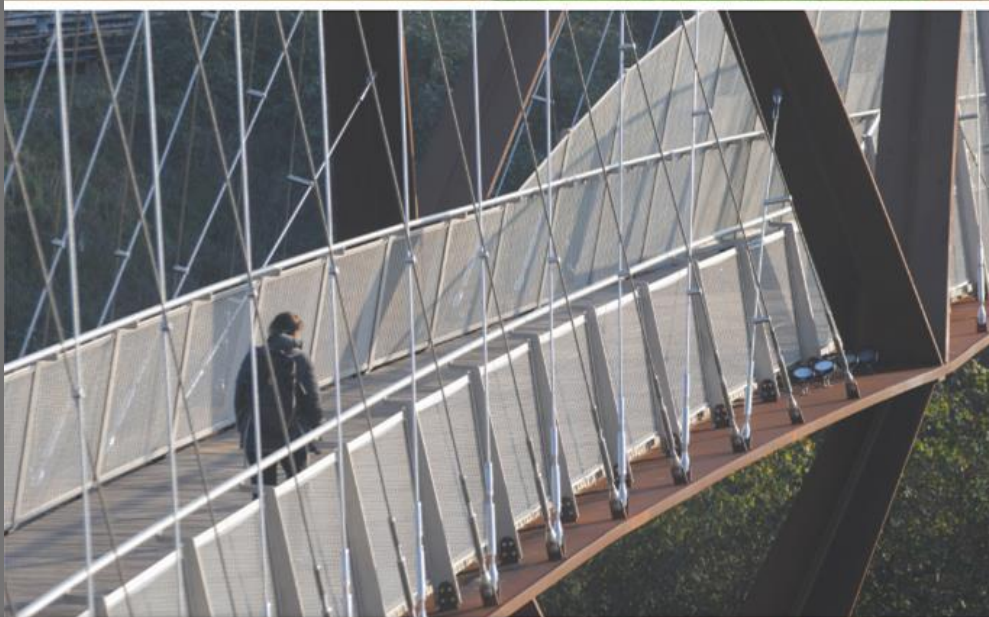
MAYOR OF LONDON

DESIGN FOR A CIRCULAR ECONOMY

PRIMER

GOOD GROWTH BY DESIGN





The Institution of **StructuralEngineers**

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Practical application of circular economy principles

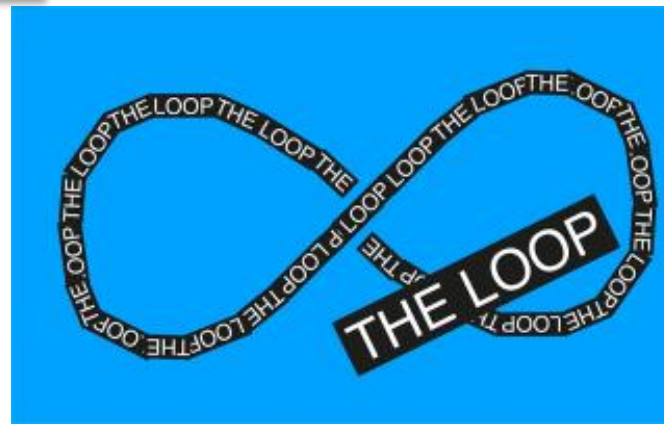
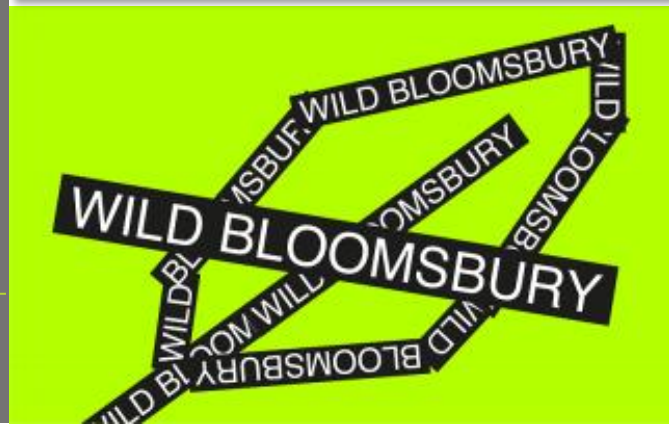
Date published
30 May 2020

Author
Eva MacNamara MStructE



UCL Sustainable Building Standard

A standard for the sustainable design, construction and operation of our built environment



Context for the Circular Economy

We face an ECONOMIC issue

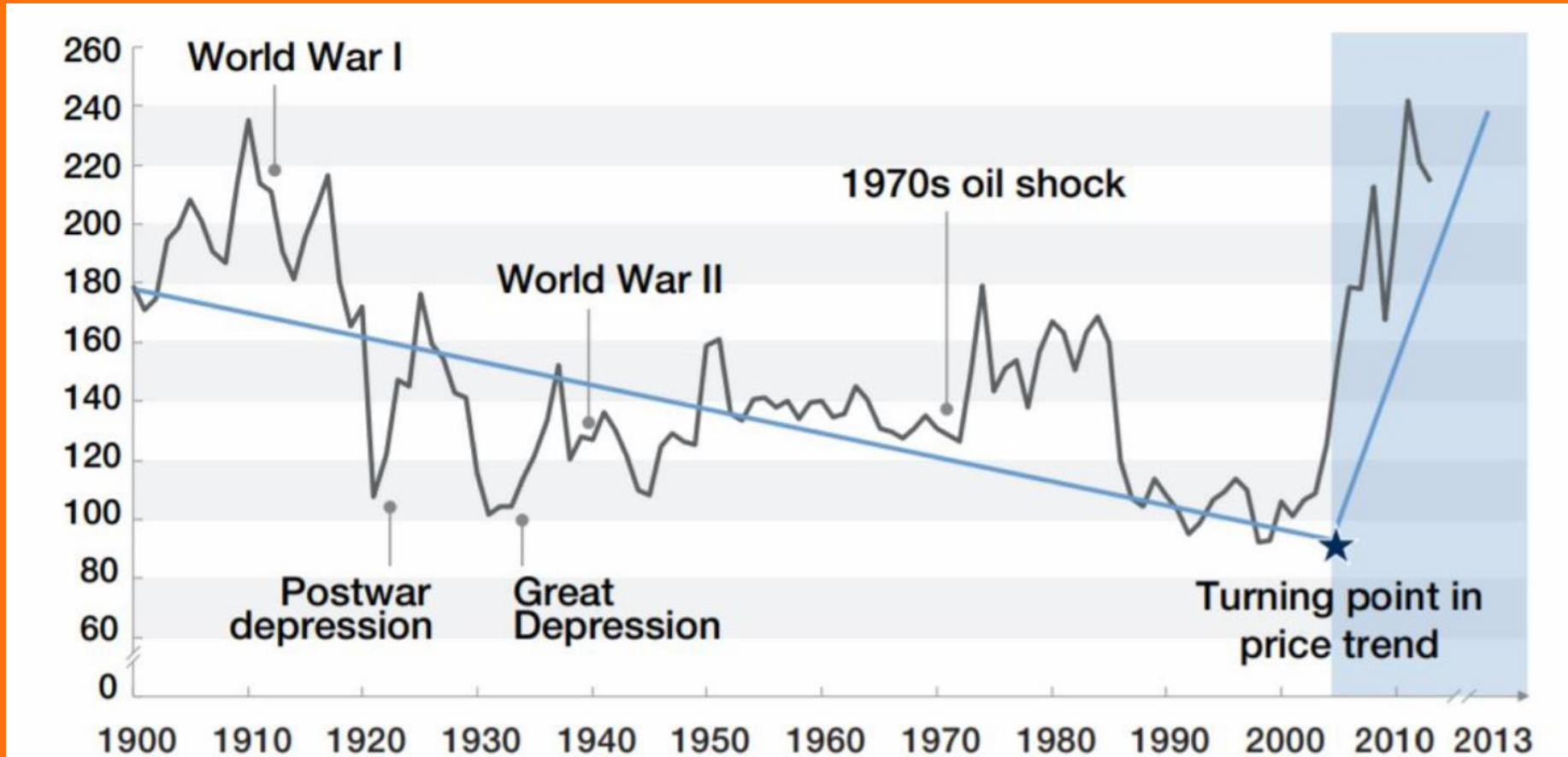


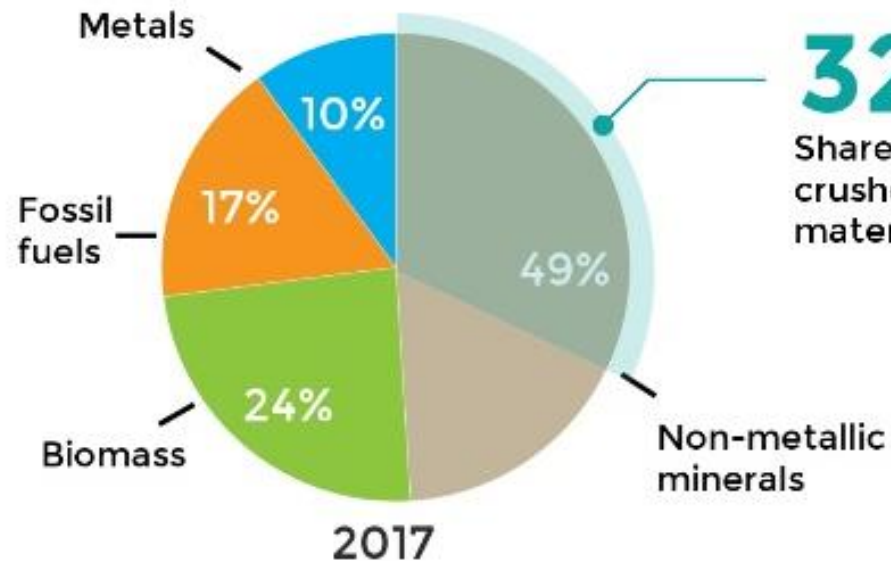
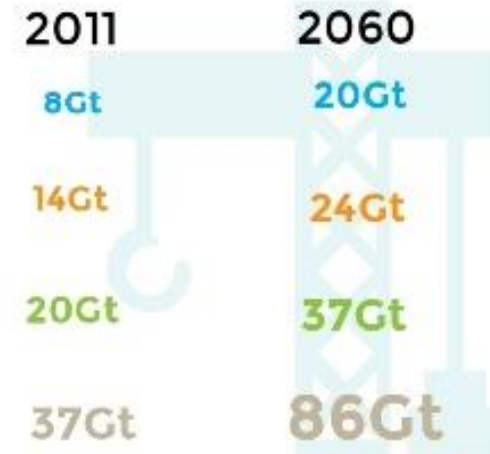
Figure 1: Sharp increases in commodity prices since 2000 have erased all 20th century price declines, following the McKinsey Commodity Price Index ([WE Forum, 2017](#)).

We face a MATERIAL issue

Materials use increase



-  Metals
-  Fossil fuels
-  Biomass
-  Non-metallic minerals



32%

Share of sand, gravel and crushed rock in total materials use



Construction materials use stabilises in China after 2025



We face a SYSTEMIC issue

Growth of materials use and GDP, 2011-2060



Uncouple Growth from Resource Extraction

Take – Make – Use – ~~Discard~~

Re-Make – Use again

Re-Make – Use again

...

LINEAR ECONOMY



RECYCLING ECONOMY

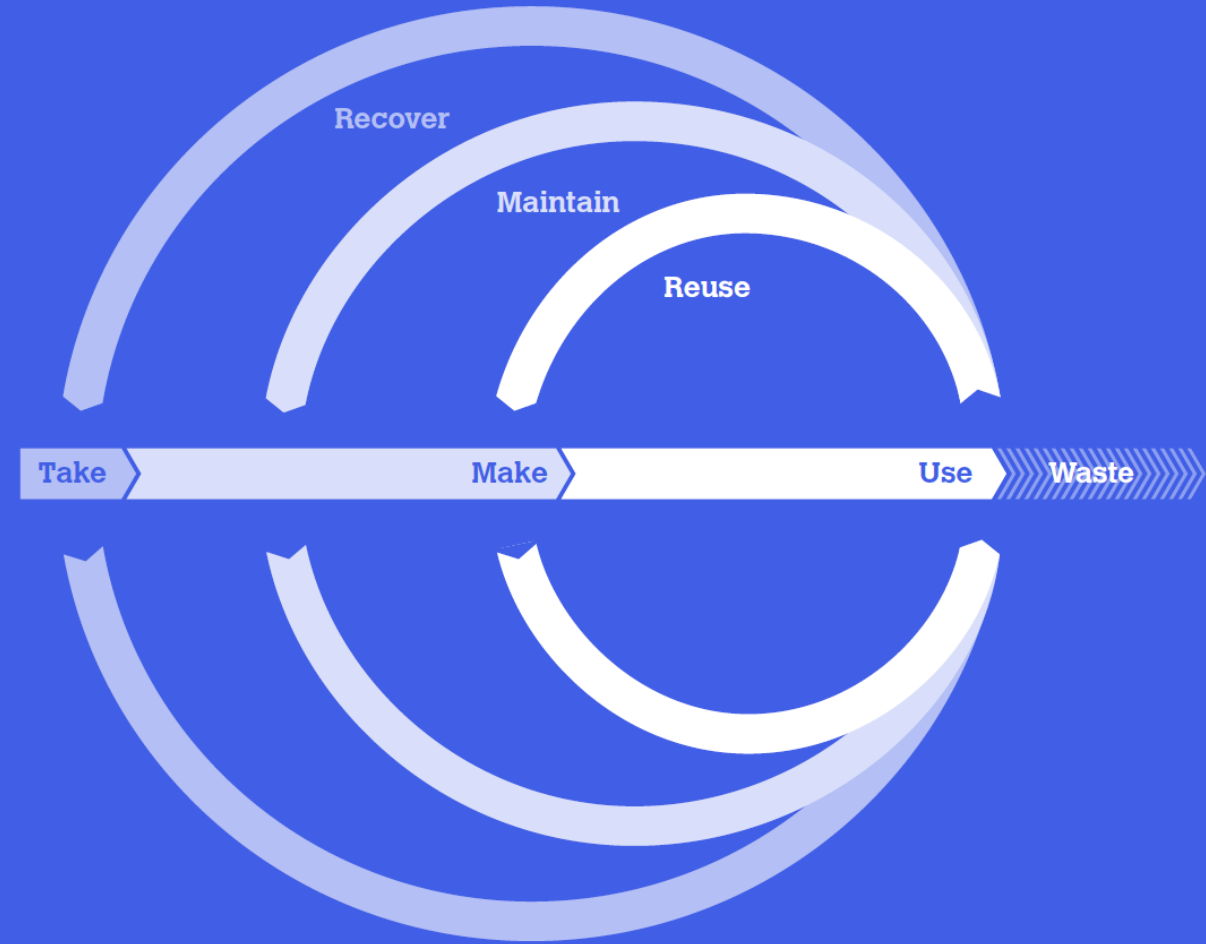


CIRCULAR ECONOMY



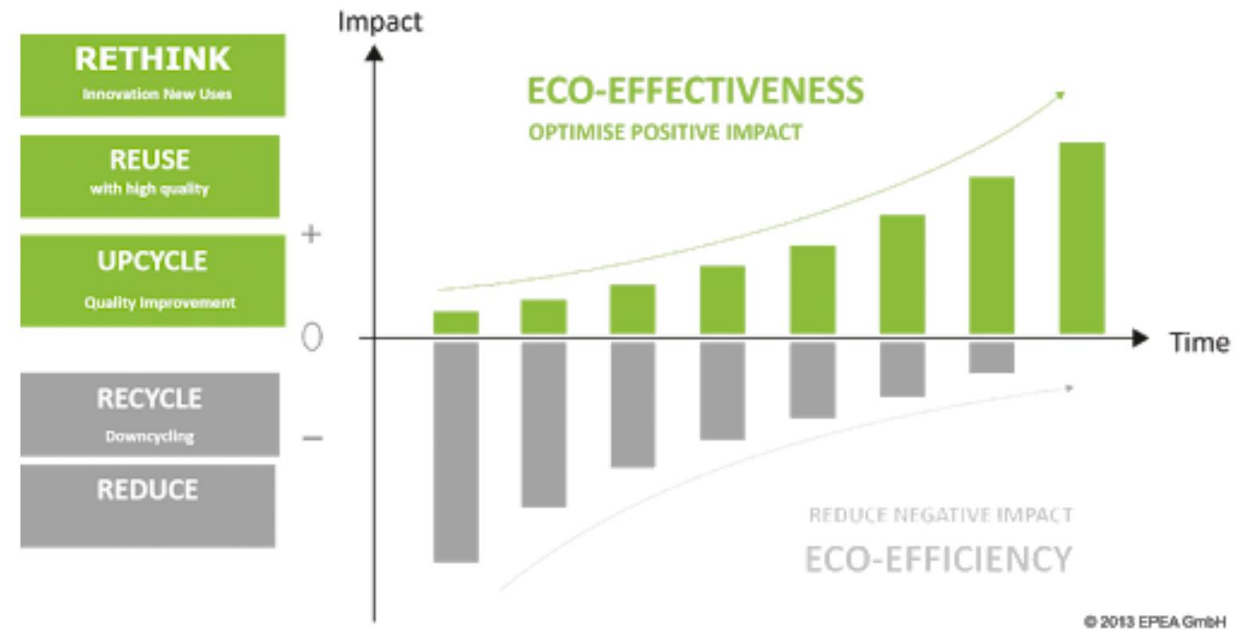
What is a Circular Economy

- Design out waste and pollution
- Keep products and materials in use
- Regenerate natural systems

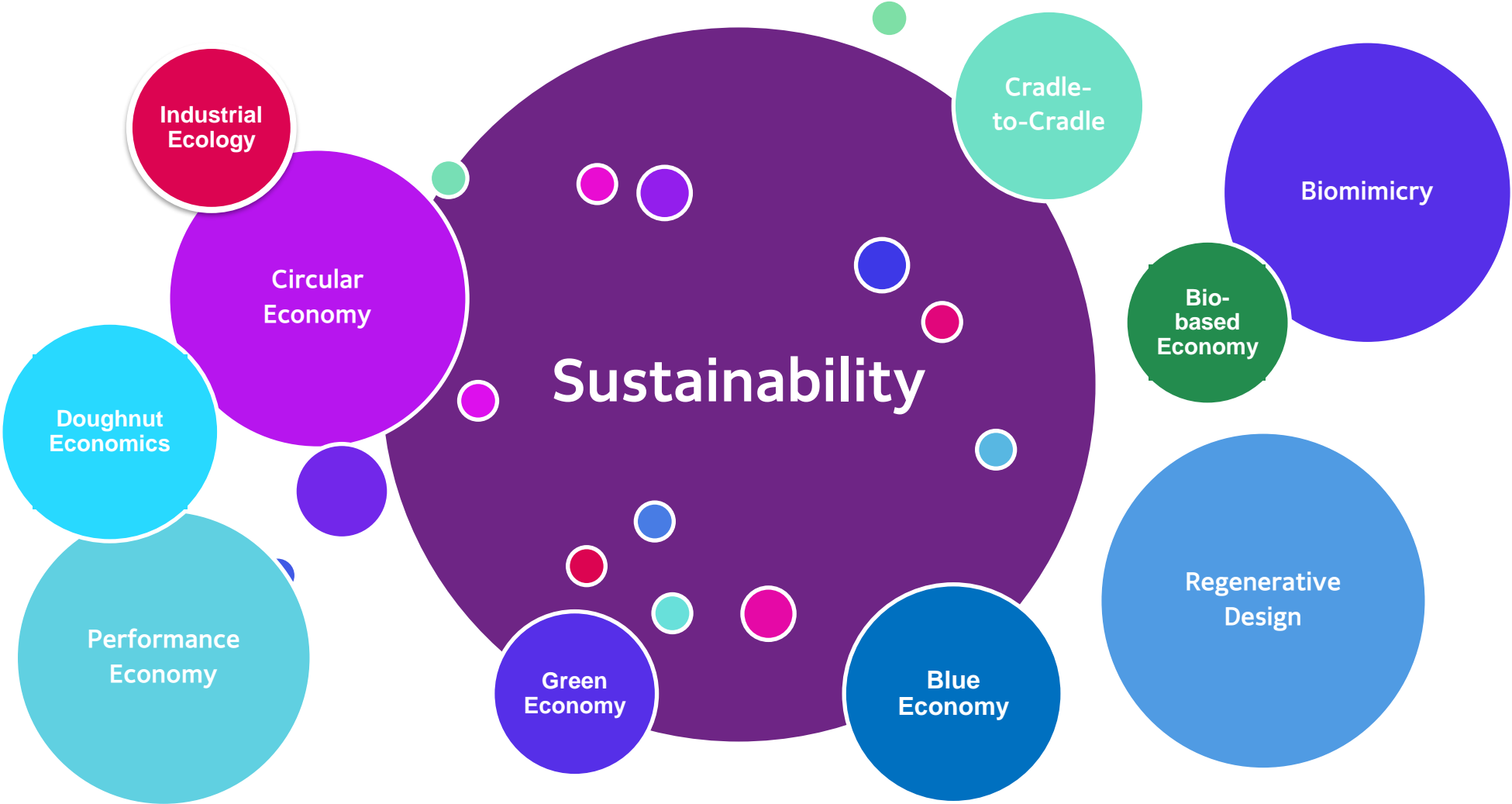


How to build a Circular Economy

- Innovation
- New Business Models
- Collaboration & User Behavior



Ecosystem of Sustainability Philosophies



Local context

GLA's Policy SI7

- Using resources efficiently and sourcing sustainably
- Eliminating waste by designing for modularity, flexibility, re-assembly, dis-assembly
 - **Recycling at least 65% of municipal waste by 2030**
 - **Recycling/beneficial use at least 95% of CD&E waste**
 - **Zero biodegradable and recyclable waste to landfill by 2026**
- Managing any waste generated as high up the Waste Hierarchy as possible

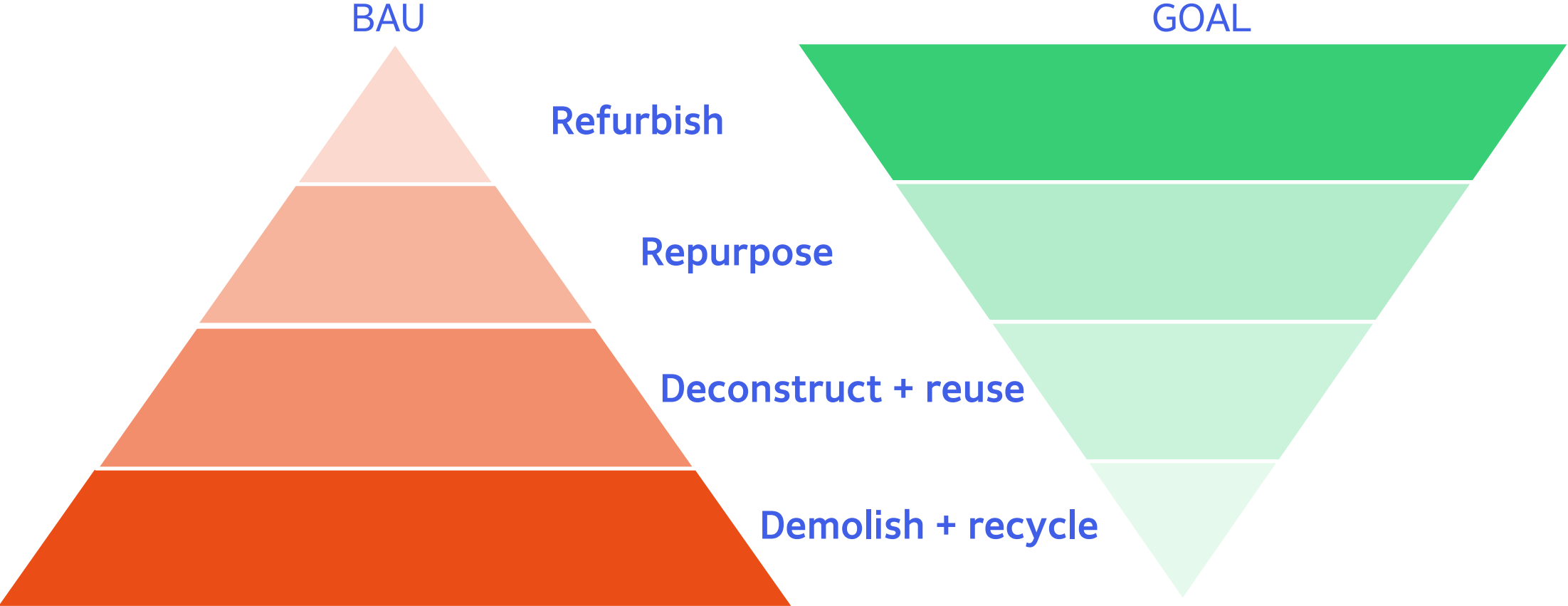
Directly complementary to policies D1, SI2

Goals

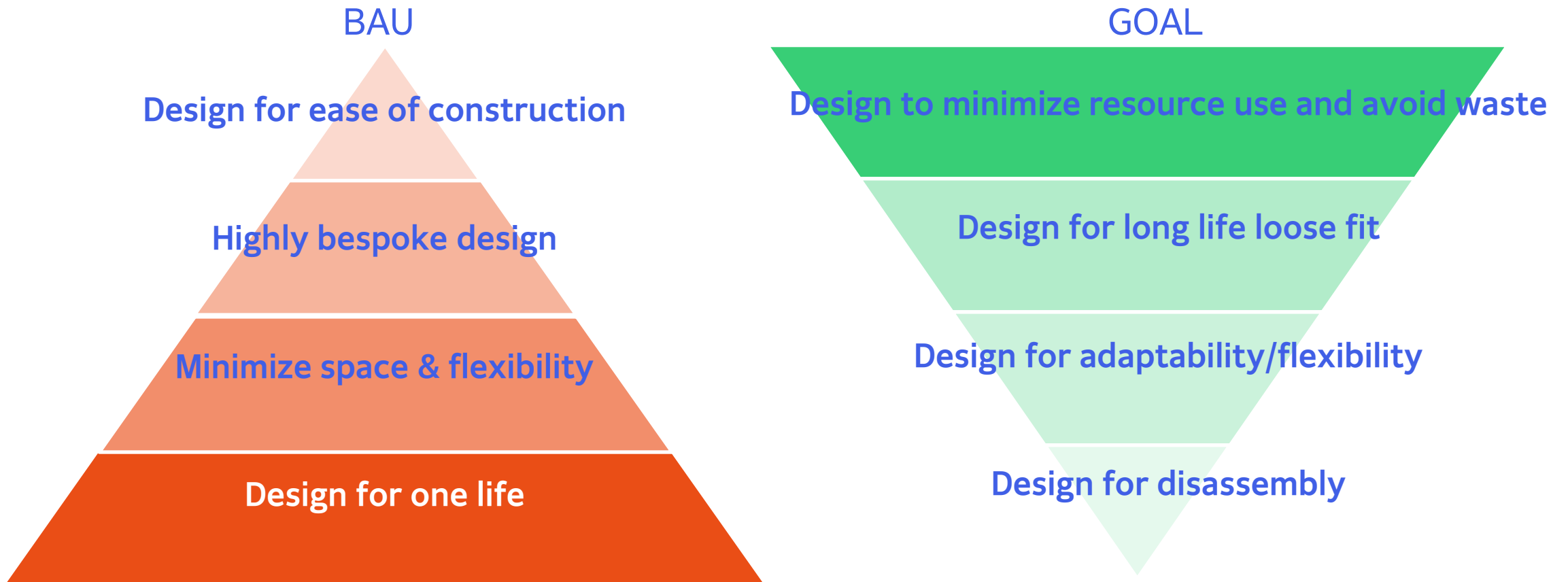
- **Conserve resources, increase efficiency and source ethically**
- **Design to eliminate waste and for ease of maintenance**
- **Manage waste sustainably and at the highest value**

A Strategic Approach

Strategies for existing structures



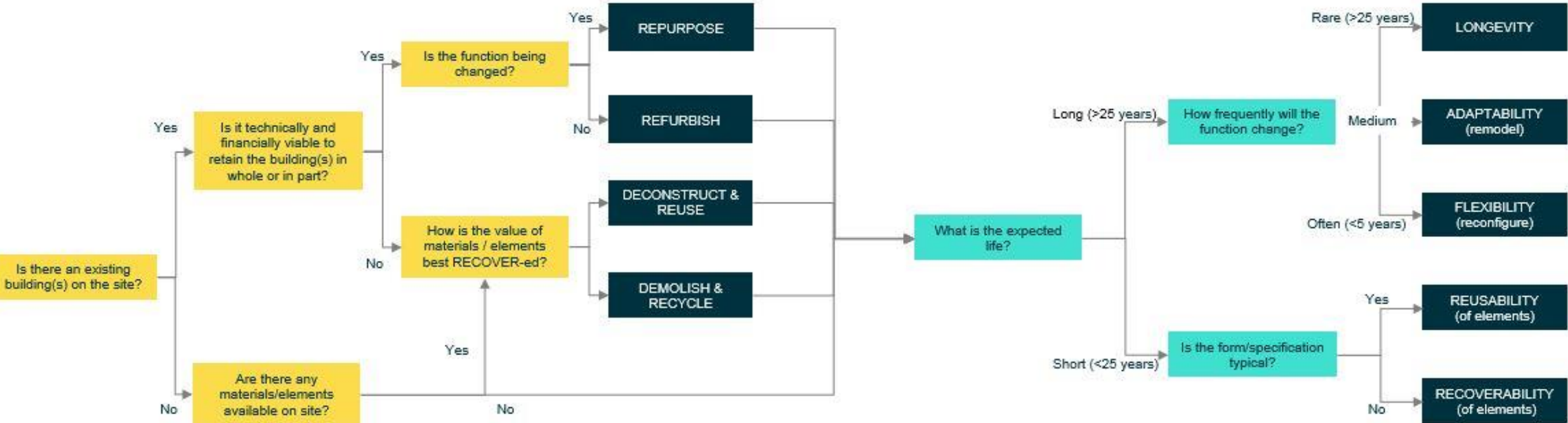
Strategies for new development



Identify appropriate strategies

Retain existing value by...

Conserve resources and create value by designing for...



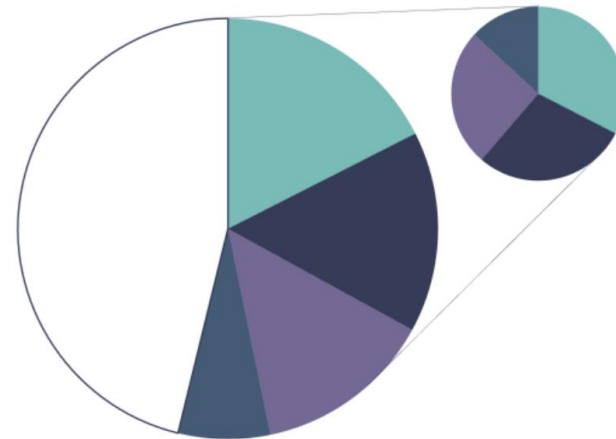
Tools



Credit Summary

| Circularity Principle | Selected Circularity Aim | Building Layer | Circularity Credits | | | Awarded Circularity Rating |
|-----------------------------|--------------------------|----------------|---------------------|----------------------------|-----------------------------|----------------------------|
| | | | Total | Percentage of Selected Aim | Percentage of Total Credits | |
| Design for Adaptability | Basic Circularity | Site | 1 | 100% | 50% | Basic Circularity |
| | | Structure | 6.357143 | 106% | 64% | Partial Circularity |
| | | Skin | 4.642857 | 155% | 77% | Full Circularity |
| | | Services | 1.642857 | 82% | 82% | Full Circularity |
| | | Space | 1.428571 | 143% | 36% | Basic Circularity |
| | | ALL | 15.07143 | 116% | 63% | Partial Circularity |
| Design for Deconstruction | Partial Circularity | Site | 0.642857 | 64% | 64% | Partial Circularity |
| | | Structure | 3.714286 | 93% | 74% | Partial Circularity |
| | | Skin | 3.5 | 117% | 70% | Partial Circularity |
| | | Services | 2.357143 | 79% | 59% | Partial Circularity |
| | | Space | 3.071429 | 102% | 77% | Full Circularity |
| | | ALL | 13.28571 | 95% | 70% | Partial Circularity |
| Circular Material Selection | Partial Circularity | Site | 0.714286 | 71% | 71% | Partial Circularity |
| | | Structure | 4.714286 | 67% | 67% | Partial Circularity |
| | | Skin | 2.142857 | 54% | 36% | Basic Circularity |
| | | Services | 2.142857 | 54% | 36% | Basic Circularity |
| | | Space | 2.142857 | 54% | 36% | Basic Circularity |
| | | ALL | 11.85714 | 59% | 46% | Basic Circularity |
| Resource Efficiency | Full Circularity | Site | 1.428571 | 36% | 36% | Basic Circularity |
| | | Structure | 1.428571 | 36% | 36% | Basic Circularity |
| | | Skin | 1.071429 | 54% | 36% | Basic Circularity |
| | | Services | 1.071429 | 54% | 36% | Basic Circularity |
| | | Space | 1.071429 | 54% | 36% | Basic Circularity |
| | | ALL | 6.071429 | 36% | 36% | Basic Circularity |

Awarded Credits by Circularity Principle



Awarded Credits by Building Layer

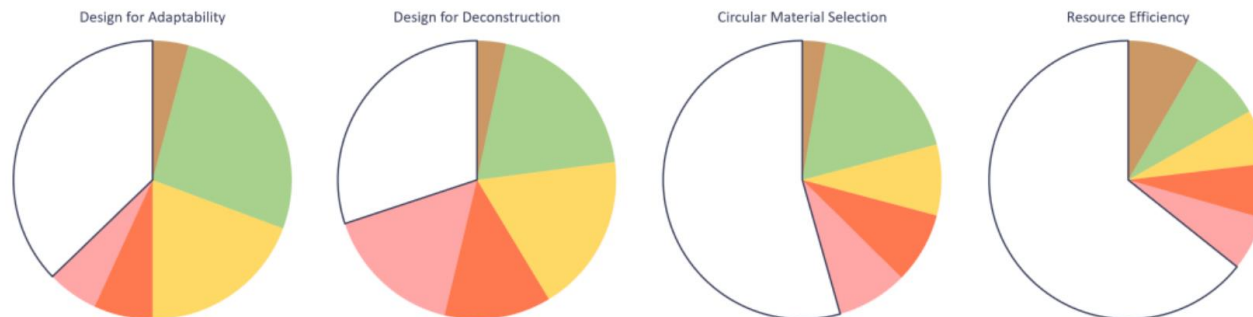


Figure 2: Example output from regenerate

Essential Ingredients

- 1) Leadership
- 2) Brief
- 3) Design team
- 4) Procurement
- 5) Enlightened contractor
- 6) Supply chain
- 7) Collaboration & Risk sharing

**UK Architects
Declare Climate and
Biodiversity Emergency**

**UK Structural
Engineers
Declare Climate
and Biodiversity
Emergency**

**UK Building
Services
Engineers
Declare Climate
and Biodiversity
Emergency**

**UK Civil
Engineers
Declare Climate
and Biodiversity
Emergency**

**Construction
Declares Climate
and Biodiversity
Emergency**

Practical Implementation

HS2

27% less material

2700 tonne reduction in carbon

£7m savings



How

Start off right...

- The right consultants at the right time
- The importance of contract documentation

Take every opportunity...

- Emerging materials
- Social value in creation and ownership
- Meanwhile sites
- Responsibility for the existing
- The importance of contract

Be aware...

- **Idea sharing**
- **Construction declares**

The right consultants at the right time ...

The right consultants at the right time challenge the brief



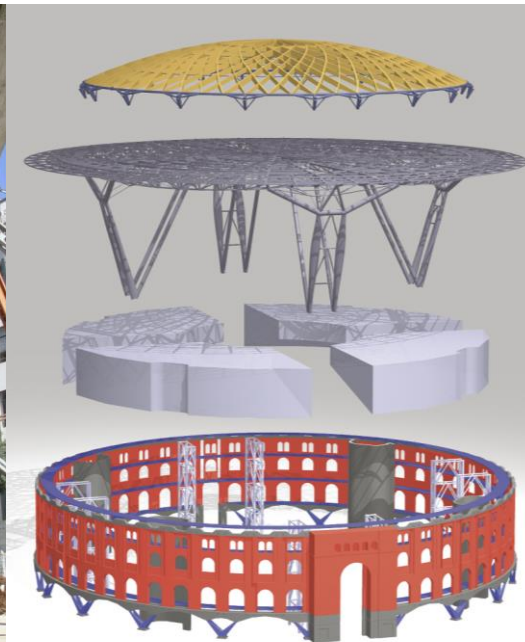
- 1950s building
- Unattractive to modern commercial tenants
- Developer expected to demolish and rebuild... but first consulted their engineer...
- 70% of original building retained
- Targeted demo -> floor area to increase by 30%
- Programme reduced to 3 years.



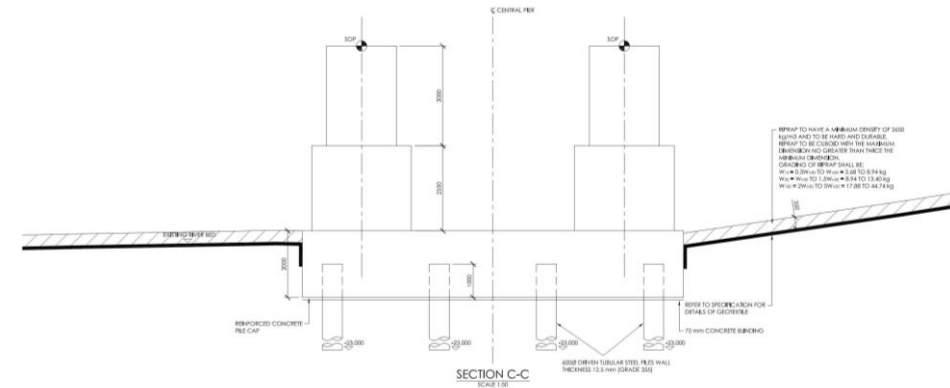
The right consultants at the right time challenge the brief



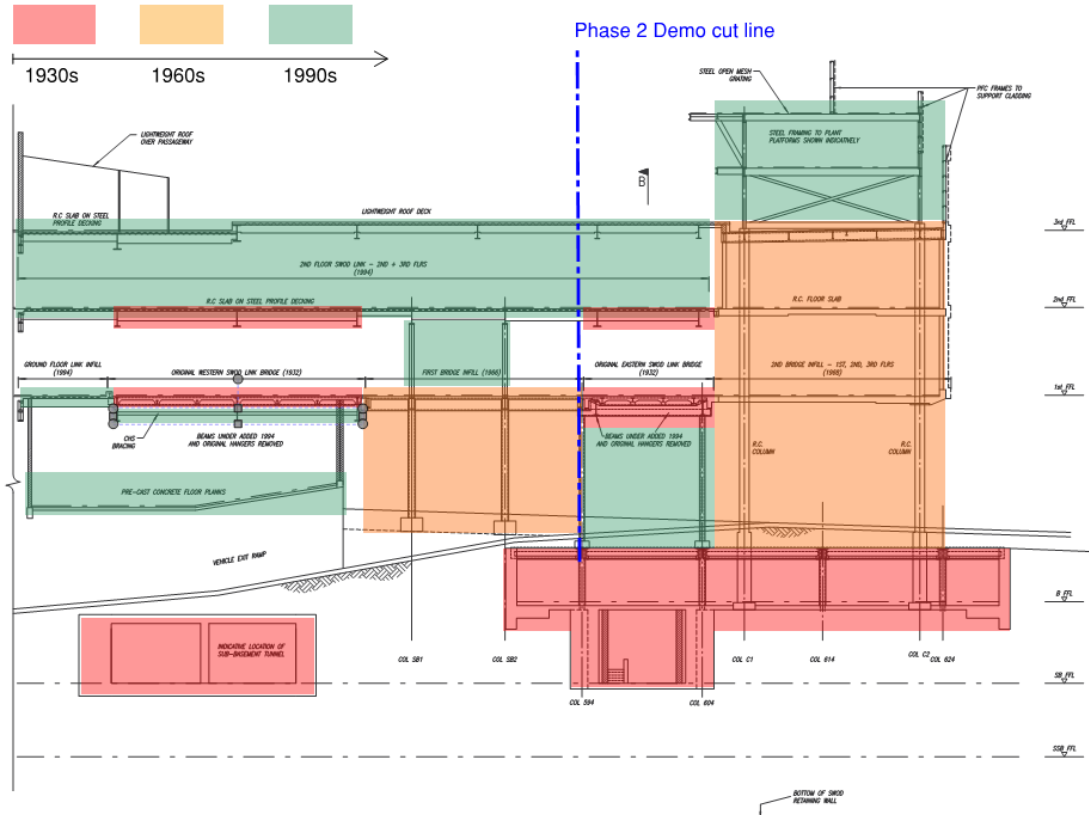
- Derelict for years
- Repeatedly failed proposals
- Engineering ideas unlock the development



The right consultants at the right time challenge the brief



The right consultants at the right time challenge the brief

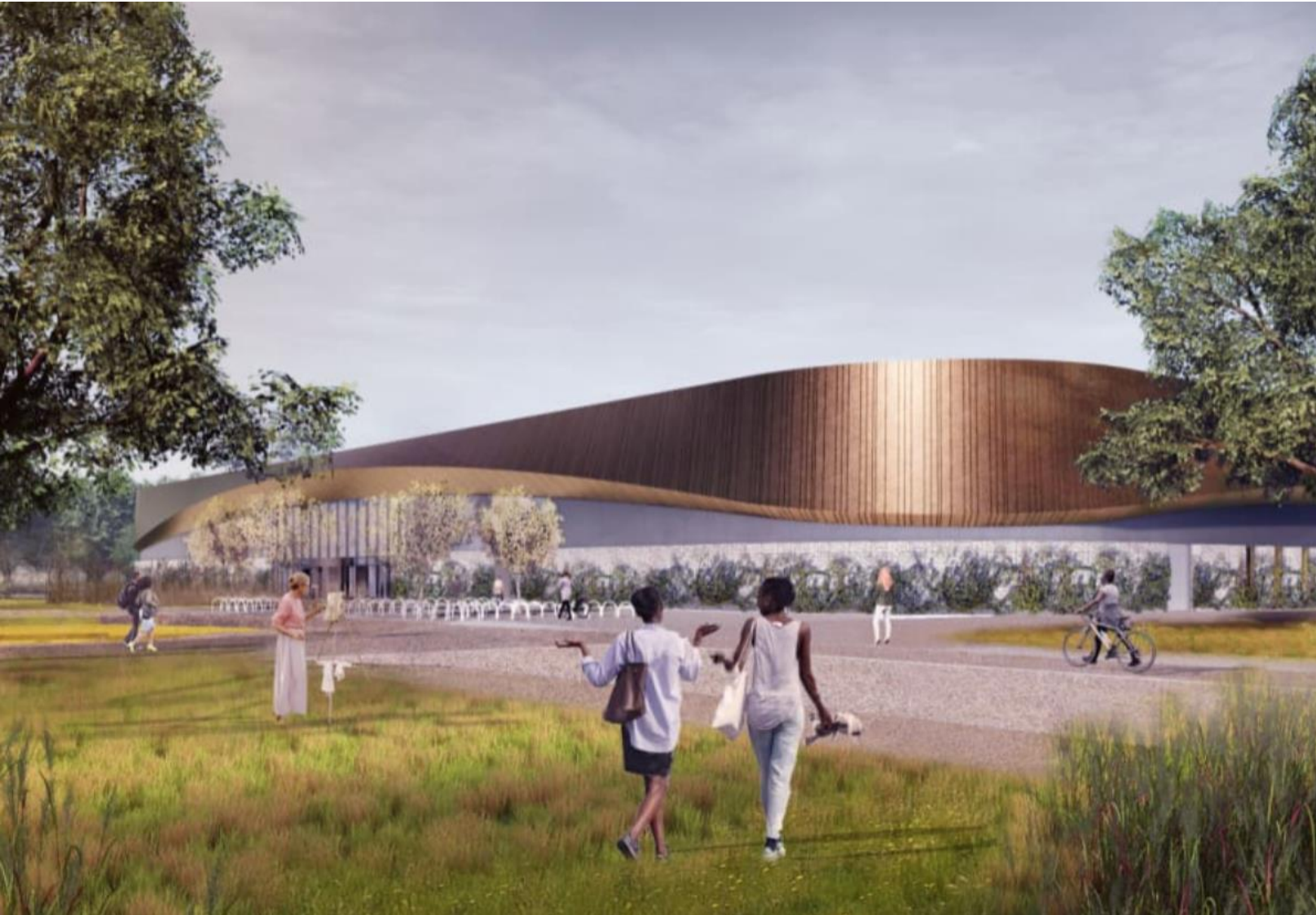


Importance of contract documentation

Importance of contract documentation



Importance of contract documentation



Importance of contract documentation



Emerging Materials

How can emerging materials help?

Displacement rate
= 0.5 mm/min

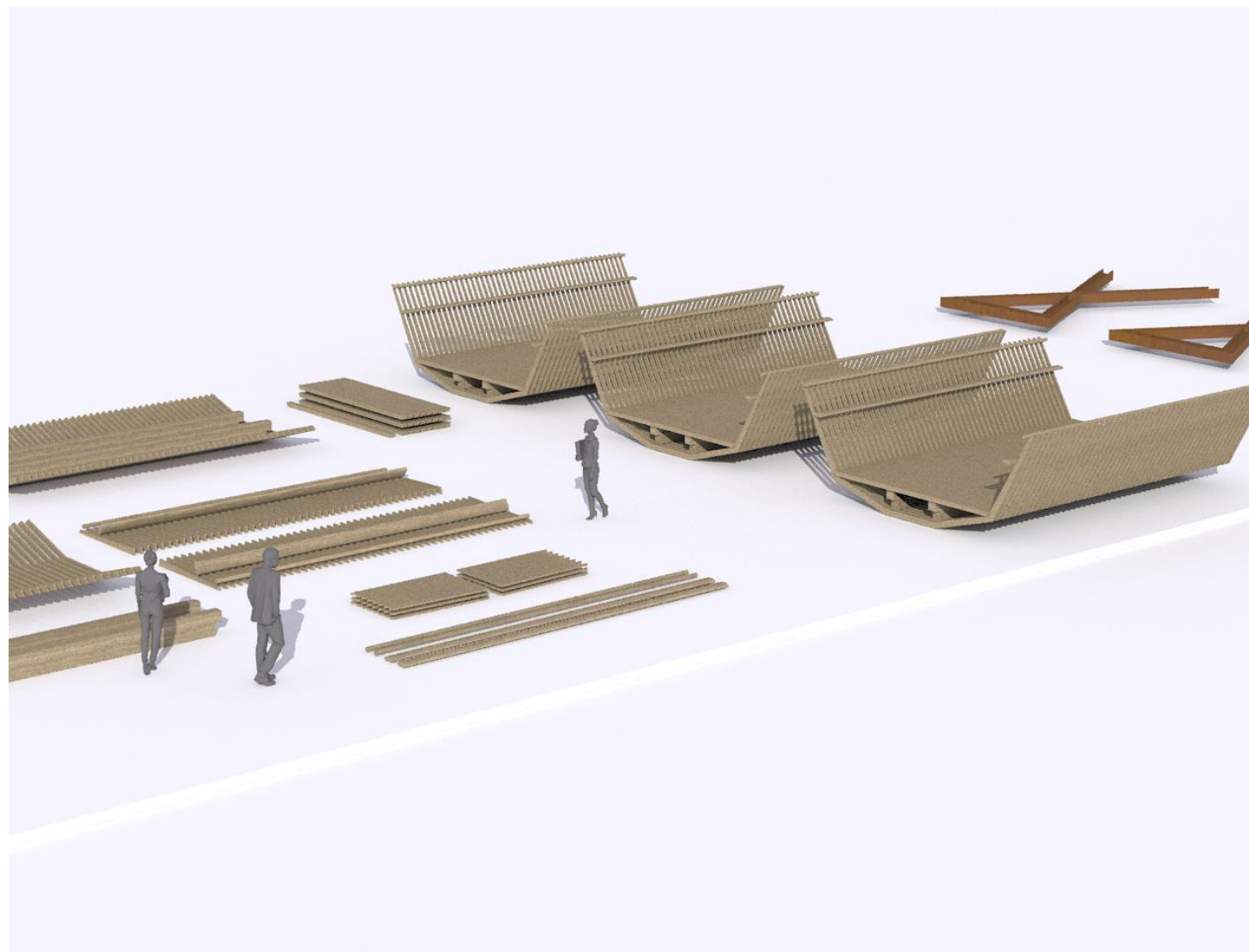
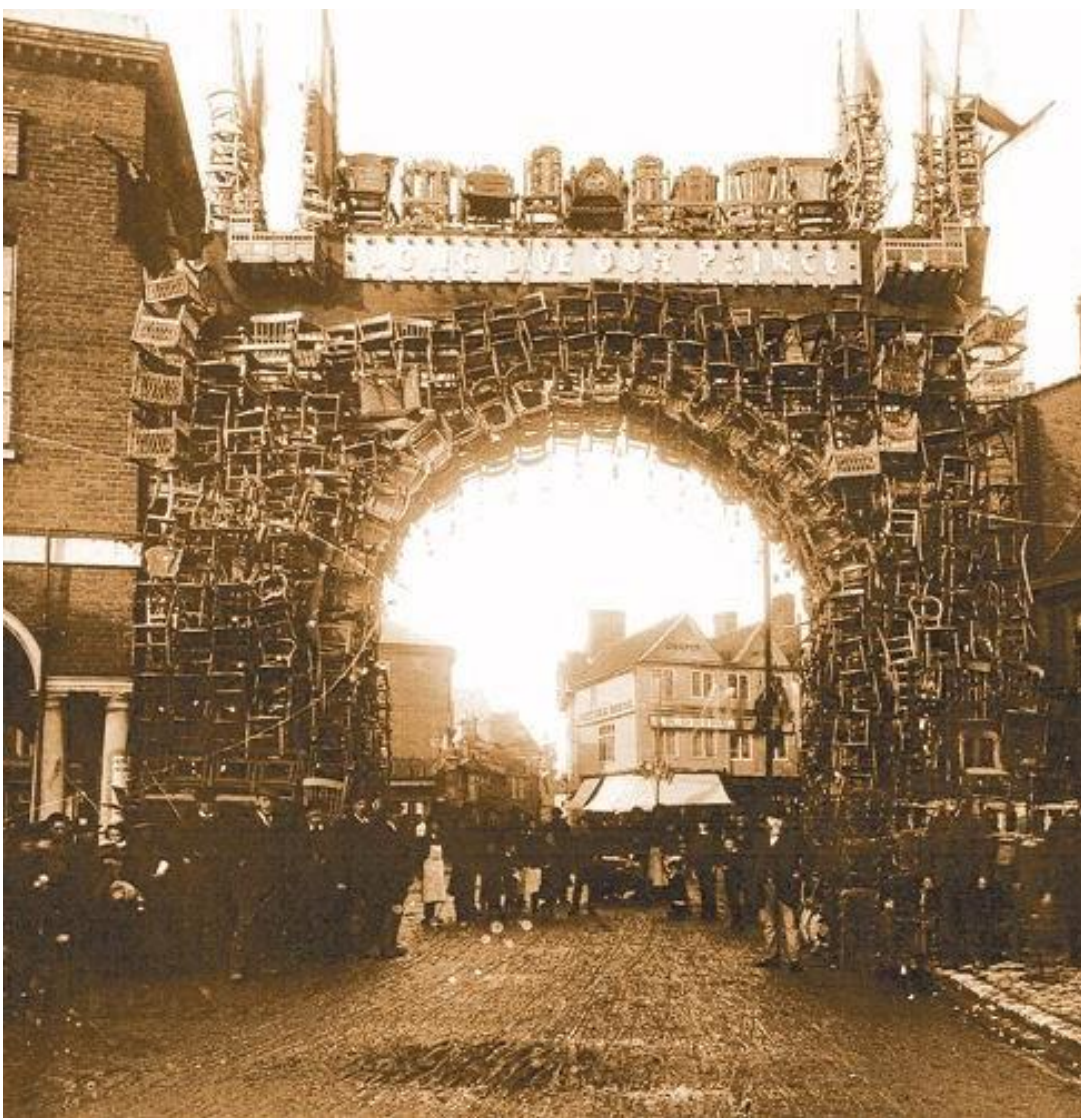
Deflection
= 30 mm



Engineered Geopolymer Composite

Social Value

Social Value



Meanwhile Sites

Meanwhile Sites



Circular Economy at UCL

Aims & Objectives

- Minimise environmental impact
- Going beyond current best practice
 - adaptability and flexibility
 - climate change impacts
 - embodied carbon
- Estates projects - opportunities
- Culture of 'circularity'
- Exemplar buildings/ innovative solutions
- REDUCED COSTS!

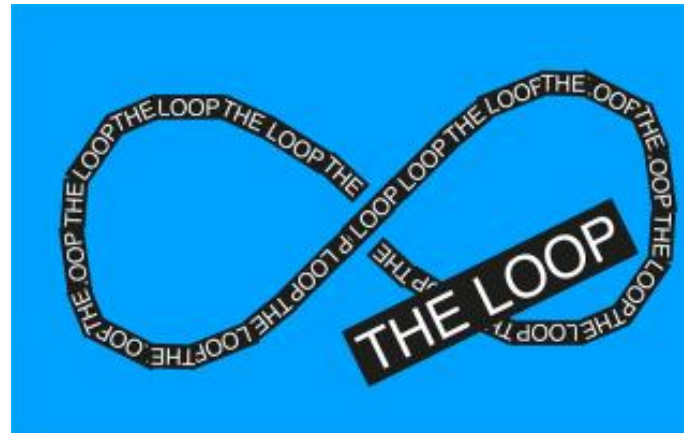


Workstreams

- **UCL Estates**
 - 'Transforming UCL' and UCL East
 - Waste and resource management (inc. plastics)
 - Logistics and storage
 - Catering
- **UCL Bartlett – Circular Economy Lab (CircEL)**
- **AECOM – Applying the Circular Economy to the Built Environment**
- **Arup – Servicing the Circular Economy; Life Cycle Analysis**
- **EMF – New Plastics Economy Global Commitment**



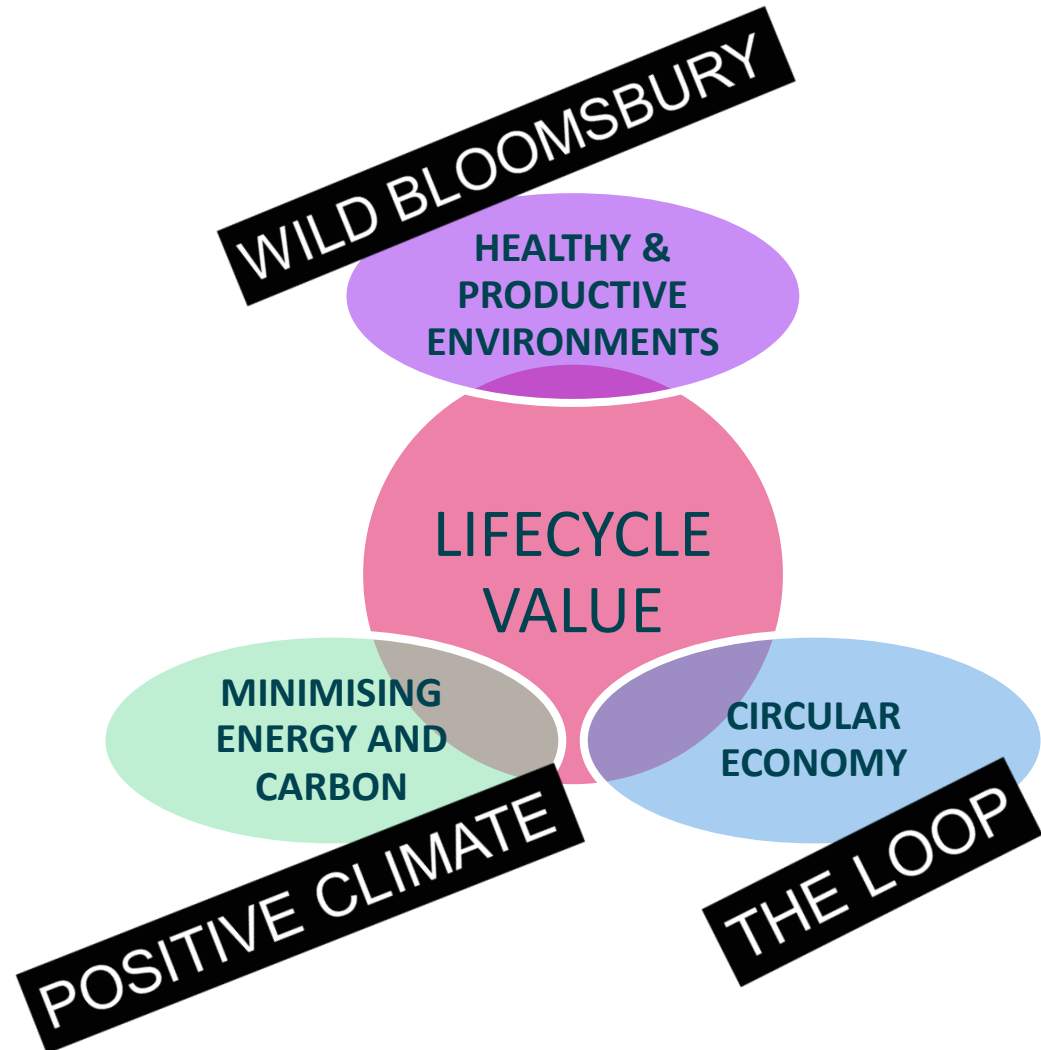
Change Possible – A Strategy, 2019-2024



The Loop = Circular Economy



Sustainable Building Standard



UCL Sustainable Building Standard

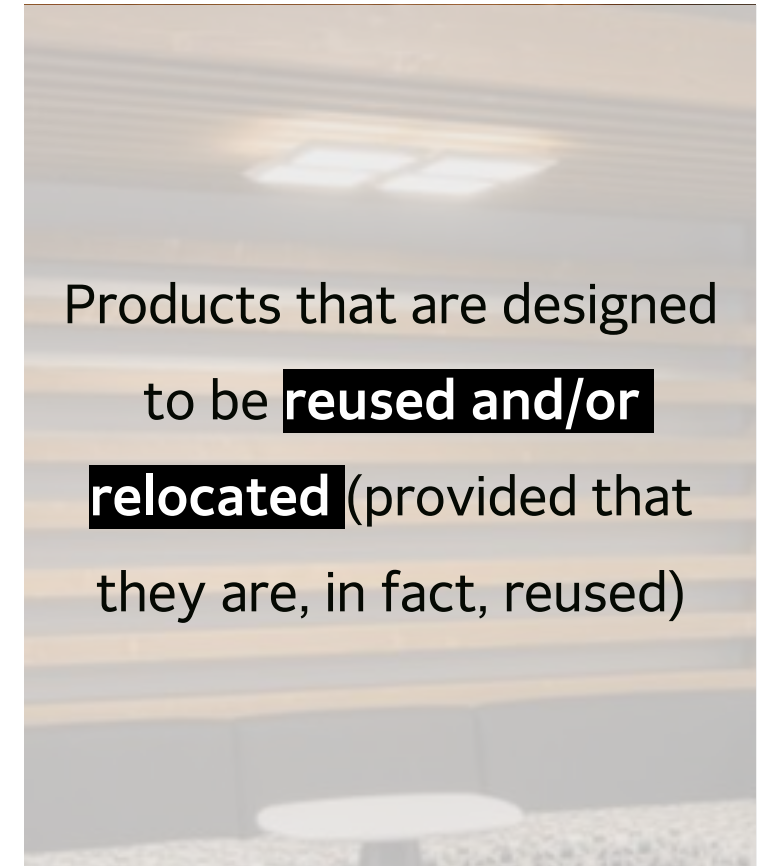
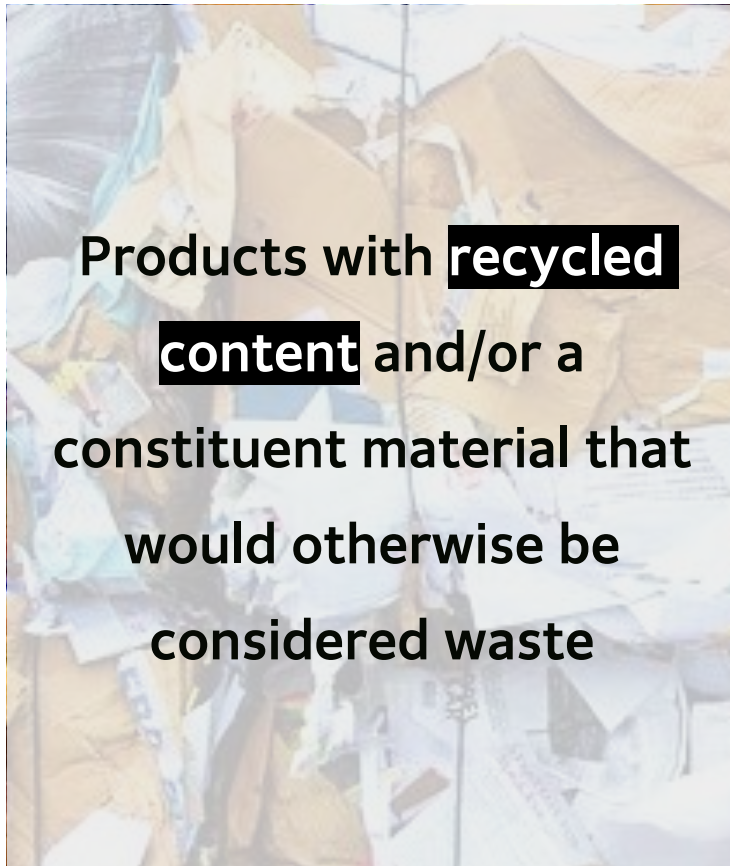
A standard for the sustainable design, construction and operation of our built environment



Addressing value – quantitative & qualitative considerations

| | | | |
|--|--------------------------------------|---------------------------------------|--|
| Shorter installation time | Diverting waste from landfill | Lower embodied carbon | Unlocking potential resale value |
| Reducing need for extra labour or materials | Using less new material | Healthier materials | Positive impressions (PR narrative, planning, etc.) |
| Reducing construction waste | Greater durability | Lower maintenance requirements | Better opportunities for material reclamation |

Findings – savings tend to be associated with:



Servicing the Circular Economy

- Arup – UCL - Schneider – AECOM: testing circular economy principles on the MEP Systems at the UCLE Marshgate site.
- Focus on designing out waste and using new business models to create value from resources.
- Aim to improve asset value and reduce whole life cost while also reducing environmental impacts.
- Published by CIBSE – May 2020

Scenario 1:
Joint Venture



Scenario 2:
Universal Building



Scenario 3:
Passive



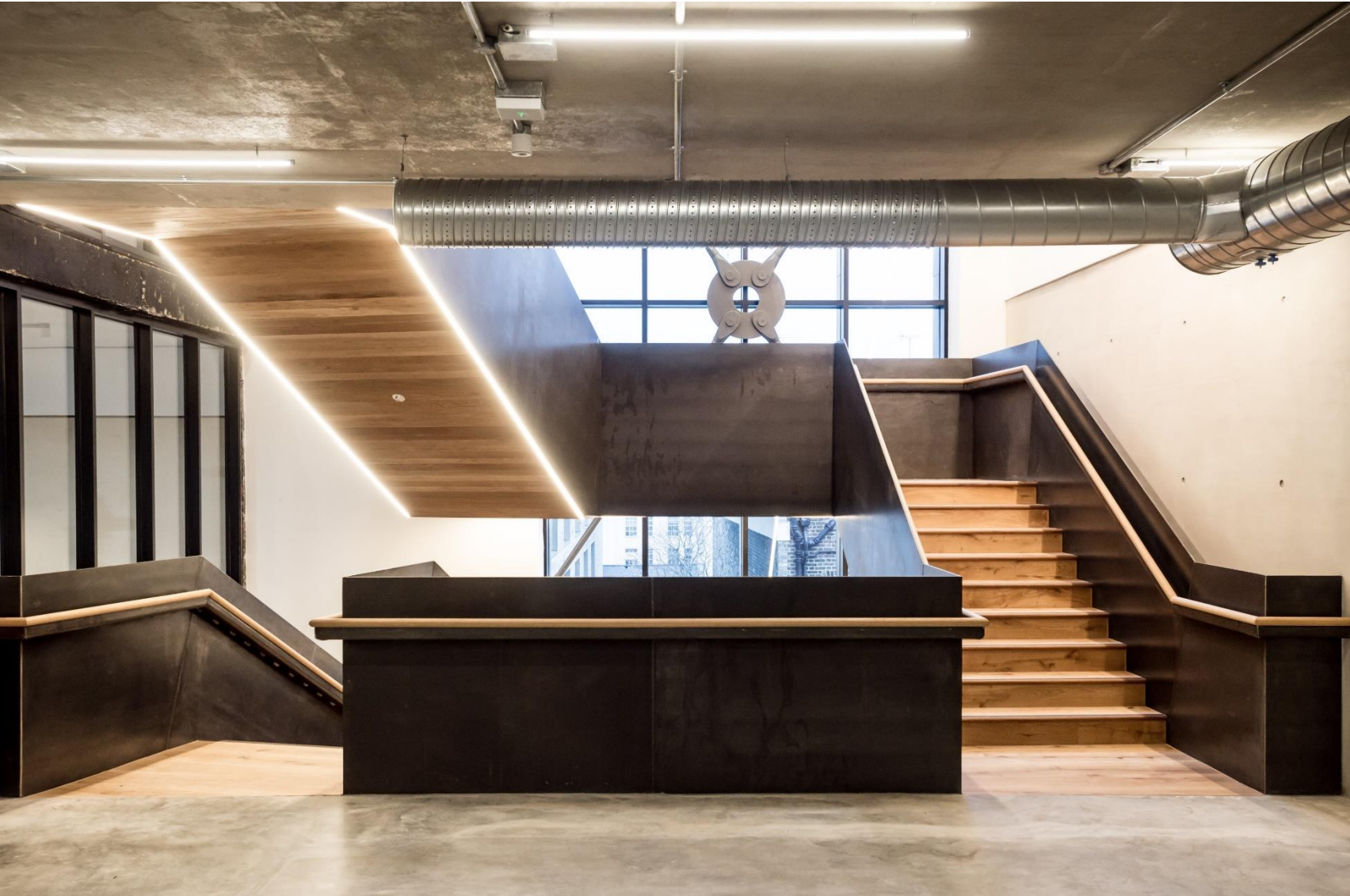
Scenario 4:
Pre-loved



Scenario 5:
Recover



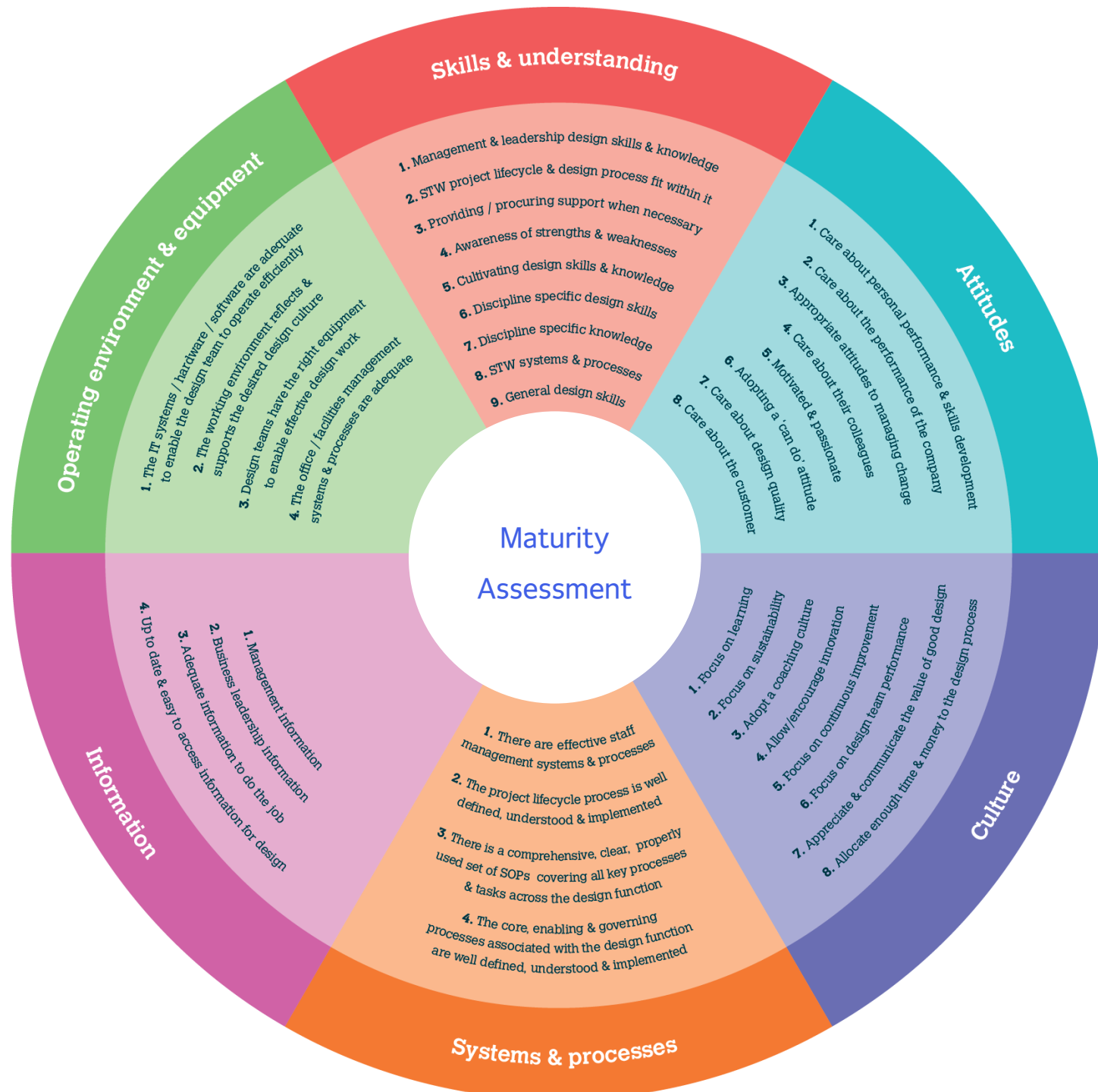
22 Gordon Street – Bartlett School of Architecture



UCL Student Centre



Where are the barriers to
scaling the implementation
of Circular Economy principles?



Poll results

Questions



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Thank you



expedition

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