



Construction Resources

For a Circular Economy



EUROPE & SCOTLAND
European Regional Development Fund
Investing in a Smart, Sustainable and Inclusive Future

A circular economy is about retaining the value of all products and materials for as long as possible. Ideally it is a closed loop system, reducing non-renewable raw material input, and minimising any 'leakage' of materials out of the system.

It is an approach that needs to be designed and planned for, so we can move from our current linear economy practices to a circular economy. We can apply this circular economy approach to how we plan for, design, construct, maintain and replace all of our buildings and infrastructure.

General circular economy construction resources

Who is this relevant for?	<ul style="list-style-type: none"> • All construction project stakeholders, organisations and workforces • All project types and all build phases and end of life: RIBA 0 to 7
Drivers and calls to action	<ul style="list-style-type: none"> • The 17 sustainable development goals (SDGs) to transform our world, United nations • Making Things Last: a circular economy strategy for Scotland, 2016 • RIBA Sustainable Outcomes Guide • SCOTLAND'S CIRCULAR ECONOMY Call to action for the infrastructure sector
Delivery mechanisms	<ul style="list-style-type: none"> • Extended Producer Responsibility (EPR) • Building Standards technical handbook 2017: domestic buildings
Good practice guidance	<ul style="list-style-type: none"> • Towards a Circular Economy, NetRegs • Practical how-to guide: Build Circular Economy Thinking into Your Projects, UKGBC
Implementation Tools	<ul style="list-style-type: none"> • Top Tips for Embedding Circular Economy Principles in The Construction Industry, The Green Construction Board, 2017
Training resources	<ul style="list-style-type: none"> • Circular Economy & the Construction Sector - City of Glasgow College • Circular Economy in the Built Environment – Sign up to UKGBC's Course Mail series for on-demand weekly emails • Circular Economy for a Sustainable Built Environment, Delft University of Technology. Free 6 module online course
Case studies	<ul style="list-style-type: none"> • Circular Economy UKGBC Sustainability 360 survey findings, 2017 • Circularity in The Built Environment: Case Studies, Ellen MacArthur
Publications, presentations and media articles	<ul style="list-style-type: none"> • Building Revolutions by David Cheshire • Cradle to Cradle. Remaking the Way, We Make Things by Michael Braungart and William McDonough • Supporting the construction industry to achieve zero waste, recorded PowerPoint by Clive Bowman • A circular economy approach to designing for a changing climate, recorded PowerPoint by Clive Bowman • The circular economy concept explained - Brendon Rowen, Cradle to Cradle Marketplace Ltd for Government Europa Quarterly, 2018 • Can the circular economy in construction really work?, Raconteur • Can the circular economy make construction more sustainable?, PCBtoday 2020 • Closing the circle Circular economy: Opportunity for the welsh built environment, CE Wales • Sustainable Construction Guidelines for Public Authorities - A Circular Economy perspective, ACR 2019 • MI-ROG - The Circular Economy And Net Zero Carbon, 2020

Resources specific to circular economy construction principles

10 construction circular economy principles

The concept of a circular economy approach to construction can be explained through 10 principles which we believe can be applied to all aspects of building design and placemaking activities, to deliver a wide range of benefits. The principles are as follows and supporting resources are detailed under each principle.

- [Collaboration](#)
- [Whole life value](#)
- [Health and wellbeing](#)
- [Long Life / Loose Fit](#)
- [Low carbon](#)
- [Smart construction](#)
- [Material recoverability](#)
- [Design Out Waste](#)
- [Circular products and services](#)
- [Material management](#)

The list of resources in this document are a collection of suggested useful resources from across a wide range of sources collated by the Zero Waste Scotland Construction Industry Support Programme.

If you would like to suggest any other useful resources that could be included in this document please contact circularconstruction@zerowastescotland.org.uk.

The [Zero Waste Scotland Construction Industry Support Programme](#) provides 1-2-1 advice and support to SMEs in the construction sector in Scotland to help embed circular economy principles into live projects. For more information please access the following Zero Waste Scotland Support a Circular Construction Industry flyers:

- [Construction support service summary](#)
- [Support for circular design](#)
- [Support for sustainable procurement](#)
- [Support for construction site material and waste management](#)
- [Support for digital technology solutions](#)

Creating the demand for Circular economy principles in construction projects

At the end of this document there is a list of the potential benefits and reasons why a client or designer should consider embedding each of the 10 circular economy principals into a construction project.



1. Collaboration

The principle explained

To successfully embed circular economy principles throughout the construction industry and ensure our built environment is fit for future, we need to collaborate and align objectives right across policy levels, supply chains and stakeholders for the whole life of projects. This means working together to pool our expertise and experience and share our resources to ensure opportunities are not missed to deliver best practice.

Who is this relevant for?

- All construction project stakeholders, organisations and workforces
- All construction activity and project types
- All build phases: **RIBA 1 to 7**

Drivers and calls to action

- [A circular economy design approach](#) – Clive Bowman for RIAS Journal issue 40 page 42.
- [Cambridge Centre for Smart Infrastructure and Construction 2020 Annual Review](#) calls for collaboration to address industry challenges and build a sustainable future for post-Covid-19 recovery

Drivers and delivery mechanisms

- Vertical and horizontal policy alignment
- Supply chain workshops
- Stakeholder engagement
- Digital communication tools e.g. BIM, Virtual Reality (VR)
- [Breeam](#) and [Leed v4](#) provide incentives to follow more integrated design processes

Implementation Tools

- [Building Information Management \(BIM\)](#)
- [Cloud based Project management software](#)

Case studies

- [VR improves collaboration and saves money for Anglian Water](#)
- [How a collaborative approach between Network Rail and Costain encouraged a sustainability 'blueprint', Thames Link Programme](#)

Publications and presentations

- [Construction industry needs a collaborative 'evolutionary jump' towards a circular economy](#), Edie 2016
- [Collaborative Placemaking](#), John Thompson & Partners
- [Better together: why construction needs collaboration to work efficiently](#), The Guardian 2014
- [Collaborative construction - Achieving common goals](#), Balfour Beatty 2018
- [Is industry-wide collaboration the key to sustainability in construction?](#) PCBtoday 2019
- [Sustainable Buildings FOR EVERYONE, EVERYWHERE](#), World GBC, 2020



2. Whole Life value

The principle explained

Upfront construction costs are only one type of cost to consider when building. The key to sustainability and carbon reduction is taking a wider, long-term view. The lifetime positive and negative impacts of a building on society and on the environment, from its construction, use, maintenance and repairs, decommissioning and disposal, need to be recognised and accounted for.

Who is this relevant for?

- Construction project stakeholders and decision makers
- New build, refurbishment, but particularly asset and facility management
- All project types: residential, commercial, industrial, infrastructure
- Planning, early design phases and in use: **RIBA 0 to 3 & 7**

Industry standards / Regulations

Sustainable procurement duty, Scottish Government 2014

Drivers and calls to action

- An ecosystem / whole-systems approach that considers Natural Capital
- Procuring for Value, Construction Leadership Council, 2018
- Why governments should prioritize well-being, Nicola Sturgeon

Delivery mechanisms

- Sustainable procurement
- Placemaking – a place-based approach to planning policy, The British Academy, 2017
- Policies and mechanisms that enable 'climate ready' investment delivering long-term, lasting social, environmental and economic benefits: Scotland's National Performance Framework

Good practice guidance

- Driving social value in new development: options for local authorities, UK Green Building Council (2019)
- Building Value - A pathway to Circular Construction Finance - January 2019

Implementation Tools

- Whole Life Cost tool - calculate your building and infrastructure lifetime costs using Zero Waste Scotland's whole life costing tool.
- Whole Life Appraisal Tool for the Built Environment, Scottish Futures Trust

Training resources

- Whole Life Costing Tool training modules, ZWS

Case studies

- Procuring for Value, Construction Leadership Council

Publications and presentations

- Zero waste Scotland NPF4 consultation response, April 2020
- Whole-life value in construction is a lot like buying a new car, Construction News, 2019
- Sustainable Buildings FOR EVERYONE, EVERYWHERE, World GBC, 2020

Research

- Researching whole life value methodologies for construction



3. Health and wellbeing

The principle explained

We should be designing and maintaining all of our infrastructure, both indoor and outdoor spaces to maximise quality of life, comfort, productivity, mental and physical wellbeing. We need to consider of air quality, ventilation, active and low carbon travel opportunities, flexible and adaptable working and living spaces, quality indoor and outdoor greenspace, public spaces and neighbourhoods, and access to healthy food, social connectivity. A healthier population uses less resources and is more productive.

Who is this relevant for?

- All construction project clients, designers and specifiers
- New Build, refurbishment and facility management
- All project types: Residential, commercial, Industrial, infrastructure
- Planning, design phases and in use: **RIBA 0 to 4 & 7**

Industry standards, policies and regulations

- [Building standards technical handbook 2019: domestic buildings](#)
- [Building standards technical handbook 2019: non-domestic buildings](#)

Drivers and calls to action

- [The Real Cost of Poor Housing](#), Simon Nicol, BRE, 2013
- [The cost of poor housing to the NHS - Briefing Paper](#), BRE 2015
- [Health, Wellbeing & Productivity in Offices The next chapter for green building](#), WorldGBC

Delivery mechanisms

- [WELL certification](#)
- [BREEAM 2018](#)
- [Home Quality Mark](#)

Good practice guidance

- [Good Homes Alliance overheating tool and guidance](#)
- [WELL Building Standard v2 Preconditions](#), 2019.
- [CIBSE TM40: Health and wellbeing in building services webinar](#)
- [Applying BREEAM and The WELL Building Standard](#). WELL Building (2019)

Implementation Tools

- [Design and detailing for toxic chemical reduction in buildings – Sandy Halliday](#), SEDA
- [Prescription for Healthier Building Materials: A Design and Implementation Protocol](#), AIA, ARUP

Training resources

- [Sustainable Construction and Development](#) – University of Bath

Case studies

- [Acharacle Primary School](#) by Gaia Architects
- [Inverness new-build](#)
- [The Piggery](#) by Sam Foster Architects

Publications and presentations

- [Occupant Comfort and the circular economy and Circular Economy Materials for Low Carbon, Healthy Buildings](#) – Clive Bowman
- [Office buildings are key to workers' health, wellbeing and productivity](#), The Guardian, 2014
- [Ventilation and Indoor Air Quality in New Homes](#), Aecom Ltd, 2019

Research

- [The impact of classroom design on pupils' learning](#), Uni of Salford



4. Long Life / Loose Fit

The principle explained

A building's ability to evolve and adapt through time to reflect changes in fashion, use, needs and impacts such as climate change, population, digital technology and demographics. The 'sheering layers' principle recognises layers that have different life spans and designing with this principle in mind can help a building adapt and last longer, with a minimum of 'wasted' resources.

Who is this relevant for?

- All construction project stakeholders, designers and decision makers
- New build, refurbishment and facility management
- All project types: residential, commercial, industrial, infrastructure
- Planning, design stages and in use: **RIBA 0 to 4 & 7**

Industry standards, policies & regulations

- [National Planning Framework 4](#) (currently in consultation)

Drivers and calls to action

- [The time is right for long life, loose fit](#), New London Architecture
- [RetroFirst: Can policy change encourage more retrofitting?](#), AJ

Delivery mechanisms

- [Climate change adaptation](#): integrated 'green' and 'blue' infrastructure
- Policies and mechanisms that enable 'climate ready' investment delivering long-term, lasting social, environmental and economic benefits: [Scotland's National Performance Framework](#)

Good practice guidance

- [Sustainable renovation guide](#) – Chris Morgan, SEDA and The Pebble Trust.
- [Designing buildings for adaptability, durability, and positive impact](#), Ellen Macarthur Foundation

Training resources

- [How Buildings Learn - Stewart Brand - 6 of 6 - "Shearing Layers"](#)

Case studies

- [Design for future climate: adapting buildings competition, CIRIA 2019](#) - A selection of factsheets that provide insight into the approaches taken to consider climate change effects in the design of real-life construction and building refurbishment projects.
- [Brummen Town Hall, Netherlands](#), Construction Manager Magazine.

Publications and presentations

- [The case for ... never demolishing another building](#) – The Guardian, January 2020
- [Operating and Maintaining buildings for maximum regenerative performance](#) Ellen Macarthur Foundation

Research reports and documents

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5. Low carbon / sequestration

The principle explained

Design all infrastructure to facilitate both a low operation **and** a low embodied carbon, low resource use society. We need to create landscapes and built assets which sequester (draw down) carbon dioxide by using and producing more products based on materials that we have grown rather than mined, extracted or processed.

Who is this relevant for?

- All construction project stakeholders and decision makers,
- All build types and all project types
- All planning & build phases through to end of life: **RIBA 0 to 7**

Industry standards, policies & regulations

- [Scottish Government Net Zero Carbon 2045 target](#)
- Whole life carbon assessment

Drivers and calls to action

- [The Living Building Challenge 3.1- Imperative 11 Embodied Carbon Footprint](#)

Delivery mechanisms

- Whole Life Embodied Carbon Assessment tools
- Accreditation schemes e.g. [BREEAM](#), [CEEQUAL](#), [Home Quality Mark ONE](#) and [Passivhaus](#)

Good practice guidance

- [Whole Life Carbon Assessment for Built Environment](#), RICS (2017)
- [Embodied and whole life carbon assessment for architects](#), RIBA
- [Five key Components of Net-Zero Carbon Buildings](#), WGBC
- [Net Zero Carbon Buildings: A Framework Definition](#), UKGBC
- [Targeting Zero: embodied and whole life carbon explained](#), RIBA
- [Embodied carbon - Developing a client brief](#), UKGBC 2017
- [Delivering Low Carbon Infrastructure](#), UKGBC 2017
- [LETI Embodied Carbon Primer](#) LETI (2019)
- [Cutting embodied carbon in construction projects](#) WRAP

Implementation Tools

- [One Click LCA](#)
- [RICS Building Carbon Database](#)
- [The Carbon Smart Materials Palette](#)

Training resources

- [A range of free online Construction CPD and Courses at the BRE Academy on BREEAM](#)

Case studies

- [Passivhaus standard with the MAKAR off-site n-Sip panel system](#)

Publications and presentations

- [Whole Life-Cycle Carbon Assessments guidance – London Plan Pre-consultation draft.](#)
- [Embodied carbon in construction setting the scene for Scotland](#), edited by Clive Bowman, ZWS for RIAS April 2020.
- [Options for incorporating embodied and sequestered carbon into the building standards framework - Report prepared by AECOM for the Committee on Climate Change, 2019.](#)

Research reports and documents

- [UK Green Building Council](#)
- [Embodied Carbon Scoping Study for Zero Waste Scotland - JH Sustainability Ltd, March 2020.](#)



6. Smart construction

The principle explained	Making use of digital technology, modularisation and modern methods of construction to increase resource efficiency, improve quality and monitor performance.
Who is this relevant for?	<ul style="list-style-type: none"> • All construction project stakeholders, organisations and workforces • All build and asset management activities • All project types: Residential, commercial, Industrial, infrastructure • All planning, design, build use and end of life phases: RIBA 0 to 7
Industry standards, policies & regulations	<ul style="list-style-type: none"> • UK BIM Framework Standards & Guidance
Drivers and calls to action	<ul style="list-style-type: none"> • Use of technology, database platforms and quality accreditation schemes to support a material reuse marketplace
Delivery mechanisms	<ul style="list-style-type: none"> • BIM and digital twins, • materials and buildings passports, • augmented and virtual reality • offsite construction & modular building • Building performance monitoring and data analysis
Good practice guidance	<ul style="list-style-type: none"> • Smart Construction - A Guide for Housing Clients, Construction Leadership Council.
Implementation Tools	<ul style="list-style-type: none"> • Building Information Modelling (BIM)
Training resources	<ul style="list-style-type: none"> • Online BIM resources at the Construction Scotland Innovation Centre (CS-IC) • Offsite Systems Fundamentals: Modern Methods of Construction, SCSS
Case studies	<ul style="list-style-type: none"> • Improved Building Information Modelling set to achieve material savings of 15% for Carbon Dynamic. • PORTAL offers a new approach to building to meet the challenges of the Circular Economy. • DfMA Case study • Richmond House, London – using thermal imaging to refurbish and reduce operational energy use
Publications and presentations	<ul style="list-style-type: none"> • New Housing & Future Construction Skills Adapting and Modernising for Growth, Professor Sean Smith, Chair of the Short Life Working Group, New Housing & Future Construction Skills, May 2019. • Working Together, Transforming Construction, Manufacturing Technology Centre. • WEF - The Future of Construction, Shaping the Future of Construction - A Breakthrough in Mindset and Technology (2016).
Research reports and documents	<ul style="list-style-type: none"> • Increasing offsite housing construction in Scotland: An evidence base to support new policy and systems, in January 2020 for Scottish Government, SE, and the CSIC. • Research paper explores how blockchain technology can benefit the built environment industry



7. Material recoverability

The principle explained

Design from the outset for deconstructability is needed for 100% material recoverability. This requires pre-planning for end of life by designers, clients, facility managers and demolition contractors, and an established infrastructure network with regulation, quality control and consumer market that allows 'waste' and secondary resources to retain value and be reused.

Who is this relevant for?

- All construction project stakeholders, organisations and workforces
- New build, refurbishment and facility management
- All project types: residential, commercial, industrial, infrastructure
- Planning, all build phases and end of life: **RIBA 0 to 7**

Industry standards, policies & regulations

- [EU Construction and Demolition Waste Management Protocol](#), 2018.
- [ICE Demolition Protocol](#), 2008

Drivers and calls to action

- Material supply chain resilience

Delivery mechanisms

- Pre-demolition audits
- Building standards
- Material passports
- Extended Producer Responsibility (EPR)

Good practice guidance

- [Guidelines for the waste audits before demolition and renovation works of buildings](#) (May 2018).
- [Design for Deconstruction](#) - SEDA Design Guides for Scotland.
- [DfD: Design for Disassembly in the built environment - a guide to closed-loop design and building](#), City of Seattle

Implementation Tools

- [Material passports](#).
- [EU GPP criteria for Office Building Design, Construction and Management](#).
- [EU GPP criteria for Road Design, Construction and Maintenance](#).

Training resources

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Case studies

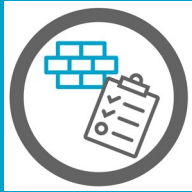
- [Buildings as Material Banks \(BAMB\)](#)
- [Amsterdam Temporary Courthouse](#), Archi-Europe Group.

Publications and presentations

- [Building Glass in a Circular Economy](#), UKGBC October 2018
- [The Oil and Gas Deconstruction for Construction Workshop Slides](#), CSIC, November 2018.

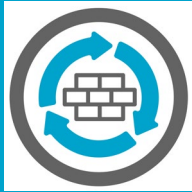
Research reports and documents

- [Opportunities & barriers to the establishment of a network of building materials reuse centres](#) – A report for ZWS, Ricardo 2019



8. Design out waste

The principle explained	We need to plan, design, maintain and decommission all our built assets in line with the waste hierarchy – avoid - reduce - reuse – recycle - energy recovery - and lastly waste disposal to minimise the unnecessary use of primary materials and promote efficient use of secondary materials.
Who is this relevant for?	<ul style="list-style-type: none"> • All construction project stakeholders, organisations and workforces • New build, refurbishment and facility management • All project types: residential, commercial, industrial, infrastructure • all planning, design and build phases and end of life: RIBA 0 to 7
Industry standards, policies & regulations	<ul style="list-style-type: none"> • The Waste Hierarchy
Drivers and calls to action	<ul style="list-style-type: none"> • RIBA Sustainable Outcomes Guide, Royal Institute of British Architects 2019.
Delivery mechanisms	<ul style="list-style-type: none"> • Alternative design and construction methods • Waste-efficient procurement- project waste reduction targets • Digital tools to increase resource efficiencies • Design recognising ‘layers’ and material lifespans
Good practice guidance	<ul style="list-style-type: none"> • Designing Out Construction Waste - A guide for project design teams • Procuring Resource Efficient Construction Projects - Model procurement wording for public and private sector clients and contractors on construction projects. • Guidance to minimise plasterboard waste – FIS. • Sustainable Construction: Clients – Constructing Excellence
Implementation Tools	<ul style="list-style-type: none"> • Waste tracking spreadsheet template – Zero Waste Scotland • Net Waste Tool
Training resources	<ul style="list-style-type: none"> • Net Waste Tool training modules.
Case studies	<ul style="list-style-type: none"> • Resource Efficient House a demonstration construction project • London Bridge Station, Thames Link Programme • The circular economy and the promise of glass in concrete, Ellen McArthur Foundation.
Publications and presentations	<ul style="list-style-type: none"> • Circular economy guidance for construction clients: How to practically apply circular economy principles at the project brief stage. • Lean in construction – Implementation support – CIRIA 2016.
Research reports and documents	<ul style="list-style-type: none"> • Resource efficiency and climate change - Material Efficiency Strategies for a Low-Carbon Future, Summary for Policymakers, UN.



9. Circular products and services

The principle explained

Utilisation of assets, use of renewable, recycled, pre-used or surplus built assets, products and materials. Use of local, renewable, natural materials that can be returned to the earth at end of life and alternative business models to facilitate circularity such as greater servicisation.

Who is this relevant for?

- All construction project stakeholders and decision makers
- New build, refurbishment and facility management
- All project types: residential, commercial, industrial, infrastructure
- Planning, all build phases and end of life: **RIBA 0 to 7**

Industry standards, policies & regulations

- [Vacant & Derelict Land Register](#)

Drivers & calls to action

- [Why do we need a circular performance assessment?](#) Clive Bowman for RIAS Practice Notes, January 2020.
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Delivery mechanisms

- Circular procurement
- Maximise building and infrastructure utilisation - adapt, refurbish and reuse existing buildings & materials
- Asset and stock data and maintenance coordination
- Adoption of repair/reuse/lease approaches across supply chains through alternative business models

Good practice guidance

- [Reuse and Products as a Service Implementation Packs](#) – UKGBC, 2020
- [Circular Business Models for The Built Environment](#), Arup

Implementation Tools

- [Material Considerations: A Library of Sustainable Building Materials](#) - A web and a physical resource based at The Lighthouse, Glasgow,

Training resources

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Case studies

- [Bute Recycling Centre](#) – Collective Architecture
- [Cleveland Steel Warehouse](#), ASBP
- [Park 2020, Amsterdam](#)

Publications and presentations

- [Circular Economy Implementation Packs for Reuse and Products as a Service](#) – UKGBC has published implementation packs on reuse and Products as a Service to assist built environment projects adopt circular economy principles.
- [The Circular Economy](#), Brendon Rowen, Cradle to Cradle Marketplace Limited for Government Europa Quarterly 29

Research reports and documents

- [Identification of Circular Economy Opportunities in the Scottish Construction Sector](#) by Dan Whittaker, Eunomia, and Mervyn Jones, SGR, April 2017.



10. Material Management

The principle explained	Best Practice management of construction materials from specification and ordering through to packaging, delivery, handling, storage, use and reallocation of surpluses on site, will help minimise wastage and retain values.
Who is this relevant for?	<ul style="list-style-type: none"> • All construction project designers, specifiers, manufactures, suppliers and installers • New build, refurbishment and facility management • All project types: residential, commercial, industrial, infrastructure • all design and build phases and end of life: RIBA 2 to 7
Industry standards, policies & regulations	<ul style="list-style-type: none"> • The Waste (Scotland) Regulations 2012 - targets/landfill bans
Drivers and calls to action	<ul style="list-style-type: none"> • Scottish Landfill Tax (SLfT)
Delivery mechanisms	<ul style="list-style-type: none"> • Coordination of activities and trades through use of digital communication tools • Accurate quantity and timely ordering, and careful handling and storage of materials • Waste management cost forecasting and forward planning to maximise surplus material values • Handling and storage of materials to retain value • Set standards for best practice management of deliveries, packaging and storage
Good practice guidance	<ul style="list-style-type: none"> • Maximising re-use of materials on-site guide. • Best practice guide to improving waste management on construction sites – Zero Waste Scotland. • A Practical Handbook for Supervisors (Circular Construction) • Managing packaging waste on your construction site
Implementation Tools	<ul style="list-style-type: none"> • Site Waste Management Planning - Track and quantify construction waste on construction sites with Zero Waste Scotland's free tool. • Construction Material Exchange Post a listing for construction materials you don't need but don't want to pay for disposal. • mywasteportal.com
Training resources	<ul style="list-style-type: none"> • Site Waste Management Plan Tool training modules.
Case studies	<ul style="list-style-type: none"> • Balfour Beatty Video - What happens to construction waste? • SCSS Video - Reducing construction waste in Scotland – Carey
Publications and presentations	<ul style="list-style-type: none"> • With the right tools, we can mine cities - identifying the material resources in 13,000 buildings in central Melbourne, Australia. • SEPA Video - How to Manage Waste on a Construction Site
Research reports and documents	<ul style="list-style-type: none"> • Saving money and raw materials by reducing waste in construction: case studies

Creating demand for Circular economy principles in construction projects

Below is a list of the potential benefits and reasons why a client, funder or designer should be considering embedding each and all of the 10 circular economy principals into a construction project.

“architects were able to guide the client towards particular solutions by providing multiple reasons to support a better design” - Architect-client interactions research project - Summary of findings.

Circular Economy Principle	Client and project benefits
Collaboration	<p>Can de-risk project pipelines, generate reliable lower-risk cash flow and create stronger, longer lasting relationships</p> <p>Creates alignment of business and delivery strategies with policy, supply chains and stakeholders</p> <p>Builds better dialogue, trust and respect between the client and the different members of the construction team, leading to time and economic savings.</p> <p>Maximises the identification of opportunities</p>
Whole life value	<p>Reduces risks associated with potential early demolition, change of use or building obsolescence due to varying externalities such as changes in local land values.</p> <p>Maximises the value achieved during the decades of operation, maintenance and adaptation that follow</p> <p>Provides the evidence base to inspire decision makers, and that will in turn, support future work streams.</p> <p>Increases social value of a development</p> <p>Illuminates cost savings that can be made over the term of the asset’s life cycle.</p>
Health and wellbeing	<p>Contributes towards sustainability benchmarking schemes, such as BREEAM and HQM.</p> <p>Leads to improved health and wellbeing for building users through material ingredient transparency and optimisation</p> <p>In commercial buildings, this is likely to improve productivity and staff retention and reduce sick leave, in educational buildings it can increase learning potential, in health sector buildings it can increase recovery times.</p>
Long Life / Loose Fit	<p>Reduce risk to external factors such as shifting planning policy, increases in land value, changes in market demand or technological advances - retains the asset value.</p> <p>Maximise the marketing opportunity with future tenants by highlighting flexibility of space - future proof the asset and make it flexible for future tenants’ needs, increasing length of occupancy.</p> <p>More likely to be granted planning permission due to consideration of future adaptability of the built asset</p> <p>Less disruption - the tenant can remain in place while the works happen, causing less disruption and eliminating void periods.</p>

Maximising material value – should enable extraction at end of life/use with minimal damage, facilitating reuse/repair/recycling

Low carbon /
sequestration

Reduces embodied carbon impact, supporting organisational, local, and national targets

Long term operational cost and whole life carbon savings can be achieved with design to reduce the need of repairing and replacing damaged elements from operational wear and tear.

Low carbon design drives resource efficiency, unlocks innovation, provides competitive advantage and commercial potential

Can assist in achieving credits in some building assessment sustainability rating scheme

Planning authorities are beginning to acknowledge embodied carbon.

Smart construction

Applied at scale, SMART construction will reduce running costs, while improving delivered quality, performance, and durability of the built asset.

Pre-delivery inspections, factory-controlled installation conditions, traceability of components for maintenance or later modification, and properly planned interfaces reduce defects in the final building.

Standardised elements mean raw materials can be ordered 'to size' and in bulk with minimal excess - results in less waste in manufacture and construction.

Offsite manufacture enable less material to be used, especially with structural elements for high-rise construction and precision in factory manufacturing.

Higher and more consistent quality, more reliable performance through repeat production - greater predictability of performance and outcomes.

Easier quantifying of repeat standardised elements and better representation in BIM models.

Increasing the proportion of pre-manufactured components radically improves the speed of delivery, with groundworks and construction occurring in parallel to the major build phase and main elements built in a quality-controlled environment.

Higher standards of indoor air quality, visual, acoustic and thermal comfort, along with low energy use.

Materials passports or equivalents may facilitate proactive maintenance leading to cost and material savings.

Material recoverability,
refurbishment & reuse

Reduce disruption to local neighbourhood from construction works, e.g. noise and dust, leading to better community relationships

Reduce construction traffic impacts - potential to lead to an easier planning route

Provide cost and programme savings, depending on the scope of refurbishment

Phased refurbishment could allow parts of the asset to remain in operation

Achieve BREEAM and HQM credits

Save on the cost of procuring new materials

Contribute towards reuse and recycling targets

Reduce landfill costs and contribute towards reduced waste and diversion from landfill targets.

Design Out Waste

Minimise demolition waste and new resource depletion

Reduce waste arising from the project and associated landfill costs.

Reduce embodied carbon resulting in cost and carbon savings.

Enable BREEAM and other certification credits to be achieved.

Reduce the number of finishes, which may result in greater flexibility in use.

A disassembly and recycling guide for the asset could result in an additional potential source of future revenue for the client.

Deliver reputational benefits, especially associated with academic / university buildings.

Achieve faster construction times and reduced snagging / quality assurance issues, particularly if this is achieved through offsite construction.

Circular products and services

Requires less time and budget in maintenance and management of services – guaranteed service is delivered by a specialist organisation.

Enable greater opportunities for future reuse and recycling of parts.

Reduce initial investment required for the renovation and construction of high-performance building envelopes.

Deliver reallocation of risk from building owner to the equipment / component supplier.

Leasing incentivises the supply chain to optimise proactive maintenance, maximise equipment economic life, avoid unplanned downtime, monitor and record service life data to assist in maintenance, minimise waste and avoid the use of virgin materials.

Material management

Deliver cost savings on logistics and waste management.

Ensure safer working environment for those on site.

Contribute toward reuse and recycling targets.

Contribute towards sustainability benchmark schemes.

Reduce costs and time through avoidable waste.

Sources:

[Circular economy guidance for construction clients](#), UKGBC

[Embodied carbon - Developing a client brief](#), UKGBC

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[Sustainable Construction: Clients – Constructing Excellence](#)

[Architect-client interactions research project - Summary of findings](#), The Bartlett School of Construction and Project Management

 01786 433930

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