

What is a circular economy (CE)?

- [Why is there a need?]
- [Are there definitions of CE?]

Is there a policy context and driver for CE?

- [What is the European Commission doing on CE?]
- [What are UK government(s) doing on CE?]
- [What are local and regional government doing on CE?]

Are there non-governmental drivers for CE?

What will the Green Construction Board Circular Economy Working Group focus on?

- [What is the Green Construction Board (GCB)?]
- [What is the GCB Circular Economy Working Group?]
- [What will the GCB CE Group aim to achieve?]
- [What is the scope of the GCB Circular Economy Working Group?]
- [How will the group function?]
- [Has the GCB done any previous work relating to construction waste and resource efficiency (materials and water)?]

What are/might be the business benefits of applying CE thinking to construction and the built environment?

- [Has anyone tried to quantify the economic benefits of applying CE thinking to construction and the built environment?]
- [Are there other business benefits to CE Thinking?]

What are likely to be the challenges for CE thinking in the built environment?

The Green Construction Board

What approaches are already happening in the built environment world that contribute to a Circular Economy?

There is much already happening in construction that can be deemed to be part of delivering circular economy thinking. The following applies to the UK.

- [What is happening in the client & investor community?]
- [What is happening in the design community?]
- [What is happening in the manufacturing sector?]
- [What is happening in the contracting community?]
- [What is happening in the engineering community?]
- [What is happening during the refurbishment and end of life stages?]
- [Are construction products and materials being reused, remanufactured or reconditioned?]
- [What mechanisms and initiatives are taking place to divert construction and demolition waste from landfill?]
- [Are there any examples of circular economy business models being used in the built environment sector?]

CIRCULAR ECONOMY

What needs to happen next to deliver CE thinking in the built environment sector?

This is very much the focus of the GCB CE Working Group: how to help catalyse the practical action to deliver the business benefits that are predicted with circular economy thinking. Possible questions might include:

- [How can CE thinking be promoted in the client community?]
- [What is required to facilitate the design community to adopt CE thinking?]
- [What does procuring with CE thinking in mind look like?]
- [What measurement and information management tools are needed?]
- [What is required to enable the flow of materials?]
- [What can Manufacturers do to facilitate the ongoing flow of their materials/products within the economy?]
- [What business models are required?]
- [What are the Research and innovation challenges?]

Measuring and Managing Information for the Circular Economy

- [Does a Circularity Indicator exist?]
- [Does a formal British, European or international (ISO) standard exist relating to the circular economy?]
- [Are there existing standards in construction that are evolving to cover circularity issues?]
- [What is the role for Digitalisation and BIM – Building Information Modelling?]

Construction and Demolition Waste (CDW) – measuring, understanding and eliminating it?

- [Do we know how much construction and demolition waste and the type is produced in the UK?]
- [How is CDW data collected?]
- [How much CDW is recovered?]
- [Do we know how much CDW goes to landfill?]
- [Do we know how many materials are reclaimed?]

Are there any examples of CE happening in the built environment?

- [Buildings]
- [Infrastructure]
- [Materials]
- [Research projects on CE thinking relevant to construction]

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Why is there a need?

Circular economy thinking means maintaining access to materials and resources for continual and future use. With an ever expanding human population and rising standards of living across the globe, it is likely to be the only viable option to maintain standards of living.



Measuring and Managing Information for the Circular Economy

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- [How do we know how many materials are reclaimed?]

Where are any examples of CE happening in the built environment?

- [Examples of CE thinking in buildings]
- [Examples of CE thinking in infrastructure]
- [Examples of CE thinking in materials]
- [Research projects on CE thinking relevant to construction]

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Measuring and Managing Information for the Circular Economy

- [Does a Circularity Indicator exist?]
- [Does a formal British, European or international (ISO) standard exist for measuring CE?]

Is there a policy context?

- [What is the European context?]
- [What are UK government policies?]
- [What are local and regional policies?]

Are there non-governmental organisations?

What will the Green Construction Board do?

- [What is the Green Construction Board?]
- [What is the GCB Circular Economy Working Group?]
- [What will the GCB Circular Economy Working Group do?]
- [What is the scope of the GCB Circular Economy Working Group?]
- [How will the group fund itself?]
- [Has the GCB done any work on waste and resource efficiency?]

What are/might be the barriers to applying CE thinking in the built environment?

- [Has anyone tried to apply CE thinking in the built environment?]
- [Are there other business models?]

What are likely to be the enabling factors for CE thinking in the built environment?

- [What is required to enable the flow of materials?]
- [What can Manufacturers do to facilitate the ongoing flow of their materials/products within the economy?]
- [What business models are required?]
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Are there definitions of CE?



Yes, there are a number of differing definitions and views of CE. Popular ones are:

- Ellen MacArthur Foundation which has produced a series of in-depth think tank pieces, including a definition of CE, an indicator for measuring CE and detailed consideration of the business case for CE. <http://www.ellenmacarthurfoundation.org/circular-economy>
- A number of organisations have adopted their own definitions of circular economy. Whilst these vary to an extent, they include common aspects such as keeping materials at a highest value possible, having circular loops of materials and developing appropriate business models. Examples include WRAP (<http://www.wrap.org.uk/content/wrap-and-circular-economy>); The Scottish Government (<https://consult.scotland.gov.uk/zero-waste-delivery/making-things-last>), Green Alliance <http://www.green-alliance.org.uk/CETF.php> ; Aldersgate Group (<http://www.aldersgategroup.org.uk/asset/download/242/Report%2520-%2520Resilience%2520in%2520the%2520Round.pdf>), Chatham House (https://www.chathamhouse.org/sites/files/chathamhouse/public/Research/Energy,%20Environment%20and%20Development/bp0312_preston.pdf).
- The concept of CE is a vibrant subject area in the academic community involving various schools of thought such as cradle to cradle, performance economy, industrial ecology and biomimicry.
 - E.g. The Industrial Society <http://www.is4ie.org/> ; the 2005 conference on Industrial Ecology for a Sustainable Future <http://www.is4ie.org/resources/documents/abstractbook-oral%20050603.pdf> and the Industrial Ecology Gordon Research Conference <https://www.grc.org/programs.aspx?id=12729>; as well as editions of academic journals. E.g. Journal for Industrial Ecology <http://jie.yale.edu/cfps> and the Proceedings of the Institution of Civil Engineers – Waste and Resource Management <http://www.icevirtuallibrary.com/toc/jwarm/current>
- Of course, CE as a concept builds on a mountain of themes relating to waste reduction, recycling, reuse, material efficiency, security of supply, sustainable consumption and production, better design, sharing of resources etc. All these are strands of circular economy thinking.

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- [Does a formal British, European or international (ISO) circular economy?]
- [How can construction that are relevant to construction and BIM – Building Information Modelling – be measured?]

Is there a policy context?

- [What is the European Commission doing?]
- [What are UK government policies?]
- [What are local and regional policies?]

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What will the Green Construction Board (GCB) do?

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- [What is the GCB Circular Economy Working Group?]
- [What will the GCB CE Group do?]
- [What is the scope of the CE Group?]
- [How will the group function?]
- [Has the GCB done any previous work on waste and resource efficiency?]

What are/might be the challenges for applying CE thinking in the built environment?

- [Has anyone tried to quantify the benefits of applying CE thinking to the built environment?]
- [Are there other business models?]

What are likely to be the challenges for CE thinking in the built environment?

The Green Construction Board

What is the European Commission doing on CE?

- The European Commission in December 2015 adopted a new Circular Economy Package to stimulate Europe's transition towards a circular economy; it is intended to boost global competitiveness, foster sustainable economic growth and generate new jobs. http://ec.europa.eu/environment/circular-economy/index_en.htm
- The Government of the Netherlands has produced a knowledge map for the Circular Economy, from which this report takes its inspiration. <http://www.circle-economy.com/news/knowledge-map-circular-economy/>
- The European Environment Agency (EEA) will contribute to the knowledge base on circular economy by developing a comprehensive analytical framework by which to better understand it and to measure progress. Its first report *Circular economy in Europe - Developing the knowledge base* was published in January 2016. It looks at four aspects: the concept and benefits, the main enabling factors and transition challenges, metrics for measuring progress and contextual issues that requiring research or policy. <http://www.eea.europa.eu/publications/circular-economy-in-europe>
- Europe 2020 is the EU's Growth Strategy and includes major strands of work including a Resource Efficient Europe which underpins thinking on the wise use of resources. <http://ec.europa.eu/resource-efficient-europe/>
- A strand of the Resource Efficiency Roadmap led to an EU Communication on Resource Opportunities in the Building Sector. <http://ec.europa.eu/environment/eussd/pdf/SustainableBuildingsCommunication.pdf>
- This is being taken further forward in a 2015-17 research project by the Commission to identify macro-objectives for resource efficient buildings. http://susproc.jrc.ec.europa.eu/Efficient_Buildings/docs/151222%20Resource%20Efficient%20Buildings_Macro%20Objectives%20WP_Final%20version.pdf



- [What are the Research and innovation challenges?]
- [What is required to enable the flow of materials?]
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Construction Waste (CDW) – and eliminating it?

- [How can construction and demolition waste be managed?]
- [How much waste goes to landfill?]
- [How much waste is reclaimed?]

What is happening in the built environment?

- [What is relevant to construction?]

It is always welcome to discuss CE at #cethinking

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What are UK government(s) doing on CE?

- The government response to the EU 2015 consultations on its Circular Economy package are available. Defra is the policy lead for the CE and convenes a stakeholder group to discuss the UK input to EU negotiations and plans. <https://www.gov.uk/government/publications/circular-economy-and-waste-markets-uk-government-response-to-european-commission-consultations>
- The Scottish government published in February 2016 a circular economy strategy. <http://www.gov.scot/Resource/0049/00494471.pdf>
- A Scottish Institute for Remanufacture (SIR) has been established funded by the Scottish Funding Council and Zero Waste Scotland and is hosted at the University of Strathclyde. <http://www.scot-reman.ac.uk/>
- Wales – the Welsh Government have released a written statement on achieving a more circular economy in Wales. <http://gov.wales/newsroom/environmentandcountryside/2016/160304-minister-pledges-wales-commitment-to-the-circular-economy/?lang=en>
- The Government / industry [Green Construction Board \(GCB\)](#) has a working group on the circular economy to provide leadership to the construction industry to start to move towards more CE thinking.



Measuring and Managing Information for the Circular Economy

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Digitalisation and BIM – Building Information Modelling?

Demolition Waste (CDW) – standing and eliminating it?

- [How much construction and demolition waste is generated in the UK?]
- [How much is recycled?]
- [How much is covered?]
- [How much CDW goes to landfill?]
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Examples of CE happening in the built environment?

CE thinking relevant to construction]



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What are local and regional government doing on CE?

- In London, the London Waste and Recycling Board (LWARB) has produced a routemap for CE, with the built environment as a priority sector <http://www.lwarb.gov.uk/what-we-do/accelerate-the-move-to-a-circular-economy-in-london/towards-a-circular-economy/>
- Peterborough is developing a Circular City <http://www.peterboroughdna.com/circular-economy/>
- Glasgow has a vision and action plan for CE <http://www.circle-economy.com/wp-content/uploads/2016/06/circular-glasgow-report-web-low-res.pdf>

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Any examples of CE happening in the built environment?

- [Are there any projects on CE thinking relevant to construction?]



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What will the GCB CE Group aim to achieve?

- To help catalyse the industry to change its practices so as to adopt a less wasteful, more efficient and CE way of thinking

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What is the scope of the GCB Circular Economy Working Group?



It is not the intent of the GCB to duplicate what is already happening but to help catalyse action by organisations, companies and individuals. The Group will look at:

- Buildings, infrastructure and materials/products
- But the Group will not cover renewable or clean energy, energy efficiency, carbon reporting or sharing assets such as buildings – because there are many other initiatives and organisations that are focused on these topics.

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- [Are construction products and materials being reused?]

How will the group function?



A Steering Group of individuals from across the built environment and a Community of Practitioners.

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- [Are there existing standards in construction that are evolving to cover circularity issues?]
- [What is the role for Digitalisation and BIM – Building Information Modelling?]

Construction and Demolition Waste (CDW) – measuring, understanding and eliminating it?

- [Do we know how much construction and demolition waste and the type is produced in the UK?]
- [How is CDW data collected?]
- [How much CDW is recovered?]
- [Do we know how much CDW goes to landfill?]
- [Do we know how many materials are reclaimed?]

Are there any examples of CE happening in the built environment?

- [Buildings]
- [Infrastructure]
- [Materials]
- [Research projects on CE thinking relevant to construction]

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What is a circular economy (CE)?

- [Why is there a need?]
- [Are there definitions of CE?]

Is there a policy context and driver for CE?

- [What is the European Commission doing on CE?]
- [What are UK government(s) doing on CE?]
- [What are local and regional governments doing?]

Are there non-governmental drivers for CE?

What will the Green Construction Economy Working Group focus on?

- [What is the Green Construction Board?]
- [What is the GCB Circular Economy Working Group?]
- [What will the GCB CE Group aim to achieve?]
- [What is the scope of the GCB Circular Economy Working Group?]
- [How will the group function?]
- [Has the GCB done any previous work relating to waste and resource efficiency (materials and water)?]

What are/might be the business benefits of applying CE thinking to construction in the built environment?

- [Has anyone tried to quantify the economic benefits of applying CE thinking to construction in the built environment?]
- [Are there other business benefits to CE Thinking?]

What are likely to be the challenges for CE thinking in the built environment?

The Green Construction Board

What approaches are already happening in the built environment world that contribute to a Circular Economy?

- There is much already happening in construction that can be deemed to be part of delivering circular economy thinking. The following applies to the UK.
- [What is happening in the client & investor community?]
- [What is happening in the design community?]
- [What is happening in the manufacturing community?]

Has the GCB done any previous work relating to construction waste and resource efficiency (materials and water)?

Yes, the GCB from 2007 to 2013 developed a methodology for measuring construction, demolition and excavation waste (CD&E) to landfill, as well as annual reporting. The group also developed an action plan. <http://www.greenconstructionboard.org/index.php/resources/greening-the-industry/top-tips/waste?id=401>

The construction product sector produced a series of sector Resource Efficiency Action Plans (REAPs), advanced understanding of embodied impact information and with BRE and BSI developed responsible sourcing schemes and standards.

Water: contractors and manufacturers produced guidance on water usage in the manufacturing and construction processes. <http://www.greenconstructionboard.org/index.php/resources/greening-the-industry/water-management-planning/introduction> & <http://www.constructionproducts.org.uk/publications/technical/display/view/water-efficiency-the-contribution-of-construction-products/>

- [What does procuring with CE thinking in mind look like?]
- [What measurement and information management tools are needed?]
- [What is required to enable the flow of materials?]
- [What can Manufacturers do to facilitate the ongoing flow of their materials/products within the economy?]
- [What business models are required?]
- [What are the Research and innovation challenges?]

Measuring and Managing Information for the Circular Economy

- [Does a Circularity Indicator exist?]
- [Does a formal British, European or international (ISO) standard exist relating to the circular economy?]
- [Are there existing standards in construction that are evolving to cover circularity issues?]
- [How is Digitalisation and BIM – Building Information Modelling – helping?]



Demolition Waste (CDW) – standing and eliminating it?

- [How much construction and demolition waste is generated in the UK?]
- [How much is recycled?]
- [How much is covered?]
- [How much CDW goes to landfill?]
- [How many materials are reclaimed?]

Examples of CE happening in the built environment?

[Examples of CE thinking relevant to construction]



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What is a circular economy (CE)?

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Is there a policy context and driver for CE?

- [What is the European Commission's position on CE?]
- [What are UK government(s) doing?]
- [What are local and regional government doing?]

Has anyone tried to quantify the economic benefits of applying CE thinking to construction and the built environment?



- The EU Circular Economy package does not mention the built environment specifically but quantifies the adoption of a circular economy in Europe as bringing net savings of 600 billion euros. http://europa.eu/rapid/press-release_MEMO-15-6204_en.htm
- The Ellen MacArthur Foundation/McKinsey Growth Within Report states that around £60 billion of net savings of primary resources could be made by 2030. <http://www.ellenmacarthurfoundation.org/publications>
- The London Circular Economy Report calculates that CE opportunities in the built environment will add £3-5bn to GDP by 2036. <http://www.lwarb.gov.uk/what-we-do/accelerate-the-move-to-a-circular-economy-in-london/>
- There are also European Studies. A Danish study suggests that creating enabling policy conditions in the construction and real estate sectors amount to an economic opportunity of around €1bn, with €100 - 150 million from the reuse and high-value recycling of components and materials. <http://circulatenews.org/2015/12/reimagining-construction-in-denmark-a-e1bn-opportunity/>
- A study on Amsterdam suggests that a circular building chain can lead to a 3% increase in productivity growth, representing a value of €85 million per year <http://www.circle-economy.com/wp-content/uploads/2016/04/Circular-Amsterdam-EN-small-210316.pdf>

Are there non-governmental organisations working on CE?

What will the Green Construction Board (GCB) Circular Economy Working Group do?

- [What is the Green Construction Board?]
- [What is the GCB Circular Economy Working Group?]
- [What will the GCB CE Group do?]
- [What is the scope of the GCB CE Working Group?]
- [How will the group function?]
- [Has the GCB done any previous work on waste and resource efficiency?]

What are/might be the barriers to applying CE thinking to the built environment?

- [Has anyone tried to quantify the economic benefits of applying CE thinking to construction and the built environment?]
- [Are there other business barriers?]

What are likely to be the challenges for CE thinking in the built environment?

- [What measurement and information management tools are needed?]
- [What is required to enable the flow of materials?]
- [What can Manufacturers do to facilitate the ongoing flow of their materials/products within the economy?]
- [What business models are required?]
- [What are the Research and innovation challenges?]

Construction Waste (CDW) – Reducing and eliminating it?

- [How much CDW is generated in construction and demolition waste in the UK?]
- [How much CDW is recycled?]
- [How much CDW goes to landfill?]
- [How much CDW is reclaimed?]

What are the opportunities for CE happening in the built environment?

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Feedback is always welcome
Please join the debate at #cethinking

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- [Has anyone tried to quantify the economic benefits of applying CE thinking to construction and the built environment?]
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What are likely to be the challenges for CE thinking in the built environment?

The Green Construction Board

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Are there other business benefits to CE Thinking?



- Security of Supply. The EU has produced a study on the security of supplies and scarcity of raw materials. <http://eplca.jrc.ec.europa.eu/uploads/RawMat-scarcity-of-raw-materials.pdf>
- The UK Government (Defra and BIS) published a study in 2012 entitled *A Resource Security Action Plan: Making the most of valuable materials*. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69511/pb13719-resource-security-action-plan.pdf
- Understanding the business risk of availability and price of materials in a world of limited supply and increasing competition, is part of the circular economy debate. It is questionable how much security of supply is an issue for construction materials. Some studies suggest there may be a future supply issue with aggregates (due to planning constraints) and availability of certified timber. There are a number of critical raw materials used in components such as batteries, sensors and PVs.
- Future proofing of business activities, such as investigating the effect of business models compatible with CE thinking and building business resilience in the CE area. There could be an enhanced relationship with customers, if moving to a leasing based business model.
- Is there a competitive advantage to being an early adopter of CE thinking?

Possible questions might include:

- [How can CE thinking be promoted in the client community?]
- [What is required to facilitate the design community to adopt CE thinking?]
- [What does procuring with CE thinking in mind look like?]
- [What measurement and information management tools are needed?]
- [What is required to enable the flow of materials?]
- [What can Manufacturers do to facilitate the ongoing flow of their materials/products within the economy?]
- [What business models are required?]
- [What are the Research and innovation challenges?]

Measuring and Managing Information for the Circular Economy

- [How do we measure CE?]
- [Do standards exist?]
- [Are there European or international (ISO) standards for the circular economy?]
- [Are there standards in construction that are relevant to CE?]
- [What are the data issues?]
- [How do we manage information?]
- [What are the challenges?]
- [How do we integrate CE with other technologies such as digitalisation and BIM – Building Information Modelling?]

Construction and Demolition Waste (CDW) –

- [How do we measure and eliminate it?]
- [How do we manage construction and demolition waste in the UK?]
- [How do we reduce CDW?]
- [How do we reuse CDW?]
- [How do we ensure CDW goes to landfill?]
- [How do we ensure materials are reclaimed?]

Research projects on CE thinking in the

[Research projects on CE thinking relevant to construction]

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What is a circular economy (CE)?

[Why is there a need?]
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What approaches are already happening in the built environment world that contribute to a

Measuring and Managing Information for the Circular Economy



What are likely to be the challenges for CE thinking in the built environment?

Much of the work to develop CE thinking to date has been focused on short-lived consumer goods such as phones, computers, washing machines etc. But can this thinking also be applied to buildings and infrastructure that exist for decades if not centuries.

Examples of the reuse of buildings or construction materials and products litter the millennia, but how can modern buildings and modern materials be designed to be better used, last longer and be available for similar or alternate purposes at end of life. The challenges for adapting CE thinking in construction are likely to be complex and include:

Products, buildings and infrastructure:

- Long life of buildings, infrastructure and products.
- Complexity of buildings.
- Variable lifespans of components of buildings.
- Existing, especially more recent, buildings are not designed for today's End of Life issues.
- Changes in specification and technology over time mean that many products may become redundant in future.

Recovery of products/materials:

- Often a low commercial value of materials/products (apart from metals) at demolition.
- Lack of widespread secondary market mechanisms.

- Lack of quality assurance for secondary and recycled materials.
- Problematic logistics of moving and storing materials.
- Constraints of existing waste legislation.
- Complex materials and products which are increasing in use can be difficult to reuse.
- Viability of extended user responsibility requirements for long-lived buildings and products
- Changes in legislation may mean that recovered material no longer complies with certain regulations e.g. REACH.

Business considerations:

- Value of adopting CE practices.
- Use of discount rates can effectively mean the value of recovered materials in 20 years' time can be zero.
- Most companies will build in depreciation so the value of products in the future are written off.
- Viable business models e.g. leasing products as a service may only be relevant to short-lived products such as lights and carpet tiles.
- Ownership of resources (IP), testing, warranties, guarantees etc of reused, reclaimed products.

Other considerations:

- Understanding life cycle thinking to aid complex decisions, e.g. delivering lower carbon in performance but creating end of life issues? Or the opposite, creating good end of life possibilities but increasing carbon emissions in the process.
- A potential disconnect between developer and constructor, freeholder or leaseholder and occupant make keeping track and benefiting from CE over a building lifecycle difficult.
- Applying systems thinking (i.e. the whole supply chain working together).
- Measuring circularity for complex long-lived buildings and infrastructure made of multiple products and materials.
- Information management and data needs – what information is needed, when is it needed to make informed decisions, who needs this information and in what format.
- Engaging SME businesses.

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[What business models are required?]

[What are the Research and innovation challenges?]

What is a circular economy (CE)?

- [Why is there a need?]
- [Are there definitions?]

Is there a policy?

- [What is the European policy?]
- [What are UK government policies?]
- [What are local authority policies?]

Are there non-governmental organisations (NGOs)?

What will the Green Construction Board (GCB) do?

- [What is the Green Construction Board?]
- [What is the GCB's role?]
- [What will the GCB do?]
- [What is the scope of the GCB?]
- [How will the group be funded?]
- [Has the GCB done any work on waste and resource efficiency?]

What are/might be the barriers to applying CE thinking in the built environment?

- [Has anyone tried to apply CE thinking in the built environment?]
- [Are there other barriers?]

What are likely to be the enablers of CE thinking in the built environment?

- [What are the enablers?]

What approaches are already happening in the built environment world that contribute to a circular economy?

- [What are the current approaches?]

Measuring and Managing Information for the Circular Economy

- [How can we measure and manage information for the circular economy?]

What is happening in the design community?



There is much already happening in construction that can be deemed to be part of delivering circular economy thinking. The following applies to the UK.

- Whilst many buildings/infrastructure projects are designed with sustainability principles and may incorporate aspects of circular economy there are few examples as yet, of the 'full' application of circular economy thinking.
- A reasonably high level of understanding of the generic principles of designing for deconstruction exist (but there seems little commercial appetite for doing it).
- BRE has produced an outline methodology for designing for deconstruction and written 5 case studies <http://brebuzz.net/tag/circular-economy/>
- The Association of Sustainable Building Products (ASBP) also have information on designing for deconstruction <http://www.asbp.org.uk/resources/>
- Building rating schemes such as **BREEAM**; **LEED**; **CEEQUAL**; and **Ska**, address some elements of circular economy such as diverting waste from landfill, reuse of products and designing out waste.
- The British standard BS8895 Part 1 and 2 has been written to address material efficiency at the design stages of buildings. <http://shop.bsigroup.com/ProductDetail/?pid=00000000030258602> and <http://shop.bsigroup.com/ProductDetail/?pid=00000000030296208> Part 3 focusing on technical design is currently being drafted.
- The Royal Society of Arts (RSA) ran a project called the *Great Recovery* between 2012 and 2016 working with Innovate UK. It looked at the challenges of waste and the opportunities of a circular economy through the lens of design. Access the learning from the project at: <http://www.greatrecovery.org.uk/>
- *Building Revolutions: Applying the Circular Economy to the Built Environment* written by David Cheshire is available from RIBA Bookshops. It provides an overview of circular economy principles in the building sector along with a number of design case studies. <http://www.ribabookshops.com/item/building-revolutions-applying-the-circular-economy-to-the-built-environment/86743/>
- *The Re-Use Atlas: A designers guide to the circular economy* by Duncan Baker-Brown will shortly be available from RIBA Bookshops.
- Arup has produced research on the circular economy in the built environment http://publications.arup.com/publications/c/circular_economy_in_the_built_environment and a report on Facade design for the circular economy http://publications.arup.com/publications/f/facade_design_for_the_circular_economy They also have produced a couple of videos: https://www.youtube.com/watch?v=s03dNDg_hWQ <https://www.youtube.com/watch?v=hgOIMolJFLI>

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- [What is the European Commission doing on CE?]
- [What are UK government(s) doing on CE?]
- [What are local and regional government doing on CE?]

Are there non-governmental drivers?

What will the Green Construction Board (GCB) Circular Economy Working Group focus on?

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What are/might be the business benefits of applying CE thinking to construction in the built environment?

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The Green Construction Board

What approaches are already happening in the built environment world that contribute to a Circular Economy?

There is much already happening in construction that can be deemed to be part of delivering circular economy thinking. The following applies to the UK.

- [What is happening in the client & investor community?]
- [What is happening in the design community?]
- [What is happening in the manufacturing sector?]
- [What is happening in the contracting community?]

What is happening in the client & investor community?

- A number of clients are involved in circular economy initiatives. Examples include HS2 who are investigating how circular economy principles can be embedded. Other examples include Gatwick Airport and SEGRO <http://www.building.co.uk/data/cost-data/whole-life-carbon/whole-life-carbon-circular-economy/5085228.article>. The Better Building Partnerships are looking at circular economy in their market transformation working group.
- The financial sector, including investors such as ING <https://www.ing.com/Newsroom/All-news/Features/Circular-economy-challenges-financial-business-models.htm> and ABN Amro are also exploring the circular economy <https://www.abnamro.com/en/sustainable-banking/our-focal-points/circular-economy/index.html>.

Measuring and Managing Information for the Circular Economy

- [Does a Circularity Indicator exist?]
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Construction and Demolition Waste (CDW) – Understanding and eliminating it?

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Any examples of CE happening in the built environment?

[What are the key products on CE thinking relevant to construction]

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What approaches are already happening in the built environment world that contribute to a Circular Economy? There is much already happening in

Measuring and Managing Information for the Circular Economy

[Does a Circularity Indicator exist?]

What is happening in the manufacturing sector?



- Many manufacturers recycle their production waste back into their processes.
- There are a number of take back schemes for surplus materials and offcuts as well as packaging such as pallet reuse. This includes for plasterboard, ceiling tiles, mineral wool insulation, bricks and blocks.
- A number of sectors have produced Resource Efficiency Action Plans (REAPs) (<http://www.constructionproducts.org.uk/index.php?id=1658>) and are now looking at the challenges and opportunities of the circular economy. Examples include the Gypsum to Gypsum project (<http://gypsumtogypsum.org/>) and PaintCare UK <http://www.paintcare.org.uk/>
- Some sectors are looking at reuse of their products, e.g. Innovate UK is funding several research projects looking at the reuse of steel. https://connect.innovateuk.org/web/sustainabilityktn/article-view/-/blogs/innovate-uk-projects-on-circular-economy-in-the-built-environment-sector?_33_redirect
- Some sectors have well established recycling schemes such as Recovynl, Recofloor and Carpet UK. http://www.carpetrecyclinguk.com/find_a_recycler_near_me.php, <http://www.recofloor.org/> & <http://www.recovynl.com/>
- In 2016 Glass For Europe produced an economic study on building glass recycling <http://www.glassforeurope.com/en/issues/recycling-of-glass-products.php>
- Life cycle thinking is well established and can be considered a mature approach for understanding environmental impacts, initially due to the BRE Green Guide <https://www.bre.co.uk/greenguide/podpage.jsp?id=2126> and now with the more recent adoption of the European standards on measuring and reporting the sustainability performance of construction works and construction products (CEN 350 and EN 15804). <http://www.constructionproducts.org.uk/publications/technical/display/view/a-guide-to-understanding-the-embodied-impacts-of-construction/>
- Many companies and sectors have developed sustainability plans, with targets, indicators and reporting with elements of relevance to circular economy thinking. E.g. Hanson, <http://www.hanson.co.uk/en/sustainability>; Marshalls <http://www.marshalls.co.uk/about-sustainability> and the Mineral Products Association <http://www.mineralproducts.org/sustainability/>
- The CBI Minerals Group produced in February 2016 a report on the UK Mineral Extraction Industry. http://www.mineralproducts.org/documents/CBI_UK_Mineral_Extraction_Industry_2016_2.pdf
- The Construction Products Association, the umbrella trade association for UK-based manufacturers and distributors, provides leadership and learning to help catalyse thinking and action by its members on circular economy and broader sustainability and technical issues. <http://www.constructionproducts.org.uk/publications/technical/>

[What can Manufacturers do to facilitate the ongoing flow of their materials/products within the economy?]

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What is happening in the contracting community?



- High levels of diversion of construction waste from landfill are typical for many construction projects, with contractors setting targets including zero waste to landfill
- Build UK (incorporating the former UK Contractors Group - UKCG) has member commitment to both reduce waste to landfill, as well as reduce the amount of overall waste arising. They have also produced a statement for applying circular economy in construction and are working towards a number of objectives. http://archive.ukcg.org.uk/fileadmin/clients/UKCG/document/Environment/UKCG_Circular_Economy_statement.pdf
- The Chartered Institution of Wastes Management (CIWM) in late 2016 formally adopted a Construction and Demolition Forum of leading building contractors.
- MI-ROG - The Major Infrastructure – Resource Optimisation Group is an initiative with companies in the utilities and construction sectors aiming to eliminate waste and optimise resource reuse across projects and supply chains. The companies involved in MIR-OG include Network Rail, National Grid, Anglian Water, HS2, Thames Gateway, Environment Agency Flood Defence and EDF Energy. <http://www.aecom.com/projects/circular-economy-action-major-infrastructure-resources-optimisation-group-mi-rog/>

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Examples of CE happening in the built environment?

[What are examples of CE thinking relevant to construction?]



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- [How do we adopt CE thinking?]
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- [Are there existing standards in construction that are relevant?]
- [How can BIM – Building Information Modelling – be used?]

What is happening during the refurbishment and end of life stages?



- CIRIA have produced a guide on environmental good practice for fit-out www.ciria.org/c757
- The demolition industry recovers much of the waste that is produced at end of life, but a large proportion may be downcycled. In 2012, the National Federation of Demolition Contractors (NFDC) members reused or recycled 94% of demolition waste <http://demolition-nfdc.com/news/posstat.html>
- The National Federation of Demolition Contractors (NFDC) has produced a series of 'Demolition and Refurbishment Information Sheets (DRIDS) to encourage the industry to reuse and recycle materials wherever possible. <http://demolition-nfdc.com/page/drids.html>
- The NFDC and ICE have published a resource protocol for the management of demolition materials http://demolition-nfdc.com/files/en/group/download/file/70_nfdcpredemolitionbrochureoct16press.pdf
- BRE along with a number of other organisations such as Build UK are producing a code of practice for pre-demolition audits. BRE has also produced guidance on difficult demolition waste <https://www.brebookshop.com/details.jsp?id=327123>
- The European Demolition Association (EDA) has a working group on recycling and have produced a report on the state of the demolition industry, which also covers pre-demolition audits. <http://www.europeandemolition.org/communication/news/comprehensive-report-demolition-recycling-cd-waste-management-europe>
- The European Commission published in late 2016 a Protocol on Construction and Demolition Waste. http://ec.europa.eu/growth/tools-databases/newsroom/cf/itemdetail.cfm?item_id=8985

- [What measurement and information management tools are needed?]
- [What is required to enable the flow of materials?]
- [What can Manufacturers do to facilitate the ongoing flow of their materials/products within the economy?]
- [What business models are required?]
- [What are the Research and innovation challenges?]

Construction Waste (CDW) – Managing and eliminating it?

- [How is construction and demolition waste managed in the UK?]
- [How much waste goes to landfill?]
- [How much waste is reclaimed?]

What is happening in the built environment?

- [What is relevant to construction?]

It is always welcome to share your thoughts at #cethinking

What is a circular economy (CE)?

- [Why is there a need?]
- [Are there definitions of CE?]

Is there a policy context and driver for CE?

- [What is the European context?]
- [What are UK government policies?]
- [What are local and regional policies?]

Are there non-governmental drivers for CE?

What will the Green Construction Board do?

- [What is the Green Construction Board?]
- [What is the GCB Circular Economy Working Group?]
- [What will the GCB CE Working Group do?]
- [What is the scope of the Working Group?]
- [How will the group fund itself?]
- [Has the GCB done any work on waste and resource efficiency?]

What are/might be the barriers to applying CE thinking in the built environment?

- [Has anyone tried to quantify the benefits of applying CE thinking in the built environment?]
- [Are there other business models?]

What are likely to be the challenges for CE thinking in the built environment?

The Green Construction Board

What approaches are already happening in the built environment world that contribute to a Circular Economy?

There is much already happening in construction that can be deemed to be part of delivering circular economy thinking. The following applies to the UK.

- [What is happening in the client & investor community?]

Are construction products and materials being reused, remanufactured or reconditioned?

- An established Reclamation industry exists, particularly for high value architectural products such as stone, parquet flooring, fireplaces etc. <http://www.salvo.co.uk/>
- Salvo has published an article on the carbon benefits of reusing reclaimed building material <http://www.salvonews.com/story/the-carbon-benefit-of-reusing-reclaimed-building-material-x97870x9.html>
- Material exchanges are springing up such as:
 - Recipro <http://www.recipro-uk.com/>;
 - Construction Material Exchange <http://cme.resourceefficientscotland.com/>;
 - Enviromate <http://enviromate.co.uk/> and;
 - Trade Leftovers <http://www.tradelleftovers.com/>
 - Loop Hub <http://loop-hub.co.uk/>
- Community Reuse schemes are growing in number, though they can struggle if based on a sponsorship model. Examples include:
 - Community Wood Recycling <http://www.communitywoodrecycling.org.uk/>;
 - Reuseful UK <https://www.scrapstoresuk.org/>;
 - Community Repaint <http://www.communityrepaint.org.uk/> and;
 - Furniture Reuse Network <http://www.frn.org.uk/>
- A number of companies remanufacture construction equipment. There is the Scottish Institute for Remanufacturing. <http://www.scot-reman.ac.uk/>



Measuring and Managing Information for the Circular Economy

- [Does a Circularity Indicator exist?]
- [Does a formal British, European or international (ISO) standard exist relating to the circular economy?]
- [Are there existing standards in construction that are relevant?]

and BIM – Building

Waste (CDW) –
and eliminating it?
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Measuring and Managing Information for the Circular Economy

- [Does a Circularity Indicator exist?]
- [Does a formal British, European or international (ISO) circular economy?]
- [What are the key indicators for construction that are relevant?]
- [How are BIM – Building Information Modelling and BIM – Building Information Management used?]

Is there a policy context for CE?

- [What is the European Commission's position on CE?]
- [What are UK government policies on CE?]
- [What are local and regional policies on CE?]

Are there non-governmental organisations (NGOs) working on CE?

What will the Green Construction Board (GCB) Circular Economy Working Group do?

- [What is the Green Construction Board?]
- [What is the GCB Circular Economy Working Group?]
- [What will the GCB CE Group do?]
- [What is the scope of the CE Group?]
- [How will the group function?]
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What are/might be the barriers to applying CE thinking to the built environment?

- [Has anyone tried to quantify the benefits of applying CE thinking to the built environment?]
- [Are there other business models that could be applied?]

What are likely to be the enablers for CE thinking in the built environment?

- [What is required to enable the flow of materials?]
- [What can Manufacturers do to facilitate the ongoing flow of their materials/products within the economy?]
- [What business models are required?]
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What mechanisms and initiatives are taking place to divert construction and demolition waste from landfill?

- The Landfill Tax in the UK, is a key fiscal measure that has encouraged the avoidance of waste to landfill. <https://www.gov.uk/green-taxes-and-reliefs/landfill-tax> Landfill Tax has now been devolved to Wales and Scotland. In Wales, Landfill Disposals Tax (LDT) will replace Landfill Tax from April 2018 http://gov.wales/topics/environmentcountryside/epq/waste_recycling/disposal/landfill/tax/?lang=en
- There has been much funding from organisations such as Innovate UK, WRAP and EPSRC to increase the recovery of wastes, including construction and demolition.
- The waste industry and in particular waste transfer stations are becoming ever more efficient at managing waste.
- A number of material focused organisations, as well as the waste industry, continue to undertake work on developing recycling routes for construction and demolition waste. For example, Carpet Recycling UK <http://www.carpetrecyclinguk.com/> and Composites UK <https://compositesuk.co.uk/>
- The paint industry has developed Paintcare - a programme aimed at tackling the large quantities of leftover paint. <http://www.paintcare.org.uk/>
- The Environment Agency had an End of Life Committee to assess when a waste product can be deemed no longer a waste but a new resource and thus not subject to waste regulations for storage, transport and disposal. This Committee has been disbanded.
- BRE has produced a guide for material efficiency in construction <https://www.brebookshop.com/details.jsp?id=327790>



Construction and Demolition Waste (CDW) – How can we reduce and eliminate it?

- [How can we reduce construction and demolition waste?]
- [How can we reduce CDW to landfill?]
- [How can we ensure CDW is reclaimed?]

What are the key CE happening in the built environment?

- [What are the key CE relevant to construction?]

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What are/might be the business benefits of applying CE thinking to construction in the built environment?

- [Has anyone tried to quantify the economic benefits of applying CE thinking to construction in the built environment?]
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What are likely to be the challenges for CE thinking in the built environment?

The Green Construction Board

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- There is much already happening in construction that can be deemed to be part of delivering circular economy thinking. The following applies to the UK.
- [What is happening in the client & investor community?]
 - [What is happening in the design community?]
 - [What is happening in the manufacturing sector?]

What is required to facilitate the design community to adopt CE thinking?

- Are there suitable design tools and information to facilitate designing for circularity including deconstruction?
- Are there existing lesson learning?
- Can the demolition industry provide advice?
- What needs to be done to shift theory to practical action?
- Does infrastructure need different tools than buildings?
- Which organisations will lead on transitioning to this thinking?



Measuring and Managing Information for the Circular Economy

- [Does a Circularity Indicator exist?]
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- [Are there existing standards in construction that are evolving to cover circularity issues?]
- [What is the role for Digitalisation and BIM – Building Information Modelling?]

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- [How much CDW goes to landfill?]
- [How many materials are reclaimed?]

Examples of CE happening in the built environment?

- [What are some examples of CE thinking relevant to construction?]

- [How can we encourage the design community to adopt CE thinking?]
- [What does procuring with CE thinking in mind look like?]
- [What measurement and information management tools are needed?]
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What can Manufacturers do to facilitate the ongoing flow of their materials/products within the economy?



- Can the same performance be delivered with less, or different material, through better design?
- Can more use be made of secondary materials in a product's manufacture without increasing the environmental impact?
- Do technologies such as 3D printing enable more bespoke and less wasteful products?
- Does the design stage for the product consider end of life issues?
- Will extended producer responsibility have a part to play?
- Is it logistically and financially viable to set up take back schemes – surplus, offcuts and at end of life?
- What role does packaging play in the CE?

- [How can manufacturers adopt CE thinking?]
- [What does procuring with CE thinking in mind look like?]
- [What measurement and information management tools are needed?]
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Examples of CE happening in the built environment?

Examples of CE thinking relevant to construction]



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There is much already happening in construction that can be deemed to be part of delivering circular economy thinking. The following applies to the UK.

[What is happening in the client & investor community?]

Does a Circularity Indicator exist?

- Yes; the Ellen MacArthur Foundation in collaboration with Granta Design have published a methodology for measuring circularity. http://www.ellenmacarthurfoundation.org/assets/downloads/insight/Circularity-Indicators_Project-Overview_May2015.pdf
- Is it suitable and relevant for construction? Or does it need to be adapted?
 - The published indicator is well suited to short-lived consumer goods and is probably less likely to be useful for long-lived products or buildings.



Measuring and Managing Information for the Circular Economy

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Construction that are...
[What are the...]
and BIM – Building

Construction Waste (CDW) – Reducing and eliminating it?

Construction and demolition waste...
[How much...]

[How much...]
[How much...]

What CE thinking is happening in the built environment?

[How much...]
[How much...]

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to see you at #cethinking

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- [What is required to enable the flow of materials?]
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 - [What is happening in the manufacturing sector?]

Are there existing standards in construction that are evolving to cover circularity issues?

- CEN 350 is a suite of European standards for measuring the sustainability performance of buildings and construction products and is wrestling with how to measure different end of life scenarios.
- EN 15804 is the methodology for measuring the embodied impacts of construction products and for producing an EPD (an Environmental Product Declaration); it already measures the impact of recycled content and recyclability at end of life and is assessing additional indicators for resource efficiency. Its Module D looks at End of Life of products and is developing ways to calculate the impact of when a product is reused or recycled at End of Life. A new work programme for 2017 will see six task groups look in much greater depth at how to measure / report the potential impact of different end of life scenarios. This is a very important activity.
- The Belgian Building Research Institute is doing a lot of work to look at end of life scenarios for construction products, looking at recyclability of products, reuse and recycled content and how to measure the related impact.

- [How can we encourage the built environment to adopt CE thinking?]
- [What does procuring with CE thinking in mind look like?]
- [What measurement and information management tools are needed?]
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Examples of CE happening in the built environment?

- [What are some examples of CE thinking relevant to construction?]



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 - [What is happening in the design community?]

What is the role for Digitalisation and BIM – Building Information Modelling?

- Digitalisation means the everyday use of common data and is essential for the industry to deliver BIM Level 2. A huge amount of work is going on to develop the systems to manage the information about buildings. The BIM Task Force led the work in the UK. <http://www.bimtaskgroup.org/> In October 2016, the UK BIM Task Group evolved into the UK BIM Alliance a new cross-industry alliance established to lead the industry-wide drive for awareness, education and adoption of BIM Level 2 compliance. The aim of the organisation is to provide a common and clear point of reference for built environment companies of all disciplines to enable and support their digitalization journey. <http://www.ukbimalliance.org>
- BIM4M2 is the subgroup focused on materials and is preparing the templates that will be required to identify material objects onto which information such as Environmental Product Declaration will hang. <http://bim4m2.co.uk/>
- Digitalisation of product information will be a central element in helping to deliver circularity in relation to the built environment. The vision and the challenge is set out in the publication The Future of Construction Product Manufacturing. <http://www.constructionproducts.org.uk/publications/corporate-and-industrial/the-future-for-construction-product-manufacturing>

Measuring and Managing Information for the Circular Economy

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Examples of CE happening in the built environment?

[What are examples of CE thinking relevant to construction?]

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What are/might be the business benefits of applying CE thinking to construction and the built environment?

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Do we know how much construction and demolition waste and the type is produced in the UK?

- Yes; in 2014, in the UK, 55.4 million tonnes of C&D waste was generated. Of this 450,585 tonnes was hazardous. In England, 49.1 million tonnes of C&D waste was generated; of this 260,000 tonnes was hazardous. 93% of the UK C&D waste is mineral waste (by tonnage).
<https://www.gov.uk/government/statistical-data-sets/env23-uk-waste-data-and-management>



Construction and Demolition Waste (CDW) – Measuring, understanding and eliminating it?

- [How much construction and demolition waste is produced in the UK?]
- [How much CDW data collected?]
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Are there any examples of CE happening in the built environment?

- [Infrastructure]
- [Materials]
- [Research projects on CE thinking relevant to construction]

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- [What is the role for Digitalisation and BIM – Building Information Modelling?]

How is CDW data collected?



- In the UK, CDW data is collected on a yearly basis. It is collected through the environmental protection agencies using waste management data from licensed waste management facilities as well as other sources such as industry data related to recycled aggregates. This may also be supplemented by surveys. Whilst efforts are made to synchronise approaches across England, Scotland, Wales and NI, methodologies are not identical and are under review. http://ec.europa.eu/environment/waste/studies/mixed_waste.htm

Construction and Demolition Waste (CDW) – Measuring, understanding and eliminating it?

- [Do we know how much construction and demolition waste and the type is produced in the UK?]
- [How is CDW data collected?]
- [How much CDW is recovered?]
- [Do we know how much CDW goes to landfill?]
- [Do we know how many materials are reclaimed?]

Are there any examples of CE happening in the built environment?

- [Buildings]
- [Infrastructure]
- [Materials]
- [Research projects on CE thinking relevant to construction]

JANUARY 2017



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What is a circular economy (CE)?

- [Why is there a need?]
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- [What is the European Commission doing on CE?]
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What are/might be the business benefits of applying CE thinking to construction and the built environment?

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The Green Construction Board

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- [What is happening in the client & investor community?]
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 - [What is happening in the manufacturing sector?]
 - [What is happening in the contracting community?]

Measuring and Managing Information for the Circular Economy

- [Does a Circularity Indicator exist?]
- [Does a formal British, European or international (ISO) standard exist relating to the circular economy?]
- [Are there existing standards in construction that are evolving to cover circularity issues?]
- [What is the role for Digitalisation and BIM – Building Information Modelling?]

How much CDW is recovered?



- In 2014, of the 55 million tonnes of non-hazardous CDW generated in the UK, 49.9 million tonnes was recovered, representing a recovery rate of 89.9%. This was calculated in accordance with the EC Waste Framework Directive. For England, the recovery rate is 91.4%.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/577752/UK_Statistics_on_Waste_statistical_notice_Dec_2016_FINAL.pdf.
- For Scotland, the recovery rate in 2014 was 89.2%.
<https://www.sepa.org.uk/media/219149/wfas-2014-commentary-final-v141.pdf>.

Construction and Demolition Waste (CDW) – understanding and eliminating it?

- [How much construction and demolition waste is produced in the UK?]
- [What data collected?]
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Any examples of CE happening in the built environment?

[...]

Possible questions might include:

- [How can CE thinking be promoted in the client community?]
- [What is required to facilitate the design community to adopt CE thinking?]
- [What does procuring with CE thinking in mind look like?]
- [What measurement and information management tools are needed?]
- [What is required to enable the flow of materials?]
- [What can Manufacturers do to facilitate the ongoing flow of their materials/products within the economy?]
- [What business models are required?]
- [What are the Research and innovation challenges?]

[Research projects on CE thinking relevant to construction]

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- [Has the GCB done any previous work relating to construction waste and resource efficiency (materials and water)?]

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What are likely to be the challenges for CE thinking in the built environment?

The Green Construction Board

What approaches are already happening in the built environment world that contribute to a Circular Economy?

There is much already happening in construction that can be deemed to be part of delivering circular economy thinking. The following applies to the UK.

- [What is happening in the client & investor community?]
- [What is happening in the design community?]
- [What is happening in the manufacturing sector?]
- [What is happening in the contracting community?]
- [What is happening in the engineering community?]
- [What is happening during the refurbishment and end of life?]

Do we know how many materials are reclaimed?



- There is a downward trend in the amount of materials reclaimed. In 2011, it was estimated to be around 750,000 tonnes, compared to 1.8mt in 2007 and 2.3mt in 2008. There are no more up to date figures available.
<http://salvonews.blogspot.co.uk/2008/12/bigrec-survey-shows-predicted-decline.html>

Possible questions might include:

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V.3 JANUARY 2017



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- [How will the group function?]
- [Has the GCB done any previous work on waste and resource efficiency (materials)?]

What are/might be the business cases for applying CE thinking to construction in the built environment?

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- [Are there other business benefits?]

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Buildings:



There are buildings that are designed and constructed with a number of circular economy aspects, such as adaptability, design for deconstruction, the use of reclaimed products and recycled materials. The examples listed represent those buildings that have the most circular aspects.

- ABN Amro Pavillion <https://www.abnamro.com/en/sustainable-banking/our-focal-points/circular-economy/circular-construction/index.html>
- Brummen Town Hall <http://www.ellenmacarthurfoundation.org/ce100/directory/royal-bam-group>
- Circular Building <http://circularbuilding.arup.com/>
- Cradle to Cradle inspired buildings <http://epea-hamburg.org/en/content/cradle-cradle-inspired-buildings>
- ICEhouse <http://www.mcdonoughpartners.com/projects/icehouse/>
- Land Rover Ben Ainslie Racing Building <http://www.slideshare.net/cethinking/designing-for-the-circular-economy-land-rover-ben-ainslie-racing-building-portsmouth-cethinking>
- Liander <http://www.rau.eu/>
- Park 20/20 <http://www.park2020.com/en/>
- The Ellen Macarthur Foundation has published 12 case studies on circular economy in the built environment <https://www.ellenmacarthurfoundation.org/assets/downloads/Built-Env-Co.Project.pdf>

Measuring and Managing Information for the Circular Economy

- [Does a Circularity Indicator exist?]
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What are the key standards in construction that are relevant to circular economy issues?]

How is data collection, digitalisation and BIM – Building Information Modelling – used?]

Construction and Demolition Waste (CDW) – Reducing and eliminating it?

How is construction and demolition waste managed in the UK?]

How much CDW is generated?]

How much CDW goes to landfill?]

How much CDW is recycled?]

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- [What measurement and information management tools are needed?]
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Infrastructure:

- MI-ROG - The Major Infrastructure – Resource Optimisation Group is an initiative with companies in the utilities and construction sectors aiming to eliminate waste and optimise resource reuse across projects and supply chains. The companies involved in MIR-OG include Network Rail, National Grid, Anglian Water, HS2, Thames Gateway, Environment Agency Flood Defence and EDF Energy.
<http://www.aecom.com/projects/circular-economy-action-major-infrastructure-resources-optimisation-group-mi-rog/>



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Any examples of CE happening in the built environment?

- [Are there any examples of CE happening in the built environment?]
- [What projects on CE thinking relevant to construction?]



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What are/might be the barriers to applying CE thinking to the built environment?

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Materials:

- Creating a Circular Economy for leftover decorative paint in the UK <http://www.paintcare.org.uk/>
- Gypsum to Gypsum <http://gypsumtogypsum.org/>
- Steel <http://www.asbp.org.uk/resources/>
- Material Sector Resource Efficiency Action Plans (REAPs) - <http://www.constructionproducts.org.uk/index.php?id=1658>
- Take back schemes (manufacturer specific) including:
 - British Gypsum <http://www.british-gypsum.com/about-us/sustainability/plasterboard-recycling>
 - Siniat <http://www.siniat.co.uk/en/knowledge-centre/sustainability/recycling>
 - Knauf; Armstrong http://www.armstrong.co.uk/commlgeu/eu1/uk/gb/environment_recycling_program.html
 - Rockwool, Travis Perkins <http://www.travisperkinsplc.co.uk/news-and-media/our-stories/waste-take-back.aspx>
 - Kingspan Insulation <http://blog.kingspaninsulation.co.uk/waste-take-back-scheme/>
 - Recoflor <http://www.recoflor.org/>
 - Recovynyl <http://www.recovynyl.com/>



Measuring and Managing Information for the Circular Economy

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Information and BIM – Building

Construction and Demolition Waste (CDW) – Reducing and eliminating it?

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What is relevant to construction]

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Measuring and Managing Information for the Circular Economy

[Does a Circularity Indicator exist?]

Is there a policy?

[What is the European Commission's position?]

[What are UK government policies?]

[What are local authorities doing?]

Are there non-governmental initiatives?

What will the Green Construction Board do?

[What is the Green Construction Board?]

[What is the Green Construction Board's role?]

[What will the Green Construction Board do?]

[What is the scope of the Green Construction Board?]

[How will the Green Construction Board be funded?]

[Has the Green Construction Board done anything yet?]

What are/might be the challenges of applying CE to the built environment?

[Has anyone tried to apply CE to the built environment?]

[Are there other challenges?]

What are like-minded organisations doing to support CE thinking in the built environment?

Research projects on CE thinking relevant to construction



- EU project "Towards a Common Construction & Demolition Waste Management Protocol". The aim of the Protocol is to increase confidence in C&D waste management process and trust in the quality of C&D recycled materials. http://ec.europa.eu/growth/tools-databases/newsroom/cf/itemdetail.cfm?item_id=8983
- EU funded 'Buildings as Material Banks' (BAMB) <http://www.bamb2020.eu/>
- EU funded 'Holistic Innovative Solutions for an Efficient Recycling and Recovery of Valuable Raw Materials from Complex Construction and Demolition Waste' (HISER) <http://www.hiserproject.eu/>
- The EC commissioned a study to look at the management of C&D waste across the EU and provide recommendations http://ec.europa.eu/environment/waste/studies/mixed_waste.htm
- WellMet 2050 <http://www.lcmp.eng.cam.ac.uk/wellmet2/introduction>
- REBus is an EU Life+ funded partnership project, which has developed resource efficient business models (REBMs) for a circular economy. <http://www.rebus.eu.com/>
- EU Funded 'Fostering Industrial Symbiosis for a Sustainable Resource Intensive Industry across the extended Construction Value Chain' (FISSAC) <https://fissacproject.eu/en/project/>
- Innovate UK has funded a number of projects in this area including:
 - A tool to identify and reclaim high value materials at end of life.
 - The reuse of structural steel.
 - The development of a reclaimed wood certification mark
 - Novel materials from waste
 - A design approach to reusable construction components and houses that are adaptable and fully deconstructable at end of life

A full list can be seen on the Innovate UK website. <https://ktn-uk.co.uk/articles/innovate-uk-projects-on-circular-economy-in-the-built-environment-sector>