Assets decarbonisation through reuse of key materials

14 May 2024

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Embedding circularity into construction and decommissioning of assets

Rebecca Maskrey
Principal Sustainability Consultant, Carbon & ESG Advisory
AECOM

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A joint research project on behalf of the Energy Institute and Construction Industry Research and Information Association (CIRIA)

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01 Project overview

Project background

- An evolving resource management landscape - government recognition and growing resource scarcity
- Construction and energy sectors play a crucial role, but no blueprint to enable a move from theory to implementation
- ‘Unlocking of circularity’ – represents an opportunity to shift from linear processes by transitioning to new business models.
- Taking an integrated approach to circularity from concept design to the end of life represents a significant win-win-win opportunity

Project aim:
To aid the production of a singular, practical guidance document to enable sustainability stakeholders to embed circularity into the construction and decommissioning of both construction and energy assets.

Project outputs:

- Phase 1: Literature review and scope of works
- Phase 2: Development of guidance document based on Phase 1

Phase 1 outputs:

❶**Literature review:**

Evaluation of available information on where circularity is considered within construction and decommissioning based on research to date and where there are gaps.

Carried out via material type: aggregate, concrete, asphalt, ferrous metals, non-ferrous metals, and composites

❷**Proposed scope of work for a guidance document, informing Phase 2**

02 Our approach

Project methodology:

- 6 key materials of **aggregates**, **concrete**, **asphalt**, **ferrous metals**, **non-ferrous metals** & **composites**
- A circularity 'profile' for each material based on the following:
  - Industry standard practice;
  - Market status;
  - Top guidance/ procedure documents reviewed (in terms of comprehensive, practical);
  - Standards/ regulations for the material – and where they apply (e.g., country/ sector specific);
  - Gaps (in literature found);
  - Barriers (in terms of circularity); and
  - Opportunities being missed (in terms of case studies).

The level of circularity for each material was presented using a Red Amber Green (RAG) rating, based on:

1. Availability of technical standards.
2. Maturity of secondary material markets.
3. Availability of material-specific industry guidance documents.
4. Evidence of uptake/ implementation of circular practices within the industry.

03 Key findings

Key findings – by material

Material	Rating	Industry standard practice
Aggregate		Traditional construction practices use primary/ virgin aggregates. Materials used to be destined for landfill. Industry recognition to grow implementation of secondary/ recycled aggregates through circularity for cost, availability and sustainability. Regional protocols for control, regulation and testing of secondary and recycled aggregate products.
Concrete		Limited to reusing concrete demolition waste for low-grade applications and blending SCMs for performance enhancements. Push for higher-value products from demolition, retention and re-use of concrete structures and facades. Urgency to reduce reliance on conventional Portland-cement. Certain international regions ahead for implementation, global recognition for circularity.
Asphalt		Recycling asphalt pavements common practice since 1970s. Globally, average RAP content in new asphalt mixes increased in to >25%. However, % of RAP in new plant mix varies by country. Durable, easy to repair, 100% re-usable and recyclable, continually developing and innovative technologies will increase circularity.
Ferrous metals		Producing virgin steel has large environmental impact. BRE found 96% environmental impact saving by reclaiming and reusing 99 tonnes of structural steel. New steel sections have 60% recycled content on average, but 25 times environmental impact of reclaimed and reused steel sections. Widely recycled as scrap metal in decommissioning.
Non-Ferrous metals		Unclear if standard practices implemented outside of high-level ambitions.
Composites		*Wind energy sector* - Industry standard (up until 2020s) was to landfill decommissioned wind turbine blades. Forthcoming decommissioning of first wave of wind energy assets (installed 2000s, likely to peak 2023-2025) and public scrutiny has prompted in-depth examination of existing wind turbine blade disposal technologies. *Other industries (marine, aerospace, oil and gas, automotive, construction)* – FRP used in boats, aircraft, vehicles and construction sector. Recycling routes for higher-value CFRP from aircraft manufacturing, but EoL GRP construction materials are typically landfilled, or sent for energy recovery.

Key findings - overall

- Guidance focused on the construction sector
- Buildings skew
- Not material focused – project phase focused

Energy/ infrastructure sector (and associated assets) may benefit from bespoke guidance

- Both construction and energy sectors can play a leading role in improving secondary material markets through their procurement policies and market share

The embedding of circularity at an organisational level may help - possibly via a ‘circularity maturity’ matrix with associated levers to improve maturity

Key findings - overall

- There are lots of barriers to circularity
- Could be classified in terms of intrinsic and external properties
- No shortage of academic work on challenges around circularity

Practical guidance on how to ‘unlock’ barriers is largely missing

- Search protocol covered a wide scope of geographies
- No obvious observations in terms of regions that may be deemed more important for circularity
- Majority of the guidance sourced (excluding some waste guidance specific to the UK) could be applied universally

Guidance should be geography agnostic, although there will be aspects unique to materials/ products linked to the maturity of the relevant market

04 Next steps

Development of Phase 2

Taking the findings from Phase 1, to aid stakeholders in taking action to overcome barriers to circularity

A 4-step guidance structure:

1. Principles

- Drivers for circularity
- Audience
- Circularity ‘framework’

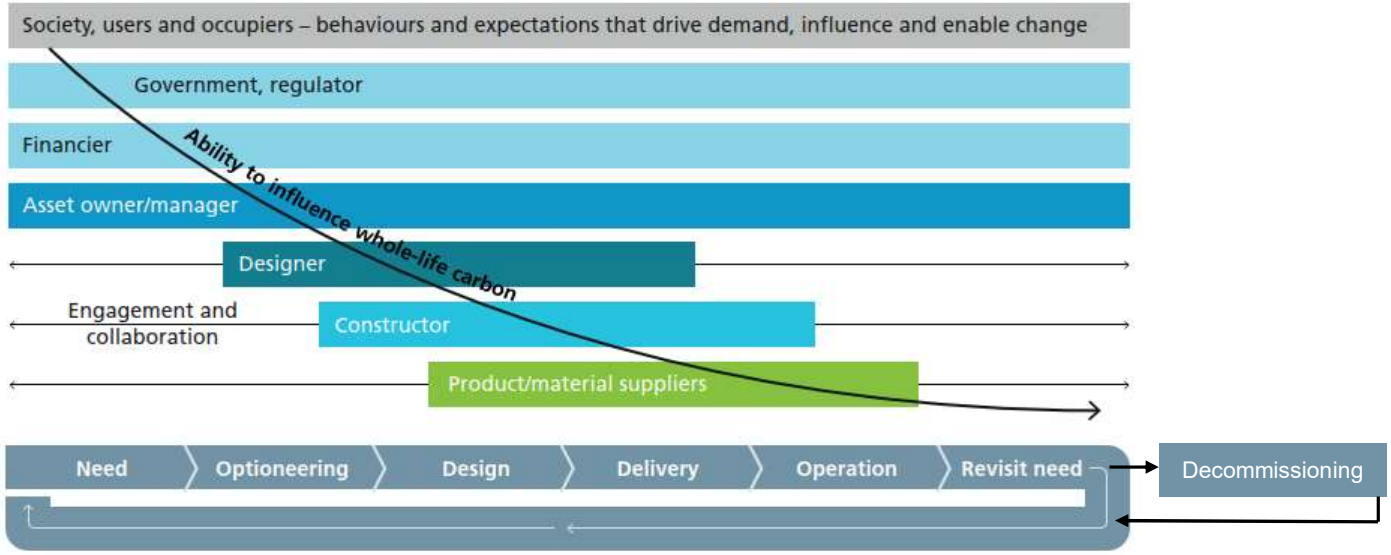


Fig 2.1: Value-chain members’ ability to accelerate decarbonisation throughout the delivery process

Source: ICE, 2023

Development of Phase 2

A 4-step guidance structure:

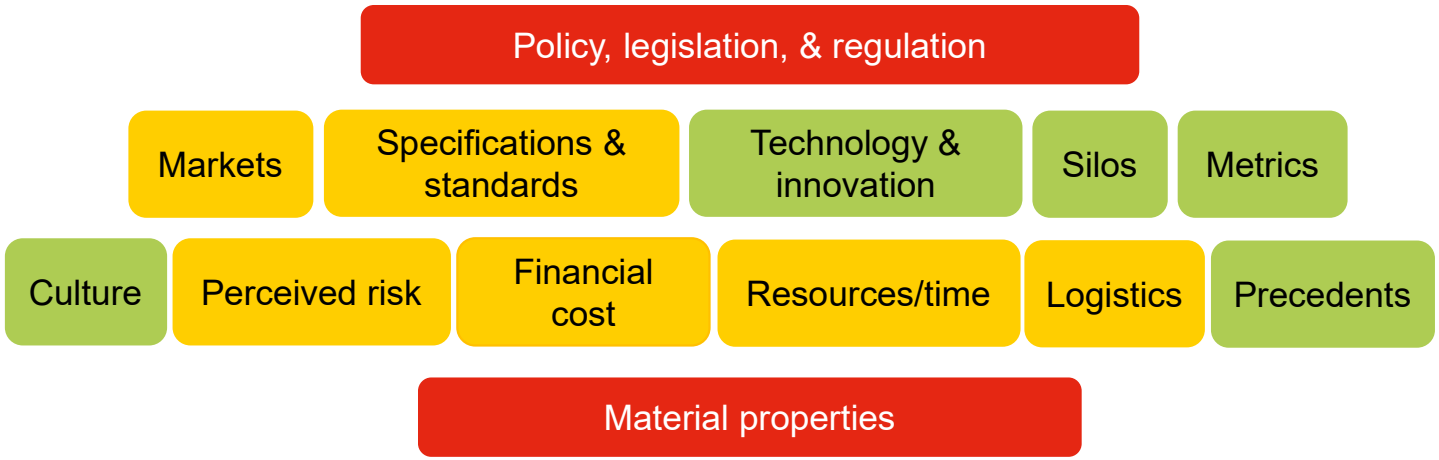
1. Principles

- Drivers for circularity
- Audience
- Circularity ‘framework’

2. Issues

- Barriers
- Enablers

Barriers:



Development of Phase 2

A 4-step guidance structure:

1. Principles
- Drivers for circularity
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- Circularity ‘framework’

2. Issues
- Barriers
- Enablers

3. Method
- Solutions to overcoming barriers

Enablers:

Development of Phase 2

A 4-step guidance structure:

1. Principles
- Drivers for circularity
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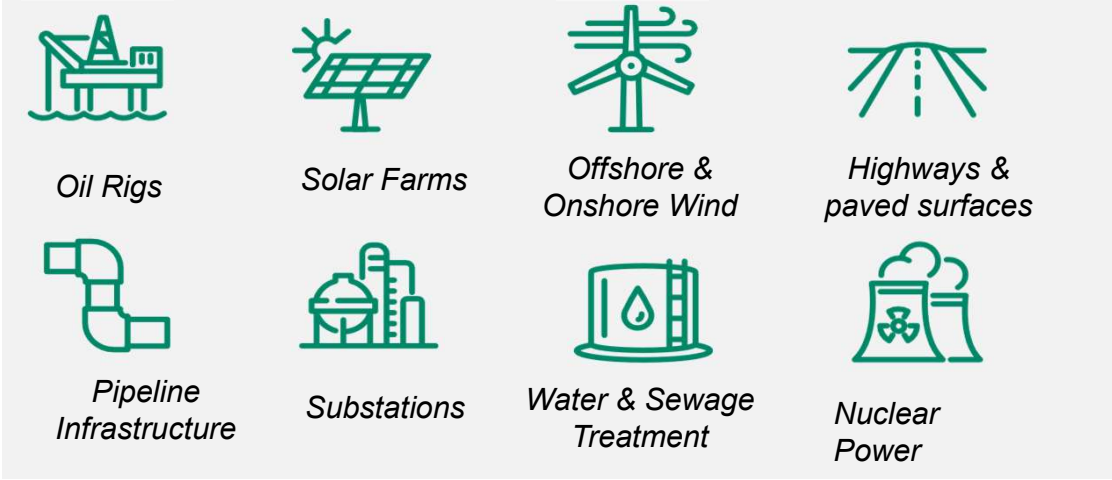
2. Issues
- Barriers
- Enablers

3. Method
- Solutions to overcoming barriers

4. Examples
Application of guidance in a range of contexts



Thank you.

Any questions?

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