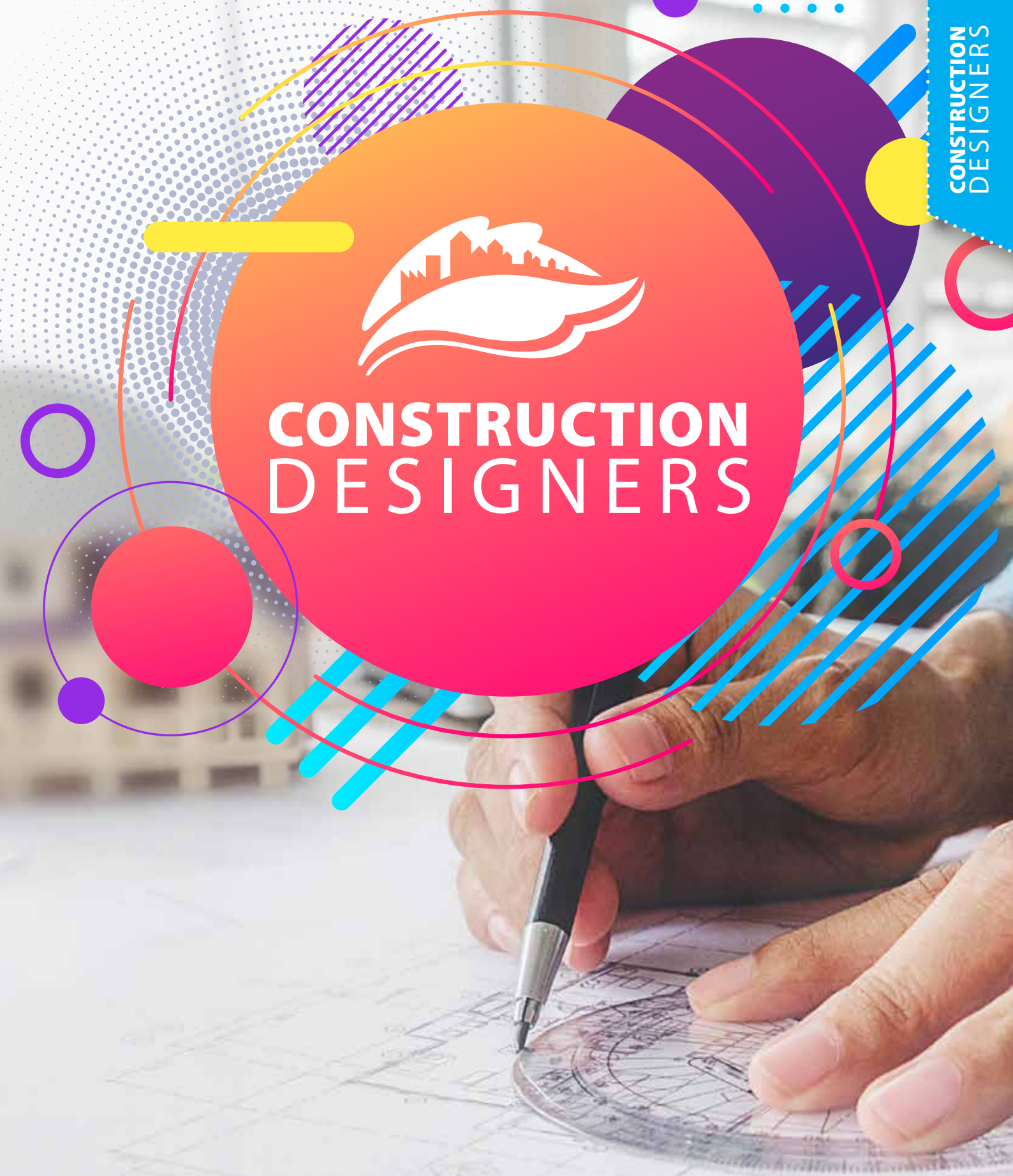
CONSTRUCTION DESIGNERS



connacht-ulster **waste region**

eastern - midlands **waste region**

southern **waste region**

epa LAPN
Local Authority Prevention Network

Introduction

This series of Circular Economy 'beginners' checklists has been developed by Resource Futures Ltd at the request of the Southern Waste Region using EPA grant funding and with peer review input from the Build360 Group in GMIT led by Dr. Mark Kelly. The aim of the checklists is to raise awareness of the Circular Economy with key actors within the construction sector who all have a role to play in making the sector more circular and provide some early considerations to contemplate.

What is circular construction?

The Construction sector is responsible for half of all extracted materials. In 2017, an estimated 4.7Mt of Construction and Demolition (C&D) waste was collected by authorised waste collectors. This represented approximately 31% of Ireland's total waste production making it the largest waste producing sector in the country.

Whilst most of this waste is diverted from landfill into other recovery options, it is recognised that a large proportion of this waste could have been prevented altogether and recovered into higher value products if Circular Economy thinking were embedded at all stages.

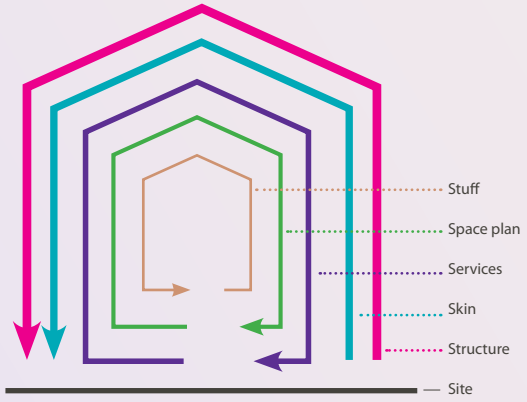
The Circular Economy can be summarised into 3 key principles:

1. designing out waste and pollution;
2. keeping products and materials in use; and
3. regenerating natural systems.

Circular Construction seeks to eliminate waste production at all stages of the build process, from procurement and design through construction and into operation and then eventual end of life destinations. Circular Construction also seeks to reduce the demand for virgin materials by keeping products and materials in use for as long as possible and using recovered materials.

One technique to help envisage how to do this is to think of your project in layers and within each layer there are different opportunities:

- The site should be reused continuously.
- The structure should last as long as possible.
- The skin and services should be accessible and replaceable.
- The space plan should be flexible and adaptable.
- The stuff should be durable and reusable.



What should I do?

Previous research[1] has found that poor design contributes significantly to Construction and Demolition Waste (C&DW) generation, and that that **33% of all on-site waste** may be due to a failure to implement waste reduction measures during the design stages[2].

To fully embrace Circular Construction projects, we need designers to not only be aware of the benefits that a more circular project provides, but also proactively communicate these to the client and design with whole life impacts in mind. Circular construction drives consideration of how the use of an asset can be maximised both in the short-term but also in the long term.

To enable construction projects to become more circular, it is important to consider how they are designed. It is important to consider how we design for future disassembly, the potential for standardisation and modularity of materials and systems, the use of secondary materials, avoiding the use of hazardous materials and composite materials which may hinder future reuse and recycling opportunities.

Underpinning the move to a more circular construction sector is the need for more data, such as the material composition of products, the residual value, test results and warranties and in-use data where relevant, which may reduce any potential risk from reuse. Building or Material Passports are a developing topic which will help to show how buildings are repositories of valuable materials that already have a significant embodied footprint and should be managed considerately.

To help construction designers know where to start, here are our recommended first steps to embed circular thinking within your projects:

1. Run a circular design workshop

A circular design workshop starts the initial conversation about embedding circular economy principles into a project. This conversation will continue through all stages of the project, taking what you learn from one stage forward to the next.

An initial circular design workshop should be held at RIBA Stages 2 or 3 of a project to explore the circular opportunities of the project and map out against the client brief requirements. Of course, design is an iterative process and there will need to be ongoing conversations around the circular economy throughout the project at all stages.

The first stage of any circular design workshop is to **identify** the opportunities which are possible for your project. To do this however you must first ensure the design workshop participants understand the basic principles of circular economy.

This is not about making everyone in the room an expert but about giving them sufficient understanding to be able to come up with new ideas and explore new concepts.

It is important to then prioritise and assess the potential impacts of these opportunities, as well as to understand the client specific drivers as these are likely to drive prioritisation of the opportunities identified.

Prioritising the list of opportunities is then followed by **investigating** the viability of the actions, starting with the high impact and easy to do actions to ensure that these are progressed first for the project.

The third stage is then to **implement**. The opportunities which are proven to be viable need to be embedded, communicated and recorded to ensure that they become core to the project, to remove the risk of them getting eroded away at later stages.

[1] Bossink and Bouwers, 1996; Faniran and Caban, 1998; Ekanayake and Ofori, 2000; Chandrakanthi et al., 2002, Osmani et al., 2008
[2] Innes, S. (2004) Developing tools for designing out waste pre-site and on-site, Proceedings of Minimising Construction Waste Conference: Developing Resource Efficiency and Waste Minimisation in Design and Construction.

2. Calculate a waste forecast and record it in a SWMP

In order to say whether or not a project has been designed and constructed efficiently in terms of waste production, a **robust waste forecast** is essential at the design stage. The Site Waste Management Plan (SWMP) is the perfect tool to record this information and provide a contract between forecast and actual waste productions and destinations.

The SWMP is a key document for specifying and improving waste reduction strategies. It should be developed at an early stage of the project by the design team and/or quantity surveyor and handed over to the contracting team.

As part of the design stage, a SWMP should be agreed with the client, and should:

- Identify each type of waste expected to be produced during the project;
- Estimate the quantity of each type that will be produced i.e. the forecast;
- Identify actions for waste prevention, reduction including on or off-site reuse, on- or off-site recycling, or disposal.

The SWMP allows the design team to proactively identify materials which are available for reuse either originating from a previous project or from the construction of the new project, and record these in a robust way.

3. Employ lifecycle thinking

The key to achieving sustainability, carbon reduction and zero waste is taking a wider, longer-term view. By thinking whole life value, we can deliver long-term, lasting social, environmental and economic benefits through construction projects.

The **Greater London Authority (GLA) circular economy decision tree** is a useful strategic design approach which prompts designers and developers to consider opportunities for maximising the residual value of any buildings, materials or elements on site, before considering strategies for adding value over the lifetime of the development.

Presenting a long-term vision of the project allows the design team to promote:

- value and utility;
- multi-functionality and adaptability;
- durability, low maintenance and replacement cycles;
- resilience and risk management solutions;
- reuse and refurbishment;
- reversibility and disassembly; and
- end-of-life circular loops.

GREATER LONDON AUTHORITY (GLA) CIRCULAR ECONOMY DECISION TREE

Is there an existing building on the site?

- No → Are there any building materials or elements available on site?
- Yes → Is it technically feasible and viable to retain the building(s) in whole or in part?

Is it technically feasible and viable to recover the 'residual value' of the building elements or materials?

- No
- Yes → Is the existing building suited to the new use and requirements?

Is the existing building suited to the new use and requirements?

- No → Repurpose
- Yes → Refurbish

Are there any building materials or elements available on site?

- No → Demolish and recycle
- Yes → Deconstruct and reuse

Strategies for maximising value over the lifetime of the development by adding new buildings/infrastructure

Is the expected life long or short?

- Short → Will there be a market for elements with the required dimensions/specifications?
  - No → Design for recoverability
  - Yes → Design for reusability
- Long → Will the use and or requirements change? If so, how frequently?
  - Often (>5yrs) → Design for flexibility
  - Intermittent (5-25yrs) → Design for adaptability
  - Rare (>25yrs) → Design for longevity

All developments should design of DISASSEMBLY

4. Design with future deconstruction in mind

To design a project which is not just deconstructable in the future but also allows for its materials to be recoverable and reusable, designers must consider the way the products and elements of project are assembled and connected together. Using mechanical fixings rather than bonding is preferable, as is making sure that shorter lived products are accessible and are not enclosed by longer lived ones.

The communication of the deconstruction design measures employed during the original construction, to those considering future refurbishments or replacement, needs to be thoughtfully recorded to avoid lost opportunities. Identifying and prioritising items with a shorter anticipated lifespan or greater maintenance requirement is helpful in this process.

A deconstruction plan is one method which could be employed to overcome this issue and enable anyone who may work on the building in the future to easily identify how to access, repair, maintain or replace each item without excessive disruption and time. The plan identifies every component of the building and details how they can be located, accessed, repaired and eventually removed if necessary. All elements of the proposed building should be identified on drawings, schedules or digital models and include relevant information such as material characteristics (for example, toxicity), fixings, location and access arrangements.

The deconstruction plan is given to the contractor at the start of the construction phase so that the relevant sections can be completed during the build. It will then be given back to the client as part of, or alongside, the health and safety file, and operation and maintenance manuals, etc.

Why should I seek to make my projects more circular?

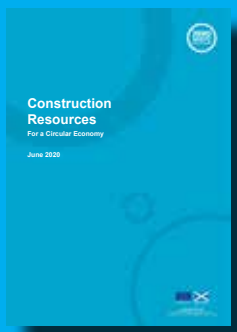
The requirement of future projects to both meet the demands of our society in the future balanced against the our designs ability to prevent and mitigate the impacts of climate change, will require designers to rethink and redesign their business models to become more circular in order to:

Win more work - circular economy and sustainability aspirations are on the increase, driven through the legislation / policy agenda and user demands;
Influence - designers have a responsibility to tackle the climate crisis in every project and ensure the security and prosperity of our future generations;
Recruit - the pressure to recruit / retain talented designers will be linked to the quality of the products that you are designing.

Key resources

The following recommended resources will help you to continue your circular journey and embed the above mentioned tips within your projects:

- Irish Green Building Council (IGBC)
  Towards a circular economy in construction: Assessing low carbon, healthy, responsible products for the construction sector
- UK Green Building Council (UKGBC)
  - Circular economy guidance for construction clients: How to practically apply circular economy principles at the project brief stage
  - Circular Economy Implementation Packs for Products as a Service and Reuse
- Zero Waste Scotland
  - Construction Resources For a Circular Economy
  - Procuring resource efficient construction projects
  - Design out waste in construction Guide
  - Maximising re-use in construction
  - Create a SWMP
- ARUP
  - Circular Economy in the Built Environment



Support available

Should you wish to learn more or have a pilot or demonstration project which you would like support with to explore circular construction approaches then please get in touch with:

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