

Circular Economy in Greenways and Rural Cycleways



Circular Economy in Greenways and Rural Cycleways

What is circular economy?

TII aims to adopt a circular economy approach to standards, operations, and TII delivered and funded projects and programmes. The circular economy seeks to keep materials, components, and products in use for as long as possible. The TII approach to circular economy aims to:

- Reduce resource consumption;
- Keep assets, components and materials at their highest value;
- Maintain safety and technical function of services, assets and components;
- Promote restorative and regenerative design; and
- Reduce emissions.

How is circular economy applied to greenways and rural cycleways?

The 9Rs are a categorisation system proposed for circular economy by the European Commission and can be applied to greenways as shown below.



R1 Refuse	Ensure a clear need is demonstrated for new greenways or rural cycleways. Consider alternatives in detail and maximise use of existing infrastructure.
R2 Rethink	Intensify the use of existing infrastructure, e.g. reallocate road space for cycleways, incorporate existing roads/paths/assets/components - in greenway and cycleway development.
R3 Reduce and Design for Deconstruction	Ensure design for disassembly, and maintenance, is central to development. Employ lean design during greenway and cycleway development.
R4 Re-use	Re-use assets, components, and materials within greenway or cycleway development.
R5 Repair	Continue to repair and maintain greenway and cycleway assets and components as appropriate to prevent asset deterioration or degradation.
R6 Refurbish	Recover used greenway and cycleway assets and components as appropriate to current standards to extend their useful life.
R7 Remanufacture	Incorporate remanufactured materials and components (re-used and repaired with new parts) into greenway or cycleway development.
R8 Repurpose	Incorporate repurposed materials and components (e.g. retired safety barriers, turbine blades old sleepers) into greenway or cycleway development.
R9 Recycling	Incorporate recycled materials into greenway and cycleway development.

Note: Adapted from the European Commission Categorisation System for the Circular Economy, 2020.

Why do we need to implement circular economy for greenways and rural cycleways?

Circular economy strategies for greenways and cycleways present practical means to support TII's contribution to the following national carbon and circular economy objectives.

Climate Action Plan (CAP) 2023

- Contribution to industry emissions reductions from 7 MtCO₂eq (2018) to 4 MtCO₂eq in 2030;
- Decrease embodied carbon in construction materials produced and used in Ireland by at least 30% by 2030; and
- Achieve a reduction in demand for construction materials: 20% less than a 'do nothing' scenario in 2025 and 30% less in 2030.

National Investment Framework for Transport in Ireland (NIFTI)

At project and programme level, through application of strategies, such as the 9Rs above, Circular economy supports application of the Intervention Hierarchy:

- (1) Maintain;
- (2) Optimise;
- (3) Improve; and
- (4) New.

The value of existing assets, components and materials is maximised and supplemented which keeps existing materials in circulation and minimises the embodied carbon that is associated with producing new materials and assets.

Whole of Government Circular Economy Strategy 2022-2023

The Circular Economy and Miscellaneous Provisions Act 2022 underpins Ireland's move towards a more sustainable pattern of production and consumption. It gives statutory footing to the Department of Environment, Climate and Communication's Whole of Government Circular Economy Strategy.

Circular economy can also contribute to the preliminary sectoral actions included in the Whole of Government Circular Economy

Strategy, which include the following:

Actions to increase resource efficiency and re-use in construction:

- Increased use of offsite design and manufacture;
- Modular building design;
- Refurbishment and retrofitting of existing stock;
- Tackling dereliction and bringing stock back into occupancy; and
- Increased use of Construction & Demolition Waste as a secondary construction material.

Actions to increase resource efficiency and re-use in transport

- Increased use of telecommuting, as well as of local and regional hubs;
- Prioritising resource efficient personal mobility, e.g., walking and cycling; and
- Expanding public transport capacity and promoting shared mobility schemes.

How circular economy can help TII deliver on these objectives

- Reduce environmental impacts of assets and materials by applying life cycle thinking and assessment techniques in planning and decision making;
- Reduce environmental impact of construction by supporting selection and specification of low carbon and alternative materials;
- Reduce demand for construction materials by enabling re-use and life extension of existing assets, materials and components;
- Support early-stage planning to enable re-use of materials, particularly pavement, soils and ancillary components; and
- Design for maximum value for communities in a systemic manner through increasing access to active mobility and reinvigorating local and regional hubs.



How can circular economy be implemented on greenway and rural cycleway projects?

The adjacent diagram represents the circular life cycle of greenway or rural cycleway. It shows the flow of materials, components and resources through each life cycle stage. Retention of resources is an essential part of the circular economy. Re-use should take place at the highest possible value.

- Resource flows
- Life cycle thinking
- Maximise positive environmental impacts

Bring new life to local and heritage assets

Map materials in the area that could be incorporated in the greenway. Can railway sleepers become tables or benches? Can old buildings become shelters, rest areas, or businesses? Can the foundations from heavy machinery accommodate a coffee van or a bike depot?

Maintain digital material logs

Retain material data and sources, expected re-use and recyclability in easily accessible format for operation and maintenance.

Greenways projects often have the space and capacity in terms of land and resources, to add natural capital and social value to projects. Actions can be taken on linear projects, subject to local needs and planning requirements, to integrate them with and enhance local ecosystems and communities.

Natural Capital and Social Value

- Identify opportunities to increase the size and enhance the condition of a core conservation habitats and create better connectivity between high quality core habitats;
- Identify and implement opportunities to create habitat, and manage habitats sensitively such as through "Low mow" regimes for maintenance of grassed areas;
- Consider native species planting and habitat connectivity (e.g. through the use of wildlife bridges and badger passes);
- Utilise landscaping to integrate soft features and mitigate visual impacts; and
- Adopt soft solutions where possible, such as integrated wetlands over traditional retention ponds.

Understand resource flows

- Map volumes, properties and potential re-use of pavement, structural, earthworks and ancillary materials at Phase 2; and
- Research how these materials are supplied and where they will go if they leave the project.

Design for the life cycle

Adopt design for disassembly concepts including modularity and adaptability to minimise material use in maintenance, repair and upgrade. Short lifespan technology needs to be designed for deconstruction.

Minimise material use by design

- Apply performance-based methods such as the Irish Analytical Pavement Design Method (IAPDM);
- Maximise recycled content of pavement materials;
- Monitor material use throughout the design - especially concrete, earthworks and steel;
- Minimise earthworks and incorporate existing root layer to support paths; and
- Consider renewable energy sources in remote locations to reduce ducting.

Plan for material re-use

- Which existing materials can be integrated on the project and where do they need to be stored and certified?
- Which materials will leave the project? Where will they be stored and which permits need to be in place?
- Incorporate contract requirements and monitoring for re-use of materials during construction, operation and maintenance.

Create positive environmental impact by design

- Monitor and minimise carbon emissions from concept stage;
- Monitor and maximise positive impacts on biodiversity, including light, noise, air, water and habitat connectivity; and
- Plan for storage and testing of living soils.

Establish digital material logs

- Incorporate data on material sources, re-use and recyclability in the digital project environment to allow use of the information later in the life cycle; and
- Update with construction information.

Effective material management

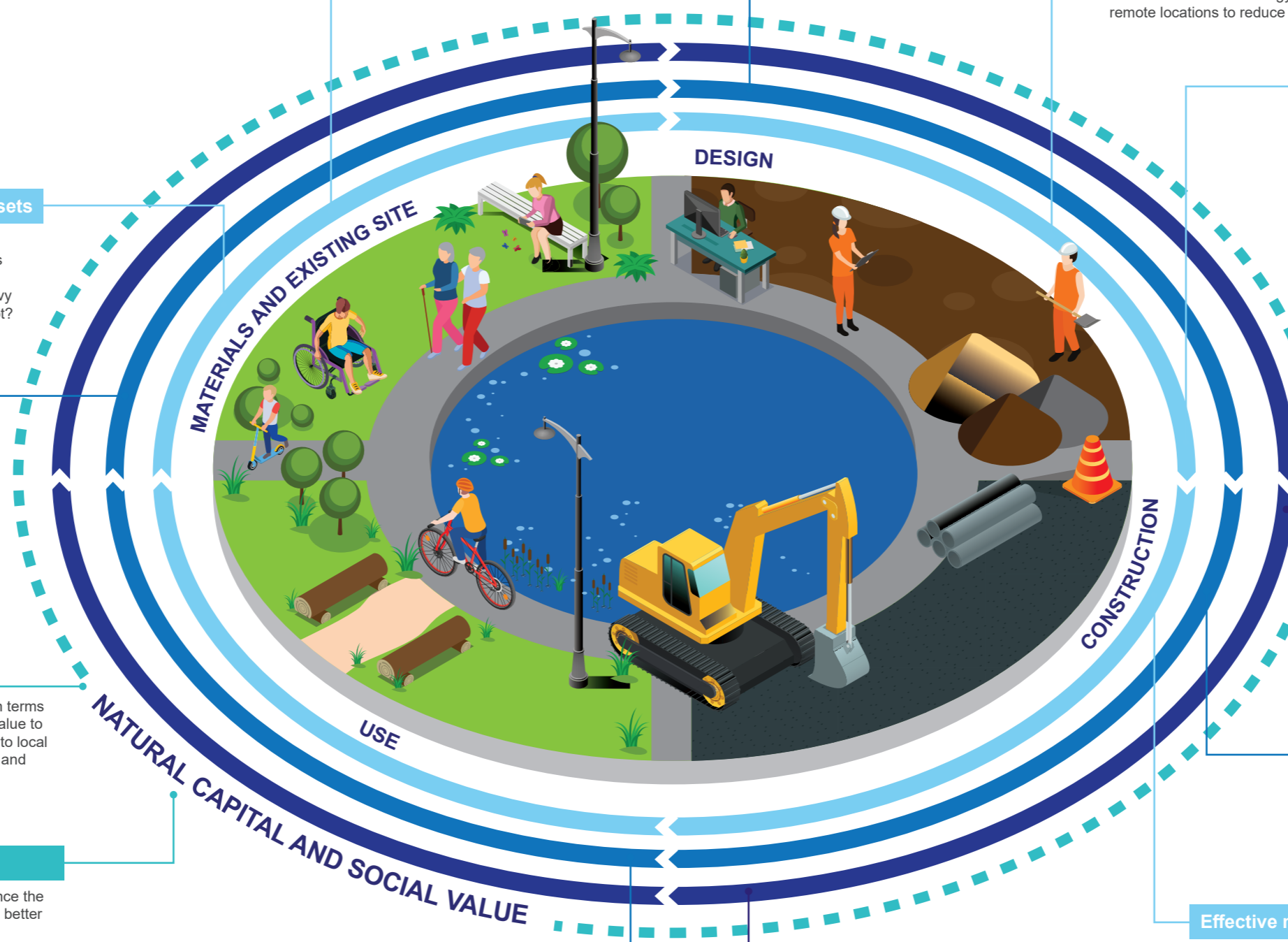
Manage materials and resources on site to retain their value.

Maintain for the life cycle

- Maintain design for disassembly concepts integrated in the design; and
- Incorporate contract requirements and monitoring for re-use of materials during operation and maintenance.

Low impact construction methodology

- Minimise weight and emissions of construction equipment; and
- Optimise deliveries to site to minimise transport.





Navigating circularity in regulations, standards and specifications

	Materials or Product Standards	Supply Chain Consideration	PMG Deliverables Documentation	Article 27 By Products & 28 End of Waste
Phase 2 Option Selection	<ul style="list-style-type: none"> Identify material standards for re-use (e.g. TII Specification for Road Works Series 600 Earthworks, Series 800 Road Pavements - Unbound and Hydraulically Bound Mixtures); Identify clause within standards which permit re-use of material and allowable % by weight of re-used materials. If re-used product is not permitted, consider if a departure application is required; and Identify ground investigation test requirements for each option. 	<ul style="list-style-type: none"> Review the facility permits/licences of the materials and products source sites; Desk study on locations of relevant facilities for processing and/or storage near the options; and Understand the market need for each expected re-used material. 	<ul style="list-style-type: none"> Estimate quantity of material required in tonnes for each option. Consider quantity of materials required during options assessment; and Estimate storage required for each option and potential locations. Consider during options assessment. 	<ul style="list-style-type: none"> Identify market need for expected by products and end of use waste materials.
Phase 3 Design & Environmental Evaluations	<ul style="list-style-type: none"> Undertake earthworks materials assessment as part of ground investigation; Capture decisions and changes made and document circularity aspects in the Options Selection Report; Undertake hazardous or scarce material testing or risk assessment; Begin type testing to ensure re-used materials meet specifications; and Undertake more detailed earthworks and pavement materials assessment as part of ground investigation. 	<ul style="list-style-type: none"> Understand expected costs for processing, storage and transport of products and materials; Understand what technology is in place for processing of materials; and Seek certification by Market Surveillance Authority if required. 	<ul style="list-style-type: none"> Detail quantity of material required in tonnes for the development; Detail storage required for the design (i.e., volume, location etc.); Size and identify storage site locations for materials or components. Ensure it is identified in the planning consent application documentation; and Set destination site locations and detail in the planning consent application documentation. 	<ul style="list-style-type: none"> Identify if risk assessments are required for each material; Identify if there is a precedent where similar Article 27 By Products has been determined; Identify if Article 28 End of Waste rules for the product or material are in place; and Identify if further processing is required and if a permit/licence is required.
Phase 4 Statutory Processes	<ul style="list-style-type: none"> Refer to material and product standards within the planning application. 		<ul style="list-style-type: none"> For re-used and recycled content, note source site location in the planning application & ensure it has required consents; Apply for, or ensure necessary storage sites have, permits/licence. 	<ul style="list-style-type: none"> Ensure that regulatory processes around material re-use are aligned with planning documentation and include details in planning consent documentation.

**Phase 2
Option Selection**

**Phase 3
Design & Environmental Evaluations**

**Phase 4
Statutory Processes**

The table to the right describes key actions for navigating regulation around material re-use on greenway and rural cycleway projects. Scoping, Concept and Feasibility activities (Phases 0-1) and Construction/Implementation stage activities (Phases 5-7) are also considered, however impactful actions for material re-use do not sit in these stages.

Implementing circular economy principles will occasionally require deviations from existing specifications or standard elements (e.g., benches, fencing, lighting) as knowledge, skill, and a new suite of standards and construction processes emerge. It is important that project scoping, preliminary appraisal and feasibility studies promote innovation and circular economy thinking to achieve national carbon and circular economy objectives.

Updates are underway to TII specifications to support circularity as part of Series 600 Earthworks and Series 900 Pavement, among others. Technical knowledge of best practice in materials for other similar assets such as roads and ITS systems should be applied in the meantime at smaller scale to enable circular economy for greenways and rural cycleways.

Note: sequence of actions can vary between projects and is linked to contract form and risk allocation.





For further information on the TII approach to circular economy, refer to the TII Circular Economy Policy and the TII Circular Economy Strategy.

Circular economy outcomes and the resulting sustainability and project delivery benefits can be achieved through technical and commercial skill.



How will you make circular economy a reality on your project?



Take action