

Transport Infrastructure Ireland

Circular Economy Strategy

2023 - 2025

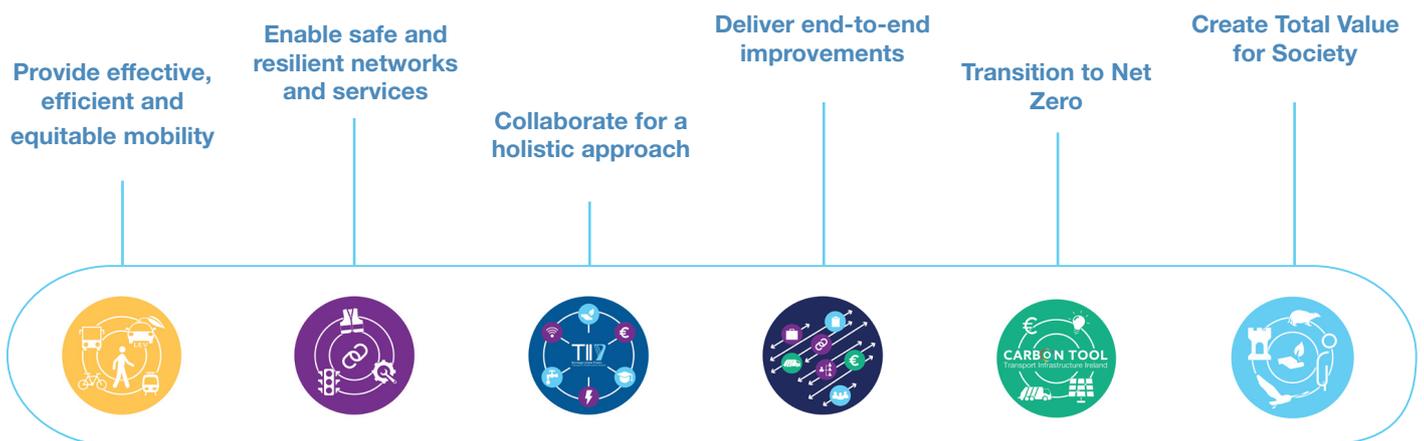
Circular Economy and TII's Strategic and Sustainability Aims

Circular economy is a means by which Transport Infrastructure Ireland (TII) addresses its vision of being leaders in the delivery and operation of sustainable transport infrastructure. The TII Circular Economy (CE) Strategy aims to assist TII to deliver on many of the aspects of its Statement of Strategy (2021-2025).

This Strategy will support TII in its key role to deliver its projects under the National Development Plan 2021-2030. It will also play an important role in achieving national carbon reduction targets. It will contribute to achieving TII's Statement of Strategy Goals with particular emphasis on the following goals:

- **“Existing Infrastructure** - Operate, maintain and extend the life of national roads and light railway infrastructure to ensure the safety and efficiency of our transport networks, ensure appropriate management of environmental resources and contribute to the transition to a low-carbon and climate-resilient society.”
- **“New Infrastructure** - Deliver national road, light railway, metro and Active Travel infrastructure, contributing to compact growth, sustainable mobility, enhanced regional accessibility and the transition to a low-carbon future.”
- **“Services** - Operate TII's light rail, tolling and traffic control systems and contribute to the electrification and digitalisation of transport, benefiting our customers and contributing to sustainable mobility and decarbonisation of transport.”

Implementation of the TII Circular Economy Strategy on TII's projects and programmes also contributes to delivering on all six principles of **TII's Sustainability Implementation Plan - Our Future**.



This Strategy covers the period of the next 2 years (2023 - 2025). The focus areas and actions in this document apply to this period, and will be updated as appropriate thereafter.

Focus Areas

The realisation of TII's Circular Economy vision will be guided by the focus areas set out in the TII Circular Economy Policy. These are further elaborated here.



Life Cycle Assessment (LCA)

TII will consider operation and maintenance at the early project phases. Appropriate models will be used which strike a balance between economic, environmental and social costs.



Materials and Data

TII will continue the process of gathering resource data for assets, components and materials. TII will enhance the use of asset management data to inform such areas as design, redesign, investments, divestments, etc.



Asset Management¹

Asset Management at TII will evolve to embed the principles of and support the transition to a circular economy.



Collaboration

TII will engage with the supply chain and other agencies to influence and promote the implementation of TII's Circular Economy objectives, as outlined in the Policy.



Transformation to Circular Systems

TII will consider whole of life value from the outset of projects. The layers of change² design concept will be implemented as appropriate, to enable design for deconstruction, ease of maintenance and to lengthen asset life.



Procurement

TII will further embed whole life costing in procurement, taking account of environmental and social criteria as relevant to the procurements taking place.

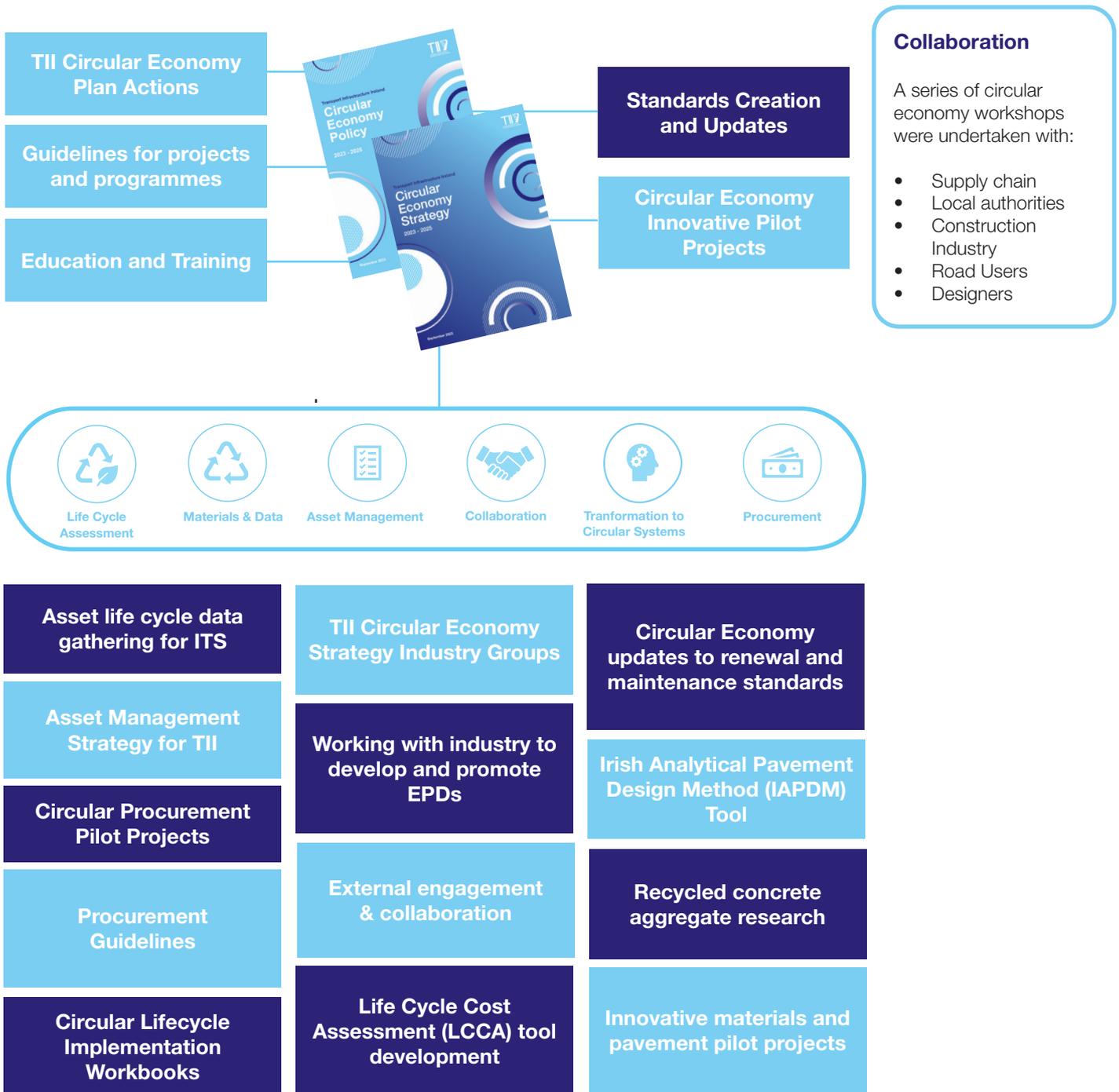
Note 1: Asset Management is the coordinated activity of an organisation to realise value from assets. Realisation of value will normally involve a balancing of costs, risks, opportunities and performance benefits. The term “activity” has a broad meaning and can include, for example, the approach, the planning, the plans and their implementation. Activity can also refer to the application of the elements of the asset management system. (Source: ISO 55000:2014).

Note 2: The layers of change design concept is based on grouping assets of similar life duration such that when change is required non destructive adaptability, replacement and maintenance are feasible.

TII Approach

Steps TII will be taking to transition from a linear to a circular approach

These are a series of actions which are planned and already underway to enable TII's transition from a linear to a circular approach. The activities will be reviewed and amended as required.



Circular Economy Actions

This Strategy elaborates on how each of the aforementioned focus areas will be applied to activities, programmes and projects undertaken and funded by TII. Below is a series of actions we will be implementing over the next 2 years to achieve TII's circular economy objectives. These actions will be updated following this period.

Life Cycle Assessment

- New appropriate models will be used which strike a balance between economic, environmental and social costs. Guidance on LCA and procurement will be published.

Materials and Data

- TII will commence the process of implementing material passport-type data gathering for assets, components and materials. Pilot projects will be undertaken.

Asset Management

- Data gathering will commence relating to resource consumption using asset management systems . The pavement asset management system will be first to be updated.

Collaboration

- The TII Circular Economy External Collaboration Committee will continue to meet to promote implementation of circularity and adoption of TII's Sustainability Implementation Plan.

Transformation to Circular Systems

- Circular lifecycle implementation workbooks will be published and training provided to embed circular economy in TII funded projects and programmes.

Procurement

- TII will further embed whole life costing in procurement, this will be achieved through multiple pilot projects.
- The findings of these pilot projects will be incorporated into new guidance on LCA and procurement.

How Circular Economy Extends Across TII Activities

Circular Strategy activities and initiatives will be adopted with the more circular activities lying higher up the 9R hierarchy. Figure 1, below, was developed by the EU and tailored for TII.

9R Categorisation Depicted with Energy Loops (Adapted from Rijkswaterstaat and the European Commission Categorisation System for the Circular Economy, 2020.)

R1. Ensure a clear need is demonstrated for transport assets. Consider alternatives in detail and maximise use of existing infrastructure e.g. reduce the need for construction through reuse of existing roads and local access interventions.

R2. Intensify asset use e.g. by delivering transport in shared vehicles, and in particular buses, by incorporating a bus lane with priority measures on TII funded schemes.

R3. Decrease asset impact in construction or use (throughout the lifecycle) through design for deconstruction and consuming fewer natural resources and materials e.g. integrate modular assets within TII funded schemes.

R4. Reuse by another asset or organisation of a discarded asset which is still in good condition and fulfils its original function e.g. removing lighting columns no longer required on one scheme for use as lighting columns on another scheme.

R5. Repair and maintain a defective asset which is still in good condition and fulfils its original function e.g. Early surface treatment of pavement to avoid the need for full depth reconstruction.

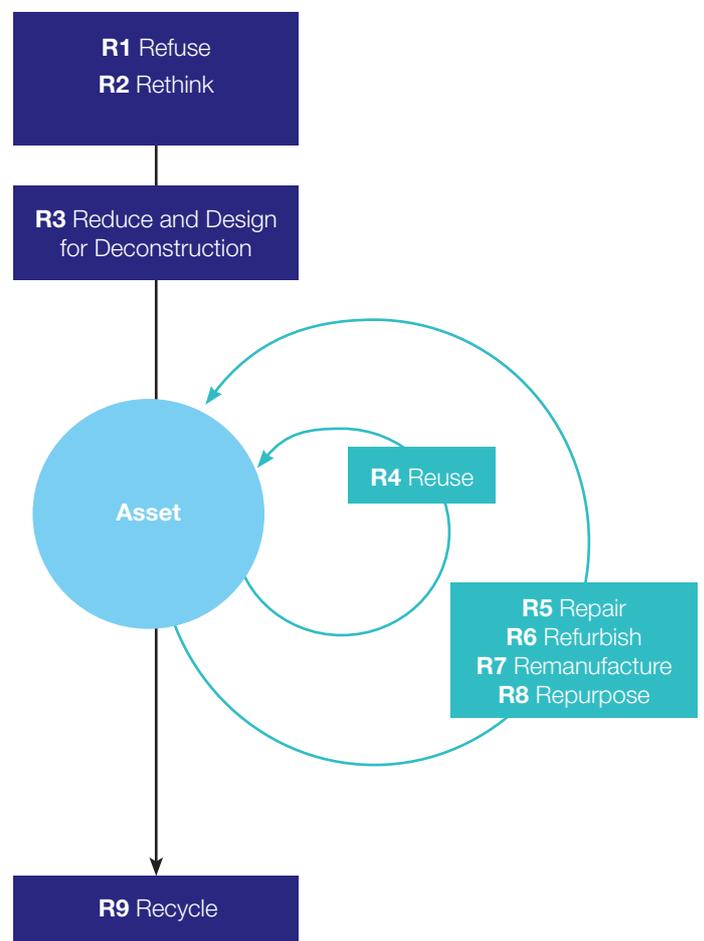
R6. Refurbish an old asset and bring it up to date e.g. upgrading existing signage to align with new symbology, rather than producing new signage.

R7. Use parts of a discarded asset in a new asset with the same function e.g. incorporating reused modular components in new construction.

R8. Use discarded asset or its parts in a new asset with a different function e.g. upcycling end-of-life materials for use in pavement design.

R9. Recover and process materials to obtain the same (high grade) or lower (low grade) quality. eg processing construction materials for reuse in construction, operation and maintenance projects.

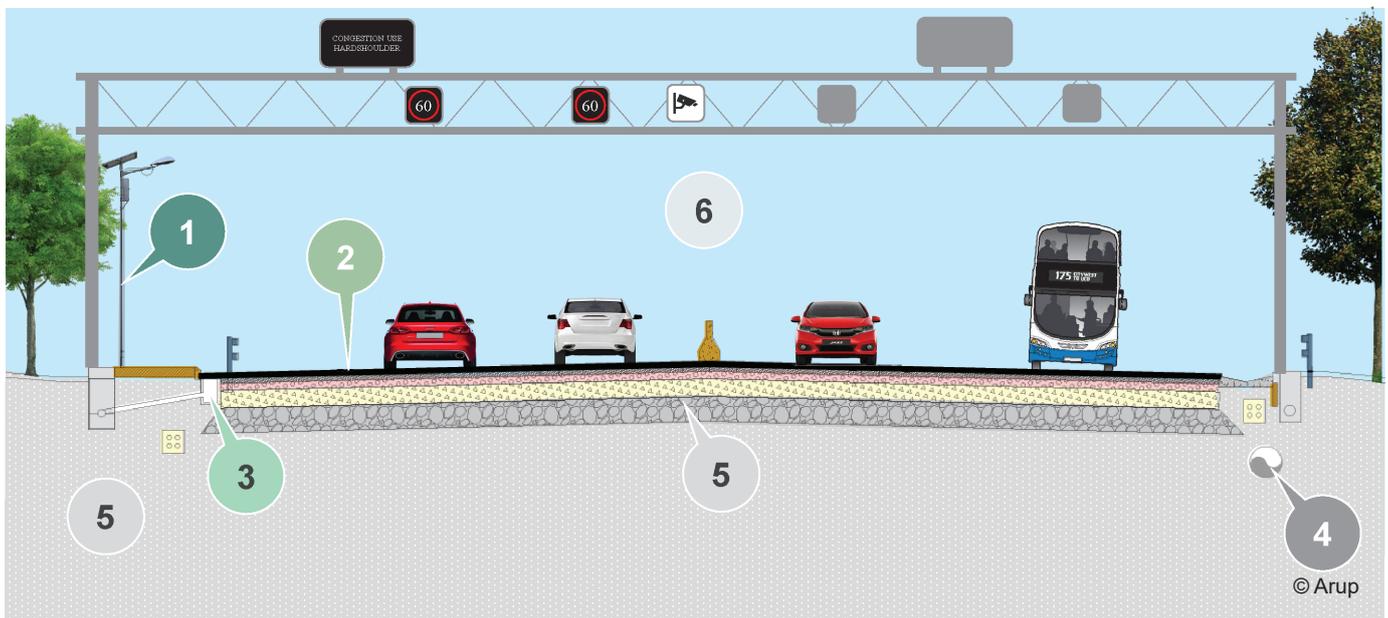
Figure 1: 9R Categorisation of Circular Economy Strategies



Layers of Change Design Concept

Roads are made up of a collection of components and materials with varying life durations. Shorter life components and materials are replaced regularly, and they interact with longer life duration components and materials in the road cross section. The layers of change design concept is based on grouping components of similar life duration such that when change is required non-destructive adaptability, replacement and maintenance are feasible. Figure 2 presents an example of its application on a Road Cross Section.

Figure 2: Layers of Change design concept



1 The items next to or around the carriageway, and how the carriageway is laid out, e.g. road markings, gantries and guardrails.

5-25 years

2 The wearing course, median barriers and any verge material packed on top of the lower layers (typically fill).

10-50 years

3 Shallow services are those services closer to the surface which are maintained more often such as internal drainage, ducting and cables

10-25 years

4 Deep services are those services that are typically maintained or replaced less often, and often have their own access system through the layers, e.g. sewers and external drainage

10-50 years

5 The formation of the road - a combination of earthworks and structures.

50-200 years

6 Site is the fixed location of the road and the geographical setting.

Outlasting All

System is the wider network the road is part of, e.g. a transport, economic or city network.

New appropriate models will be used which strike a balance between economic, environmental and social costs. Guidance on LCA and procurement will be published.

Capturing Value along the Asset Lifecycle

The TII Circular Economy Strategy is taking a life-cycle approach to resource consumption and asset management. Materials re-use, data gathering and circular procurement are considered by TII at every stage of the asset life cycle.

At each stage of the project lifecycle TII and its partners have the ability to capture value and increase circularity. During the construction phase significant resources are consumed. Also during operation, maintenance, upgrade, and reuse, large quantities of resources are utilised, providing opportunities to achieve circular economy objectives.

Figure 3 below plots the scale of resource consumption along the lifecycle of a typical project.

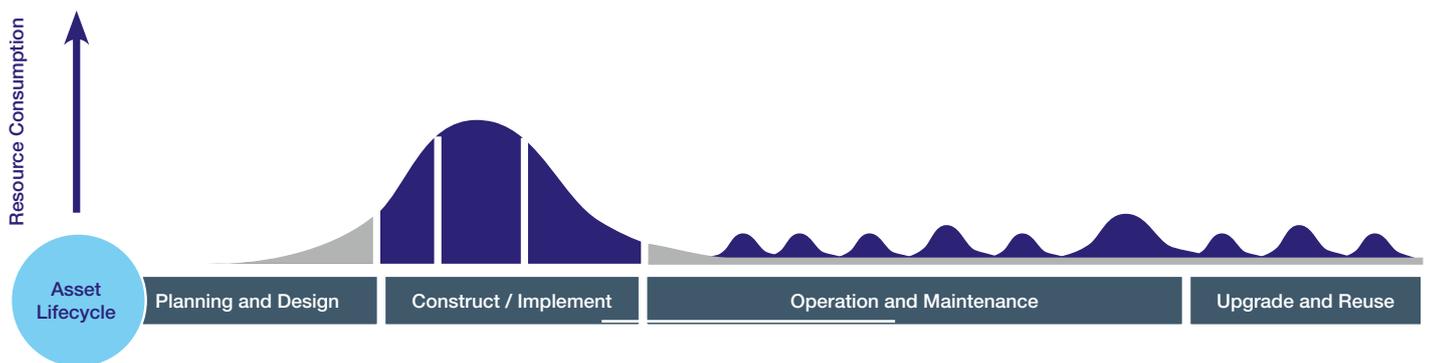


Figure 3: Resource Consumption Along the Asset Lifecycle



Industry Collaboration & EPDs

TII is working with industry to promote development of Environmental Product Declarations (EPDs) for construction materials. Environmental Product Declarations provide data on carbon and environmental performance of a product over its life cycle and allow informed evidence-based decisions to be reached on the circularity of design choices and options.

TII will commence the process of implementing material passport-type data gathering for assets, components and materials. Pilot projects will be undertaken.

TII is taking a materials management and collaborative approach to the circular economy, from a starting point of knowledge, understanding and optimisation of material management.

To support a lifecycle approach to project planning, it is proposed to create Circular Lifecycle Workbooks to inform the practical implementation of TII's circular economy actions in TII funded projects and programmes. This will strengthen the link between the planning and design phase of projects, operation, maintenance, and upgrade / end-of-life.

How do we reduce the impact of resource consumption?

This can be achieved by smarter materials management.

Dunkettle Interchange



Dunkettle Interchange Upgrade Scheme

The Contractor in tandem with the Employer pursued a successful strategy in sourcing general fill material for the scheme. Nearby developments supplied over 450,000t of general embankment fill material of Class 1 & 2 required by the scheme. This took place under Article 27 notification to the EPA. This led to a significant reduction in the carbon footprint of the scheme associated with material transportation. Fill material was sourced from sites on average within an 8km radius of the site while the closest licenced quarry source for such material is approximately 15km from site. There is also the benefit of waste prevention and avoidance of landfill disposal. Topsoil (3,000t) has also been sourced under an Article 27 notification with resulting carbon reduction benefits to the scheme.

A value hierarchy approach is being taken to materials management with the objective of moving materials management up the value chain through systems re-engineering. A sample value hierarchy for asphalt reuse is presented in Figure 4 below. Where generation of asphalt is unavoidable the highest value management option is depicted at the top of the ladder. The higher up the ladder a reuse option sits the more value is retained on the transport network.

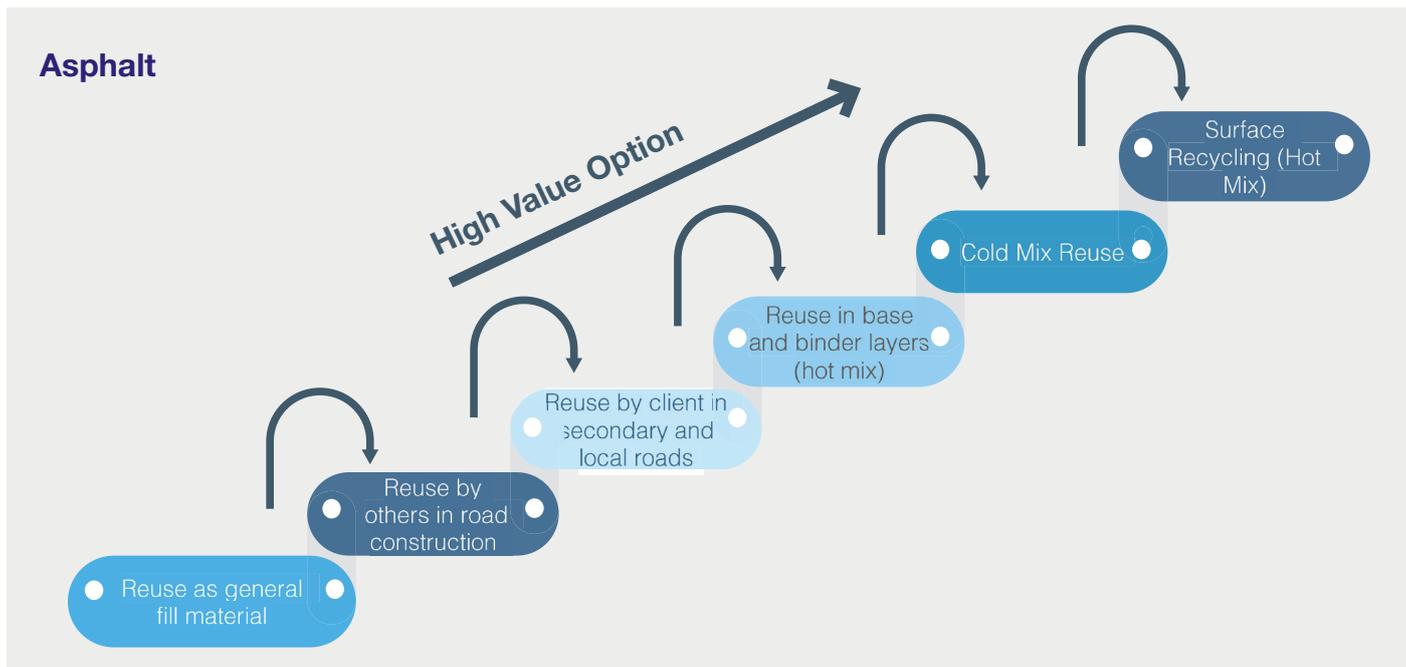


Figure 4: Sample Value Hierarchy for Asphalt Reuse

The circular economy is the means of enabling reuse of material, through systems re-engineering. Material should be reused at its highest value³ and as close to its source as possible, to reduce environmental impact, biodiversity loss and carbon emissions.

The TII Circular Economy Policy and Strategy aim to capture and retain value throughout the whole lifecycle of assets, not just at its end-of-life.

The national road network is of strategic significance to the Irish economy and is currently valued at in excess of €30 billion. Circular economy principles, applied along all stages of an asset's life cycle, support value capture and retention. The approach applies equally to roads, light rail and greenways.

The Environmental Protection Agency reports that 3.6 million tonnes of by-products were reused in Ireland in 2018, however much of this is "downcycling" where much of its inherent value is lost.

The circular economy systemic approach provides a significant opportunity to avoid value loss.

Note 3: Reuse of an asset component or material which seeks to give the highest possible economic, environmental and social value to the asset component or material, subject to technical and economic viability.

Data gathering will commence relating to resource consumption using asset management systems . The pavement asset management system will be first to be updated.

Through introduction of circular economy principles into asset management, value is captured and retained. The TII approach to asset management is shown in Figure 5.

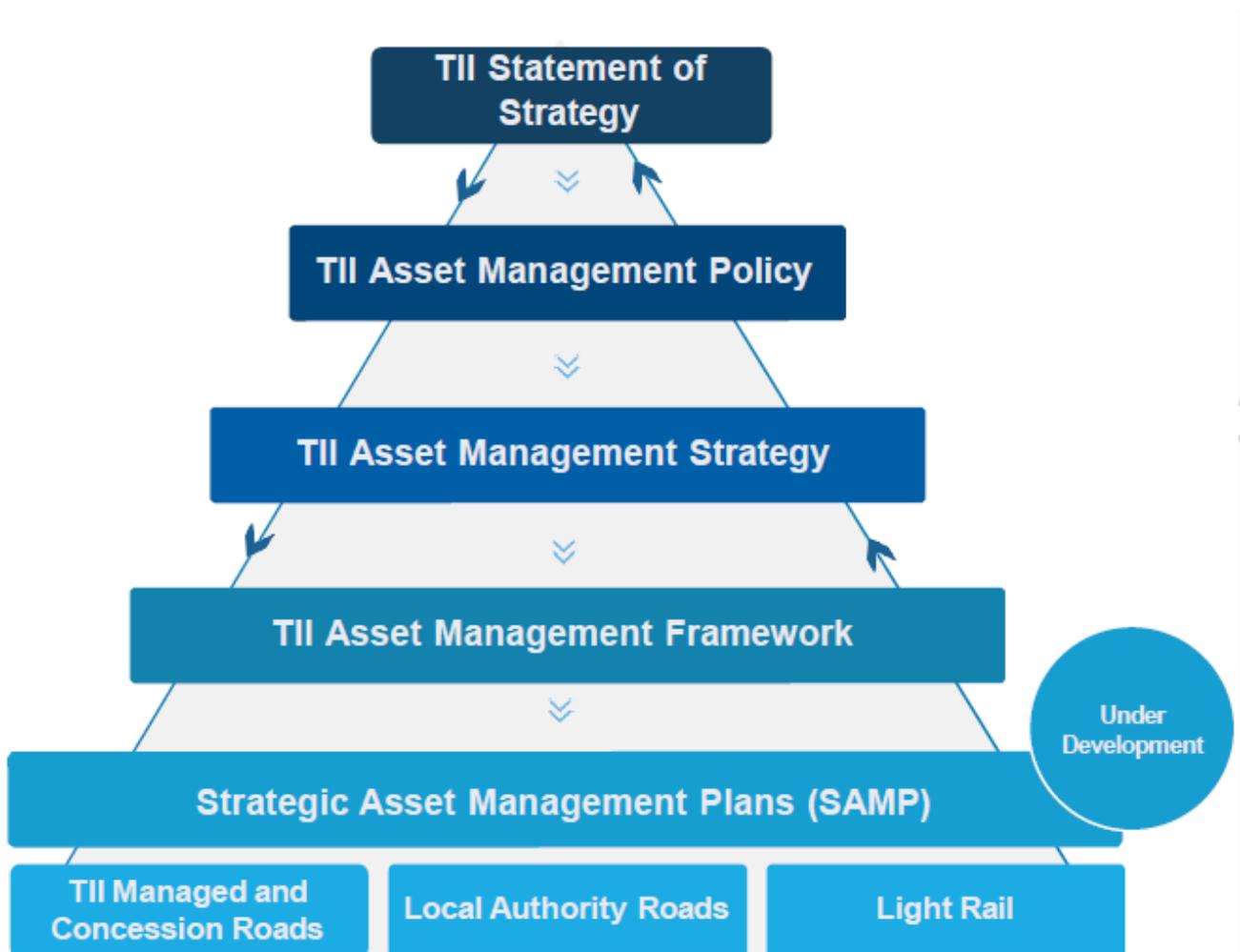


Figure 5: TII approach to asset management

Collaboration

The TII Circular Economy External Collaboration Committee will continue to meet to promote implementation of circularity and adoption of TII's Sustainability Implementation Plan.

N26 Cloongullane, Beam lift



Collaboration with various industry stakeholders will take place as required. Pilots and trials, undertaken with industry, are playing a key role in TII's transition from a linear, to a circular approach.

The following organisations have engaged with TII to collaborate on developing a strategy to transition to a circular economy in construction and transport:

Department of Transport

Department of the Environment
Climate Change and Communications

Environmental Protection Agency

National Standards Authority of Ireland

TII has created an external collaboration committee to support it in creation of its Circular Economy Plan.

TII Circular Economy External Collaboration Committee Members

Association of Consulting Engineers of Ireland
Cement Manufacturers Ireland
City and County Managers Association
Construction Industry Federation
Engineers Ireland Geotechnical Society
Institute of Asphalt Technology
Institute of Geologists

Irish Asphalt Pavement Association
Irish Concrete Federation
Irish Concrete Society
National Standards Authority of Ireland
Pavement Management Services Ltd
Road Management Office

Many technical functional systems interact in delivery of road, light rail and greenways projects. Examples are the government and regulatory system, materials supply system, construction industry system, energy systems and the users or local community systems, among many more.

In the transition to a circular economy new relationships between systems and actors are required. These include updates to standards, new materials and resource processing methods (e.g. recycling plant) and new relationships between systems (eg. take back systems) may be used for end-of-life components. Re-engineering of systems to deliver circularity is a key component of TII's transition to a circular approach. This is required at each stage along the asset lifecycle as depicted in Figure 6.

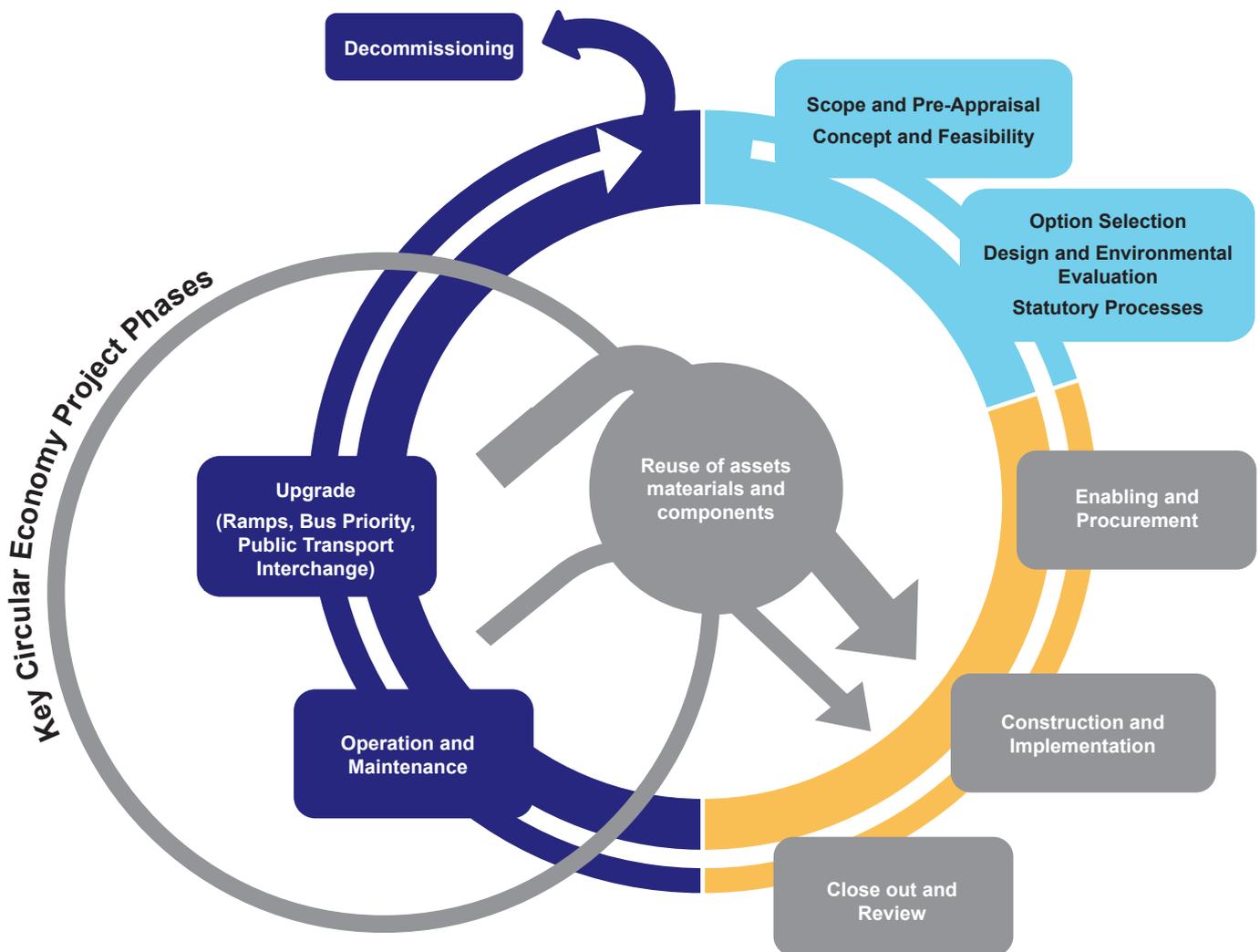


Figure 6: Key Circular Economy Lifecycle Phases

- TII will further embed whole life costing in procurement, this will be achieved through multiple pilot projects.
- The findings of these pilot projects will be incorporated into new guidance on LCA and procurement.

Procurement provides a lever to implement circular economy along supply chains and drive demand for circular products and services.

TII will enhance its role in the circular economy and its influence along its supply chain using sustainable and circular procurement principles.

TII will further embed whole life costing in procurement, taking account of environmental and social criteria as relevant to the procurements taking place.

Sustainable Procurement provides an opportunity for specification of refurbished products and components over new. It can be used to specify the use of reused and recycled assets, components and materials. Optimisation of design can be enabled through the use of tools such as the Irish Analytical Pavement Design Method (IAPDM) in procurement or through procurement of low energy asphalt for road construction, maintenance and renewal.

TII will embark on a series of innovation pilots to explore opportunities for circular procurement criteria.

N59 Moycullen Bypass



N22



Great Western Greenway

Steet Furniture made from Wind Turbine Blades

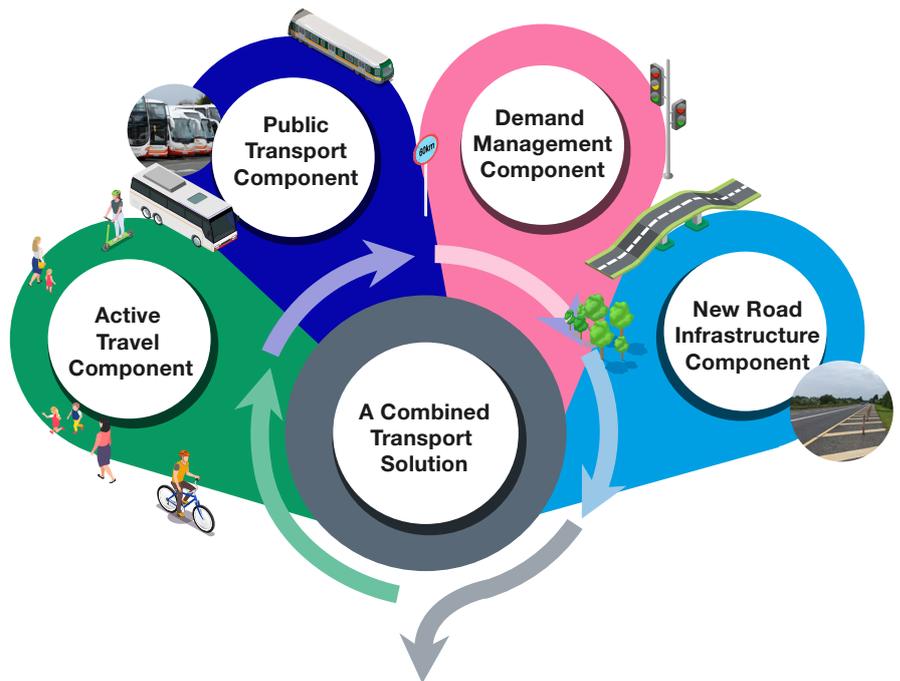
TII have commissioned the manufacture of bespoke street furniture made from end-of-life wind turbine blades as part of the Achill Sound to Cashel Section of the Great Western Greenway.

The end-of-life wind turbine blades, which had previously generated power for over 15 years in Ireland, are typically consigned to disposal. By repurposing the blade waste from the wind energy sector, this decouples the generation of renewable energy from the production of waste and promotes sustainability and circular economy. The furniture was manufactured by an Irish based company Blade Bridge.

N4 Carrick on Shannon to Dromod

A circular economy plan was prepared for the N4 Carrick on Shannon to Dromod Phase 1-4 project. Through mapping flows of resources and opportunities it aimed to make the project more circular. A key project objective is reducing the need for construction through local access interventions and enhancing active travel. The project aims to have net zero import and export of earthworks materials through identification of local deposition areas and borrow pits.

The Transport Vision for the N4 Corridor All elements of transport working together...



...to achieve an integrated sustainable solution.

Sustainability and the Circular Economy

This strategy contributes to achieving the United Nations Sustainable Development Goals (UN SDGs) as follows:

SDGs strongly and directly benefitting from TII CE practices



SDGs indirectly benefitting from TII CE practices



 Ionad Ghnó Gheata na Páirce,
Stráid Gheata na Páirce,
Baile Átha Cliath 8, D08 DK10, Éire

 Parkgate Business Centre,
Parkgate Street,
Dublin 8, D08 DK10, Ireland

 +353 (01) 646 3600

 +353 (01) 646 3601

 www.tii.ie

 info@tii.ie

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