Welcome

9 March 2023

Improved management and use of construction and demolition waste in Australian road infrastructure

Sustainable Built Environment National Research Centre

Griffith UNIVERSITY Queensland, Australia

RMIT UNIVERSITY

Curtin University

Acknowledgement of country

We acknowledge the people who are the traditional custodians of the land, pay respect to the Elders, past and present, and extend that respect to other Aboriginal and Torres Strait Islander peoples.

Who are we?

Professor Tim Ryley

Dr Savindi Caldera

The team has extensive industry based research experience in construction and demolition waste management, climate change, sustainable business practice, cleaner production and circular economy.

Griffith UNIVERSITY
Cities Research Institute

Sustainable Built Environment National Research Centre

C&D Waste Project Research Pathway (2018-2023)

Sustainable Built Environment National Research Centre AUSTRALIA

1.65 A National Economic Approach to Improved Management of Construction and Demolition Waste

Completed (2018-2020)

1.75 Creation and Stimulation of End Markets for Construction and Demolition Waste

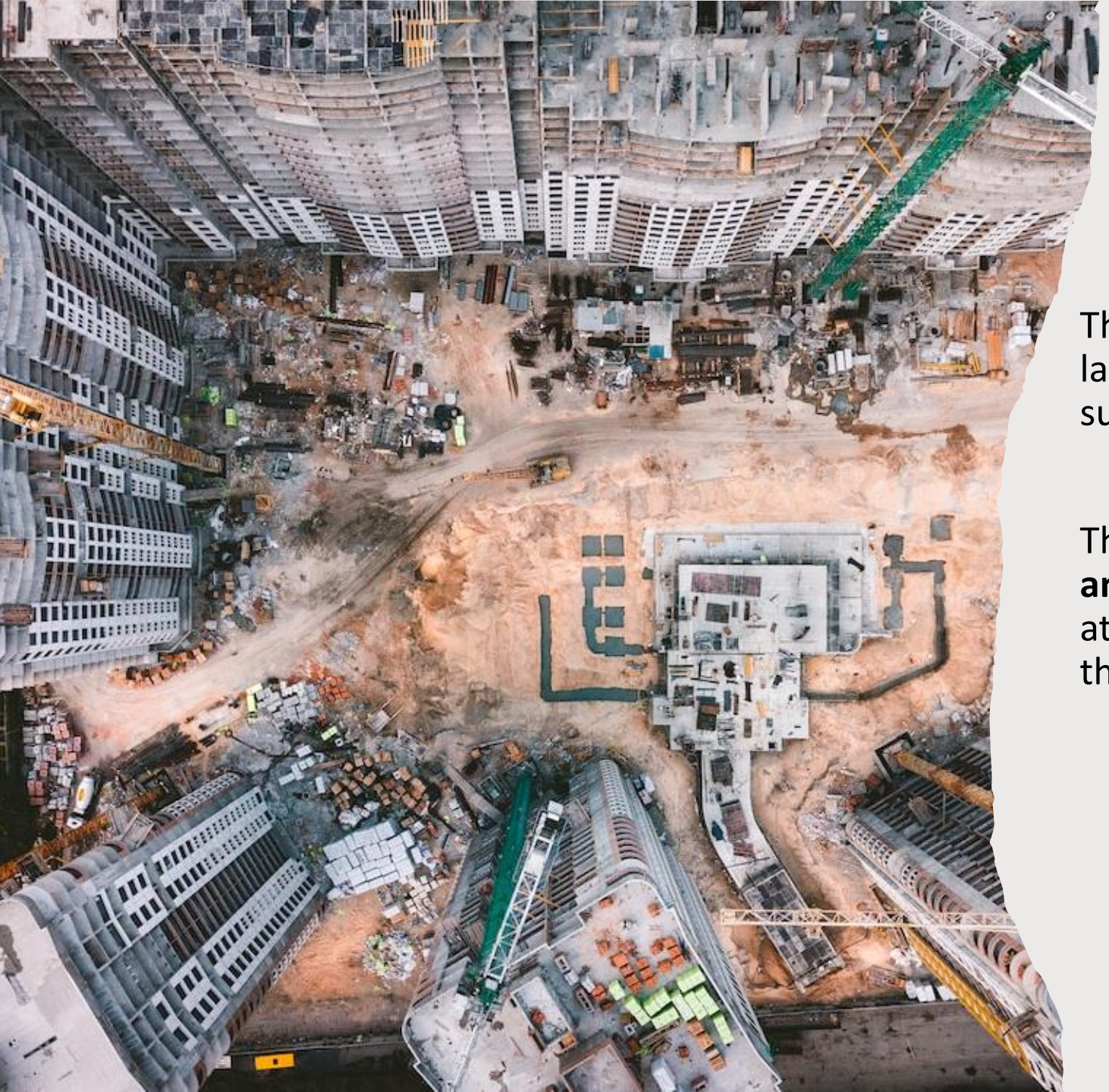
Completed (2020-2021)

1.85 Enhancing the Use of Products with Recycled Contents in the Australian Construction Industry

In progress (2021-2023)

Course content

1. Understand the significance of the waste problem
2. Describe the types of C&D materials and market opportunities
3. Learn and identify opportunities for creating a circular economy



Understanding the problem

The construction sector is one of the world's largest consumers of energy and raw materials such as concrete, steel and cement.

The construction industry uses **35% of energy and releases 40% of carbon dioxide** into the atmosphere (Luangcharoenrat et al., 2019), at the global level.

SUSTAINABLE DEVELOPMENT GOALS

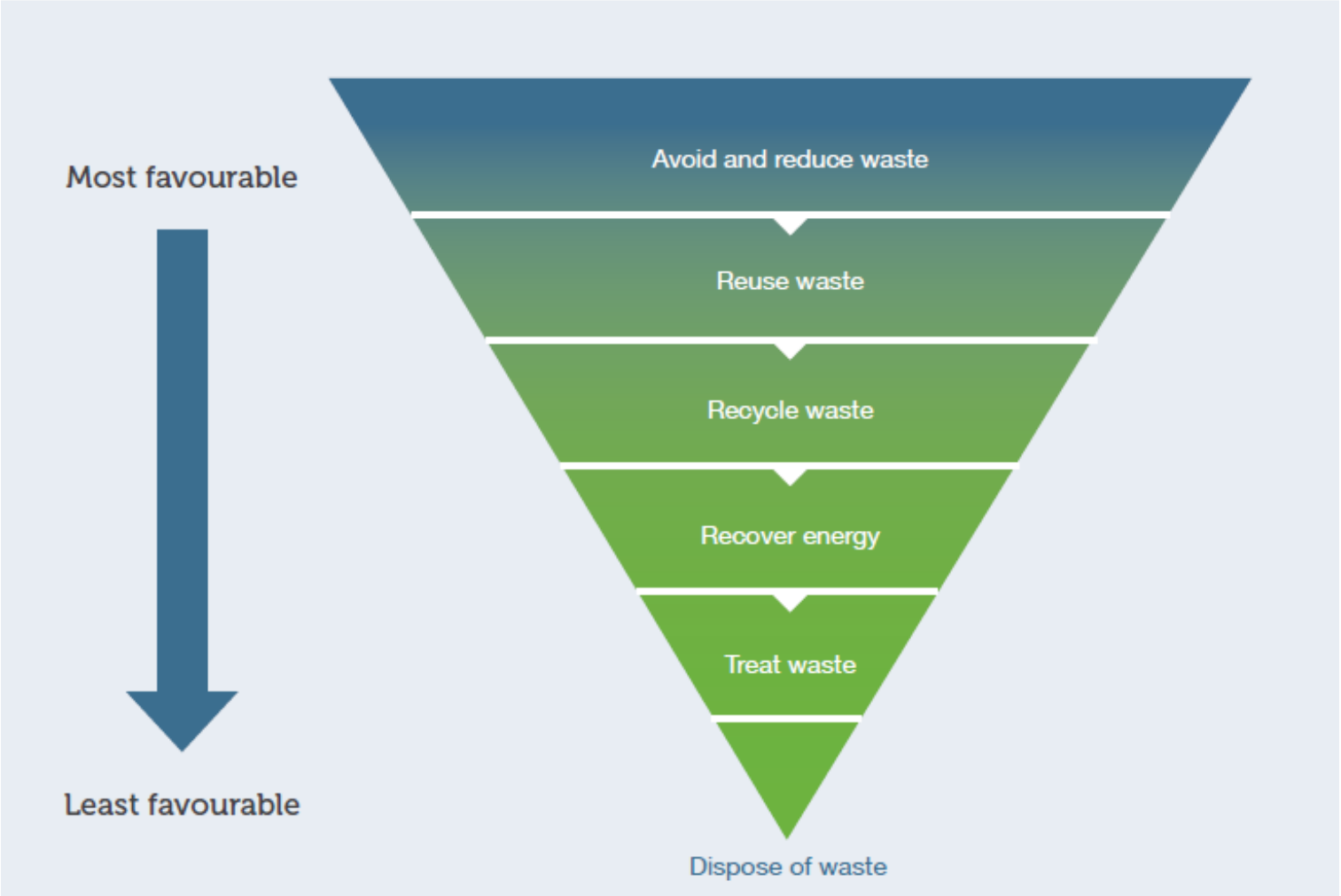
What is Construction and Demolition (C&D) waste?

The waste generated by the economic activities involving the construction, maintenance, demolition and deconstruction of buildings and civil works

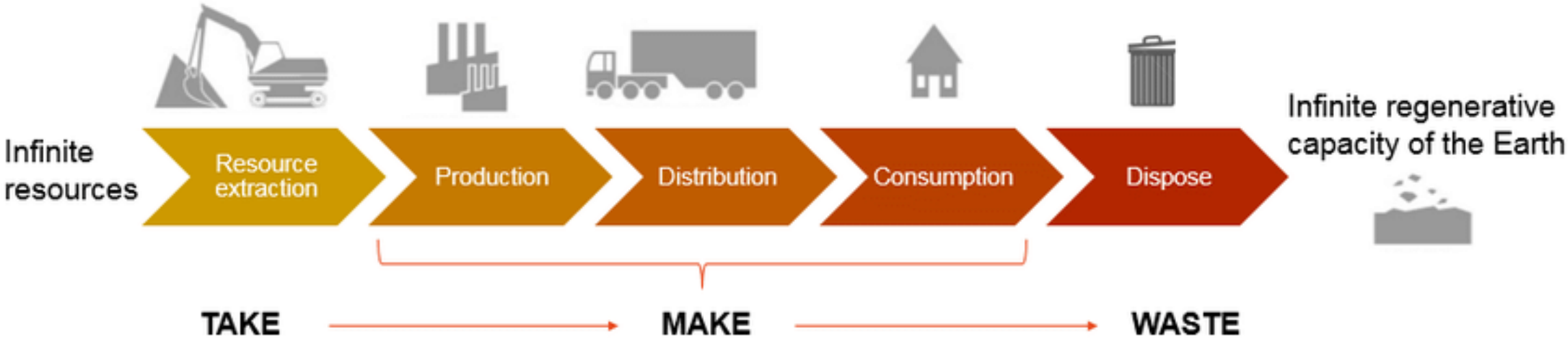
Let’s re-think…

A resource material after construction, renovation and demolition activities, which needs to be transported from the site and has the potential to be repurposed through downcycling or upcycling

The waste hierarchy



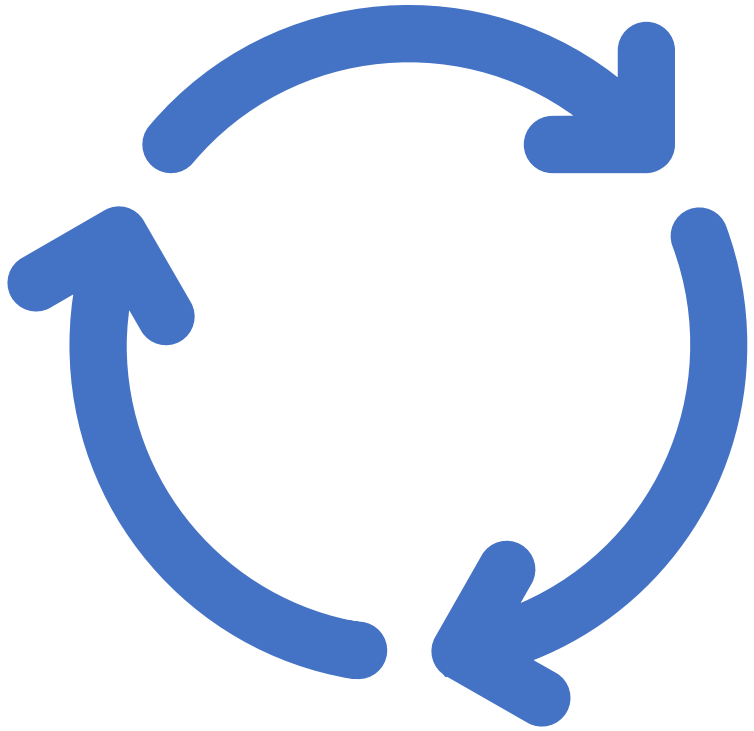
Linear economy



- Our current economic model relies on the traditional linear economy (take-make-waste)
- Leads to increasing pressure on finite resources
- Generates significant waste and emissions

Source: Wautelet, T. (2018). Exploring the role of independent retailers in the circular economy: a case study approach. European University for Economics and Management.
Figure: https://www.researchgate.net/figure/The-linear-economy-The-take-make-and-waste-approach-of-production_fig2_323809440

Why do need to shift to a circular economy?



Extends the life of products and materials prevents the over-generation of waste and recovers the full value of products

Creates new business opportunities and revenue streams

Minimises the environmental impact of mining, resource extraction, refining and manufacture.

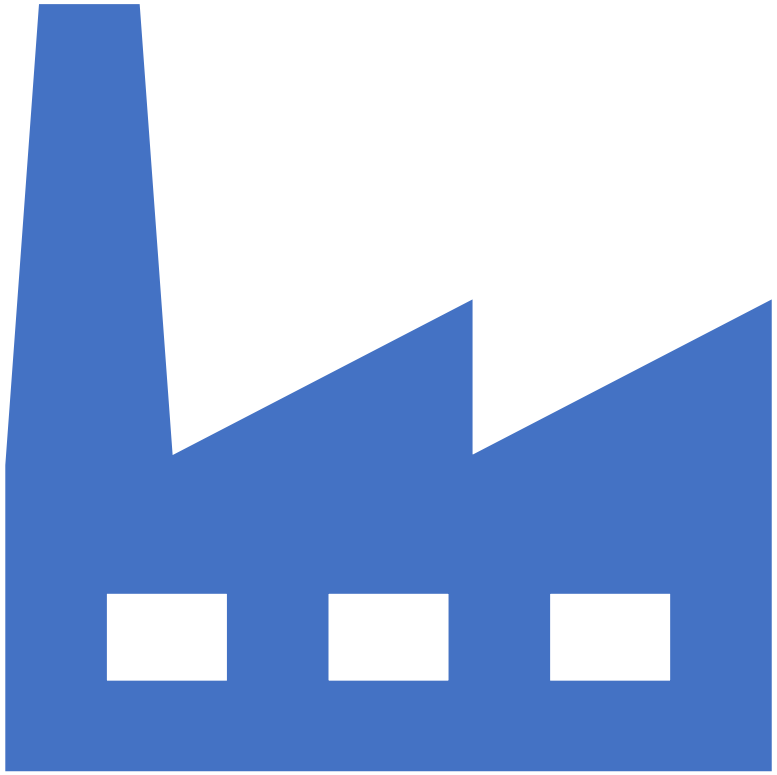
What is Circular Economy?

A system that acquires and transforms material and energy in ways that extend their utility to us and future generations

Three principles

1. Design out waste and pollution
2. Keep products and materials in use
3. Regenerate natural systems

Source: https://archive.ellenmacarthurfoundation.org/explore/the-circular-economy-in-detail



Extended producer responsibility

The producer/manufacturer of a product is economically connected to the product beyond a simple sales transaction.

- Leasing products instead of selling them.
- Promising to pay the consumer at the product's end of life.

Who contribute to C&D waste management decisions in Australia?

Source: Construction and Demolition Waste Management in Australia Final Industry Report, Project 1.65 (Maqsood, Shooshtarian, Wong, Yang, Khalfan, Ryley, Caldera, 2020)

Question 1

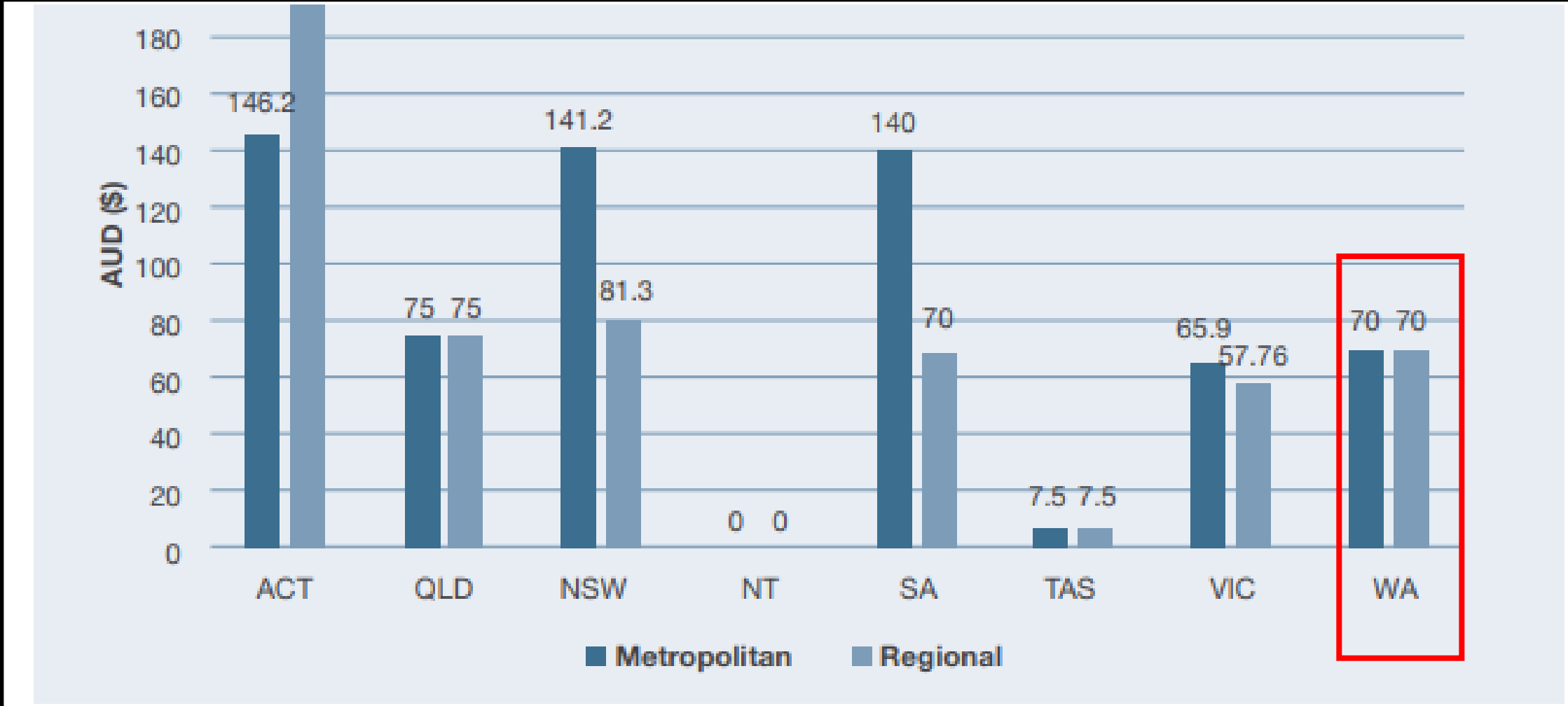
Which of the following SDG is the most relevant for your work

1. Industry innovation and infrastructure [SDG 9]
2. Sustainable cities and communities [SGD 11]
3. Responsible consumption and production [SDG 12]
4. Climate action [SDG 13]

Question 2

Which aspect of circular economy is most important to you?

1. Less landfill waste
2. Re-use of material
3. Environmental benefits



Question 3: Do landfill levies encourage recycling and resource recovery?

Materials and market opportunities

Material 1: Concrete

- Used for road, bridge and building construction
- Concrete is one of the more widely used building materials
- Concrete makes up the greatest proportion of masonry material recycled in Australia (around 60%)

Let’s apply the 3Rs

- Reduce – it is common practice to have extra concrete ready when building some elements on site. It could be possible to have another pour ready that could be staged and use the remaining concrete
- Reuse - use recycled concrete in non-structural elements
- Recycle - use crushed recycled concrete on pavements

Concrete: Circular Economy Opportunities

Recognise

Recognise that recycled concrete aggregate (RCA), when produced to conform to the standard specification criteria, is a technically viable alternative

Improve

Improve onsite separation to sort concrete waste material from other C&D waste

Utilise

Utilise advanced density separation techniques to grade crushed concrete fines to increase homogeneity and reduce the presence of foreign inclusions

Material 2: Glass

- Glass is a hard substance that may be transparent or translucent and is brittle in nature

- In infrastructural projects, the application of glass includes but is not limited to sound barriers and tunnels and as ingredients for road surfaces such as asphalt and insulators

How to reduce glass waste?

- Promote the use of glass aggregate in road constructions
- Improve the purity of cullet and prevent colour contamination to enhance the value and recyclability of cullet

Other opportunities

Plastic

- Recycled noise walls
- Plastic in streetlights
- Mechanical stabiliser of road layers

Rubber

Crumbed rubber for roads

Roads to Reuse

34,225 tonnes

34,225 tonnes of crushed recycled concrete used in road construction.

100,000 tonnes

Main Roads is now committed to using 100,000 tonnes of crushed recycled concrete within th
years and 200,000 tonnes in later years.

WARRIP

- 3.8 km of Kwinana Freeway and Marmion Avenue used for crumb rubber trials.
- Crumb rubber open graded asphalt used on almost one third of freeway resurfacing projec
- The equivalent of over 4,000 car tyres recycled, instead of going into landfill.

Turning Waste into Roads

Local example: Turning waste into roads

- Click on this link to access the video : https://annualreports.mainroads.wa.gov.au/AR-2020/welcome/our-stories/turning-waste-into-roads.html

Technical publications

Home > Business and industry > Technical publications > Project waste reporting

Project waste reporting

Under the Waste Reduction and Recycling Act 2011, we are required to report annually on the volumes of waste generated, reused, recycled and disposed to landfill and on progress contributing to the Queensland Government's waste reduction targets.

A significant part of our waste is generated from infrastructure construction and maintenance projects. Contractors are required to report on the waste generated from these projects. Reporting requirements are outlined in Technical Specifications MRTS51 Environmental Management.

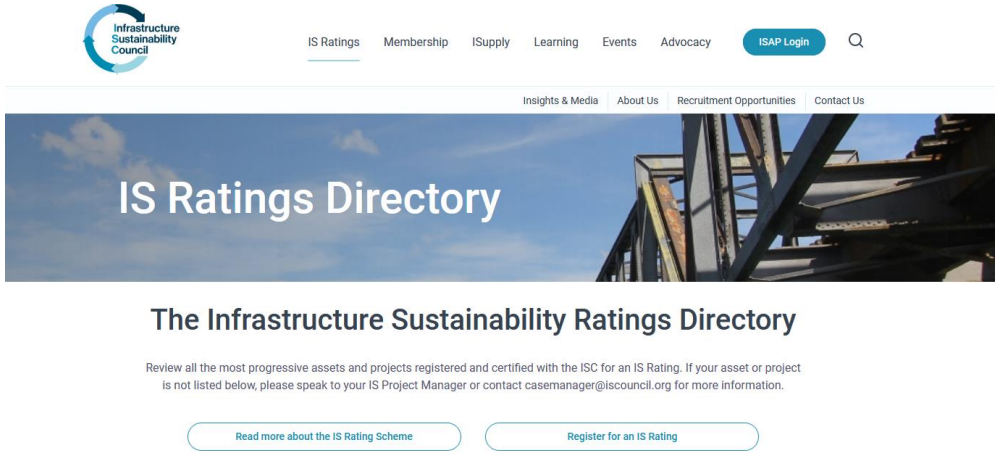
To help contractors and infrastructure designers to better plan project waste generation, management and diverting it from landfill, a waste estimate is required when:

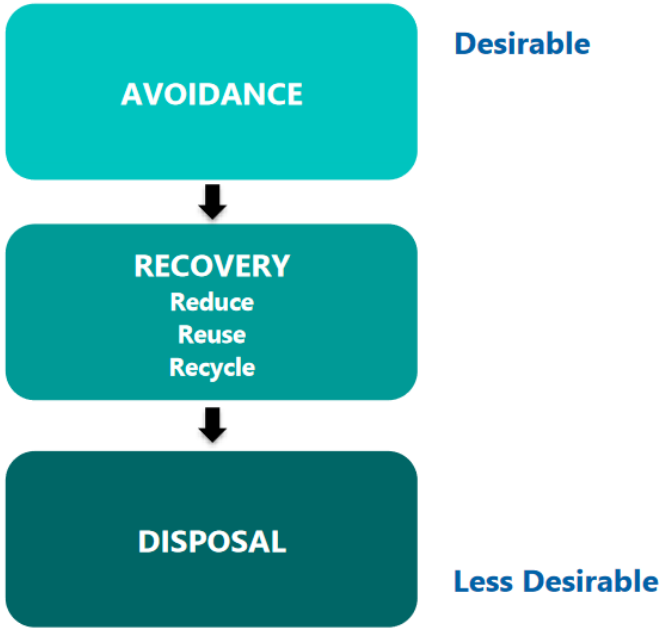
- the project is required to undergo a formal Infrastructure Sustainability Council (ISC) rating; includes the assessment and management of waste and construction materials (when the infrastructure project over $100M).
- the project/contractor is required to generate a waste estimate under C7558 Terms of Reference for Review of Environmental Factors.

Read the Waste 2 Resource Strategy to find out how we plan on achieving our vision of becoming a zero waste organisation and transport industry sustainability leader through circular economy practices.

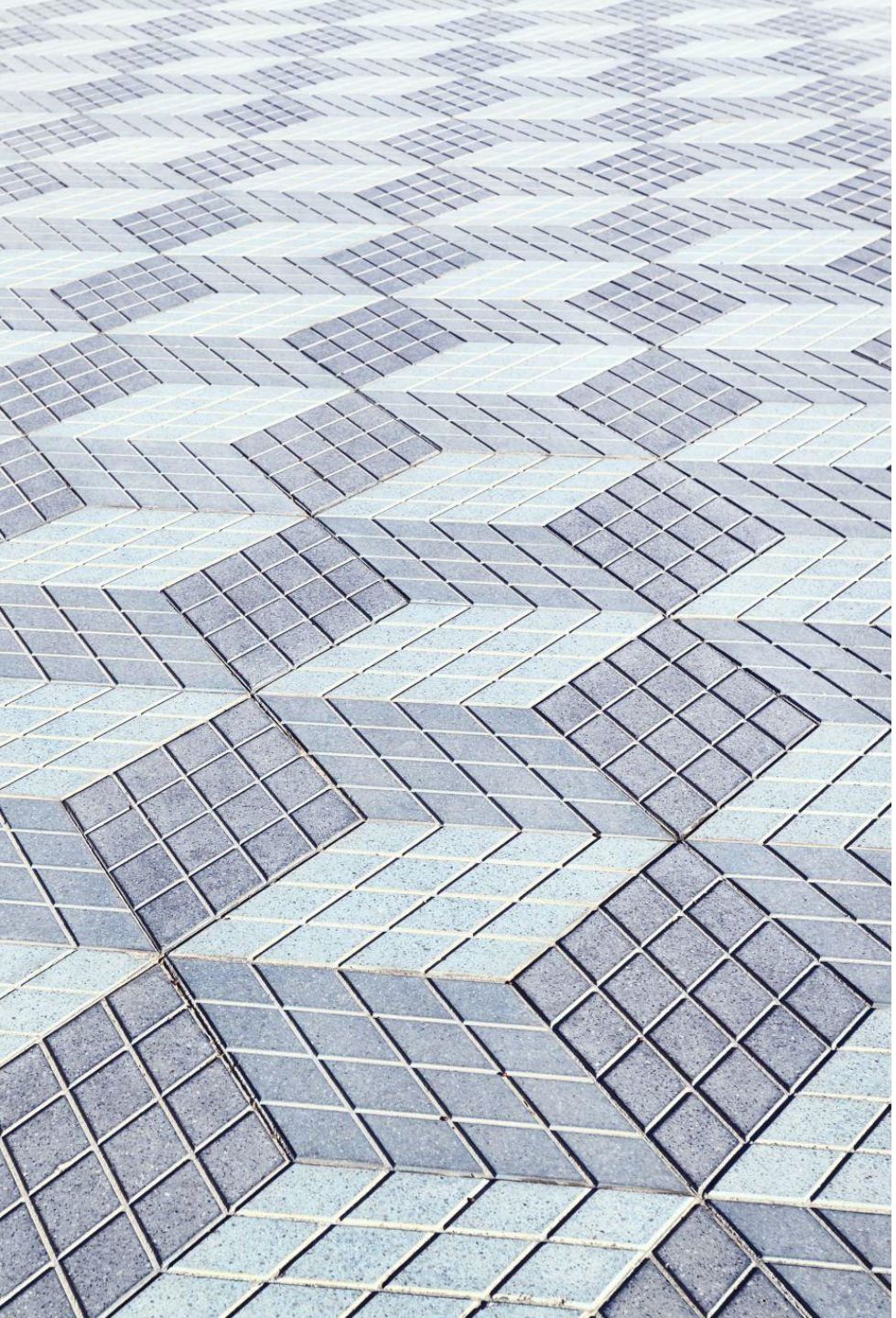
ISC requirements on recyclable and reusable material use

ISC rewards the development and implementation of Resource Efficiency Strategies, and associated Resource Efficiency Action Plans.





Recycled and Sustainable Materials at Main Roads Reference Guide, Main Roads, WA 2022



Question 4

Which C&D waste material has the most potential for creating a circular economy in your organisation?

1. Concrete
2. Glass
3. Plastic
4. Rubber

CASE STUDY: MORDIALLOC FREEWAY (TRANSPORT)

- 75% recycled plastic rotationally moulded panel (RMP) noise walls (10 km of noise walls using 600 tonnes of plastic waste equalling to 32,000 m^2)
- 100% recycled subbase pavement materials and 44% PwRC in asphalt pavements (over 270,000 tonnes of pavement material incorporating the maximum allowable recycled content)
- 10% crushed glass and 30% reclaimed asphalt product in the asphalt pavement
- 100% recycled polypropylene plastic (PP) concrete reinforcing mesh (30 tonnes of plastic waste)
- 100% recycled high-density polyethene (HDPE) stormwater drainage pipe (4.6 km installed totalling 75 tonnes of plastic waste)

How can waste trading help?

With an increasing volume of C&D waste going into landfill sites, there are urgent calls to divert waste from the landfill

The creation of markets for recycled C&D waste is a solution that benefits both society and industry

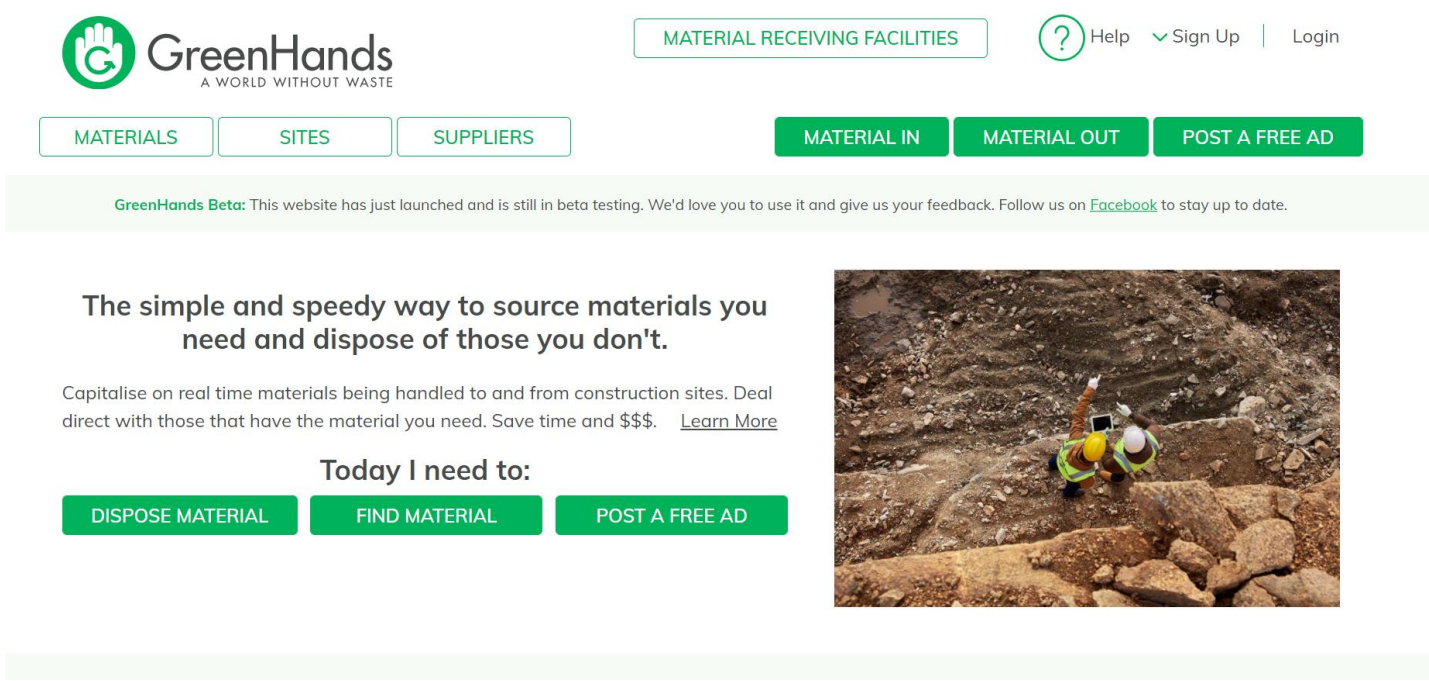
Key benefits: lower disposal costs for the waste producer and the aggregate user, together with lower environmental costs for the society

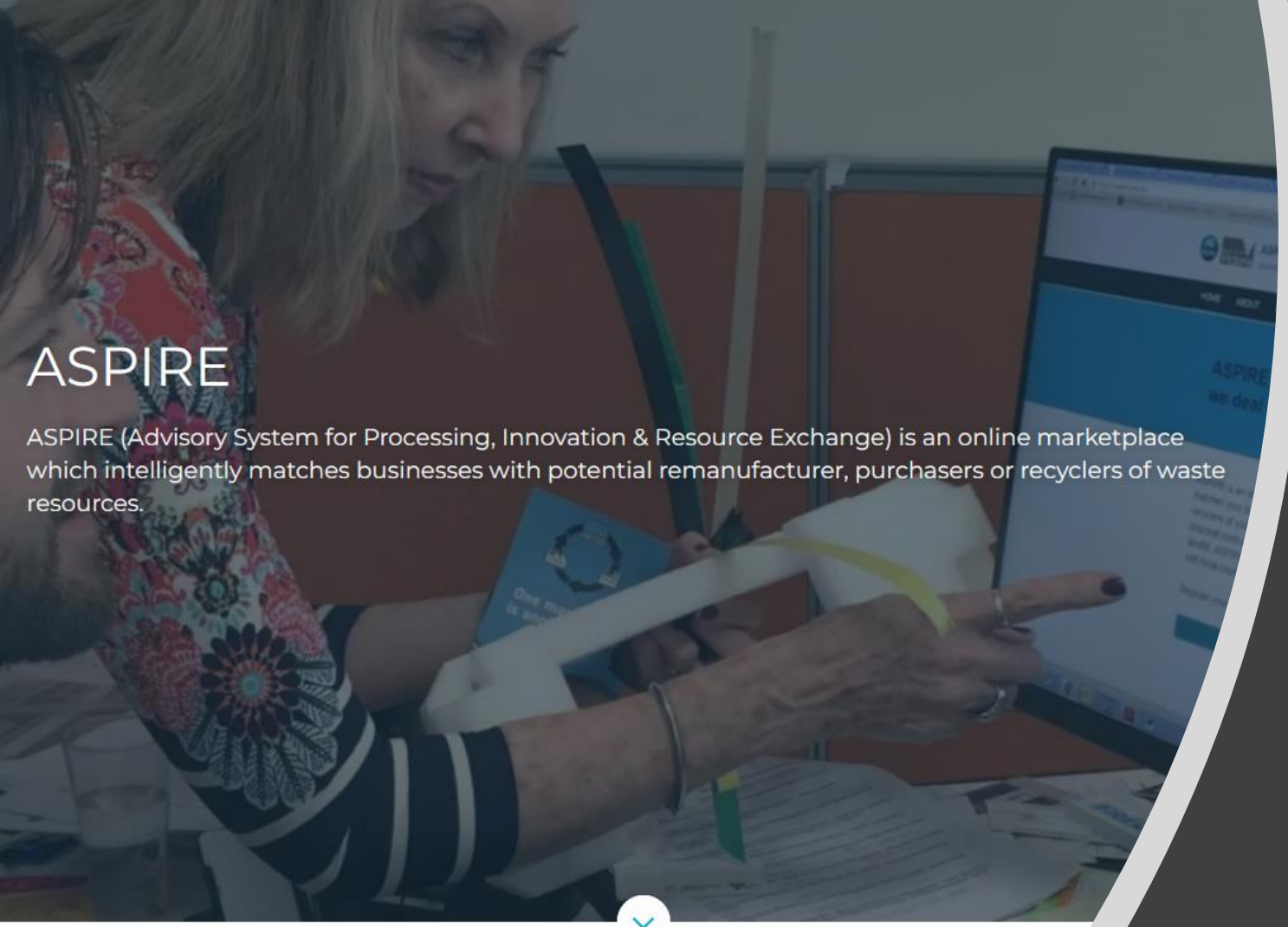
C&D waste end-market snapshot

Potential end-markets for various C&D waste resources in three states of Australia – NSW, Victoria and WA – are shown in Figure 1. These three states have the largest quantity of waste materials, based on available information.

Figure 1: Potential end-markets for C&D waste

Example 1: Waste trading platform





ASPIRE is an Australian example of industrial symbiosis where a digital tool supports a social busi
region. ASPIRE extends beyond passive digital systems, where information is posted by 'seller
one step further than a passive waste exchange by actively suggesting business to busines
developed in response to manufacturing companies talking to their local councils about

Example 2:An Australian example of industrial symbiosis where a digital tool supports a social business network

CE Guidelines for the built environment and alignment with the EMF CE principles

Broader Scope	Strategy	Alignment with EMF CE principles		
		Design out waste and pollution	Keep products and materials in use	Regenerate natural systems
Circularity practices	Circular economy procurement	H	H	M
	Design for Deconstruction (DfD)	H	M	L
	Design for flexibility and adaptability	M	H	L
	Design for long life	H	H	L
	Eliminate building components	H	L	L
	Reuse building/building elements	H	H	M
	Restore and regenerate	L	L	H
	Design out hazardous/pollutant materials	M	L	H
	Climate resilient design	M	L	H
	Sharing economy/shared space	M	H	L
Resource management	Waste prevention on the construction site	M	H	L
	Material/component recycling	H	H	L
Innovation and optimisation	Use of digital technology (e.g. material passports)	M	M	L
	Construction Innovation (e.g. modular construction)	M	L	M
	Green supply chain (e.g. use of bio-based materials)	H	L	H
	Use and integration of sustainable technology	H	L	M


Questions

Hope you enjoyed the course!

Here is the link to the survey and details for the certificate of participation https://forms.office.com/r/QNwgBide5K

Feel free to contact us if you have any questions.

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