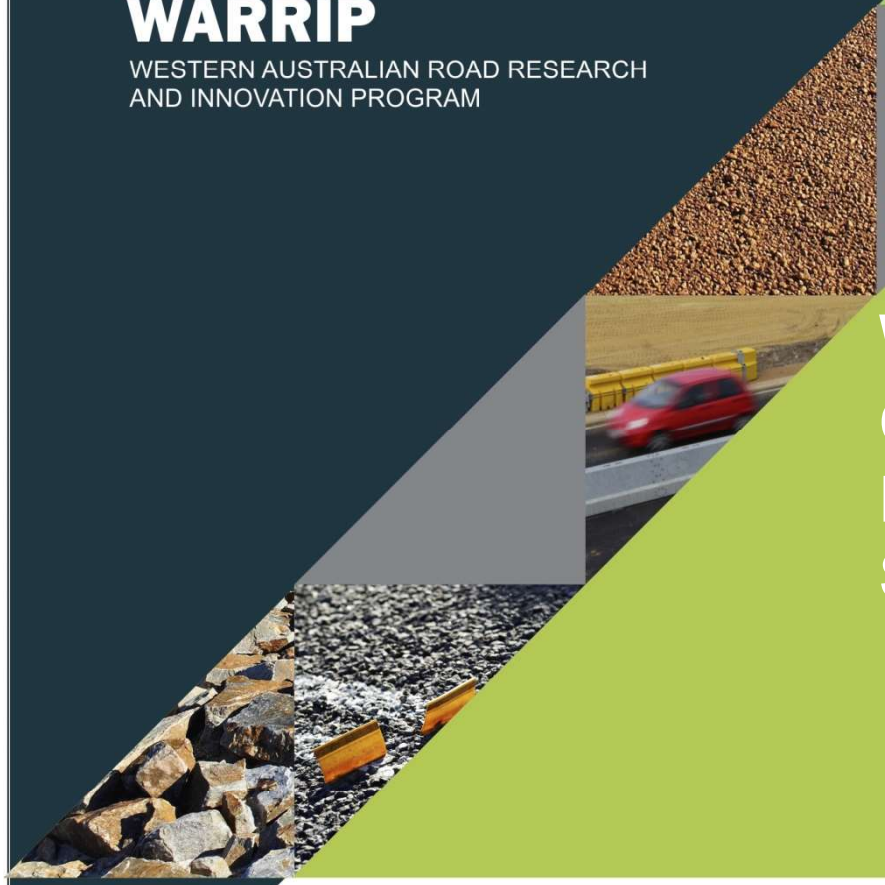
WARRIP

WESTERN AUSTRALIAN ROAD RESEARCH AND INNOVATION PROGRAM



WARRIP 2020-004
Optimising the Use of Recycled Materials in Granular Support Layers in WA

AN INITIATIVE BY:

THE GOVERNMENT OF WESTERN AUSTRALIA

mainroads WESTERN AUSTRALIA

arrb

Objectives

- Increasing the use of recycled materials in granular support layers when applicable, particularly where they result in a cost saving and environmental benefits.
- Identifying uses of recycled material to improve pavement performance while diverting landfill.
- Identify potential upcycled products to make better use of recycled materials.
- Evaluate design properties of potential new products and provide design guidance.

Overview

- Review the Western Australian waste stream and existing markets to facilitate the development of new technologies incorporating recycled materials, focusing on:
  - Recycled crushed glass (RCG)
  - Crusher dust

Background

- Substantial crusher dust quantities are produced which may be used for high-value applications.

- Historically in WA, recycling of waste materials in civil infrastructure has been low.
- Tonnes of glass are processed into cullet in WA but the nearest cullet reprocessing facility is in SA.

Recycled Crushed Glass (RCG)

Source: ABC (2019).

- Produced primarily from container glass.
- Collected in municipal waste.

Source: Balkan Green Energy News (2016).

- Crushed into small particles.
- Typically requires colour and other sorting for new containers.

Source: Open Access Government (2019).

- Mixed coloured and fine glass commonly sent to landfill.

- No colour sorting in pavement construction

Crusher Dust

- Fine fraction of crushed stone after primary and secondary crushing
- Produced at approx. 8% to 25% of the total mined aggregate.
- May be used for structural and non-structural applications.

Source: Mineral Crushing Services (2017).

Current Main Roads Specifications

- Specification 302 permits up to 20% RCG blend for embankment construction.
- RCG does not meet current drainage or bedding material specifications.
- RCG is not precluded for drainage backfill.
- Crusher dust permitted as subject to design considerations and compliance.

National Practice (State Road Agencies)

- Recycled crushed glass:
  - Victoria have the most applications (limit not specified)
- Crusher dust:
  - No state road agency specifically permits usage

Criteria	WA	Qld	NSW	Victoria	NT
Materials permitted	• RCG (MRWA). • Crusher dust (City of Karratha).	• RCG	• RCG	• RCG	• RCG
Permitted uses	• RCG – embankment (up to 20%). • Crusher dust – subbase (up to 100%).	• Unbound granular drainage layer (up to 10%).	• Selected material for on top of natural subgrade (up to 5%).	• Drainage, structural material and permeable fill (no specified limit).	• Bedding material for drainage works (up to 100%).

International Practice

- Recycled crushed glass :
  - Up to 100% by mass in non-structural and drainage applications
- Crusher dust:
  - Up to 100% by mass as a fines replacement in subbase

Criteria	WA	New Zealand	Florida	Oregon	Vermont	Washington
Materials permitted	• RCG (MRWA). • Crusher dust (Karratha).	• RCG.	• Crusher dust.	• RCG.	• Crusher dust.	• RCG
Permitted uses	• RCG – embankment (up to 20%). • Crusher dust – subbase (up to 100%).	• Unbound granular subbase (up to 5%).	• Pavement structural layers (up to 100% passing the 9.36 mm sieve).	• Non-structural backfill (up to 100% by mass). • Drainage layer (up to 100%).	• Subbase filler (up to 90% passing 4.75 mm sieve).	• Non-structural and structural layers (up to 20%).

Benefits

- Recycled crushed glass:
  - Relatively free draining material
  - Blends have lower OMC
  - Reduced landfill
- Crusher dust:
  - Granular stabilisation of expansive materials
  - Permeable material
  - Reduced carbon footprint
  - Reuse of quarry by-products

Perceived Barriers to Implementation

- Recycled crushed glass:
  - Safety and environment
  - Practicability and constructability
  - Performance
  - Economic and sustainability considerations
- Crusher dust:
  - Safety and environment
  - Practicability and constructability
  - Permeability inversion and capillary rise

Market Survey: RCG

- RCG supply is variable
- Limited crushing facilities
- Perth's MRFs recycled approx. 75 000 tonnes of glass annually
- Generally, recovered glass is sent to Eastern states

Market Survey: Crusher Dust

- Production of crusher dust is substantial
- Currently used for landscaping applications
- Competing market may preclude increased usage

Next Steps

- Develop detailed laboratory testing program for locally-sourced RCG
- Develop potential product specification for a drainage blanket comprised of RCG to limit capillary rise
- Knowledge transfer activities
- Demonstration projects

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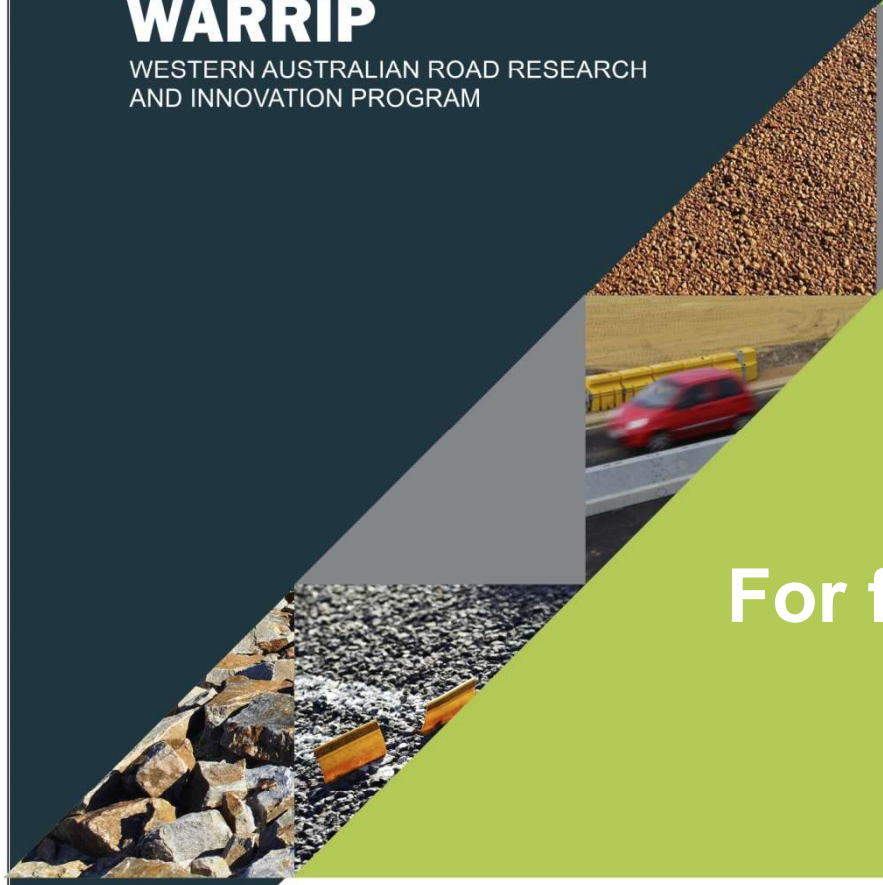

For further information visit the WARRIP website

www.warrip.com.au

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