

LG TRRIP practitioners' guidelines

Reclaimed Asphalt Pavement (RAP) in Asphalt Applications on Local Government Roads in WA

About LG TRRIP



The Local Government Transport and Roads Research and Innovation Program is a joint initiative between WALGA and Main Roads Western Australia.

LG TRRIP seeks to provide collaborative research that positively contributes to the design, construction and maintenance of safe, sustainable transport infrastructure for local government in Western Australia.

Our purpose



The objective of the program is to achieve better implementation of innovative practice by improving the specialist capability of local government through a collaborative program of projects which deliver advanced technology, cost effective and practical solutions.





Introduction to our projects



NTRO was engaged by WALGA and MRWA to develop a series of practitioners' guidelines

Projects in progress

- Crumb rubber in sprayed seals
- Crumb rubber in asphalt
- Catalogue of standard pavement profiles

Completed projects

- Rural low-cost LG safety treatments
- ► Guide for seal upgrade
- Sustainable construction
- Crushed recycled concrete

Meet the LG TRRIP champions



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Meet the team

Performance - NTRO





Performance - NTRO

6







Project objectives

► The project objectives

develop guidelines to facilitate the adoption of recycled content in WA local government roads where practicable

provide a simple reference to appropriate specifications for use

This project has developed

► a technical basis report

► a guideline for RAP in asphalt

This session

share the project outcomes and key learnings

▶ introduce the RAP in asphalt guideline



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Technical basis report

Desktop research and stakeholder engagement



The materials



Reclaimed asphalt pavement

- derives from the milling of existing asphalt or plant returns
- ▶ in 2021-22, 119,208 tonnes of asphalt were recovered in WA
- ideally reused locally in highest value application



Reclaimed asphalt pavement



- Incorporated back into asphalt either in situ at an asphalt plant
- In Australia, half of RAP generated is used in HMA
 - the remainder in base or subbase layers
- RAP management plans are critical documents that guide the processing, stockpiling and use of RAP materials



Reclaimed asphalt pavement



► In batch plants:

- RAP can either be transferred via a cold feed bin and weigh hopper into the pugmill at ambient temperature or added to the aggregates at discharge from the dryer
- In continuous (parallel or counter flow) asphalt plants:
 - The most common way of adding RAP in a parallel flow mixing drum is by using a split feed with separate inlets for the virgin materials and RAP



Benefits



► Performance

- mixes containing 15 wt.% RAP are typically found to have comparable performance and
- ► typically, do not require mix design adjustments

Environmental

- decreases waste to landfill
- decreases new material requirements
 - decreases quarrying activities and, hence, the deprivation of natural resources and emissions
 - decrease in emissions from haulage activities

Risks and mitigations



► RAP is considered as Inert Waste Type 1:

- ▶ non-flammable
- non-biodegradable
- chemically not reactive
- contains contaminants below specified limits

 RAP deriving from asphalt that did not contain recycled materials originally is not considered to pose any additional risks to WHS
 additional consideration may be required if RAP includes modifiers and

additives

- Use of rejuvenators in RAP may have some WHS and environmental impacts
 - should be considered on a case-by-case basis due to variability





- Key challenge of RAP is oxidation and increased viscosity
 affected by environmental and loading conditions, and type of binder
- Incorporation of more than 15 wt.% RAP may require adjusting binder grade or using rejuvenators, to compensate for the stiffness of the aged RAP binder
- The practical limit for conventional asphalt plants is between 30 and 50 wt.% RAP depending on the plant type

Current LG experience

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Reported uses of RAP:

- ► Wearing course (8)
- ► Base course (7)
- Intermediate course (3)
- Hardstand/driveway (1)
- Majority use in DGA

- Significant practical experience
- Some practical experience
- Some awareness, however no practical experience
- No experience

- Less than 15 wt.%More than 30 wt.%
- Between 15 and 30 wt.%

Current LG practice



Perceived availability



- Readily available in my jurisdiction
- Limited availability in my jurisdiction
- Not available in my jurisdiction
- Not sure

Perceived benefits:

- sustainability
 - circularity and waste reduction
 - use of less virgin materials
- possible cost savings

Perceived challenges:

- not practical for remote areas
- irregular availability or insufficient supply
- concerns associated with variability and quality control
- lack of understanding or technical knowledge



Practitioners' guideline

Use of reclaimed asphalt pavements in asphalt



Use of RAP in asphalt guideline



Purpose and scope

- provide practitioners with relevant information to make informed decisions regarding the selection, specification, and construction includes:
 - ► an overview of RAP
 - ▶ impacts of RAP to the pavement
 - potential risks and mitigation measures
 - available specifications and guidance
 - material supply
 - mix design considerations
 - additional considerations during asphalt construction

Limitations

- ► this document is a guideline only
- selection of asphalt mix type should be based on engineering judgement considering:
 - expected operating environment
 - required in-service functional, structural, and performance properties
 - quality and availability of materials
 - availability of asphalt plants and equipment
 - environmental and sustainability impacts
 - whole-of-life costs

Key resources



Key documents:

- Australian Road Research Board (ARRB) Sealed Roads Best Practice Guide (Lyons et al. 2020)
- Austroads (2024) Guide to Pavement Technology Part 2: Pavement Structural Design
- Austroads (2014) Guide to Pavement Technology Part 4B: Asphalt
- Austroads (2019) Guide to Pavement Technology Part 8: Pavement Construction
- Institute of Public Works Engineering Australasia (IPWEA) & Australian Flexible Pavement Association (AfPA) (2023) Asphalt Specification (WA) Technical Specification, Tender Form and Schedule for Supply and Laying of Asphalt Road Surfacing
- Each section references a list of key documents
- Additional resources provided at end of guide, for further information and support

Additional Resources

AfPA (2022)	Reclaimed Asphalt Pavement (RAP) Management Plan Best Practice
ARRB Hall et al. (2022)	Best Practice Expert Advice on the Use of Recycled Materials in Road and Rail Infrastructure: Part A: Technical Review and Assessment
Austroads	Guide to Pavement Technology Part 2: Pavement Structural Design (2024)
	Guide to Pavement Technology Part 4B: Asphalt (2014)
	Guide to Pavement Technology Part 4E: Recycled Materials (2022)
	Guide to Pavement Technology Part 8: Pavement Construction (2019)
	Maximising the Re-use of Reclaimed Asphalt Pavement: Outcomes of Year Two – RAP Mix Design (2015b)
	Maximising the Use of Reclaimed Asphalt Pavement in Asphalt Mix Design: Field Validation (2016)
	ATS 3135: Supply of Reclaimed Asphalt Pavement Material
LG TRRIP	Practitioners Guideline: Sustainable Road Construction Practices for Local Government roads in WA
National Asset Centre of Excellence (NACOE)	Implementing the Use of Reclaimed Asphalt Pavement (RAP) in TMR – Registered Dense-graded Asphalt Mixes – Year 1 (Yousefdoost et al. 2018)
	Implementing the Use of Reclaimed Asphalt Pavement (RAP) in TMR – Registered Dense-graded Asphalt Mixes – Background Analysis Report (Yousefdoost 2018)
Western Australian Road Research and Innovation Program (WARRIP)	Implementing the Increased Use of Reclaimed Asphalt Pavement (RAP) (van Aswegen & Latter 2019)

What to expect

► Asphalt mixes containing up to 15 wt.% RAP have comparable:

- tensile strength
- weathering performance
- rutting resistance
- raveling resistance
- fatigue cracking resistance with asphalt without RAP

Constraint	Mitigation
Potential inconsistencies in RAP management and mix design practices	 Ensure an appropriate RAP management plan is in place
Managing RAP variability and additional testing requirements	 Ensure appropriate RAP management plan is in place Confirm laboratory capacity to undertake relevant testing
Availability of supply, especially in areas of low RAP generation	 Carefully consider RAP availability at a project level Consider sustainable levels of RAP content in a mix
RAP viscosity	 Ensure the assessment of RAP binder viscosity when more than 10 wt.% RAP is considered for use in the mix

Asphalt containing more than 15 wt.% RAP is expected to exhibit:

- greater stiffness
- increased deformation resistance
- decreased fatigue resistance due to the ageing of the RAP binder
- when appropriate adjustments to the mix are not made

22

Specification (WA)

Specification 517

Specification 516

Project selection and delivery

Appropriate asphalt mix treatments depend on:

10

10 and 14

Crumb rubber-modified asphalt mixes

Mix type

DGA

SMA

GGA⁽¹⁾

OGA(1)

- overall pavement design
- performance requirements
- condition of existing pavement
- operating environment
- construction requirements
- whole-of-life costs

These guide decisions regarding:

- asphalt mix type
- nominal size of the aggregates in the mix
- layer thickness
- ► type of binder
- type of aggregate

	Asphalt construction		
Aggregate nominal size (mm)	Application	Can RAP be used?	Relevant specification(
10, 14 and 20	Highways, arterial, industrial and distribution roads	YES in 50 blow mixes (maintenance and < 2,000,000 ESA)	IPWEA/AfPA Asphalt Specification (WA)
5, 7, 10 and 14	Residential streets, cul-de-sacs and recreational areas	YES	IPWEA/AfPA Asphalt Specification (WA)
5, 7, 10 and 14	Where good rut resistance and fatique	NO	IPWEA/AfPA Asphalt

performance are required

Arterial roads

Medium to heavily trafficked roads where

improved crack resistance is required⁽¹⁾



NO

NO

NO

Asphalt mix type selection

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RAP selection and specification

Primary requirements for RAP

- Source
- Purity and contaminants

Important properties to consider

- Contaminant levels
- RAP materials
- PSD
- Moisture content
- Binder content

Supply and management

- Local use
- Identify sustainable level of RAP usage content based on local availability
- Processing and storage requirements
- Stockpile management and testing
- RAP management plan

Key documents:

- AfPA (2022) Reclaimed Asphalt Pavement (RAP) Management Plan Best Practice
- IPWEA & AfPA (2023) Asphalt Specification (WA) Technical Specification, Tender Form and Schedule for Supply and Laying of Asphalt Road Surfacing
- Specification 511: Materials for Bituminous Treatments
- Austroads Technical Specification ATS 3135: Supply of Reclaimed Asphalt Pavement Material

Mix design considerations



RAP approval levels have been adopted considering:

- levels of screening/grading
- stockpiling and management requirements
- performance testing
- impact on the resultant mass content of RAP allowable

► If less than 15 wt.% RAP:

no changes to the mix design

► If more than 15 wt.% RAP:

Step	Test methods
Determine RAP binder content	WA 730.1
Determine RAP binder viscosity	AGPT/T193
Determine RAP moisture content	WA 212.1
Determine RAP aggregate PSD	WA 210.1



design volumetrics



Manufacture and transport:

	Manufacture and transport guidance
Asphalt mixing plant	 Central mixing plant of any configuration (batch, continuous or drum) as long as it complies with AS 2150
	 Consider plant capability when adding > 15 wt.% RAP
Asphalt mix temperature	 May need to adjust virgin aggregate temperature due to RAP moisture, temperature of RAP and greater stiffness in RAP binder
Use of additives	 Rejuvenators may be used in high-content RAP mixes

Asphalt placement, compaction and finishing requirements:

no additional requirements

Work health and safety and environmental considerations

- associated with the materials of original asphalt
- ▶ if no recycled materials have been used, there are no risks
- when recycled materials included, additional considerations (e.g. risk assessment)
- risk of rejuvenators needs to be considered case-by-case



Thank you!

Questions?

Project summary



Program Development





How to get involved



Find out more on our websites
https://warrip.com.au/lg-trrip/
https://walga.asn.au/policy-andadvocacy/our-policyareas/infrastructure/resources/lg-trrip

Nominate projects and get involved:
► <u>https://warrip.com.au/lg-trrip/</u>

