Viability of Recycled Plastics in Asphalt and Sprayed Sealing

Christina Chin
Principal Consultant

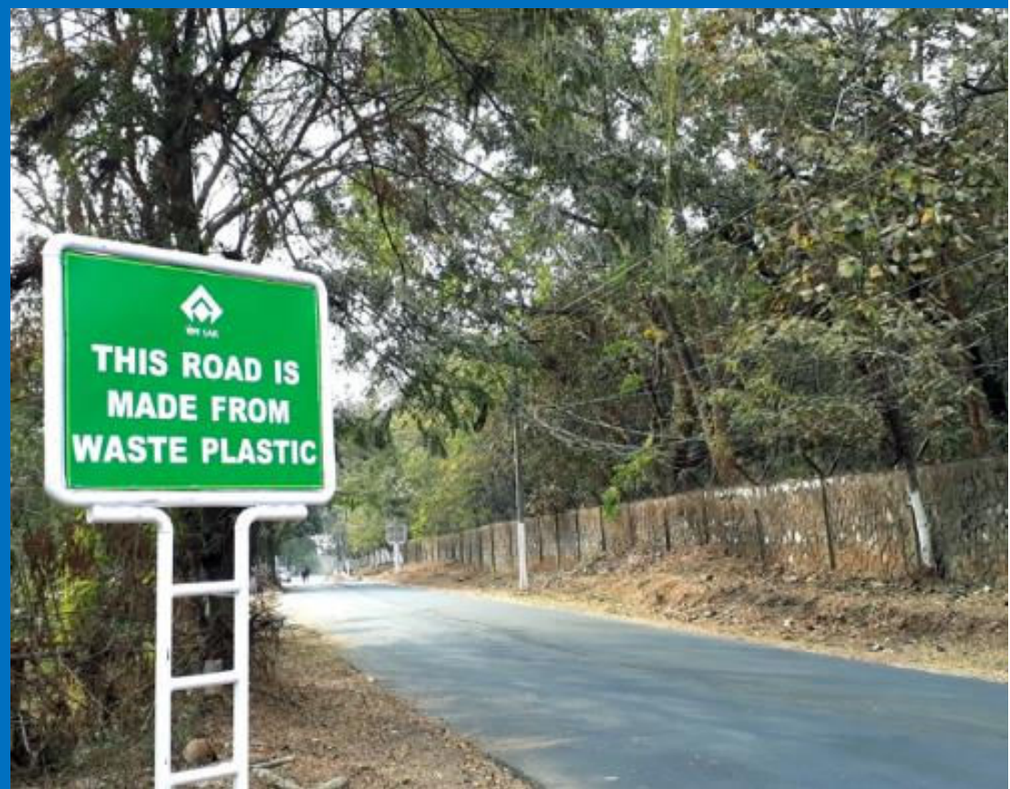
12 March 2020

Project Objectives

- Provide Australia and New Zealand road authorities with a better understanding of the viability of using recycled plastics in asphalt and sprayed sealing
- Provide guidance on future R&D priorities
- Conduct a local and international literature review discussing the benefits and challenges of using recycled plastics in road pavements

Recycled Plastics on Our Roads

- The approach is similar to the use of PMBs
- Incorporate the recycled material into asphalt to enhance performance
- Two ways of mixing
  - wet
  - dry
- The role of recycled plastics as a:
  - binder extender
  - aggregate extender
  - asphalt extender



Waste Plastics

Symbol	Description	
1 PETE	Clear tough plastic such as soft drink, juice and water bottles.	
2 HDPE	Common white or coloured plastic such as milk containers and shampoo bottles.	
3 V	Hard rigid clear plastic such as cordial bottles.	
4 LDPE	Soft flexible plastic e.g. squeezable bottles such as sauce bottles.	
5 PP	Hard but flexible plastic such as microwave ware, takeaway containers, some yoghurt/ ice cream/jam containers, hinged lunch boxes.	
6 PS	Rigid, brittle plastic such as small tubs and margarine/butter containers.	
7 OTHER	All other plastics, including acrylic and nylon. Examples include some sports drink bottles, sunglasses, large water cooler bottles.	

	Binder extender	Asphalt extender	Aggregate extender
Findings	(1) Lower pen @ 25deg, higher SP, RV and ER (2) Higher SP , lower pen, better digestion	(3) Improves properties significantly (4) Higher temperature susceptibility, low temp anti-cracking, improved rutting and fatigue resistance	Reduce extraction of natural product
Challenges	(1) Smaller temperature susceptibility (2) Not all improve properties	(3) Lack of elastic recovery (4) Only looked into PEs	Weakened bonds
Comments	HDPE, LDPE better performer	(3) Need some form of elastomeric polymer (4) < 6% addition of plastics	Introduce oxidizing agent

4. Case Studies – Australian Experience

- MacRebur

- 2018 - Brisbane City Council
- Limited info

Case Studies – Australian Experience

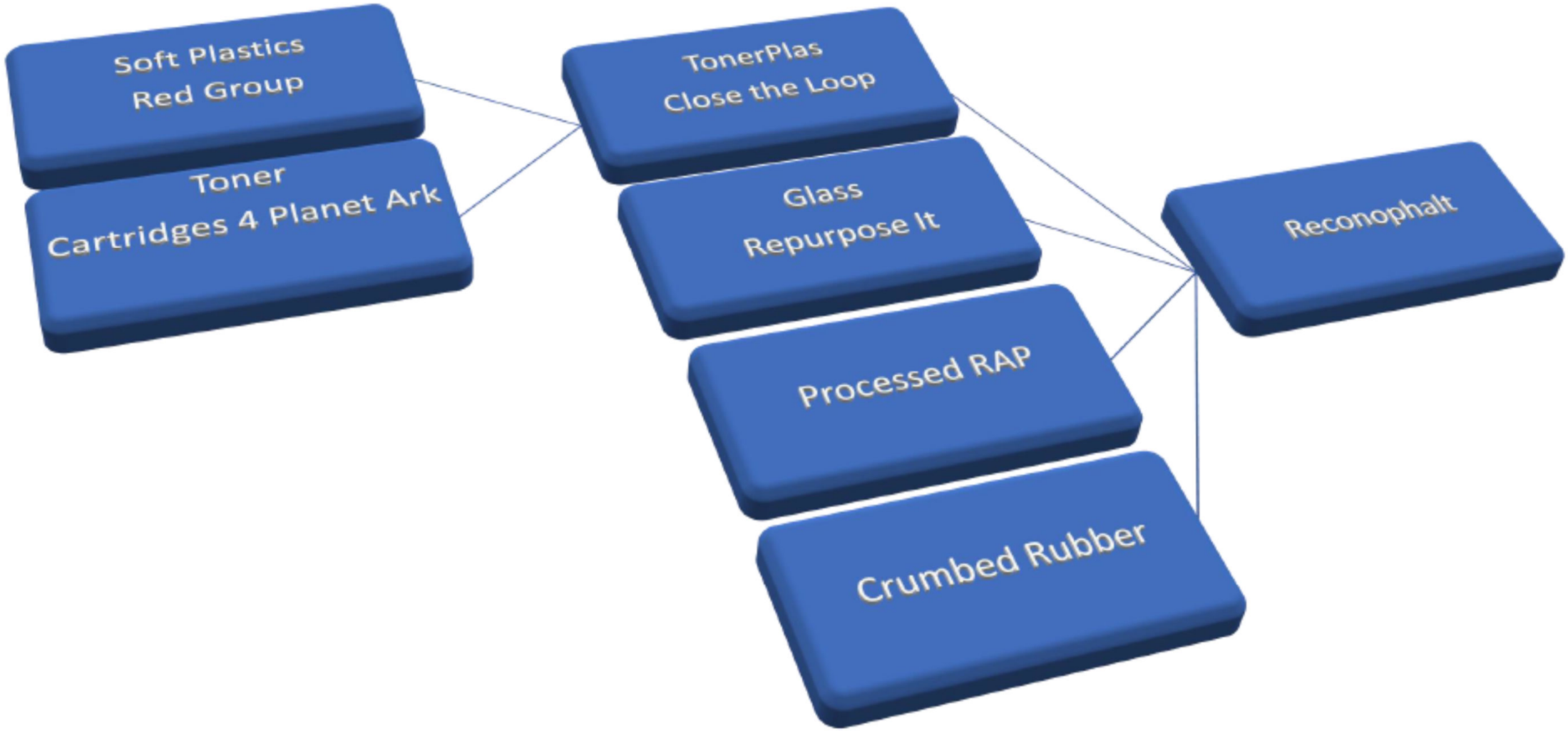
- Downer Group – Reconophalt

Every 1km of 2 lane way road:

- 530,000 plastic bags
- 168,000 glass bottles
- 12,500 waste toners

REDcycle/ Close the Loop – collects plastic bags from supermarkets

Reconophalt



Case Studies – Australian Experience

- Alex Fraser - PolyPave
- City of Yarra

- Fulton Hogan - PlastiPhalt®
- 2018 - City of Port Philip
- 2019 - City of Port Adelaide
  - Plastic bags and 20% RAP

Case Studies – New Zealand Experience

- Fulton Hogan - PlastiPhalt®

- Used oil containers
- Christchurch airport

Case Studies – Overseas Experience

- Netherlands - Zwolle

- PlasticRoad
- 30m long bike path
- 70% recycled plastics: old plastic bottles, beer cups, cosmetic packaging, plastic furniture
- last 3 times longer

Case Studies – Overseas Experience

- India

- First built in 2002
- Technology by Prof Vasudevan
- Mix shredded plastic to hot bitumen and aggregate
- Mainly used on rural and lightly loaded roads
- 2015, mandatory to use waste plastic on urban roads

5. Benefits of using recycled plastics

- Reduced landfill
- Reduced reliance on virgin non-renewable resources
- Improved road building material options
- It is a consistent and reliable source of recycled materials
- Improved sustainability
- Climate and infrastructure resilience benefits

6. Areas of Concern

- OH&S – possibility of highly toxic emissions, fuming, toxic elements remain in environment and build up in food chain
- Microplastics – breaking down into tiny particles, threat to marine life
- Re-recyclability – no studies done to date
- Storage stability – storage at high temperature could affect properties
- Materials lifecycle sustainability – use of ISCA Materials calculator

7. Governance Framework

- The need to address sustainability issues while maintaining pavement performance
- Use of recycled plastics on roads in Australia is still new
- Concerns over the incorporation of ‘other’ additives
- EAPA position statement on waste in asphalt
- Waste legislation is ill-defined and complex
- Benefits of recycling with respect to hazard classification and risk assessment is unknown
- One of the common hurdles (AU, NZ, EU) is the lack of confidence in the quality of recycled materials
- There is a need for an Australian framework
- Adoption of Environmental Product Declarations (EPD)

Specification

- **Performance based** and prescriptive approach
- Desired performance level but does not make demands on how it is achieved
- Encourages flexibility in innovation
- Performance based airport asphalt specification (AAPA, 2018)
  - warranty schedules
  - tender schedules
  - risk and maintenance pricing ….
- Risk allocation – producers main risk bearers
  - principles and warranties to be considered

8. Recommendations

1. Governing framework
2. Independent review
3. Long term economic benefit
4. Lifecycle sustainability assessment
5. The use of HDPE and LDPE
6. Performance and prescriptive based specification
7. Road trials
8. Sprayed sealing research
9. Monitoring complimentary projects


Mountain
Dew

Thank you

LEVEL 5 DESIGN

Inspiring Innovation in Parking and Transport

www.level5design.com.au

Christina Chin – 0452 490 880

christinac@level5design.com.au

Peter Damen – 0410 438 084

peterd@level5design.com.au