Viability of Recycled Plastics in Asphalt and Sprayed Sealing

Christina Chin
Principal Consultant

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

Soft Plastics
Red Group

Toner
Cartridges 4 Planet Ark

TonerPlas
Close the Loop

Glass
Repurpose It

Processed RAP

Crumbed Rubber

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
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
Thank you

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www.level5design.com.au

Christina Chin – 0452 490 880
christinac@level5design.com.au

Peter Damen – 0410 438 084
peterd@level5design.com.au