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PAVER-LAID IN-SITU RECYCLING: A SUSTAINABLE APPROACH TO PAVEMENT REHABILITATION

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Stabilised Pavements of Australia

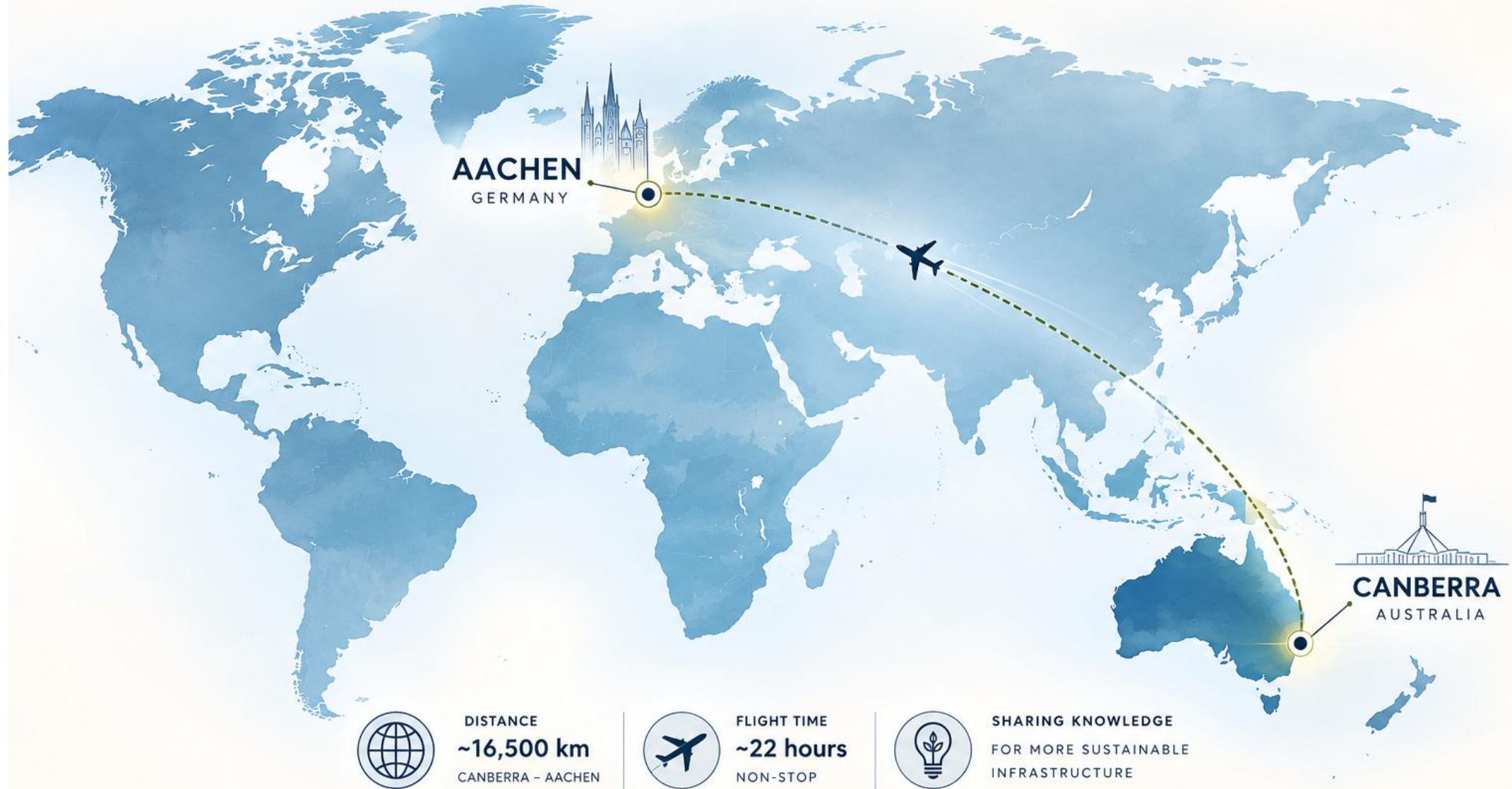
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Stabilised Pavements of Australia



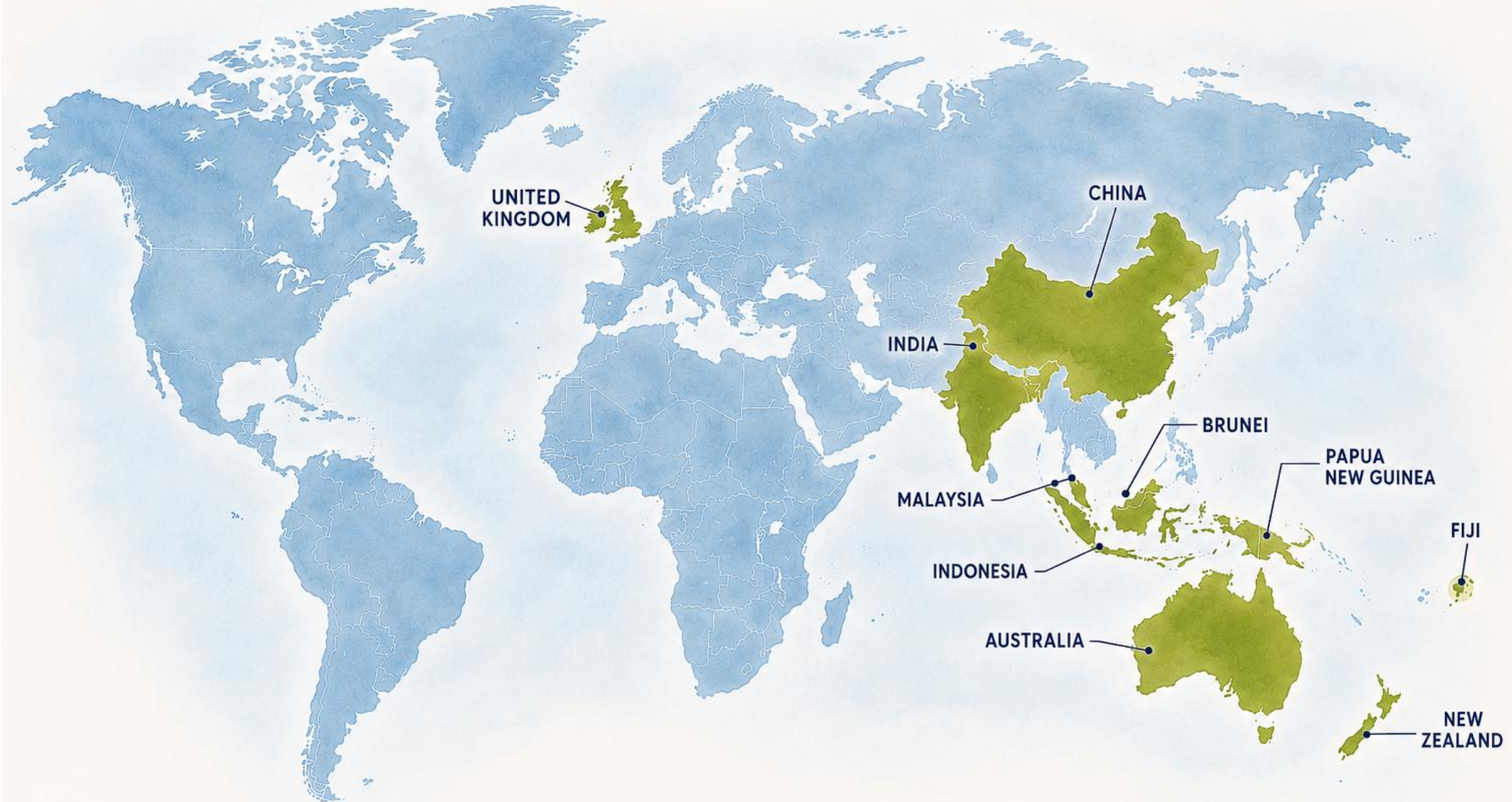
CANBERRA TO AACHEN

CONNECTING INNOVATION IN ASPHALT RECYCLING



SPA GROUP OF COMPANIES

CONNECTING INNOVATION IN ASPHALT RECYCLING



Pavement Stabilisation & Rehabilitation



For over 40 years, Stabilised Pavements of Australia (SPA) and its associated companies have been stabilising all types of pavements using:

- Lime
- Cements
- Cementitious Blends
- Foamed Bitumen
- Bitumen Emulsion

Since the late 1990's, SPA has been using foamed bitumen stabilisation extensively

SPA Group of Companies does tens of millions of square metres annually

Our Work



Paver-Laid In-Situ Recycling

Since 2020, SPA also specifically undertakes **in-situ asphalt recycling works** using Paver-Laid In-Situ Recycling with the Wirtgen 380 Cold Recycler (W 380 CRi)

Full Depth Asphalt Recycling

- Depths up to 300 mm
- Existing granular and asphalt materials
- Full rehabilitation

Cold In-Place Asphalt Recycling

- Depths of 75-100 mm
- Predominantly existing asphalt
- Maintenance solution



Isabella Drive, ACT



This paper details the Isabella Drive project – one of SPA's Paver-Laid In-Situ Recycling jobs for the ACT Government

- **1.7km major arterial road** in Canberra for the ACT Government
- Design traffic: **3.38×10^7 ESA over 20 years** (>10,000 AADT, 10% heavy vehicles)
- Conventional rehabilitation: **excavate existing pavement + Deep Lift Asphalt**
- SPA proposed a **Paver-Laid In-Situ Recycling** alternative
- Existing asphalt was recycled **in situ with foamed bitumen**
- Delivered using the **Wirtgen W 380 CRi**

Prior to Rehabilitation



Isabella Drive prior to rehabilitation with significant rutting, potholes, cracking and deformation



Testing and Investigation

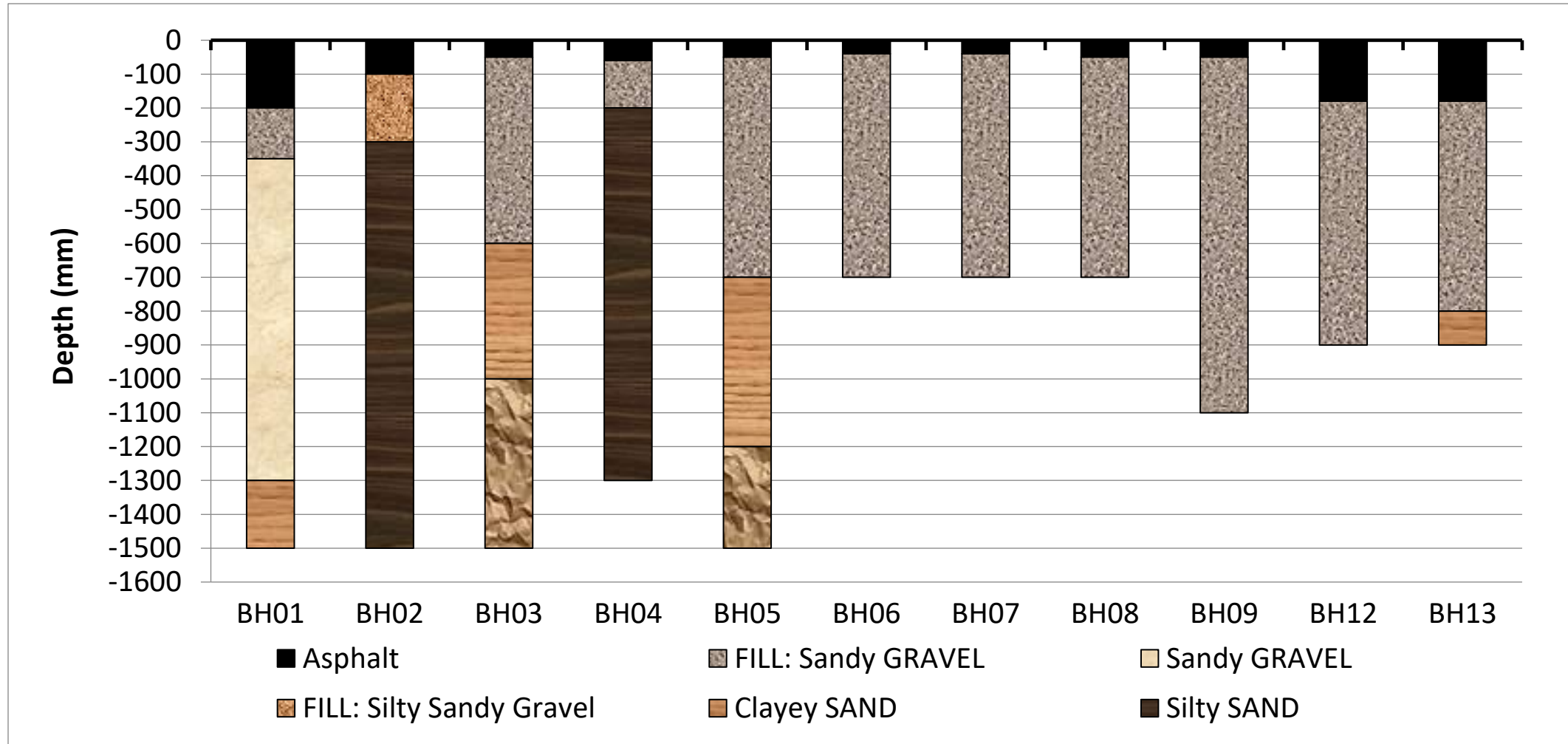
High laboratory CBR
results

Conservative design
subgrade CBR of 6%

11 boreholes

Existing asphalt
(50-200 mm)
Well-graded sandy
gravel

Variable Existing Pavement



Design Meets Construction

The W 380 CRi is the key plant item in SPA's Paver-Laid In-Situ Recycling process

Key Features

- Powerful down-cutting rotor
- Enhanced lateral and longitudinal blending
- Cutting widths up of 3.2m, 3.6m and 3.8m
- Paves in a single layer up to 6m wide

Design Outcomes

- Handles variable asphalt concentrations
- Laboratory blending replicated the field process
- Tailored foamed bitumen mix design to suit





Paver-Laid In-Situ Recycling

▶ Paver Laid ▶ Single Pass ▶ Variable Width



Recycling the Existing Pavement: Foamed Bitumen Mix Design Development

- Representative samples from the existing pavement were tested to assess suitable foamed bitumen treatment options
- Trial mixes included:
 1. 3.0% C170 bitumen, 2.0% hydrated lime **mix design adopted**
 2. 3.0% C170 bitumen, 1.0% 70:30 GP cement: fly ash
 3. 2.5% C170 bitumen, 1.0% 70:30 GP cement: fly ash
 4. 2.5% C170 bitumen 2.0% hydrated lime

Summary of Resilient Modulus Test Results

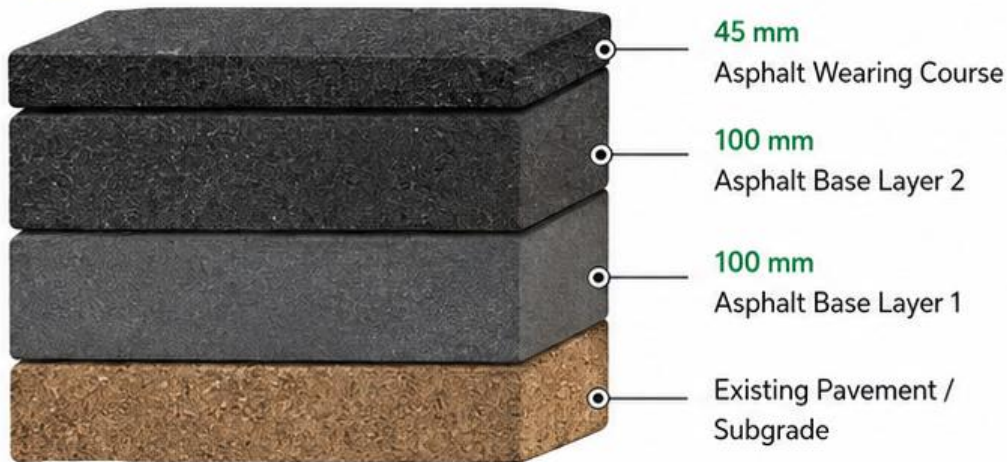
Borehole	Mix Design Trial	Average Cured Modulus (MPa)	Average Soaked Modulus (MPa)	Average Retained Modulus (MPa)
BH 03	3.0% C170 bitumen, 2.0% hydrated lime	4300	2400	56
	3.0% C170 bitumen, 1.0% 70:30 GP cement: fly ash	5500	2650	48
	2.5% C170 bitumen, 1.0% 70:30 GP cement: fly ash	4650	2550	54
	2.5% C170 bitumen 2.0% hydrated lime	4400	2400	54
BH 09	3.0% C170 bitumen, 2.0% hydrated lime	4850	2650	54
	3.0% C170 bitumen, 1.0% 70:30 GP cement: fly ash	5300	3150	60
	2.5% C170 bitumen, 1.0% 70:30 GP cement: fly ash	4900	2550	52
	2.5% C170 bitumen 2.0% hydrated lime	4800	2750	58
BH 12	3.0% C170 bitumen, 2.0% hydrated lime	3300	2600	78
	3.0% C170 bitumen, 1.0% 70:30 GP cement: fly ash	3250	2750	84
	2.5% C170 bitumen, 1.0% 70:30 GP cement: fly ash	3550	2950	84
	2.5% C170 bitumen 2.0% hydrated lime	3100	2600	84

Target design modulus = 2,000 MPa

Pavement Designs



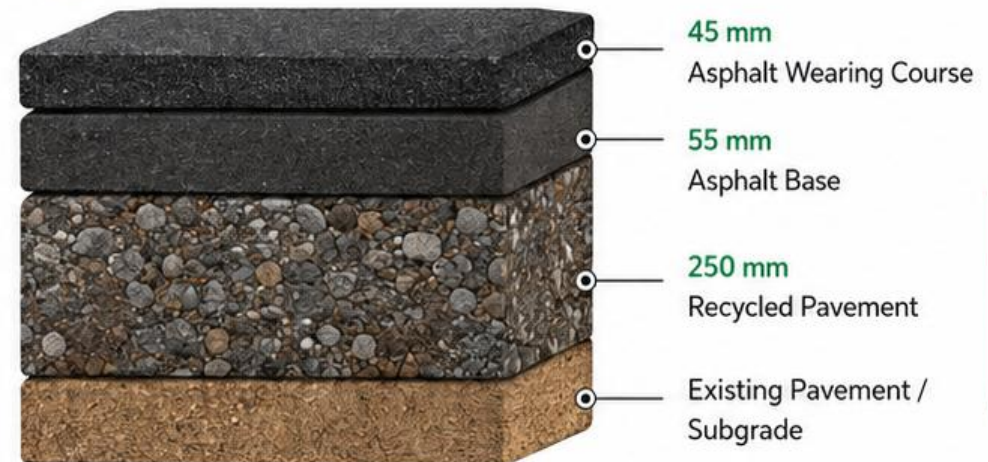
Deep Lift Asphalt



	Layer materials	AC14 (A15E) DGA modulus 3,400 MPa AC20 (C450) DGA modulus 4,000 MPa
	Total thickness	245 mm
	Existing pavement/subgrade	CBR 6%
	Note	Minimum of three asphalt layers required



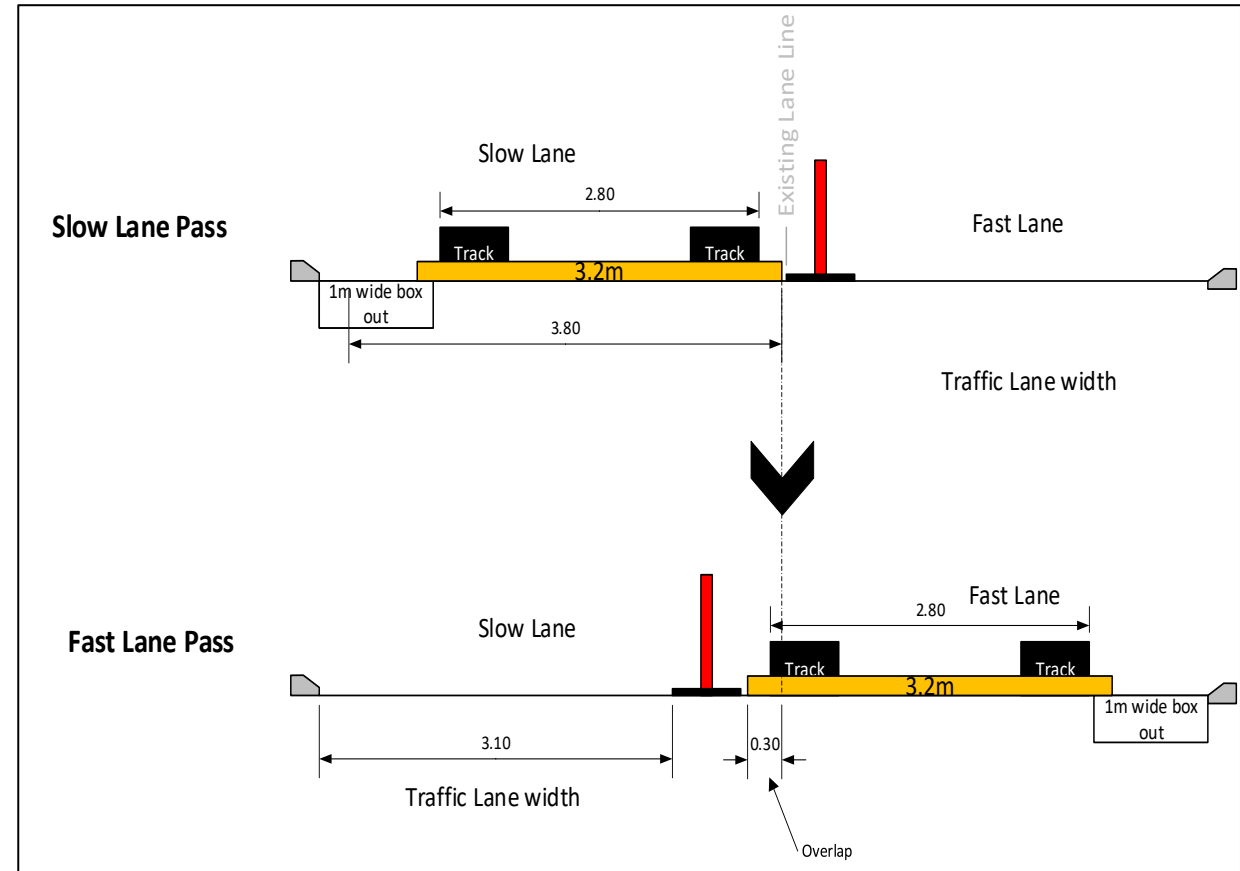
Paver-Laid In-Situ Recycling



	Layer materials	AC14 (A15E) DGA modulus 3,400 MPa AC20 (C450) DGA modulus 4,000 MPa Foamed Bitumen modulus 2,000 MPa
	Total thickness	350 mm
	Existing pavement/subgrade	CBR 6%

Detailed Planning and Delivery: Typical Work Shift

- Implement Lane Closure
- Mobilise equipment within the closure
- Box-out (removal) of excess material from the pavement using a road profiling mill
- Start the Paver-Laid In-Situ Recycling process
- Complete final compaction with rollers
- Cure placed material with watercart
- Open the treated lane to full traffic



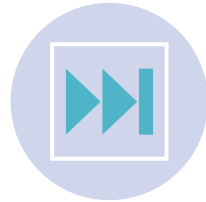
Paver-Laid In-Situ Recycling Works



Post Construction



Points of Interest



High productivity rates - 450-600 lineal metres per shift. Either 3.3m or 4.5m width.



Quality Control - Paver-laid technology provides the “cut” or a “window” of the pavement underneath to be inspected.



Achieved required compaction - up to 80% upon initial placement, behind paver.



Environmentally friendly – recycling materials, less CO₂, reduced truck movements



Constructability - pavement opened to full traffic at the end of each work shift.



Specification – worked closely with designer to develop one for the project.

Sustainability Outcomes

5,888 tonnes recycled

vs 1,257 t with Deep Lift Asphalt

Simply by treating and rejuvenating the existing road pavement materials



82% less material exported

1,020 t vs 5,768 t

Reduction in materials exported from site to disposal, preserving natural and finite resources

81% reduction in truck travel

6,100 km vs 32,780 km



53% lower GHG emissions

637 t CO₂-e vs 1,346 t CO₂-e

Beyond Environmental Sustainability



Single-pass rehabilitation

- 250 mm of existing pavement recycled in situ in a single layer operation

Construction efficiency and time savings

- Reduced construction time by 10 weeks – Over 50% reduction
- Reduced plant requirements on site
- Continuous traffic during works and pavement open to traffic at the end of each shift

Long-term rehabilitation

- Designed as a structural rehabilitation solution, with the potential for the pavement to be recycled again at the end of its service life

Cost Savings

- Lower direct cost by 30%



Conclusion

The Paver-Laid In-Situ Recycling of the existing asphalt pavement in Isabella Drive using foamed bitumen was a highly successful job, resulting in a pavement with at least the same (& more than likely exceeding) the Deep Lift Asphalt alternative



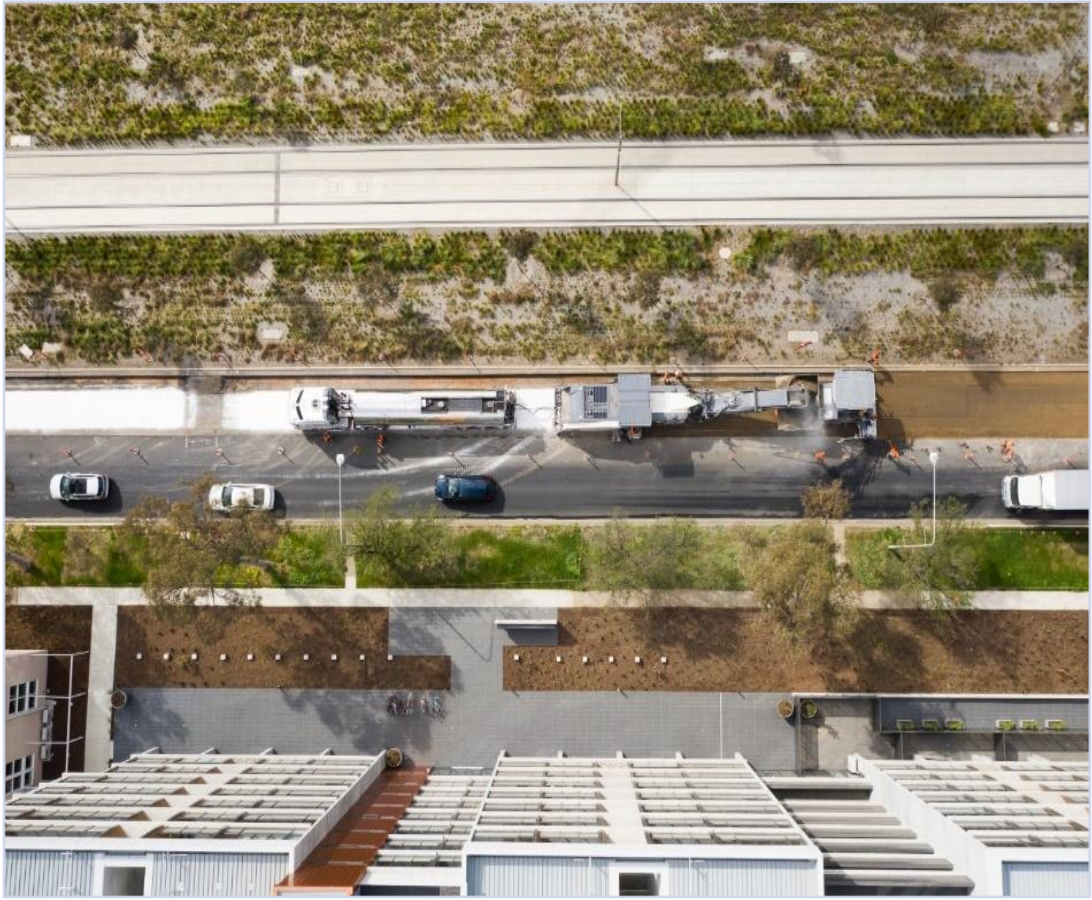
The Asphalt recycling process using the Wirtgen W 380Cri and paver system produced the following advantages compared to the traditional dig out and replace with deep lift asphalt

- With average daily productions over 3,000 and up to 5,380m² per day, the construction time was reduced by in excess of 50%
- The In-Situ Recycling led to a reduction in Waste of approximately 82%
- Damaging Truck Movements were reduced by approximately 81%
- Carbon Dioxide emissions were reduced by approximately 50%
- Cost savings compared to the traditional Deep Lift Asphalt replacement method were approximately 50%



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RECYCLERS**

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Thank you