Case Study: CarbonBind C170 in Darling Downs

Client

Darling Downs District

Project Partners

- **Puma Bitumen** – Innovation Lead & Binder Supply
- **RPQ** – Spray Sealing Contractors
- **Darling Downs District** – Asset Owner

Background

Spray Sealing is the most commonly used road maintenance activity in Australia. It acts by applying thin layer/s of bitumen commonly followed by various aggregate sizes, the variation of aggregate sizes, bitumen types and amount account for various treatment designs that are engineered for each situation. Bitumen has the highest Global Warming Potential (GWP) when maintaining the roads. When analysing the GWP for a typical spray seal, using 2.3 l/m^2 of C170 binder, it estimates that over half the emissions are produced from the binder alone. Therefore, to reduce the emissions of road maintenance the GWP of bitumen must be reduced.

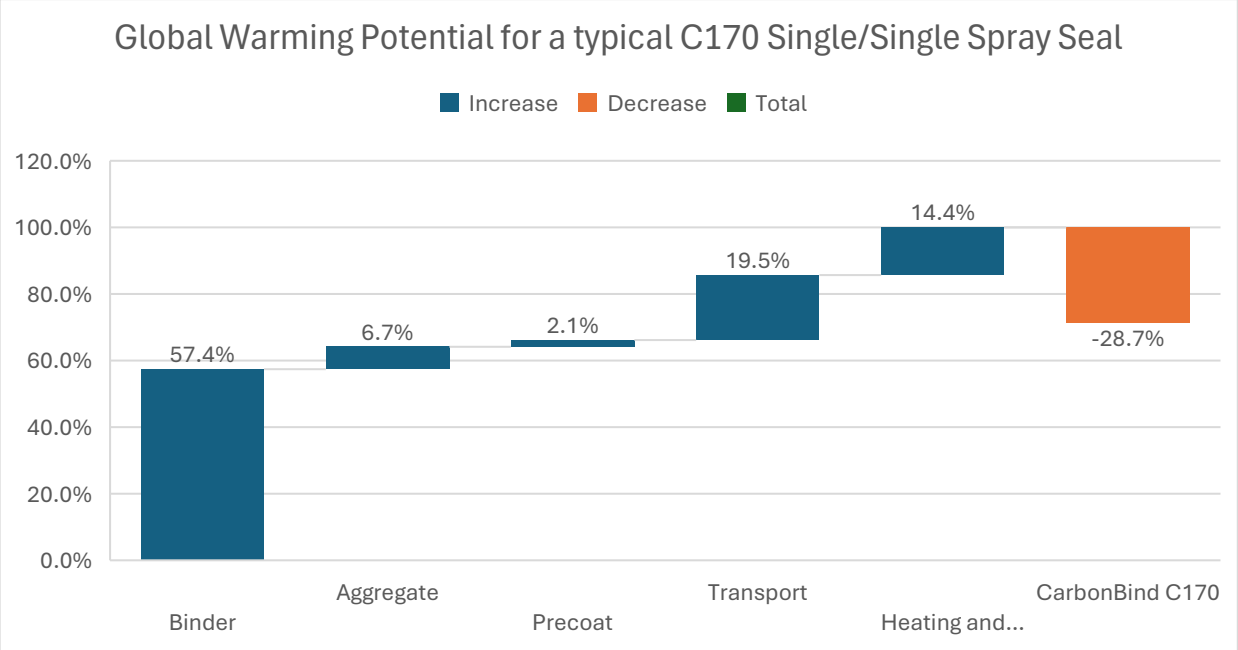

Figure 1, Global Warming Potential of typical C170 Spray Sealing Site

Puma Energy have developed a bitumen with this biogenic component, that reduces the GWP of Paving Grade C170 bitumen by 50%. This reduction expressed across a spray sealing example, shown in Figure 1.

C170 is the most commonly used binder for spray sealing across Australia, and currently there are no sustainable alternatives to standard paving grade binder, limiting options to reduce the GWP of standard spray sealing in the industry.

Application

A more sustainable C170 has never been used in Australia before for spray sealing. Fortunately, Darling Downs District is supportive to the use of innovations around their network. As this product has never been used before, a low volume road was selected.

This existing road had low volume of traffic but had existing defects that are likely to reflect through the existing seal. Records of these existing defects were taken.

The site was used as a demonstration where there are two sections:

1. Section 1: CarbonBind C170 applied at 2.1l/m^2 with 14mm aggregate
2. Section 2: Standard C170 applied at 2.1l/m^2 with 14mm aggregate

Both sites were similar condition and were used alongside each other to compare the condition of both sites over time.

Figure 2, CarbonBind C170 sprayed on site

Quality

The requirements for this project were to ensure conformance to AS2008 C170 binder grade. To ensure quality performance of the manufactured product:

- A comprehensive quality regime was applied from manufacture to delivery
- State of the art testing was used to show that CarbonBind C170 met AS2008 C170 specifications.
- Handling guidance and technical assistance provided to site teams
- Lab and field testing confirmed seamless integration into the paving process

CarbonBind C170 Production Results

Table 1, Results for CarbonBind C320 Production Run to AS2008 specification

Analysis	Method	Units	Results	Min	Max
Dynamic Viscosity @ 60°C	AS/NZS 2341.2	Pa.s	152	140	200
Dynamic Viscosity @ 135°C	AS/NZS 2341.2	Pa.s	0.380	0.25	0.45
Penetration at 25°C	AS 2341.12	pu	83	62	
Dynamic Viscosity at 60°C after RTFO Treatment	AS/NZS 2341.2	Pa.s	336		
Short Term Effect of Heat & Air	AS/NZS 2341.10	%	221		300
Flashpoint	AS 2341.14	°C	>300	250	
Matter Insoluble in Toluene	AS/NZS2341.8	% mass	0.6		1.0

Sustainability Benefits

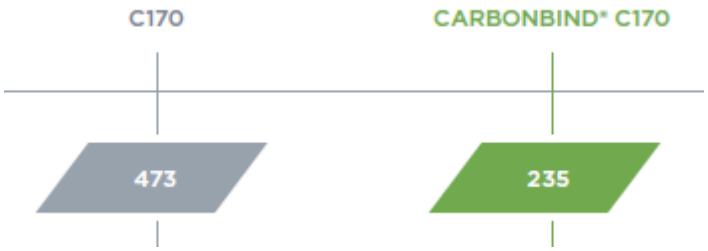

Figure 3, EPD Comparison between standard C170 and CarbonBind C170

CarbonBind C170 has a carbon footprint 238kgCO_2/tonne less than standard C320, this reduction over the span of the project resulted in a savings of **5,236kg** of CO_2 for the asphalt surfacing project in the Darling downs district.

These carbon savings have verified EPDs and LCAs to verify the sustainability figures.

Figure 4, Site Photo of CarbonBind C170 being sprayed for the first time

Figure 5, CarbonBind C170 being Sprayed

Results

Environmental Impact

- 5,236 kg CO_2 saved through binder substitution alone
- Stored biogenic carbon directly within the pavement
- Supported transparent LCAs and EPDs reporting

Operational Impact

- No additional testing, delays, or equipment changes required
- Demonstrated seamless substitution

Industry Impact

- Demonstrated that sustainable binders can be commercially viable at scale

Key Learnings

- Sustainability goals can be achieved without sacrificing technical performance or cost efficiency.
- Co-production of standard and sustainable binders allows for direct performance benchmarking, aiding future adoption.