

Case Study: CarbonBind S15E in Toowoomba

Client

Darling Downs District

Project Partners

- **Puma Bitumen** – Binder Supplier
- **RPQ** – Spray Seal Operator
- **Darling Downs District & Transport and Main Roads**- Customer

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 2.1 l/m² of S15E binder, it estimates that **76%** of the emissions are produced from the binder alone. Therefore, to reduce the emissions of road maintenance the GWP of bitumen must be reduced.

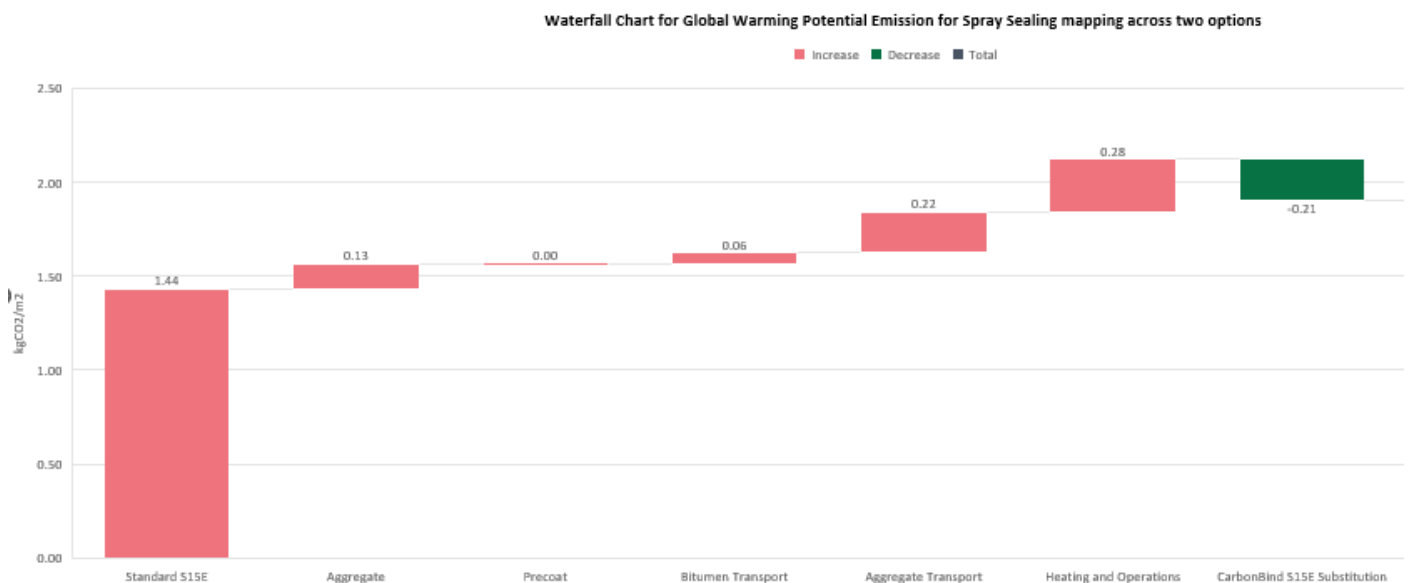


Figure 1, Global Warming Potential of typical S15E Spray seal site

Puma Energy have developed a bitumen with this biogenic component, that reduces the GWP of Paving Grade S15E bitumen by 99kgCO₂/tonne. This reduction expressed across a spray sealing example, shown in Figure 1.

S15E is commonly used in high stress locations for spray sealing across Australia, in these locations typical C170 binder will not be suitable due to the conditions of the road. Therefore, modification with high performance polymers will extend the life of the treatment giving a better, long term result for the road.

Challenge

Implementing this project at a scale of delivering 540 tonnes of binder over April 2025 is the first instance of the sealing bitumen being used at this scale.

An initial demonstration of 42,000L was initially ordered, and without any issues by RPQ, the entire program was moved to CarbonBind S15E.

The existing road networks were going through an existing resurfacing program, and the use of a low carbon option was proposed with CarbonBind S15E over the Olexobit S15E, as it had sustainability gains without any quality detriments.

The Department of Transport and Main Roads are supportive towards low carbon solutions so long as they meet current S15E specifications.



Figure 2, Spraying CarbonBind S15E

Quality

The requirements for this project were to ensure conformance to ATS3110 S15E 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 Olexobit S15E and CarbonBind S15E met ATS3110 S15E specifications.
- Every batch tested to monitor performance
- Handling guidance and technical assistance provided to site teams
- Maintained consistent supply of 60+ tonnes/day
- Lab and field testing confirmed seamless integration into the paving process

CarbonBind S15E Production Results

Table 1, Results for CarbonBind S15E Production Run to ATS3110 specification

Analysis	Method	Units	Results #55645	Result #55647	Min	Max
Softening Point of PMB	AG:PT/T131	°	61	62	55	75
Torsional Recovery at 25°C	ATM 122	%	41	39	32	62
Brookfield Viscosity @ 165°C	ATM 111	Pa.s	0.37	0.33		0.55

Existing Structure

The local conditions had considerable traffic, with some of the roads being main arterials from Toowoomba travelling south. Because of this, there were some areas on the reseal program that had pavement failures, that will likely reflect into the new seal. These locations were dry matted to help reduce this reflection.



Figure 3, Existing Failures example

Sustainability Benefits

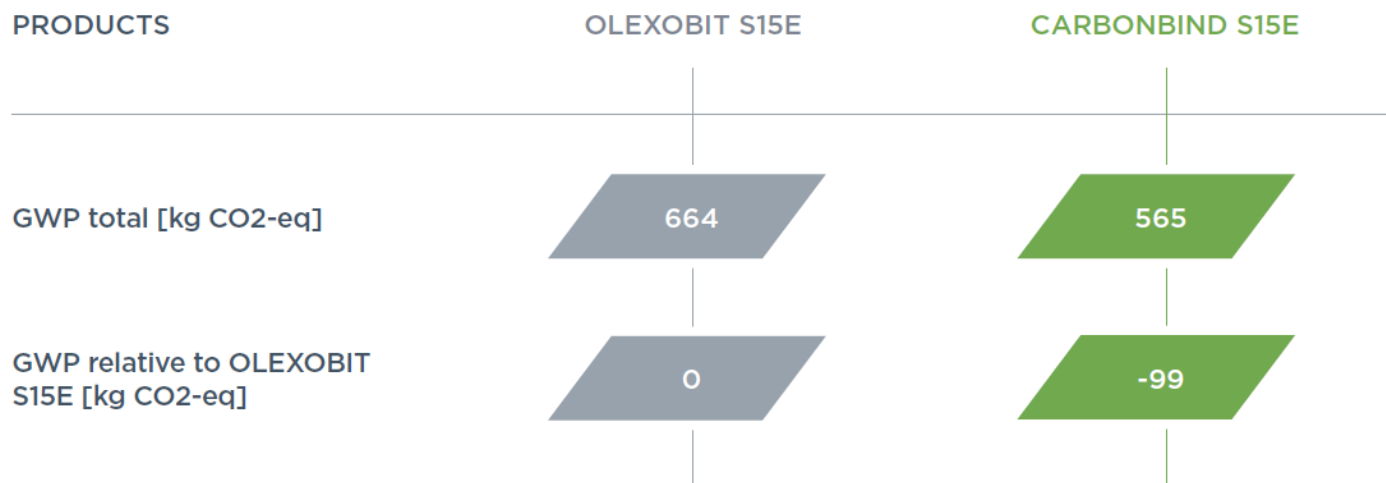


Figure 4, EPD Comparison between standard Olexobit S15E and CarbonBind S15E

CarbonBind S15E has a carbon footprint 99kgCO₂/tonne less than Olexobit S15E, this reduction over the span of the project resulted in a savings of over **53,460kg** of CO₂ for the spray sealing programme in Toowoomba.

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

Results

Environmental Impact

- 53,046 kg CO₂ 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.