Case Study: CarbonBind C320 in Queensland

Client

Sunshine Coast Regional Council

Project Partners

- **Puma Bitumen** – Innovation Lead & Binder Supply
- **Boral** – Asphalt Producer and Asphalt Contractor
- **Sunshine Coast Council** - Customer

Background

Asphalt is a core material in road construction, in the market, it is a key contributor to Global Warming Potential due to the use of Bitumen and high energy demands to produce the asphalt. Biogenic Bitumen modifiers are an innovate technology to reduce the carbon footprint of the asphalt product, by targeting the key emission material; bitumen, the Global Warming Potential of asphalt can be reduced without any detrimental effects on performance.

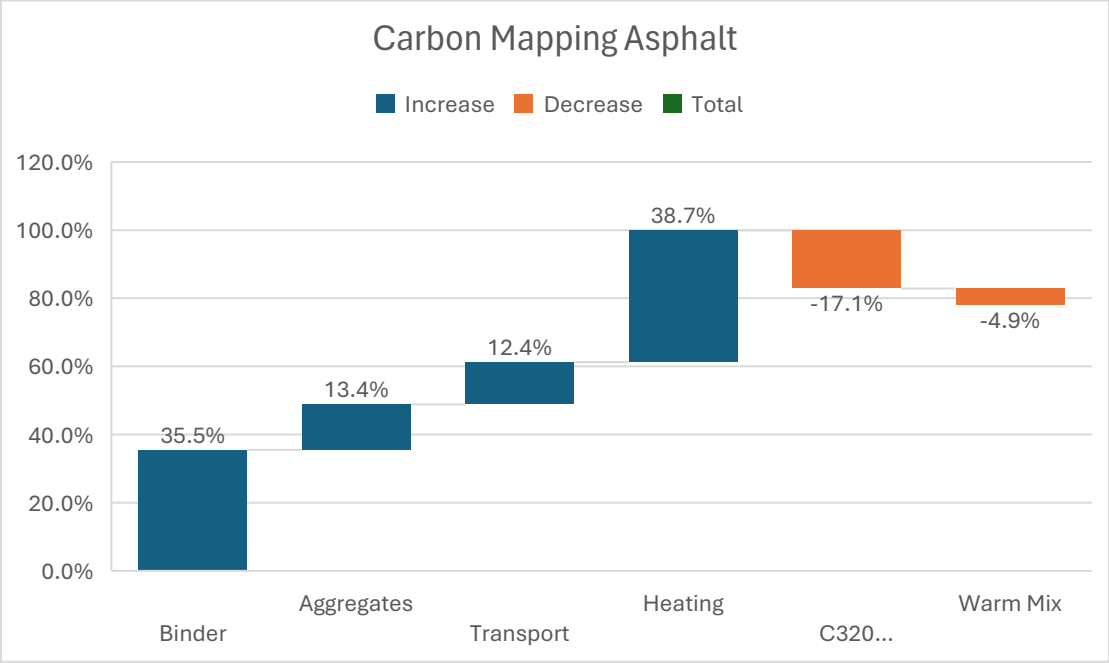

Figure 1, Global Warming Potential of typical AC14 Asphalt

Puma Energy have developed a bitumen with this biogenic component, that reduces the GWP of Paving Grade C320 bitumen by 40%. This reduction expressed in the final asphalt, can be shown in Figure 1.

C320 is the most commonly used binder for asphalt across Australia, and currently there are no alternatives to standard paving grade binder, limiting options to reduce the GWP of standard asphalt in the industry.

Challenge

The flexible pavement industry is highly risk-averse, with focuses towards meeting specifications and reducing costs, biogenic bitumen must be able to meet these demands while remaining cost competitive. Key challenges include:

- Resistance to deviation from existing products
- Concerns over cost and performance parity
- Technical integration into existing production processes
- Meeting Market Demands

CarbonBind C320 Quality

To meet the stringent performance requirements of AS2008:

- A comprehensive R&D testing programme was completed to show the formulation was able to meet existing AS2008 specifications
- Each batch was tested post manufacturing to the full AS2008 spec to ensure high quality performance

CarbonBind C320 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	305	260	380
Dynamic Viscosity @ 135°C	AS/NZS 2341.2	Pa.s	0.571	0.40	0.65
Penetration at 25°C	AS 2341.12	pu	61	40	
Dynamic Viscosity at 60°C after RTFO Treatment	AS/NZS 2341.2	Pa.s	876		
Short Term Effect of Heat & Air	AS/NZS 2341.10	%	287		300
Flashpoint	AS 2341.14	°C	>300	250	
Density @ 15°C	AS2341.7	kg/m^3	1039.2		
Matter Insoluble in Toluene	AS/NZS2341.8	% mass	0.2		1.0

Sustainability Benefits

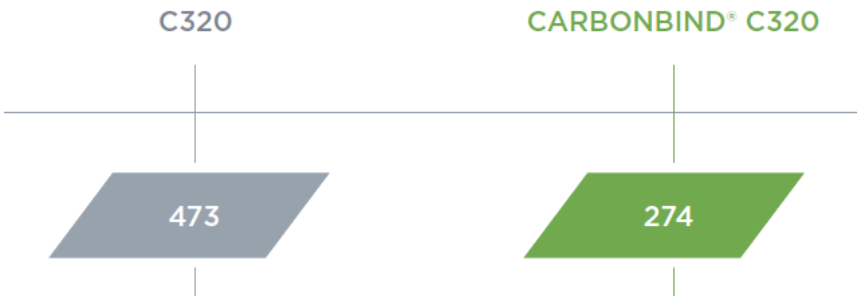

Figure 2, EPD Comparison between standard C320 and CarbonBind C320

CarbonBind C320 has a carbon footprint 199kgCO_2/tonne less than standard C320, this reduction over the span of the project resulted in a savings of **3,570kg** of CO_2 for the asphalt surfacing project in Sunshine Cost council.

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

Innovation

Puma Bitumen developed CarbonBind C320, a binder incorporating renewable, modified plant-based materials that have already sequestered CO_2 from the atmosphere. This innovation:

- Reduced carbon intensity by 199 kg CO_2 per tonne of binder
- Fully compliant with AS 2008 C320 specifiation
- No additional plant modifications or special handling
- Compatible with existing mix designs and other paving grades

Manufacturing took place at Puma Bitumen's Bulwer terminal, using refined tank farm dosing systems and supported by a NATA-accredited laboratory for rapid quality control.

Construction and Performance

400 tonnes of asphalt was produced runs in the asphalt run performing at their expected rates, and were able to produce a uniform mix at temperature.

Compaction also went smoothly with the material compacting and responding well to existing compaction plans. The material was used with existing asphalt plant and equipment, and had no major differences to standard C320 asphalt.

Figure 3, Image of CarbonBind C320 Laid

Results

Environmental Impact

- 3,570 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.