



**Centre of Excellence**  
for Decarbonising Roads

# ECOFLAKES PRO

## Technical Note

### Abstract

The trial evaluated the use of EcoFlakes PRO, a polymer modification designed to replace virgin polymers. By decreasing the reliance on bitumen in asphalt production, EcoFlakes PRO help lower both carbon emissions and material costs for every ton of asphalt produced.

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# Executive Summary

This report documents and evaluates the live trial of EcoFlakes Pro on the B7029 - Chapelknowe Road, North Lanarkshire (October 2025). The trial assessed carbon savings, lifecycle costs, operational suitability compared with conventional asphalt alternatives and the potential for wider application.

## Introduction

EcoFlakes PRO is a polymer modifier engineered to transform standard bitumen into 'high-performance' Polymer-Modified Bitumen (PMB) directly at the asphalt mixing plant, as claimed by EcoPals. Produced using reactive polyolefins and copolymers, EcoFlakes PRO uses post-consumer plastics to deliver a durable, 'high-performance' binder while lowering carbon emissions and reducing reliance on virgin materials.

Available as 5 mm granules or 1 mm powder, EcoFlakes PRO melts between 140–170°C, blends fully with bitumen, and is simple to dose via existing feeders. At a standard addition rate of 6.5% of binder content, it increases softening point, enhances elasticity, and slows oxidation and ageing according to manufacturer claims. These claims may result in increased load-bearing capacity, reduce deformation and fatigue, and extend pavement service life, potentially making it ideal for heavy-traffic roads.

According to manufacturer data EcoFlakes PRO contributes to substantial CO<sub>2</sub> reductions, enables flexible on-site PMB production, and minimises the need for storage of extra binder grades. Its stable storage range (-15°C to +45°C), non-hazardous classification, and moisture-free handling requirements ensure safe and efficient use.

This specific Live Labs 2 trial aims to evaluate EcoFlakes PRO as a scalable, low-carbon alternative to conventional asphalt binders. The trial examines installation efficiency, improved performance and durability, and reduced CO<sub>2</sub> emissions. By comparing EcoFlakes PRO asphalt against traditional surface course materials, the trial generates insights into lifecycle costs, future analysis on long-term performance of the material, and procurement implications, supporting a transition to more sustainable and resilient road construction.

## Methodology

The EcoFlakes PRO additive is designed to be incorporated directly into the asphalt mixing process at the batching plant. Manufacturer literature indicates that EcoFlakes PRO are typically introduced via the filler line or added directly into the mixing drum during the dry mixing stage to ensure even dispersion before binder addition. This process allows the polymer-based flakes to distribute uniformly throughout the mix, supporting consistent modification of the asphalt matrix. The trial followed this standardised incorporation method, with the additive introduced as part of the controlled batching process at the plant.

For this trial, the asphalt was produced in accordance with the Hot Rolled Asphalt (HRA) mix recipe dated 09.01.26, identified as 35/14F 40/60 EcoFlakes PRO. In this designation, 35/14 specifies the coarse aggregate content: a total of 35% coarse aggregate made up of 14 mm material, with smaller aggregate sizes permitted under the British Standard to achieve the required percentage. In this trial, 13.7% of 10 mm aggregate and 21.7% of 14 mm aggregate combine to meet the 35% coarse aggregate requirement. The letter "F" denotes the fine aggregate grading category used in HRA mix specifications. The 40/60 refers to the penetration grade of the bitumen binder, representing the depth (in tenths of a millimetre) a standard needle penetrates the binder under specified conditions (25 °C, 100 g load, 5 seconds), equating to a penetration range of 0.4–0.6 mm. Full details of the asphalt recipe used for this trial are provided below.

- 10mm aggregate: 13.7%
- 14mm aggregate: 21.7%
- Fines: 48.5%
- Reclaimed filler: 4.5%
- Limestone filler: 4.3%
- Binder content: 6.8%
- EcoFlakes PRO additive: 0.5%

This adheres to the manufacturer's recommendation that EcoFlakes PRO should typically be dosed at 0.5% of total mix, meaning no deviations from the supplier's stated requirements in regard to overall percentage of additive inclusion. However, it should be noted that EcoPals specifies a required addition rate of 6.5% binder content, whereas the asphalt mix design used in this trial incorporated a slightly higher 6.8% total binder content. According to the supplier, EcoFlakes at a 6.5% binder addition is intended to increase softening point, enhance elasticity, and slow oxidation and ageing, which in turn may improve load-bearing capacity, reduce deformation and fatigue, and extend pavement service life, particularly under heavy traffic conditions. Given that the trial mix contained a marginally higher binder content than the manufacturer's baseline recommendation, this could influence the performance outcomes, potentially amplifying some of the claimed benefits, such as increased elasticity or reduced susceptibility to early-life ageing, or altering the balance between stiffness and deformation resistance. As a result, any improvements observed during the trial may partly reflect the effects of this elevated binder content, and the deviation should be considered when interpreting the material's field performance.

The field trial was undertaken on 7 October 2025 on the B7029 (Chapelknowe Road) under a full road closure delivered by HOCHTIEF. The closure enabled resurfacing and all associated testing to take place within a controlled, traffic-free environment. This allowed the team to carry out temperature checks, monitor material behaviour and operate plant safely and consistently.

To support accurate assessment of material behaviour during installation, environmental parameters were recorded hourly. Ground temperature, air temperature and wind speed (measured using an anemometer at 2 m height) were captured to establish real-time site conditions. This data allowed the team to understand how environmental factors influenced cooling rates, compaction behaviour and overall workability, providing important context for interpreting the trial outcomes relative to typical installation conditions.

Temperature management was a key aspect of the trial. Infrared thermometers were used throughout laying to ensure the asphalt achieved the minimum rolling temperature requirement of 105°C, in line with BS EN 12697-13:2017. Maintaining temperatures above this threshold was essential to ensure adequate compaction and binder mobility to aid long-term durability of the material. Laying records show that the temperatures achieved on site were within the appropriate tolerances.

For example, on the eastbound lane of Chapelknowe Road between chainage 0–48, the surface course material containing the EcoFlakes PRO additive was laid with an initial temperature of 171°C, which is within the guidance range of 165–195°C for this mix type. During rolling, the material temperature was 128°C, remaining comfortably above the outlined minimum rolling temperature of 105°C. Similar compliance was observed across other sections of the site, indicating that temperature control throughout transport, laying and compaction was consistent with specification requirements.

Through this process, the EcoFlakes PRO asphalt mix was benchmarked directly against a conventional HRA mix to determine whether it could meet or exceed standard performance in areas such as compaction behaviour, temperature retention, surface finish and overall texture quality. The recorded environmental data, temperature logs and material production information ensured that the trial was carried out in accordance with recognised standards, including BS 594987 for asphalt transport, laying and compaction, BS EN 13108-4 for HRA material specifications for UK-specific guidance on mixture requirements and type-testing protocols. This compliance supports a robust and reliable comparison between the modified and conventional materials.

# Environmental & Sustainability

Refer to ‘[Input reference to Carbon Report when I know it](#)’ for details of carbon and sustainability findings.

## Limitations

While the trial provided valuable insight into the behaviour of the EcoFlakes-modified asphalt under live installation conditions, several limitations affect the strength and completeness of the analysis. These limitations relate to the scope of the trial, constraints in data collection, uncertainty around material specification compliance, and gaps in performance testing.

The EcoFlakes-modified surface course was laid on a single day under relatively stable environmental conditions. As a result, the dataset does not capture how the material performs under a broader range of weather scenarios, particularly colder, wetter, or more variable conditions that may influence cooling rates, compaction behaviour and workability. Recommendation is that further trials are to be conducted to obtain more detailed comparative data to address this limitation.

The trial only assessed performance at the surface layer and did not control for variability in the underlying pavement structure. If the base or binder layers, or the overall foundation, were deteriorated, cracked or uneven, this could influence surface behaviour, compaction results and long-term performance independently of the EcoFlakes PRO additive. Without a full structural condition assessment prior to resurfacing, these effects cannot be fully separated.

Although the recorded mix design (35/14F 40/60 EcoFlakes PRO, Recipe dated 09.01.26) shows a 0.5% EcoFlakes PRO content, consistent with supplier dosing recommendations, there remains a limitation in confirming full compliance with all manufacturer requirements. No evidence has yet been provided to verify whether all aspects of the mix, including binder grade, aggregate gradation or mixing procedure, fully align with the supplier’s specification for EcoFlakes PRO. If any deviations from suppliers’ specification for the material occurred during the mixing process, this may influence material performance and will have impacted validity of the technical and operational data used in the analysis of this report.

No structured feedback has been obtained from site operatives or the surfacing crew regarding mix workability, compaction response, spreading behaviour or thermal sensitivity. Operative observations are valuable for understanding the practical handling characteristics of modified asphalt materials, and their absence limits the qualitative assessment of onsite performance.

The trial was completed recently, meaning insufficient time has passed to allow meaningful assessment of long-term properties such as durability, resistance to deformation, cracking performance and surface texture retention. Any conclusions regarding lifecycle performance, maintenance needs or whole-life cost benefits cannot yet be substantiated.

No laboratory testing was carried out for key mechanical properties that would typically support the evaluation of a modified asphalt mixture. This includes testing methods such as:

- Indirect Tensile Strength (ITS) test
- Marshal Stability and Flow test
- Tensile Strength Ratio (TSR) test for moisture susceptibility

The absence of these tests limits the ability to benchmark the EcoFlakes PRO mix against standard requirements or to validate manufacturer performance claims, particularly those relating to structural capability and load-bearing improvement.

Sand patch testing was undertaken only for the conventional HRA surface course between chainage 100–150, resulting in a macrotexture depth of 1.2 mm. However, no sand patch tests were completed for the EcoFlakes-modified surface between chainage 0–100, preventing any like-for-like comparison. Macrotexture is important because it influences high-speed skid performance by allowing water to escape from the tyre–road interface. Whereas microtexture, the fine roughness of the aggregate governs low-speed friction. Without equivalent macrotexture data for both materials, and without microtexture or direct friction testing, skid-related performance differences between the two mixes cannot be assessed.

The EcoFlakes PRO additive is marketed as enhancing performance characteristics. However, no testing aligned with these claims were undertaken. The absence of this data means the current evaluation cannot verify whether the additive provides measurable structural benefits.

## Review and Discussion of 3<sup>rd</sup> Party Laboratory Tests

As part of this assessment of the material, this technical note has incorporated lab test data supplied within the technical data sheet provided by the supplier EcoPals and therefore the validity of the data cannot be confirmed and assessments have been made based on interpretations of the data. The data included within this report consists of Hamburg Wheel Track Testing (HWTT) which aids evaluation of the rutting resistance and moisture susceptibility of asphalt mixes, the data provided shows the test what carried out for a German specification surface course graded '25/55-55-A' and a AC16 50/70 penetration strength specified surface course mix which included the EcoFlakes PRO additive. Results of the test can be seen in Table 1.

**Table 1 – Results of Hamburg Wheel Track Testing**

AC16 DTS	Rutting Depth (mm)	Prop. Rutting Depth (%)
25/55/-55-A	2.65	4.5
50/70 + EcoFlakes PRO	2.0	3.4

The HWTT results show that the EcoFlakes-modified AC16 mixture classification exhibits a rut depth of 2.0 mm, compared with 2.65 mm for the 25/55-55A control mix. This represents an improvement of roughly 25%, indicating that the EcoFlakes PRO mixture offers greater resistance to permanent deformation under repeated loading. This enhanced rutting resistance suggests the material is less likely to develop wheel-tracking or surface depressions over time, particularly under slow-moving or heavy traffic.

The fact that the EcoFlakes PRO mix outperforms a polymer-modified binder (25/55-55-A) while using a softer 50/70 binder implies that the additive contributes to improved binder cohesion and stiffness. This can help reduce early-life degradation and slow the progression of structural fatigue of the surface course.

Overall, the reduced rutting depth measured in the HWTT indicates that the EcoFlakes-modified asphalt has the potential to deliver greater durability and extended service life, with a slower rate of surface degradation and fewer maintenance interventions compared to the conventional mixture. However, these laboratory results should be supported by longer-term field monitoring to confirm the full extent of whole-life benefits.

Further laboratory testing was conducted in the form of a Braunschweig ageing test carried out both prior to ageing and after ageing of the material. The test was conducted to highlight issues with asphalt surface courses are subjected to artificial ageing and determine the fracture temperature from continuous freeze-thaw cycles. Results of which are shown in both Table 2 and Table 3.

**Table 2 – Results of Braunschweig Ageing Test Before Ageing**

	<b>Bruchtemperatur / Ductile-brittle transition temperature (<math>T_F</math>) (°C)</b>	<b>Bruchspannung / Breaking stress (<math>\sigma_F</math>) (MPa)</b>
AC11 EcoFlakes PRO	-22.4	3965
AC11 PmB 25/55-55-A	-24.0	3964

**Table 3 – Results of Braunschweig Ageing Test Before Ageing**

	<b>Bruchtemperatur / Ductile-brittle transition temperature (<math>T_F</math>) (°C)</b>	<b>Bruchspannung / Breaking stress (<math>\sigma_F</math>) (MPa)</b>
AC11 EcoFlakes PRO	-18.3	3655
AC11 PmB 25/55-55-A	-15.8	3549

As seen in Table 2 before ageing, the EcoFlakes PRO mixture achieved a ductile-brittle transition temperature ( $T_F$ ) of  $-22.4\text{ }^\circ\text{C}$ , compared with  $-24.0\text{ }^\circ\text{C}$  for the polymer-modified control mix. These values indicate that both mixtures perform similarly at low temperatures in their unaged state, with only a minor difference between the two. Breaking stress results were almost identical (3965 MPa vs 3964 MPa), suggesting no meaningful variation in fracture strength prior to ageing. This demonstrates that incorporating EcoFlakes PRO does not negatively affect early-life thermal resistance or the structural integrity of the mixture in its unaged condition.

As seen in Table 3 after ageing notable differences emerge. The EcoFlakes-modified mixture recorded a transition temperature of  $-18.3\text{ }^\circ\text{C}$ , compared with  $-15.8\text{ }^\circ\text{C}$  for the polymer-modified mixture. Since higher transition temperatures indicate earlier onset of brittleness, the lower  $T_F$  value for the EcoFlakes PRO material demonstrates better retention of low-temperature flexibility following the ageing process. Similarly, the breaking stress of the EcoFlakes PRO mix remained higher after ageing (3655 MPa vs 3549 MPa), indicating that the material maintains greater tensile capacity and crack resistance under freeze-thaw fatigue.

This performance suggests that the EcoFlakes PRO additive helps slow down the stiffening and embrittlement processes that typically occur as asphalt oxidises and loses ductility over time. As a result, the EcoFlakes-modified mixture is likely to exhibit improved resistance to thermally induced cracking during later stages of pavement life, particularly in colder climates or locations subject to repeated freeze-thaw cycling. In practical terms, the enhanced retention of flexibility and higher residual fracture strength imply that pavements containing EcoFlakes PRO may experience reduced cracking rates, slower degradation and potentially longer service life compared to conventional polymer-modified mixtures when subjected to long-term environmental ageing.

The final test that was carried out comprised of a uniaxial tensile test that was conducted to determine the mechanical properties of the material under tensile loading. This included assess the material's strength, ductility, and stiffness which are essential for ensuring a pavement's performance and durability. Results of the uniaxial tensile test are seen below in Table 4.

**Table 4 - Results of the Uniaxial Tensile Test**

<b>AC11 DC</b>	<b>Fracture Strain (‰)</b>	<b>Fracture Load Cycle Number (n)</b>
25/55-55-A	4.5	38.360
50/70 + EcoFlakes PRO	6.85	108.886

The EcoFlakes-modified AC11 DC mixture achieved a fracture strain of 6.85‰, compared to 4.5‰ for the 25/55-55A polymer-modified mixture. Higher fracture strain indicates that the material can undergo greater deformation before cracking, demonstrating improved ductility and flexibility. This suggests that the EcoFlakes PRO mixture is better able to accommodate tensile stresses generated by traffic loading, temperature fluctuations and foundation movement without initiating cracks.

The improvement is further supported by the fracture load cycle results. The EcoFlakes-modified mixture withstood 108,886 load cycles before failure, nearly three times higher than the 38,360 cycles sustained by the 25/55-55A mixture. This substantial increase in fatigue resistance indicates that the EcoFlakes PRO mixture can endure significantly more repeated stress cycles before structural cracking develops. In pavements, enhanced fatigue performance translates to slower crack propagation, reduced surface deterioration and extended time before maintenance interventions such as patching or resurfacing become necessary.

Overall, the uniaxial tensile test results demonstrate that incorporating EcoFlakes PRO meaningfully improves both the tensile strength capacity and fatigue resistance of the asphalt mixture. The combination of higher fracture strain and greater load cycle endurance suggests that the EcoFlakes-modified asphalt is less prone to premature cracking and better equipped to maintain structural integrity over its service life. These improvements indicate a strong potential for enhanced pavement longevity, particularly in environments subject to repeated traffic loading or thermal cycling.

## Conclusions & Recommendations

The results obtained from the laboratory testing indicate that EcoFlakes PRO has the potential to enhance key aspects of asphalt performance. Improvements in rutting resistance, retention of low-temperature flexibility after ageing and significantly higher tensile fatigue performance suggest that the additive may contribute positively to long-term durability. These findings indicate potential benefits for service life and whole-life performance when compared to conventional polymer-modified mixtures.

However, several gaps in the current dataset limit the ability to draw firm conclusions. Important performance claims, particularly relating to load-bearing capacity and structural strength, cannot yet be verified due to the absence of stiffness, moisture sensitivity, wheel-tracking at multiple temperatures and skid resistance testing. No texture or SCRIM-equivalent testing was carried out on the EcoFlakes PRO surfacing during the field trial, and no cores were taken to assess compaction quality or early-life degradation. These limitations mean that further evidence is required before a reliable long-term assessment can be made.

It is therefore recommended that additional laboratory and field testing be undertaken. This should include skid resistance measurements, stiffness modulus testing, moisture susceptibility (TSR), and structural performance tests capable of validating the manufacturer's load-bearing claims. Coring from the trial site, both immediately and after a defined period, would help assess in-situ density, durability and comparative degradation against conventional asphalt.

Future trials already planned provide a key opportunity to collect this missing information. If the current RAG rating for the material is low, specific data such as full laying records, compaction temperatures, density results and functional surface testing should be requested to strengthen the overall evidence base. In addition, further independent testing currently being undertaken by Nottingham University will become available after submission of this report and should be incorporated into the next stage of assessment.

Overall, while initial results are promising, additional structured testing and ongoing field monitoring are essential to fully validate the long-term suitability of EcoFlakes PRO for wider pavement application.