Centre of Excellence
for Decarbonising Roads

WINTERPAVE

Technical Note

Abstract

The trial evaluated the use of WinterPave, an anti-icing additive engineered to reduce the amount of salt needed for winter road maintenance and to limit the formation of ice on road surfaces, thereby lowering the risk of accidents

Department for Transport
ADEPT LIVELABS2 Decarbonising Local Roads
North Lanarkshire Council
Transport for West Midlands
Amey
COLAS We open the way

Contents

Executive Summary

This report documents and evaluates the trial of Iterchimica's WinterPave on the footpaths of Marmion Road, and Abbotsford Court and Abbotsford Place in Cumbernauld, Glasgow (August - October 2025). The trial assessed carbon savings, operational viability, technical performance impact, wider environmental benefits and the potential for wider application.

Introduction

The WinterPave microcapsule anti-icing additive trial is an innovative approach to improving winter resilience on the UK highway network. Developed by Iterchimica, the additive, used in surface treatment, embeds salt-storage microcapsules directly into asphalt during construction, creating a surface that lowers the freezing point of water and prevents ice from bonding to the road. According to manufacturer's claims this reduces the formation of black ice and decreases the need for traditional gritting operations. By cutting salt use and winter maintenance activities, the technology supports national aims for improved sustainability, reduced carbon emissions, and enhanced road safety.

Delivered through the Live Labs 2 programme, the trial focuses on assessing the suitability of WinterPave for wider use across the UK's local road network, with North Lanarkshire serving as the key test area. The project aims to evaluate the environmental, operational, and technical performance benefits of the technology, including reduced carbon emissions, lower winter maintenance requirements, and enhanced safety for both pedestrians and road users during cold weather.

By limiting freezing, WinterPave according to manufacturer claims also helps reduce the destructive impact of freeze–thaw cycles on the pavement structure, while simultaneously cutting corrosive damage to nearby steel street furniture caused by traditional gritting operations. In addition, reduced salt use helps minimise pollution to surrounding soil, water, and air. With manufacturer Iterchimica claiming a long service life and the ability to be recycled repeatedly throughout the entirety of its lifespan before it fails to comply with requirements set out in the standards for asphalt surfacing materials, WinterPave could potentially offer a more sustainable and resilient alternative to conventional asphalt.

By benchmarking WinterPave asphalt against conventional alternatives, the trial will provide valuable insights into real-world performance. The outcomes will help guide future procurement and specification decisions, supporting the shift toward more sustainable, efficient, and cost-effective asphalt solutions across the UK.

Methodology

The WinterPave product was installed across several footpath locations in Cumbernauld, where existing flag paving slabs were removed and the areas resurfaced using the WinterPave asphalt mixture. Installation took place along Marmion Road (1,050 m²), Abbotsford Road, and Abbotsford Court (1,505 m²). These sites were selected to provide a varied and representative range of real-world conditions, enabling the material's performance to be assessed across different pedestrian environments where traffic loading, footfall volumes, and weather exposure may vary. The chosen locations also allowed for comparison against nearby areas that continued to use traditional surfacing and standard winter maintenance practices.

To assess performance, the WinterPave asphalt mix, produced with a 4.2% additive within Iterchimica's recommended 4–5% range, was benchmarked against conventional Hot Rolled Asphalt (HRA) and standard winter maintenance practices using rock salt for footpath gritting.

For this trial, the asphalt was produced in accordance with the mix recipe dated 09.01.26, identified as AC6 100/150 WinterPave. In this designation, AC6 confirms the material is an asphalt concrete mix with a nominal 6 mm maximum aggregate size, suited to fine-graded surface course applications. The 100/150 specifies the bitumen penetration grade, indicating a softer binder with a penetration range of 1.0–1.5 mm, providing greater flexibility and improved performance under freeze–thaw conditions. Full details of the AC6 100/150 WinterPave recipe are provided below:

- 6mm Aggregate: 35.5%
- Fines: 49.3%
- Reclaimed filler: 2.5%
- Limestone filler: 2%
- Binder Content: 6.49%
- Warm Mix Additive: 0.013%
- WinterPave: 4.2%

Following completion of the first trial site qualitative feedback from on-site operatives present during the execution of the second trial site at the Marmion site. This feedback contributed to reducing material waste during subsequent works at the Abbotsford sites, although the specific methods used to achieve this improvement have not yet been communicated by the operations team who conducted the trial.

Beyond the initial trial period, long-term monitoring is planned over a three-year duration, with additional data to be shared to the Live Labs knowledge bank. This extended evaluation will benchmark the ongoing performance of the WinterPave mix against conventional HRA with standard winter maintenance practices, allowing both short-term and long-term outcomes to be captured effectively. The continued monitoring will help determine durability, consistency under repeat freeze–thaw cycles, and overall lifecycle benefits, ensuring that the material's performance is understood not just during early adoption but throughout its operational lifespan.

Environmental & Sustainability

Refer to 'Input reference to Carbon Report when I know it' for details of carbon and sustainability findings.

Limitations

The trial faced significant site constraints, primarily due to footpath locations with restricted vehicle access. Materials had to be transported over relatively long distances from the delivery point using dumpers, resulting in double handling and increasing the risk of temperature loss. To minimise cooling, loads were covered with heavy-duty tarpaulins immediately after being offloaded from the transport truck and fed into the asphalt paver. The material was then moved to the placement areas as quickly as possible to maintain workable temperatures.

There were also inconsistencies in recorded conditions, with only a single entry for temperature and weather documented in the data collection sheet. No additional weather information was provided for Marmion Road beyond Day 1, nor for the Abbotsford sites, limiting the ability to correlate performance with environmental factors. Although the first day at Marmion was dry, no further weather details were supplied, and factors such as wind chill, likely influential in cooling, were not observed or recorded.

For benchmarking purposes, conventional materials were laid adjacent to the WinterPave sections to allow direct comparison in terms of ice formation and potential reductions in winter maintenance. As the trials were undertaken on pedestrian footpaths, the surfacing was exposed only to footfall rather than vehicular loading. While this environment is suitable for observing ice-mitigation behaviour, it limits the ability to assess material degradation under traffic-induced stresses. Consequently, the absence of vehicle loading restricts the extent to which WinterPave's structural performance, and therefore its wider suitability for UK roadways, can be evaluated within this trial.

Regarding sample size adequacy, the first trial highlighted several shortcomings, including significant waste (5.4T), which appeared to be reduced in the second trial (~1T). However, details on how this improvement was achieved have not yet been provided, when this information is provided from on-site operatives it will be included in further Technical Reports. Similarly, weather variability was not well captured, as the sites were not tested under a meaningful range of conditions.

At this stage, internally no laboratory testing has been conducted that would provide insight into the structural and performance properties of the material. Therefore, this technical note will be analysing lab testing results cited in WorldHighways report – "Self-de-icing Asphalt Pavement - Road Surface Technology 2022", which was conducted using 4.3% WinterPave Additive similar to the trial conducted as part of the Live Labs initiative. As this testing was not carried out internally, the reliability of this information cannot be confirmed. Refer to Table 1 in 'Analysis – Technical and Operational' section for the results of the laboratory tests.

As shown in Figure 1 and Figure 2, Iterchimica also provided test data which gave insight into the total ice coverage of a surface course material which contain 5% WinterPave Asphalt and a conventional surface course when exposed to two varying real world simulating scenarios. Refer to Figure 1 and Figure 2 for results. Although both laboratory tests provide useful baseline indicators of WinterPave's anti-icing performance, the controlled conditions limit how well the results translate to real-world environments. The fixed and linearly decreasing temperatures do not reflect natural, highly variable freeze–thaw cycles typical in the UK. Test samples used in the laboratory are manufactured under controlled conditions and are therefore inherently clean, uniform, and free from wear—unlike operational pavements, which accumulate contamination, experience traffic abrasion, undergo ageing, and develop changes in surface texture over time. Water application during testing is also highly controlled and does not replicate real environmental conditions such as variable rainfall intensity, snowfall, drainage behaviour, or wind effects. In addition, the tests do not account for pedestrian loading, construction-related variability, or the long-term depletion of microcapsules within the material. The relatively short test durations further limit the ability to assess durability or performance across multiple winter cycles.

With 3rd party gathered laboratory test data being the only tangible information available to be analysed at this stage, confidence in the materials performance cannot be certain with further data gathering on trial already conducted or internal lab testing where all potentially influential parameters can be monitors and controlled required to understand practical performance.

Review and Discussion of 3rd 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 Iterchimica and therefore the validity of the data cannot be confirmed and assessments have been made based on interpretations of the data.

Table 1 – Pre and Post-production lab study of asphalt containing WinterPave (4.3% additive)

Test Parameter	Units	Obtained Value		Specification Requirement
		Pre	Post	
Air Voids @ N2 (Design)	%	3.8	3.1	3-8
Indirect Tensile Strength (ITS) @ 25°C @ N2 (Design)	MPa	1.42	1.69	>0.8
Marshall Stability @ 75 Blows	kN	20.8	25.7	>10
Tensile Strength Ratio (TSR) @ 35 blows	%	96	94	>90

The results presented in Table 1 appear to demonstrate improvements in the mechanical performance of the WinterPave-modified asphalt between pre-production and post-production stages. Air voids decreased from 3.8% to 3.1%, representing an 18% reduction and remaining within the 3–8% specification band. This reduction suggests that the full-scale production process resulted in denser aggregate packing and improved binder coating, both of which reduce permeability and limit moisture ingress. A mixture with lower permeability typically experiences slower oxidative hardening and reduced susceptibility to stripping, which in turn supports improved long-term durability. However, due to the surface course having being on the lower end of the allowable air void percentage it could have the potential to impact drainage and result in ponding if the surface course is intended to be porous.

The Indirect Tensile Strength (ITS) at 25 °C increased from 1.42 MPa to 1.69 MPa, indicating a 19% improvement in tensile capacity. This enhancement suggests stronger binder to aggregate adhesion and improved cohesion within the mixture, which helps the surface course resist tensile stresses linked to traffic loading. Such gains are beneficial for delaying the initiation of cracking and enhancing the asphalt's ability to withstand in-service strain cycles.

Marshall stability also increased, rising from 20.8kN to 25.7kN, a 23.6% improvement and above the minimum requirement of 10kN. Higher stability values indicate stronger aggregate interlock and increased shear resistance, which have to potential to translate directly into improved rutting performance under repeated loading. This is particularly valuable in areas with slow-moving or heavily channelised traffic, where deformation tends to accumulate more rapidly.

The tensile strength ratio (TSR) decreased slightly from 96% to 94%, but both results exceed the 90% specification threshold. This indicates that the mixture may retain its tensile strength after moisture conditioning and remains resistant to stripping and moisture-induced deterioration. When viewed alongside the reduced air void content, the moisture performance remains strong and does not appear to present any concern based on interpretation of the data provided.

Overall, the WinterPave-modified asphalt appears shows improved mechanical behaviour following full-scale production, with gains in tensile strength, stability and density all pointing toward better resistance to cracking, rutting and moisture-related degradation based on interpretation of the data provided. While results in Table 1 does not provide a direct comparison with an equivalent conventional surface course, the enhancements observed from pre- to post-production indicate that WinterPave has the potential to contribute positively to the mixture's structural properties and may support improved service life and reduced deterioration rates when laid in-situ.

Figure 1 and Figure 2 compare ice formation on two surfacing mix designs: one containing 5% WinterPave additive and the other comprising the same surface course mix without the WinterPave additive, assessed under two different temperature scenarios designed to simulate real-world conditions.

Scenarios I: Temperature is fixed at -20°C

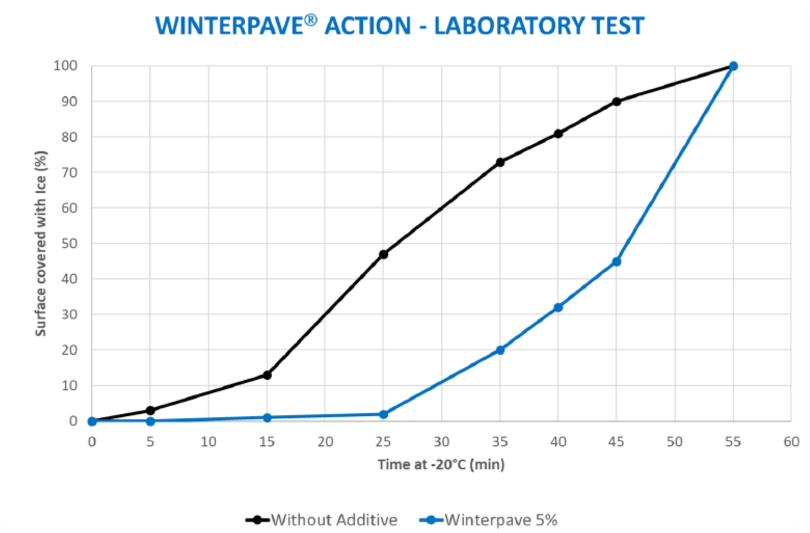

Figure 1 *– Constant Temperature*

In Figure 1, where temperature is held constant at –20°C, ice formation progresses rapidly on the untreated surface. Based on interpretation of the data provided within 25 minutes, the "Without Additive" results appear to show ~45% ice coverage, reaching ~80% coverage by 40 minutes and 100% by 55 minutes. In contrast, the WinterPave 5% sample appears to exhibit a significant delay where ice does not begin forming meaningfully until beyond 25 minutes of time elapsed, and by 40 minutes the coverage is >30%. Full ice coverage is not reached until 55 minutes. Based on interpretation of the data provided it indicates that WinterPave substantially slows the onset and progression of ice formation under continuous cold conditions (-20°C).

Scenarios II: Temperature is decreasing over the time with -0.02°C/min

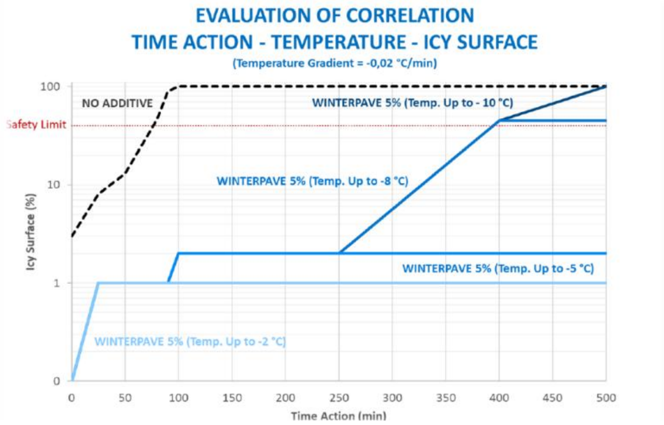

Figure 2 – *Gradual Temperature Decrease*

In Figure 2, it evaluates a more dynamic temperature scenario where temperature decreases gradually at a rate of -0.02 °C per minute. Based on interpretation of the data provided the untreated surface again ices quickly, exceeding the safety threshold early in the time sequence. The surface course which contained WinterPave demonstrates several plateaus in ice formation, each corresponding to different temperature thresholds (up to –2 °C, –8 °C, –10 °C). These plateaus indicate that WinterPave actively delays ice formation over extended periods as temperature falls. Ice coverage remains minimal for the first 100 minutes, increases slowly, and only approaches unsafe levels beyond the point 400 minutes has elapsed.

Overall based on the interpretation of the data provided by Iterchimica, both graphs show that WinterPave delays ice formation, reduces the rate of surface icing, and extends the time window before hazardous conditions develop. The additive appears to be particularly effective in both extreme cold and progressively cooling environments.

Conclusions & Recommendations

Overall, the laboratory results indicate that the WinterPave-modified asphalt demonstrates promising mechanical performance, with improvements in air voids, tensile strength, stability and moisture resistance following full-scale production. These gains suggest that WinterPave has the potential to enhance resistance to cracking, rutting and moisture-related degradation, while the ice-formation studies indicate a clear benefit in delaying surface icing under both constant and reducing temperature scenarios. However, the current dataset focuses predominantly on material characterisation and anti-icing behaviour and does not yet provide a complete picture of how the additive influences long-term pavement performance.

To fully understand the implications of using WinterPave as a surface course material, further testing is recommended. This should include sand patch testing to confirm macrotexture depth and assess skid resistance, as well as coring immediately after construction and again at pre-determined intervals to evaluate in-situ density, compaction quality and degradation over time compared to a conventional surface course. These additional measurements will help determine whether the additive influences long-term durability, drainage characteristics or functional surface performance.

Future WinterPave field trials provide an opportunity to collect this additional data. If the current RAG rating for the material remains low due to limited evidence, the next phase of trials should be used to request expanded information, including full laying records, functional surface testing and long-term monitoring data. Increasing the scope and quality of collected data will enable a more robust assessment of the material's suitability for wider adoption.

In addition, further independent laboratory testing currently being undertaken by Nottingham University will become available after the submission of this report. These results will provide additional insight into the mechanical behaviour and anti-icing performance of the additive and should be incorporated into future updates of the evaluation. Together, these further data sources will help build a fuller understanding of WinterPave's effects on pavement performance, whole-life durability and potential operational benefits.