



Department for Transport

ADEPT **LIVELABS2**
Decarbonising Local Roads

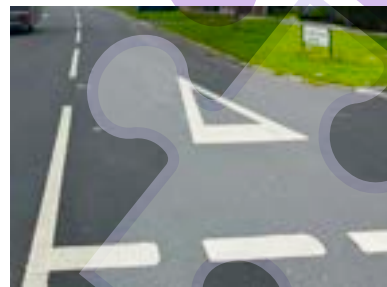


**LIVERPOOL
LIVE LABS**
DRIVING DECARBONISATION

LIVERPOOL LIVELABS

CASE STUDIES

These case studies highlight the extensive scope of collaboration with a goal to create a framework for decarbonising local roads in the UK in order to achieve net zero by 2030.



LIVERPOOL LIVELABS

CASE STUDIES

LOW CARBON APPROACH TO ASSET MAINTENANCE

Reducing Embodied Carbon in Highway Surfacing

This Low Carbon Approach to Asset Maintenance case study forms part of a wider suite of case studies capturing the findings from the Liverpool Live Labs programme and reflects the city's commitment to decarbonising highway infrastructure.

Live Labs 2 is a three-year, £30 million, UK-wide programme funded by the Department for Transport that will run until March 2026, with a five-year subsequent, extended monitoring and evaluation period.



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FOREWORD

The ADEPT Live Labs 2: Liverpool programme has been an enriching learning experience for Liverpool City Council, our highways teams, our communities, and the many SMEs that form the backbone of our local innovation ecosystem. Decarbonisation sits at the core of long-term resilience, and with Liverpool's ambitious goal of becoming a net zero city by 2030, this programme has played a critical role in accelerating our progress, alongside our wider evolution as a Council.

Through Live Labs 2, Liverpool is now equipped with a cohort of professionals who are familiar with a nationally accepted carbon assessment and capture methodology – giving us the tools, understanding and confidence to make informed, accountable decisions about carbon reduction across the lifecycle of our highways assets. This capability will long outlast the programme itself, embedding a legacy of informed, data-driven decarbonisation in the city's operations where these have been proved by the programme.

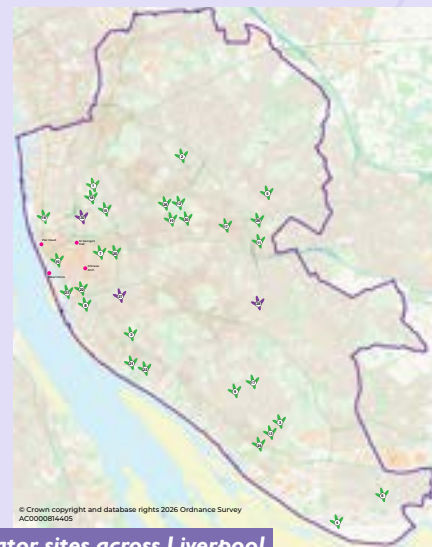
Within the programme ecosystem, we tested 26 innovations, spanning far more than materials alone. These included new processes, toolkits, decision-making approaches, and practical interventions that collectively support our commitment to building a functioning highways decarbonisation ecosystem. Supported by an expert panel, each option was rigorously assessed for its innovation potential and its ability to meaningfully reduce carbon before being adopted. Our ambition from the outset was clear: embrace innovation, remain open to challenge, and work collaboratively to understand what truly moves the needle on carbon reduction.

Despite needing to align with wider changes within the Council, and the challenges faced by nearly all Authority's across the UK, the programme succeeded because of the strength, expertise, and dedication of our partners across the ecosystem. We would like to extend our sincere thanks to the core members of the innovation ecosystem developed through the programme:

- **Colas** – Programme Delivery & Innovation Management Partner, also realising new ways of including carbon impacts into road condition-based Asset Management approaches.
- **Bird & Bird** – Co-developer of a pioneering procurement toolkit.
- **Pell Frischmann** – Developers of the Options Configurator Tool.
- **Proving Services** – Independent testers of our assumptions and carbon assessment approaches.
- **Liverpool John Moores University** – Innovators in materials development.
- **Dowhigh and Huyton Asphalt Civils** – Our committed local contractors installing innovation products and embracing new ways of working.
- **Newcastle City Council and Aberdeen City Council** - Partner cities for demonstrators and vital knowledge sharing.

Another defining strength of the programme was its verge-to-verge scope. This was not limited to resurfacing or traditional asset management innovations. We trialled solutions in road marking, drainage, reuse and recycling, operational processes, and more – reflecting the full complexity and opportunity of the road environment.

From the 26 innovations we trialled, 17 innovations spanning categories such as Decision-Making & Network Management, Road Markings, Intelligent Lighting, Asset Maintenance, Drainage, and People-Focused Street Enhancements have already been adopted or are moving toward becoming business-as-usual, provided the site conditions are suitable. Others are undergoing extended monitoring and evaluation over the next five years to better understand performance, durability, and long-term carbon reduction potential. And while not every innovation delivered the outcomes we hoped for, each trial provided valuable learning - an essential part of any genuine innovation journey.



Demonstrator sites across Liverpool

As we present this suite of case studies, we do so with pride in what can be achieved with a laser-sharp focus, unwavering dedication and a culture of collaboration. These pages represent countless hours of collaboration, problem-solving, curiosity, and shared ambition across partners, teams, and communities.

On behalf of Liverpool City Council, I would like to extend our sincere thanks to the Department for Transport (DfT) and ADEPT as the funding and commissioning bodies, whose support and leadership have been essential in enabling this work. I would also like to thank every partner, every member of our LCC teams, every contractor, SME, academic, and every community voice – big or small – who contributed to the success of this project. Your effort and commitment have not only delivered a highly successful programme but have also helped build the foundations for a cleaner, more resilient, and more sustainable Liverpool.



Director of Sustainable Transport,
Highways and Parking,
Liverpool City Council





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CASE STUDY LOW CARBON APPROACH TO ASSET MAINTENANCE

Reducing Embodied Carbon in Highway Surfacing

1. Executive Summary

The Carriageway Resurfacing & Low-Carbon Asphalt category evaluates alternative asphalt materials, resurfacing techniques and pothole solutions trialled in Liverpool as part of the ADEPT Live Labs 2 where the primary driver for selection was measurable embodied carbon reduction compared to traditional asphaltic resurfacing materials.

Traditional resurfacing is carbon intensive due to:

- High-temperature production
- Virgin aggregate use
- Bitumen content
- Transport of materials
- Plant energy use
- Shorter maintenance cycles

Each innovation in this category was independently assessed against its Business-As-Usual (BAU) resurfacing equivalent to determine embodied carbon savings, lifecycle implications, and suitability for wider deployment.

The innovations are:

Evotherm, HALO RubberPave, Milepave, RubberPave LIFE, Techscreed, RoadPatch MMA

2. Business-As-Usual (BAU) Baseline

The typical BAU solutions used as baseline scenarios include:

- Hot-mix asphalt with virgin aggregate material and bituminous binder
- Warm-mix asphalt
- Reactive pothole repair after failure.
- Traditional hot-applied pothole repair.

The most significant carbon impacts are attributable to:

- Asphalt, primarily resulting from the bitumen content and high production temperatures.
- Fuel usage (particularly diesel) for plant items
- Long-term maintenance requirements due to the limited lifespan of the asphaltic surface.



CASE STUDY LOW CARBON APPROACH TO ASSET MAINTENANCE

Reducing Embodied Carbon in Highway Surfacing

3. Innovation Funnel & Advisory Panel

To support consistent, transparent and evidence-based decision-making across the programme, an Expert Advisory Panel was established to guide the evaluation and selection of all innovations considered for Live Labs trials. The panel brings together specialists from local authorities, academia, engineering, behavioural insights, lighting, and innovation management, providing a balanced and multidisciplinary review of each proposed solution.

Working alongside the scoring workshop, the panel independently assesses technical feasibility, safety benefits, carbon impact, operational risks, installation constraints and long-term sustainability. Through structured scoring, expert discussion and refinement, the panel ensures that only the most suitable, high-value technologies progress to the planning and implementation stages. This process has been instrumental in ensuring that all chosen innovations are robust, appropriate for local conditions, and aligned with the overarching objectives of safety, decarbonisation and improved user outcomes.

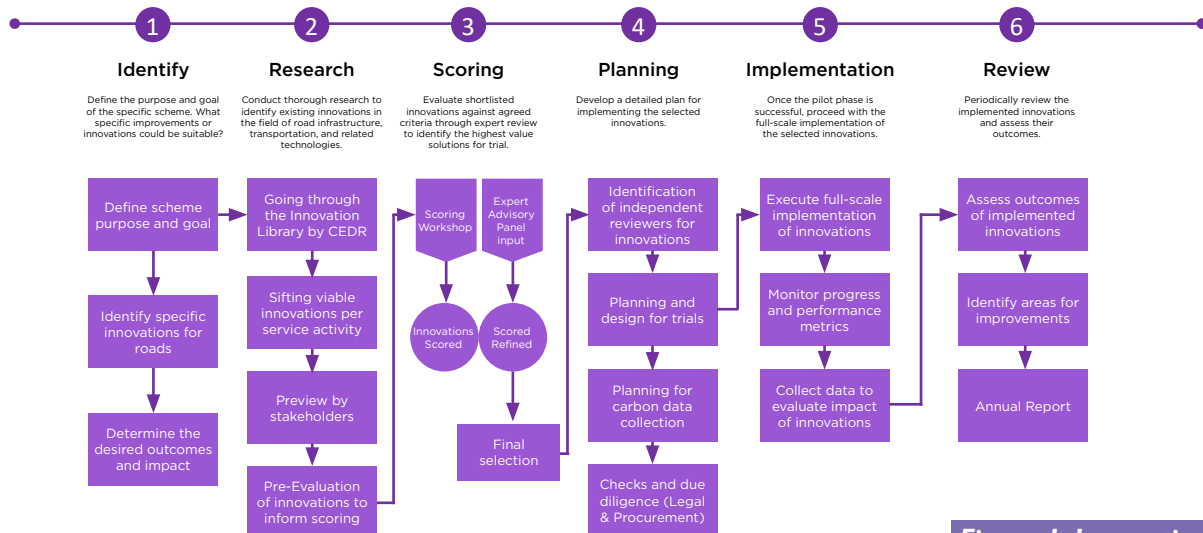


Figure 1: Innovation Funnel

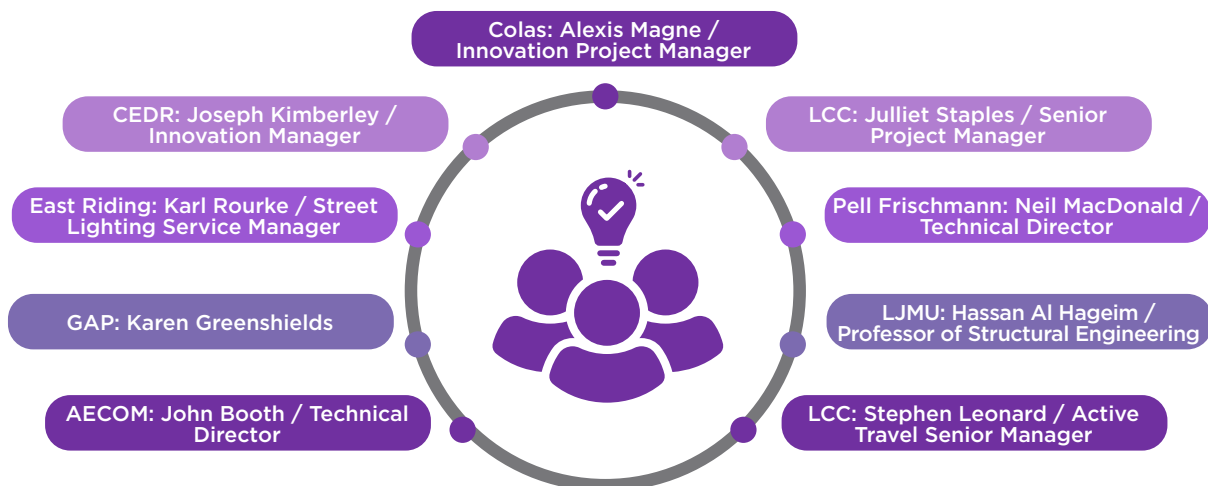


Figure 2: Expert Panel

CASE STUDY LOW CARBON APPROACH TO ASSET MAINTENANCE

Reducing Embodied Carbon in Highway Surfacing

4. Carbon Assessment Methodology

Each innovation was assessed against its BAU comparator using whole-life carbon principles, in accordance with the Carbon Calculation and Accounting Standard (CCAS) process (as outlined in Figure 3) and the PAS2080 carbon lifecycle stages.

Carbon calculations considered:

- The embodied carbon of the materials used
- Transportation and travel to site
- Installation processes and plant use
- Operational energy requirements (where applicable)
- The processing of waste removed from site
- Maintenance frequency
- Expected lifespan

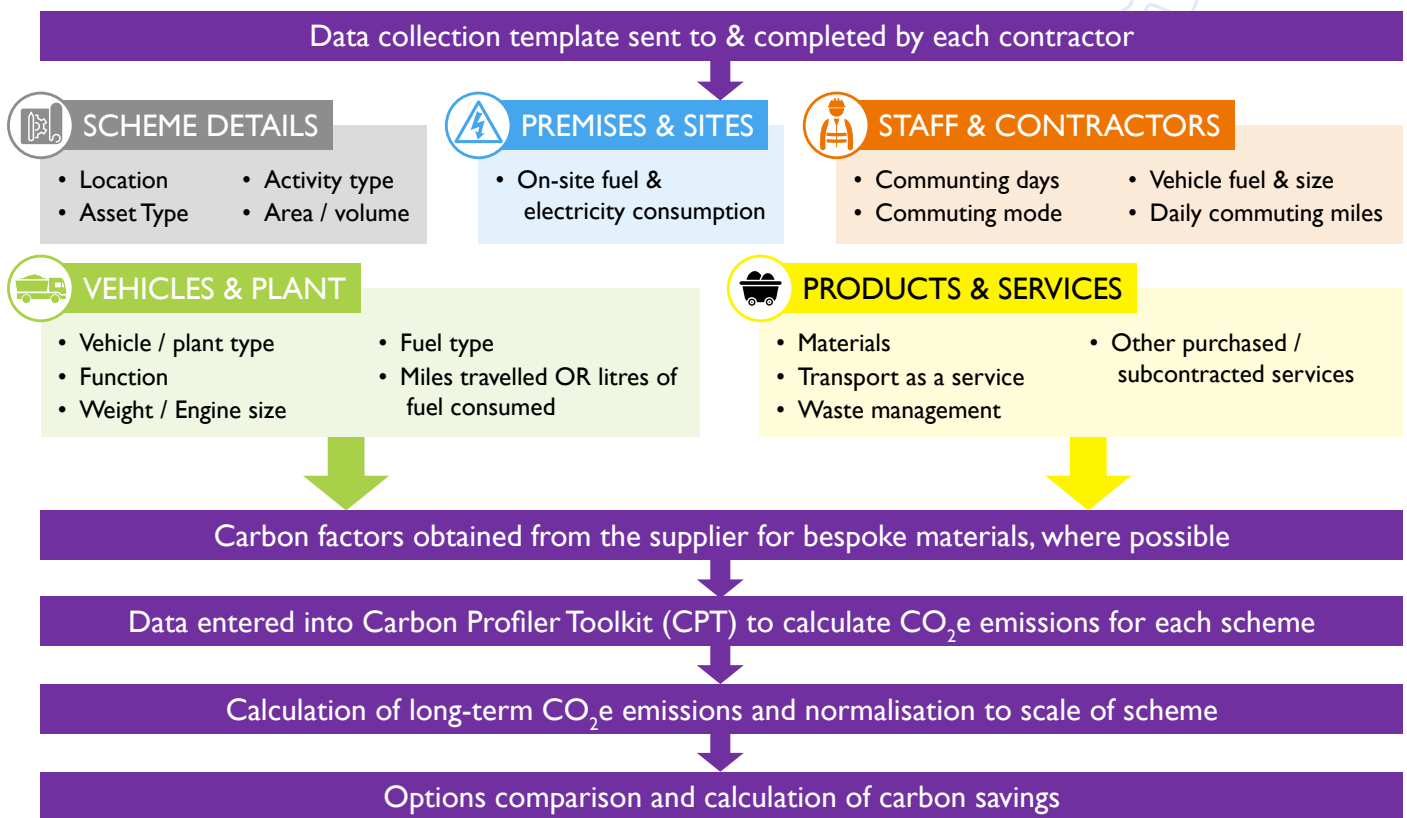


Figure 3: The carbon assessment process

Percentage reductions stated in the Carbon Impact section of each case study reflect the difference in carbon emissions between the innovation and its conventional equivalent. Carbon reductions are presented relative to conventional HMA resurfacing, except for where the baseline was explicitly stated to be an alternative product.

CASE STUDY LOW CARBON APPROACH TO ASSET MAINTENANCE

Reducing Embodied Carbon in Highway Surfacing

5. EVOTHERM: WARM-MIX ASPHALT ADDITIVE

Type: Warm-mix asphalt additive

Primary Driver: Reduced production temperature and costs remaining consistent with BAU

Installed on site by: Tarmac/Huyton Asphalt Civils

5.1 Innovation Description

Evotherm: a chemical warm-mix asphalt (WMA) additive, designed to lower asphalt production and paving temperatures while improving performance, workability, and sustainability. The product can reduce asphalt mixing temperatures by up to ~90°F compared to conventional materials, this lowering energy consumption and emissions, and also result in less odour and improved air quality when laying. This produces a workable asphalt mix, without the need for high heat.

5.2 Context and site selection

Millersdale Road sits within a suburban residential area characterised by semi-detached housing, schools, and local services. The corridor experiences regular local traffic and forms part of an established neighbourhood network where maintaining ride quality and safety is

essential. Its selection for resurfacing was influenced by its suburban context, consistent vehicle loading, and the need to address surface deterioration proactively to prevent repeat maintenance cycles.

5.3 BAU Comparator

- Conventional materials produced at higher temperatures.



Figure 4: Millersdale before intervention



CASE STUDY LOW CARBON APPROACH TO ASSET MAINTENANCE

Reducing Embodied Carbon in Highway Surfacing

5.5 Carbon Impact

Carbon savings were primarily achieved through reduced energy demand during production and laying.

- 6.1 tCO₂e upfront saving
- 12.3 tCO₂e saving expected over 40 years
- 15% reduction vs BAU

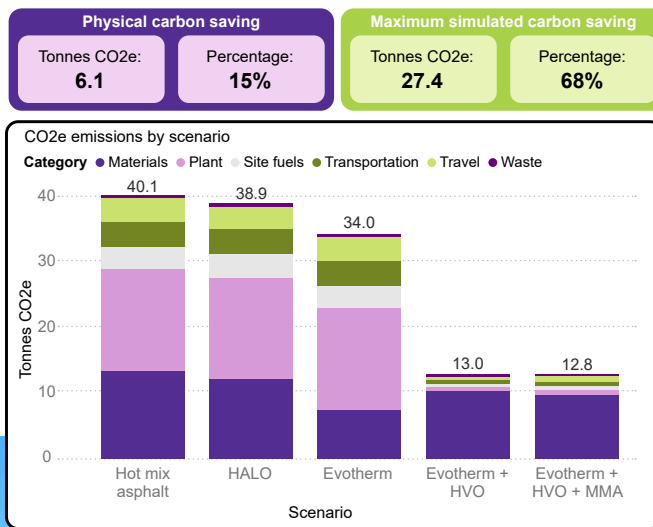


Figure 5: Carbon profiles for Evotherm on Millersdale Road



Figure 6: Millersdale Road after resurfacing

5.5 Outcomes and Learning

- Warm-mix technologies offer scalable carbon reduction without altering laying processes.
- Strong candidate for Business-As-Usual integration.
- Carbon benefit is incremental but replicable across high volumes of resurfacing.
- The scheme demonstrated that Evotherm did not incur higher costs compared with the BAU approach. This reinforces an important learning: carbon reducing alternatives are not necessarily more expensive, and viable low carbon choices can be delivered within existing budgets.
- While initial performance and carbon savings are positive, it is essential to undertake ongoing Monitoring & Evaluation (M&E) to assess how the Evotherm enhanced warm mix asphalt performs over its operational life.

CASE STUDY LOW CARBON APPROACH TO ASSET MAINTENANCE

Reducing Embodied Carbon in Highway Surfacing

6. HALO RUBBERPAVE: LOW CARBON ASPHALT

Type: Low-carbon asphalt incorporating recycled tyres and HALO material

Primary Driver: Lower carbon than BAU and local SME innovation

Installed on site by: Huyton Asphalt Civils

6.1 Innovation Description

HALO RubberPave is a rubber-modified asphalt surface course that integrates recycled end-of-life tyres with low-carbon warm-mix asphalt (WMA) technology to deliver a high-performance, durable, and lower-carbon surfacing solution. The material incorporates rubber equivalent to one tyre per tonne of asphalt, typically equating to 500–750 recycled tyres per kilometre, depending on road width and surfacing variant. This approach directly supports circular-economy objectives by diverting tyre waste from landfill and re-purposing it as a valuable road-building material.

Using warm-mix technology, HALO RubberPave reduces production temperatures by up to 40°C, lowering energy consumption and associated greenhouse gas emissions. The system is BBA-accredited and achieves Level 3 very quiet surface performance (-3.5 dB(A)), offering reduced noise, improved flexibility, enhanced rut-resistance, and strong long-term durability compared with conventional hot-mix surfacing.

6.2 Context and site selection

Alder Wood Avenue is situated within the Speke ward of Liverpool, a suburban area characterised by extensive post war housing estates, community facilities, and a dense residential population. The road functions as an important local distributor route, connecting neighbourhoods with key destinations such as schools, small retail centres, healthcare services, and public transport links. At approximately 1.2 km in length, it plays a significant role in enabling daily movement for residents, particularly in a community with a higher than average proportion of younger families and regular school related traffic.

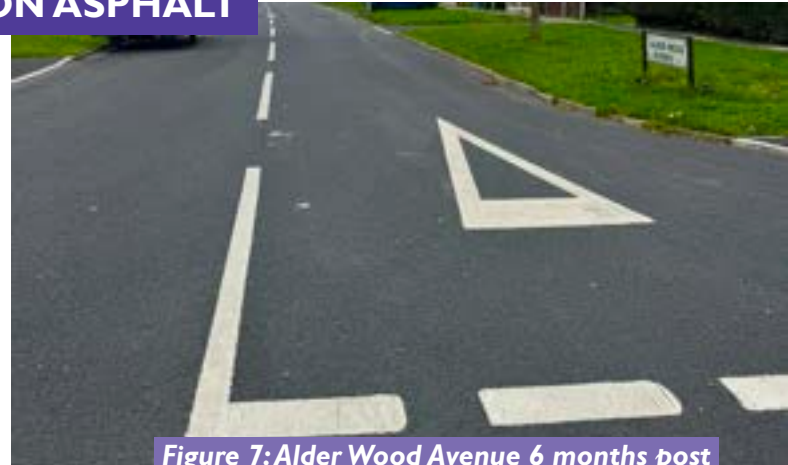


Figure 7: Alder Wood Avenue 6 months post installation with HALO RubberPave

The area experiences consistent vehicle usage, including private cars, service vehicles, and local bus movements, which collectively contribute to progressive wear of the carriageway surface. Routine inspections had identified ongoing deterioration, including early stage cracking and surface fretting, driven largely by the constant flow of short trip residential traffic rather than heavy goods vehicles.

Alder Wood Avenue was selected for the innovation trial because:

- The road's function as a busy community connector makes maintaining a safe, smooth, and resilient surface essential for residents' mobility and overall neighbourhood accessibility.
- The site offered a representative residential traffic profile, making it a practical location to evaluate the performance of low carbon materials under typical suburban loading conditions.
- Addressing the early deterioration proactively was seen as a means of reducing future reactive maintenance, lowering lifecycle costs, and minimising disruption to residents.
- The road's continuity and length provided an ideal testbed for deploying a full scale surfacing innovation, enabling meaningful comparison in terms of carbon, performance, and constructability.

CASE STUDY LOW CARBON APPROACH TO ASSET MAINTENANCE

Reducing Embodied Carbon in Highway Surfacing

6.3 BAU Comparator

- Conventional asphalt using virgin aggregates.

6.4 Carbon Impact

- 59.5 tCO₂e upfront saving
- 109.9 tCO₂e saving expected over 40 years
- 19% reduction vs BAU

Carbon savings were primarily achieved through reduced asphalt temperatures and the replacement of virgin aggregate with recycled rubber.

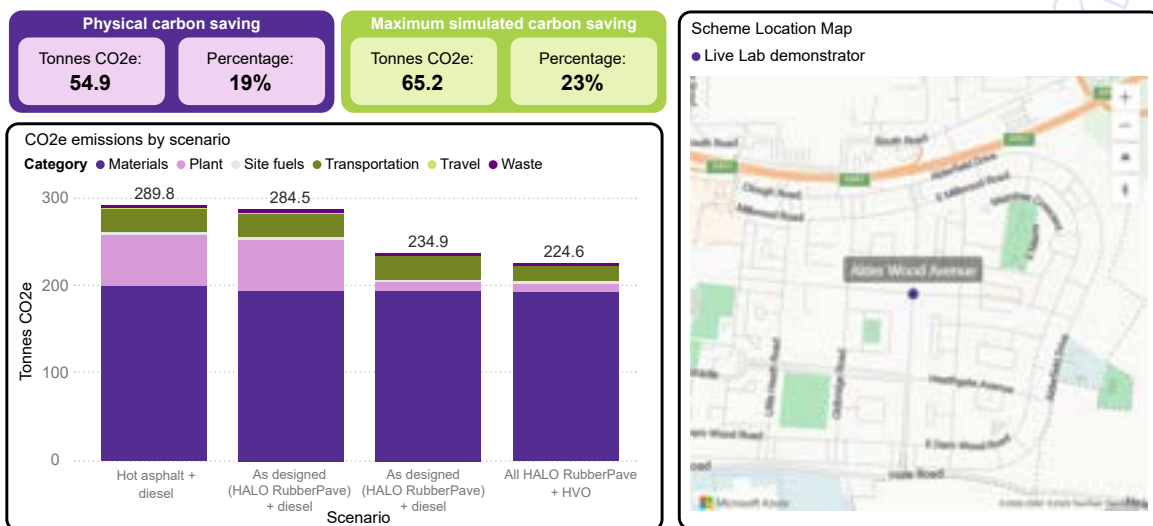


Figure 8: Carbon profiles for HALO Rubberpave scheme on Alder Wood Avenue

6.5 Learning

- Recycled content significantly reduces embodied carbon. Incorporating end of life tyre rubber into the asphalt mix demonstrated meaningful reductions in embodied carbon, primarily through the displacement of virgin aggregate and the repurposing of waste material that would otherwise enter landfill.

- User-focused benefits—noise reduction and smoother ride quality—add value beyond carbon. The material's quieter running surface delivered perceptible noise reduction in a residential setting, aligning well with community priorities and local authority objectives. This user-experience improvement strengthens the case for using such materials in residential and mixed-use environments where amenity value is critical.
- Supply chain consistency and material sourcing are key.
- Performance validation in high-wear environments is critical. Although early performance was positive, confidence in widespread adoption requires continuous monitoring of how the surfacing behaves under everyday conditions.

CASE STUDY LOW CARBON APPROACH TO ASSET MAINTENANCE

Reducing Embodied Carbon in Highway Surfacing

7. RUBBERPAVE LIFE: RUBBER-MODIFIED ASPHALT

Type: Rubber-modified asphalt with oxidation-reducing additive

Primary Driver: Lower carbon than BAU and local SME innovation

Installed on sites by: Huyton Asphalt Civils

7.1 Innovation Description

RubberPave LIFE is an advanced next generation rubber modified asphalt that combines recycled tyre rubber with Shell's enhanced Cariphalte AgeSafe binder chemistry to deliver a more durable, lower carbon surfacing solution.

Building on the HALO RubberPave concept, the technology repurposes end of life tyres within the asphalt matrix and uses low temperature warm mix production to reduce energy consumption and carbon output. The improved binder system enhances ageing resistance, enabling pavements to achieve up to 20% longer life - equivalent to around three additional years of service compared with conventional PMB based surfacing.

This makes RubberPave LIFE particularly effective in high stress locations such as roundabouts, junctions, and urban carriageways, where it reduces cracking and deformation and lowers the need for maintenance interventions. Each kilometre incorporates approximately 750 recycled tyres, supporting circular economy goals and reducing waste while delivering measurable CO₂e savings through fewer resurfacing cycles and reduced plant, material, and transport emissions.

As demonstrated in the Liverpool Live Labs programme, RubberPave LIFE showcases how innovative binder chemistry combined with sustainable material reuse can create longer lasting, resilient, and lower carbon roads that support municipal decarbonisation objectives.



Figure 9: Installation of RubberPave on Church Road



7.2 Context and site selection

Church Road is a key corridor within Garston, a historic district in South Liverpool shaped by its dockside heritage, industrial footprint and mixed residential streets. The route supports steady daily traffic and provides important access to destinations such as St Michael's Church and the South Liverpool NHS Treatment Centre. Its role as a connector between residential neighbourhoods and local commercial areas, combined with noticeable carriageway wear and fatigue, made it an ideal candidate for inclusion in the Liverpool Live Labs resurfacing programme.

CASE STUDY LOW CARBON APPROACH TO ASSET MAINTENANCE

Reducing Embodied Carbon in Highway Surfacing

7.3 BAU Comparator

- Conventional asphalt without additives.

7.4 Carbon Impact

- 7.9 tCO₂e upfront saving
- 133.8 tCO₂e saving expected over 40 years
- 6% reduction vs BAU
- 34% reduction expected over 40 years

Savings achieved through both material substitution and projected lifespan extension.



Figure 10: Carbon profiles (top) and 40-year carbon profiles (bottom) for RubberPave LIFE scheme on Church Road, Garston

CASE STUDY LOW CARBON APPROACH TO ASSET MAINTENANCE

Reducing Embodied Carbon in Highway Surfacing

7.5 Learning

- Enhanced binder chemistry provides meaningful lifespan extension, improving whole life carbon performance.
- Particularly suited to high stress sites, where reduced deformation can limit future maintenance.
- Carbon benefits increase significantly over time due to fewer future resurfacing cycles.
- Requires long term durability verification to confirm predicted ageing resistance and lifecycle savings.



Figure 11: Construction of RubberPave LIFE on Church Road



CASE STUDY LOW CARBON APPROACH TO ASSET MAINTENANCE

Reducing Embodied Carbon in Highway Surfacing

8. MILEPAVE: ASPHALT GROUTED SURFACE

Type: Asphalt grouted surface (combination surfacing technique)

Primary Driver: Lower carbon than BAU

Installed on site by: Huyton Asphalt Civils

8.1 Innovation Description

MilePave by Miles Macadam is a BBA/HAPAS approved asphaltic grouted surface course that provides a durable, waterproof, flexible, and low carbon alternative to conventional asphalt, suitable for both urban and rural highways, including concrete carriageways.

The system consists of a hot, paver laid open graded asphalt layer that is deeply penetrated by a specialist grout, producing a high strength, fully sealed surface. This impermeable finish prevents water ingress, reducing freeze thaw damage, potholing, fretting, and stone loss. Its flexibility also helps manage underlying concrete movement, limiting reflective cracking and joint distress.

MilePave can typically be trafficked around one hour after curing, making it efficient for network management.

MilePave is specifically engineered to reduce environmental impact through:

- Lower mixing temperatures.
- Reduced bitumen content.
- Lower energy requirements during manufacture.
- Use of fewer raw materials.
- Ability to incorporate recycled aggregates (e.g., steel slag).

Figure 12: MilePave on Princess Drive



8.2 Context and site selection

Princess Drive is a major distributor road in West Derby serving a health centre, nursery, local businesses and hundreds of homes. It forms a critical east–west link and experiences high daily vehicle movements, including buses and service vehicles. The corridor was selected as a Live Labs resurfacing site due to its scale, strategic importance, and the opportunity to demonstrate low-carbon resurfacing techniques on a heavily trafficked, mixed-construction (rigid + flexible) carriageway.

Key Characteristics Supporting MilePave’s Selection for Trial:

- Extended pavement life.
- High resistance to cracking, deformation, and thermal stresses.
- Fully impermeable, preventing water ingress.
- Proven performance on stressed surfaces such as concrete pavements.
- Suitable for local authorities seeking long term, sustainable network management solutions.

8.3 BAU Comparator

- Full conventional resurfacing or reconstruction with baseline material.



Figure 13: MilePave surface

CASE STUDY LOW CARBON APPROACH TO ASSET MAINTENANCE

Reducing Embodied Carbon in Highway Surfacing

8.4 Carbon Impact

- 160.7 tCO₂e upfront saving
- 321.5 tCO₂e saving expected vs BAU

- 38% reduction vs. BAU

Savings achieved primarily through material reduction and avoidance of full reconstruction.

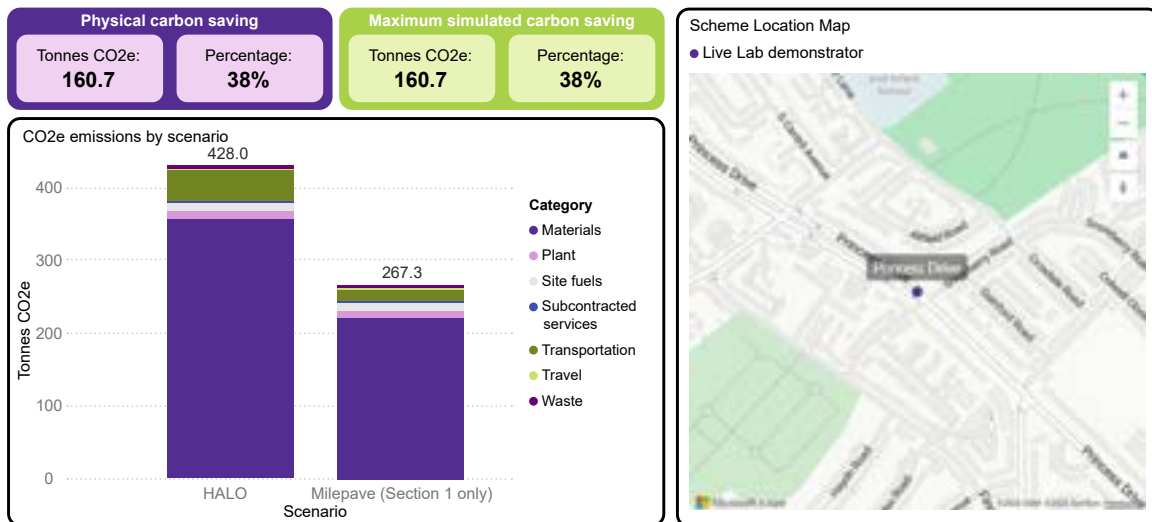


Figure 14: Carbon profiles for Milepave scheme on Princess Drive

8.5 Learning

- Combination surfacing solutions can deliver substantial upfront carbon savings, especially where reconstruction is avoided.
- Fully grouted system provides strong performance on mixed and concrete pavements, supporting resilience.
- Rapid curing enables efficient traffic management on strategic routes.
- Monitoring needed to confirm longevity and reflective-crack resistance in mixed-construction corridors.



CASE STUDY LOW CARBON APPROACH TO ASSET MAINTENANCE

Reducing Embodied Carbon in Highway Surfacing

9. TECHSCREED: CRACK REPAIR & OVER-BANDING SYSTEM

Type: Crack repair and over-banding system

Location: Everton Viewing Terrace

9.1 Innovation Description

TechScreed is a BBA/HAPAS certified thermoplastic crack and patch repair system designed for long lasting maintenance of both asphalt and concrete pavements. Applied in molten form, it flows into cracks and surface defects to fully fill voids, creating a tough, flexible, and waterproof seal that withstands traffic loading and temperature variations.

It is suitable for repairing a wide range of defects including:

- Cracks (typically 5–40 mm)
- Potholes and patch failures
- Surface ravelling and chipping loss
- Rutting and edge deterioration
- Lane joint failures

By incorporating high PSV aggregates, TechScreed provides strong anti skid properties and is also effective as a pre surface dressing treatment, helping prevent reflective cracking and extend pavement life.

Its rapid curing time of around 15–20 minutes enables quick reopening of the road, making it well suited to reactive and planned maintenance. With excellent flow characteristics and durable performance, TechScreed offers a versatile, long term repair solution for highway networks.

9.2 Context and site selection

Everton Viewing Terrace lies within the Everton/Vauxhall area close to major regeneration activity around the new Everton stadium at Bramley-Moore Dock. With increased footfall, development traffic and streets forming part of the wider public realm transformation around the

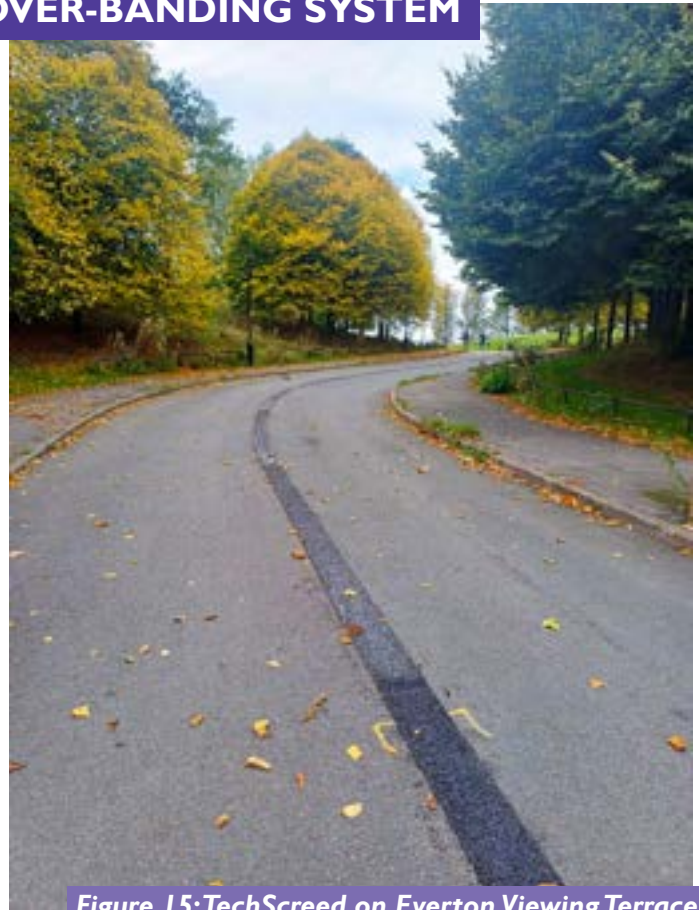


Figure 15: TechScreed on Everton Viewing Terrace

waterfront stadium zone, maintaining safe and reliable surfacing is vital. The site was chosen due to its proximity to key movement corridors and its role in supporting the changing urban environment, ensuring durability and carbon-efficient maintenance. The site also acts as a key public space for walking activities for local residents, with access to the green space at Everton Park popular, as is access to the 'mini roads' cycle tracks.

9.3 BAU Comparator

- Traditional hot-applied pothole repair.

CASE STUDY LOW CARBON APPROACH TO ASSET MAINTENANCE

Reducing Embodied Carbon in Highway Surfacing

9.4 Carbon Impact

- 0.6 tCO₂e upfront saving
- 2.2 tCO₂e expected saving over 40 years
- 49% reduction vs BAU (40% in combination with RoadPatch MMA)

Savings achieved through preventative intervention and reduced repeat visits.

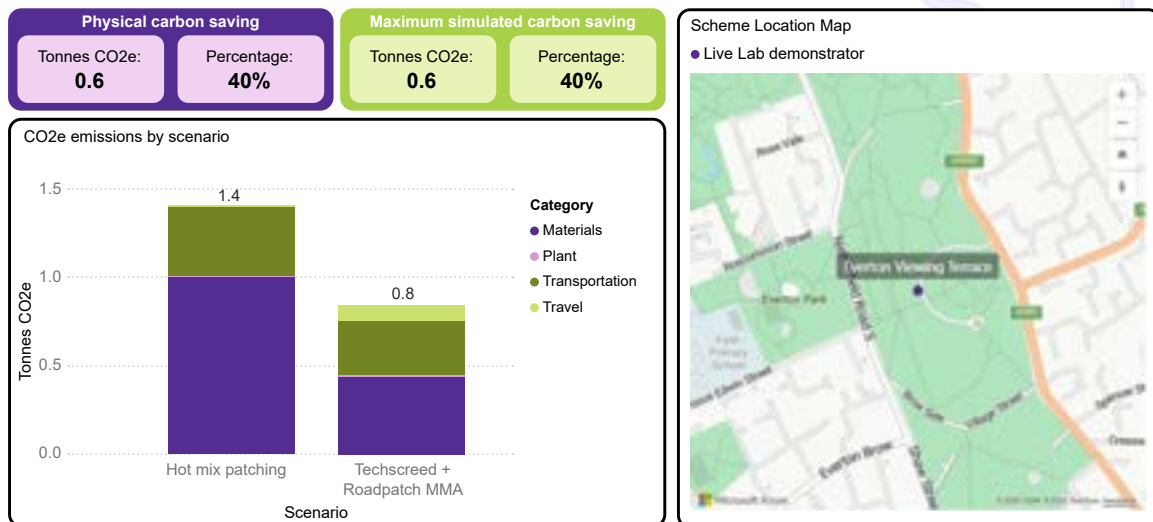


Figure 16: Carbon profiles for Techscreed + Roadpatch MMA scheme on Everton Viewing Terrace



CASE STUDY LOW CARBON APPROACH TO ASSET MAINTENANCE

Reducing Embodied Carbon in Highway Surfacing

9.5 Learning

Preventative maintenance significantly reduces whole life carbon.

Using TechScreed as an early stage intervention prevents minor surface defects from developing into larger, carbon intensive failures. By sealing cracks, stabilising ravelling, and protecting lane joints, the treatment avoids the need for later structural patching or resurfacing.

Early intervention improves network resilience and reduces repeat visits.

Because TechScreed restores surface integrity and prevents water ingress, it slows deterioration and reduces the frequency of reactive repairs. This leads to fewer site mobilisations, lower operational carbon, and reduced disruption for pedestrians and traffic on busy regeneration corridors such as Everton Viewing Terrace.

High friction performance enhances safety in public realm areas.

The inclusion of high PSV aggregates delivers good skid resistance, which is particularly beneficial on pedestrian routes, cycle tracks, and high footfall spaces close to the stadium redevelopment zone.

Rapid curing supports efficient maintenance planning.

With a curing time of 15–20 minutes, TechScreed enables short traffic management durations, supporting both planned and reactive programmes without major disruption.

Suitable for diverse defect types, improving treatment efficiency.

Its versatility - handling cracks, small potholes, patches, and ravelling - makes it a multi purpose tool, reducing the need for multiple treatment types on a single site and enabling carbon efficient asset management.

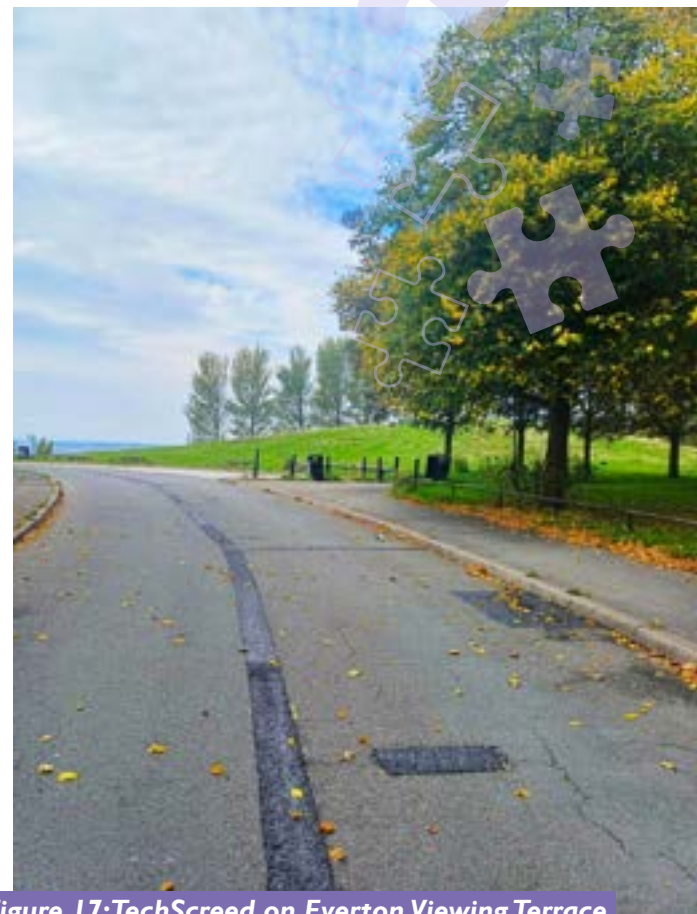


Figure 17: TechScreed on Everton Viewing Terrace

CASE STUDY LOW CARBON APPROACH TO ASSET MAINTENANCE

Reducing Embodied Carbon in Highway Surfacing

10: ROADPATCH MMA: COLD APPLIED POTHOLE REPAIR

Type: Cold-applied permanent pothole repair

Location: Everton Viewing Terrace

10.1 Innovation Description

RoadPatch MMA is a cold applied, permanent pothole and surface repair system based on Methyl Methacrylate (MMA) resin technology. Designed for long lasting repairs on both asphalt and concrete, it offers rapid curing, exceptional durability, and strong resistance to traffic wear and extreme environmental conditions.

Engineered for permanent pothole repairs, surface patching, and defect filling, RoadPatch MMA provides superior bonding, flexibility, and thermal stability compared to traditional asphalt-based materials. Because it requires no compaction, installation is quick and simple, and the repair can be trafficked within 30 minutes, minimising disruption in busy highway environments.

The MMA formulation ensures high skid resistance, excellent resistance to UV, chemicals, and road salts, and reliable performance in all weather conditions, including cold or variable climates. The product does not shrink and maintains long service life, reducing future maintenance interventions.

10.2 BAU Comparator

- Traditional hot-applied pothole repair.

10.3 Carbon Impact

- Up to 40% carbon reduction in combination with Techscreed.

Savings derived from:

- Cold application (no heating energy)
- Reduced repeat repairs
- Extended durability



Figure 18: RoadPatch installation at Everton Viewing Terrace



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10.4 Learning

Cold applied systems reduce both embodied and operational emissions.

RoadPatch MMA requires no heating energy, cutting fuel use and associated CO₂ emissions. Combined with TechScreed, it delivers up to 40% reduction versus traditional hot applied repairs.

Longer lasting repairs reduce whole life carbon and maintenance demand.

Its strong bonding, flexibility, and resistance to shrinkage reduce the likelihood of premature failure. This extends the life of repairs, minimises repeat visits, and lowers overall carbon intensity over time.

Rapid curing minimises disruption in sensitive or high activity areas.

The ability to reopen the surface within 30 minutes supports efficient maintenance around pedestrian routes, stadium approaches, and high footfall regeneration zones.

Reliable performance in all weather conditions supports year round maintenance.

RoadPatch MMA remains workable in cold or variable weather, enabling continuity of service and reducing delays in the maintenance programme.

No compaction installation improves safety and reduces plant requirements.

By eliminating the need for rollers or heavy compaction equipment, the system lowers plant related emissions and reduces operational complexity on constrained sites like Everton Viewing Terrace.

10.5 Trial Findings

- Environmental and Sustainability Benefits - Testing allowed us to compare carbon impacts, recycled content levels, and energy use during production and laying. Some materials demonstrated clear advantages in reducing the environmental footprint of resurfacing works.
- Performance of Different Materials - We gained valuable insight into how various asphalt and surface treatments performed under real world traffic and weather conditions. This allowed us to identify which mixes delivered the best durability, skid resistance, and long term value.
- The trials highlighted differences in how easy each material was to lay, compact, and finish. Understanding the practical aspects of installation helped us assess the impact on programme time, traffic management requirements, and workforce efficiency.
- Cost Effectiveness Over the Lifecycle - By comparing whole life costs - not just installation costs - we learned which solutions offer the best balance between durability, performance, and budget.
- Evidence Based Decision Making - Most importantly, the trials provided robust data to inform future resurfacing schemes, ensuring that materials selection is based on performance evidence rather than assumptions.
- Collaboration and Process Improvement - The trials strengthened relationships between contractors, suppliers, and the project team, helping improve communication, data collection, and on-site decision making.
- Through our exploration of pothole solutions, we have learned that long term success depends on a combination of material innovation, early intervention, and improved operational practices.
- We also found that using data driven inspection methods - including digital condition monitoring and predictive modelling (such as infracare) - can help to identify defects earlier, reducing the likelihood of repeat failures.
- Overall, the key learning is that pothole prevention relies not on a single product, but on a systematic, evidence led approach that integrates materials, technology, and process improvement.



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11. Recommendations for integration into BAU

- Integrate warm-mix technologies as default where feasible.
- Prioritise recycled content within specifications.
- Use surface rehabilitation before full reconstruction.
- Incorporate whole-life carbon modelling into resurfacing decision-making.

12. Testimonials

Princess Drive was a fantastic scheme to be involved in as part of Live Labs 2. Working with Live Labs was a really positive experience, giving us the opportunity to trial innovative, lower carbon materials in a live highways environment while still maintaining programme, quality and safety standards.

I was the Works Supervisor / NEC Supervisor on site during delivery, and the use of Milepave from Miles Macadam was a key part of the scheme, particularly across the rigid sections. From an installation point of view, the product was straightforward to work with and integrated well into the overall construction process. There were no significant changes required to normal working practices, which made it easy for operatives to adopt on site.

Feedback from both the site teams and operatives was positive. The material handled well during installation and achieved a high-quality finish, which is always a key concern when introducing new products.

From a delivery perspective, it demonstrated that more sustainable solutions can be implemented without adding unnecessary complexity to the works. Although the benefits of the product are primarily in carbon reduction, it was clear during delivery that schemes like this are a step forward in embedding sustainability into standard highways practice.

It was encouraging to be part of a project that not only delivered successfully on site but also contributed to wider programme objectives.

Jon Colton, Supervisor

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13. PARTNER CITY TRIALS - ABERDEEN

These trials tested low-carbon resurfacing approaches in alternative geographic contexts.

Primary evaluation criteria:

- Carbon reduction vs BAU
- Performance under varied climatic conditions
- Scalability beyond Liverpool

13.1 Low Carbon Asphalt Trials within the Aberdeen City Adopted Roads Network



Aberdeen City Council are currently undertaking a series of low-carbon asphalt trials between June 2025 through to March 2026. The aim was to reduce the carbon emissions associated with resurfacing works by trialling alternatives to traditional hot mix asphalts (HMA), aligning with the Council's Net Zero goals.

Initial results from visual inspections and early performance monitoring are positive, with no signs of early failure observed to date. Additional benefits include improved on-site working conditions due to reduced fumes and lower material temperatures, alongside positive feedback from operatives regarding workability. Carbon savings have been calculated through Colas as part of Live Labs 2 reporting, with further scheme-level data awaited.

13.2 Project Background

Road resurfacing activities represent a significant contributor to the carbon footprint of highways maintenance due to the high energy demand required for conventional asphalt production and placement. In response to Aberdeen City Council's net zero objectives, this project focused on whether lower-carbon asphalt

alternatives could be successfully implemented across the road network without compromising performance, safety, or durability.

13.3 Objectives

The objectives of this project are to reduce the carbon emissions associated with road resurfacing works while maintaining performance, safety, and durability across Aberdeen's road network. This was achieved through assessing the suitability of lower carbon asphalt materials under local traffic and climatic conditions, alongside evaluating their constructability and impact on day-to-day operations. A further objective was to improve health and safety and overall working conditions for operatives by reducing laying temperatures and exposure to fumes. Collectively, the project aimed to build organisational confidence and develop an evidence base to support the wider adoption of lower carbon resurfacing materials within future maintenance programmes.

13.4 Methodology

A number of schemes were identified within the Capital programme as being suitable for a trial of lower carbon asphalts. Materials used within the trial include warm mix Stone Mastic Asphalts (SMA's), Hot Rolled Asphalts (HRA's) and Asphalt Concretes (AC's), as well as a cold mix. Further to this a scheme has been identified to carry out in-situ recycling which will be resurfaced using a warm mix material. The schemes have been carried out by both internal and external contractors.

Monitoring of each site is currently underway, where sites are visually inspected with a focus on joints and around iron works. We are looking for signs of early failure; chip loss and cracking.

Feedback from operatives around the use and handling of materials is also recorded.

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13.5 Implementation

The programme of works were as follows;

DATE	LOCATION	MATERIAL USED
June 25	Byron Crescent	Warm mix SMA
June 25	Kingswells P&R	Warm mix SMA and delayed set mix
June 25	Holburn Road	Warm mix HRA
August 25	Marchburn Drive	Warm mix SMA
September 25	Dominies Road	Warm mix SMA
October 25	Smithfield Road	Warm mix SMA
November 25	Lilybank Place	Warm mix SMA
November 25	Cameron Way	Warm mix SMA
December 25	Sunnybank Road (footway) – to be continued	Cold mix Rigabond and warm mix AC
January 26	Grandholm Street	Warm mix AC
February 26	Oakhill Road – phase 2	Warm mix AC
February/March 25	Stronsay Crescent	Warm mix AC
March 26	Skene Road	In-situ recycling and warm mix SMA

13.6 Adaptations

Minor adaptations were made during the laying of the materials. This was around the compaction of material around ironworks, due to the increased stiffness observed by operatives.

13.7 Outcomes and impact

As the trial is still underway, we will only be reporting on sites that have been completed. Across the completed sites, feedback from visual inspections and operatives have been positive, with mention being made on the temperature reduction and the workability. There have been no signs of early failure detected during post site inspections.



Figure 19: Laying of WMA SMA at Byron Crescent



Figure 20: Laying of WMA HRA at Holburn Road

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Figure 21: Laying cold mix Rigabond with a WMA AC at Sunnybank Road



13.8 Carbon Impact

13.8.1 Warm Mix Asphalt

Locations: Byron Crescent, Cameron Way, Dominies Road, Holburn Road, Lilybank Place, Marchburn Drive, and Smithfield Drive (Aberdeen)

BAU comparator: standard hot mix asphalt

Carbon impact:

- 37.4 tCO₂e upfront saving (16%) in total
- Upfront carbon savings per scheme:
 - 14.6 tCO₂e saving (24%) on Byron Crescent with enriched 10 surf R15 WMA
 - 1.4 tCO₂e saving (8%) on Cameron Way with RIGAtex Warm Mix SMA
 - 3.5 tCO₂e saving (23%) on Dominies Road with enriched 10 surf R15 WMA
 - 3.6 tCO₂e saving (9%) on Holburn Road with warm mix HRA
 - 1.0 tCO₂e saving (8%) on Lilybank Place with RIGAtex Warm Mix SMA
 - 8.9 tCO₂e saving (25%) on Marchburn Drive with enriched 10 surf R15 WMA
 - 4.4 tCO₂e saving (10%) on Smithfield Drive with RIGAsphalt Warm Mix SMA

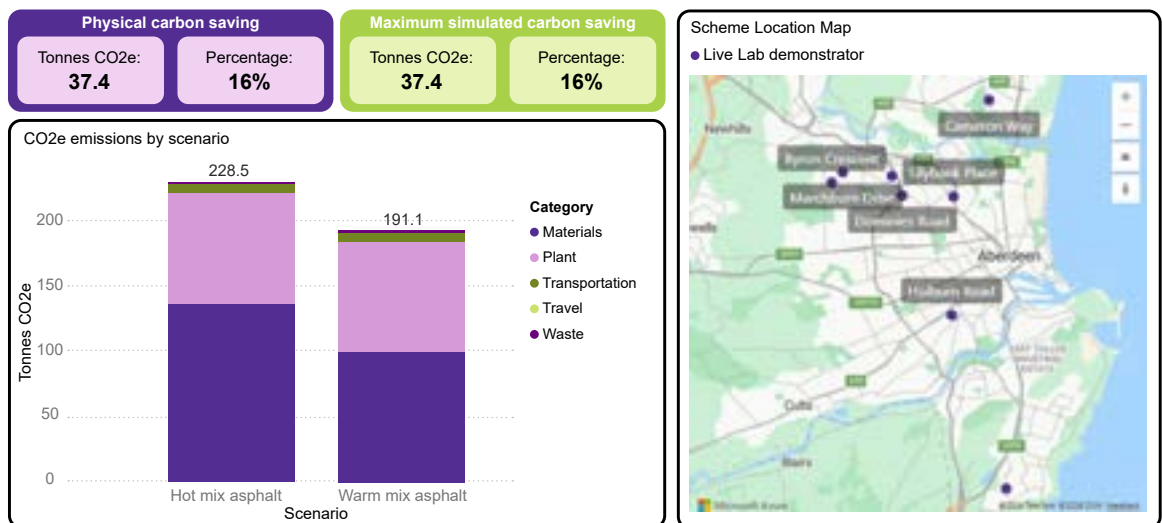


Figure 22: Combined carbon profiles for all warm mix asphalt resurfacing schemes in Aberdeen (excluding in-situ recycling or combined WMA + CMA schemes)

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13.8.2 RIGAtex Warm Mix SMA

- Location: Charleston Road, Aberdeen
- BAU comparator: standard hot mix asphalt
- Carbon impact: 3.0 tCO₂e saving (7%) with hot AC20 base and RIGAtex warm mix SMA surface

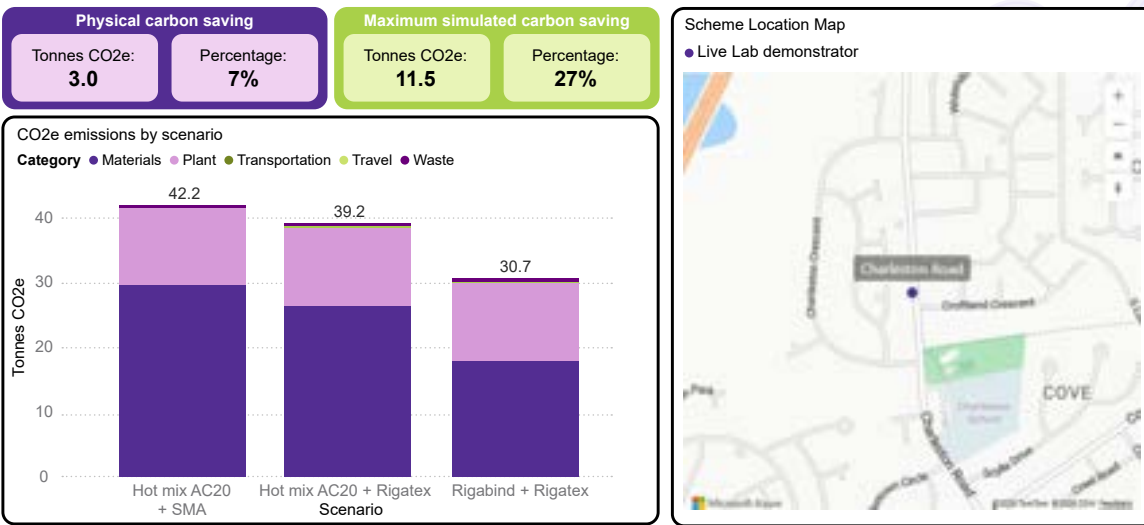


Figure 23: Carbon profiles for hot mix AC20 and RIGAtex warm mix SMA on Charleston Road, Aberdeen

13.8.3 RIGAbind Cold Mix Asphalt

- Location: Sunnybank Road, Aberdeen
- BAU comparator: standard hot mix asphalt
- Carbon impact: 0.6 tCO₂e saving (28%) with half RIGAbind CMA and half AC6 WMA

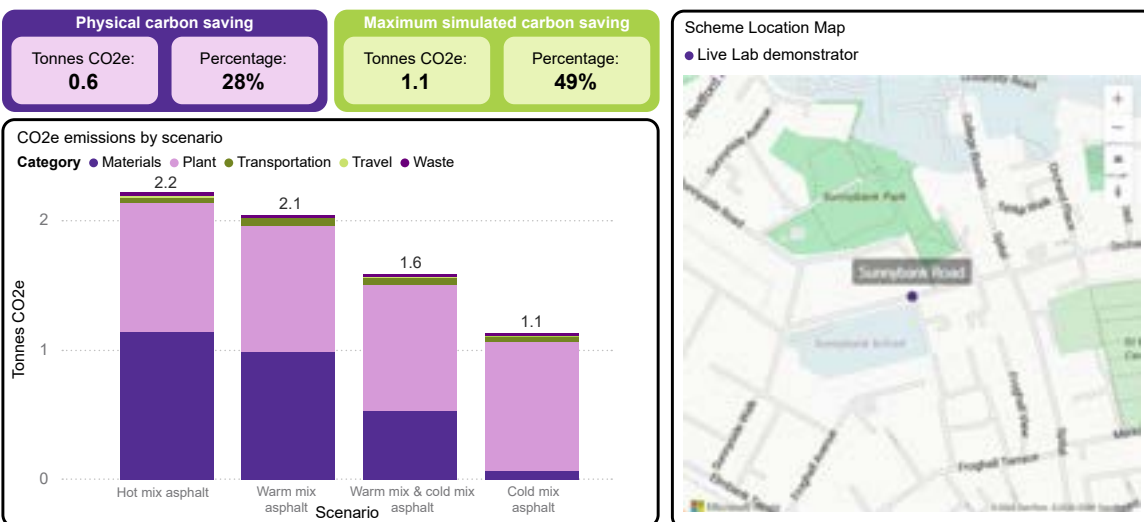


Figure 24: Carbon profiles for WMA & RIGAbind CMA resurfacing scheme on Sunnybank Road

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13.8.4 Delayed Set Asphalt

- Location: Kingswells Park & Ride, Aberdeen
- BAU comparator: Standard hot mix patching
- Carbon impact:
 - 1.0 tCO₂e saving (16%) with WMA + delayed set asphalt
 - 0.4 tCO₂e saving (6%) with all delayed set asphalt

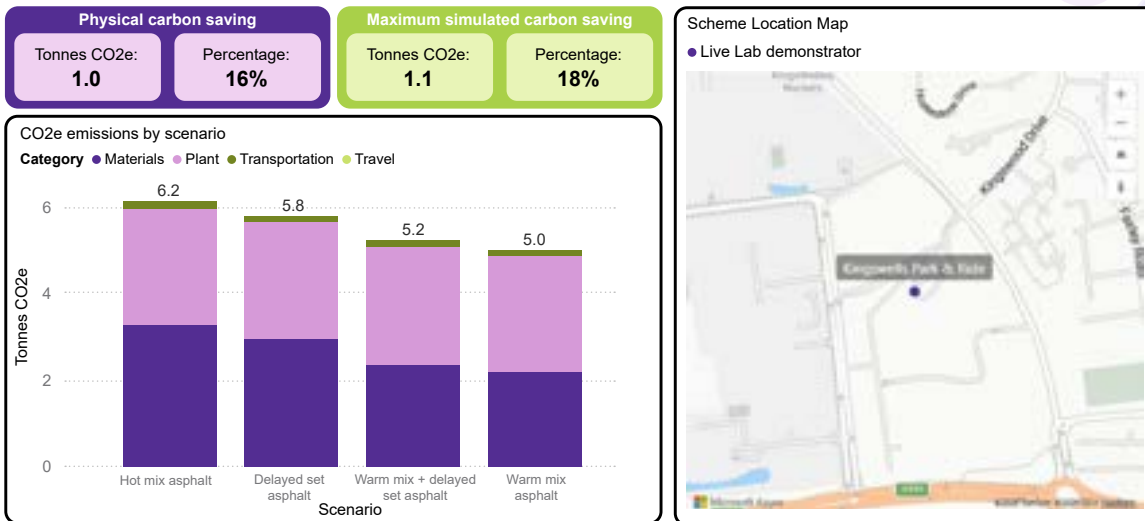


Figure 25: Carbon profiles for WMA & delayed set asphalt patching scheme at Kingswells Park & Ride, Aberdeen

13.8.5 Deep In-Situ Recycling with RIGAtex SurfWMA

- Location: Skene Road, Aberdeen
- BAU comparator: Standard carriageway resurfacing with hot mix asphalt
- Carbon impact: 44.6 tCO₂e saving (29%)

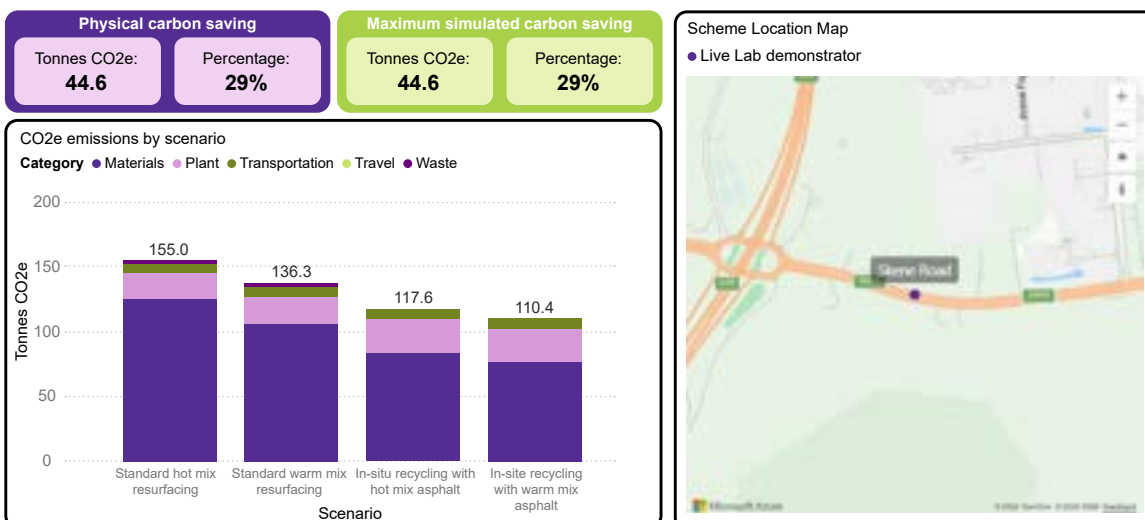


Figure 26: Carbon profiles for deep in-situ recycling scheme with RIGAtex SurfWMA on Skene Road, Aberdeen

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13.9 Learning and reflections

The trials demonstrated that warm mix asphalt can perform comparably to traditional hot mix materials under local conditions. Early performance has been positive, allowing confidence to be built up surrounding the use of lower carbon materials within the network. Schemes will continue to be monitored in terms of long-term performance.

The key challenge identified in this trial has included limited availability of warm mix products from local quarries, this is partly due to buy in from local suppliers. This has resulted in schemes being pulled from the trial. We have been engaging with local suppliers to ensure that we can have access to these materials for future schemes.

Overall, we have seen that lower carbon asphalts are a viable material choice when it comes to resurfacing. The findings have provided a strong foundation for expanding the use of materials across future resurfacing schemes.

13.9.1 Next steps

With approximately 20% of schemes within this financial year's capital list being done in lower carbon materials, our aim is to expand this to approximately 50-75% of schemes for 26/27 across carriageway and footway resurfacing.

Ongoing monitoring will continue for the next 2 years on each scheme carried out, to ensure performance is adequate and this will help further push confidence in the use of the material, as a default in carriageway resurfacing.



Figure 27: Laying of WMA SMA at Byron Crescent

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14. PARTNER CITY TRIALS - NEWCASTLE

A659 Scotswood Road, Newcastle – Carbon Reduction through Highway Maintenance.

14.1 Purpose of the note

It was proposed to trial innovative carbon reduction methods and materials in an upcoming highway maintenance scheme to increase potential carbon savings that contribute to Newcastle City Councils Net Zero 2030 action plan. This note details the methods and materials to be used and outlines the potential carbon saving that will be achieved in doing so.



Figure 28: Before and After of A659 Scotswood Road, Newcastle



14.2 Background

NCC are a partner in the Live Labs 2: Decarbonising Local Roads in the UK programme. The Live Labs 2 programme is a three-year, £30 million UK-wide initiative funded by the Department for Transport. The programme's overarching goal is to decarbonise the UK's local roads infrastructure and assets by bring together local authorities working in partnership with commercial and academic organisations. Live Labs 2 targets planning, design, construction, and maintenance of local highway.

Under this project, Newcastle has been awarded a grant of £20,000 to collaborate with the lead LA Liverpool City Council and other partners. Our role focuses on testing and providing feedback on innovative tools and materials such as the Carbon Optioneering tool, running our own trial scheme, baselining our embodied carbon and sharing best practices to support the city's transition to Net Zero.

The road resurfacing scheme selected for this trial was A695 Scotswood Road (eastbound) which has high volumes of traffic, is an approved HGV route, and carries a lot of bus traffic and serves as a well-used route to and from Newcastle city centre.

14.3 Net Zero Target

The council are currently working to the "Net Zero Newcastle - 2030 Action Plan" which sets out ways in which each of us can play our part in achieving the Net Zero commitment. Highway maintenance can play a key role in achieving this target if the trial of innovative methods and materials proves to be a success.

By trialling innovative methods and materials, we aim to increase the carbon saving on highway maintenance works over the coming years. The results of these trials will be recorded and compared to schemes where standard processes and materials have been used to attain a fair assessment on whether the trial has been a success.

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14.4 Proposed innovative methods, processes and materials

Use of Reclaimed Asphalt Pavement (RAP) - MGL Group have invested in the machinery/plant required to use RAP in its road resurfacing projects as a sustainable and cost-effective solution. MGL Group's in-house company, Tynedale Roadstone, incorporates RAP into its asphalt mixes, which helps reduce carbon emissions and waste to landfill. Using RAP reduces the need for new aggregate and bitumen, conserving natural resources.

Biogenic Binder (Nypave RE) – Biogenic binders are specially formulated to allow significant reduction in asphalt mixing and compaction temperatures. Lower mixing and compaction temperatures mean that fuel consumption, fume and odour can be significantly reduced at both the asphalt mixing plant and at the job site. It is generally accepted that a 10°C reduction in temperature reduces fumes by 50%. Lower mixing temperatures also mean that the bitumen experiences reduced oxidation and should therefore be more durable in service.

Locally produced materials all within a 60mile radius of Newcastle:

- All aggregate will be attained from Longhoughton Quarry (Alnwick)
- All sand will be sourced from Thompsons of Prudhoe (Corbridge)

- Up 10% of the material will be reclaimed asphalt pavement (RAP), therefore the reclaimed material from our highway is taken to a plant, crushed, screened, and tested to ensure consistent quality for reuse.

Modern/newly purchased plant and machinery: MGL have invested in the most environmentally efficient plant and vehicles available, which further reduces the carbon footprint of the operations carried out during a road resurfacing scheme.

14.5 Carbon reduction target

With the inclusion of the methods and materials highlighted in this note, the target was to achieve a total carbon reduction between 35-50% for the road resurfacing works at A695 Scotswood Road.

Estimated Reduction:

- MGL Group Carbon Reduction = 5.2 tCO₂e (14%)
- Biogenic Binder Reduction = 11.3 tCO₂e (31%)
- Total = 16.5 tCO₂e (45%)

The cost of the Biogenic Binder on this scheme, which is the biggest factor in carbon reduction, will be covered by the £20,000 Live Labs contribution.

Figure 29:
Carbon profiles for MGL Group asphalt with low carbon bitumen on Scotswood Road, Newcastle

