Department for Transport

ADEPT LIVELABS 2 Decarbonising Local Roads

Centre of Excellence for Decarbonising Roads

Insights into the Barriers to Decarbonising Roads

North Lanarkshire Council & Amey

2025

Content

Executive Summary

The Barriers to Decarbonising Roads Sandbox (BDRS) formed part of ADEPT's Live Labs 2 programme, which explores how innovation can accelerate the decarbonisation of the UK's local roads. Delivered in collaboration with the Centre of Excellence for Decarbonising Roads (CEDR) and the Safetytech Accelerator, the Sandbox provided a national testbed where emerging companies could work directly with local authorities, contractors and academic partners to identify and overcome barriers to the adoption of low-carbon materials and technologies.

The Barrier to Decarbonising Roads Sandbox (BDRS)

Through structured collaboration, the programme mapped the buying journey, identified and evaluated key barriers, and supported pilot preparation to understand how innovative solutions could be successfully deployed within real-world procurement and delivery settings. The insights gained are intended to inform the wider highways sector and guide future developments in road materials decarbonisation.

The programme itself ran in two main phases:

Exploration Phase – Each participating company examined the UK highways ecosystem, identifying regulatory, financial, technical and cultural barriers to innovation.

Mitigation Phase – Companies developed and tested practical strategies to address those barriers, including trial design, stakeholder engagement, and market readiness activities.

Through this process, the Sandbox provided a bridge between innovation and adoption, helping innovators, councils and industry partners to understand how low-carbon materials can be introduced into a traditionally risk-averse sector.

Aim of this Report

This report brings together the findings directly from the six technology companies that participated in the **Sandbox: Uberbinder, Biozeroc, Ecopals, Sima Environment, DMAT, and PRG Scotland**. It presents a summary of their innovations, what they learned, and their collective advice for how the CEDR, local authorities and industry can work together to deliver low-carbon change at scale.

How to Read This Document

Each section of this report corresponds to one of the six projects undertaken during the Sandbox. The sections are designed to be read independently or as part of the full narrative. Together, they provide a comprehensive picture of the innovation landscape and the shared barriers to decarbonisation in UK roads.

Every project summary follows a consistent format, covering:

- **Overview of the Solution** – A brief introduction to the company and its innovation.
- **Barriers Identified** – The technical, cultural, or commercial challenges encountered.
- **Mitigations Identified** – The steps taken to overcome those barriers.
- **Procurement Process** – How the product or material could progress to market adoption.
- **Next Steps** – Planned actions to advance development or live trials.
- **Recommendations** – Advice for the CoEDR, local authorities, and industry bodies.

The final section draws these findings together, summarising common themes and presenting a set of collective recommendations for policy, practice, and industry collaboration.

Acknowledgements

Special thanks go to the six companies for their openness, insight and determination to challenge existing practice within a complex and risk-averse sector. Their contribution has shaped the national understanding of how innovation can be embedded in the highways industry.

We also extend our sincere thanks to the mentors, local authorities, and delivery partners who supported the Sandbox through technical input, guidance, and introductions across the sector. Their involvement ensured that findings reflect the real-world conditions of public procurement and infrastructure delivery.

About Live Labs 2

BDRS is part of Live Labs 2, a three-year, UK-wide £30 million programme, funded by the Department for Transport, aimed at decarbonising the local highway network. It includes seven projects, grouped by four interconnected themes, led by local authorities working alongside commercial and academic partners. North Lanarkshire Council, with support from Amey, leads the north campus for the Centre of Excellence for Decarbonising Roads, while Transport for West Midlands, with support from Colas, leads the south campus, creating a national framework for collaboration and knowledge sharing.

Read more

North Lanarkshire Council · Transport for West Midlands · Amey · Colas · Safetytech Accelerator

Uberbinder – eco-friendly road binder that reduces emissions

Barriers to Decarbonising Roads Regulatory Sandbox

Uberbinder

Uberbinder's bio-polymerised sulphur binder offers significant environmental and operational benefits in road construction. By replacing traditional bitumen with a binder derived from abundant sulphur and renewable biomaterials, it reduces carbon emissions by over 25% and lowers energy consumption by enabling application at ambient temperatures.

Overview

As part of the BDRS process, Uberbinder engaged a broad range of organisations across the UK's local road infrastructure ecosystem. Much of Uberbinder's effort focused on understanding whether there was enough shared interest and alignment to justify moving into deeper discovery work and potential pilot projects.

Throughout these discussions, many of the well-documented challenges to decarbonising local highways infrastructure, such as those outlined by BIT for LiveLabs2, were strongly reinforced. It became clear that these issues are not only persistent but systemic. When uncertainty or perceived risk emerged, most stakeholders tended to fall back into a protective 'gatekeeper' role rather than leaning into the opportunity to act as strategic partners, advisors, or champions of change.

Despite this, the sandbox process has enabled meaningful progress for Uberbinder in several important areas:

Strengthened impact assessment

Uberbinder's cost–benefit analysis is being expanded to reflect a wider set of considerations, including upfront project costs, lifetime costs, environmental impacts, and questions of material sovereignty.

Secured early investment

Initial forward investment has already been confirmed. Additional in-kind contributions from collaborators and stakeholders will still be required as work progresses.

Detailed specification study

Uberbinder will be conducting an in-depth review to determine which technical specifications it can meet.

This will be supported by clear evidence tracing engineering requirements and defining where changes may be needed.

Uberbinder – eco-friendly road binder that reduces emissions
Barriers to Decarbonising Roads Regulatory Sandbox

Post-sandbox planning

Development of a robust plan for the next phase of work is already underway. Identifying capability gaps remains essential for successful full-scale implementation.

These gaps, and the strategies required to address them should be explored collaboratively with the stakeholders. To do so, it is important to address the risk aversion mindset and to provide incentives for stakeholders to take on leadership roles.

Through this understanding of barriers of mindset, Uberbinder is now better prepared to re-engage key stakeholders and expects those conversations to be more productive as overall readiness continues to improve.

Barriers Identified

The barriers identified by Uberbinder were behavioural and cultural rather than regulatory. Uberbinder found that there are entrenched tendencies within the system that require all innovations arrive fully 'shovel-ready', complete with proven mechanical performance, sustainability credentials, and viable unit economics.

Even though the fundamental obstacles to developing and piloting low-carbon solutions in road construction and maintenance are well understood, the stakeholders involved continue to rely on deeply ingrained ways of working and systems. In many cases, these behaviours are reinforced rather than challenged, and opportunities for innovative approaches to be considered are rarely offered.

Mitigations Identified

The mitigation factors identified by Uberbinder were either to present innovations in a fully shovel-ready state, complete with all required credentials, or to secure stakeholders willing to share or assume a degree of risk. Such stakeholders would need to act as strategic mentors or collaborators, supporting Uberbinder in maturing the technology together towards a viable pilot stage.

Uberbinder – eco-friendly road binder that reduces emissions
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Procurement Process

The procurement of Uberbinder's binder as part of a low-carbon asphalt solution first requires the tendering or appointment of a contractor to carry out a trial using the innovative material, with clearly defined objectives. The scope and cost must be set out and agreed, ensuring that the procurement of Uberbinder's novel binder is incorporated as a specific component of the plan.

Next Steps

As a result of its learnings, Uberbinder will focus on more clearly validating and substantiating its mechanical performance, long-term cost benefits, and carbon accounting (as a broader indicator of sustainability and circularity).

Recommendations

For the Centre for Excellence for Decarbonising Roads

- Continue to support essential dialogue and match-making initiatives

Ensure dialogue between innovators and the decision-making stakeholders responsible for shaping the future of durable, low-carbon road infrastructure across the UK. This will help maximise the value of open innovation and enable progress at scale.

For contractors, local councils, industry bodies and/or standardbodies

- Ensure a clear innovation scope & approval criteria

Being clear from the outset about the types of innovations willing to be considered, supported, and piloted, as well as the parameters that must be met before any proposal can be taken forward. This clarity would help ensure a better match between innovators and decision-makers and could save considerable time currently spent trying to determine whether genuine interest and alignment exist.

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ADEPT LIVELABS2 Decarbonising Local Roads

Safetytech Accelerator

Biozeroc – offering a low-carbon cement alternative product BioCem™
Barriers to Decarbonising Roads Regulatory Sandbox

Biozeroc

Biozeroc is at the intersection of construction and biotechnology, bringing over 20 years of industry experience. Biozeroc focused their participation on investigating barriers to market adoption of BioStoneTM, a precast architectural material produced using Biozeroc's proprietary binder technology.

Overview

Throughout the Sandbox programme, Biozeroc engaged with mentors and stakeholders introduced through the organisers, including representatives from South Gloucestershire Council, Colas, Amey, and PYE Management. Further discussions were initiated with academic partners such as the University of Birmingham, and Biozeroc maintained continuous dialogue with commercial clients and engineering partners.

Barriers Identified

Barriers identified at the outset of the Sandbox formed the focus of Biozeroc's investigation throughout the programme. Collectively, they relate to the early-stage adoption challenges faced by novel construction materials entering a risk-averse and cost-sensitive market.

Information and Transparency Gaps

The process highlighted that current procurement practices often expect early-stage innovations to provide recognised documentation and long-term performance data. When this information is absent, confidence among organisations with formal procurement requirements is limited.

Varied Technical Expectations

The Sandbox showed that clients and partners frequently sought a wide range of product formats and integration options. This demand sits at odds with the more standardised nature of many early-stage low-carbon materials, making it difficult to meet the full breadth of technical requests.

Scale and Cost Constraints

Limited production capacity and restricted pilot funding introduced perceived risks for larger organisations. While many stakeholders are committed to decarbonisation, the financial and

operational implications of adopting new materials can slow progress.

Structural Misalignment with Established Industry Practices

Differences in procurement timelines, liability structures, insurance requirements and capital expectations continue to create friction between innovators and established industry actors. These systemic factors make market entry particularly challenging for early-stage technologies in highly regulated sectors.

Summary of Findings

Overall, the findings indicate that industry-wide adjustments are needed to accelerate the uptake of innovative low-carbon materials. Clearer data requirements and consistent third-party validation would help build confidence among institutional buyers. Testing and procurement frameworks, still largely shaped around traditional bulk or in-situ materials, must evolve to support emerging formats. Addressing cost and scale barriers will require stronger risk-sharing mechanisms and collaboration with established manufacturers. More streamlined procurement pathways, alongside clearer liability and insurance models, would create a more enabling environment for new materials to reach the market at scale.

Mitigations Identified

To address these findings, Biozeroc began exploratory discussions with mentors and introductions via the programme on substituting the precast focus of BioStone with pilot testing of BioCemTM, the low-carbon cement alternative that can integrate directly into existing concrete manufacturing processes. This shift offers a pathway better aligned with infrastructure needs and public-sector interest, while maintaining Biozeroc's core decarbonisation objectives. Although partners expressed strong interest in trialling BioCemTM, the product remains at an earlier TRL stage, and current production capacity is insufficient to meet the required test volumes.

Procurement Process

As BioCem™ has not yet entered formal trials, the following outlines the anticipated procurement pathway, developed through Biozeroc's engagement with industry partners and aligned with established practices for comparable low-carbon materials.

Stage 1:

At pilot stage, BioCem™ would be supplied for limited-scale trials under a structured agreement between the client (such as a local authority or infrastructure owner), the contractor, and a concrete producer. This agreement would define testing protocols, success criteria, data-sharing arrangements, and the allocation of risk. Trials would be independently verified by a third-party laboratory or academic partner to ensure transparency and credibility.

Biozeroc – offering a low-carbon cement alternative product BioCem™
Barriers to Decarbonising Roads Regulatory Sandbox

Stage 2:

Once successfully validated, the product would progress to an approved-list or specification-inclusion stage, enabling procurement through standard channels. At that point, BioCem™ would be purchased directly by concrete producers under a standard supply agreement covering quality assurance, certification, and warranty provisions, and installed by contractors as part of routine works.

This procurement approach is expected to evolve in consultation with delivery partners and industry stakeholders as BioCem™ advances toward pilot implementation and commercial scale.

Next Steps

The Sandbox provided Biozeroc with valuable visibility into the expectations, risk frameworks, and procurement constraints of the UK infrastructure sector. While it ultimately confirmed that BioStone was not an ideal fit for the testing environment and client base engaged through this programme, it helped redirect Biozeroc's focus toward BioCem™ as a more scalable and compatible route to delivering impact within the infrastructure sector. The work undertaken has clarified where adoption barriers truly lie and have defined a structured pathway for mitigating them, through verification partnerships, clearer commercial frameworks, and more targeted sector engagement.

As a result of these learnings, Biozeroc will focus on:

- Advancing internal performance testing of BioCem™ toward pilot readiness
- Completing internal performance and durability testing, refining production processes, and defining target sectors for early adoption
- Establishing data-sharing frameworks and pre-defined pricing structures with partners to ensure trials are well targeted and resource-efficient
- Building collaborative links with academic and testing institutions to provide independent validation and accelerate readiness for large-scale trials

Planned BioCem™ trials are anticipated for summer–winter 2026, likely extending beyond the Sandbox timeframe but directly informed by the insights gained through it.

Biozeroc – offering a low-carbon cement alternative product BioCem™
Barriers to Decarbonising Roads Regulatory Sandbox

Recommendations

For the Centre for Excellence for Decarbonising Roads

Biozeroc recommends that the Centre for Excellence for Decarbonising Roads adopt a more structured and proactive approach to supporting early-stage materials innovation within infrastructure. This should involve both strategic planning and practical funding mechanisms that make it viable for innovators to participate meaningfully in testing and validation processes.

- Establish a Clear Roadmap and Funding Framework for Low-Carbon Material Trials

A defined roadmap outlining testing requirements, material quantities, and funding provisions would significantly reduce uncertainty for both innovators and adopters. At present, each partner or local authority appears to operate independently, requiring separate trials and testing at the innovator's cost and risk.

Creating a centralised testing framework - with consistent parameters, standardised sample volumes, and accessible co-funding opportunities - would enable more efficient, data-driven decision-making.

This should be paired with explicit carbon pricing mechanisms within procurement budgets, ensuring that the environmental and long-term economic benefits of low-carbon materials are properly reflected in purchasing decisions. Without internal carbon accounting or valuation, cost reduction will always outweigh sustainability in short-term tendering.

- Simplify Engagement and De-Risk Collaboration

The Centre should create a single-entry point or "concierge" model for innovators, with defined project phases (screening, pilot, validation) and clear decision gateways. This would make participation more predictable and align expectations on both sides.

Furthermore, establishing a structured risk-sharing framework - covering aspects such as insurance and liability - would reduce the exposure faced by smaller companies. Larger partners or councils could carry shared liability during early-stage pilots, recognising that innovation inherently involves uncertainty.

- Address Economic Misalignment in Early Trials

A notable finding from this programme was the fixation on short-term cost comparisons. While commercial clients frequently assess value in terms of brand, carbon reduction, and aesthetic impact, public-sector counterparts often seem to view cost in isolation.

We recommend that the Centre support the integration of whole-life cost analysis and carbon-adjusted procurement criteria into public frameworks. This would ensure that the true economic case for low-carbon materials can be demonstrated, particularly as regulations tighten and embodied carbon becomes a quantifiable liability.

- Encourage Coordinated Knowledge Sharing and Data Reuse

Each trial currently operates as an isolated exercise, leading to repeated testing of similar materials under different authorities. A coordinated, centralised data-sharing platform - possibly hosted by the Centre - would allow results, performance data, and durability metrics to be reused across projects and partners, significantly accelerating market validation.

Summary

In short, the Centre for Excellence for Decarbonising Roads can play a critical role by moving from a fragmented, reactive testing landscape to a strategic, standardised, and financially supported model for innovation.

By embedding carbon valuation, simplifying engagement, and de-risking participation, the Centre can help ensure that credible low-carbon materials - such as Biozeroc's BioStone and BioCem - can transition from pilot to adoption at the pace required for true sector decarbonisation.

For contractors, local councils, industry bodies and/or standard bodies

- Adopt Shared-Risk and Co-Funding Models

Innovators entering early pilot projects often absorb full financial and performance risk, despite limited influence over site conditions or test protocols.

Contractors and councils can promote meaningful adoption by implementing shared-risk frameworks, in which early-stage suppliers are not penalised for experimental outcomes. This could include:

- Pre-agreed liability limits for pilot materials.
- Partial co-funding of trials or sample manufacturing.
- Collaborative testing with third-party laboratories or academic partners to ensure transparency and data credibility.

- Integrate Carbon Valuation and Long-Term Impact in Procurement

Procurement decisions often prioritise the lowest initial cost, overlooking the long-term carbon and reputational benefits of innovative materials. Councils and industry bodies should integrate carbon-adjusted pricing and whole-life value assessments into their evaluation criteria. This will allow low-carbon materials to compete on total benefit rather than unit price alone, supporting broader net-zero targets.

- Strengthen Knowledge Sharing and Validation Pathways

Industry and standards bodies can accelerate adoption by establishing shared validation frameworks, so that once a material has been tested or verified with one authority, the data can be recognised across others. This would reduce redundant testing and encourage faster uptake.

- Reconsider Adoption Pathways for Innovation

Current procurement frameworks and testing pathways are designed for established manufacturers rather than emerging innovators. Expecting early-stage low-carbon materials to meet the same commercial and insurance requirements without dedicated innovation budgets creates an uneven playing field and discourages participation.

We recommend that buyers and public-sector clients introduce explicit innovation or decarbonisation allowances within project budgets. These should cover trial materials, additional testing costs, and the administrative overheads often carried by startups. Without this, the market will remain dependent on incumbent suppliers who, while stable, are structurally limited in the pace and depth of decarbonisation they can deliver.

Summary

For low-carbon materials to succeed in the UK infrastructure and construction sectors, procurement models must evolve alongside innovation. Buyers and public bodies must be willing to share early-stage risk, value carbon reduction economically, and streamline validation processes. Without these changes, meaningful decarbonisation will remain limited to incremental improvements from established manufacturers, rather than transformative innovation from emerging material technologies.

Ecopals – an innovative polymer modifier for asphalt
Barriers to Decarbonising Roads Regulatory Sandbox

Ecopals

Ecopals is a German startup dedicated to transforming plastic waste into high-performance materials for road construction. The company has developed EcoFlakes®, an innovative polymer modifier designed for use in asphalt. By incorporating recycled plastics into asphalt mixes, EcoFlakes® enhances road durability, reduces carbon emissions, and supports the wider transition toward a circular economy. EcoFlakes® technology has now been used in 40+ construction projects across 7+ countries.

Overview

During the Sandbox programme, Ecopals analysed the UK market landscape to identify and examine barriers, and test appropriate mitigation strategies. Ultimately, the process helped Ecopals refine its product positioning, strengthen stakeholder engagement, and secure its first pilot project in UK.

Barriers Identified

Ecopals began its work in the Sandbox with an initial list of interested stakeholders which was expanded through introductions facilitated by Safetytech Accelerator. These discussions enabled Ecopals to build a clear picture of its current position within the UK market and the barriers it would need to overcome.

These interview rounds provided Ecopals with a much clearer understanding of the UK road ecosystem. They helped Ecopals deepen its knowledge of technical and regulatory expectations, identify the stakeholders who shape decision-making and adoption, and map the market-perception challenges associated with recycled plastics.

The barriers identified were:

Environmental concerns (Cultural and Technical)

Persistent scepticism about microplastic leaching and water contamination associated with asphalt modifiers.

Performance and recyclability (Technical)

Initial questions regarding long-term behaviour, including rutting resistance, cold-weather cracking, and compatibility with RAP.

Competition and positioning (Market)

The presence of alternative low-carbon solutions, such as bio-binders, ACLA, and biochar-based products.

Trial (Operational)

A lack of UK-specific trial data.

Ecopals – an innovative polymer modifier for asphalt
Barriers to Decarbonising Roads Regulatory Sandbox

Mitigation Identified

In response to the barriers identified and the objectives set, Ecopals began implementing a series of targeted strategies:

Product perception and narrative

Ecopals refined its communication to emphasise that EcoFlakes® are not generic recycled plastics but a highly curated, quality-controlled material. Outlining detailed production and quality-assurance steps was key to demonstrate homogeneity, safety, and reliability.

Performance documentation

As performance emerged as the central criterion for consideration of a trial, Ecopals gathered a suite of professional technical documents from its previous road infrastructure projects tailored to the needs of public-sector actors. Together, these materials provided the concrete evidence required to establish credibility with both industrial and public stakeholders.

Industrial engagement

Through introductions facilitated by public actors, Ecopals engaged with asphalt mixing plants and gained insight into operational considerations such as plant compatibility, pricing structures, and handling processes. These findings prompted the development of a practical integration manual offering clear, step-by-step guidance for incorporating EcoFlakes® at asphalt production facilities.

These mitigation efforts strengthened Ecopals' market credibility and addressed both cultural and technical concerns.

Most importantly, they enabled Ecopals to secure a pilot project in collaboration with North Lanarkshire Council under the Live Labs 2 programme. The agreed trial will cover a road section in the UK, representing a significant milestone for the company and validating the effectiveness of the strategies developed during the programme.

Procurement Process

To support the introduction of its product into the UK market, Ecopals identified and mapped several key procurement stages during the Sandbox programme. Based on Ecopals' experience, the pathway from early interest to formal adoption within a local project typically follows the sequence below:

Ecopals – an innovative polymer modifier for asphalt
Barriers to Decarbonising Roads Regulatory Sandbox

Stage 1: Public authority identifies need and conducts technical review

A public authority begins by identifying a specific technical or environmental need, such as reducing carbon footprint or improving circularity, and conducts a preliminary review of Ecopals' solution against its climate objectives and the alternative options available on the market.

Stage 2: Council technical committee assessment

Once the need is established, the council's technical team or materials committee evaluates the relevance, safety, and potential performance benefits of the proposed solution. At this stage, Ecopals' technical documentation plays a critical role in supporting assessment.

Stage 3: Industrial partner engagement (quarry/asphalt producer)

Following initial approval at council level, an industrial partner, typically a quarry or asphalt producer, is engaged to assess production feasibility and support field implementation. Their involvement is essential for confirming operational compatibility and preparing for trial execution.

Stage 4: Pilot execution and performance evaluation

A controlled pilot trial is then conducted to validate the performance of EcoFlakes® under real-world conditions. The site results are closely monitored and documented to build a robust short- and medium-term performance dataset.

Figure 1: Laydown of the EcoFlakes

Stage 5: Specification inclusion pathway

If the pilot results are successful, the final step is to work towards formal inclusion of the product in local or national technical specifications. Achieving this milestone enables broader procurement and replication across additional authorities, paving the way for wider adoption.

Figure 2: Flattening process of the material

Figure 3: Finished result obtained with EcoFlakes

Ecopals – an innovative polymer modifier for asphalt
Barriers to Decarbonising Roads Regulatory Sandbox

Next Steps

The Sandbox provided us with a structured exploration of the UK market, tailored mitigation strategies that refined our narrative, and secured a concrete outcome in the form of a pilot project. This entire process not only improved our readiness for the UK market but also laid the groundwork for broader adoption of EcoFlakes. Going forward, the pilot will serve as proof of concept, enabling further stakeholder confidence, investment planning, and scaling opportunities.

After BDRS, our objective is to build upon the progress made and transition from learning to implementation. Our upcoming priorities are designed to consolidate our presence and credibility within the UK market:

- **Execute North Lanarkshire pilot (October 2025)** in collaboration with local and industrial partners.
- **Develop UK case studies and reference sheets** from trial results derived from real-world trial results to demonstrate impact and replicability.
- **Generate some PR around the North Lanarkshire Project** through coordinated actions in partnership with involved stakeholders.
- **Engage with key industry events** such as Highways UK, MPA, and LCRIG to strengthen our network and visibility.
- **Expand partnerships with additional quarries** and other public councils across the UK.

Recommendations

For the Centre for Excellence for Decarbonising Roads

The Centre for Excellence for Decarbonising Roads has played an instrumental role in the success of the programme, enabling Ecopals to gain traction in a market where the company previously had no established contacts. However, two areas could make the programme even more impactful:

- Initial market orientation

Providing a concise primer on the UK market at the beginning of the programme—covering procurement processes, cultural norms, and key regulatory considerations—would help participants structure their exploration more effectively from the outset.

- Broader industrial engagement

While it is understandable that mobilising private-sector actors can be challenging, involving a larger number of asphalt producers and contractors would further strengthen the Sandbox's impact. These stakeholders hold essential operational knowledge relating to plant integration, pricing, and logistics. In Ecopals' case, engagement was primarily with public councils; a wider pool of industrial contacts would have enriched the process.

Ecopals – an innovative polymer modifier for asphalt
Barriers to Decarbonising Roads Regulatory Sandbox

For contractors, local councils, industry bodies and/or standards bodies

Drawing on Ecopals' experience in the programme, different stakeholder groups have distinct roles in supporting innovation adoption. The following recommendations reflect the contributions each group can make:

Local councils - Continue taking a leadership role

Local councils championed Ecopals' solution, facilitated introductions to trusted industrial partners, and ultimately created the conditions for securing the first UK pilot project. They acted as the primary drivers of progress.

They should continue to act as connectors between innovators and industrial partners. This support provides the reassurance and legitimacy that private actors often require before engaging.

Asphalt companies - Adopt a solution-oriented mindset

Asphalt producers typically focused on plant integration, cost implications, and alignment with existing operational processes. They should adopt a solution-oriented mindset, evaluating innovations not solely in terms of potential operational risks but also for the opportunities they create in sustainability, regulatory compliance, and market differentiation.

Industry bodies - Promote a shift toward an evidence-driven approach

The most significant barrier encountered by Ecopals was cultural rather than technical. A strong preconception against recycled plastics, shaped by negative past experiences, continues to influence decision-making, often preventing new materials from being evaluated on the basis of actual performance data. Industry bodies should engage more closely with innovators, review real-world trial outcomes, and support the development of transparent evaluation frameworks for emerging materials.

Sima Environment –
Testing a bitumen extender produced from recycled ULDPE
Barriers to Decarbonising Roads Regulatory Sandbox

Sima Environment

Sima Environment is a specialised asphalt additive company focused on developing sustainable asphalt solutions without compromising performance. The company has developed PolyPave, a bitumen extender produced from recycled ultra-low-density polyethylene (ULDPE). Supplied as granules and transported in bulk bags for ease of handling, PolyPave is added directly into the mixer of an asphalt plant during production, where it melts and homogenises with the bitumen.

With a low density of 400 kg/m³ and a melting point between 95°C and 125°C, PolyPave offers an efficient and sustainable alternative to virgin bitumen. Its low density enables 1 kg of PolyPave to replace 3 kg of virgin bitumen while maintaining the same binder volume and overall material richness; similarly, 2 kg can replace 5 kg of virgin bitumen.

These combined benefits position PolyPave as a practical, scalable contribution to more sustainable road-building practices.

Overview

Throughout the programme, Sima engaged actively with the Sandbox community with a series of productive meetings with key stakeholders, including Pye Management, Nottingham University, Norse Group, and Amey, among others. In addition, Sima also conducted trials in collaboration with North Lanarkshire Council, HOLCIM, and Hochtief, while developing a range of financing models to make equipment purchase more accessible to producers.

The Sandbox experience provided valuable insight into the barriers facing PolyPave's adoption. Initial assumptions were revisited and refined following mentor feedback, leading to a reprioritisation of focus areas. Several new barriers were identified, while others were confirmed or dismissed. Key issues included market preconceptions, regulatory and performance concerns, limited trial data, and the cost of required equipment. One important discovery was the critical role of engaging not only asphalt producers but also public authorities and contractors, whose confidence and collaboration are essential for large- scale implementation.

While early trials faced some technical challenges, particularly during collaborative work with Live Labs and North Lanarkshire Council, PolyPave demonstrated promising performance and strong potential for substantial cost and carbon savings. The experience underscored that, although PolyPave's environmental credentials are compelling, the economic benefits, such as a potential saving of up to £1 per tonne of asphalt produced, also play a key role in driving industry interest.

By the conclusion of the Sandbox, Sima Environment had developed clearer pathways to market, including rebranding efforts, academic partnerships, live trials, and flexible financing options to reduce adoption barriers. With new data, strengthened relationships, and enhanced understanding of industry dynamics, Sima now plans to scale up PolyPave's deployment, pursue lifecycle certification, and expand trials across the UK, supporting the transition toward a lower-carbon future for road construction.

Sima Environment – Testing a bitumen extender produced from recycled ULDPE
Barriers to Decarbonising Roads Regulatory Sandbox

Barriers Identified

The main barriers identified were:

Preconceptions

The first reaction of potential stakeholders is that "plastic roads" have been trialled before and did not work. There have been multiple companies that have tried to introduce recycled plastic into asphalt. Many of these left asphalt producers disappointed as they did not perform as promised. Some of the plastics did not melt, even when put in a furnace at 500C. So instead of "extending" the bitumen, they became plastic aggregates, which break down into microplastics through wear and tear on the road surface.

Specifications

Potential customers have also been concerned about the existing asphalt specifications and how reducing the virgin bitumen content by up to 5kg per tonne of asphalt may result in compliance issues. This is particularly relevant now, as many asphalt producers have been attempting to reduce bitumen contents as much as possible in an effort to save money; therefore, any further reductions may take the material out of specification. However, when clients refer to "specification", they often refer to PD6691, which is in fact a guide to interpret BS EN 13108, the specification. It contains recipes for commonly used asphalt mixes used in the UK at the time of the introduction of BS EN 13108 and states that it should not be quoted as a specification or code of practice and should not be regarded as a British Standard.

Long term performance, circularity and future recyclability

There have been concerns raised about how material made with PolyPave may affect the durability of an asphalt mix. There have also been questions asked about what may happen after the pavement is milled and reused as RAP. The durability, however, is the main concern, as a pavement that requires more frequent replacement will negatively impact the new cradle-to-cradle approach applied in asphalt Life Cycle Assessments (LCAs).

Evidence through trials

A further barrier is related to testing and data. So far, we have only conducted one real-life trial, which went very well. A lot of potential customers are still concerned that we do not have enough data or evidence to back that our product works, and a general risk aversion in the industry means that asphalt producers want to avoid being the first to test a material, in case it does not work.

Sima Environment – Testing a bitumen extender produced from recycled ULDPE
Barriers to Decarbonising Roads Regulatory Sandbox

Upfront equipment costs

In order to dose PolyPave into the mixer, modifications to the asphalt plant may need to be carried out. Many plants already have a fibre dosing system for SMA materials, in this case, a second hopper can be added for PolyPave and the same system can be used to dose both fibres and our polymers. On plants that do not have a hopper, a new dosing system needs to be installed. The upfront capital expenditure to install a dosing system is a major barrier for asphalt producers, especially as many are already sceptical until they see more case studies and test results that the product works.

Mitigation Identified

Multiple action points have been developed with guidance from assigned mentors to address the barriers identified earlier. Sima Environment has already taken several steps to accelerate market acceptance and demonstrate the value of its technology.

Product Rebranding

Sima Environment has rebranded its product description from "recycled plastic" to "recycled polymer." This shift in terminology helps differentiate PolyPave from previously unsuccessful plastic-based road materials and reduces the influence of historical stigma associated with plastic in asphalt.

Showcasing PolyPave at NARC

PolyPave was presented at the NARC conference in Nottingham, providing Sima Environment with the opportunity to address questions and concerns from academics, industry experts, and prospective clients. This engagement was an important step in challenging preconceptions about recycled materials in road construction.

Live Trials

Sima Environment is participating in live trials in North Lanarkshire, where a 100-metre section of hot-rolled asphalt made with PolyPave will be laid adjacent to a standard material.

The parallel placement will allow direct comparison of binder richness and material performance.

Extensive testing will be conducted in collaboration with the University of Nottingham.

Visual footage, case studies, and trial data will be used to showcase performance and address stakeholder concerns.

This trial will play a central role in building confidence among potential customers.

Sima Environment – Testing a bitumen extender produced from recycled ULDPE
Barriers to Decarbonising Roads Regulatory Sandbox

Equipment Finance Options

To reduce the cost barrier for asphalt producers, Sima Environment has introduced several financing models for dosing equipment:

- A 10–15% increase in PolyPave's price per tonne, with dosing equipment supplied at no upfront cost.
- A rental model in which the equipment is leased for two years and then becomes the customer's property.
- A standard upfront purchase option.

These flexible models help address capital-cost constraints and facilitate adoption.

Academic Engagement

Sima Environment is engaging with academic experts to strengthen scientific understanding of how its polymers interact with asphalt mixtures, particularly with bitumen.

The objectives include:

- Studying long-term performance impacts and recyclability.
- Developing independent academic evidence to support durability claims.

Early tests already indicate that PolyPave improves resistance to deformation, enhancing pavement durability. Additional academic validation will reinforce these results.

Lifecycle Analysis (LCA) and Carbon Footprint

A certified LCA is essential for verifying PolyPave's carbon-saving claims and is increasingly required by asphalt producers and local authorities.

- Sima Environment is exploring options to finance a full LCA, either through external support or using future commercial income.
- Certification will be key as carbon-accounting requirements expand and legislation places greater emphasis on emissions reduction.

Cost vs Benefit Analysis

Using PolyPave reduces asphalt-production costs. For instance:

- Asphalt mixtures made with PolyPave provide equivalent binder volume at a significantly lower cost.
- For one tonne of asphalt with a 5.5% design binder content, replacing 5 kg of virgin bitumen with 2 kg of PolyPave enables asphalt producers to save up to 3.3% on binder costs.

This demonstrates that PolyPave offers both environmental and financial value.

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Procurement Process

Stage 1: Present PolyPave to asphalt producer, demonstrate benefits and cost savings

Stage 2: Produce and deliver a sample for asphalt producer (Holcim) to test

Stage 3: Laboratory trials by contractor

Stage 4: Plant trials by contractor

Stage 5: Approach public authority for plant trial (Live Labs, North Lanarkshire)

Stage 6: Conduct plant trial with public authority and asphalt producer

Stage 7: Reach commercial agreement with asphalt producer

Stage 8: Install dosing equipment for asphalt producer and start sales

Case Study: PolyPave Live Trial

Sima Environment – Hot Rolled Asphalt (HRA) Trial on Chapelknowe Road, Motherwell

1. Background and Trial Objective

As part of the Live Labs programme in North Lanarkshire, Sima Environment prepared for a live trial to evaluate the performance and practical deploy ability of PolyPave, a recycled-polymer binder extender. The trial involved planning the production and laying of 100 tonnes of HRA 35/14 surface course, containing a 7% virgin binder content and 10% RAP, on Chapelknowe Road (B7029) in Motherwell.

Two asphalt plants, Duntilland (primary) and Blantyre (backup), were identified to supply the trial material. Both facilities make use of fibre/pellet dosing systems commonly used to feed pigments and fibres into hot- mix asphalt.

The aim was to demonstrate that PolyPave could replace part of the virgin bitumen content without compromising mix richness, workability, or performance.

2. Initial Production Test at Blantyre

2.1 Setup

Blantyre's dual-silo system, one silo for fibres and another adapted for PolyPave, was used to produce a 1.5-tonne batch of PolyPave-modified HRA for comparison against a control mix.

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2.2 Observations

During production, it was noted that PolyPave exhibited a slower-than-expected feed rate from the silo to the mixer due to its low density. Despite this, the resulting asphalt mix was encouraging.

According to the Area Technical Manager, Lyall Docherty:

- The PolyPave-modified mix appeared just as binder-rich as the control.
- The mix was more workable, despite containing 5 kg less virgin bitumen.

2.3 Outcome

The Blantyre trial confirmed PolyPave's technical potential; however, it also highlighted that its lightweight form factor may exceed the limits of certain gravity-fed dosing systems.

3. System Test at Duntilland Asphalt Plant

3.1 Setup

Following the positive outcome at Blantyre, Sima Environment proceeded to Duntilland Asphalt to test its dosing system and attempt a PolyPave batch.

- Duntilland uses a single-silo fibre dosing system.
- The silo was partially filled with PolyPave to replicate pilot conditions.

3.2 Observations

When producing the first batch, significant issues were encountered:

- No PolyPave was delivered to the mixer. The material inside the hopper did not gravity-feed through the outlet due to its very low weight.
- Manual agitation was attempted to encourage material flow. This caused a blockage further down the system, specifically in the cyclone.
- The Duntilland dosing system requires material to pass through multiple hoppers and a cyclone, any of which can become blockage points for lightweight polymers.

3.3 Parallel Issues at Blantyre

While testing was occurring at Duntilland, Blantyre also reported pipeline blockages in its dosing system caused by PolyPave accumulation. This confirmed that both plants faced similar limitations using their existing gravity-fed systems.

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4. Decision to Abort the Live Trial

Given the risk of:

- Blocking the fibre dosing systems at both asphalt plants
- Delaying asphalt delivery and resurfacing works

Preventing the timely reopening of Chapelknowe Road it was determined that proceeding with PolyPave during live resurfacing posed an unacceptable operational risk.

Standard HRA material was laid on 9 October '25 to complete the roadworks without disruption.

Figure 1: Two silos to be mixes

Figure 2 : With Polypave

Sima Environment – Testing a bitumen extender produced from recycled ULDPE
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Figure 3 : Dosing system with one silo

Figure 4 : Without Polypave

5. Summary of Findings

5.1 Positive Technical Findings

- PolyPave delivers equivalent binder richness even with significantly reduced virgin bitumen.
- Mixes produced at Blantyre were more workable than the standard control.
- The material itself performed as expected.

5.2 Operational Challenges Identified

- Current PolyPave flake size and density are incompatible with UK gravity-fed fibre/pellet dosing systems.
- The risk of system blockages is high in complex pathways involving multiple hoppers and cyclone units.
- Equipment limitations, not material quality, prevented the live trial from going ahead.

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6. Immediate Mitigation Actions

Sima Environment has already begun addressing the identified constraints:

6.1 Development of a larger PolyPave form factor

- Larger flakes increase bulk density and improve gravity feeding.
- First samples of the revised form factor are being dispatched to Duntilland this week for renewed testing.

6.2 Ongoing coordination with stakeholders

Discussions continue with HOLCIM, Hochtief, and North Lanarkshire Council to plan a revised trial once material-handling challenges are resolved.

7. Conclusion and Next Steps

Although dosing-system limitations prevented PolyPave from being laid during the scheduled resurfacing works, the trial successfully demonstrated that the material itself performs strongly, offering:

- Reduced virgin bitumen usage
- Equivalent or enhanced mix richness
- Improved workability

The main barrier is engineering compatibility, not material viability. Sima Environment is now addressing this through form-factor optimisation, with the expectation of confirming system compatibility and progressing toward a full live trial in the near future.

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Next Steps

Following the Sandbox, Sima Environment aims to progress a series of development, engagement, and validation activities to accelerate the adoption of PolyPave in the UK market. The planned actions include:

Product Form-Factor Redesign

Redesigning the PolyPave form factor to ensure full compatibility with existing dosing systems at asphalt plants, particularly those used for feeding pellets, fibres, and pigments.

Engagement with UK Low-Carbon Initiatives

Expanding participation in low-carbon and innovation programmes across the UK, including organisations such as LCRIG, the Future Highways Research Group, and other Live Labs initiatives such as the programme in Devon. Further presentations will also be organised with the IAT and at other industry conferences to broaden market visibility.

Reinvestment in Testing and Carbon Certification

Reinvesting income generated from early sales to fund additional laboratory testing. Producing a certified carbon-footprint figure remains a top priority, as this will support procurement decisions and future commercial opportunities.

Ongoing Stakeholder Engagement

Maintaining contact with mentors and stakeholders engaged during the Sandbox to support continued learning, collaboration, and market development.

Additional Live Trials

Conducting further trials on a wider range of road types, testing PolyPave with various asphalt mixes and under different traffic-loading conditions to demonstrate versatility and performance robustness.

Continued Mitigation Work

Building on the mitigation strategies developed during the Sandbox and integrating them into ongoing commercial and technical development.

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Future Development Timeline

Q4 2025

- Complete the North Lanarkshire trial and associated data collection
- Visit production facility and refine PolyPave based on trial results
- Receive the first commercial order from an asphalt producer

Q1 2026

- Install the first dosing system at an asphalt plant
- Supply at least two asphalt producers and at least three plants
- Commission the design of Sima Environment's website

Q2 2026

- Deliver new presentations at IAT branches
- Launch the company website
- Gain at least two additional customers
- Supply a minimum of ten asphalt plants
- Commission a full LCA and EPD report
- Begin a durability study with the University of Nottingham or the University of Birmingham
- Develop a compression device for PolyPave to increase shipping efficiency

Q3–Q4 2026

- Supply at least twenty asphalt plants
- Study higher PolyPave dosage levels and their performance impacts
- Install a storage silo at the production facility to enable bulk deliveries via tanker

2027+

- Supply at least fifty asphalt plants across the UK
- Establish second and third production facilities, with planned locations in Scotland and South Wales

Sima Environment – Testing a bitumen extender produced from recycled ULDPE
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Recommendations

For the Centre for Excellence for Decarbonising Roads

- Develop a universal, freely accessible carbon-calculation tool

A certified online tool that allows innovators to calculate the carbon footprint of their products would significantly reduce barriers for early-stage companies. Producing a certified carbon figure is currently expensive and often prohibitive for small businesses, yet it is rapidly becoming a mandatory requirement. A freely available tool would support fairer market access and encourage wider innovation.

- Strengthen partnerships with asphalt producers

Deeper collaboration between the Centre and asphalt producers would improve access to meaningful trial opportunities for participating companies. Increased involvement from these actors could also open additional funding avenues for the Centre. During the Sandbox, asphalt producers proved the most difficult group to engage, suggesting that closer cooperation would be highly beneficial.

For contractors, local councils, industry bodies and/or standards bodies

- Make the use of low-carbon materials a requirement

Introducing minimum thresholds, such as requiring a defined proportion of asphalt laid in a project to contain low-carbon materials, would help accelerate adoption and create clearer demand signals for innovation.

- Adopt annual trial obligation

Drawing on resources such as the Live Labs 2 knowledge bank, every local council could be required to select and trial at least one new low-carbon material each year. This structured approach would normalise innovation and reduce systemic inertia.

- Procure based on sustainability credentials as well as cost

Contractors and asphalt producers selected for public-sector projects should be evaluated not only on price but also on their environmental performance. Embedding sustainability criteria in procurement would reward responsible practice and incentivise wider uptake of materials such as PolyPave.

DMAT – Providing next-generation concrete and mortar solutions

Barriers to Decarbonising Roads Regulatory Sandbox

DMAT

DMAT is a technology company pioneering next-generation concrete and mortars. DMAT is redefining construction standards by enabling up to 60% CO_2 reduction while significantly improving resistance to cracking, carbonation, and water penetration. By combining enhanced durability with self-healing properties, DMAT solutions extend the service life of infrastructure, reducing maintenance needs and lowering total lifecycle costs.

Key advantages offered by DMAT solutions

Extended service life

Infrastructure can last up to twice as long owing to the material's self-healing capability, reduced carbonation rates, and prolonged reinforcement protection supported by the mix's high alkalinity.

Preserved impermeability

The material can self-heal cracks up to 0.5 mm, restoring watertightness and improving overall structural integrity.

Environmental sustainability

Total CO_2 emissions can be reduced by up to 60%, achieved through lower clinker content during production and a substantially longer service life.

Overview

The Sandbox provided DMAT with a structured environment to explore the introduction of its next-generation concrete and mortar solutions into the UK infrastructure market. The primary objective was to understand the opportunities and constraints involved in deploying DMAT's low-carbon, self-healing technologies within the UK's regulatory, commercial, and procurement landscape.

DMAT – Providing next-generation concrete and mortar solutions
Barriers to Decarbonising Roads Regulatory Sandbox

Key activities undertaken included:

Targeted stakeholder engagement

Highways, as well as technical consultants (Pye Management) and academic experts (University of Birmingham), to gather DMAT held discussions with public-sector bodies such as North Lanarkshire Council and National insights into adoption drivers and material-approval pathways.

Assessment of procurement and validation requirements

These meetings examined procurement challenges, performance-validation needs, and environmental-compliance frameworks, with a particular focus on how such requirements influence the introduction of innovative materials into UK road infrastructure.

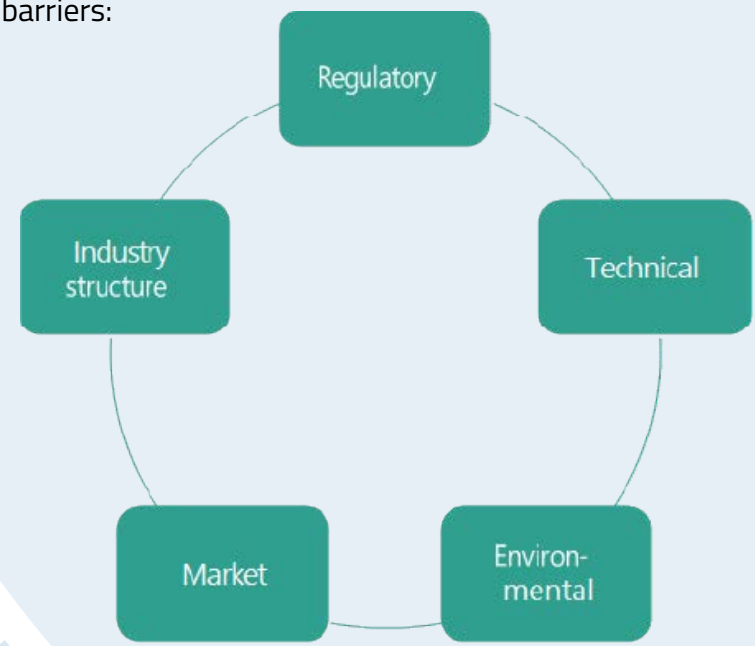
Mapping procurement and approval processes

DMAT analysed procurement cycles, public-sector frameworks, certification pathways, and buyer specifications to understand how these mechanisms can enable innovation, while highlighting the challenges.

These activities enabled DMAT to assess market readiness, determine where its technologies fit within the UK procurement chain, and identify the types of support needed to achieve scale within the UK market.

Barriers Identified

A key goal of the Sandbox was to identify and understand the barriers that prevent or slow the adoption of promising innovations in the UK market. Through its sessions, DMAT identified five core categories of barriers:



DMAT – Providing next-generation concrete and mortar solutions
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Regulatory Barriers

The absence of a dedicated approval route for low-carbon materials creates uncertainty and slows adoption.

Technical Barriers

No established UK testing methodology currently exists for self-healing concrete, making validation and comparison challenging.

Environmental Barriers

Adoption in public projects increasingly depends on the strength of environmental credentials, including Environmental Product Declarations (EPDs) and Life Cycle Assessments (LCAs).

Alignment with PAS 2080 and National Highways' carbon-accounting frameworks is becoming essential for acceptance.

Market Barriers

Limited uptake of sustainable solutions among SMEs slows early-stage demand and adoption of low-carbon concrete alternatives.

Industry Structure

A mature and consolidated industry landscape may slow the adoption of externally developed technologies, as established suppliers dominate specifications and supply chain.

Mitigations Identified

To address the challenges and barriers identified during the Sandbox, DMAT developed a set of targeted mitigation actions. These actions were shaped through engagement with stakeholders including North Lanarkshire Council, the University of Birmingham, Pye Management, and National Highways. The measures below outline the steps designed to overcome each barrier and support the adoption of DMAT's technology within the UK infrastructure market.

DMAT – Providing next-generation concrete and mortar solutions

Barriers to Decarbonising Roads Regulatory Sandbox

Regulatory Barriers

Mitigation Actions

Engage a UK-based regulatory partner to formally assess the pathway to UKCA certification, building on existing CE marking and associated technical documentation.

Map and compile the regulatory documentation required to meet UK public-infrastructure procurement standards.

Expected Outcome

Establishes a clear and compliant route for DMAT products to enter the UK market, particularly in public infrastructure projects, reducing risk and uncertainty for buyers and specifiers.

Technical Barriers

Mitigation Actions

Validate self-healing performance using test protocols developed or adapted in collaboration with UK academic institutions, complementing validation already performed by an accredited third-party laboratory overseas.

Expected Outcome

Provides locally recognised evidence of DMAT's performance, enabling public-sector engineers and specifiers to evaluate the product with confidence.

Environmental Barriers

Mitigation Actions

Develop a UK-specific Environmental Product Declaration (EPD) and Life Cycle Assessment (LCA), aligned with PAS 2080 and National Highways' carbon-accounting frameworks.

Produce a carbon-performance summary tailored to UK public procurement teams, clearly quantifying emissions reductions.

Expected Outcome

Equips procurement and sustainability stakeholders with the environmental documentation required for the approval of low-carbon materials and alignment with national decarbonisation targets.

DMAT – Providing next-generation concrete and mortar solutions

Barriers to Decarbonising Roads Regulatory Sandbox

Market Barriers

Mitigation Actions

Prioritise pilot projects in collaboration with independent precast manufacturers and regional ready-mix suppliers.

Develop and disseminate case studies demonstrating DMAT's performance compliant with UK protocols, with emphasis on CO_2 reduction and long-term maintenance savings.

Expected Outcome

Drives early adoption in agile market segments, builds trust through real-world data, and creates replicable use cases that support wider industry uptake.

Industry Structure Barriers

Mitigation Actions

Focus engagement efforts on stakeholders responsible for material specification, including engineering firms, infrastructure developers, and local authorities.

Position DMAT as a long-term performance solution for asset owners rather than a direct like-for-like material substitution aimed at producers.

Expected Outcome

Stimulates demand-side adoption by engaging developers and construction firms that influence specifications and long-term asset strategies.

Procurement Process

DMAT's commercial model combines the production and sale of a proprietary concrete additive with the licensing of proprietary advanced concrete mix designs. The company's solutions are already CE-marked in Europe and comply with EN standards. They are designed to integrate seamlessly into existing concrete-production workflows, requiring no capital expenditure from the client.

DMAT – Providing next-generation concrete and mortar solutions

Barriers to Decarbonising Roads Regulatory Sandbox

The procurement pathway for DMAT materials typically involves the following stages:

Stage 1: Regulatory compliance

Before any commercial use, DMAT ensures that its materials meet all local regulatory requirements for production and application in the target country. In the UK, this includes pursuing UKCA marking or other relevant certifications demonstrating conformity with applicable standards.

Stage 2: Production through collaboration with local manufacturers

Using DMAT's proprietary intellectual property and know-how, the company establishes partnerships with local producers to manufacture its filler using locally sourced materials. This model enables flexible, scalable, and geographically adaptable deployment.

Stage 3: Delivery and implementation via direct supply

Materials are supplied directly to clients, supported by DMAT's technical teams and customer-support services to ensure proper implementation and performance.

The public sector, being the primary driver of infrastructure development, generally operates through procurement processes governed by national or local frameworks. These frameworks require product prequalification, certification, and inclusion on approved material lists before any project-level adoption can occur.

The UK market presents several structural challenges for the procurement of innovative construction materials:

Framework-based public procurement

Public authorities frequently rely on pre-approved lists or framework agreements, which can limit visibility for new entrants that have not yet secured accreditation or specification inclusion.

High risk-aversion

There is a strong tendency to favour, legacy materials, particularly in regulated or safety-critical environments, making it more challenging for novel solutions to be considered.

Mature and consolidated market

The UK concrete sector is largely dominated by vertically integrated groups that control both cement production and the majority of concrete supply, creating additional frictions for external technologies seeking market entry.

DMAT – Providing next-generation concrete and mortar solutions
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Next Steps

Product Development Outcomes

As a result of its participation in the Sandbox, DMAT has outlined a series of development activities to support the successful deployment of its technology in the UK. These activities will be initiated once an appropriate local pilot project has been completed, enabling DMAT to generate performance data aligned with UK infrastructure requirements.

This approach ensures that all development outcomes are grounded in a live UK infrastructure context, providing practical relevance and supporting meaningful engagement with public-sector clients and infrastructure stakeholders.

The pilot project can be carried out in collaboration with a public-sector body such as North Lanarkshire Council, acting as the project owner or end client. In this scenario, DMAT would rely on the Council to facilitate the connection with a designated construction company or concrete producer.

The planned development activities include:

DMAT – Providing next-generation concrete and mortar solutions
Barriers to Decarbonising Roads Regulatory Sandbox

Phase 1: Pilot Setup

a. Pilot Project Identification

Identify a suitable infrastructure project, preferably in partnership with a public-sector client such as North Lanarkshire Council, that can serve as a UK-based reference project for DMAT's low-carbon, high-performance concrete or mortar.

b. Project Requirements Definition

Establish the technical, environmental, and operational requirements of the selected pilot project. This includes defining:

- The exposure class and structural application.
- Performance targets related to durability and CO_2 reduction.
- Any site-specific constraints that may influence production, logistics, or construction.

Phase 2: Technology Adaptation

a. Concrete Producer or Construction Company Engagement

- Engage with a concrete producer or construction company capable of supporting the execution of the pilot. Where the pilot is sponsored by a public authority, this partner will be identified and introduced by the project owner.
- Working with local producers and contractors ensures alignment with UK standards, existing supply chains, and established operational practices.

b. Mix Design Development & Laboratory Testing

Tailor and validate the mix design based on local materials and project requirements. This involves:

- Adapting DMAT's formulation to UK standards and material availability.
- Conducting laboratory testing to meet the specified technical requirements.

Phase 3: Implementation

a. On-site Construction Using DMAT Products

- Deliver the pilot construction using DMAT-enhanced concrete or mortar. For the first UK project, DMAT's proprietary materials will be shipped from its existing production site while local production partnerships are established.
- This phase will include on-site technical support to monitor implementation and ensure correct application.

b. Impact Assessment & Demonstration Report

- Document and communicate the outcomes of the pilot, including durability results, CO_2 savings, construction performance, and lessons learned.

DMAT – Providing next-generation concrete and mortar solutions
Barriers to Decarbonising Roads Regulatory Sandbox

Recommendations

For the Centre for Excellence for Decarbonising Roads

- Act as a national enabler

Coordinate pilot opportunities between public authorities and innovative material providers. This includes facilitating matchmaking between councils, contractors, and suppliers to accelerate deployment.

- Promote performance-based specifications

Ensure performance-based specifications within road and infrastructure projects, enabling new materials to be assessed on functional performance and sustainability impact rather than legacy standards alone.

- Support the creation of a recognised evaluation framework

Create a low-carbon concrete technologies framework. This should include performance benchmarks, carbon-accounting tools, and practical guidance for public-sector procurement teams.

- Encourage adoption of common data and validation protocols

Ensure common data and validation protocols cover durability, carbon savings, and lifecycle performance, ensuring comparability and transparency across pilot projects.

For contractors, local councils, industry bodies and/or standards bodies

- Encourage long-term procurement models

Procurement models should prioritise long-term performance, carbon reduction, and total cost of ownership, rather than short-term cost considerations.

- Embed Carbon Requirements into Tenders and Frameworks

Integrate carbon-reduction requirements into project tenders and framework agreements, aligned with PAS 2080 and National Highways' carbon-reporting frameworks.

- Support Evidence Development for Low-Carbon Innovation

Work collaboratively with innovators to develop the technical evidence, validation data, and specification documentation required to support wider adoption of low-carbon materials such as those developed by DMAT.

PRG Scotland – Using waste tyres to produce bitumen
Barriers to Decarbonising Roads Regulatory Sandbox

PRG

PRG Scotland Ltd, established in 2023, focuses on transforming waste tyres into valuable low-carbon materials for road construction. Through its Continuous Reductive Distillation (CRD) process, PRG converts end-of-life tyres into carbon black, fuel oil, steel, and gas, unlocking circular economic value from one of the UK's most persistent waste streams.

With support from the National Highways Low Carbon Accelerator programme, PRG Scotland Ltd adapted its CRD process to produce bitumen additives suitable for asphalt. The company works closely with partners across academia, industry, and the public sector to advance sustainable road-building materials that contribute to national Net Zero ambitions.

PRG Scotland's CRD process represents a significant breakthrough in circular-recovery technology. It converts shredded end-of-life tyres into four main outputs:

- **Recovered Carbon Black (rCB)** – used as a bitumen modifier for road surfacing.
- **Fuel-oil fractions** – suitable as cleaner process fuel or as components in bitumen blending.
- **Steel** – recycled through established UK steel-processing channels.
- **Syngas** – a by-product used to partially power the CRD process itself.

During the project, PRG Scotland Ltd refined its CRD process parameters to achieve improved production stability, greater yield consistency, and reduced emissions. The recovered carbon black was blended with conventional bitumen in laboratory-scale trials, where early testing showed enhanced flexibility and durability. These results confirm its potential to extend road service life while reducing embodied carbon.

PRG Scotland – Using waste tyres to produce bitumen
Barriers to Decarbonising Roads Regulatory Sandbox

Overview

The core objective of the project was to assess the feasibility of transforming waste tyres into sustainable bitumen additives using PRG's proprietary Continuous Reductive Distillation (CRD) process.

Throughout the Sandbox programme, PRG Scotland Ltd held six structured stakeholder meetings with a wide range of partners, including:

- Local authorities responsible for pilot-trial planning and validation pathways
- Asphalt manufacturers and contractors
- National Highways' Pavement Safety Engineering and Standards teams
- Emma Pye Consulting and other independent experts

These discussions were critical in identifying systemic barriers relating to supply chains, regulatory approval, funding access, and procurement readiness. The insights gathered enabled PRG Scotland Ltd to map practical mitigation measures and develop an adoption roadmap that integrates both technical validation and market alignment.

The programme also facilitated the establishment of collaborative partnerships with:

- **Jean Lefebvre UK Ltd (JL UK)** for material testing
- **Robert Gordon University** for lifecycle and carbon analysis
- **MIRA Technology Park** for live-trial planning

Together, these collaborations created a strong evidence base to support the transition from laboratory validation to real-world implementation.

PRG Scotland – Using waste tyres to produce bitumen
Barriers to Decarbonising Roads Regulatory Sandbox

Barriers Identified

Tyre Supply Contracts

- More than 70% of the UK's waste tyres are exported overseas, predominantly to regions with weak or non-existent environmental controls.
- This export-dependent model undermines domestic recycling initiatives and discourages investment in sustainable reprocessing technologies such as PRG Scotland Ltd's CRD system.
- No current mechanisms or incentives exist to guarantee a stable domestic tyre supply for UK-based recyclers.

Materials Validation

- There is limited independent, real-world validation of outputs produced through the CRD process.
- A circular dependency exists between local councils and National Highways: councils require National Highways approval before trialling new materials, yet National Highways typically requires data generated through council-led trials before granting such approval.
- Certification pathways for novel materials remain complex, opaque, and insufficiently resourced.

Operational and Financial Constraints

- PRG Scotland Ltd's proof-of-concept CRD unit has been mothballed due to constrained funding.
- The company currently lacks the production capacity required to supply materials at pilot or live-trial scale.
- A significant funding gap persists: the capital required to build a modular prototype is too substantial for angel investment but below the typical threshold sought by venture-capital funds.

Interrelationship Between Barriers

These barriers are interlinked and mutually reinforcing:

- The lack of a reliable tyre supply undermines operational viability.
- Limited production capacity restricts opportunities for material validation.
- Without validation data, securing investment becomes increasingly difficult.

This feedback loop keeps innovations such as PRG Scotland Ltd's CRD process locked in an extended pre-commercial phase, despite strong evidence of environmental and economic benefit. Overcoming a single barrier in isolation is insufficient; coordinated action, spanning policy reform, certification support, and targeted funding, is essential to move from laboratory success to on-road implementation.

PRG Scotland – Using waste tyres to produce bitumen
Barriers to Decarbonising Roads Regulatory Sandbox

Mitigations Identified

PRG Scotland Ltd recognises that a stable and transparent feedstock supply is essential for scaling its Continuous Reductive Distillation (CRD) process. To counter the current export-driven imbalance, the company is taking proactive steps to build local partnerships, support regulatory reform, and promote greater domestic accountability.

Engagement with Local Authorities and Disposal Contractors

Exploring regional partnerships to secure direct waste-tyre feedstock agreements, reducing dependence on intermediaries and overseas processors.

Policy Advocacy

Working with the Tyre Recovery Association (TRA) and government-backed groups to promote stronger export controls and incentives for UK-based recycling.

Supply Chain Transparency

Developing a traceability model to demonstrate responsible sourcing and strengthen regulatory and investor confidence.

Environmental Accountability Studies

Collaborating with regulatory agencies to quantify the environmental and economic impacts of tyre exports, using this evidence to support policy reform.

Market Positioning

Positioning the CRD process as a sustainable disposal option that creates local jobs, cuts emissions, and retains material value within the UK.

Outcome Sought

Creation of a stable domestic tyre-supply pathway supported by aligned policy, reducing volatility and enabling long-term production planning and investment.

PRG Scotland – Using waste tyres to produce bitumen
Barriers to Decarbonising Roads Regulatory Sandbox

Material Validation – Building Credibility Through Controlled and Live Trials

Barrier Addressed

Lack of independent, real-world validation and no recognised certification pathway for new low-carbon materials.

Mitigation Approach

PRG Scotland Ltd is adopting a step-by-step validation strategy focused on evidence generation, independent testing, and live demonstrations. This approach is designed to break the existing validation deadlock by producing credible performance data, even at small scale.

Key Actions

- Low-Scale Pothole Trials: Using approximately 250 kg of asphalt blend to conduct controlled and live demonstrations:
  - MIRA Technology Park (Nuneaton): Controlled pothole repair trial.
  - North Lanarkshire Council: Live road trial on a council-managed test network.
- Independent Performance Data Collection: Both trials will be monitored for durability, flexibility, and emissions savings, generating neutral data suitable for third-party verification.
- Stakeholder Collaboration: Working with Jean Lefebvre UK Ltd (bitumen blending), Robert Gordon University (lifecycle analysis), and Eurovia (contractor engagement) to ensure academic and industrial rigour.
- Public Communication: Sharing performance results through open reporting and case studies to build confidence among councils, highways authorities, and procurement bodies.
- Long-Term Validation Pathway: Using performance data from the trials as the basis for a formal certification submission to National Highways, enabling progression to larger-scale trials and specification inclusion.

Outcome Sought

Independent verification of CRD-derived bitumen's performance, enabling formal certification and confidence among highways authorities and investors.

PRG Scotland – Using waste tyres to produce bitumen
Barriers to Decarbonising Roads Regulatory Sandbox

Operational Constraints – Addressing the Funding and Capacity Gap

Barrier Addressed

Limited funding and insufficient production capacity to progress from proof-of-concept to prototype-scale operations.

Mitigation Approach

PRG Scotland Ltd is pursuing a blended funding and partnership strategy to unlock capital for prototype development while maintaining momentum through smaller, cost-effective activities. This approach aims to bridge the gap between early-stage innovation and commercial readiness.

Key Actions

- Targeted Funding Acquisition: Developing detailed financial models and investment cases to secure blended finance via Innovate UK, CPI, and impact-focused investors.
- Co-Funding Partnerships: Engaging councils and contractors willing to co-fund live road trials, distributing costs and strengthening shared ownership of outcomes.
- Prototype Planning: Advancing engineering designs for a modular CRD prototype capable of processing 8 kg of shredded tyres per hour, enabling continuous production for certification-scale testing.
- Leveraging Existing Data: Using validated laboratory and early field data to reinforce investor confidence and support grant applications.
- Resource Prioritisation: Deploying existing carbon-black stock for demonstrations to maintain visibility while securing full-scale investment.
- Strategic Communication: Highlighting the broader environmental, economic, and industrial benefits of PRG's technology to attract financial, political, and industry backing.

Outcome Sought

Securing sufficient funding to build and operate a prototype CRD unit, enabling consistent additive production, scaled demonstrations, and progress toward commercial deployment.

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Procurement Process

Stage 1: Identification & Pre-Qualification

Current procedures for pre-qualification are inconsistent and lack clear entry guidance for small innovators.

Change identified: Develop transparent criteria and a national innovation register to guide early-stage suppliers in submitting the required technical and sustainability data.

Stage 2: Laboratory Testing & Certification

Testing standards are designed for conventional bitumen, not recycled or recovered materials.

Change identified: Introduce updated testing and certification protocols tailored for circular materials such as tyre-derived bitumen additives.

Stage 3: Pilot Trials

A circular dependency exists: councils need National Highways approval before trials, but NH requires trial data for approval.

Change identified: Create a joint validation framework allowing small-scale trials (e.g. pothole repairs) to be co-funded and approved by both central and local authorities.

Stage 4: Performance Monitoring & Reporting

Data reporting is inconsistent and resource-intensive for small companies.

Change identified: Establish standardised monitoring templates and shared data platforms to streamline evidence submission.

Stage 5: National Evaluation & Adoption

There is no single, coherent pathway for moving proven innovations into national procurement frameworks.

Change identified: Implement a unified Low-Carbon Materials Adoption Pathway to bridge the gap between successful trials and national approval.

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Next Steps

PRG Scotland's next phase focuses on moving from small-scale validation to full-scale commercial readiness through a structured, phased plan.

1. Development Phases

Prototype Build: Design and commission a modular CRD unit to produce consistent tyre-derived bitumen additives for trials.

Pilot and Feasibility Trials: Conduct full-scale live road trials with partners to validate performance and environmental benefits.

Certification and Scale-Up: Achieve material certification and prepare for wider industry adoption.

Commercial Deployment: Establish a commercial plant integrated into regional circular economy supply chains.

Indicative timeline: 2025–2029, progressing from prototype to market deployment.

2. Prototype CRD Unit

- Continuous operation unit processing ~8 kg of tyres per hour.
- Produces recovered carbon black, oil fractions, steel, and syngas for internal energy.
- Modular and transportable design for flexible demonstration.
- Collaboration with MTC, JL UK, IPG Energy, Robert Gordon University, and Eurovia to support development, testing, and trials.

3. Funding and Commercialisation

- Pursuing a blended finance model combining Innovate UK/CPI grants with SEIS-backed private investment.
- Funding directed towards prototype build, road trials, and certification work.
- Use early trial data to attract further investment and de-risk scale-up.

4. Capability Focus

To support scaling, PRG will strengthen:

- Engineering and automation for higher throughput.
- Asphalt formulation expertise through industry partnerships.
- Regulatory navigation to accelerate certification.

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Recommendations

Recommendations For Centre for Excellence and Decarbonising Roads

- Support independent validation and specification development with funding and guidance.
- Provide forums for early adopters to share results and build confidence.
- Support funding pathways for mid-stage innovations that fall between early-stage grants and VC investment.
- Show case low carbon trials to break down barriers and encourage innovation.

For Contractors, Councils and Industry Bodies

- Share trial data openly to support certification and broader uptake.
- Consider carbon savings and lifecycle impact in procurement decisions.
- Incorporate low-carbon material criteria into procurement frameworks.
- Show case low carbon trials to break down barriers and encourage innovation.


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