

Transport for West Midlands

Centre of Excellence for Decarbonising Roads (CEDR)

South Campus

Strategic Outline Business Case

21st April 2023

Authors: Transport for West Midlands & Colas



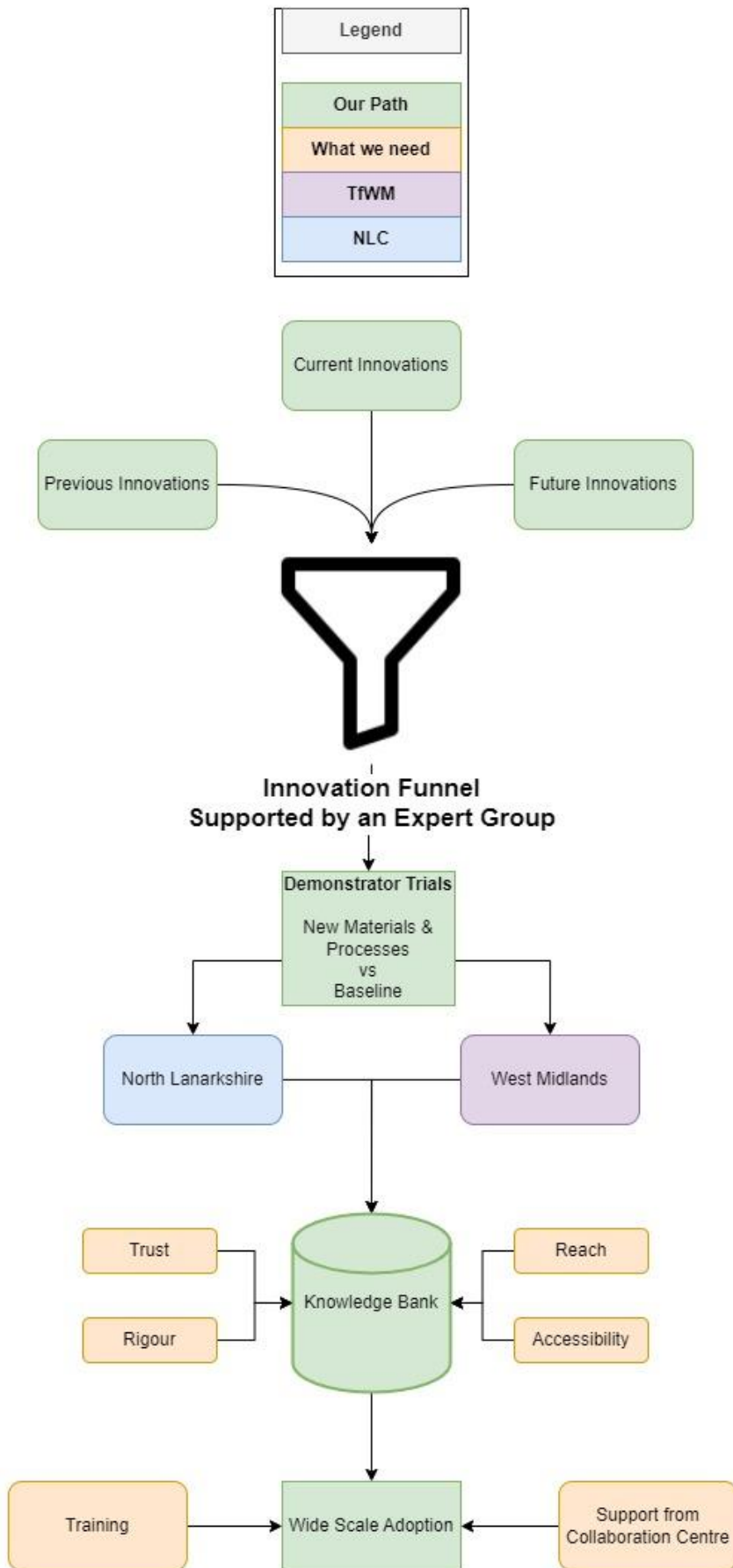
1. Elevator Pitch

Trials of innovative materials happen throughout the UK on a continual basis with authorities demonstrating locally that materials work in practice, but these demonstrators occur within silos and rarely compare against other materials in the market. Without comparison, we never really move forward, update standards or gain confidence in what others are doing/have done.

The Centre of Excellence for Decarbonising Roads (CEDR) aims to demonstrate, showcase, and evaluate a wide range of innovative decarbonised highway materials, contrasting techniques against each other across a range of complementary networks.

CEDR will be delivered by a global best-in-class team including academic partners, TRL, Connected Places Catapult and National Highways. We aim to break down silos in materials-testing and support the national deployment of the best materials to help Local Authorities to catapult over trial phases and immediately start making progress towards their net zero targets, whilst also developing an international reputation for excellence.

Figure 0 – Elevator Pitch



2. The Project Overview

Brief project description and why it is necessary.

Transport for West Midlands (TfWM) have been awarded £4,035,000 as part of a £30 million government funding pot to decarbonise UK highways. The funding has been awarded to develop and use new technologies to reduce emissions, improve regional connectivity and move to net-zero local roads.

What?

A Centre of Excellence for Decarbonising Roads. A centre to review, develop and disseminate learning and innovations related to the decarbonisation of highway materials. We will investigate low carbon materials through demonstrator sites, identify standards/specifications that may block low carbon solutions, baseline carbon emissions to compare various materials/processes, identify global best practice and make the results of our research publicly available for the greater benefit of the United Kingdom and the international community.

Why?

There's a lot of good work being carried out across the UK in relation to decarbonising local roads. However, a lot of this work is done in silos and doesn't make it to widescale adoption. A collaboration centre is needed to build trust, ensure innovation and knowledge is shared, unnecessary duplication is avoided, and innovations are adopted into widescale business-as-usual.

How?

We have a consortium of partners, each with technical expertise in a variety of areas, who will review previous innovation, trial new innovations and scan for future innovations that will lead to the decarbonisation of highway materials.

At the centre of this will be an innovation funnel to identify and test materials and an online knowledge bank, fully accessible by highways teams throughout the UK. In addition, there will be dedicated resources to measure and monitor carbon throughout the project. CEDR is needed as it's unlikely that any one single authority will accomplish this on their own.

Where?

A north and south campus. The north campus will be in North Lanarkshire and is covered in a separate business case. The south campus (the subject of this business case) will be a physical location in Birmingham used as a collaboration space to bring people together. Our intention is to scale to a UK and eventually global level in terms of reach.

Who?

Transport for West Midlands as part of the West Midlands Combined Authority, North Lanarkshire Council, Colas, Amey, Universities of Nottingham, Aston and Herriot Watt, Connected Places Catapult, TRL, National Highways, Birmingham, Coventry, Dudley, Sandwell, Solihull, Walsall, and Wolverhampton councils. This project is already generating keen interest from other partners who we will engage with.

When?

We're currently mobilising our resources to open the centre from May 2023 onwards. The project will run initially for three years. After this point we expect the centre to become self-sustaining. Various options to allow the centre to continue operations post 2026 will be explored during the project.

How Much?

The south campus will be allocated just over £4 million. The majority of this will be spent on conducting trials and identifying best practice from around the world.

Do we have political support?

Andy Street (Mayor of the West Midlands)

“I am pleased to endorse the bid submitted by TfWM on behalf of the West Midlands Combined Authority. The West Midlands history and heritage in transport is well known and we are now continuing that pioneering spirit to embed transport innovations and drive behaviour change to reduce emissions, improve air quality, and stimulate the green economy. This programme marries the two in the spirit of innovation and collaboration which are at the heart of everything we do.”

Cllr Ian Ward (WMCA portfolio holder for Transport)

“We have set out an ambitious bid which supports the aims of decarbonising local roads. We are writing a new volume of the West Midlands story and marshalling regional talents and capacity for innovation to meet a global challenge. Success means we will be able to accelerate delivery and long-term carbon reduction for our residents, communities, and all users of our networks. Our combined knowledge and strengths in highway engineering and technical innovation will give us an edge that we can expand nationally and ultimately globally.”

Cllr Ian Courts (WMCA portfolio holder for Energy and Environment).

“Effective action to deal with climate change will need to happen at scale, but it also needs to be driven by value for money principles. It will involve new technology and skills, identifying new materials and working techniques. This programme marries together the spirit of innovation, collaboration and joined up thinking particularly in the key challenge we all face of tackling climate change and reducing carbon emissions. We will host the first two HS2 stations out of London and our determination to seek the best outcomes from this project for the region are an example of the region’s determination to succeed.”

How will we save carbon?

By helping to incorporate low carbon solutions into highways activities throughout the UK – and identifying, developing, and testing new low/zero carbon innovations.

Target Objectives

- Identifying, deploying, and monitoring low carbon highways maintenance solutions.
- Publicise low carbon highways maintenance solutions.
- Become the ‘go-to place’ to manage know-how about decarbonising highways.
- Develop robust methods for trials at demonstrator sites.
- Develop an enhanced understanding of the effectiveness of various carbon calculator tools, including the FHRG Carbon Calculation and Accounting Standard.
- Develop systems and processes to scan and unlock new decarbonised technologies and enable continuous improvement and embed as BAU.
- Develop a carbon-based behavioural change initiative.

Associated Outputs

- Low carbon material demonstrator trial reports objectively reviewed and signed off.
- Standards & Specifications report objectively reviewed and signed off.
- Future materials database content accessible and useable.
- Carbon baseline for highway maintenance materials.
- Global best practice innovation reports.
- Carbon literacy training program.

3. The Strategic Case

3.1 How your proposal meets Live Labs 2 Vision and Principles



Scale – Attention to a specific need and / or problem which is commonplace elsewhere. Delivery of wider benefits within and outside the UK local roads sector. Potentially for scalability to other locations across the UK and internationally.



Net Zero – Focus on net zero carbon outcomes rather than (just) technical capabilities. Demonstratable and measurable carbon savings and associated impacts.



Financial – Improved maintenance regimes and revenue cost savings. Minimised capital costs through innovative deployment. Reduction in infrastructure/asset costs. Ageing assets being replaced/supplemented by sustainable alternatives.



Collaboration – Active private sector and academic collaboration. Creating an open and interoperable innovation eco-system.



Customer Satisfaction - Improved customer experience and outcomes. Improved network performance, reliability, and resilience.

Scale

The challenges in the materials market have been identified through consultation with local authorities, across a series of workshops.

Embodied carbon (CO₂e) in materials constitutes around 40% of the carbon footprint of road construction and maintenance with significant additional associated carbon in the transportation, distribution, sourcing and maintenance of materials and assets.

The challenges are representative of the materials market across the highways sector.

The Centre of Excellence model focuses on utilising the extensive partnership network, relationship with the DMRB and excellent comms strategy to ensure materials are fit for purpose, industry approved, not duplicated and success is scaled across the local highway authority market.

Net Zero

As we know embodied carbon (CO₂e) in materials constitutes around 40% of the carbon footprint, including the added carbon contribution from transportation, distribution, sourcing, and maintenance of materials. There is a plethora of ways in which we can attempt to solve this, through recycling, optimisation of supply and demand and cutting-edge materials that carry inherently lower embodied carbon. Furthermore, materials that drive resilience can also create positive carbon impacts long-term, for example, if a material with 50kg CO₂e/tonne lasts in the road for 20 years, its effective footprint is 2.5kg CO₂e/tonne/year. If, however, more care is taken and all best practice is adopted to extend the life to 40 years, this drops to 1.25kg CO₂e/tonne/year.

Financial

The CEDR model proposed will generate financial savings for the Highway market, testing materials within a stable, industry standard environment will save local duplicated costs of running the same trials in multiple different locales.

As the programme progresses and co-ordination of testing across the industry improves, the current high level of duplication will decrease, local authorities will be able to learn from each other. This is opposed to the current state-of-play in which multiple local authorities spend public money testing the same materials (unaware it was trialled and tested in another area). A collective industry approach driven by a well-funded and co-ordinated Centre of Excellence will drive significant savings.

Focusing on reducing the carbon and harmful pollutants that are emitted as part of construction and maintenance of the roads across the West Midlands will lead to direct improvement in air quality. The target of the programme is to reduce carbon output in the materials we use by 25% by 2026 and 50% by 2030.

Customer Satisfaction

Increased air quality and lower carbon improves the experience for all using the road or footpaths and cycleways. The impacts of climate change and future mobility will be our focuses when considering the “materials of the future”. This will ensure our roads are built with resilience, leading to reduced downtime, maintenance and other activities which disrupt the network for the customer. We will engage with our established citizen panels to better understand our customers satisfaction levels and carbon reduction appetite.

Collaboration

The Centre of Excellence model brings together over 20 different organisations, spanning the public, private and academic sector. This includes, Tier 1 contractors, suppliers, SMEs, three Universities, CPC, TRL, industry bodies including SCOTS, National Highways and Transport Scotland.

Workshops, expert groups, and design-thinking programmes will bring together leaders from across the industry, supported by a tested and proven innovation framework, developed in Live Labs 1. This will lead to high functioning collaboration and innovation ecosystem required to tackle the challenges faced by the local authority highways market.

3.2 How it meets national, sub-national and local policies and strategies.

National

The government has outlined its strategic ambition to reduce greenhouse gases and to achieve a net zero carbon growth position for the UK. Since then, various strategies and policy statements have been released that the Live Labs 2 programme aligns with.

Clean Growth Strategy

Clean growth means growing our national income while cutting greenhouse gas emissions. Achieving this is at the heart of the UK’s Industrial Strategy and will increase productivity, create jobs, and help protect the climate and environment upon which we and future generations depend.

Decarbonising Transport a Better, Greener Britain

This strategy sets out how the government is going to achieve its ambitions to decarbonise our transport sector and deliver the carbon emissions reductions required. Whilst there are many ambitions outlined in the document our proposed Live Labs projects specifically support the following commitments:



Delivering decarbonisation through places



Supporting UK research and development as a decarbonisation enabler

Alongside this strategy, the Department for Transport has also initiated a Carbon Management Programme to embed an integrated system for managing whole life carbon of infrastructure projects at a portfolio level. This is complemented by wider government efforts to reduce emissions from construction, as set out in the National Infrastructure Strategy and Construction Playbook.

National Infrastructure Strategy

The government wants to deliver an infrastructure revolution: a radical improvement in the quality of the UK's infrastructure to help level up the country, strengthen the Union, and put the UK on the path to net zero emissions by 2050.

Net Zero Strategy: Build Back Greener

The Net Zero Strategy, published in October 2021, sets out the vision for transitioning to a net zero economy and outlined the path to hit the 2050 target. This strategy also states the government commitment to moving towards a circular economy by keeping built assets and materials in use for longer, by reusing and making greater use of secondary materials.

Our Live Labs projects also supports this principle by reducing duplication and waste in the innovation process, breaking silos between disparate local authorities and sharing best practice in materials choices and processes.

Climate Change Committee 2022 Progress Report

This report from the Climate Change Committee to Parliament is an assessment of the Government's performance in combatting climate change. Within the report is a summary of the range of actions and conditions that combine to enable decarbonisation of surface transport and how this works together to deliver the sectors decarbonisation pathway. A key enabler of this is "behaviour to reduce waste" which, through our Live Labs we will identify and work towards.

WMCA Environment and Energy 5 Year Plan

[Environment and Energy \(wmca.org.uk\)](https://www.wmca.org.uk)

In 2019 the WMCA declared a climate emergency and set out a vision to make the West Midlands net zero by 2041. The five-year plan explains how WMCA can deliver a 33% reduction in carbon use across local transport, homes, and businesses by 2026. The work also involves creating a more circular and resource efficient economy for the West Midlands, and working with partners to protect, restore and enhance our natural environment – creating greener places and cleaner air.

Birmingham Transport Plan 2031

[Birmingham transport plan](#) | [Birmingham transport plan](#) | [Birmingham City Council](#)

A bold approach to reducing transport emissions by reallocating road space, transforming the city centre, promoting active travel, and managing demand through parking. Now in its delivery phase, Birmingham transport plan sets out to radically transition the city towards sustainable forms of transport.

Coventry City Council Climate Change Strategy

[Tackling climate change – Coventry City Council](#)

The strategy sets out the foundations for creating a sustainable zero carbon city. The strategy seamlessly supports the delivery of the City's One Coventry Plan, which includes

tackling the causes and consequences of climate change as one of its three key priorities. The strategy aims to protect the most vulnerable mitigate the impact of climate change and will help build resilience across the city, while also maximising the economic benefits of the green industrial revolution through new employment opportunities.

Dudley Council Plan (2022-2025)

[council-plan-2022-25-final.pdf \(dudley.gov.uk\)](#)

The council's climate commitment is to create a sustainable borough on its way to net zero carbon emissions, improved air quality, reduced fuel poverty and outstanding waste and recycling services.

Sandwell Metropolitan Borough Council Climate Change Strategy 2020-2041

The strategy covers both mitigation of climate change by reducing greenhouse gas emissions and adaptation to the effects of climate change on the area, to reduce harm from heatwaves, floods, and air pollution among other impacts. Sandwell's Climate Change Strategy includes an Action Plan to get them to their target of net zero carbon emissions for the Council and the whole of the Borough.

Solihull Net Zero Carbon Council Plan

[Net Zero Carbon Council Plan | solihull.gov.uk](#)

Alongside the borough-wide net zero action plan, we are also committed to making sure the Council's own operations are net zero by 2030. The plan outlines how the Council intends to build on the previous decade's achievements which have seen Council emissions reduce by over 70% since 2009. Key to the success so far has been the switch to LED street lighting, reductions in emissions from waste collection services and continual improvements to our buildings through energy efficiency works and responsible management.

Walsall Council Climate Emergency Action Plan 2020-2025

[Walsall Climate Emergency Action Plan](#)

Walsall Council declared a climate change emergency on 16th September 2019 and committed to becoming a net zero carbon authority by 2050. This plan describes the actions the council will take to achieve carbon neutrality and has been categorised in target areas of action.

City of Wolverhampton Council Future Generations Strategy

[Climate Change and sustainability | City of Wolverhampton Council](#)

The council produced our Future Generations' Commitment document in 2019. The document shows our duty to reduce carbon. We produced it in response to our climate emergency declaration. The council aims to make all council activities net carbon zero by 2028.

Midlands Connect Strategy Transport Plan

[MC - STP Doc Digital \(midlandsconnect.uk\)](#)

The plan looks at the sources of transport related carbon emissions in the Midlands and pledges to release a decarbonisation policy toolkit to provide evidence to local authority partners on the decarbonisation approaches they could use in their local plans and pathways.

3.3 How it addresses future challenges not covered above.

Future Mobility

The most impactful way to remove carbon from highways delivery is either to not build or to increase resilience (PAS 2080). HGVs and buses cause 90%+ of highway damage, while

new mobility modes (Connected and Autonomous Vehicles, Electric Vehicles, Green Hydrogen Vehicles and Micro mobility) present novel challenges for infrastructure providers. Current efforts to mitigate are uncoordinated across sectors. This Live Lab presents a strategic innovation programme to: (1) identify and forecast critical impacts from HGVs, buses, and future mobility on roads, (2) lead the development of a suite of materials that can prepare the sector for the sweeping shifts in our mobility landscape.

3.4 Confirmation of partners, roles, and any funding sources / leverage

Partner	Role	Funding / Leverage
West Midlands Local Authorities	The seven West Midlands Local Authorities will utilise their forward programmes to incorporate low carbon material demonstrators.	A percentage of their CRST's Maintenance grant pledged to be used on low carbon materials/process in the WM area.
Colas	TMC / Consultant	World class research & development facilities give clients access to innovative new products, processes & ideas.
North Lanarkshire	Authority Partner	Access to additional demonstrator's sites with unique geographical location & climate variations.
Amey	TMC / Consultant	Consultancy offering unique engineering and operations experience, together with data driven insight from their consulting business, which delivers better results for clients.
University of Nottingham	Academic Partner Nottingham will sit on our expert panel and provide technical guidance to decision makers.	Nottingham evaluates the engineering environmental & sustainable aspects of elements of road infrastructure. Concerned with the sustainability, resilience, and maintenance of the existing infrastructure asset as well as envisioning future transport systems.
Aston University	Academic Partner Aston will sit on our expert panel and provide technical guidance to decision makers.	Birmingham is one of the UK's most diverse cities. Students from over 120 countries choose to study at Aston University giving access to a diverse pool of knowledge & thinking.

National Highways	Advisory / Knowledge / Support	NH use a carbon management system to embed approaches that minimise emissions, including lean construction practices and the principles of the circular economy.
FHRG	ME Supplier The FHRG will provide a carbon calculator to compare carbon emissions between various materials.	FHRG is developing the Carbon Calculation tool & Accounting Standard (CCAS)
The Connected Places Catapult	Innovation Enabler. CPC will help identify low carbon materials / innovations from lesser-known organisations.	Access to global and multisector networks regarding materials decarbonisation.
Transport Research Laboratory	Innovation Enabler. TRL will deliver a standards and specifications work package to help identify and remove barriers to implementation.	TRL is a team of expert scientists, engineers and conduct leading edge research into infrastructure, vehicles and human behaviours which enables safer, cleaner, more efficient transport. They also have access to global and multisector networks.

3.5 A description of the drivers for change

We have set an objective to accelerate the local and sector highways decarbonisation beyond the natural trajectory (ultimately defined by government targets and legislation). We also consider that breaking down silos of innovation will be key to reducing our collective carbon emissions as we seek to improve collaboration and create greater asset life for improved carbon cost savings.

This Live Lab will examine and address the following drivers for change and associated challenges on the journey to net zero highways:

- **Highway maintenance will still be required as a statutory legal duty** A key driver for change is the reality that although new highway construction could reduce, and in some cases, cease over time as part of wider societal and economic changes to address climate change, highway maintenance will still be required as a statutory legal duty of local authorities and as such, will have to be decarbonised to meet the government's commitment to achieve net zero by 2050. Given this imperative, decarbonising the materials used in highways maintenance needs to be affordable and become 'business as usual' as soon as possible.
- **Understanding barriers to using new low carbon materials where future activity is required** – the sector needs to identify which materials can be used using existing knowledge and taking a collaborative approach to materials choices. This includes both low carbon materials at point of use and through an asset's lifecycle.
- **Effective decision making that balances decarbonisation against other needs** – there is no existing systems-approach to balance environmental and economic needs

of highways. For example, the impact decarbonisation has on the reliability, safety, and performance of highway networks, or even a true understanding of a material's economic potential rather than simply delivering a pure carbon reduction.

- **Cross-sector collaboration** – decarbonisation is a sector-wide problem, however opportunities to share learning are frequently missed. Local authorities, contractors and academia must work in partnership to pool expertise, share lessons learned (both positive and negative) and jointly implement a new way of working that has correct materials selection at its core.

As the emissions from highways materials are experienced across scopes 1, 2 & 3, this naturally leads us to involving and engaging with national supply chains and local as well as regional materials suppliers, all of whom are pursuing this agenda from their own perspective as part of their corporate social responsibility and governance.

The learning gained from this Live Lab will be immensely valuable at a sector level and will move the highways industry forward significantly in its working methods and selections of materials.

- **Measuring and evaluation (M&E) of carbon impacts** – the measurement of carbon is a complex issue, with a range of tools available. With the potential introduction of carbon budgeting, a robust approach to measurement is required.
- **Behavioural & attitudinal change** - we identified a need for substantial engagement with communities and local authorities to create both understanding and subsequently behavioural and attitudinal changes necessary to deliver reductions in carbon emissions. This ranges from a better understanding of how and why emissions are created in current highway maintenance operations and the role that all can play in reducing them. We will address this via carbon literacy training and communications.

As we know embodied carbon (CO₂e) in materials constitutes around 40% of the carbon footprint, including the added carbon contribution from transportation, distribution, sourcing, and maintenance of materials.

Whilst the authorities have a platform for collaboration, innovation knowledge is typically undertaken in isolated pockets, risking duplication and waste, with a lack of consolidation and communication and implementation as BAU. It is not straightforward to access other centres of excellence, academic bodies, projects of the private sector and SMEs to support decarbonisation.

Traditional specifications – As with much of the country, highways specifications in the West Midlands region have remained largely unchanged and with limited scope for transition to achieve net zero.

Lack of decarbonisation knowledge and skills - People and organisations working in highways often lack the knowledge and resources to assess the feasibility and impact of low carbon solutions. This limits and slows the uptake of such innovations. We will strive to be the catalyst of change working with our transport skills academy.

Resource availability – Local authorities have limited capacity to implement alternative ways of working and are not necessarily organised in a way to promote collaboration across a whole region.

A series of workshops and consultations were held between the West Midlands local authorities, Transport for West Midlands, University of Nottingham, University of Aston,

Colas, National Highways, Connected Places Catapult and TRL. North Lanarkshire Council (NLC), Amey, and their partners conducted similar workshops, and both identified a set of key challenges and opportunities within the materials space, that are set out in figure 1.

Inherently high CO₂ Materials

Construction is the main source of CO₂ in the Highways and Roads Environment. Although the materials marketplace has attempted trials for low carbon materials for years, progress has been slow. Local authorities have been inundated with low carbon solutions, which either have not had the desired impact or have been too complex to implement large-scale.

Uncoordinated innovation

The industry has been slow to adopt new innovations, especially low carbon materials. There are many reasons for this, including restrictions placed on contractors and suppliers by the specifications on long term contracts . The industry has added to this through uncoordinated trials, and knowledge not shared across the industry.

An immature Supply Chain

The highways and roads market has a narrow view of available suppliers for use on the network. Too often, highways and roads authorities and their partners source materials from far afield, needlessly increasing CO₂ output across the supply chain. Consideration is not given to other sources of recyclable materials at the local authority's disposal from other sectors.

Underutilised assets from wider industry

Disposal and replacement of assets is carbon heavy. Often overlooked in terms of low carbon innovation is the importance of solutions that can be applied in the maintenance phase, to maximise the life of assets we already have.

Figure 1 – challenges and opportunities for a materials approach

We are confident that these challenges are representative of those faced across the industry and materials market, based on the diverse geographies, industry backgrounds and services providers of those surveyed.

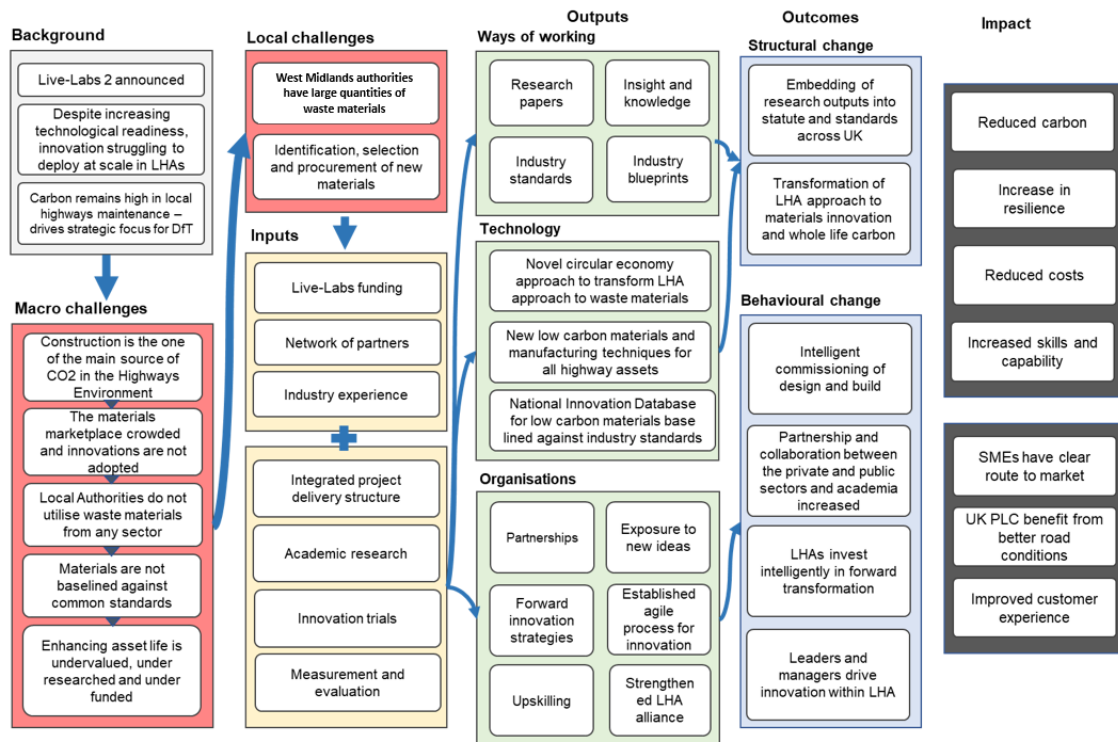
3.6 Details of process / locational maps where appropriate

We will aim to identify locations suitable for demonstrator trials in each of the West Midlands local authority areas. We will conduct a match making process to pair the materials identified from the innovation funnel with the most suitable sites from the LA's forward maintenance programmes. Providing in situ real life testing situations.

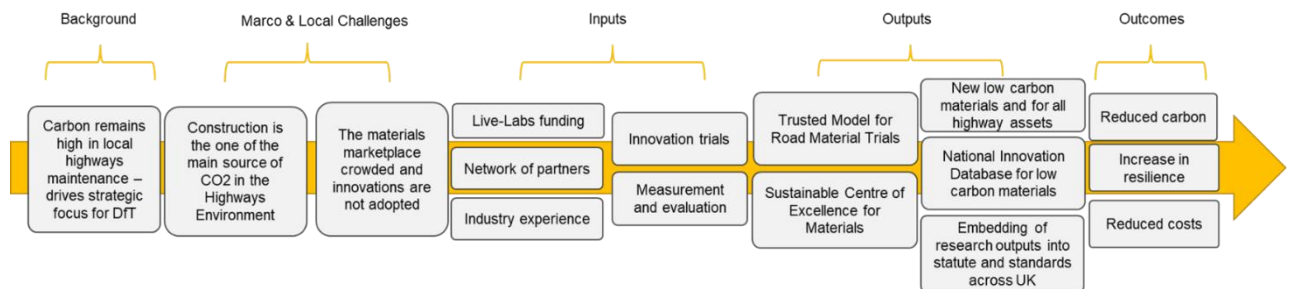
Initiatives delivered on each demonstrator site will vary from quick wins to longer term projects and the precise innovation profile of each scheme will be optimised through a robust innovation process developed with support of our expert group drawing on their specialist expertise. This will incorporate a process of Early Carbon Contractor Involvement (ECCI) and essentially 'speed dating' to link the right innovation and demonstrator sites. This will be co-ordinated and supported by CEDR.

We will align our project with existing programmes to maximise the benefit of the funding award. An example of this is the Sprint bus priority corridor. The project links Walsall to Solihull and Birmingham Airport in one continuous route and is designed to reduce congestion and increase uptake of public transport supporting achievement of the region's target to achieve net zero by 2041. Phase 2 construction is due to commence later in 2023 and this provides potential demonstrator sites for our Live Lab projects improving the overall positive impact of the project.

3.7.1 Detailed theory of change / logic map for your proposal



3.7.2 Golden Thread



3.8 Details of how you will measure impacts and how these links with M&E Activities

We will collect a range of M&E data to support the monitoring and evaluation of the project.

This will enable us to verify whether the project has been successful in achieving its aims in alignment with the project's Theory of Change model. Data collection will be conducted throughout both the three-year project duration and the five-year trial. The types of data that we will collect for this project include:

- Carbon footprint: to demonstrate that the project successfully reduces carbon emissions, we will implement a comprehensive carbon measurement process. We will ensure that the evaluations take account of the full suite of GHG emissions, giving results in CO2 equivalent (CO2e)
- Asset data: we will measure the impact decarbonisation has on the highway assets performance, particularly where we have used an innovative material or new maintenance approach. As a minimum this will be monitored through routine Scanner, Coarse Visual Inspection (CVI), routine safety inspections, defect history, photographs, and grip tester surveys.

- Industry engagement: Capturing stats on the number and broad demographics of those engaged with throughout the project.
- Public satisfaction: the perception at demonstrator sites will be assessed through the monitoring of complaints/compliments and surveys. Public satisfaction data will highlight any social issues caused by decarbonisation in the demonstrators. We will engage with our established citizen panels to better understand public satisfaction levels.
- Cost: to enable our project to be replicated and scaled up, we will collect data on the financial impact of decarbonisation – with the aim of understanding what drives the perception of low carbon approaches being more expensive and challenge these views by showing decarbonisation can be better value.
- Operational data: we will collect details of the required change to operational delivery, including time on site, type of traffic management required, whether works can be delivered at day or night, and the level of resources needed.
- Culture change: we will conduct annual surveys of our project teams (both local authority and term contractor) to assess changes in behaviour, particularly whether carbon is more prominent in decision making.
- Jobs created: we will monitor the number of jobs created through the project including the number of student placements.
- Social Value: we will use the TOMS framework to evaluate the social impact of alternative approaches ranging from biodiversity scores to employment and volunteering that has been generated through the new approach to working.
- EDI: we will monitor the diversity of the team delivering the project throughout its duration and the diversity of people engaged through demonstrator sites as part of project specific EDI Assessments.

4. The Economic Case

4.1 Projected Benefit-Cost Ratio(s) informing the value for money category with a breakdown of the estimated costs and benefits and discussion of any significant risks and uncertainties that might influence a scheme's value for money.

The purpose of the Economic Case is to demonstrate public value by comparing the economic performance of the do-nothing scenario, i.e., a business-as-usual scenario, and comparing this to the Do-Something case, i.e., that with Centre of Excellence for Decarbonising Roads (CEDR) active, the online knowledge bank (database) and the materials testing programme complete. A Value for Money (VfM) category is assigned by comparing the monetised benefits to the capital and operational costs of the scheme.

Most of the economic benefits from the scheme will come through reductions in embodied carbon and greenhouse gas emissions for end users. As expressed in the Government's policy paper "Valuation of greenhouse gas emissions for policy appraisal and evaluation", these generate an economic value that society places on the prevention of a unit mass emission of carbon dioxide (CO₂) or an equivalent volume of another greenhouse gas factored by its Global Warming Potential (GWP) relative to that of CO₂. Benefits are therefore expressed in £ per tonne of CO₂ equivalent (CO₂e).

The value of a tonne of CO₂e at 2020 prices is expressed in Figure 2. The central series represents the core value calculated while the low and high series represent a 50% uncertainty in the values, lower and higher respectively.

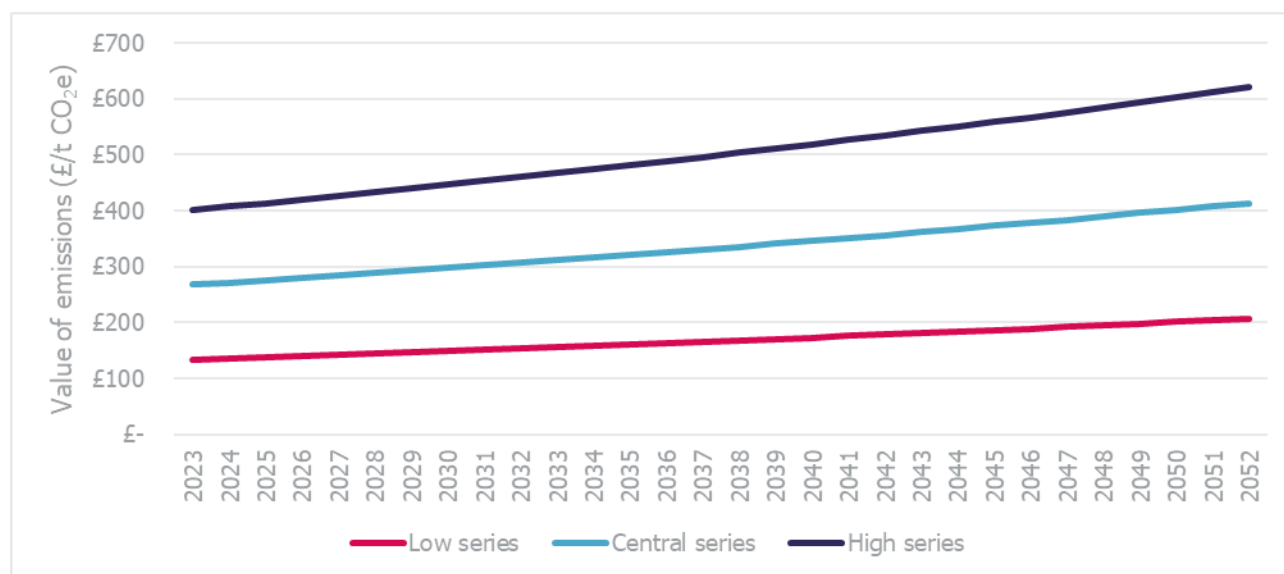


Figure 4.1: Value of emissions, £ per tonne of CO₂ equivalent, 2023 prices and values

All benefits and costs should be rebased to the Present Year of 2020 (the Government's price base year for CO₂ emissions) using the Government's GDP Deflator series. This accounts for the impacts of inflation on costs occurring in the future. All values are further discounted to represent the social time preference for the consumption of goods and services now rather than in the future. Using guidance from the Green Book, a discounting rate of 3.5% per annum should be applied to all benefits and costs which occur in the years beyond 2020.

The Value for Money (VfM) Category will be determined by dividing the present value of benefits by the present value of costs. This Benefit to Cost Ratio (BCR) will be assigned a

Value for Money category and will be identified according to the Department for Transport's Value for Money framework.

The Innovation Project itself is unlikely to recoup its costs since it represents an experimental phase where the emphasis is on increasing knowledge, not generating benefits. The BCR is therefore likely to be less than 1 and the VfM category will be poor. As described below, the Trial Stage is calculated to deliver a BCR of 3.25 over a 20-year renewal period. This represent a High VfM category.

The innovation project will drive benefits, as well as those observed directly in the trial stage (the low carbon materials testing) and those from the knowledge bank. For example, each authority that doesn't have to carry out a separate trial, market review and validation carries a cost saving benefit for those that takes advantage of the centre's knowledge bank.

Innovation project

One of the key benefits of the Live Labs programme is that it recognises that whilst innovation is critical it also needs to be carefully managed to ensure the realisation of benefits.

As part of our project, we want to highlight the economic benefit of innovation management which will be monitored and measured throughout the project.

- Faster introduction of new products and higher launch success rates.
- Earlier detection of non-viable ideas and better plans for implementation.
- Greater monetary efficiency.
- Better collaboration between West Midlands local authorities for quicker results and improved confidence and relationships
- If the innovation trials were to be scaled up for use across the counties, it is anticipated that all the benefits of the trial stage would be increased with economies of scale such as more intensive use of vehicles and digesting equipment likely to result in reductions in marginal costs, improving the Benefit to Cost Ratio (BCR) and Value for Money (VfM) category.

Trial stage

The scheme proposal identifies anticipated benefits and outcomes through iterative and radical testing of new low carbon materials and dissemination of the learning and benefits across the highways network. Therefore, the volume of embedded CO₂e emissions prevented per unit mass of the materials will be determined. This will in turn be converted into a monetary value using the data shown in Figure 4.1: Value of emissions, £ per tonne of CO₂ equivalent, 2023 prices and values

Due to the unknown nature of the range of innovations due to be evaluated, exact projections are difficult, however we will consider materials in the below categories and use the below set of baselines and evaluation methods.

The categories of materials assessed include:

- Asphalt: Existing hot-rolled construction asphalt generates 0.24 tonnes of CO₂e per m³. We will calculate the new quantity of CO₂e for each material and extrapolate that over a given sample of roads within the Local authority's network to give an estimate of the emissions reduced and the £value that could be saved.

- Concrete: Existing CEM grade I Ordinary Portland Cement has baseline embedded emissions of 0.91 tCO_{2e} per tonne of cement. Alternative innovative cements will be tested and evaluated, and these figures will be extrapolated over the current quantity of cement used within the region, taking account of supply factors of the eco-cementitious alternatives.
- Surface Treatments: A range of surface treatments could be considered as an alternative to full scale resurfacing, evaluating an asset's entire lifecycle, with a range of treatments over that asset's lifetime. For instance, a road could be considered for 25 years with a programme of surface treatments and rejuvenation, rather than full resurfacing interventions. We will model the asset's whole lifecycle cost and ensure that the right mix of treatments is advised, given the information that is available. We would model the economic impact of each of those interventions, within the 25-year lifecycle, as well as the carbon impacts of each intervention as a part of the asset's entire lifecycle.

As well as the potential economic savings of our future innovation projects, a reduction in emissions will have secondary benefits such as the improvement of air quality and reduction of particulates, as well as promoting improvements in general health and wellbeing with a reduction in health costs and premature deaths. These non-monetised benefits should be considered in addition to the Benefit to Cost Ratio and Value for Money Category.

The production of more durable materials, if identified, should result in operational benefits for the authority responsible for maintenance as the burden, including for third party transport infrastructure and traffic management providers, as the volume of roadworks required per year is reduced. This in turn offers an economic benefit to road users in the form of Transport Economic Efficiency (TEE) benefits as their journey times are reduced due to encountering roadworks less frequently.

In addition to the direct benefits from emissions reduction, the completion of the Centre of Excellence will permit more efficient use of materials on a wider scale going forward. This will result in less lost time pursuing research that has already been carried out, less local government spending going to waste.

[4.2 Sensitivity testing to provide an understanding of the impact of the risks and uncertainties.](#)

The core assessment scenario utilises the Central series of CO_{2e} emissions economic values shown in Figure 4.1 above. It is therefore recommended that the impact of substituting the Low and High series values on the net benefits are considered. These impacts are shown in Table 4.2 below. The Low Series benefits result in a BCR of 1.62 (Medium VfM category) and the High Series a BCR of 4.87 (Very High BCR).

Category	Central Series benefits	Low Series benefits	High Series benefits
Asphalt	£2.1767 million	£1.083 million	£3.251 million
Concrete	£8.647 million	£4.323 million	£12.970 million
Lighting	£0.490 million	£0.245 million	£0.735 million
Rebar	£3.588 million	£1.794 million	£5.382 million
Total	£14.892 million	£7.445 million	£22.338 million

4.3 Key metrics such as projected infrastructure costs, supporting costs, and costs per tonne of carbon saved.

The key metrics to be measured to quantify the Financial Case are the actual savings in emissions outlined in the Carbon Case, as well as the assumptions on the volume of materials to be used by the West Midlands local authorities (assumptions for which there is currently very limited data but a baseline that we will develop fully as the Live labs' carbon evaluation framework is developed).

Material longevity and endurance is a key part of the efficiency of a material / treatment that we evaluate. After every demonstrator / trial we will take cores of both the baseline material and of the new innovative material as laid. We will then have those core samples analysed in a highway laboratory and the suite of metrics provided by the laboratory (including fatigue, stress resistance, stiffness modulus etc) will factor into the final performance factors of the material, the pavement design analysis and hence the expected lifetime of the respective material before failure.

All these longevity factors will fit into the lifecycle analysis of the product and ensure that not only the embodied carbon of the material across the BS EN15804 system boundaries A1-A5 are represented but also the lifecycle of that asset.

Changes to the government's carbon dioxide equivalent valuations will be monitored and compared to the values shown in Figure 4.1. Further investigation is also required to value the trial stage outputs in terms of their net economic gain for adopters of the database, as well as true values of reduction obtained by the theoretical options.

The full carbon evaluation framework will explore other data sources for carbon emissions related to highway maintenance activities. We will provide a range of values based on achieving each proposed benefit.

5. The Commercial Case

5.1 Clear statement of the projected procurement / intellectual activities

The process this programme will follow is that TfWM will make a direct award and commission Colas Limited (company number 02644726) to provide the following services:

- The establishment of an expert group to identify new areas of materials innovation and design/monitor trials sites alongside local authority partners in the West Midlands. Including the production of content for the online knowledge bank.
- Identify global best practice for trials on UK roads.
- Carbon baselining, monitoring and evaluation.
- Future road material technical specifications and standards report.
- Project management of the centre of excellence.

The contract will begin in August 2023 and end in May 2026. Colas will subcontract our partners CPC, TRL, University of Nottingham, Aston University and the FHRG to help provide the services mentioned above.

TfWM will also utilise grant agreements with the seven WMCA local authorities to fund the extra over costs for the demonstrator trials across the West Midlands. The use of grant agreements is a proven method used frequently in the West Midlands for similar projects.

5.2 The intended procurement routes for the project's key outputs and activities as well as how they will secure the factors outlined in the economic case.

The Crown Commercial Services (CCS) RM6088 framework is the preferred procurement route. This route will enable TfWM to procure services from Colas that will include the remaining academic and commercial partners as sub-contractors.

Project Activity/Output	Delivered By (Brackets indicate a subcontractor)	Procurement Route
Project Management	Colas	CCS RM6088
Carbon Baselining/Monitoring	Colas (FHRG & Carbon Analyst)	CCS RM6088
Expert Group	Colas (University of Nottingham & Aston University)	CCS RM6088
Standards and Specifications Report	Colas (TRL)	CCS RM6088
Cores and Testing	Colas (3 rd party)	CCS RM6088
Global Best Practice	Colas (CPC)	CCS RM6088
Physical Location	TfWM	Direct Award
Communications/Other Internal Services	TfWM	Internal Resource
Demonstrator Trials	The 7 WMCA Local Authorities	Grant Agreements

5.3 How the proposed approach will comply with procurement, subsidy control and, where applicable, state aid regimes inc. Section 151 / 73 officer sign off.

The preferred procurement route is fully compliant with WMCA's internal procurement policy and the Public Contracts Regulations 2015.

As part of the WMCA governance process for projects between £1-5 million, the CEDR business case was approved by the Statutory Officers Panel on 29/03/2023.

The panel was comprised of the WMCA Chief Executive, WMCA Section 151 Officer and the WMCA Monitoring Officer. This further ratifies the proposed procurement approach as the business case has been approved via the WMCA Single Assurance Framework.

5.4 Any early consultation with the supply side, making reference to any existing supplier or partnership arrangements.

Educational / academic / research partners

Organisation: University of Nottingham

- *Role:* Director of the Nottingham Transportation Engineering Centre
- *Role in programme:* Participation in Expert Panel, link to academic research, support with carbon measurement, link to international asphalt groups.
- *Selection criteria:* We chose to work with the university of Nottingham due to their expertise in the field of pavement design. Members of our team have worked with the team at NTEC before and their reputation within the industry will help bring validity to our process.

Organisation: Aston University

- *Role:* Head of Civil Engineering Department
- *Role in programme:* Participation in Expert Panel, link to academic research, support with carbon measurement, link to international asphalt groups.
- *Selection criteria:* We chose to work with the members from Aston university due to their expertise in pavement engineering and their existing relationships within transport for west midlands. Many members of the research teams at Aston are well regarded within the industry and are well connected which will bring a breadth of research that the project needs.

Other partners

Organisation: TRL

- *Role:* Account Director
- *Role in programme:* Supporting innovation processes and carbon measurement. Delivering demonstrator projects on enabling assets.
- *Selection criteria:* We chose to work with TRL due to their ability to research into a broad range of topics and their broad network. They can provide unique skillsets that may be missing from the core team.

Organisation: Connected Places Catapult

- *Role:* Engagement Manager
- *Role in programme:* Facilitating partnerships with innovators.
- *Selection criteria:* We chose to work with CPC due to their broad network and their proven ability to fast track projects, and to accelerate the development of supply chain.

Organisation: National Highways

- *Role:* Group Head of Category Management

- *Role in programme:* Co-ordinating collaboration with National Highways innovation programmes
- *Selection criteria:* We chose to work with National Highways due to the notoriety of their delivery model and the validity that proof of materials for use on their network will bring to local authority models.

Organisation: Colas

- *Role: Director UK Contracting*
- *Role in programme:* Facilitating partnerships with innovators, resourcing project management and carbon monitoring roles.
- *Selection criteria:* Colas were selected because they are experts in materials, are pioneers in cold asphalt techniques, recycling solutions, emulsion-based products and were responsible for bringing micro asphalt to the UK, nearly 25 years ago. Their inclusion brings an expertise in materials that is vital to the programme.

5.5 As so far as is possible, an outline output / outcome-based specification.

Our aim is to establish "Centre of Excellence for Decarbonising Roads (CEDR)". This will be achieved through close collaboration with the West Midlands Combined Authority, strategic partners, and a global supply chain. Our strategy will involve engaging with this supply chain, identifying, and reviewing leading innovations, trialling them on a live network and utilising our strategic partners expertise to evaluate and scale successful solutions.

1. To deliver a fit for purpose Centre of Excellence for Decarbonising Roads (CEDR), with the confidence of the industry to act as a "single source of truth" for material testing and knowledge dissemination.
 2. Establish proven research methodologies to ensure outputs from the CEDR are reliable and accurate
 3. Ensure research looks holistically when testing new materials
 4. Identify research partners that can provide specific expertise
 5. Look at scope 1, 2 and 3 emissions for materials
 6. Create a global partnership network to collaborate internationally on testing and developing materials for highways decarbonisation
 7. Communicate and promote the usage of the CEDR for all Local and Regional authorities
- End goal of having a thriving CEDR that is trusted by the industry, lowers the carbon footprint of the materials across the road sector and balances the economic and social considerations at every level.

6. The Financial Case

6.1 Details on accepting financial responsibility for the project going forward and background on sources of other funding contributions, and how funding has been secured.

WMCA has accepted financial responsibility for the project via the approval of an internal business case at the Statutory Officers Panel, in which the WMCA S151 officer is a member. In addition, the project has been assigned a project accountant who will ensure the budget is managed in a responsible manner.

Apart from the matched funding mentioned in section 6.2, no other monetary funding contributions currently exist for this project. However, we have received and will continue to receive contributions of time from Colas, National Highways, University of Aston, University of Nottingham, and our Local Authority partners. We will continue to look for other funding sources as the project progresses.

6.2 As so far as is possible, demonstrate the long-term financial viability of the proposal by providing an explanation of how the proposal will be sustained beyond the life span of the scheme including how benefits will endure beyond the period of the scheme without any further funding.

The purpose of the project is to create a sustainable Centre of Excellence (CEDR) that will continue to trial material innovations after the live lab funding has ended. The purpose of the CEDR is to centralise the identification and trialling of new materials, manufacturing techniques and processes for roll out into the sector. For the CEDR to be successful in the long-term, it is imperative we spend a significant amount of focus in the initial stages of the programme putting in place the correct foundations and applying a methodology, testing and evaluation process that can be respected and trusted by the majority of the UK local authority network. These measures include the FHRG carbon review process, sector and academic material technical review, state-of-the-art live demonstrator testing, and other measures outlined in this document.

Once this industry trust has been established there are numerous ways the CEDR will continue in the long-term and ensure the outcomes and benefits are sustained beyond the live span of the scheme.

The following will all be explored as future operating models throughout the life of the programme, a preferred option will be established in June 2024, reviewed in April 2025 and a finalised plan in September 2025.

Subscription Operating Model

The database will act as a potential revenue scheme, this will be the ultimate “acid test” for the CEDR in the five-to-eight-year period from the programme commencing. The time taken to establish trust and correct testing process to give the wider industry confidence in the CEDR “rubber stamp” should not be overestimated. Once successful, local authorities and suppliers could pay a small subscription fee to access the database or input solutions for the market to access.

Revenue avenues will also be identified, once the CEDR is established, we anticipate the highways materials supply chain will gain recognition and faster adoption rates if innovations are tested as part of the programme and under the established CEDR framework. Therefore, our wide supply chain would need to cover all costs related to trialling and certification of the material, which in turn will add value and revenue for the programme. Reducing the associated risks with trialling new materials has the potential to be “game changing” for the local authority sector.

We also anticipate that the CEDR will act as a gate keeper and access point for the international market, enabling global innovations access to the UK market ensuring we have the “best in class” available to the UK local authority road sector. Therefore, new entrants to the market will need to prove the concept or quality to the CEDR, paying a fee for testing and review and to be listed on the database for local authority adoption.

Industry Body Ownership

It may also be considered that if the programme can demonstrate not only significant carbon savings but cost & efficiency savings, that central government or industry body funding may be beneficial to lower costs across the sector. The value of industry testing in a collective manner or failing fast on specific interventions to save replications cannot be overstated as demonstrated in the economic case.

The central government or industry bodies include but are not limited to:

- The Department for Transport (DfT)
- The Association of Directors of Environment, Economy, Planning and Transport (ADEPT)
- Local Council Roads and Innovation Group (LCRIG)
- Transport Scotland
- National Highways

Future Funding Opportunities

The CEDR will work directly with our programme partners and supply chain to seek further funding opportunities from other innovation competitions, such as UKRI, and other nation and global competitions. This will happen throughout the life of the programme and post the live lab funding period.

Enhanced Scope of the CEDR

The programme will explore whether a similar methodology and approach can be applied to other local authority highway activities or focus areas, such as digitisation, decarbonisation of industry fleet and plant, the management of biodiversity and the green estate or further high carbon activities across the highway sector.

Certification programme

The centre could establish a certification program for low-carbon materials and processes in highway maintenance. This will provide a trusted third-party verification of the sustainability and effectiveness of these materials and processes.

A certification program for low-carbon materials and processes in highway maintenance could include the following elements:

Standards: The certification program should have clear and measurable standards for low-carbon materials and processes that are based on scientific and industry-based research. The standards should cover areas such as energy efficiency, carbon reduction, materials sourcing, waste reduction, and safety.

Assessment: The certification program should include an assessment process to verify that materials and processes meet the established standards. The assessment should be conducted by qualified and independent third-party assessors who are knowledgeable about highway maintenance decarbonization.

Labelling: Products and processes that meet the standards should be labelled with a certification mark that signifies their sustainability and effectiveness. This label can be displayed on product packaging or in marketing materials.

Renewal: Certification should be renewable at regular intervals to ensure continued adherence to the established standards. This will encourage companies to continue improving their sustainability practices over time.

Transparency: The certification program should be transparent about the standards and assessment process to promote trust and credibility with industry experts and stakeholders. This can be achieved through public reporting of certification results and assessments.

Recognition: The certification program should be recognized by industry associations, regulatory bodies, and other relevant stakeholders. This recognition can help to promote the adoption of low-carbon materials and processes in highway maintenance and increase the credibility of the certification program.

Overall, a certification program can provide a trusted and objective way to verify the sustainability and effectiveness of low-carbon materials and processes in highway maintenance. By establishing clear standards, an objective assessment process, and transparent reporting, the certification program can promote the adoption of sustainable practices and help to build a more sustainable future for highway maintenance.

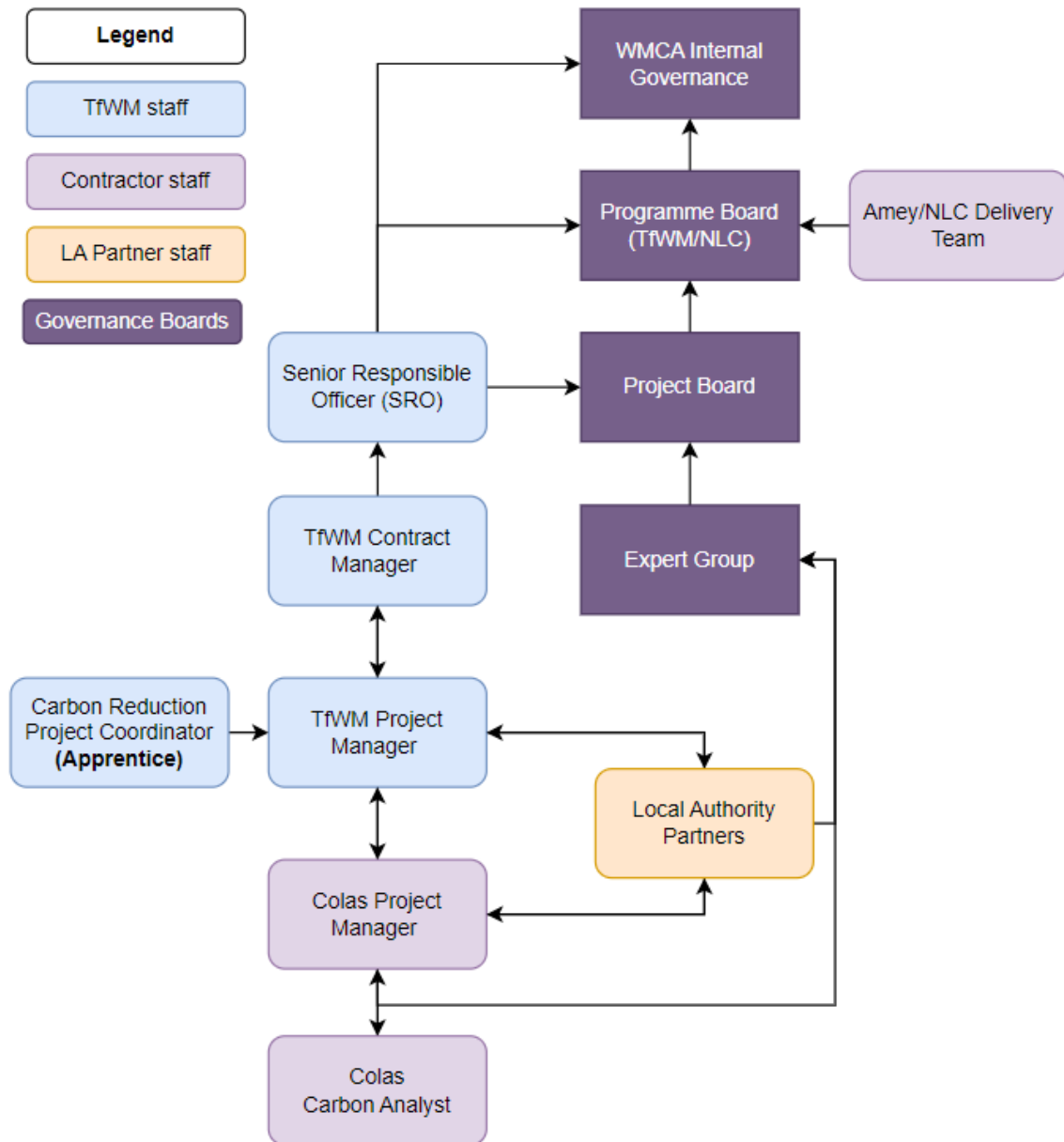
Programme Benefits

The programme benefits will be maintained beyond the period of the scheme without any further funding through the immediate adoption of viable innovations to Business as Usual (BAU). Benefits from the innovations will be scaled at pace across the West Midlands Council's operations and adopted across Colas/Amey's core Local Authority, National Highways and Transport Scotland highway contracts where applicable.

The programme benefits and outcomes will also be housed on the external dashboard and database, alongside other communication material such as white papers and detailed technical reports, which will be maintained for at least 5 years following the end of the programme, enabling other local and national highways authorities to exploit the benefits of the CEDR model.

7. The Management Case

7.1 A diagram illustrating the governance structure and key roles and responsibilities that will be in place to provide controlled and informed decision making.



7.2 A description of the key roles, lines of accountability and how they are resourced – identifying the Senior Responsible Owner of the project.

Senior Responsible Officer (SRO) – The SRO is ultimately accountable for the project. They will provide crucial decision-making capabilities and a direct link into the WMCA governance structure as chair of the project board. The SRO is accountable to the Statutory Officers Panel, ADEPT and the Department for Transport. The SRO's time is resourced internally utilising existing WMCA funding.

TfWM Contract Manager – The contract manager will monitor contractual performance. The contract manager is accountable to the SRO for the performance of the preferred suppliers. 20% of the contract managers time will be recharged to the TfWM top slice of the budget.

TfWM Project Manager (PM) – The TfWM Project Manager will help create the project plan and then monitor and report on project performance in relation to the plan. The TfWM PM is accountable to the SRO. 60% of the TfWM PM’s time is rechargeable to the project budget.

Project Manager (Colas) – The project delivery team will be led by the Colas Project Manager. The Colas PM will be responsible for mobilising the project, establishing the expert group, reporting on demonstrator sites and monitoring/evaluation. The project manager will be supported by a wider project team including a carbon analyst.

Carbon Analyst (Colas) – The carbon analyst will be a dedicated resource responsible for overseeing the carbon monitoring and evaluation framework. They will provide expertise in relation to carbon baselining, calculations, and monitoring. The Carbon Analyst will report directly into the Colas Project Manager.

<i>RACI Chart - Table 7.2</i>						
	SRO	TfWM Contract Manager	TfWM Programme Manager	Project Manager (Colas)	Carbon Analyst (Colas)	Local Authority Partners
Mobilise the project	A	C	R	R	C	C
Establish technical governance board	A	I	C	R	C	C
Chair project board	A	I	I	I	I	I
Manage supplier contracts	A	R	C	I	I	I
Identify demonstrator sites	C	I	C	A	C	R
Produce demonstrator trial reports	I	I	A	R	C	C
Project monitoring and reporting	A	I	R	R	R	C
Monitoring and Evaluation	A	I	R	R	R	I
Project closure	A	C	R	R	C	I

7.3 Any reporting arrangements to provide key updates on progress and how these mesh with the Live Labs programme cadence.

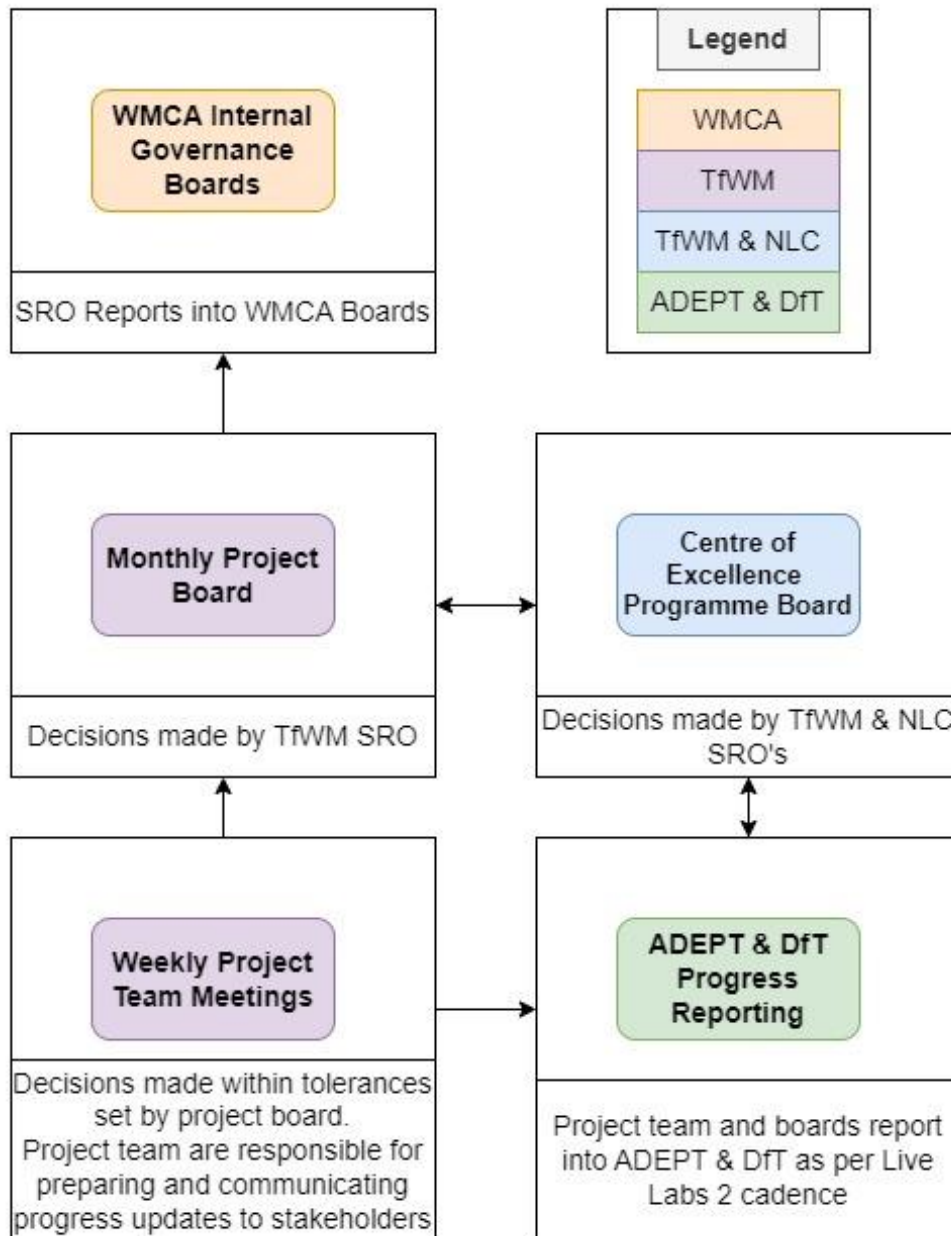


Figure 7.3 – Reporting Arrangements

Weekly Project Team Meetings

The project team will meet weekly to discuss progress against the project plan and make decisions within the tolerances set by the project board. The project team will keep a detailed list of stakeholders that will be accompanied by a communications plan providing detail of the cadence of communications with each stakeholder. The project team will be responsible for preparing and distributing progress updates as well as escalating risks, issues and decisions that exceed the tolerances set by the project board.

The project team will report into two main areas, the monthly project board and ADEPT/DfT as per the Live Labs 2 cadence.

The project team will adapt the reporting cadence as per stakeholder requirements.

Monthly Project Board

The project board will be chaired by the TfWM SRO and will comprise of senior users, suppliers, and other key stakeholders. The project team, including the expert group, are responsible for supplying the SRO with adequate information to allow project board level decisions to be made.

The SRO will be responsible for reporting into WMCA's internal governance boards as and when required. The TfWM SRO, and where appropriate members of the project team, will report into the Centre of Excellence Programme Board.

Centre of Excellence Programme Board

The purpose of the programme board is to allow theme centric decisions to be made between TfWM and our partner North Lanarkshire Council (NLC). The SRO's from TfWM and NLC will have decision making capabilities. Where appropriate, the programme board will report into ADEPT/DfT as per the Live Labs 2 cadence.

WMCA Internal Governance Boards

The TfWM SRO will report into a variety of boards internally at WMCA. These include, the Statutory Officers Panel (who approved the internal business case), WMCA Board, TfWM Leadership Team, and Network Resilience Management Team.

[7.4 A project plan that will be used to track the progress and delivery of the project and its resulting outcomes.](#)

Please see table 7.5 below.

7.5 Gantt Chart for Centre of Excellence Live Lab



7.6 A first draft of what will be an active risk register.



Live Labs Risk Register.xlsx

8. The Carbon Case

8.1 Description of a carbon baseline estimation and reduction target relative to that

The programme does not yet have a definitive schedule of trial interventions and as such baseline emissions are to be calculated on a trial-by-trial basis. It is possible to estimate baseline emissions for several key construction elements associated with highways projects whilst accepting that interventions may be trialled outside of these areas and for which calculation of additional baselines may be necessary.

To establish a carbon baseline estimation, data has been collated for emissions associated with typical practise for highways construction and greenhouse gas emissions have been calculated for the following elements:

1. Asphalt
2. Concrete
3. Surface Treatments

Table 8.2 below presents baseline carbon emissions that includes some typical materials/construction methods together with baseline carbon emissions associated together with estimated targets.

8.2 Description of your expected carbon benefits / reductions broken down by intervention type and cross referencing to estimated whole life cost per tonne.

At this stage of the project, we are unaware of what the final interventions chosen for analysis will be. As a result, we have presented examples of typical emissions reductions attained from previous innovations applied to real world projects.

Estimated savings achieved by interventions are presented in Table 8.2 below. They are provided as an indication of the scale of savings achievable.

Material	Category	Baseline		Example Intervention		Saving
Asphalt	Construction Method	Hot Mixed Asphalt	0.24tonCO ₂ e/m ³ (ICE 3.0)	Cold Rolled Construction Method Asphalt	0.21tonCO ₂ e/m ³ (ICE 3.0)	12.5%
	Binder Content	3% binder content	0.06tonCO ₂ e/ton (ICE 3.0)	7% binder content	0.07tonCO ₂ e/ton (ICE 3.0)	17%
Concrete	Cement Content	Average CEM I, Ordinary Portland Cement (OPC)	0.91tonCO ₂ e/ton (ICE 3.0)	CEM II/B-S - 28% GGBS	0.672 ton CO ₂ e/ton (ICE 3.0)	26.2%
	Structural repair method	Breakout and replacement of defective concrete		Impressed Current Cathodic Protection - Undergoing trial with Balvac on M8 Woodside		
Surface Treatments	Surface Treatments	Hot Mix Asphalt	12.6 kgCO ₂ e/me ² over 25 years	Surface treatments instead	1.5 kg CO ₂ e/me ² over 25 years	89%

Table 8.2 – hypothetical savings from category baselines

8.3 Description of your approach to the measurement of all carbon scopes / lifecycle associated with your proposal including details of proposed tools, methodologies, and source data.

Given the requirement for a laser sharp focus on carbon, we have allowed for a dedicated carbon analyst in our team structure to measure and monitor carbon emissions throughout the project duration. This will ensure that carbon is measured at every stage of the project to enable the success of our approach to be monitored and evaluated in both qualitative and quantitative forms.

Carbon baselining will be carried out by local authority partners with the support of the project team via the FHRG Carbon Measurement Tool. The data will be sourced internally from local authorities, including their term maintenance contractors. This will give us a baseline, against which we can compare the full lifecycle of new materials and processes.

For new materials, experimental profiles will be created using the FHRG tool, that will allow a direct comparison between various materials, including those currently in use by local authorities.

In addition, we will utilise the expertise of Colas and the application of their tool SEVE, which is used globally as a calculator for surfacing and earthworks, to act as a comparison to the relevant parts of the FHRG tool.

We will use a blended approach to compare the effectiveness of carbon calculators including those shown in the table below. To allow comparison between demonstrator sites, we will use the FHRG toolkit across all sites to provide a consistent measurement approach. This tool will be used both for benchmarking and the ongoing measurement of carbon emissions, so that before and after can be compared through a single tool.

Carbon calculator	Description
FHRG Carbon tool	The FHRG have produced a robust toolkit for the measurement of Scope 1 & 2 carbon emissions on projects, with a Scope 3 toolkit in development. This toolkit is aligned to the standards ISO14001, PAS2050 and PAS2080.
SEVE	Calculator for surfacing and earthworks, managed by <i>Routes de France</i> . The tool uses a range of data including how materials were transported and plant/equipment on site.
Supply Chain Sustainability School Tool	A tool that uses the UK government conversion factors and BATH ICE conversion factors for construction materials.
National Highways Carbon Calculator	A tool used to capture emissions for construction and maintenance works delivered on the strategic road network.
asPECT	asPECT, a tool developed by TRL, Highways England, the Mineral Products Association and Eurobitume UK. asPECT is used for the carbon footprint of asphalt road pavements. This is mandatory for reporting carbon footprints of asphalt as per DMRB / MCHW Series 9000.

8.4 Description of your approach to the quantification of residual emissions that cannot be cut (i.e. unavoidable emissions).

In terms of quantifying unavoidable emissions, the approach will be to first identify all the sources of emissions that are generated during highways maintenance activities. We will capture this during the carbon baseline activity.

These emissions can be categorised into two types: direct emissions, which are emissions that are directly produced by equipment, and indirect emissions, which are emissions that are generated upstream or downstream of the maintenance activities (e.g., emissions from the production of fuel).

Baseline emissions are calculated as the total emissions within the scope of the project. I.e., the sum of Capital, Operational and End of Life emissions associated with:

- Embodied emissions of construction materials
- Transportation emissions of materials and people
- Operation of plant and equipment during construction period
- Operational electricity, fuel, and water emissions
- Maintenance, repair, and replacement emissions
- End of life emissions including deconstruction and waste processing

The project will monitor carbon savings associated with the demonstrator trials. Therefore, the residual emissions will be calculated by taking monitored emissions associated with these interventions from the baseline.

8.5 Details of any academic or industrial partners who may be assisting in this process, their roles and commitment.

Educational / academic / research partners

Organisation: University of Nottingham

- *Role:* Director of the Nottingham Transportation Engineering Centre
- *Role in programme:* Participation in Expert Panel, link to academic research, support with carbon measurement, link to international asphalt groups.

Organisation: Aston University

- *Role:* Head of Civil Engineering Department
- *Role in programme:* Participation in Expert Panel, link to academic research, support with carbon measurement, link to international asphalt groups.

Organisation: TRL

- *Role:* Account Director
- *Role in programme:* Supporting innovation processes and carbon measurement. Delivering demonstrator projects on enabling assets.

Organisation: Connected Places Catapult

- *Role:* Engagement Manager
- *Role in programme:* Facilitating partnerships with innovators.

9. Equality Impact Assessment

9.1 An Equality Impact Assessment to highlight (as defined by s149 Public Sector Equality Duty – Equality Act 2010) how people from the protected characteristics will benefit from proposals and how they will ensure that any possible negative impacts are mitigated early on

We are enormously proud that the West Midlands region includes some of the most diverse communities in the country. This is well represented by the West Midlands Combined Authority workforce profile: 52.4% female, 30.5% minority ethnic background, 10.8% with a declared disability, 5.3% is under 25.

We recognise the importance of reflecting this diversity across all elements of our delivery team to ensure that our project benefits from the widest insights, perspectives, and experiences. Our commitment extends across the project management structure, delivery contractors and all associated partners.

Our project involves the coming together of local authorities, not for profit organisations and academia with links to global networks, that represents a wide range and diversity of backgrounds and break down historic barriers to help drive success of the project. An example of this comes from our partnership with University of Nottingham and its direct role in the National Asphalt Research Consortium, linked with global research organisations.

9.2 We expect engagement with relevant stakeholders who represent people from the protected characteristic groups.

We recognise that whilst much of this project focuses on us identifying and delivering new ways of working, there is a need and significant opportunity through this project to bring the public along this journey to net zero. We will engage local stakeholders and canvass their opinions through our demonstrator sites to explain how and why we may be working differently and encourage the gradual change in mindset required across all of society to mitigate the impact of climate change and achieve net zero. We have also engaged with, the Equality and Diversity Manager at WMCA for guidance and support and will continue to do so.

To support this, our project includes a Communications Plan and dedicated Communications role within our team to help us engage effectively with local people from a variety of backgrounds and experiences.

To ensure full inclusivity, our Communications lead will maximise existing relationships with key stakeholder groups in the region. We will draw upon our extensive network of equality and disability groups that are regularly engaged with through TfWM to share information, consult with and gauge interest for different initiatives.

Through the TfWM Skills Academy we will engage with school children with a net zero carbon competition as a conduit to inspiring the future generation and importantly getting the carbon reduction message back into families across the region.

9.3 Equality Impact Assessment to include: stakeholders to be consulted; relevant research/data; potential positive equality impacts; potential negative equality impacts; mitigations to negative impacts; and how the impact on equality will be monitored throughout the lifetime of the proposal.

Each demonstrator site will include an EDI assessment and identify key local stakeholders that represent the diversity of the local community. Different solutions may need different communications approaches. Therefore, we will seek solutions and communication strategies that consider different experiences/barriers (e.g., language barriers) and circumstances.

Our live lab will provide added value via a work placement scheme for lesser-privileged students from the University of Nottingham. Three students will be allocated to the live lab for their own benefit and career development; however, the students will be doing some high-level desktop market research for us, with a view to scouring the internet and carrying out their own research projects to find innovative materials that may be appropriate for inclusion in our live lab trials.

We will monitor and report on the equality impact assessment to determine whether the impacts have been realised. If any negative impacts are identified, we will create a plan to eliminate or mitigate them.

10. Monitoring and Evaluation

10.1 Details of any local, tactical M&E activities proposed aside from those being undertaken at the programme level. These should be specific to your proposals.

We will collect a range of M&E data to support the monitoring and evaluation of the project. This will enable us to verify whether the project has been successful in achieving its aims in alignment with the project's Theory of Change model. Data collection will be conducted throughout both the three-year project duration and the five-year trial.

The types of data that we will collect for this project include:

- Carbon footprint: to demonstrate that the project successfully reduces carbon emissions, we will implement a comprehensive carbon measurement process as stated in the section above.
- Asset data: we will measure the impact decarbonisation has on the highway assets performance, particularly where we have used an innovative material or new maintenance approach. As a minimum this will be monitored through routine Scanner, Coarse Visual Inspection (CVI), routine safety inspections, defect history, photographs, and grip tester surveys.
- Industry engagement: Capturing stats on the number and broad demographics of those engaged with throughout the project.
- Public satisfaction: the perception at demonstrator sites will be assessed through the monitoring of complaints/compliments and surveys. Public satisfaction data will highlight any social issues caused by decarbonisation in the demonstrators.
- Cost: to enable our project to be replicated and scaled up, we will collect data on the financial impact of decarbonisation – with the aim of understanding what drives the perception of low carbon approaches being more expensive and challenge these views by showing decarbonisation can be better value.
- Operational data: we will collect details of the required change to operational delivery, including time on site, type of traffic management required, whether works can be delivered at day or night, and the level of resources needed.
- Culture change: we will conduct annual surveys of our project teams (both local authority and term contractor) to assess changes in behaviour, particularly whether carbon is more prominent in decision making.
- Jobs created: we will monitor the number of jobs created through the project including the number of student placements.
- Social Value: we will use the TOMS framework to evaluate the social impact of alternative approaches ranging from biodiversity scores to employment and volunteering that has been generated through the new approach to working.
- EDI: we will monitor the diversity of the team delivering the project throughout its duration and the diversity of people engaged through demonstrator sites as part of project specific EDI Assessments.

For all forms of data, we will collect data prior to the start of the project to set a benchmark. We will then continuously collect data to monitor how outcomes change over the project (both in the initial three-year duration and the five-year tail)

The data we collect will be vital to our knowledge sharing approach with the wider highways sector, including other local authorities. These organisations will require evidence that the new methodology piloted in demonstrator sites was successful and does not pose a risk to their service. Therefore, the collection of this data M&E will enable a smooth roll-out to business as usual.

10.2 Details of methodologies / tools to be employed and any academics / suppliers associated with the work.

What will we monitor?	Methodology/Tools (How?)	Academics/Suppliers (Who?)
Carbon measurement	FHRG Carbon Calculator and Accounting Standard Tool. SEVE Carbon Measurement Tool.	FHRG, Colas, NLC and TfWM.
Public perception	West Midlands Greener Together Citizens Panel.	WMCA including Constituent Authorities.
Highway Maintenance Materials Menu	We will log the materials and processes currently used in the West Midlands and compare this to the materials being used in 3 years.	TfWM, Colas and WM Local Authorities.
Engagement	We'll track how many highways maintenance teams and term contractors we engage with.	TfWM and Colas.
Rigour of our materials selection and trial process	University of Nottingham and Aston University will be our scrutineers, offering credibility, validity and reliable independent feedback for the demonstrator trial sites having been part of the initial material choices verification.	University of Nottingham and Aston University.
Communications Strategy	We will monitor and record the number of hits and views for our posts over the duration of the project to establish if our approach was effective.	TfWM Communications Team and Coast.
Training	We will measure the number of people we upskill in relation to carbon literacy, including carbon baselining and measurement.	Transport Skills Academy.
Equality Impact Assessments	Our equality impact assessments we be monitored and evaluated by WMCA's Equality and Diversity Manager.	WMCA Equality and Diversity Manager.

11. Sharing, Dissemination and Working

11.1 Your proposal for continual sharing and dissemination including white papers, blogs, thought leadership etc.

Our dedicated resources based in CEDR will be focussed on the dissemination of information in accordance with tailored innovation and communication processes, developed in conjunction with ADEPT and Coast.

We will actively engage with as many local authority highway maintenance teams and term maintenance contractors as possible. As it stands our network comprises of over fifty plus local authorities, several key industry partners, world renowned academics and National Highways. We will make best use of this ever-expanding network to continually share and disseminate information.

We have made an allowance for a realistic budget for marketing, communications and industry engagement which will enable the production of informative and professional outputs (e.g., blogs, podcasts, social media posts) and participation in industry events.

Monthly updates in the form of meetings and bulletins will be issued to key stakeholders to provide updates and share lessons learned.

The development of an online knowledge portal will also maximise sharing, dissemination and ease of access to information for all.

Our physical location will assist in the human contact and face to face learning which is important in fostering good relationships, collaboration, learning and behaviour change. The West Midlands is in the centre of the country and easily accessible through good public transport and road links. This will provide a platform to continually share and disseminate our findings throughout the duration of the project and beyond.

11.2 Your proposals for marketing and communications activities to mesh with those at the strategic programme level including the use of local expertise.

Driven by our CEDR, we are keen to capitalise and align our project with activities of National Highways improving the link between local and strategic operations and learning. Between us and our supply chain we have a good working relationship across key National Highways teams and will benefit from linking in with the National Roads Academy based in Coventry.

Through University of Nottingham, we will connect into the National Asphalt Resource Consortium and link into Transport for Scotland and, Ulster University enabling two-way information exchanges across their best practice networks.

Our assembled team is highly active in the highways sector, holding prominent roles within industry bodies such as CIHT and LCRIG and working groups such as CECA. We will also utilise our links into the ADEPT National Traffic Managers Forum and the ADEPT Transport and Connectivity Board to share the emerging knowledge from the Highways Collaboration Centre. These existing relationships will provide the opportunity to deliver presentations and exhibitions providing updates and shining a light on the success of the project.

We are pleased to have the support of MHA+ as part of our project and this will enable the sharing of techniques as BAU across their membership of 35 local authorities (the largest highways alliance in the UK).

Tackling decarbonisation of local authorities requires the involvement of different functions beyond highways e.g., waste management, logistics and facilities management. Due to the complex and dynamic nature of the challenge, the Centre will actively promote supply chain collaboration and knowledge sharing around zero emission innovations (e.g., green hydrogen, recharging infrastructure, operational efficiencies), within partners, other local authorities, and supply chains.

We are privileged to include TRL and Connected Places Catapult with our project benefitting from their industrial links which include relationships with HS2, Network Rail and National Highways, breaking down historic barriers and making information more readily accessible between all parties. Connected Places Catapult will help us foster relationships with SMEs in our pursuit to find solutions to industry problems. Many of these solutions will be transferable cross-sector and Connected Places Catapult will facilitate cross-fertilisation in this way.

11.3 A statement that you will adhere to the collaborative, open and sharing spirit of Live Labs 2 and in addition what you will bring to enhance that working. These should be specific to your particular proposals.

Knowledge sharing is the foundation for our Live Lab project. Our ambition is for CEDR and our demonstrator sites to be recognised as the exemplar place to go for highways decarbonisation best practice, and the place for the industry to be seen to visibly demonstrate live innovation in practise.

We welcome the opportunity for the Centre to undertake a collaboration and communication function for the entire cohort of Live Lab 2 projects and draw in their research and learning and share via the on-line database.