

CASE STUDY



COLAS CASE STUDY

DECISION MAKING & DATA DRIVEN NETWORK MAINTENANCE

WHOLE NETWORK INTELLIGENCE FOR OPTIMISED MAINTENANCE

infra

CARE

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1. Executive Summary

As part of Liverpool Live Lab ambition, Infracare was deployed across the network to move away from reactive works and towards a fully evidence-based, optimised maintenance programme.

Traditional highway maintenance relies heavily on complaint-driven inspections, reactive repairs, and limited visibility into condition. This creates inefficiencies, high carbon outputs from repeated site visits, and difficulty justifying long-term funding requirements.

Infracare offers a transformative alternative: a digital, AI-powered pavement assessment and scenario planning tool that delivers a full network condition view, recommends optimised treatments, and integrates a bespoke carbon module to quantify and reduce whole life emissions.

The tool helps Liverpool City Council:

- **Prioritise interventions objectively rather than reactively.**
- **Reduce carbon emissions through targeted, lower-carbon treatment strategies.**
- **Build robust, data-driven evidence to support future funding and long-term investment decisions.**



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2. Context and Rationale

The trial of the Infracare carbon module was undertaken to strengthen Liverpool City Council's understanding of road-condition performance across 350 km of its network while embedding carbon considerations into every stage of maintenance decision-making, consistent with the principles of the full network carbon hierarchy.

By building on the existing Infracare platform already using AI-driven, camera-based condition assessment and cost-scenario planning, the project integrated validated carbon-cost ratios into long-term asset management so that maintenance strategies, budget choices, and lifecycle planning could be guided by accurate and transparent environmental-impact data.

The development of the carbon module enabled alignment with the Council's foundational metrics, improved the visibility of carbon impacts through enhanced data visualisation, and supported the adoption of more sustainable practices by evidencing the relative carbon performance of different maintenance options.

Through AGILE development, back-end integration, and progressive network-scale trials, the project demonstrated how carbon-informed optioneering, scenario modelling, and future emissions forecasting could be embedded into normal workflows, ultimately establishing a robust evidence base to help reduce emissions, enhance infrastructure outcomes, and integrate sustainability into everyday operational practice.



3. Business-As-Usual (BAU) Baseline

Typical Liverpool BAU without Infracare:

- Complaints-driven inspections.
- Reactive pothole repairs and localised patching.
- Limited visibility of network wide condition.
- Mechanical surveys only covering selected strategic routes.
- Repeated return visits.
- No carbon-based scenario planning.
- Less efficient targeting of preventative works.
- Shorter treatment life, leading to more potholes and surface failures.
- Lack of data for forward planning, making it difficult to justify higher budgets or demonstrate long-term need.

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4. Innovation Overview: Infracare

Type: RCM (Road Condition Monitoring) tool using AI.

Location: high-stress network (~350 km), across all highway classes including residential, urban, strategic, and high stress environments

Deployment: Continuous survey and modelling over a period of 8 months

4.1 Innovation Description

Infracare is an AI powered pavement condition monitoring and asset management platform designed to deliver full network visibility and support long-term, optimised maintenance planning developed by Colas.

The system uses a GoPro mounted on a vehicle to capture continuous road imagery, which is then processed using advanced detection algorithms and Colas' internal engineering expertise.

The platform automatically identifies surface defects, calculates road condition indices, and recommends tailored technical treatments ranging from reinforcement to maintenance, localised repair or monitoring.



Figure 1: Camera setup for Infracare trial



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Infracare supports users through every stage of the asset life cycle:

- Survey & detection: AI analysis of video data to map cracks, defects, edge failures and overall pavement condition.
- Prioritisation: Ranking of road sections based on hierarchy, traffic, severity and extent.
- Scenario planning: Annual maintenance programmes adjusted for budget, intervention type, and long-term performance needs.

- Treatment recommendations: Optimised technical solutions selected from Colas' catalogue of maintenance options.
- Performance tracking: Ability to compare annual surveys and measure deterioration or improvement.

For Liverpool, Infracare was further enhanced with a bespoke carbon module developed specifically for the Live Labs programme, enabling the council to quantify and compare the carbon impacts of maintenance scenarios in real time.

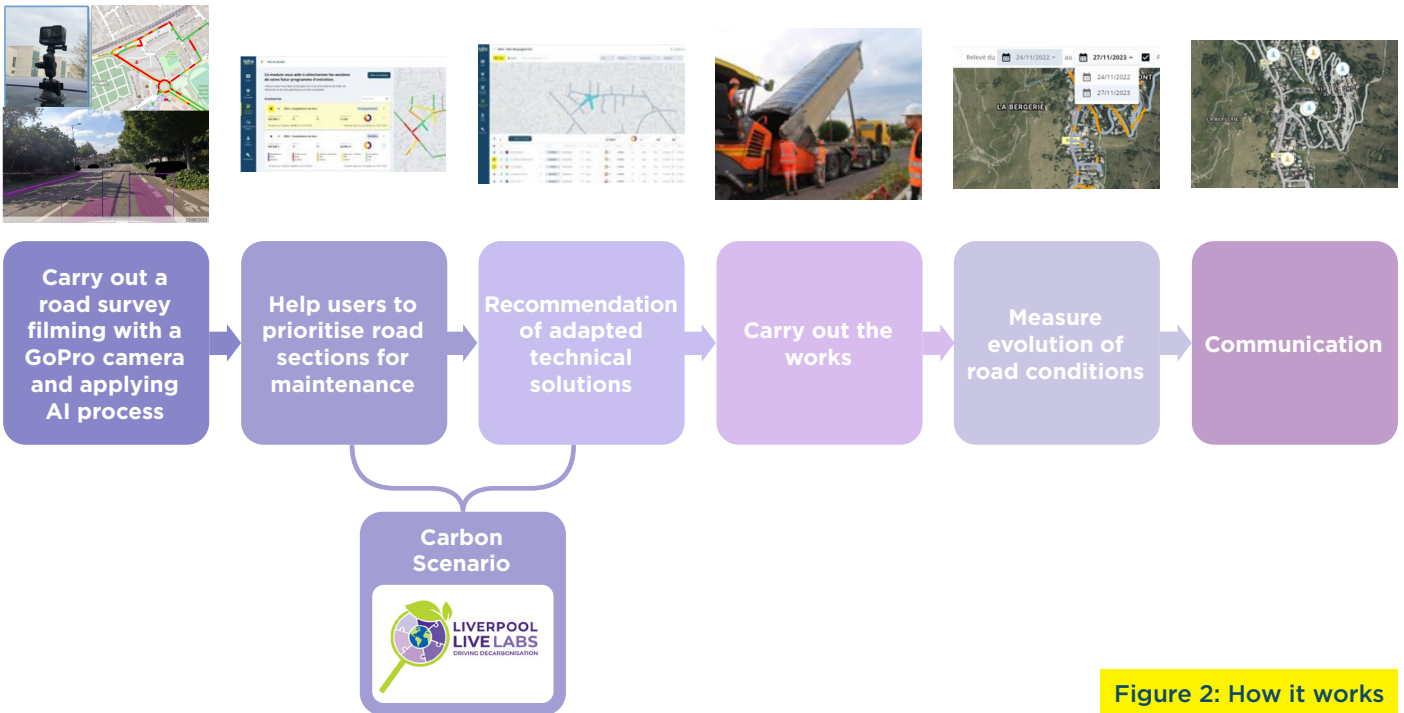


Figure 2: How it works

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4.2 Carbon Analysis

A custom carbon module was created for the Live Labs deployment, enabling Liverpool to calculate carbon ratios for every maintenance option.

Key features and impacts:

- Carbon factors linked to Live Labs innovations: Each treatment type (e.g., general maintenance, reinforcement, localised repair, resurfacing) is assigned dynamic CO₂e values.
- Scenario specific scoring: The tool selects the lowest carbon treatment compatible with road performance and traffic requirements.
- Adjustable parameters: Liverpool can modify carbon factors as new materials/innovations emerge.
- Predictive carbon modelling: Longterm scenarios demonstrate how preventative interventions significantly reduce whole life emissions.

Expected outcomes:

- Major emissions avoided by targeting early intervention rather than reactive patching.
- Carbon optimised scenario planning reduces high carbon resurfacing in favour of maintenance and reinforcement.
- Lower site visits and reduced TM requirements through optimised bundling of works.

5. Results and Learning

The trial showed the platform is easy to use, allows quick modelling of prioritised work scenarios, and delivers results rapidly after data collection, with minimal setup requirements.

Key learnings from the Liverpool deployment include:

- Data-driven maintenance can help reduce whole-life carbon by preventing high-carbon, late-stage repairs.
- Full-network visibility improves decision-making, enabling the council to identify emerging hotspots early and justify investment needs.
- Integrating carbon into scenario planning encourages the use of innovative materials and lower-impact treatments.
- Digital tools reduce inefficiencies, minimise return visits, and enhance the accuracy of asset management forecasts.
- Deployment is weather-dependent, as the tool cannot be used in rainy conditions.
- Testing the system from inside the vehicle highlighted that bright sunny days can create glare on the windscreen, obstructing filming and affecting results, while wet or dim conditions reduced image clarity and accuracy.

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6. Scalability

The successful deployment of Infracare and its bespoke carbon module in Liverpool demonstrates clear potential for scalability across other local authorities and regional networks.

Because the platform is built on a modular AI driven architecture combining repeatable camera-based surveying, automated defect detection, scenario modelling, and adjustable carbon-ratio inputs it can be rapidly adapted to different network sizes, asset types, and maintenance strategies without requiring major changes to existing workflows.

The ability to integrate new materials, evolving carbon factors, and additional

datasets ensures that the system can mature alongside organisational needs and regulatory expectations. Moreover, its emphasis on full-network visibility, data-driven prioritisation, and whole-life carbon optimisation provides a transferable framework that supports long-term funding cases and consistent maintenance planning across diverse geographies.

As demonstrated in Liverpool, once baseline processes are established, the technology can be scaled to broader corridors, neighbouring boroughs, or even combined regional programmes offering a unified, future-proofed approach to optimised maintenance and decarbonised highways management.

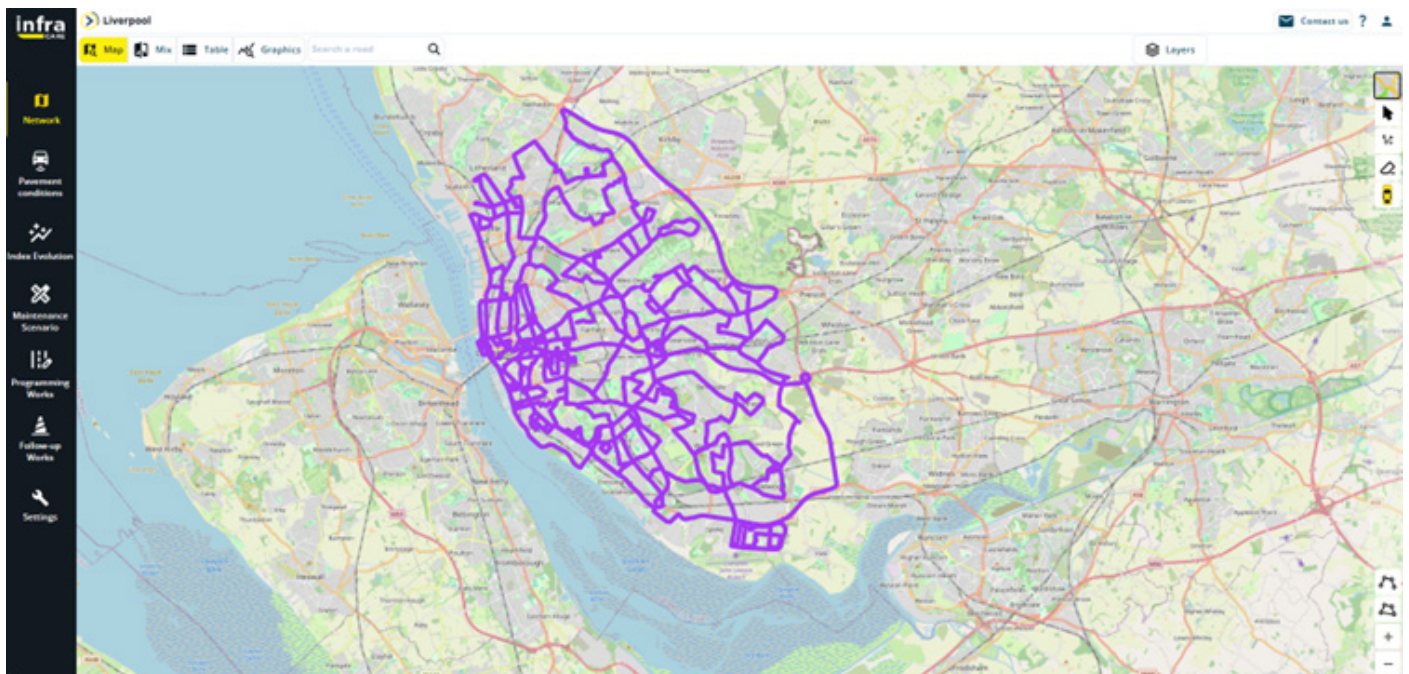


Figure 3: Overview of surveyed routes in Liverpool