

How data-driven innovation is reshaping infrastructure maintenance and planning  
Harnessing digital intelligence for better asset performance

## The Future of Intelligent Asset Management





## Introduction

The UK's road network is one of the most critical national assets. Stretching across towns, cities and rural areas, it boosts economic productivity, social mobility and community connectivity, while ensuring the safe and efficient movement of people and goods.

Whether it's a commuter rail replacement bus, a freight lorry carrying goods, or a parent on the school run... Every journey depends on this essential transport network.

The solution lies in embracing intelligent asset management. It transforms maintenance from reactive and routine to predictive and data-driven, helping authorities extend the lifespan of assets, reduce costs and plan with confidence.



### This whitepaper explores:

- The key trends shaping infrastructure management in 2025.
- The return on investment from predictive maintenance.
- How platforms like TRL's iROADS enable better planning, budgeting and funding outcomes.

## 2025 Trends Shaping Infrastructure Management

### 1 Predictive, Not Reactive Maintenance

For decades, highway maintenance has been dominated by a 'fix-on-fail' mentality. Meaning repairs only being made when defects appear or complaints are raised. While it might be simple, this approach is costly, disruptive and unsustainable. Emergency works not only cost three to five times more than planned interventions, but they also cause significant inconvenience through unplanned road closures, traffic congestion and reputational damage for authorities.

In 2025, the shift to predictive maintenance is accelerating. Using tools such as AI-driven analytics, IoT sensors and high-frequency condition monitoring, engineers can anticipate failures before they occur. Rather than reacting to potholes, cracking, or drainage failures, predictive models highlight which sections of the network are most at risk in the coming months or years. This allows councils to schedule interventions proactively, reduce risk and extend the service life of the assets. It's a financial and operational necessity.





## 2 Digital Twins & Smart Asset Modelling

Digital twins: virtual representations of physical assets have matured significantly. Local authorities are now developing digital replicas of their road networks that integrate data from pavement condition surveys, traffic flows, climate risk models and even social and economic factors.

These smart models provide a single version of truth for asset performance, replacing fragmented data sources and manual reporting. With digital twins, decision-makers can simulate scenarios such as the impact of deferred maintenance, increased heavy goods traffic, or climate-related flooding, and understand how these will affect long-term asset health.

By embedding digital twins into asset management strategies, authorities gain a powerful forecasting and planning tool that not only improves efficiency but also strengthens the business case for investment.



## 3 Climate Resilience as a Core Priority

Climate change is no longer a future threat; it is a present-day challenge that is reshaping infrastructure strategies. Extreme rainfall events, prolonged heatwaves, and freeze-thaw cycles are accelerating road deterioration and creating new risks such as flooding, surface rutting, and subsidence

Climate resilience is embedded as a core priority within asset management frameworks. Predictive modelling tools allow authorities to simulate how climate events will impact asset lifecycles, enabling them to prioritise the most vulnerable locations. This ensures that funding decisions consider not only short-term condition data but also long-term environmental resilience

By planning for resilience now, authorities can reduce emergency costs, protect communities from disruption, and align with national commitments to Net Zero and climate adaptation strategies efficiency but also strengthens the business case for investment.

## 4 Data Integration Across Agencies

Historically, highway management has suffered from disjointed data with asset condition data stored in disparate systems, financial data in another and contractor performance in yet another. This siloed approach makes it difficult to plan holistically, benchmark performance, or coordinate with regional national partners.

The trend is toward centralised, integrated platforms that unify multi-asset inventories, asset condition data, inspections and works history, budget allocations and contractor records. By consolidating these streams into a single hub, Local Authorities and National Highways create a comprehensive, transparent view of their networks.

Having this cross-agency collaboration eliminates duplication and administrative inefficiencies. Councils can align their priorities with national standards, contractors and even neighbouring authorities, delivering a more joined-up and cost-effective approach to infrastructure management.

## 5 Outcome-based Budgeting

Changes to funding structures are increasing. Central governments and oversight bodies require authorities to demonstrate tangible outcomes, rather than report on activity levels. Outcomes may include reduced pothole prevalence, improved network resilience, enhanced road safety, lower carbon emissions or improved public satisfaction with highway services

To meet these demands, intelligent asset management systems provide the analytics and evidence required to demonstrate investment outcomes. By evaluating the benefits of proactive strategies such as extended asset lifespans, reduced emergency works or measurable carbon savings, authorities can justify funding requests and defend budget allocations with confidence

Outcome-based budgeting also supports a cultural shift within authorities: away from short-term 'spend to survive' practices to long-term investment planning that delivers value for money and resilience over decades.

These forces are driving a new era of intelligent, accountable and sustainable asset management – one that enables authorities to do more with less, secure long-term funding and deliver safer, greener and more reliable road networks for the communities they serve.





## ROI Benefits of Predictive Maintenance

Investing in predictive maintenance delivers clear and measurable benefits for both finance and operations. By moving away from reactive 'fix-on-fail' approaches, Local Authorities and National Highways can achieve long-term savings while also improving service levels for the public.

### Lower Whole-Life Costs

Reactive maintenance often addresses only the immediate problem such as filling a pothole, without tackling the underlying deterioration. This results in repeat interventions, wasted resources and escalating costs. Predictive maintenance changes this dynamic by intervening before deterioration reaches a critical stage.

- **Planned interventions such as targeted resurfacing or drainage improvements are significantly cheaper than emergency full-depth reconstructions.**
- **Studies show that proactive treatments can extend pavement life by 25-40%, delaying major capital works and spreading the costs.**
- **Authorities gain better budget predictability, avoiding the financial shocks of unplanned failures.**

The reduction in whole-life costs means freeing up resources that can be reinvested into other crucial areas of the network

### Reduced Service Disruption

Emergency works often come with high levels of disruption. They require urgent mobilisation, unplanned road closures and costly traffic management, all of which have a direct impact on road users and the wider economy

Predictive maintenance allows authorities to schedule works strategically, taking into account traffic flows, seasonal weather conditions and community needs

- **Works can be programmed during off-peak periods to minimise congestion and delays.**
- **Predictive planning allows for coordinated works programmes, reducing the need to revisit the same stretch of road multiple times for different interventions.**
- **Fewer emergency closures mean higher public satisfaction and reduced reputational risks for councils.**

Authorities not only save money but also protect productivity across the economy, since delays on major routes have extensive impacts on freight, commuting and local businesses.





## Carbon and Sustainability Gains

Sustainability has shifted from being a desirable 'add on' to a central pillar of infrastructure management. As Local Authorities and National Highways are measured against Net Zero targets, the environmental footprint of roadworks is scrutinised more than ever. Predictive maintenance directly supports these goals by reducing the carbon and resource intensity of network management.

### Fewer Raw Materials

Early interventions such as surface dressing or patching require significantly less aggregate, asphalt and binder than large-scale reconstructions. Each tonne of avoided material translates into a measurable reduction in embodied carbon.

### Reduced Use of Heavy Plant

Smaller, planned works means less reliance on energy-intensive machinery such as milling rigs, paving equipment and lorries – further cutting emissions.



### Optimised Logistics

Planned programmes allow contractors to batch work geographically, reducing the number of site visits, transport trips and idle machine time. This minimises fuel use, lowers traffic disruption and reduces contractor overheads.

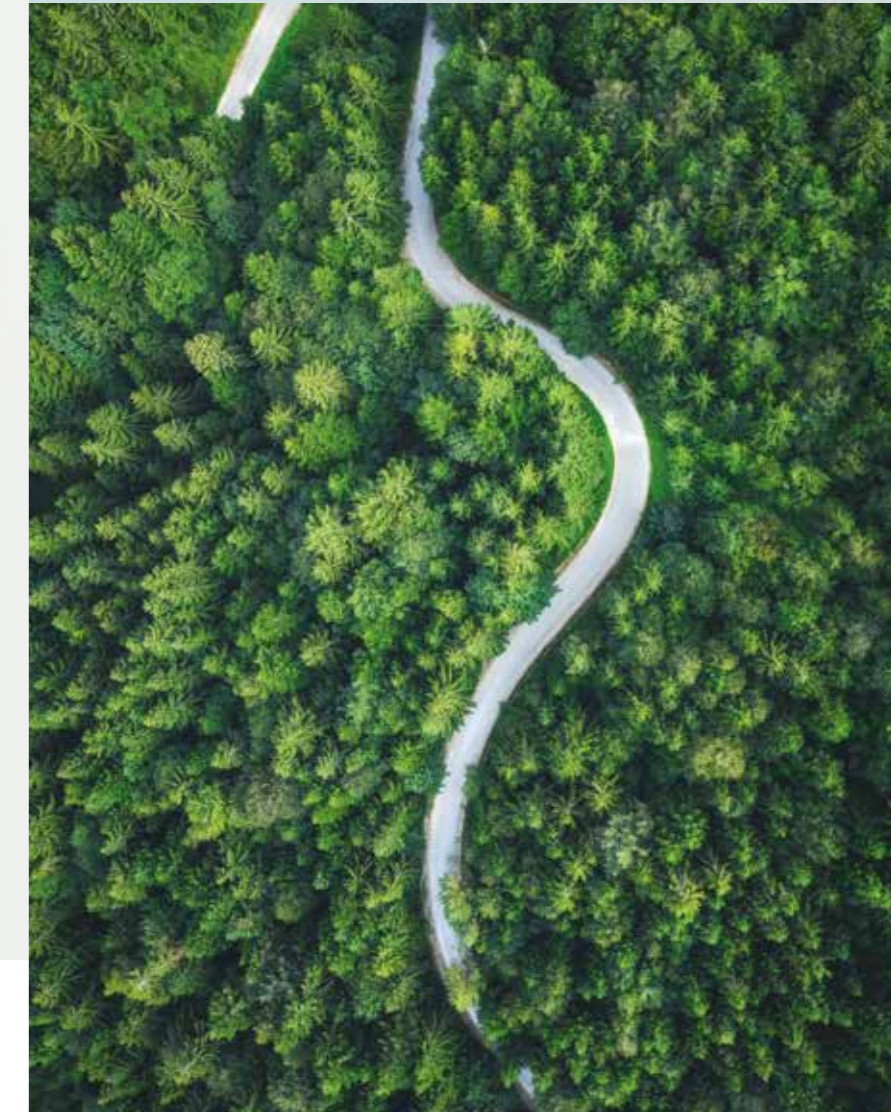
### Extended Asset Life

By prolonging the service life of pavements, drainage systems and structures, predictive maintenance slows the consumption of limited resources like aggregates, bitumen and steel which carry high environmental extraction costs.

### Alignment with Wider Goals

These sustainability benefits not only lower costs but also support corporate social responsibility (CSR) strategies. They align with local and national climate policies and demonstrate to funders and communities that the authority is acting as a responsible environmental steward.

Predictive maintenance does more than keep roads in a serviceable condition, it ensures infrastructure management actively contributes to the UK's climate and sustainability agenda.





## Strengthened Business Case for Investment

In a funding environment where every pound must be justified, predictive maintenance creates a powerful case for investment. Central government, the Department for Transport (DfT) and oversight bodies expect local authorities to demonstrate that their asset management approaches deliver long-term value, not just short-term fixes.

Predictive maintenance provides the tools that do exactly that.

### Quantifiable ROI

Authorities can present clear data on how proactive interventions cut costs, extend asset life, reduce disruption and deliver environmental benefits. This makes investment requests more compelling and defensible.

### Evidence-led Funding Bids

Predictive analytics provide strong forecasts of network condition under different funding scenarios, helping authorities prove to decision-makers the consequences of underinvestment.



### Demonstrable Alignment with Priorities

A transparent, data-driven approach builds trust with central government and grant bodies, showing that resources will be deployed efficiently and deliver measurable outcomes.

Ultimately, predictive maintenance allows councils to shift the funding narrative. Instead of asking for emergency bailouts after assets fail, they can demonstrate how proactive investment saves money, supports Net Zero and reduces future liabilities. This positions authorities not as cost centres, but as strategic custodians of national infrastructure delivering maximum return of public investment.





## Summary

Predictive maintenance is far more than an engineering technique; it is a strategic, financial, and policy tool that reshapes how infrastructure is managed and funded.

By investing in proactive interventions rather than waiting for failure, authorities can achieve a set of benefits that extend well beyond the highways department.

- **It cuts whole-life costs, reducing reliance on expensive, disruptive reconstructions and freeing up funds for other priorities.**
- **It minimises disruption, ensuring that communities, commuters and businesses experience fewer delays and less economic loss from unplanned closures.**
- **It reduces carbon emissions, conserving materials, lowering energy use and aligning directly with Net Zero commitments as well as broader sustainable agendas.**

Taken together, these benefits create a triple return – financial efficiency, operational reliability and environmental responsibility.

Predictive maintenance allows Local Authorities and National Highways to demonstrate that they are not only managing today's roads effectively but also safeguarding tomorrow's infrastructure.

TRL's iROADS is a powerful, user-friendly asset management platform already trusted by National Highways and now supporting Local Authorities across the UK. It brings together everything from streetlights to strategic roads in a single, integrated system, helping councils cut costs, secure funding, and deliver better outcomes for their communities.

With AI-driven predictive maintenance, digital twins, and climate resilience tools, iROADS reduces emergency works, models long-term strategies, and prioritises vulnerable assets. Its data integration eliminates silos, while outcome-focused analytics and PAS 2161:2024 compliance strengthen funding bids. Unique to iROADS, Strategic Decision Analysis (SDA) empowers smarter, future-ready investment planning.

iROADS empowers authorities to do more with less, build climate resilience, and deliver safer, greener, and more sustainable networks.

Find out more about [iROADS](#) or [book a demo](#).

