# Visualising Performance in UK Highway Maintenance: An Analysis of Innovative Approaches

**Slide 1 - Visualising Performance in UK Highway Maintenance**

Hello, my name is Reece, and thank you for joining me for this presentation on my proposed research: Visualising Performance in UK Highway Maintenance: An Analysis of Innovative Approaches.

Maintaining highways in the UK is a constant challenge which has a huge effect on people’s lives, sometimes without them even knowing. It directly affects the public’s safety, economy and daily life. However, recently, highway authorities have faced scrutiny and enormous pressure from the public and government to clearly show how their resources are being used, and budgets being spent (House of Commons Public Accounts Committee, 2025).

Visual methods of reporting have become more important than ever. They’re not just useful for managing data internally - they’re essential for communicating effectively with a wide range of people (Franconeri et al., 2021).

Unfortunately, traditional methods of reporting, such as tables and static graphs just aren’t effective enough, as they don’t provide the clarity needed to fully engage decision-makers or the public (Kirk, 2016).

This shows a clear need to explore more innovative techniques to present complex performance data in intuitive, interactive, and transparent ways

This is the focus of my research, to investigate new visualisation methods that can improve transparency and strengthen stakeholder understanding. This will improve the overall effectiveness of how highway maintenance is managed in the UK.

**Slide 2 - Maintaining UK Roads: A Growing Challenge**

When we think about highway maintenance, we must acknowledge the growing pressure the sector is under.

Public expectations and government scrutiny are increasing, with people expecting complete transparency, and government bodies wanting clear reporting that proves effective use of public funds. Authorities must be able to show exactly where investments are made and the impact they’re having (Public Accounts Committee, 2025).

At the same time, highway operations are becoming increasing more complex. The increasing volume of data and daily decisions to be made, is making it hard for traditional reporting methods to keep up.

That’s why accessible, transparent reporting is essential. Innovative visualisation methods can turn complex data into clear, understandable insights for everyone - whether they’re technical teams, decision-makers, or the public (Sivarajah et al., 2017).

Other industries, healthcare, aviation, urban planning, have already shown us what’s possible by adopting these advanced techniques to make data clearer and decision-making stronger (Bin Rashid and Kausik, 2024). My research will explain how we can bring these same benefits to Highway Maintenance in the UK.

**Slide 3 - Why Better Visualisation Matters**

Building on this, let’s look at why it is so important to improve visualisation in this sector.

Traditional reports, like static tables or basic charts, don’t capture the full complexity of highway maintenance data. Decision-makers and the public often struggle to interpret them, slowing down decision-making and filling the public and government with doubt.

Poorly designed reports can overwhelm people with information, creating barriers to understanding

What stakeholders really need are visuals which are accessible and engaging. Clear presentation of data supports accountability, speeds up decisions, and leads to better outcomes (Hendricks, 2020).

Innovative visualisation tools go beyond making data look good. They transform complex information into clear, meaningful stories that anyone can understand (Chapman, 2025).

That’s exactly the opportunity our research is exploring.

**Slide 4 - The Significance of My Research**

This research matters because it addresses both strategic and operational sides of highway management.

Highways represent a major public investment. It’s crucial that they not only manage those funds effectively but also communicate clearly about maintenance activities and performance outcomes (National Highways, 2025).

Traditional visual tools like basic charts still have value but often fall short, especially for non-technical stakeholders.

Other sectors have advanced rapidly and tools like augmented reality, virtual reality, interactive dashboards, and GIS mapping have improved stakeholder engagement and decision-making (FlyPix AI, 2025).

That’s the potential I see for highways.

The timing is perfect too. Digital transformation is a major focus in the government’s policy right now, especially for infrastructure (Foreign, Commonwealth & Development Office, 2024). Through this research, I aim to deliver practical, new solutions that directly support these goals - enhancing accountability, improving efficiency, and making a real impact on how we manage our roads.

**Slide 5 - Research Question**

This brings me to our research question:

How can innovative data visualisation approaches enhance decision-making, operational transparency, and stakeholder engagement within the UK's highway maintenance sector?

This question gets to the heart of the research. It’s about exploring whether innovative, interactive, and immersive methods can move beyond being a 'nice-to-have' and become essential tools that highway authorities rely on.

It’s about testing their real-world effectiveness - can these techniques genuinely support better decision-making, increase transparency, and engage stakeholders in ways that traditional methods cannot?

By answering this, I aim to give practical recommendations that help authorities embrace new visual tools with confidence.

**Slide 6 - Research Objectives**

To answer the research question, I’ve set three clear objectives.

First, I’ll explore emerging techniques from other industries and take a look at their potential to transfer to highway maintenance.

Secondly, I’ll examine how effective these tools really are. It’s not enough for them to just look good - they also need to improve transparency, efficiency, and stakeholder engagement in practice too.

Thirdly, I’ll develop clear, actionable recommendations. These will guide highway authorities in adopting these techniques, helping them integrate innovative visualisations into their reporting and decision-making from here on out.

The goal is to deliver outcomes that are not just theoretical, but immediately useful, practical and make a real difference.

**Slide 7 - Insights from Literature and Industry Innovations**

When we look at the existing literature, there’s a lot on standard visualisation techniques in infrastructure management. But what really stands out, is how little attention has been given to the advanced tools already proving successful in other industries - and how they could apply to highway maintenance.

Industries like healthcare or aviation are already using these advanced tools. Augmented reality, virtual reality, interactive dashboards, and advanced geospatial visualisations are transforming how data is shared and reported (Gasmi and Benlamri, 2022).

For example, in healthcare, AR helps to explain complicated procedures to non-specialists, making things clearer. In urban planning, VR simulations help communities visualise future developments, leading to better decisions (Solovyova, 2023).

What this shows is how powerful and interactive tools are, for simplifying complexity and improving engagement, especially for non-technical audiences.

But in UK highway maintenance, despite having equally complex data, we still rely on traditional methods. That’s the opportunity. There’s huge potential to modernise how we communicate data and make insights more accessible to internal teams and the wider public (INSPECH, 2025).

Through this research, I want to fully explore that potential - seeing how these proven methods can be adapted to meet the specific needs of highway authorities and their stakeholders.

**Slide 8 - Research Approach**

For this research, I’m using a qualitative, mixed-methods approach (UK Data Service, 2025) because it gives the depth of insight needed to understand where innovation can make a real difference.

The first phase is a cross-sector review. I’ll look at visualisation methods that have worked well in healthcare, aviation, urban planning, and logistics (Abudiyab and Alanazi, 2022). These sectors have made great progress, and by studying them, I can see what might be right for those working in highway maintenance.

Next, I’ll run case studies and stakeholder interviews within selected UK highway authorities. The goal is to understand current practices and where improvements are most needed. Through interviews with operational managers, analysts such as myself, decision-makers, and public representatives, I’ll build a rounded view of the challenges they face. I have already begun doing this in my current role as a Performance Analyst at Marlborough Highways.

Finally, I’ll do a comparative analysis (Appinio Research, 2023), looking at traditional methods alongside the innovative techniques I’ve identified. I’ll assess each method for clarity, interpretation, and decision-making support. This will help me to find the most practical solutions for highway authorities to adopt.

Overall, this structured approach means the research findings will be both insightful and practical.

**Slide 9 - Prioritising Ethical Research / Maintaining Research Integrity**

Ethical considerations are central to this research. Since I’ll be working directly with stakeholders, it’s vital to maintain strict ethical and professional standards throughout.

All participants will receive clear information about the study, how their input will be used, and their right to withdraw at any time. This ensures we make it clear that participation is voluntary, and it builds trust between myself and any respondents.

Data privacy is a top priority too. All responses will be anonymous and securely stored in a GDPR-compliant way (SurveyMonkey, 2025). Since participants may share honest feedback about their organisations, protecting confidentiality is also essential.

To minimise researcher bias, I’ll keep data collection and analysis well-documented and methodical. This promotes accountability and allows for external review, adding rigour to the process (Johnson, Adkins and Chauvin, 2020).

Finally, all findings will be reported transparently whether positive or negative. Maintaining honesty is crucial for the credibility of the research and its value to improving visualisation in highway maintenance (Jayan, 2024).

**Slide 10 - Developing a Practical Artefact**

A major outcome of this research will be a practical, interactive digital artefact. I will create a dashboard using platforms like Tableau or Power BI (Sigdel, 2022), which are already widely used.

But this dashboard will go beyond static reporting. It’ll offer user-driven navigation, so stakeholders can explore data themselves instead of just reading fixed reports. They’ll be able to dive into performance data, giving them full control over how they view and interpret the information (Grow.com, 2024).

It will also include scenario modelling tools (Hayes, 2023). So, users can adjust variables like budgeting levels or maintenance programmes and instantly see the impacts. This makes the dashboard not just descriptive, but predictive and interactive too.

The dashboard will also meet digital accessibility standards (Department for Education, 2025), so it’s usable by all stakeholders, regardless of technical ability.

Alongside this, I’ll produce a clear, step-by-step best-practice guide. It will give practical advice on implementing advanced visualisation tools in everyday work, with recommendations of tools, workflows, and tips for overcoming common barriers.

The aim is to make both the dashboard and the guide immediately usable, helping authorities build capability and see real benefits straight away.

**Slide 11 - Timeline of Research Activities**

To keep the research on track, I’ve set out a clear twelve-week timeline.

Weeks one and two will start with the literature review, which we have already made progress towards, and identifying promising visualisation techniques from other industries.

Weeks three and four will focus on targeted case studies within highway authorities, helping to understand current practices and highlight where improvements are most needed.

Weeks five to seven will be for stakeholder interviews. I’ll speak with operational managers, analysts, and public representatives to gather first-hand insights on the challenges they’re facing.

Weeks eight and nine will involve a comparative analysis, assessing traditional methods against the innovative techniques I’ve identified, focusing on clarity, engagement, and decision-making support.

Weeks ten to eleven will be for developing the dashboard and drafting the best-practice guidelines. This is the point where the research becomes practical and usable.

Finally, week twelve will wrap up the project, finalising our findings and sharing recommendations with highway authorities.

By following this timeline, I can ensure each stage is given the right focus and time, while keeping the project on track to deliver useful, actionable outcomes.

**Slide 12 - Transparency and Engagement**

A key goal of this research is improving both transparency and engagement in highway maintenance. Dynamic visualisations have huge potential to simplify complex data and make it easier to understand.

Not everyone using the data is a technical expert, especially in this sector, so good visualisation helps to bridge the gap between teams and stakeholders, making information clearer and more accessible.

Just as importantly, this clarity helps with public engagement. When insights are presented clearly, it builds trust and shows accountability to the public and regulators. People get a much clearer view of how decisions are made, bringing the community into the conversation about maintenance priorities (Naidoo, 2009).

So, ultimately, better visualisation isn’t just about appearance - it’s about improving understanding, supporting better decisions, and involving more people in the process.

**Slide 13 - Operational and Strategic Benefits**

There are clear benefits to using advanced visualisation techniques (Atlan, 2023) as they improve decision-making through scenario modelling (Hayes, 2023). Authorities can explore their different options, like funding or maintenance changes, and instantly see the potential impacts.

This makes planning far more proactive and so rather than reacting to issues when they arise, authorities can anticipate problems and manage resources more efficiently. Over time, this leads to better use of funds and real cost savings.

But it’s not just about short-term improvements. These improvements help with long-term planning too. Better insights help authorities align their strategies with immediate priorities and future goals.

Overall, adopting these techniques strengthens decision-making, improves operational efficiency, and supports better strategic planning.

**Slide 14 - Sustained Impact for Highway Authorities**

The ultimate aim of this research is to create a lasting impact for highway authorities, not just short-term improvements.

It’s about giving authorities tools they can use straight away, but also continue to build on over time. The guidelines I’m producing will give clear, step-by-step recommendations for integrating these tools into daily operations. And the dashboard will provide an interactive resource for exploring data and modelling future scenarios (Huez, 2023).

These tools help authorities build internal capability, and by working with these techniques, they can strengthen their expertise and create a more data-driven culture.

Importantly, the solutions are scalable. They’ll work for different authority sizes and regional needs.

And beyond that, this research encourages ongoing improvement. It helps authorities embrace future technologies, creating long-term, scalable improvements for both authorities and the public.

**Conclusion**

To conclude, this research into innovative visualisation techniques is an important step towards modernising highway maintenance in the UK (Infrastructure and Projects Authority, 2021). Something which has been needed for a long time.

By assessing and introducing advanced approaches, already successful in similar sectors, this project aims to improve transparency, make data more understandable, and strengthen operational effectiveness.

What makes this research so valuable is its balance of strong methodology and practical outputs. The interactive dashboard and best-practice guide will give highway authorities tools they can use immediately, alongside clear recommendations for long-term improvements.

But it’s not just about fixing current issues - it’s about building a solid foundation for future innovation. These tools and insights will help highway authorities continuously improve, adapt to new technologies, and deliver better outcomes for the public and decision-makers (FYLD, 2025).

Thank you very much for listening to this presentation. As this is a recorded session, if you have any questions or would like to discuss the research further, please feel free to contact me directly. Thank you again for your time.