



Surrey's Journey to Automate Pothole Detection using AI

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SURREY
COUNTY COUNCIL



ROUTE REPORTS

About Surrey

- 3,347 miles of roads
- Approx. 50k potholes repaired per annum
- 14 Highway Safety Inspectors needed to carry out inspections
- Corporate aspirations around digital, innovation, climate change
- Current Term Maintenance Contract started in 2022



Challenges

- Taking on Customer Inspections for public-reported potholes/defects
- Identifying duplications of reported defects
- Identifying failed repairs
- Accurately assigning defects to the safety matrix automatically



OBJECTIVE

**Making Highway Inspections
more efficient and “smarter”**

Finding Solutions

- +Add-Strategy Workshop:
Rethinking Potholes – June 2019
- 3-day facilitated workshop
- Clients, Contractors, Consultants, SME's, Tech Start-ups, Solution Providers
- Ideas included:
 - ❖ Geo-tagging Potholes for improved locational accuracy
 - ❖ Collaboration with Utilities
 - ❖ Video Data Capture and optimisation through AI
 - ❖ Covid accelerated need to look at inspecting the network differently



SURREY COUNTY COUNCIL

Rethinking Potholes

Join us and work together to explore new opportunities and to develop business cases for change....

Department for Transport | ATKINS | mtc | e2E | Brunel University London | elgin | Hobart

VACEX | emapsite | UNIVERSITY OF SURREY | wsp | Mobilized Construction

VAISALA | SKANSKA | CYIENT | Thorne | KIER | MOISS | SUTTON | SURREY COUNTY COUNCIL | Kent County Council

Connect Plus | CAPITA | SPL | SMC | 1spatial | nu-phalt | orangebus | clancydoewra | Hampshire County Council

hyperion infrastructure consultancy | MULTEVO | IHE | INSTITUTE OF HIGHWAY ENGINEERS | LIGHTS OUT | ROADMENDER | STREETWORKS SOFTWARE

TARMAC A CRH COMPANY | ses WATER

Dorking, 18th -20th June
Register FREE/ Limited places
#Get_Involved

Supported by

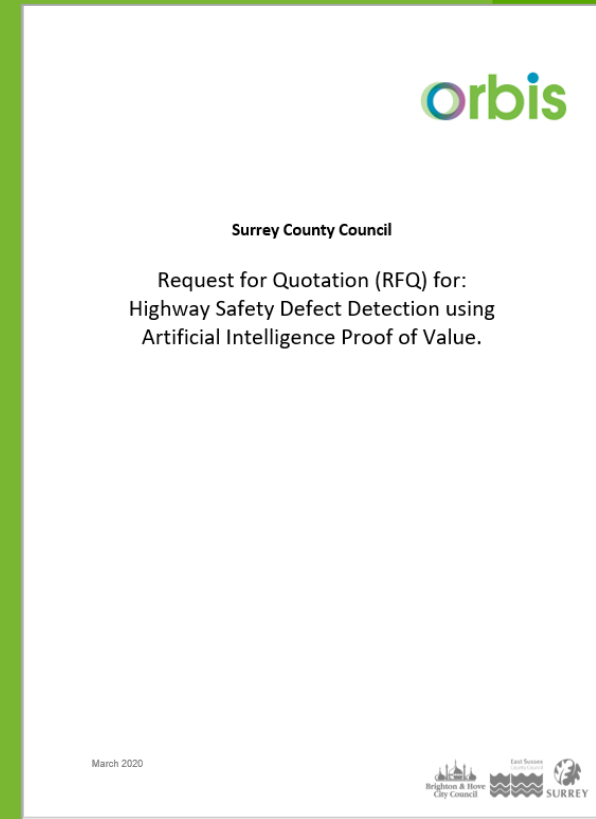
+ADD STRATEGY | **KIER**

Proof of concept

- Principal objectives:

- To establish if AI technology, can identify highways safety defects, with the priority being to accurately identify potholes, as per the safety defect matrix, from video footage/imagery.
- Develop an understanding of how safety defects identified through AI can integrate with or change the current end-to-end process.
- Understand the factors and conditions that influence the success/or not, of using video and AI technology to detect highways safety defects.
- To understand the data analytic skills and capabilities required, along with cost, so that we build our maturity and knowledge to support next steps.

- Awarded – Route Reports



Timeline

Surrey issues a tender for AI detections, which is awarded to Route Reports and a POC begins

2020

SCC and RR begin a validation and retraining process to improve the AI

2021-2022

The system is integrated with Confirm, allowing a one-click export of defects

2023

End-to-end driven inspection comparisons carried out and system improved

2024

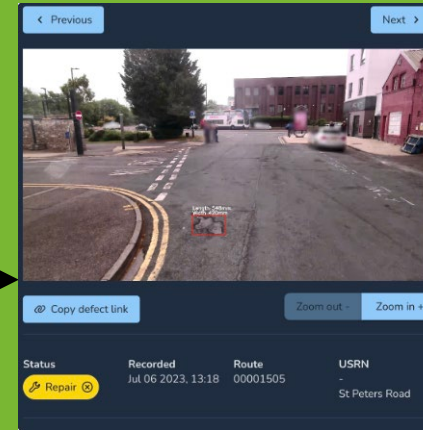
Surrey begins the transition from manual to automated inspections

2025

How it works



Purpose built devices and cameras analyse and transmit live data and anonymised imagery from vehicles over 4G



Data is displayed instantly on the platform



And can be automatically sent to an existing works management system

Installation

Fitted onto HSI vehicles

Enables direct comparison
between Route Reports
technology and HSI logged
defects



Initial validation



Example of a defect recorded by
Route Reports



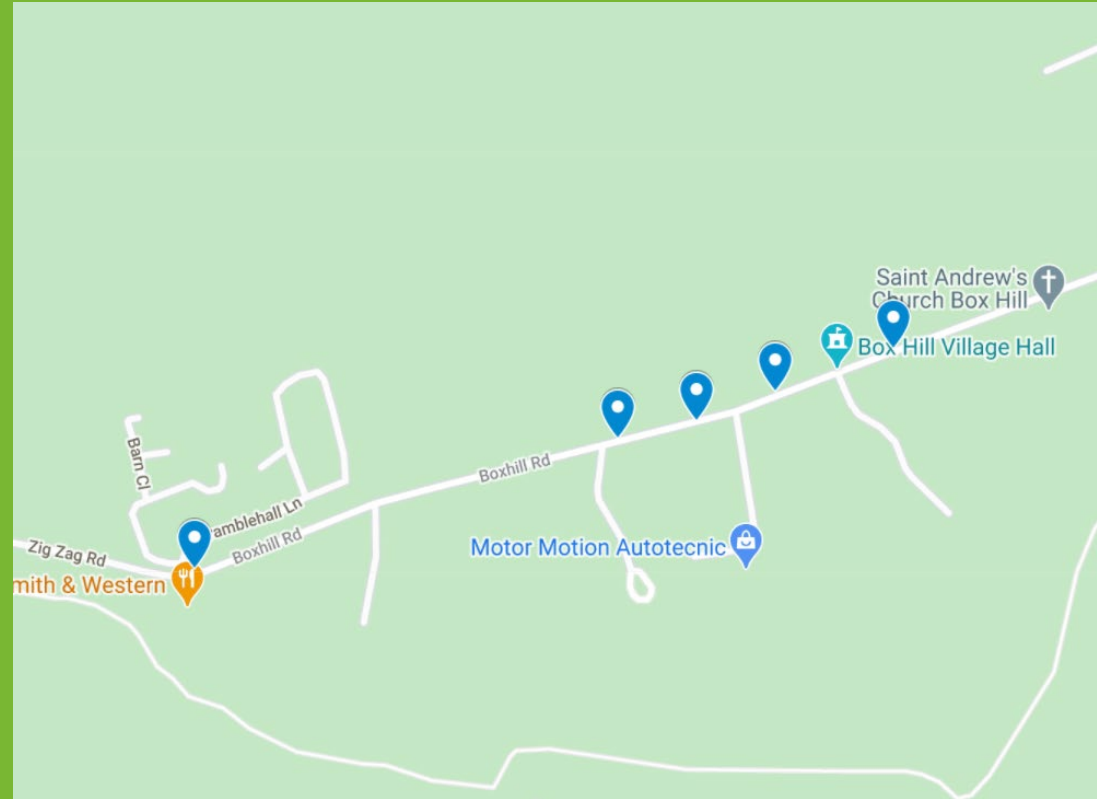
Same defect picked up and
logged by HSI

Initial validation



Defects recorded by Route Reports, but not picked up by HSI

Initial validation



Defects recorded by HSI, but not picked up by Route Reports

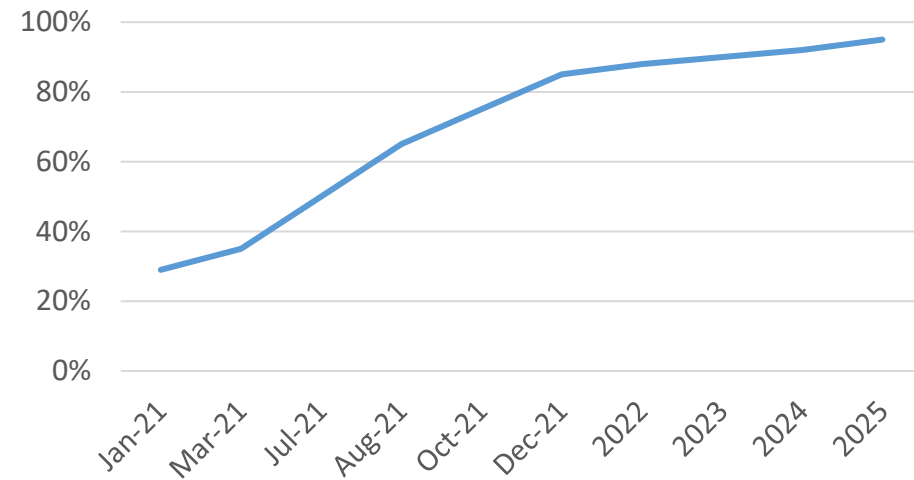
Improving the system

“Match rate” calculation to determine how close the RR AI device matched to a human inspector’s performance

Throughout the process, defects that were missed were **re-trained** in the system

By 2025, an **95% match rate** was achieved, which is similar to two highway inspectors compared on the same route.

Match Rate



Re-trainings take place **every month** to continuously improve the accuracy.

Validation by Audit

To ensure that the system is delivering accurate inspections, a continuous audit process has been set up.

Periodic manual inspections are completed to check:

- How many automated defects have measurements within a tolerance of a manual inspection
- If any additional defects are picked up manually
- What repair gangs measure when they complete repairs

Results are then used to improve the AI and measurements

Challenges of 1st time using AI

Low light, especially in Winter



Solved by testing 5 different cameras until one that worked reliably from sunrise to sunset was found.

Different weather conditions



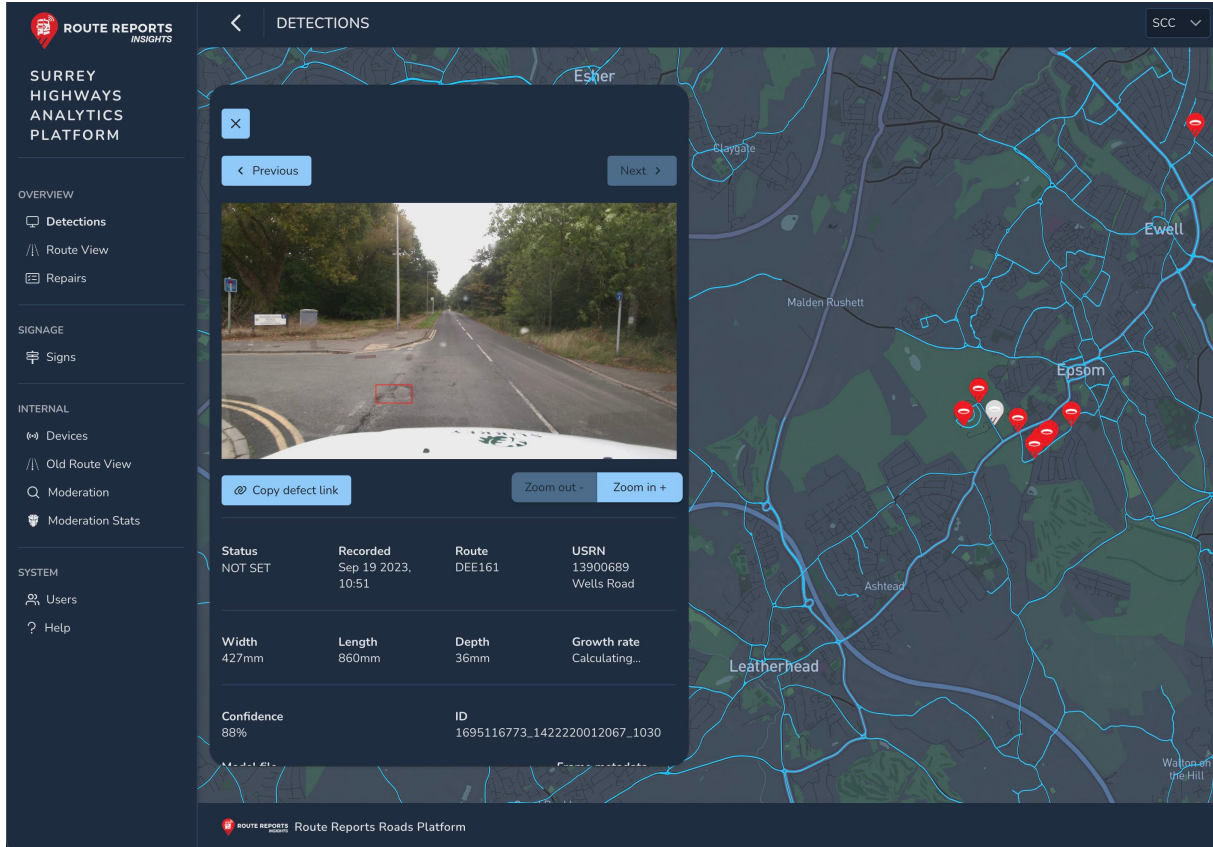
An additional 10,000 training images were used through each season to help train the algorithm for every road scene.

The traditional inspection method of **pulling over at the side of the road** was compared to a traffic speed drive through of the route.



It was found that the system was much more effective when the inspectors didn't stop - which also resulted in a **4 times faster route time**.

Defect Detection



ROUTE REPORTS INSIGHTS

SURREY HIGHWAYS ANALYTICS PLATFORM

OVERVIEW

- Detections
- Route View
- Repairs

SIGNAGE

- Signs

INTERNAL

- Devices
- Old Route View
- Moderation
- Moderation Stats

SYSTEM

- Users
- Help

DETECTIONS

SCC

Defect Details:

- Status: NOT SET
- Recorded: Sep 19 2023, 10:51
- Route: DEE161
- USRN: 13900689 Wells Road
- Width: 427mm
- Length: 860mm
- Depth: 36mm
- Growth rate: Calculating...
- Confidence: 88%
- ID: 1695116773_1422220012067_1030

Route Reports Roads Platform

Defects from Surrey's Highway Network are presented on a live dashboard, where an image of the defect is highlighted, and measurements are available with GIS links.

Currently defects can then be categorised and selected for repair in two clicks, but this process will become automated by the New Year.

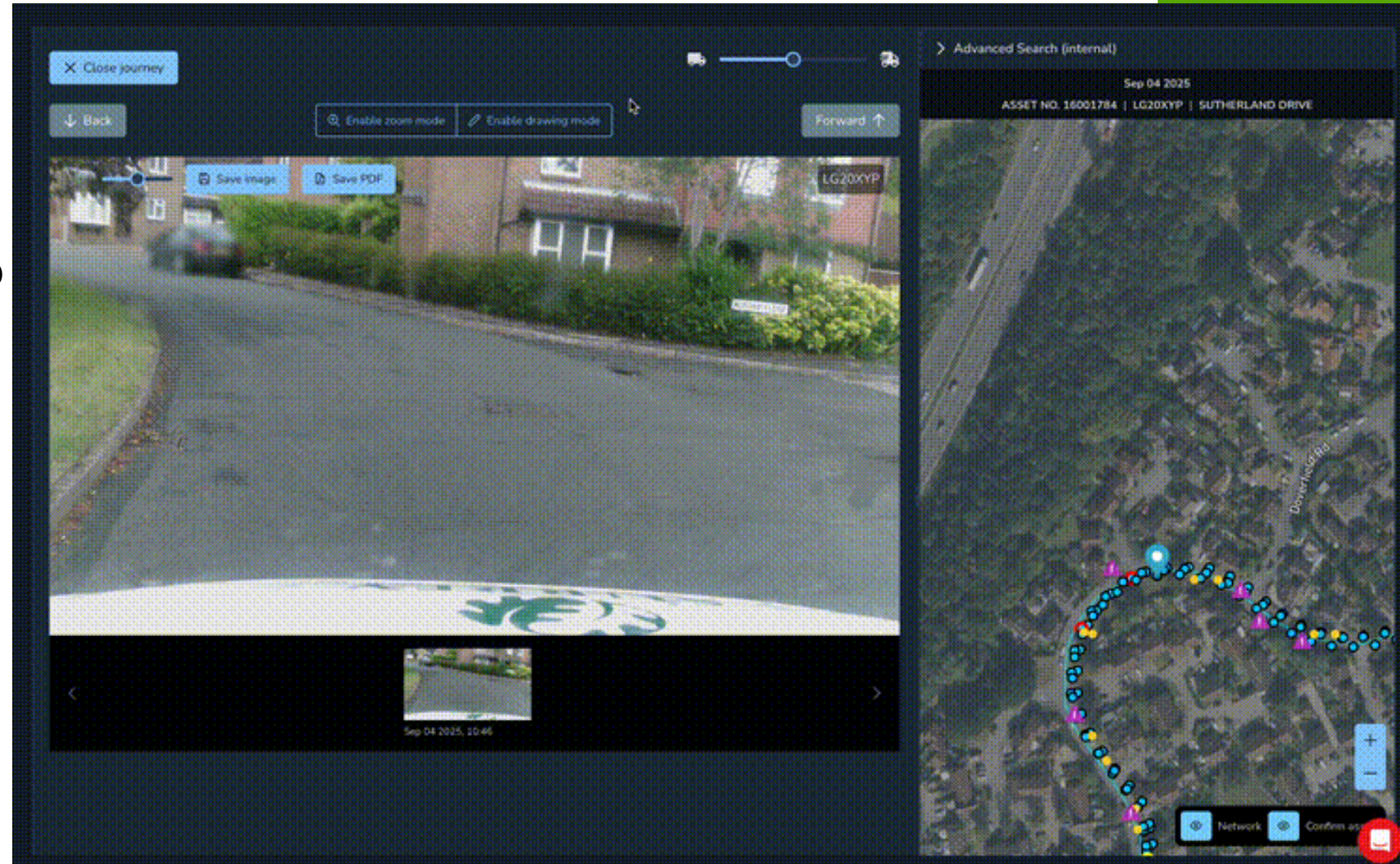
Automatic Calibration



To ensure that width, length and depth measurements are accurate, the devices can auto-calibrate with each drive. This uses a sophisticated algorithm to determine the exact position of the camera compared to the road surface, which can then be turned into a top-down view which is used for automated defect measurements.

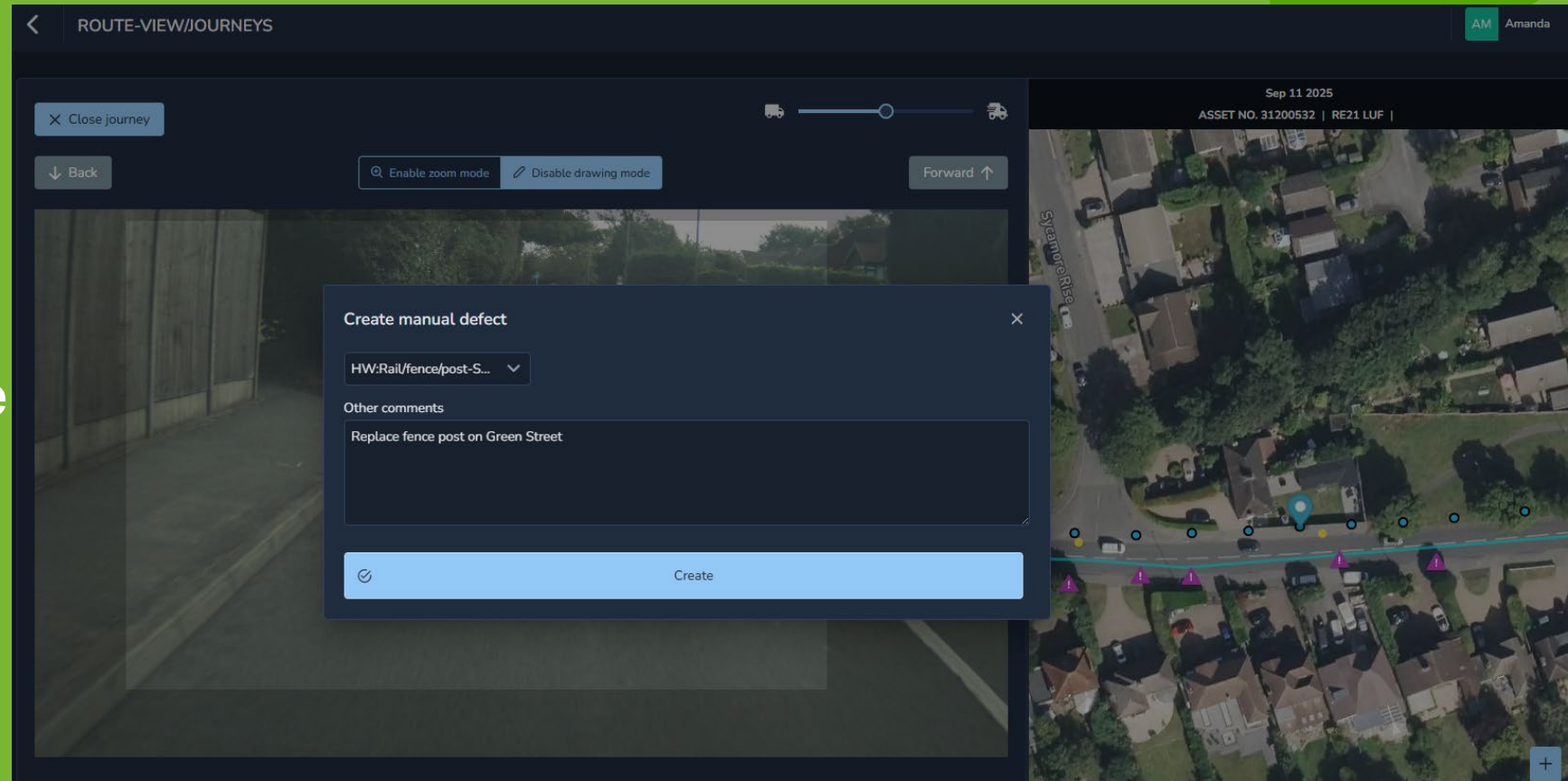
Enquiry Handling

- Surrey County Council receives an average of 1,100 resident enquiries each month
- Enquiries are synced with Confirm
- Latest imagery from the enquiry location can be viewed and a job raised directly from the platform
- The system can be used to reduce the backlog of enquiries, especially in the Winter months when reports increase

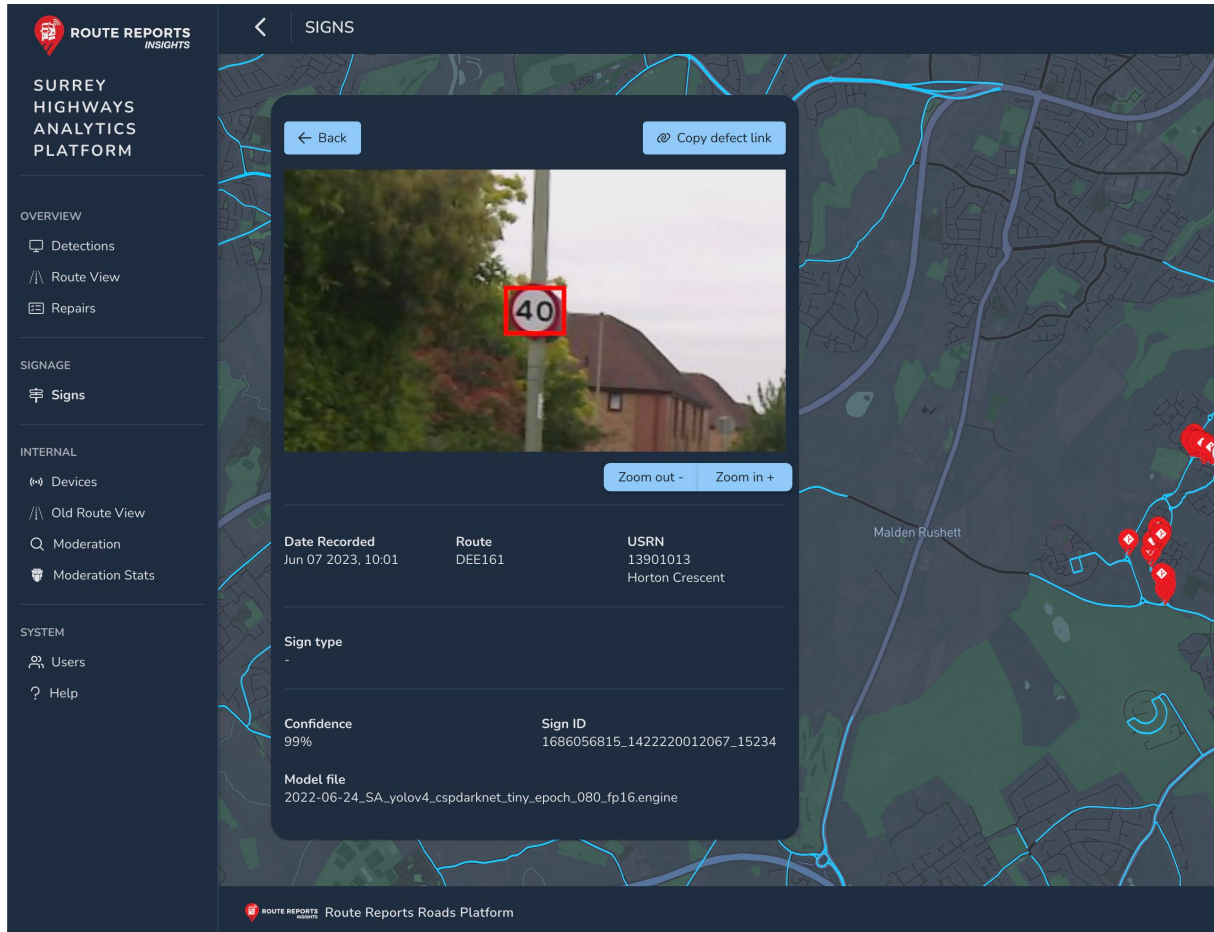


Enquiry Handling

- Pick the newest (or historical) image at any point on the road network
- Resident Enquiries can be solved much faster using Route View



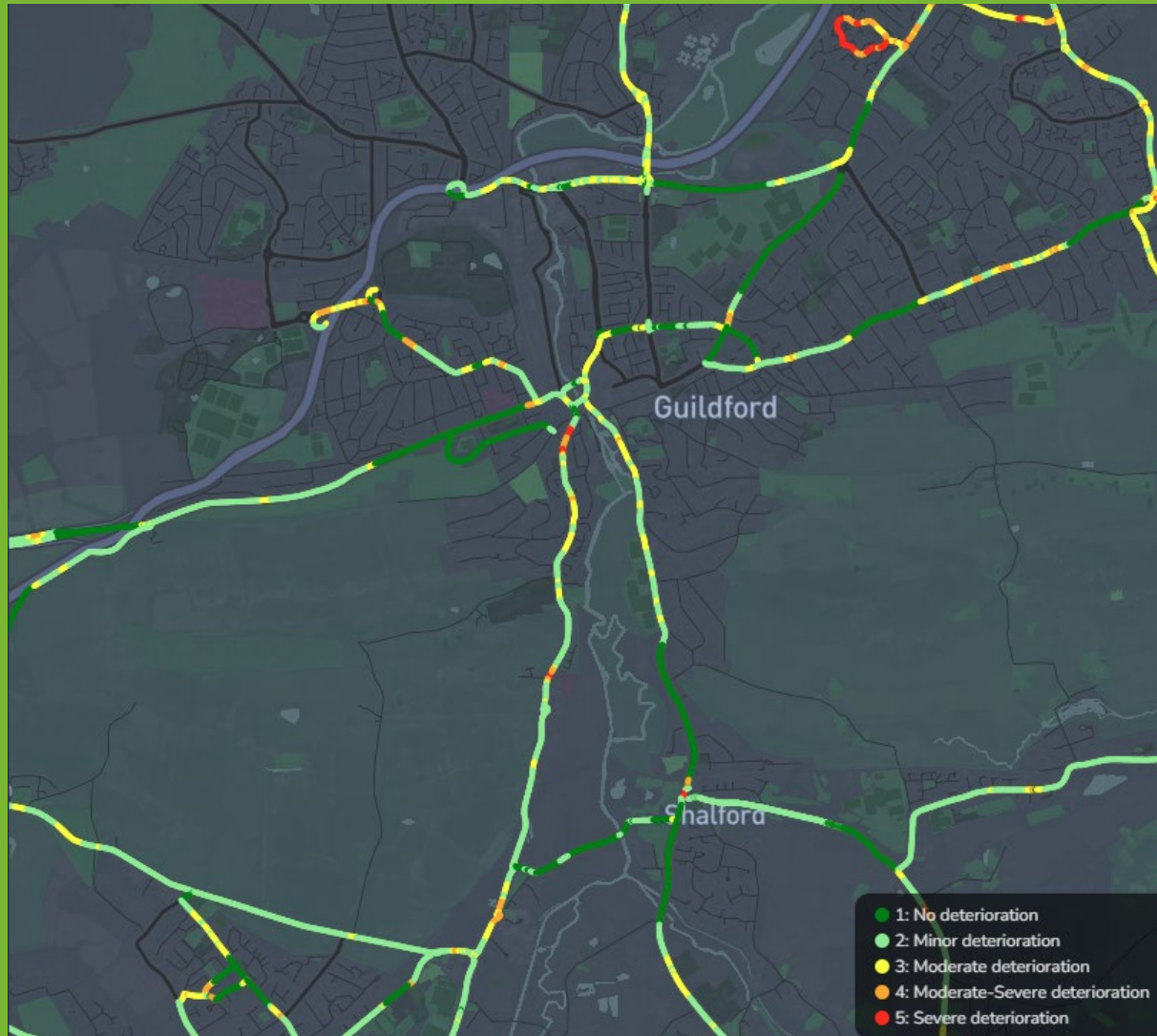
Sign Identification



All the road traffic signs across the network are collected, and signs with defects are specifically highlighted, including signs that are:

- Damaged
- Graffitied
- Covered by Vegetation

PAS 2161



- The system has been developed to PAS 2161 standards and took part in the first set of accreditation testing later in summer of 2025
- Additional features such as deterioration modelling are planned

Legal and Insurance

- Prior to entering a long-term contact discussions were had with our legal and insurance teams
- Both were happy with the process that had been followed to assure ourselves of the systems accuracy and consistency
- Zurich highlighted that they had anticipated these type of technologies to raise challenges from claimant lawyers, but it hasn't materialised
- They also highlighted that more data could frustrate S58 defence if in possession of data and not using it – mitigated by only turning technology on when starting inspection route
- Interested to see how AI can support smarter targeting of preventative maintenance to reduce/prevent hazardous defects and potential claims

Where we are now and what's next

- The system has started to take over driven inspections with the technology now installed on 10 HSI vehicles
- Route Reports are working on automating the detection of more types of defects
- We are reviewing when we will be able to move to fully automated inspections with a single Inspector in the vehicle
- PAS 2161 functionality is being further expanded, and SCC will be reviewing the Route Reports functionality alongside other technologies such as SCANNER and Vaisala
- Route Reports are developing analysis features to assist in long term asset management

Any Questions