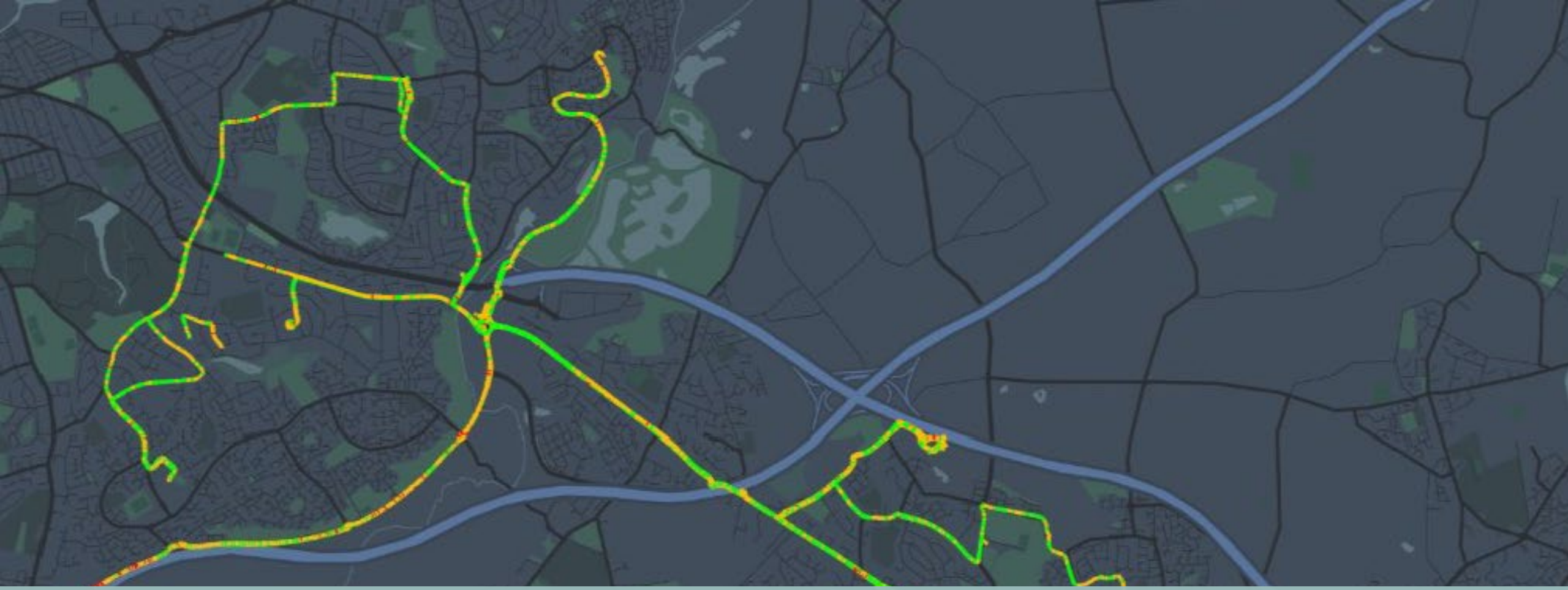


Artificially Intelligent Inspections (Route Reports)

TfL Lane Rental Industry Publication

TRANSPORT FOR LONDON

Introduction

Roads and streets breathe life into the capital. Supporting a variety of modes, they transport goods, services, and people, so it's important they're maintained. To do this, Transport for London's (TfL) contractor undertakes road condition inspections, visually assessing the road for deterioration using a pre-defined set of parameters and raising any defects which need to be actioned. From these inspections, approximately 20% are on high-speed roads requiring the use of a vehicle and two operatives, one to drive while the other assesses and records the findings. Undertaken every week, over the course of a year almost 5000km are carried out in this way.

Carrying out inspections in this way is not ideal. Rapid developments in artificial intelligence (AI), now make it possible for tasks which are repetitive, complex or require greater precision to be transferred to computer systems. This presents an opportunity to improve manual entry input tasks so that they are quicker, more cost-effective and mitigate human error.

Route Reports is a digital surveying system which can be retrofitted to existing fleets. The product provides date stamped imagery and can instantly detect, measure and geo-locate any pothole found. The use of AI technology also reduces the risk of human interpretation, enabling consistent assessments. Repeat assessments enable the AI to run analytics, identifying trends for fast deteriorating defects to channel shift from reactive to planned maintenance, which would greatly reduce disruption to road users and deliver improved network reliability.

A three-month trial of Report Reports was therefore proposed to review the technology and establish if utilisation could improve the efficiency of existing processes through automation.

Trial

For the trial Route Reports equipped two vehicles with hardware consisting of a high-performance graphics processing unit (GPU), camera, motion / Global Positioning System (GPS) sensors and 4G connectivity. While in motion the incoming video stream was analysed by the AI, detecting road surface defects in real-time, with the high definition 4K video, recording clips 10 seconds either side of a defect, capturing the data onboard. The clips were then transferred over 4G to the cloud servers via the internet, along with accompanying metadata such as GPS location and the defect width and length.

In addition, two types of periodic and automated calibration were carried out: the device in relation to the vehicle, the cameras detection of width and length, and the sensors depth detection via the suspension. This was then checked against a sample of manual inspections and adjusted as necessary.

To improve low-light capabilities, a new camera was used as part of the trial to enable better quality imagery at night or early morning, increasing accuracy. In addition to this image, data was gathered from a wide range of weather and lighting conditions for training the computer vision model. The current algorithm is now trained on approximately 35,000 images, with a further 70,000 increase expected in the next cycle.

An online dashboard was also provided, visually displaying the detection of defects, as well as giving the availability to categorise to improve data management. Users were able to export findings as a .csv file for integration into existing systems. There is also the potential to develop custom import/export tools so additional information like customer reports could be imported into the dashboard for comparison.

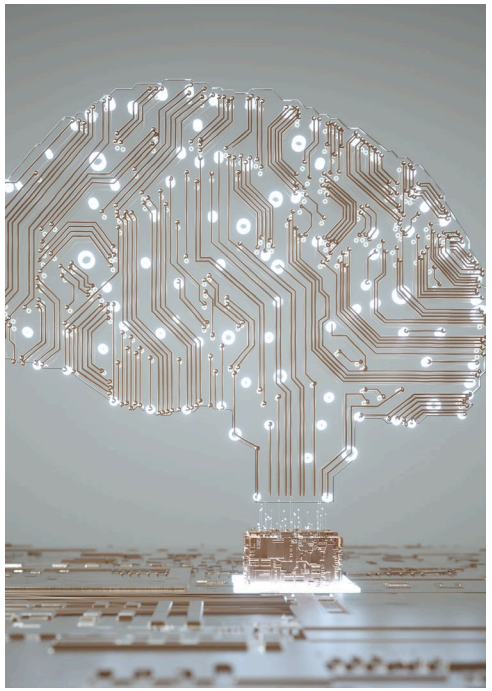
The trial documented how automated AI technology could detect, measure, and predict road defects, as well as analyse signage and lane markings, proving the primary objective. Potential benefits include reduction in time spent on network, reduced data entry and enable predictive metrics to be recorded against each defect found. The system was able to match current defect capture and show a meter by meter “route view”, which allowed qualification of inspection outcomes to be carried out online instead. This capability would deliver significant savings to road maintenance and inspection processes.

Outcomes

Conclusion

The trial successfully demonstrated the potential benefits of combining manual inspections with AI technology, with 100,000+ data points collected in total, which could be used to further analyse the outcomes of the trial and if implemented more widely, assist with the planning.

This technology has delivered better analytics which could enable more efficient maintenance, reduce the number of reactive repairs and improve network reliability. It also has the potential to provide a more robust mechanism for safety across the network by producing detailed imagery of each defect with approximate dimensions, date stamp and GPS information. This system is currently only available for carriageway inspections, so further investigation into technologies for pavements will continue.



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TfL Lane Rental Scheme

Optimising customer journeys through the delivery of safer, innovative and sustainable roadworks