CASE STUDY — INNOVATION IN HIGHWAYS MAINTENANCE

RoboPass: Autonomous Survey and AI-Assisted Programming on the MK Redway Network

Evidence submission — Local Highways Maintenance Transparency Report 2026/27 (Department for Transport)

Authority	Milton Keynes City Council (MKCC) — Highways & Transport
Asset	MK Redway network — approximately 270km of dedicated cycleway and footway infrastructure
Programme	RoboPass — an MKCC research and pilot project evaluating operational deployment of autonomous robotic platforms on the public Redway network
Components	Vaisala RoadAI AI condition survey; Capra autonomous wheeled/tracked robot as survey and winter treatment platform; MKCC Cycleway Scheme Selection Tool (developed in-house)
Sector showcase	Showcased at the LCRIG Innovation Festival, 24–25 June 2026
Status	RoadAI survey and Scheme Selection Tool in operational use; RoboPass a live pilot with autonomous survey and winter pre-treatment trial workstreams under way
Transparency link	Innovation and continuous improvement; preventative maintenance and whole-life cost; active travel asset management; governance, auditability and transferability

1. Background and strategic context

Milton Keynes has approximately 270 kilometres of dedicated Redway cycleway and footway, running alongside the grid roads and through residential areas. For many residents it is a genuine alternative to the car. Maintaining a network of that scale is a substantial asset management challenge — and active travel infrastructure is typically the part of the network that is surveyed least rigorously and maintained least consistently, precisely because conventional inspection methods do not scale to it.

Conventional condition survey on a network like this relies on an inspector walking or cycling each route and recording defects by hand. That approach is time-consuming, inherently subjective — two inspectors will score the same stretch of path differently — and at 270km it cannot deliver full coverage within a single season. The consequence is a programme built on partial and inconsistent evidence.

The Department for Transport's 2026/27 transparency reporting requirements ask authorities to evidence how they are adopting innovation and moving to preventative, data-led asset management with defensible whole-life decision making. MKCC's response for the Redway network is an integrated end-to-end workflow: AI-based condition survey, an autonomous platform to collect it, and a bespoke analytical tool that converts the data into a budget-optimised programme.

2. The innovation

Vaisala RoadAI — AI condition survey

MKCC has adopted the Vaisala RoadAI platform, which uses deep-learning computer vision — convolutional neural networks trained on large volumes of road and path imagery — to detect and classify surface defects automatically from survey video. Continuous high-definition video is captured with GPS timestamps at five-metre intervals, with no manual scoring on the ground; the AI processes the footage afterwards.

Defects are classified across multiple categories including longitudinal and transverse cracking, alligator cracking, potholes, fretting, edge defects and bleeding. A defect density is assigned to each five-metre interval and aggregated to a single composite condition score per segment, expressed as a percentage. The output is a live network heatmap with RAG banding — green at 75% and above,

amber 50–74%, red below 50% — allowing the whole network to be viewed at once and problem areas identified immediately. The 2023 survey captured 824 Redway video runs, giving near-complete network coverage from a single field deployment; the network has since been resurveyed, enabling year-on-year condition trend comparison on a consistent basis.

Capra autonomous robot — the survey platform

RoboPass takes the further step of moving that survey payload onto a Capra autonomous wheeled and tracked robot, replacing the bicycle-mounted rig. The operational case is threefold: data consistency, since the platform does not tire, vary its pace or make subjective recording decisions; deployment flexibility, since the robot can run overnight or off-peak when the Redways are quiet without deploying staff; and safety, since sending an inspector to survey 270km of path alongside busy grid roads carries real personal risk that an autonomous platform removes entirely.

Dual use — winter pre-treatment

The same Capra platform is capable of carrying a calibrated salt or de-icer spreader for winter pre-treatment of Redways. This addresses a long-standing gap: the paths are too narrow for standard gritting vehicles and run through areas a large truck cannot access, so treatment has historically relied on pedestrian-operated spreaders or has not happened at all — a safety and accessibility issue for cyclists and vulnerable pedestrians. Calibrated application avoids both over-salting, with its environmental consequences, and under-treatment. Routes are derived from the same network geometry used for the condition survey, so the two functions reinforce each other: the segments identified as most deteriorated are also those most hazardous when ice forms. This capability is currently a trial workstream within RoboPass, evaluating route adherence accuracy, salt calibration and obstacle response.

MKCC Cycleway Scheme Selection Tool — AI-assisted programming

The Vaisala Road Segment Group Report returns one row per Redway segment — several hundred rows for a network of this size, each carrying a condition score, defect percentages, coverage data and location attributes keyed to USRN. Converting that into a prioritised programme that respects the budget, sequences work sensibly and can be justified to members and auditors is a significant analytical task.

MKCC has developed a bespoke browser-based tool in-house to automate it. The tool is a single HTML file running locally without server infrastructure, so it can be used on any council laptop with no IT deployment overhead. It imports the Vaisala report directly in one step, filters to cycleway and footway segments, and applies:

- Automated RAG banding — red for segments below the intervention threshold, lower and upper amber for early deterioration, green for monitor-only.
- A priority scoring model weighting condition score, segment length, usage context and configurable additional factors, producing an objective ranked order of intervention.
- A budget optimisation engine using a greedy knapsack algorithm, selecting the combination of schemes that maximises total priority coverage within a defined financial envelope — rather than simply working down the ranked list until the money runs out.
- A structured Year One and Year Two programme output, with officer override where local knowledge or operational context applies (for example alignment with planned utility works), and every decision recorded to give a complete audit trail.

3. What changes on the network

Aspect	Conventional regime	RoboPass / RoadAI approach
Survey method	Inspector walks or cycles the route, recording defects by hand	Continuous HD video captured at 5m GPS-tagged intervals; defects classified automatically after capture
Consistency	Subjective — two inspectors will score the same stretch differently	Objective and repeatable — identical algorithm applied to every segment, enabling confident year-on-year comparison

Aspect	Conventional regime	RoboPass / RoadAI approach
Coverage	Full coverage of 270km unachievable in a single season	Near-complete network coverage from a single field deployment
Operative safety	Inspector exposed to grid road corridors while surveying alongside high-traffic routes	Autonomous platform removes surveyor exposure entirely
Deployment window	Constrained to working hours and staff availability	Robot can run overnight or off-peak when Redways are quiet, without deploying staff
Programme build	Manual analysis of several hundred segment rows against budget and priority	Automated RAG banding, priority scoring and budget optimisation, with officer override retained
Winter treatment	Paths too narrow for standard gritters; reliance on pedestrian spreaders or paths untreated	Autonomous calibrated pre-treatment on the same platform (trial workstream under RoboPass)

4. Governance: the RoboPass pilot framework

Deploying an autonomous robot on public infrastructure used by cyclists, parents with pushchairs, mobility scooter users and children is not something undertaken informally. RoboPass exists to provide that framework — defined operational parameters, risk assessment, public liability consideration, stakeholder engagement, and an agreed protocol for when something does not go to plan.

The pilot is structured around specific research questions: whether an autonomous wheeled platform can reliably navigate the Redway network, with its varied surfaces, cambers, path widths and crossing points, without human intervention; what data quality the autonomous survey delivers compared with the bicycle-mounted survey; and what the operational cost model is in people, time and equipment against conventional methods. Milton Keynes is well placed to answer them — the Redway network has consistent geometry, is well mapped, and is supported by detailed asset data going back years.

5. How this evidences the transparency report requirements

- Innovation and continuous improvement — an integrated end-to-end workflow from AI survey through autonomous collection to automated programme optimisation, formally governed as a research pilot rather than an ad hoc trial.
- Preventative, data-led asset management — objective condition scoring across the full network enables intervention to be targeted at deterioration before failure, and repeat survey on a consistent algorithm supports genuine condition trend analysis.
- Defensible decision making and auditability — every scheme in the programme is traceable to an objective AI condition score, with priority scoring, budget optimisation and officer overrides all recorded. This directly addresses the challenge of explaining not just what was done but why it was done in that order, to that standard, within that budget — precisely what DfT evidence sampling tests.
- Value for money — the knapsack optimisation maximises priority coverage for a fixed budget rather than simply exhausting it in rank order, and the tool was developed in-house at no external software cost and requires no server infrastructure.
- Operative safety — autonomous survey removes surveyor exposure to grid road corridors across 270km of network.
- Active travel and accessibility — the programme brings rigorous asset management to cycleway and footway infrastructure that is typically surveyed least, and the winter workstream addresses a treatment gap affecting cyclists and vulnerable pedestrians.
- Sector leadership and transferability — the methodology was showcased to local authority asset managers and engineers at the LCRIG Innovation Festival in June 2026, and both the survey approach and the scheme selection methodology are transferable to any authority managing a significant active travel network.

6. Next steps

RoboPass remains a live pilot generating real data on real infrastructure. Priorities are to complete the comparative assessment of autonomous against bicycle-mounted survey data quality, establish the operational cost model, and conclude the winter pre-treatment trials on route adherence, salt calibration and obstacle response ahead of any move to service deployment. MKCC is actively open to dialogue with other authorities managing significant active travel networks, and intends the survey and scheme selection methodology to be shared as a transferable approach across the sector.

Prepared by MKCC Highways & Transport — August 2026. Programme leads: Richard Moffoot (Highways Asset Manager) — RoadAI survey methodology; Mark MacDonald (Highways Operations Lead) — Capra platform and winter maintenance; Andy Dickinson (Strategic Asset Manager) — Cycleway Scheme Selection Tool; Joseph Mundy (Project Lead) — RoboPass pilot. Supporting evidence (survey datasets, tool outputs, programme records and pilot governance documentation) is held by the Highways Asset Management Team and available to DfT on request.