29-30 October 2026 | Filoxenia Conference Centre
Nicosia, Cyprus

8th Conference Sustainable Mobility and Intelligent Transport Systems

EvoRoads: Evolutionary Solutions for Realising a Holistic Safe System Approach for All Road Users

Charalambos Kyriakou

Research Associate

KIOS Research and Innovation Center of Excellence (KIOS CoE)



The Conference is implemented within the framework of the Cohesion Policy Programme "THALIA 2021–2027", Co-financed by the European Union.

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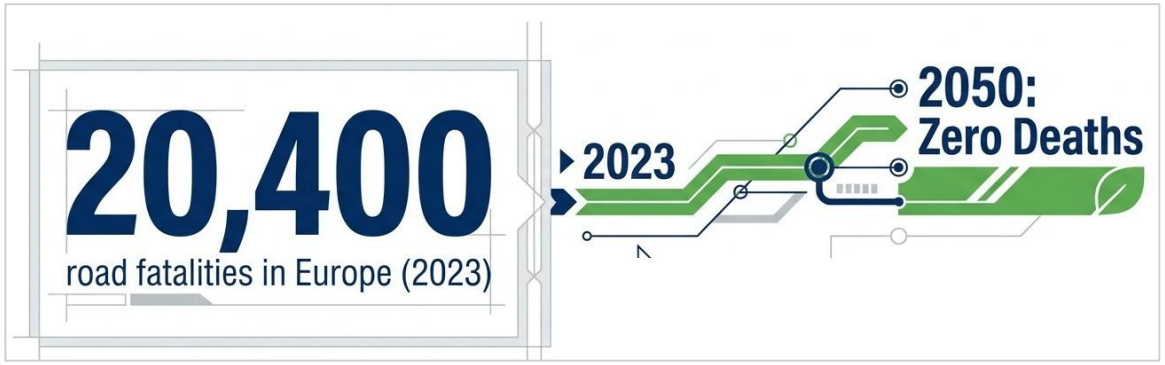
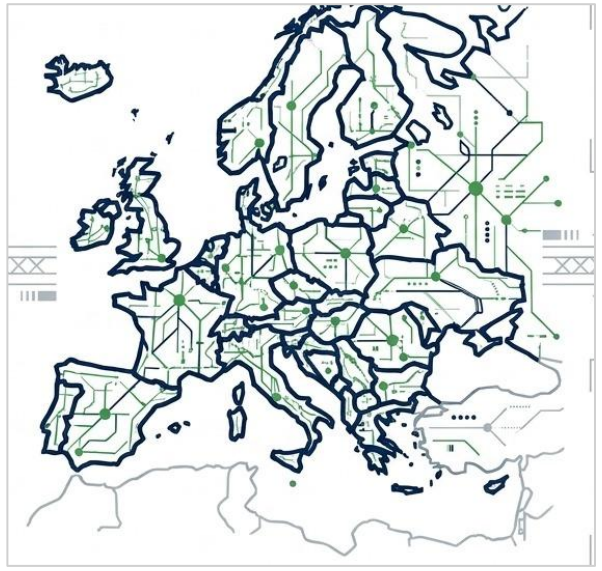
DEPARTMENT OF PUBLIC WORKS

Why EvoRoads: the road to Vision Zero



EvoRoads accelerates the EU's Vision Zero goal with a holistic framework of models, tools and services.

It defines safety criteria and KPIs for the whole Safe System approach, digitalises infrastructure on a connectivity platform, and uses AI analytics to fuse monitoring data and warn of safety risks.



20
partners, 10 countries

4
Living Labs

2024–2027
May 2024 – April 2027

Pilots in Spain, Italy, Romania and Latvia. Coordinated by ERTICO ITS Europe.

EvoRoads in three parts

1

Data-driven evolution

Defining new safety criteria and KPIs for holistic assessment

2

Dynamic monitoring

Fusing infrastructure data at different geospatial resolutions using advanced AI

3

CCAM readiness

Evaluating infrastructure readiness for Connected, Cooperative and Automated Mobility

One digitalised platform

Transport infrastructure assets are digitalised and safety assessment services run together, validated in urban and rural settings at the four Living Labs.

Data from EvoRoads partners

Satellite imagery (InSAR)
Wide-area, network-level view

Aerial footage from drones
High-resolution road surface detail

Vehicle data
Measurements from vehicles on the road

Infrastructure data
Asset and sensor information

Fused by AI

Data at different geospatial resolutions is fused with advanced AI into one picture of road condition and safety.

KIOS contributes

- Handle data from different sources through the Data Acquisition Platform (DAP)
- A crowdsourcing monitoring service, piloted in Riga (FixRiga) and Alba Iulia (FixAlbaIulia)
- The drone layer: UAV pavement monitoring and road rating

Today: the manual survey procedure

1

Survey on foot

Inspectors walk the road and survey sample units, for example a 2,500 ft² area

2

Record each distress

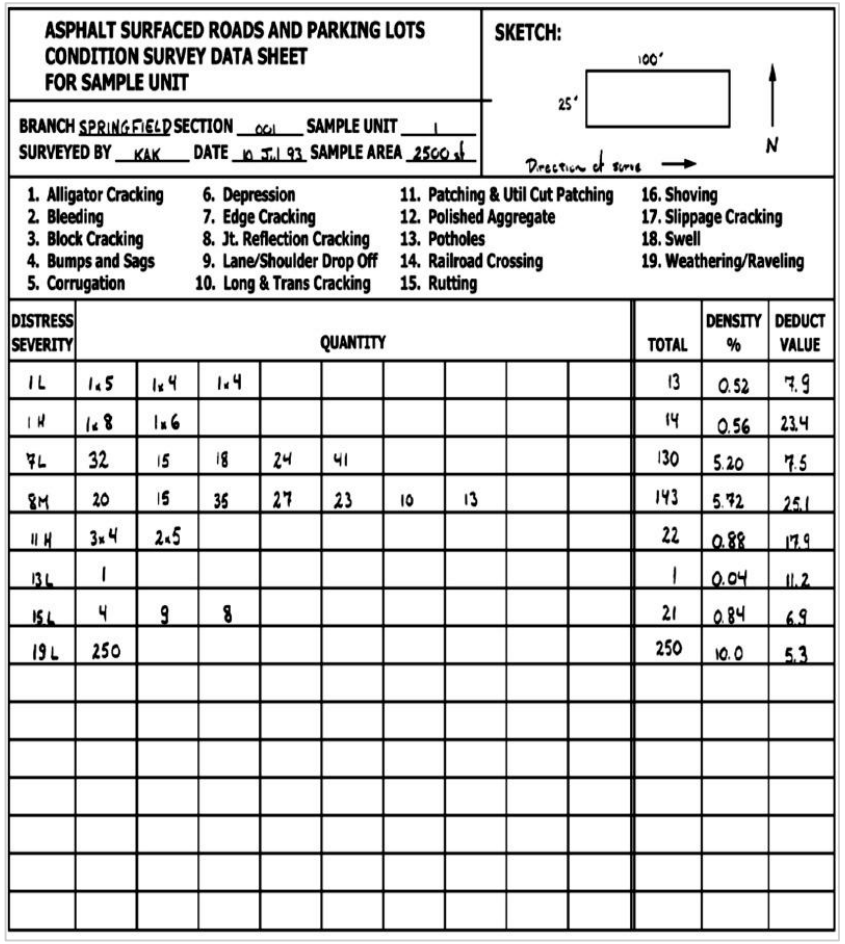
Distress types are logged by severity (low, medium, high) with quantities on a condition survey data sheet

3

Sum and score

Quantities are totalled per severity, then converted to density and deduct values

Labour-intensive and subjective: the gap our UAV approach closes.



ASPHALT SURFACED ROADS AND PARKING LOTS
CONDITION SURVEY DATA SHEET
FOR SAMPLE UNIT

SKETCH:

100'
25'
N
Direction of survey →

BRANCH SPRINGFIELD SECTION 001 SAMPLE UNIT 1
SURVEYED BY KAK DATE 10 JUL 93 SAMPLE AREA 2500 sf

1. Alligator Cracking
2. Bleeding
3. Block Cracking
4. Bumps and Sags
5. Corrugation
6. Depression
7. Edge Cracking
8. Jt. Reflection Cracking
9. Lane/Shoulder Drop Off
10. Long & Trans Cracking
11. Patching & Util Cut Patching
12. Polished Aggregate
13. Potholes
14. Railroad Crossing
15. Rutting
16. Shoving
17. Slippage Cracking
18. Swell
19. Weathering/Raveling

DISTRESS SEVERITY	QUANTITY									TOTAL	DENSITY %	DEDUCT VALUE
1L	1×5	1×4	1×4							13	0.52	7.9
1M	1×8	1×6								14	0.56	23.4
7L	32	15	18	24	41					130	5.20	7.5
8M	20	15	35	27	23	10	13			143	5.72	25.1
11M	3×4	2×5								22	0.88	17.9
13L	1									1	0.04	11.2
15L	4	9	8							21	0.84	6.9
19L	250									250	10.0	5.3

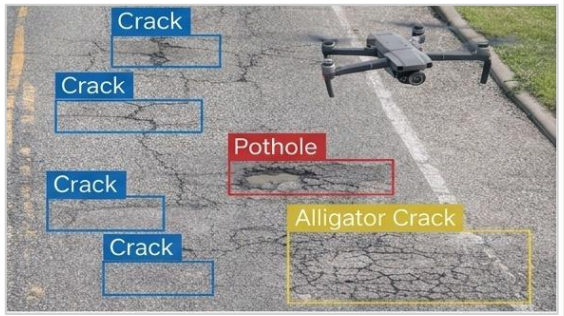
KIOS in EvoRoads: from manual to UAV inspection

Traditional inspection



- Manual human inspection
- Subjective 1–10 rating
- Rates the whole section, not each crack or pothole
- Misses localized risk zones

KIOS DBPCI framework



- Drone (UAV) automation
- Objective AI vision
- Captures spatial clustering
- **Early warning of local damage**

Our contribution: the DBPCI, a UAV-compatible pavement rating index on the PASER 1–10 scale that fits existing pavement management systems.

Our target: acting at the right time



Condition falls slowly, then steeply. Acting early costs far less than waiting for the steep part of the curve.

Each rating points to the action needed

9–10	No maintenance required
8	Little or no maintenance
7	Routine maintenance, crack sealing, minor patching
5–6	Preservative treatments (sealcoating)
3–4	Structural improvement: overlay or recycling
1–2	Reconstruction

Our DBPCI delivers this rating from drone images, so road owners know when to act.

How it works: from drone image to rating

1 Capture
UAV imagery of the pavement

2 Detect
ML finds cracks and potholes

3 Rate
Spatial analysis gives the DBPCI score



Defect types

Longitudinal cracks parallel to the centerline

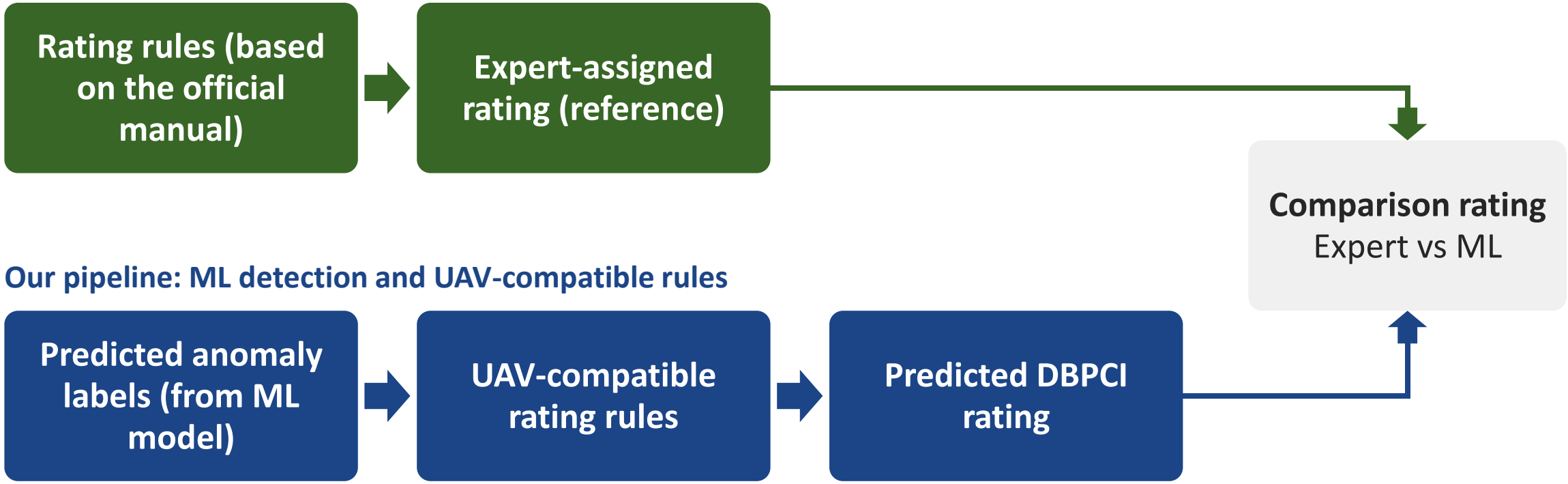
Transverse cracks perpendicular, from temperature variation

Alligator cracking interconnected, from repeated loading

Potholes surface material loss

DBPCI methodology

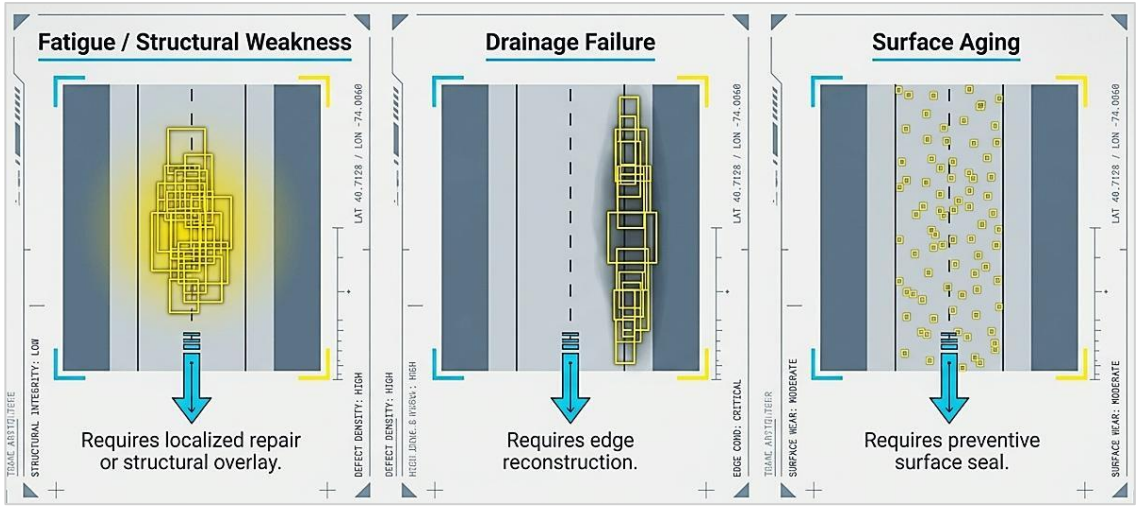
Reference: expert rating



Agreement between expert and ML ratings shows how well the DBPCI works.

DBPCI: from pixels to PASER rating

Coverage ratio + **Defect spacing** = **Predicted PASER score**



Why spacing matters

Clustered defects point to fatigue, a line along the edge to drainage failure, scattered small defects to surface ageing. Coverage alone cannot tell them apart.

$R^2 = 0.83$ agreement with expert PASER ratings

DBPCI maintenance categories

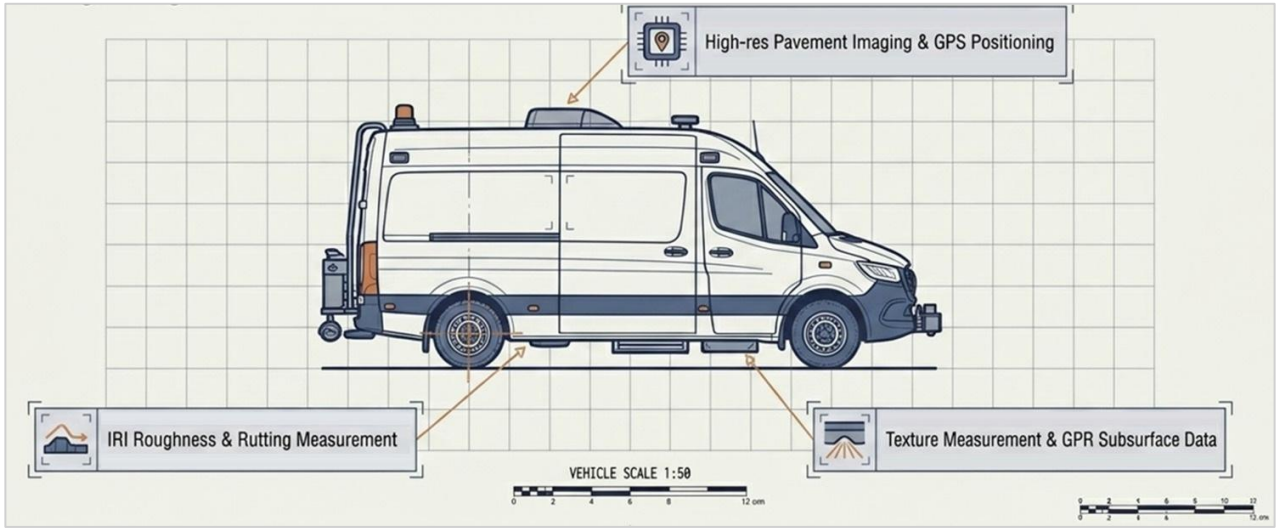
8–10 Excellent
No intervention

5–7 Good / Fair
Crack filling or sealcoat

3–4 Poor
Structural overlay

1–2 Very Poor
Full reconstruction

The Central Laboratory’s survey vehicle



A Laboratory asset

The Central Laboratory Branch of the Department of Public Works has bought this multi-purpose survey vehicle.

A strong asset: data collection stays in-house, not with contractors.

What it measures

Pavement images with GPS, roughness and rutting, texture, and subsurface data from GPR.

The vehicle already gives a rich view of the road surface and below it.

UAV-based DBPCI can add a spatial view from above.

Conclusion

1

EvoRoads

European framework for intelligent, safe infrastructure on the road to Vision Zero

2

Laboratory vehicle

Already measures roughness, texture and the subsurface along the road

\+

3

KIOS DBPCI: an add-on

Can add the spatial view from drones

The vehicle gives the Laboratory a strong base, and DBPCI can add the spatial view from drones.

Next steps: finalise the proximity thresholds, validate DBPCI on more data, and explore how drone results could add to the vehicle's survey data.

Organisers

Ministry of Transport, Communications and Works

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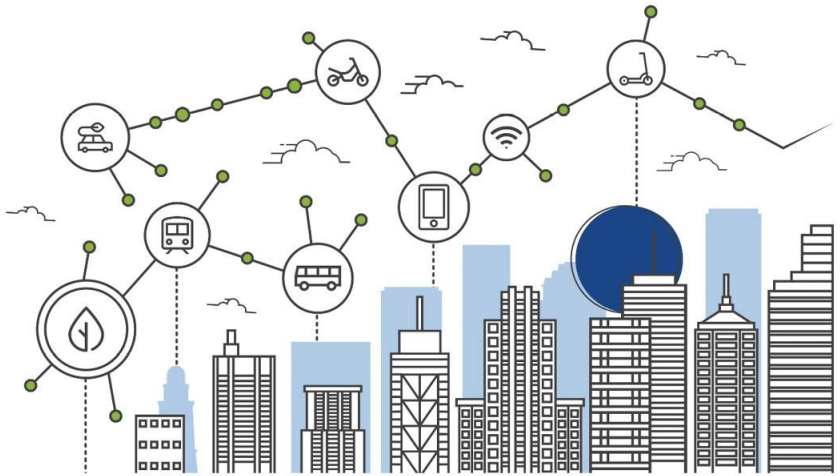

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Thank you for your attention!

Charalambos Kyriakou, KIOS Research and Innovation Center of Excellence, University of Cyprus
kyriakou.charalambos@ucy.ac.cy | www.evoroads-project.eu