

Vaisala – RoadAI

APSE – Highways & Street Lighting Advisory Group

Computer vision enabled highway data collection



VAISALA



Observations
for a better world.

VAISALA

VAISALA



Collect Geospatial video across
your road network using a
smartphone

Collect video through the RoadAI app

- Deploy in any existing vehicle
- User friendly
- Flexibility and control
- Cost-effective



Vaisala Road AI – Service Architecture

VAISALA

DATA COLLECTION



- Video Recording with RoadAI smartphone application

DATA PROCESSING



- Cloud based data storage
- Processing through machine-learning software

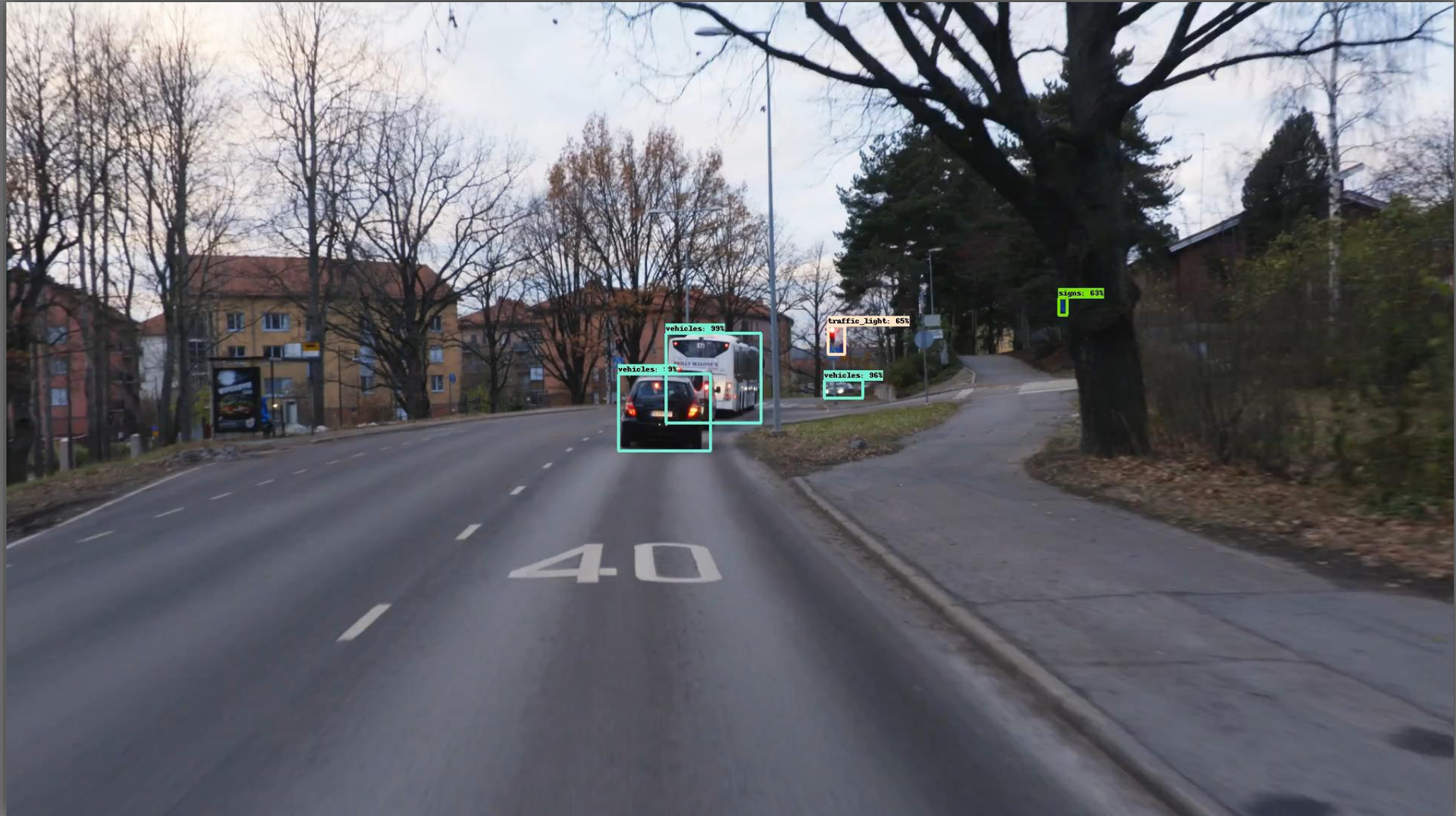
DATA MANAGEMENT



- Web based user interface
- Data transfer to other graph-based system (Excel/CSV file, GIS, HMDIF)



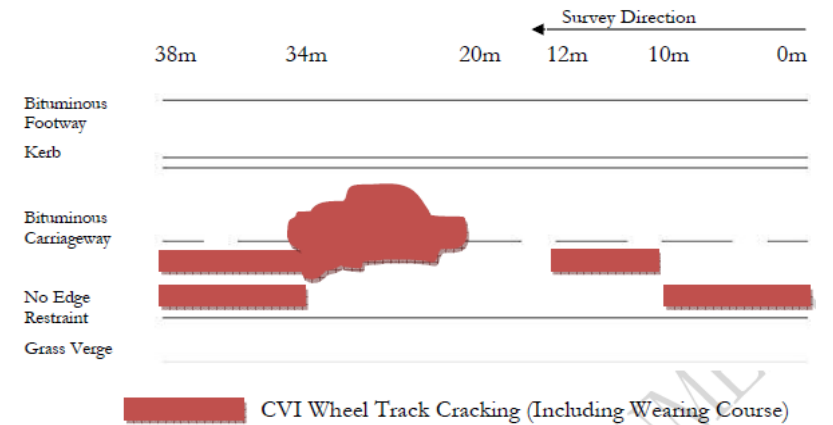
ENCRYPTED DATATRANSFER



VAISALA

2017 – Early phase development of road condition model

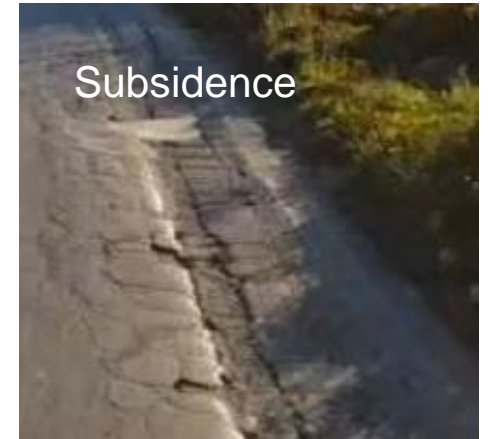
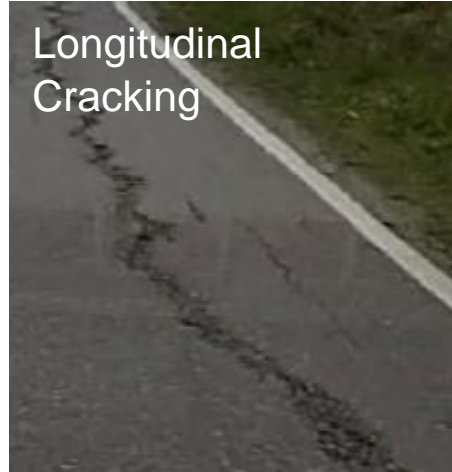




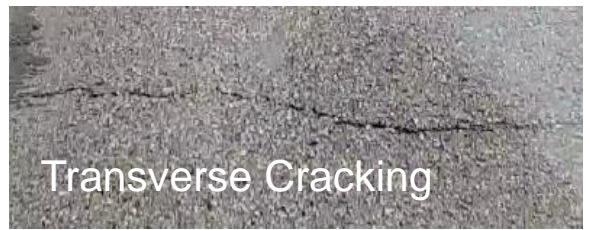
VAISALA



Computer Vision - Surface Defects



Computer Vision – Surface Defects



Pavement defects and appropriate maintenance strategies:

- Longitudinal cracking
- Transverse cracking
- Alligator cracking
- Wheel track cracking
- Fretting
- Binder bleeding
- Edge deterioration
- Potholes
- Settlement
- Subsidence
- Rutting
- Patching
- Sealing
- High Friction Surfaces

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West Lothian

- 1/32 LAs
- Central location
- 1043km (648 miles)
- Semi Urban
- New town



Background

- Demonstration
- Discussion
- Digital Transformation Fund

Mobilisation

- Hardware
- Software
- Training
- Data collection

Utilisation

- Full visual survey
- Road defects and condition
- Road signs
- Road markings
- Others



Pavement Condition Data

- Data exported in CSV format
- Filtered and scored in combination with other datasets
- Cross-referenced with web UI
- List of schemes identified

479683239761	40	50	2020-04-06 11:16	10	map	100	5
479683239761	50	60	2020-04-06 11:16	10	map	100	5
479688239705	0	10	2020-04-06 11:17	10	map	100	5
479688239705	10	20	2020-04-06 11:17	10	map	100	5
479688239705	20	30	2020-04-06 11:17	10	map	100	5
479688239705	30	40	2020-04-06 11:17	10	map	100	5
479688239705	40	50	2020-04-06 11:17	10	map	100	5
479776239838	10	20	2020-04-06 11:16	10	map	87	5
479776239838	190	200	2020-04-06 11:15	10	map	88	5
479776239838	180	190	2020-04-06 11:15	10	map	94	5
479776239838	140	150	2020-04-06 11:15	10	map	95	5
479776239838	90	100	2020-04-06 11:16	10	map	98	5
479776239838	150	160	2020-04-06 11:15	10	map	98	5
479776239838	160	170	2020-04-06 11:15	10	map	98	5
479776239838	40	50	2020-04-06 11:16	10	map	99	5
479776239838	60	70	2020-04-06 11:16	10	map	99	5
479776239838	70	80	2020-04-06 11:16	10	map	99	5
479776239838	110	120	2020-04-06 11:16	10	map	99	5
479776239838	130	140	2020-04-06 11:15	10	map	99	5
479776239838	170	180	2020-04-06 11:15	10	map	99	5
479776239838	0	10	2020-04-06 11:16	10	map	100	5
479776239838	20	30	2020-04-06 11:16	10	map	100	5



Pavement condition	0.00 %	0.00 %	100.00 %
Pavement condition class	1	<div style="width: 100%; height: 10px; background-color: #800080;"></div>	
Alligator cracking	21.01 %	0.00 %	100.00 %
Minor longitudinal cracking	2.52 %	0.00 %	100.00 %
Moderate longitudinal cracking	0.00 %	0.00 %	100.00 %
Severe longitudinal cracking	0.00 %	0.00 %	100.00 %
Wheel track cracking	25.00 %	0.00 %	100.00 %

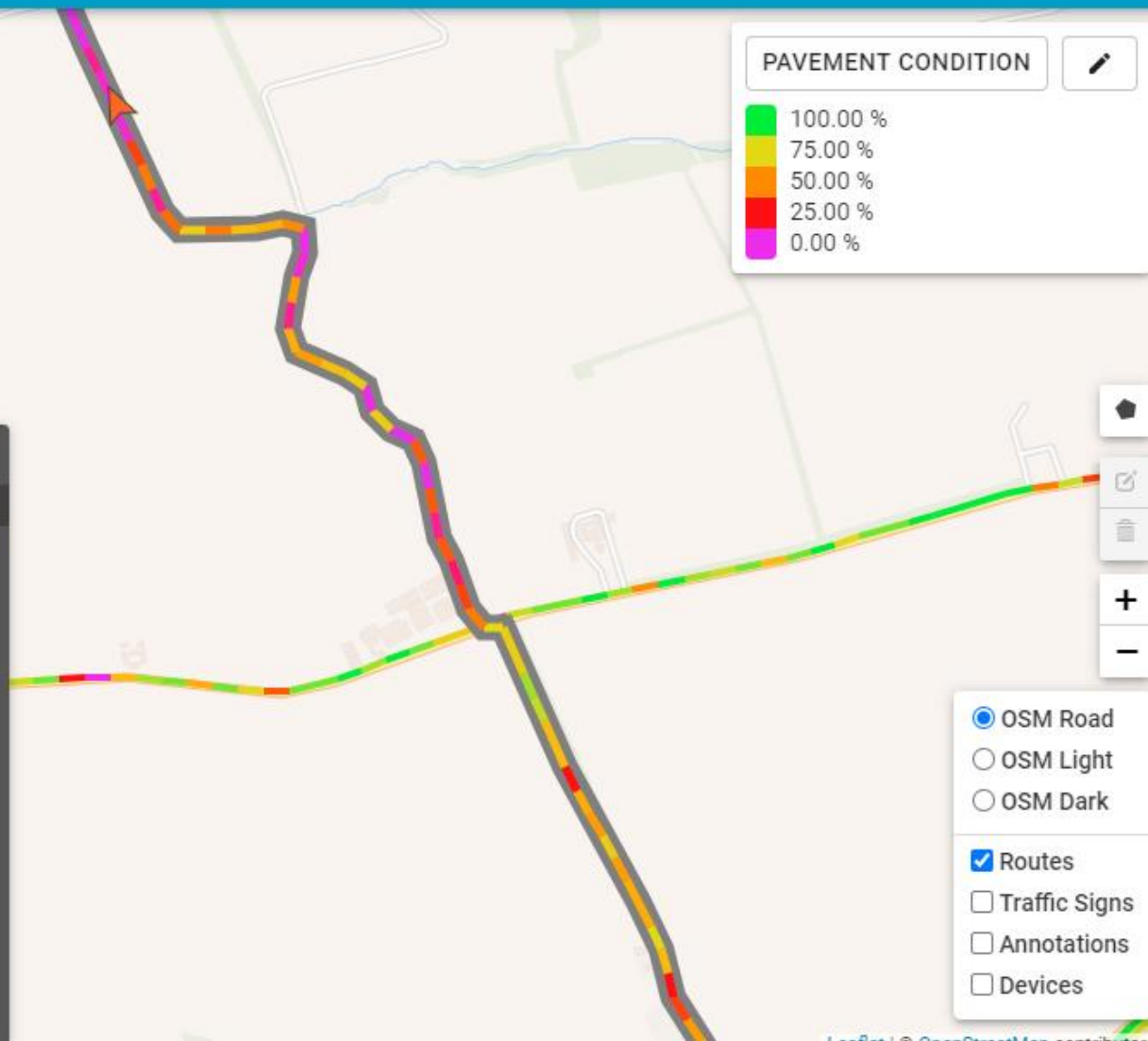


31/07/2020, 11:18
31/07/2020, 11:23

PAVEMENT CONDITION

- 100.00 %
- 75.00 %
- 50.00 %
- 25.00 %
- 0.00 %

- OSM Road
- OSM Light
- OSM Dark
- Routes
- Traffic Signs
- Annotations
- Devices



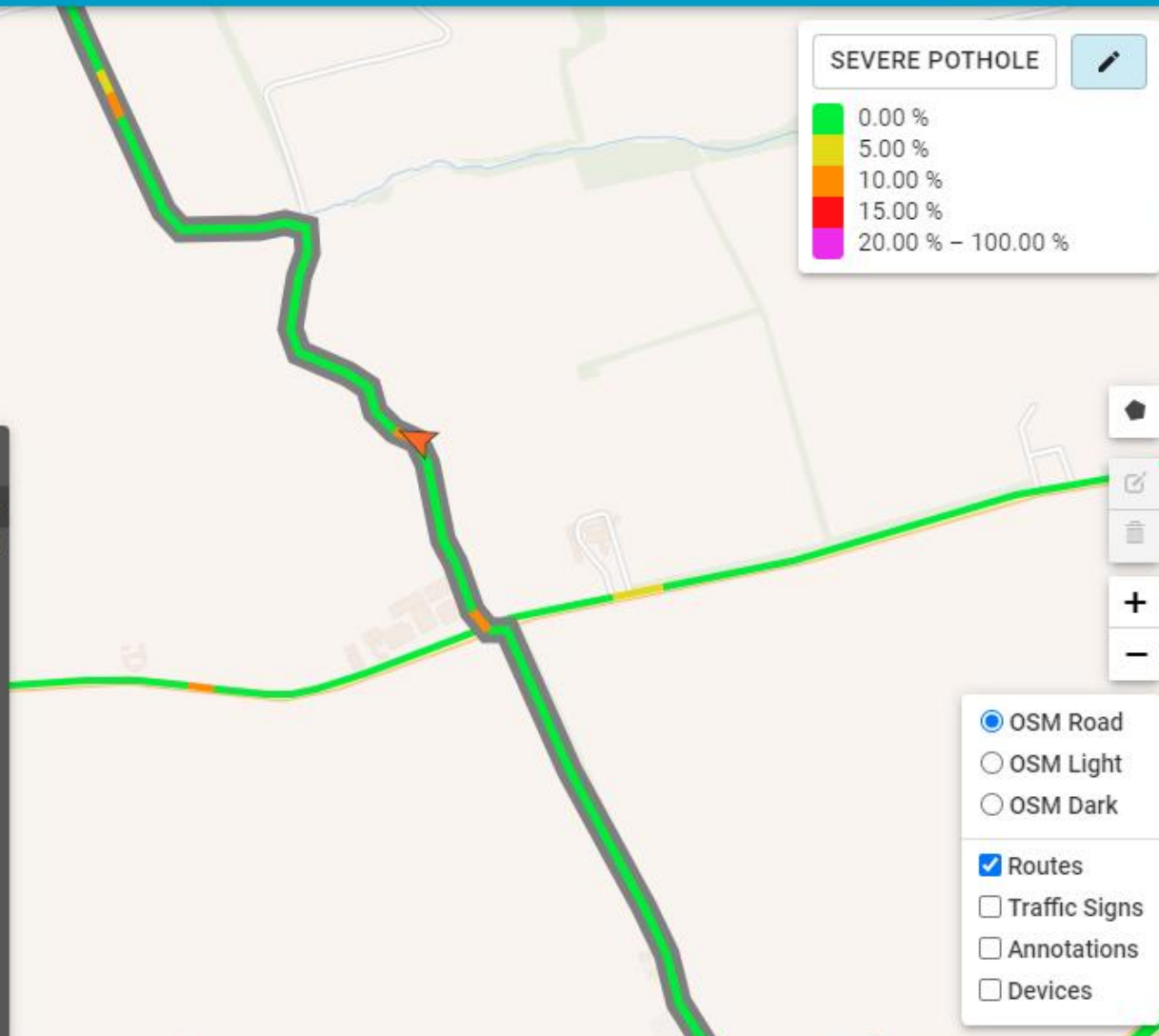
Pavement condition	66.45 %	0.00 %	100.00 %
Pavement condition class	4		
Alligator cracking	0.00 %	0.00 %	100.00 %
Minor longitudinal cracking	0.00 %	0.00 %	100.00 %
Moderate longitudinal cracking	0.00 %	0.00 %	100.00 %
Severe longitudinal cracking	0.00 %	0.00 %	100.00 %
Wheel track cracking	0.00 %	0.00 %	100.00 %

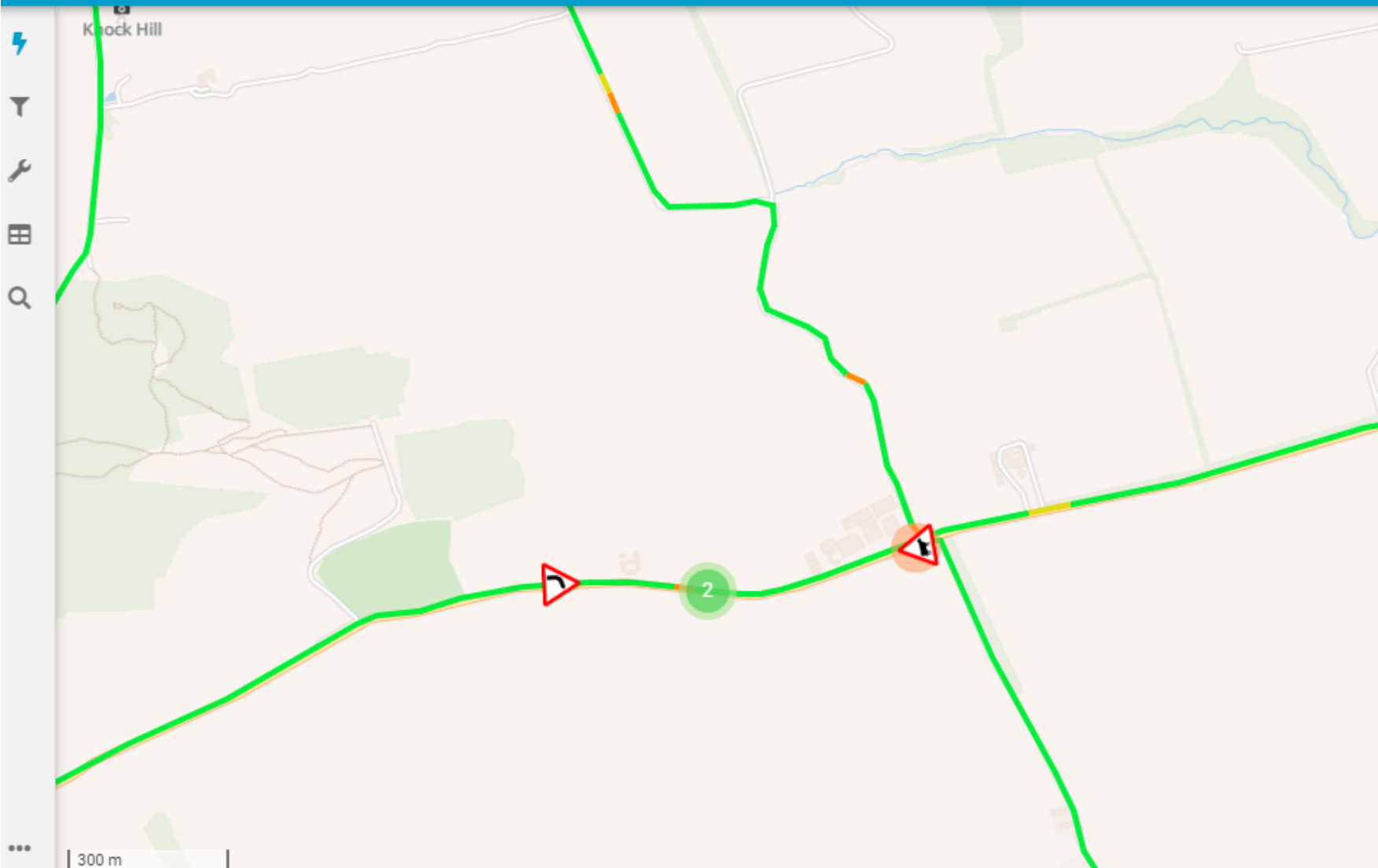
SEVERE POTHOLE

- 0.00 %
- 5.00 %
- 10.00 %
- 15.00 %
- 20.00 % - 100.00 %



31/07/2020, 11:18
31/07/2020, 11:23





3571 / 9846

Detected 2020-07-31 11:18:06 +01:00 4 months ago

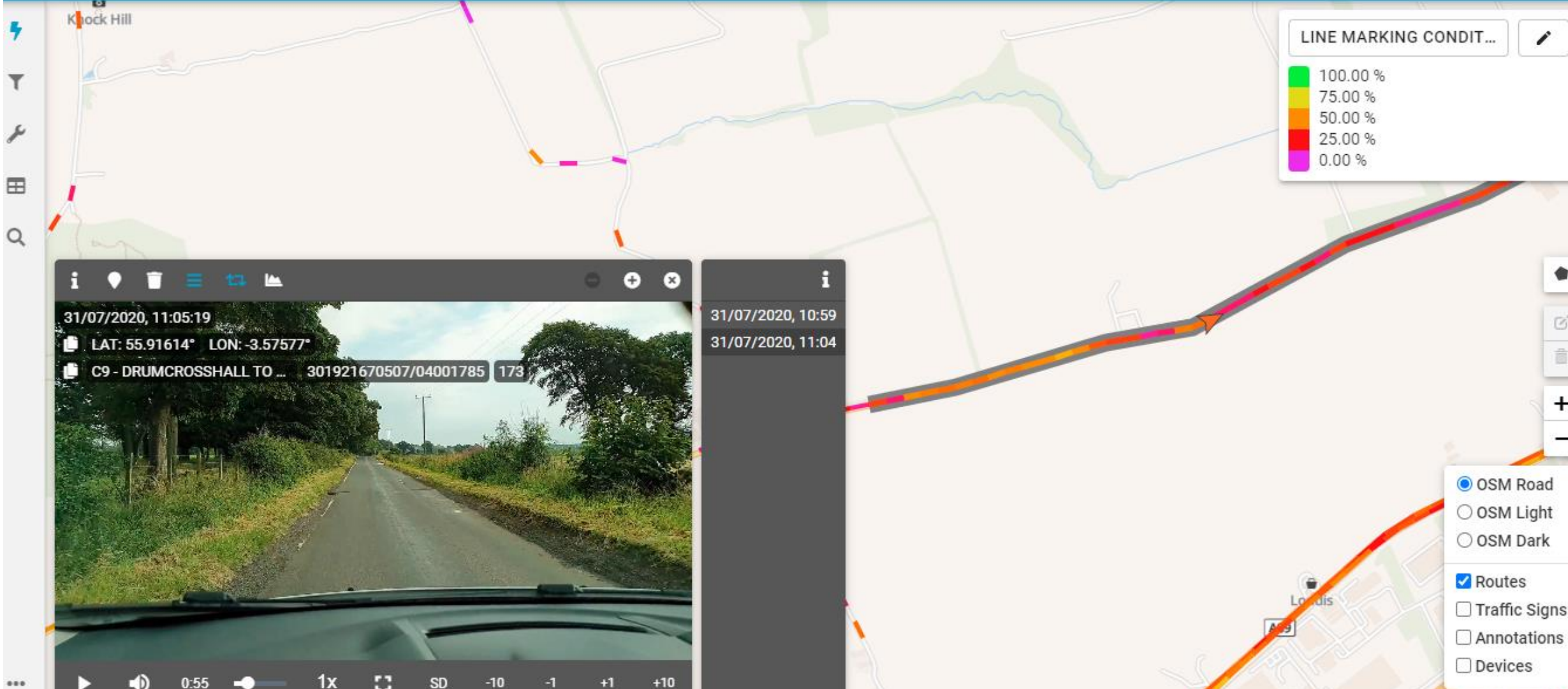
Condition

5 4 3 2 1

Action

OK Fix Replace Missing

Text	—
Category	warning
Name	Cattle
Country code	gb: 548
Additional info	—
Time	31/07/2020, 11:18:06



Summary

- 168 schemes listed
- Within just a few months, West Lothian were able to adopt a system that *“picks up the sorts of defects that members of the public are interested in”*
- Data collection continuing and schemes can then be adjusted/prioritised
- A change to *“data driven decision making”*

West Lothian Council has used a new artificial intelligence app in a survey of its roads network.



The authority has used the exercise as a trial of the technology, developed with Finnish company Vaisala, and said it is now considering its future use.

The app can be used to collect video footage of a pothole, cracks or other damage through a mobile phone, at which point the

AI function identifies the nature of the problem.

<https://www.ukauthority.com/articles/west-lothian-council-uses-ai-app-for-road-repairs/>

Computer Vision for Line Markings

- Map condition of line markings
- Export condition data

100



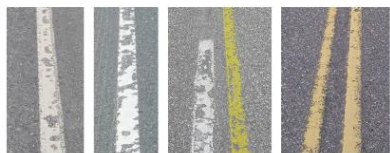
75



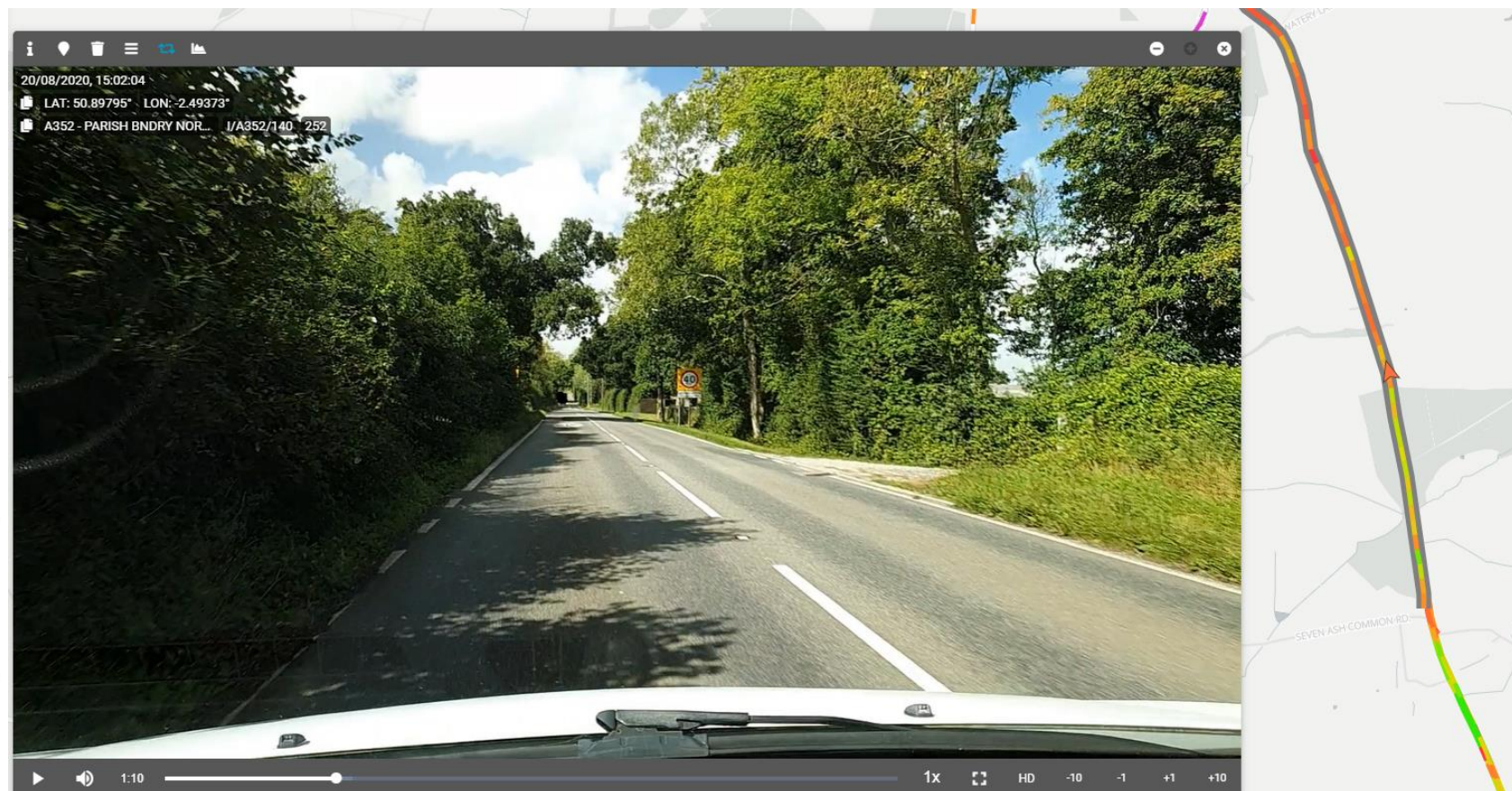
50



25



0



In development – additional road markings

- E.g. ‘Stop’, ‘Give way’, speed roundels etc.
- A user interface for condition evaluation and action planning
- Road marking reports
- Designed in collaboration with users

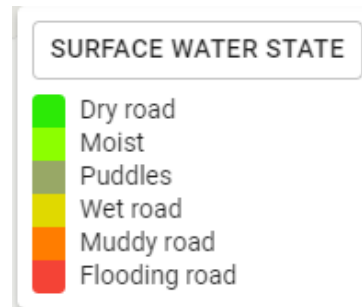
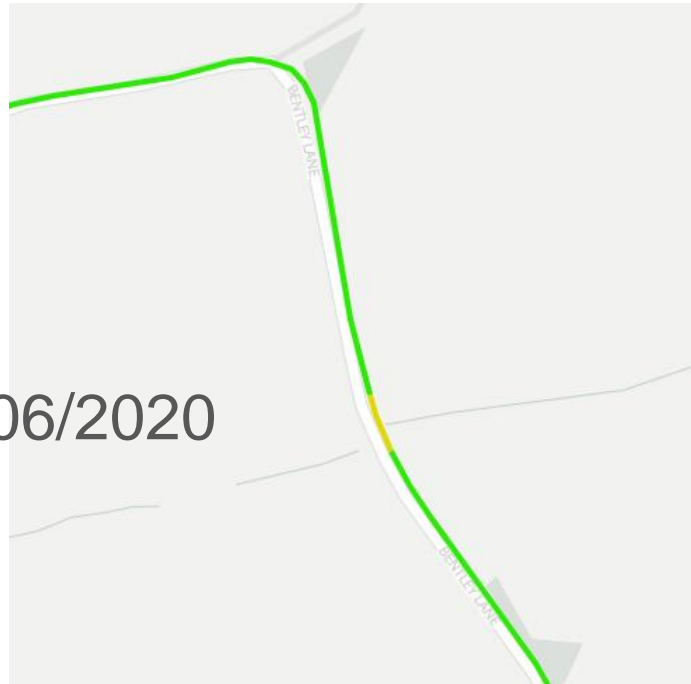
The screenshot displays the VAISALA Data interface. On the left, a sidebar contains filter categories: Time filters, General filters, Video filters, Annotation filters, Traffic sign filters, and Road markings filters. The 'Road markings filters' section is expanded, showing a dropdown for 'Road marking' and 'Road marking tags', along with sliders for 'Detection Confidence' (set to 100%) and 'Detections from videos' (set to 10).

The central map shows a street network with several road markings highlighted in green and yellow. Markings are labeled with numbers 3, 4, 5, and 6. A 'STOP' sign is visible on the map.

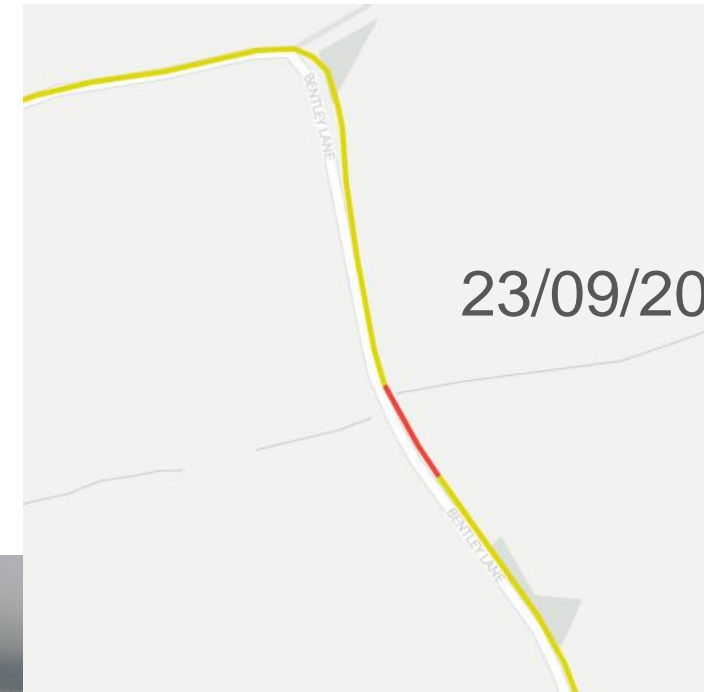
On the right, a detailed view of a 'STOP' sign is shown. It includes a thumbnail image of the sign, a timestamp 'Detected 2022-01-12 13:04:12 +02:00', and a condition scale from 5 (green) to 1 (red). Below the scale are action buttons: 'OK', 'Replace/Fix', 'Missing', 'Clean', and 'Site insp.'. A 'Tags' section includes 'add tags' and a list of tags: 'Text: Sign damage', 'Category: priority', 'Name: Stop', 'Country code: gb: 601.1', 'Additional info: --', 'Time: 12/01/2022, 13:04:12', 'Address: C3010, C3010 104, 1788', 'Location: 54.72422, -2.88794 (WGS-84)', 'Heading: 108', 'Detection confid...: 0.99959', 'Localization con...: 1', 'Group: Cumbria', '3D points: 12 (Cumbria)', 'Detections from ...: 12 / 12', and 'Misses in a row: 0'.

Computer Vision for Surface Water

19/06/2020

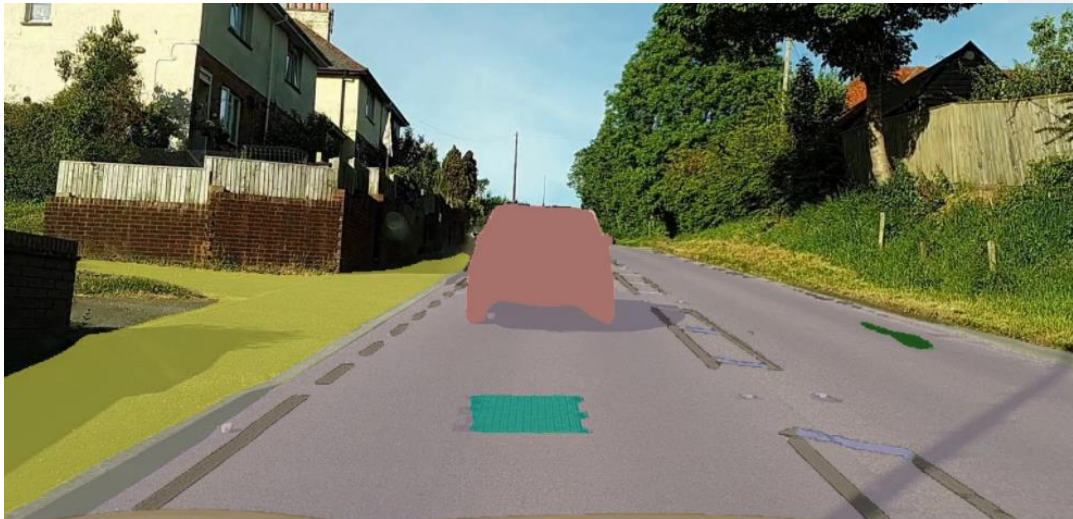
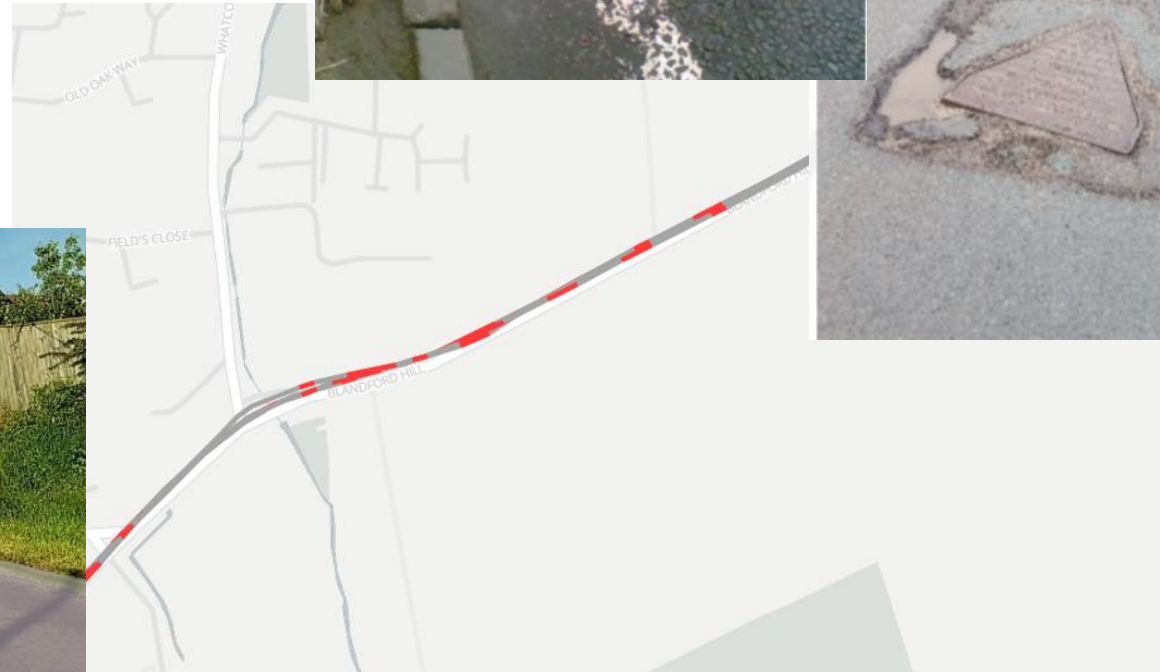


23/09/2020



Computer Vision for Asset Detection

- Detect: gullies, manhole covers, streetlights, guardrails, bollards, cones
- Assess these assets from a desktop environment
- Tools to tag, condition assess, and create workflows



Cycleways and footways

VAISALA | Data MK/REDWAY 2021 MILTON KEYNES

SURFACE DEFECTS

- No surface defects
- Moderate transverse cracking
- Severe transverse cracking
- Moderate longitudinal cracking
- Severe longitudinal cracking
- Bleeding
- Severe fretting

15/10/2021, 14:37:57
LON: -0.77007° LAT: 52.01000°

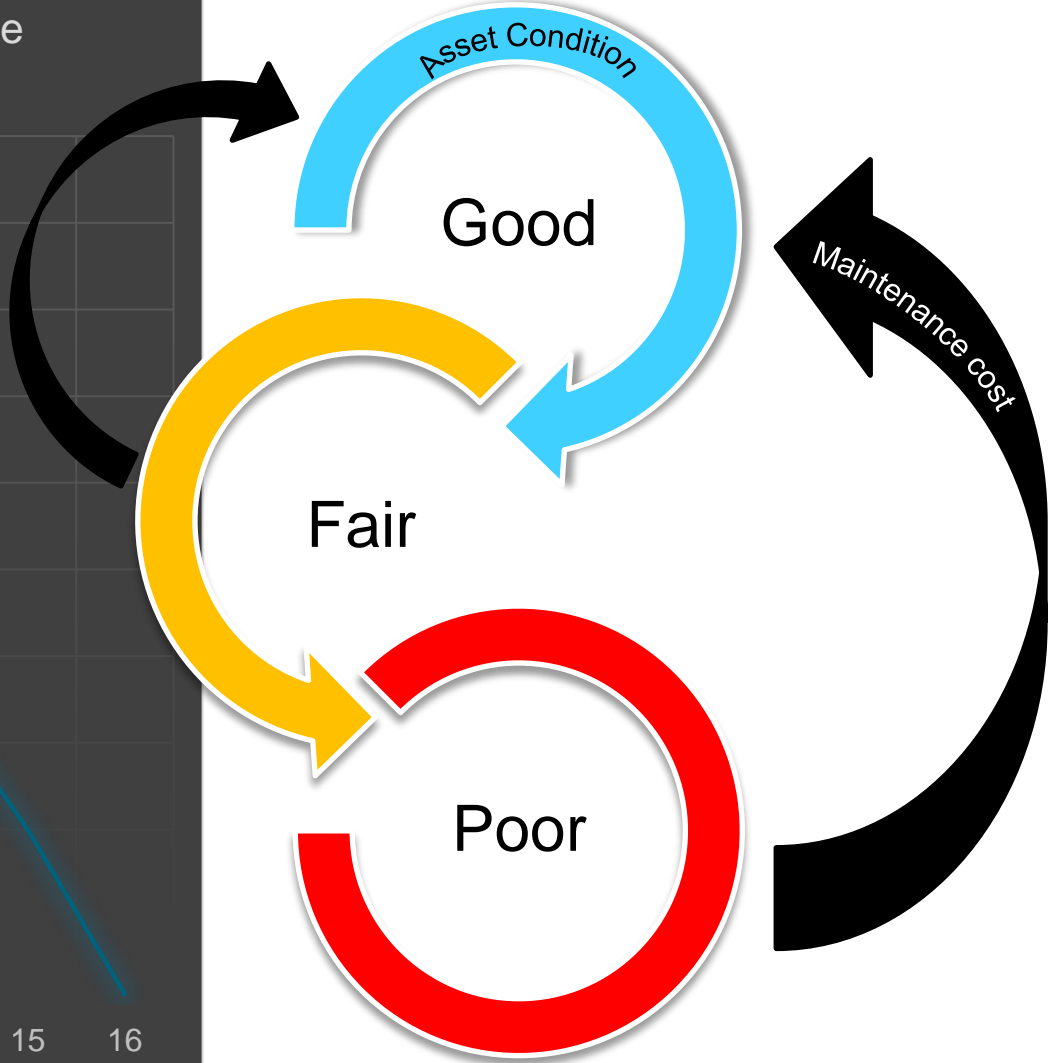
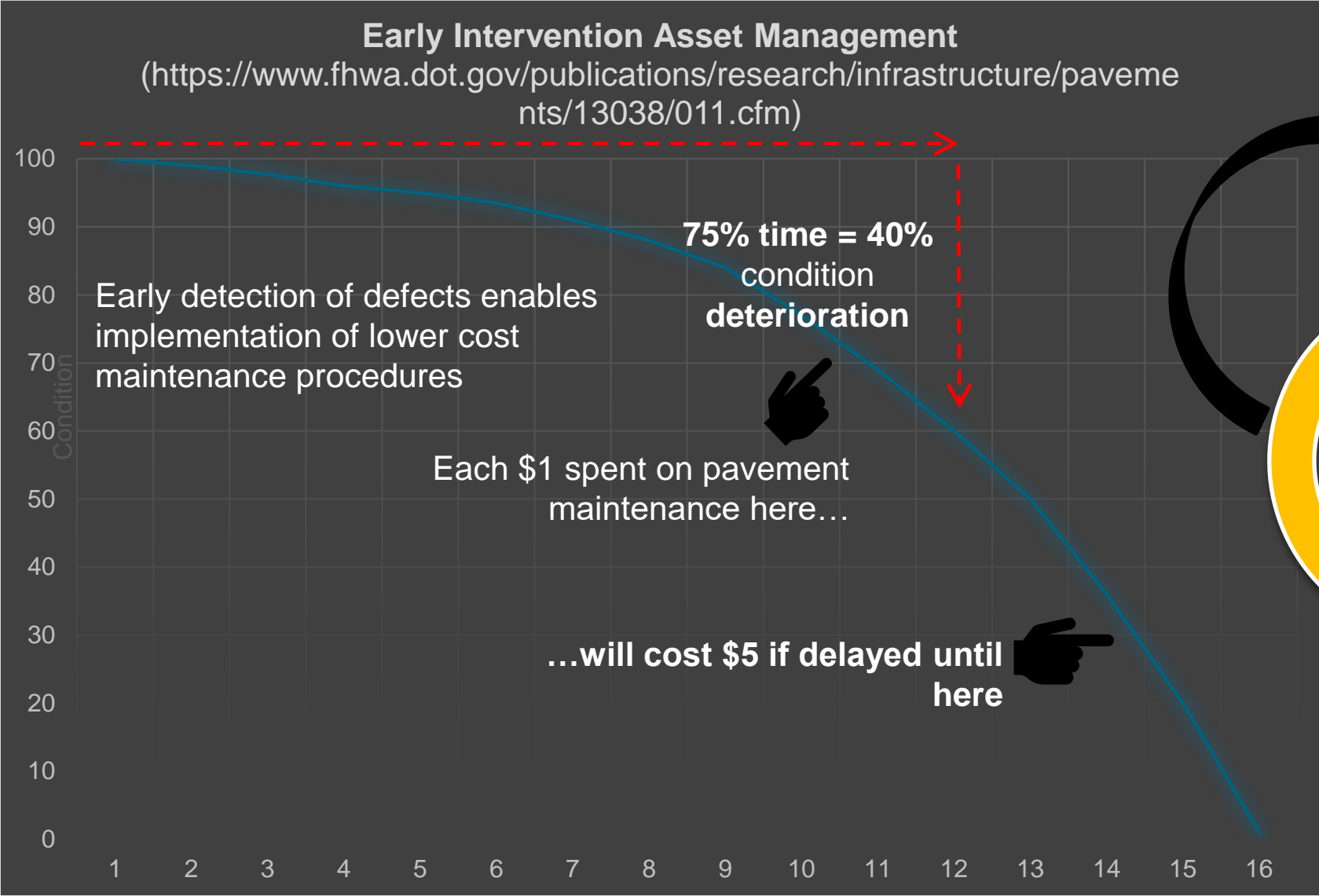
Light
 Light terrain
 Dark
 Streets
 Satellite
 Road network
 Routes
 Traffic Signs
 Annotations
 Devices

Leaflet | © MapTiler © OpenStreetMap contributors

Early Intervention Asset Management

Early Intervention Asset Management

(<https://www.fhwa.dot.gov/publications/research/infrastructure/pavements/13038/011.cfm>)



Carbon Saving

- Use existing vehicles and existing journeys to collect data
- One survey for a number of applications
- Save on ad-hoc site visits by taking more activity into a desktop environment



COMPUTER VISION



COMPUTER VISION



- Reactive maintenance
- Planned maintenance
- Asset inventory management



VAISALA

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