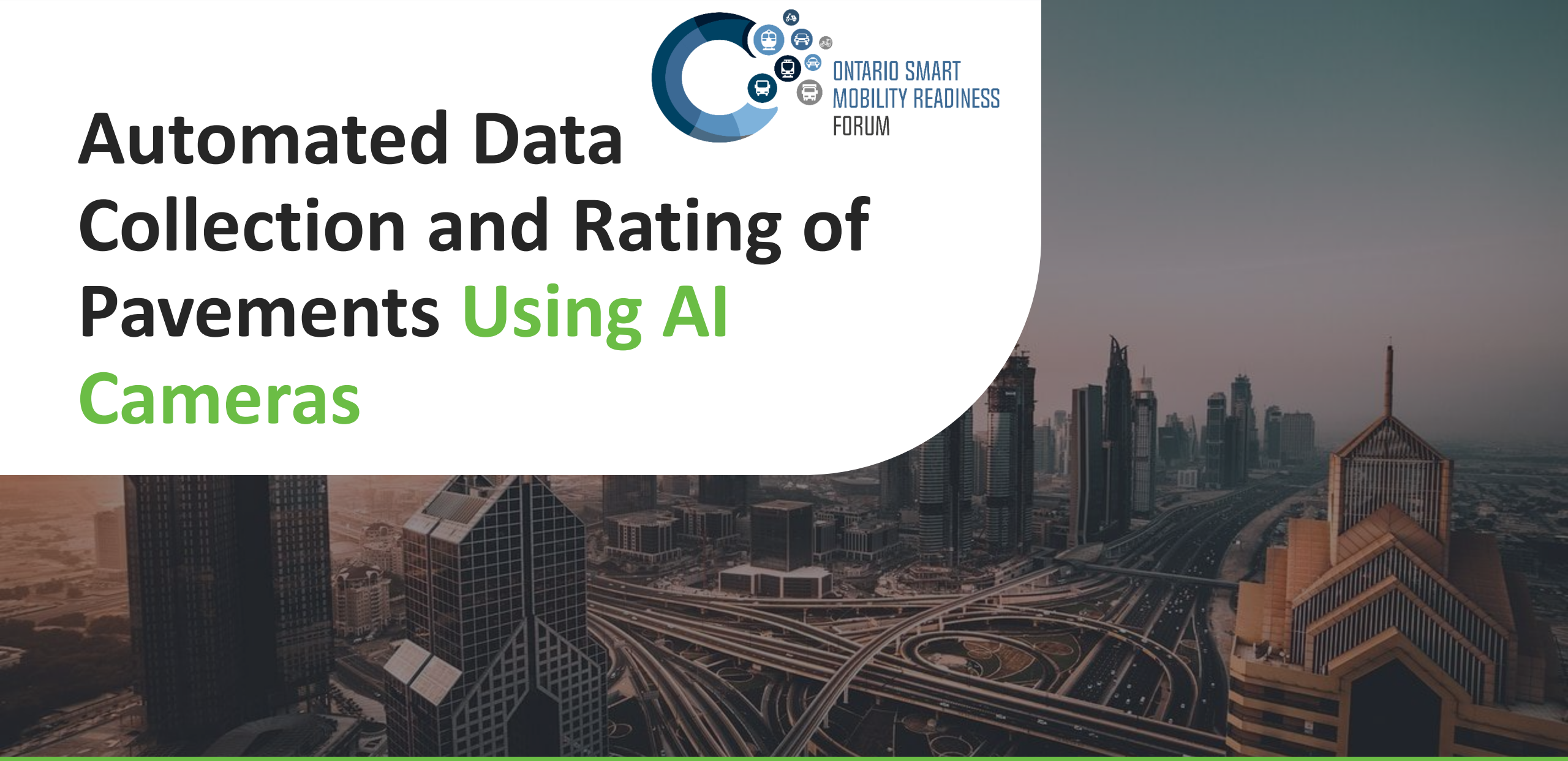
ONTARIO SMART MOBILITY READINESS FORUM

Automated Data Collection and Rating of Pavements Using AI Cameras



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Alice Lam
Director of Operations

- Alice Lam has extensive experience in engineering, operation and maintenance of road transportation systems in highway and urban settings.
- Alice has been with the City of Markham since 2014, first as the Manager of Capital and Infrastructure and currently as the Director of Operations.

Alice Lam

Director of Operations

City of Markham

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Markham
Operations Department
Deliveries
555 Miller Avenue
MARKHAM

Minimum Maintenance Standard O.Reg 239/02

"paved surface" means a surface with a wearing layer or layers of asphalt, concrete or asphalt emulsion

"pothole" means a hole in the surface of a roadway caused by any means, including wear or subsidence of the road surface or subsurface

Maintenance Standards

Patrolling : 3. (1) The standard for the frequency of patrolling of highways to check for conditions described in this Regulation is set out in the Table to this section. O. Reg. 23/10, s. 3 (1); O. Reg. 366/18, s. 3 (2).

Class of Highway	Patrolling Frequency
1	3 times every 7 days
2	2 times every 7 days
3	once every 7 days
4	once every 14 days
5	once every 30 days

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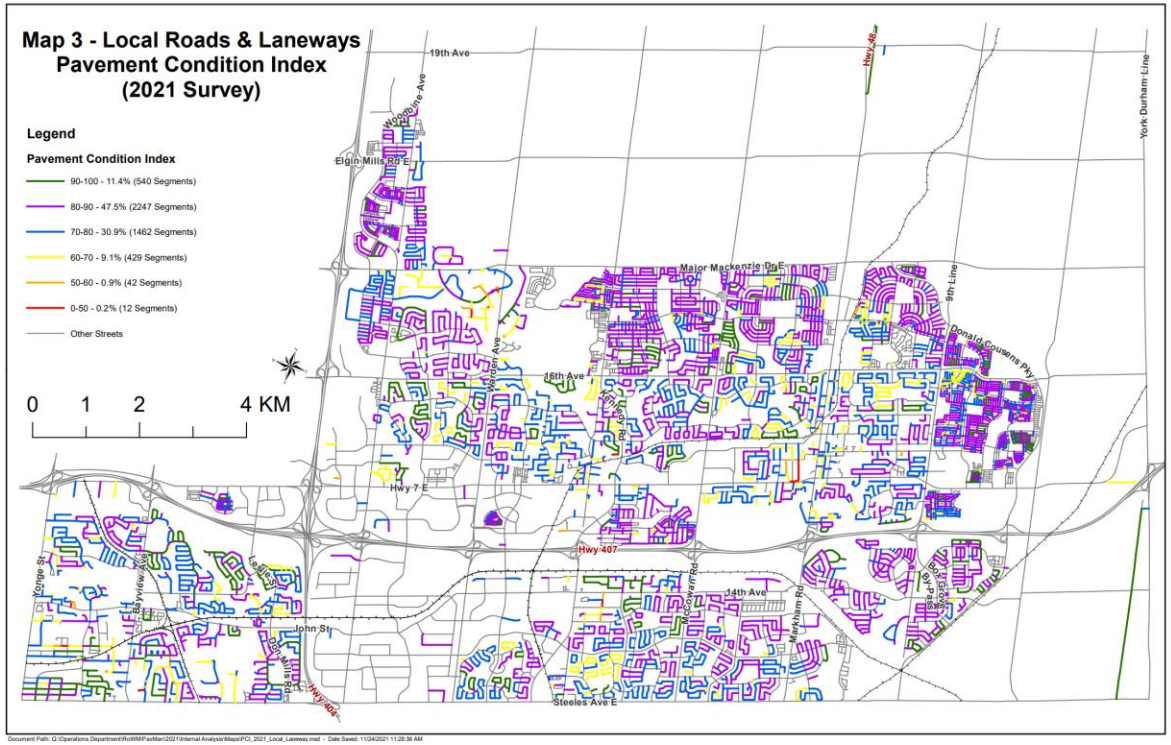
Pavement Management – Asset Management

O. Reg. 588/17

- Right technique, at the right time, on the right road to extend the life of the roads and reduce the overall annual cost of ownership
- 2,200+ lane km paved road
- Annual road preservation
- Annual road rehabilitation



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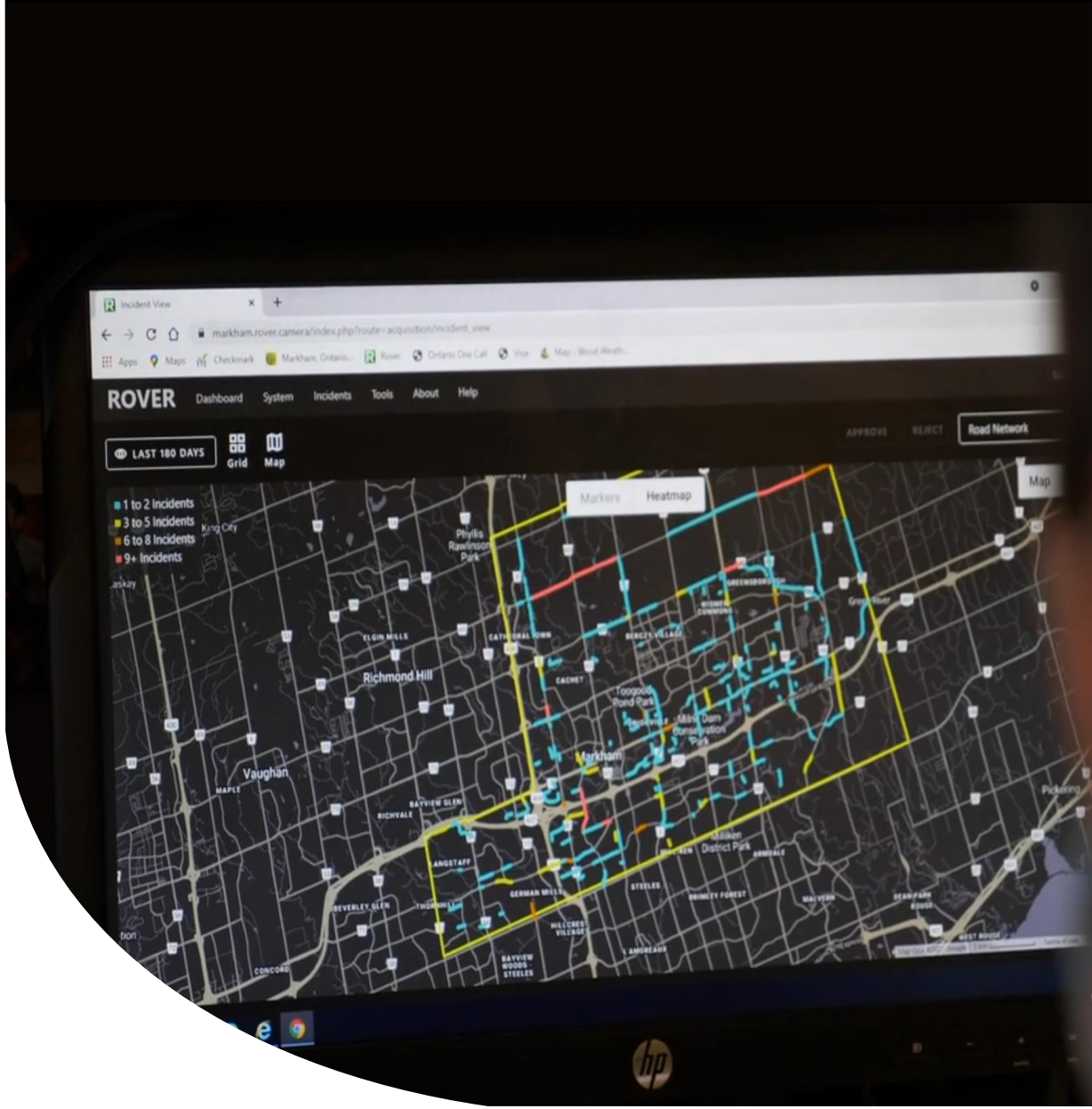
Collaboration Experience

- Collaboration – win win for Municipal Roads Operations and AI Industry
- Software Improvement through interactive response
- Record with photo and GPS location
- Staff/work scheduling
- Proactive repair -> long term saving



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Innovative maintenance practices awards

Technical Innovation of the Year

Engineering Project of the Year

IDC North America Smart Cities

OGRA John Niedra Better Practices Award

ROVER EXPANSION – BEYOND POTHOLES

PATROLLER

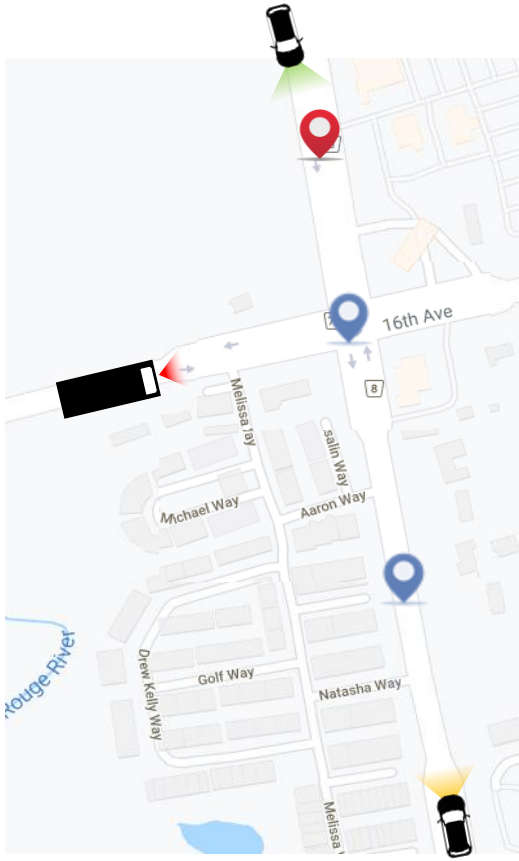
BYLAWS

WASTEMANAGEMENT

MANHOLE

SIGNAGE

POTHOLES



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Artificial Intelligence Camera & Cloud Service

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- Roy Tal has actively worked in the technology industry in for the past 17 years, serving in various technical roles.
- For the last 10 years, Roy has been the Chief Technology Officer of Visual Defence / CITYROVER.
- Roy is absolutely delighted with his role today using artificial intelligence to solve real world problems in the public works space.

Roy Tal

Chief Technology Officer

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imagine a world...

where citizens would not report any issues because they would be already fixed.

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1 Road Maintenance

and the road to a good state of repair

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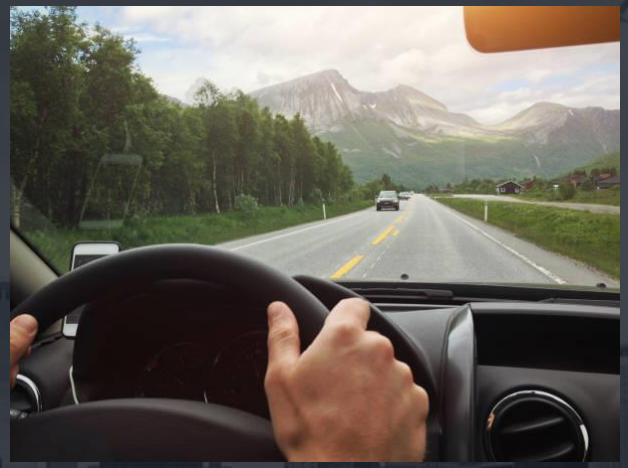
To Repair Issues
Cities Need to Find Them

Survey

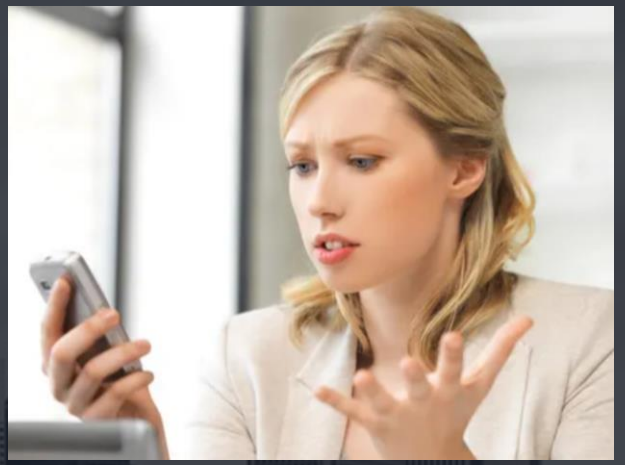
Proactive
Slowest & Most Expensive
Most Detailed
Infrequent (every 2-8 years)

Inspection / Patrol



Proactive
Slow & Expensive
Some Details are Missed
Frequent (daily – quarterly)

Reactive (Complaint Driven)



Reactive
Cheapest but Riskiest
Few Details
Public Dissatisfcation

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The road to a good state of repair

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2 CITYROVER 3rd Generation Technology

A brief overview of how CITYROVER AI works

OVIN
AUTONOMOUS • CONNECTED • ELECTRIC

Ontario

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Easy to use by design

All inclusive kit shipped

Installed by city staff

Then start driving

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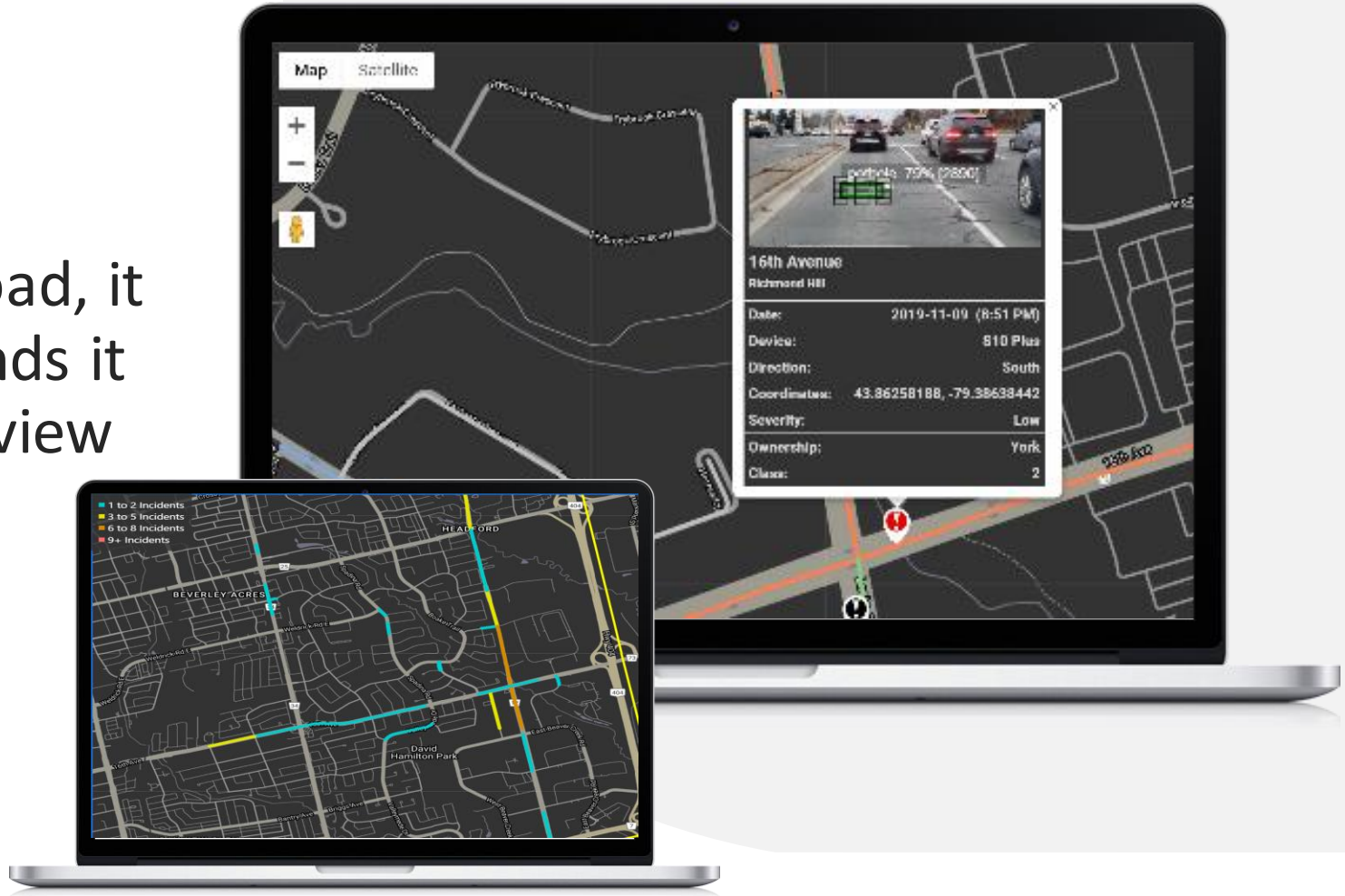
Simple access

Once the vehicle is on the road, it starts to collect data and sends it to the cloud where you can view it.



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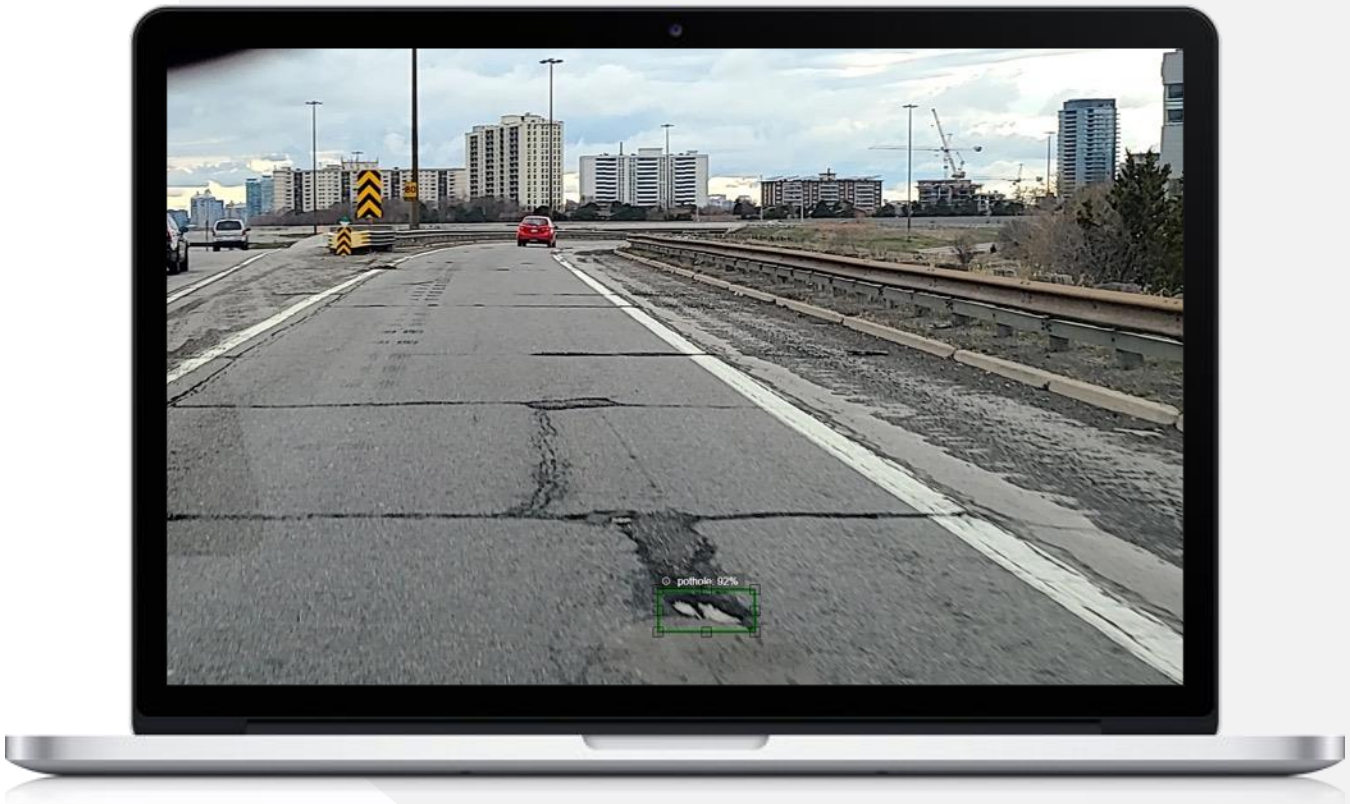
Your data includes:

- High resolution image
- GPS coordinates
- Nearest address
- Direction of travel
- Size and depth estimates
- Date and time



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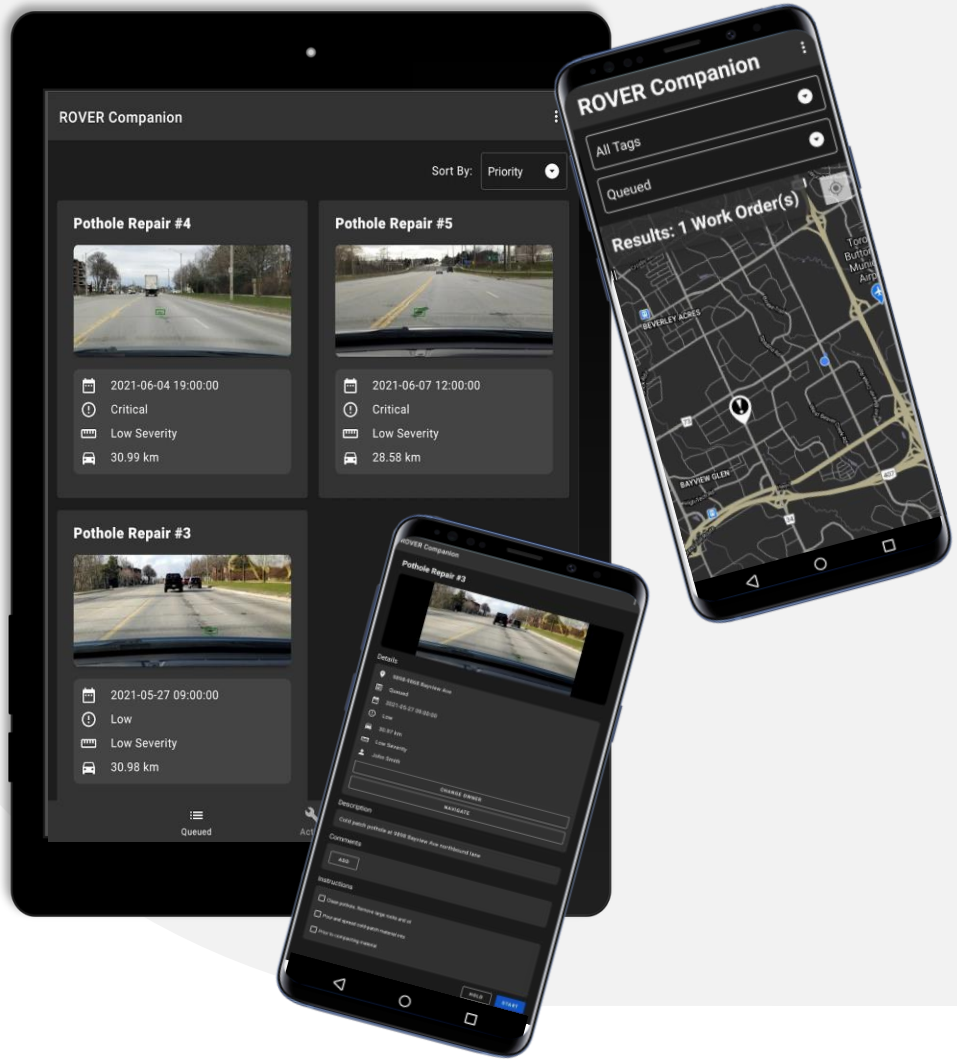
Actionable data

Service requests can be resolved within cloud system or through API integration to third party systems.



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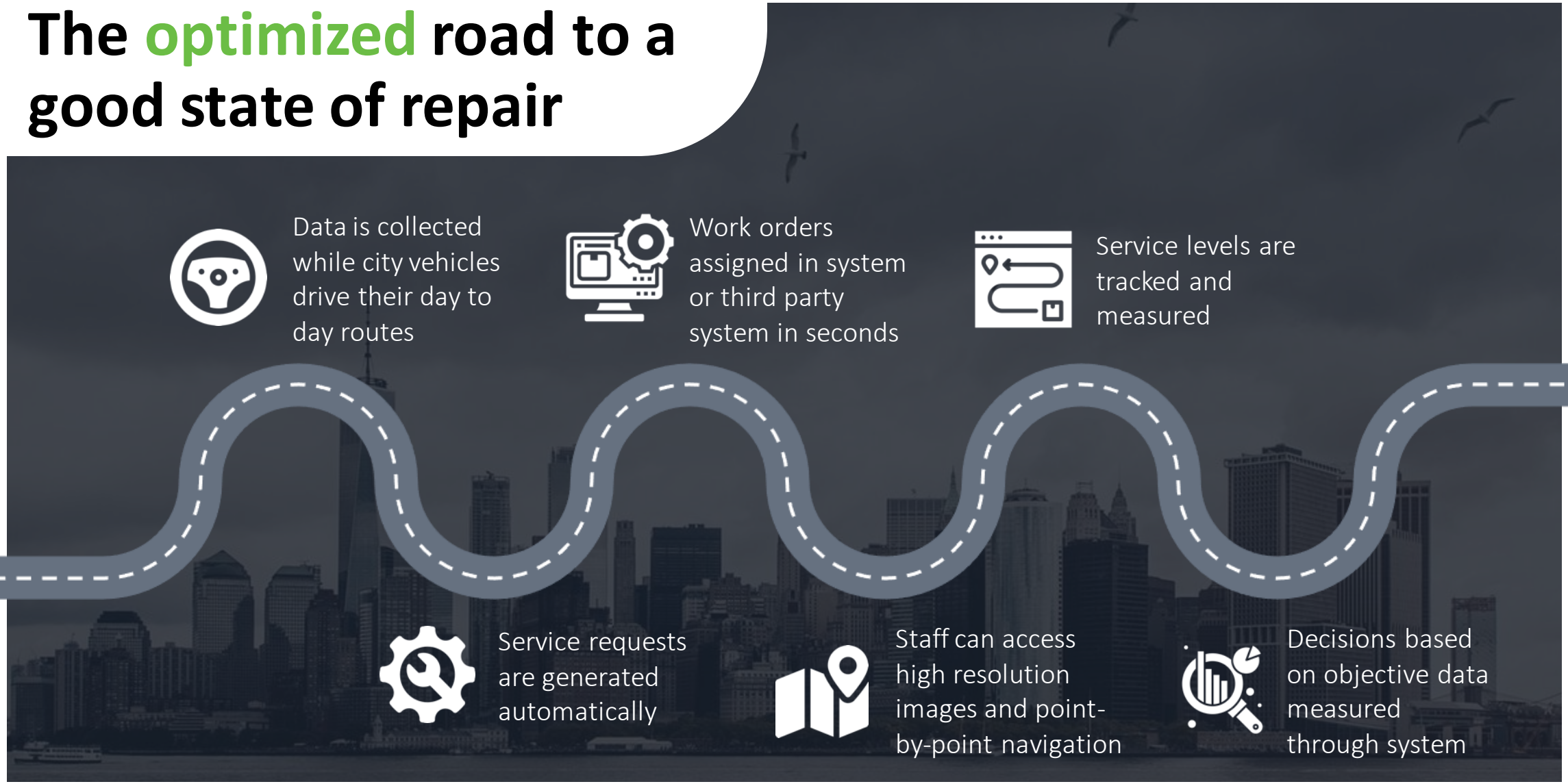
The optimized road to a good state of repair



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COMMUNITY

300+

MUNICIPALITIES

400%

More deficiencies identified by CityROVER

96%

Deficiencies captured before reported by public

97%

Repair crew productivity boost

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3 Next Generation Technology

What is next with CITYROVER AI

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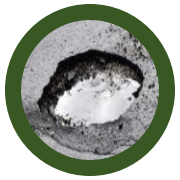
3RD GEN
CITYROVER



CITYROVER
FOR INCIDENTS

PULSE
FOR ASSETS

Generation
4

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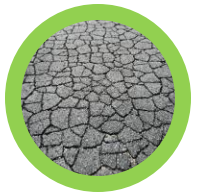
FOR TRANSIT

COMPANION
FOR WORK MGMT



INCIDENTS

DATA COLLECTION

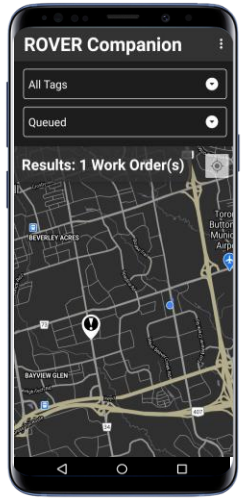
Respond | Prioritize

Cloud

Process | Analysis

REQUESTS

WORK ORDERS



Companion

Reports

API

Integrations

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AI Pavement Quality Rating

1. Based on ASTM 6433 Standard
2. Assessment of roads condition through visual surveys using the Pavement Condition Index (PCI) method of quantifying pavement condition
3. pavement condition index (PCI) is a numerical rating of the pavement condition that ranges from 0 to 100 with 0 being the worst possible condition (Failed) and 100 being the best possible condition (Excellent \ Good).

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AI Pavement Quality Rating

Deficiencies:

1. Pothole
2. Alligator Cracking
3. Block Cracking
4. Edge Cracking
5. Patching and Utility Cut
6. Raveling
7. Longitudinal Cracking
8. Transverse Cracking
9. Seal

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AI Pavement Quality Rating

- **Collect Data**
- Process Samples
- Aggregate Sub Segments
- Aggregate Segments
- Produce Reports

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AI Pavement Quality Rating

- Collect Data
- **Process Samples**
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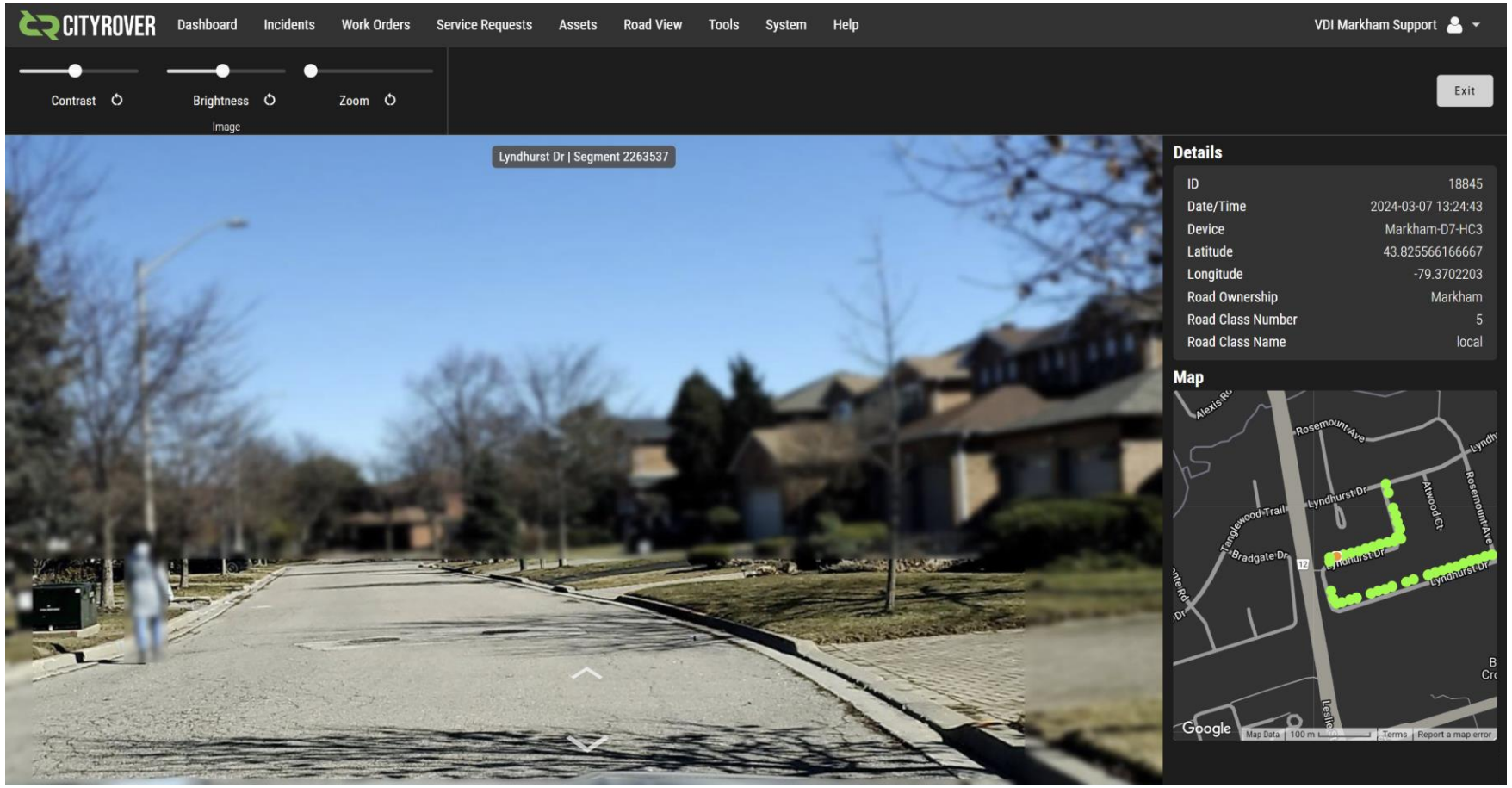

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AI Pavement Quality Rating

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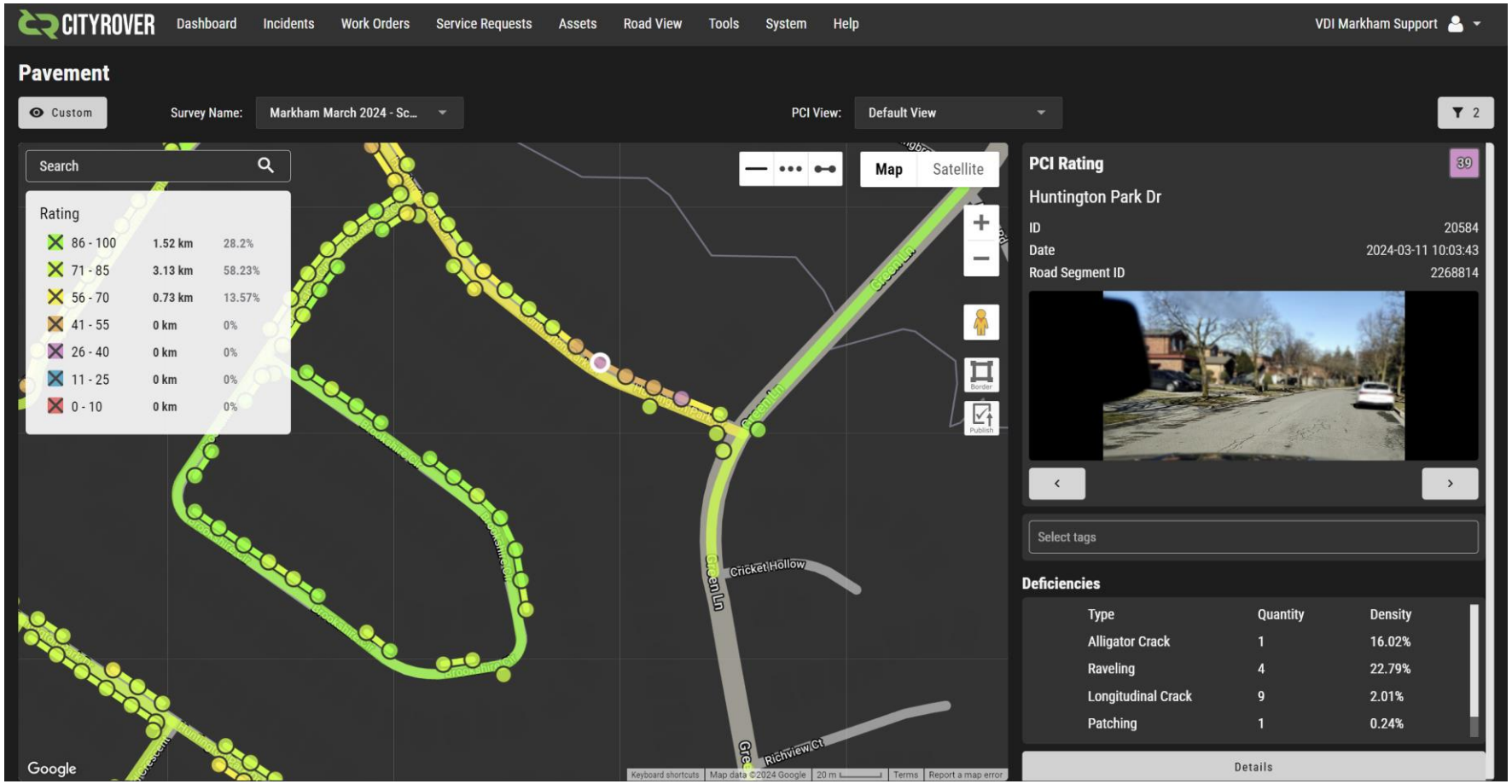

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AI Pavement Quality Rating

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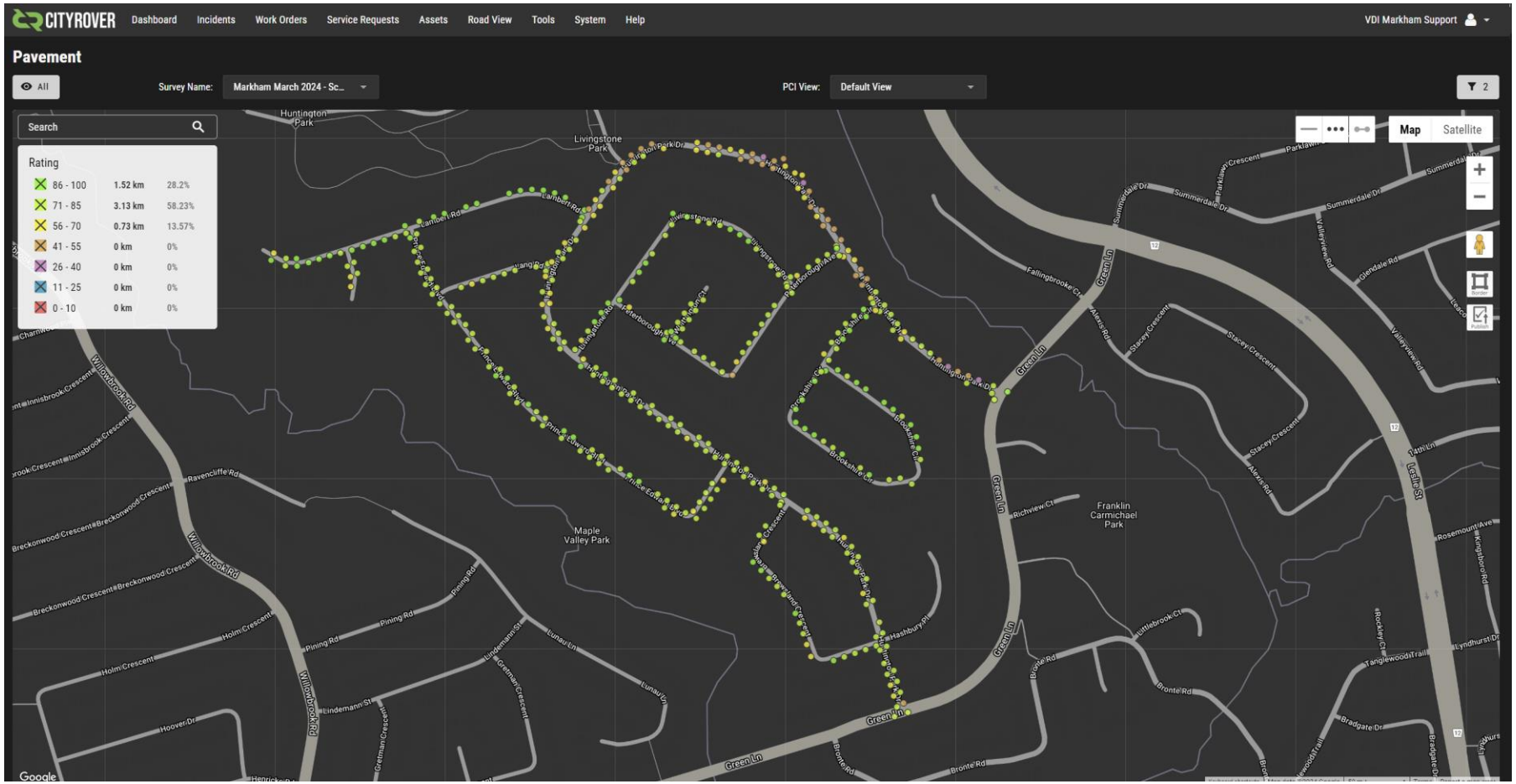

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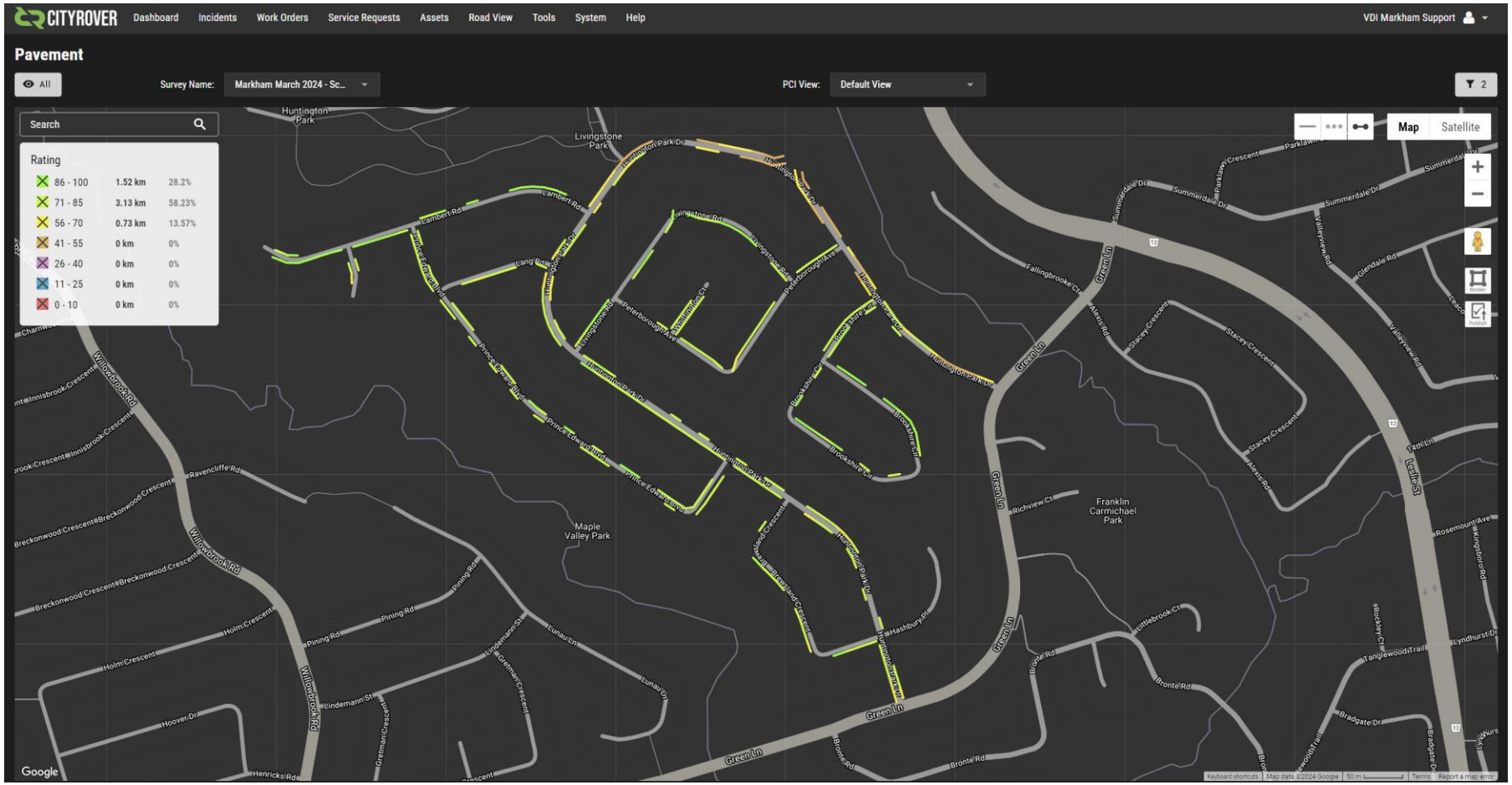
AI Pavement Quality Rating

- Collect Data
- Process Samples
- **Aggregate Sub Segments**
- Aggregate Segments
- Produce Reports



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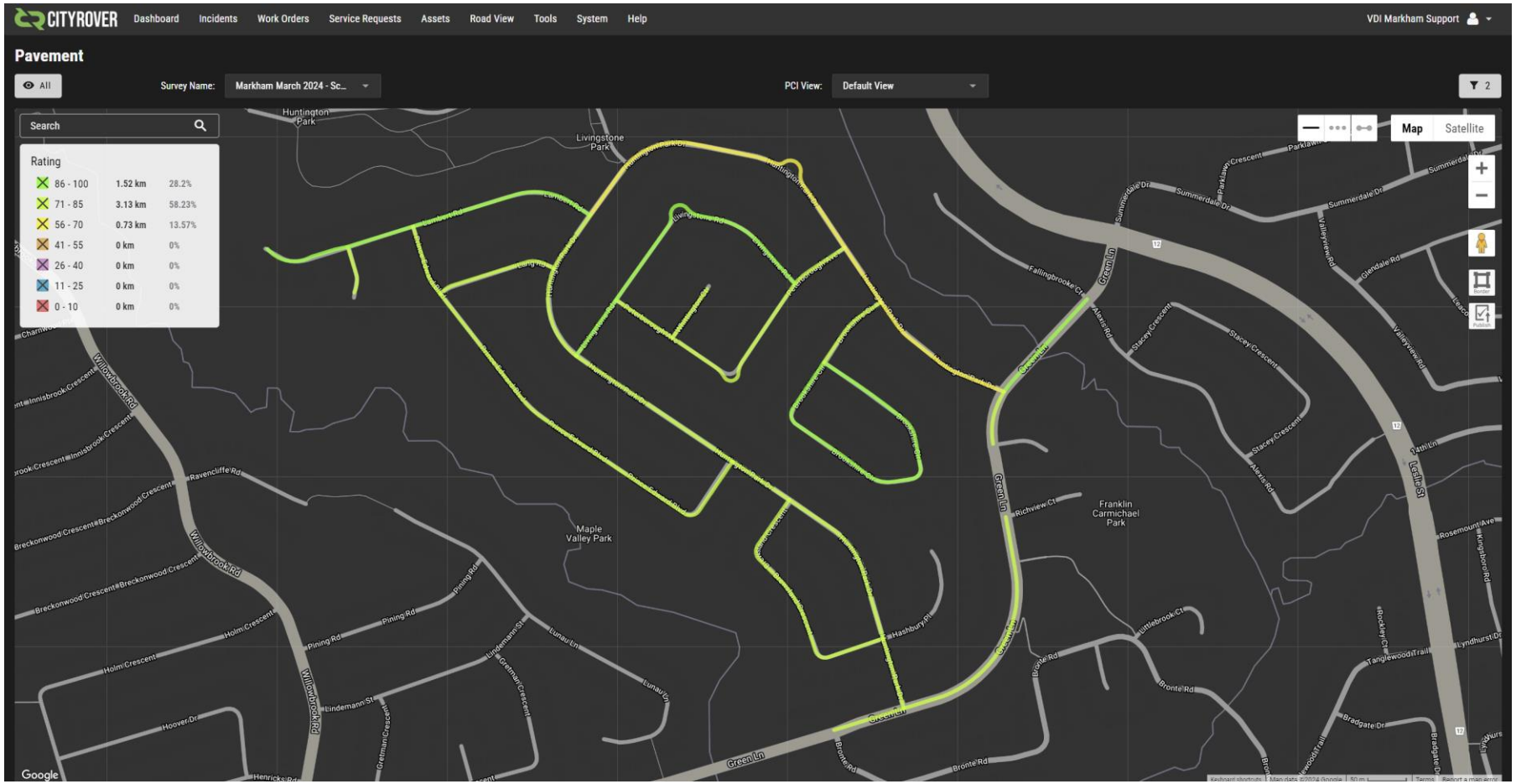
AI Pavement Quality Rating

- Collect Data
- Process Samples
- Aggregate Sub Segments
- **Aggregate Segments**
- Produce Reports



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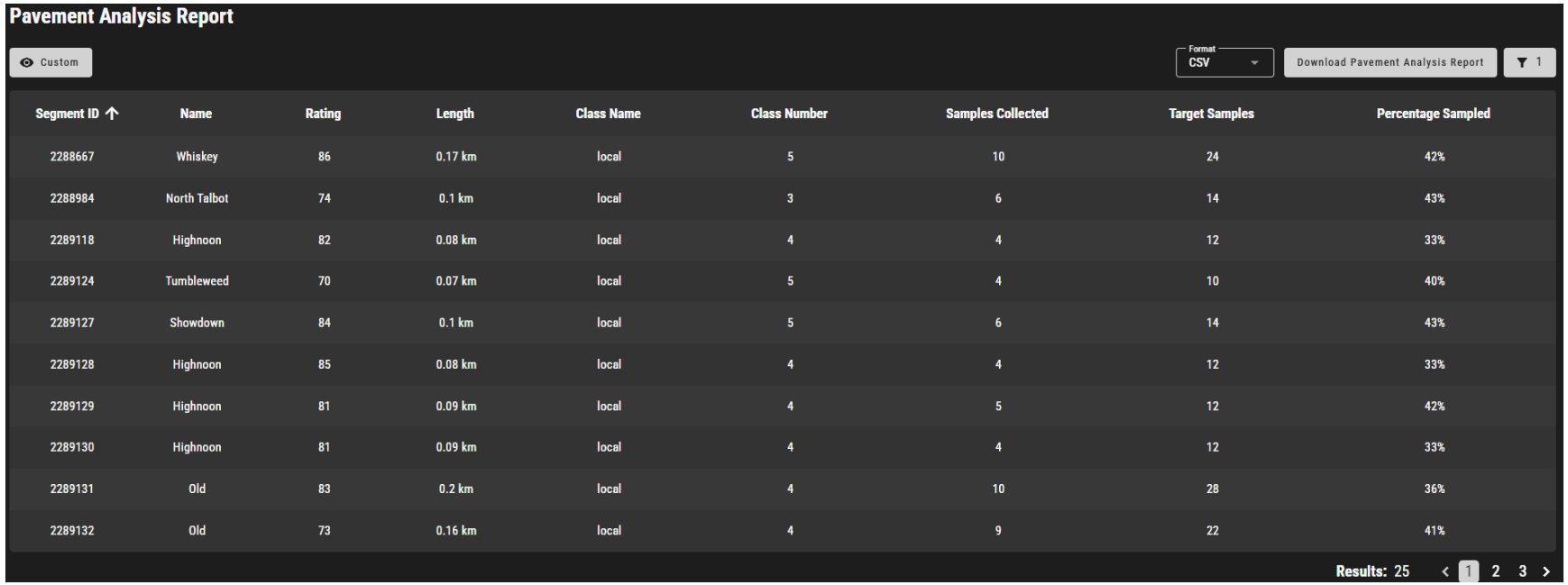
AI Pavement Quality Rating

- Collect Data
- Process Samples
- Aggregate Sub Segments
- Aggregate Segments
- **Produce Reports**



Pavement Analysis Report

Custom | Format: CSV | Download Pavement Analysis Report | 1

Segment ID	Name	Rating	Length	Class Name	Class Number	Samples Collected	Target Samples	Percentage Sampled
2288667	Whiskey	86	0.17 km	local	5	10	24	42%
2288984	North Talbot	74	0.1 km	local	3	6	14	43%
2289118	Highnoon	82	0.08 km	local	4	4	12	33%
2289124	Tumbleweed	70	0.07 km	local	5	4	10	40%
2289127	Showdown	84	0.1 km	local	5	6	14	43%
2289128	Highnoon	85	0.08 km	local	4	4	12	33%
2289129	Highnoon	81	0.09 km	local	4	5	12	42%
2289130	Highnoon	81	0.09 km	local	4	4	12	33%
2289131	Old	83	0.2 km	local	4	10	28	36%
2289132	Old	73	0.16 km	local	4	9	22	41%

Results: 25 | 1 2 3

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AI Pavement Quality Rating

- Collect Data
- Process Samples
- Aggregate Sub Segments
- Aggregate Segments
- **Produce Reports**

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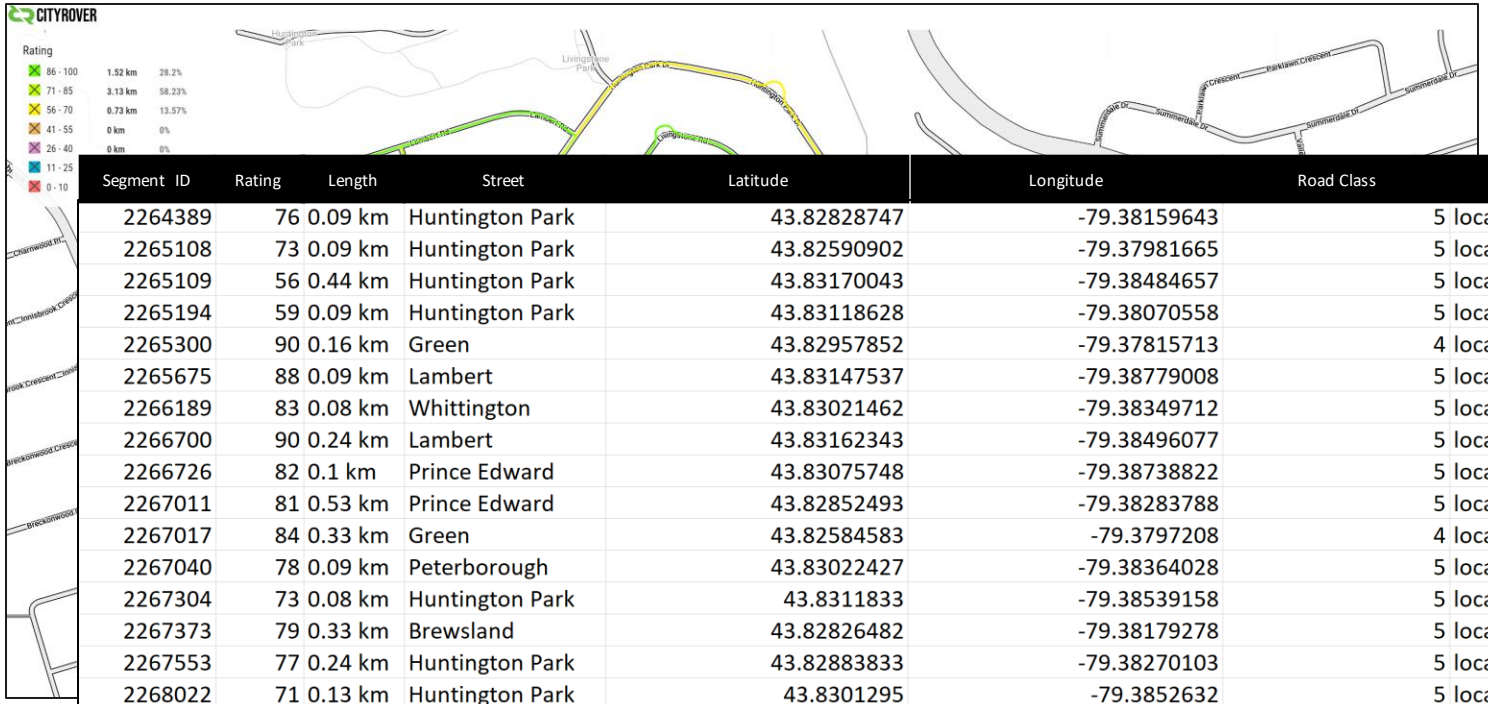
AI Pavement Quality Rating

- Collect Data
- Process Samples
- Aggregate Sub Segments
- Aggregate Segments
- **Produce Reports**



Segment ID	Rating	Length	Street	Latitude	Longitude	Road Class	Road Type
2264389	76	0.09 km	Huntington Park	43.82828747	-79.38159643	5	local
2265108	73	0.09 km	Huntington Park	43.82590902	-79.37981665	5	local
2265109	56	0.44 km	Huntington Park	43.83170043	-79.38484657	5	local
2265194	59	0.09 km	Huntington Park	43.83118628	-79.38070558	5	local
2265300	90	0.16 km	Green	43.82957852	-79.37815713	4	local
2265675	88	0.09 km	Lambert	43.83147537	-79.38779008	5	local
2266189	83	0.08 km	Whittington	43.83021462	-79.38349712	5	local
2266700	90	0.24 km	Lambert	43.83162343	-79.38496077	5	local
2266726	82	0.1 km	Prince Edward	43.83075748	-79.38738822	5	local
2267011	81	0.53 km	Prince Edward	43.82852493	-79.38283788	5	local
2267017	84	0.33 km	Green	43.82584583	-79.3797208	4	local
2267040	78	0.09 km	Peterborough	43.83022427	-79.38364028	5	local
2267304	73	0.08 km	Huntington Park	43.8311833	-79.38539158	5	local
2267373	79	0.33 km	Brewsland	43.82826482	-79.38179278	5	local
2267553	77	0.24 km	Huntington Park	43.82883833	-79.38270103	5	local
2268022	71	0.13 km	Huntington Park	43.8301295	-79.3852632	5	local
2268101	75	0.16 km	Lang	43.83105385	-79.38550745	5	local
2268186	89	0.11 km	Lambert	43.83112203	-79.3895334	5	local
2268418	88	0.48 km	Brookshire	43.82991515	-79.381047	5	local

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Questions?