

Distress Detection using Video Imaging and Artificial Intelligence



Juno

INTELLIGENCE

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Distress Detection using Video Imaging and Artificial Intelligence

Tauranga City Council and Lonrix



What is JunoIntelligence?



Technical challenges of videos and AI



How can we make use of the data?



What is JunoIntelligence?

Danielle Jarrett

What is JunoIntelligence



What?

Suite of AI tools designed to assist in road maintenance and management

How?

Automate detection Using **high quality** GPS videos

Valuable information about your network for future planning

Real time monitoring

Run Ad hoc video surveys proceeding natural events

Consistent and objective

Link all detections to your network



Why identify road distress?

Routine Maintenance (pothole repair, crack sealing)

Road Maintenance Management

Resurfacing / Repaving

FWP validation

Optimise Budgets

Plan Programmes

Efficiently, Accurately, Cost Effectively and Safely

- ✓ Detailed understanding of the state of your network and insight into network performance over time

Historically [Visual Inspections]

Resource and time intensive

Dangerous

Cumbersome

Subjective and prone to human error

Limited coverage

Changes in data requirements...

How can JI help bridge gaps in our data for informed decision making?



A closer look at JI Faults

JunoViewer Tauranga CC

Section: Tauranga City Council, C - CAMERON ROAD (SOUTHBOUND), From 7000 to 7515, All 7066

Video Lane: L1 Video: CAMERON ROAD (SOUTHBOUN...

Virtual FIT Image Viewer - JunoViewer Web - Google Chrome

secure.junoviewerweb.com/pages/mainviews/customviews/fullPageImagePlayer.aspx?VM=VirtualFIT#

Switch to panel

7068

Crocodile Cracking (A:1.01m2)

Bitumen Spot

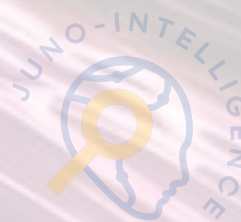
MaintPA-25/26, PreSeal_Rep-26/27, ChipSeal-27/28	
79	158
4.0	11.9
1354	1155
0.6	0.9
	2.08
	3.11
	1.1
	0.48
	3.5
	15.62

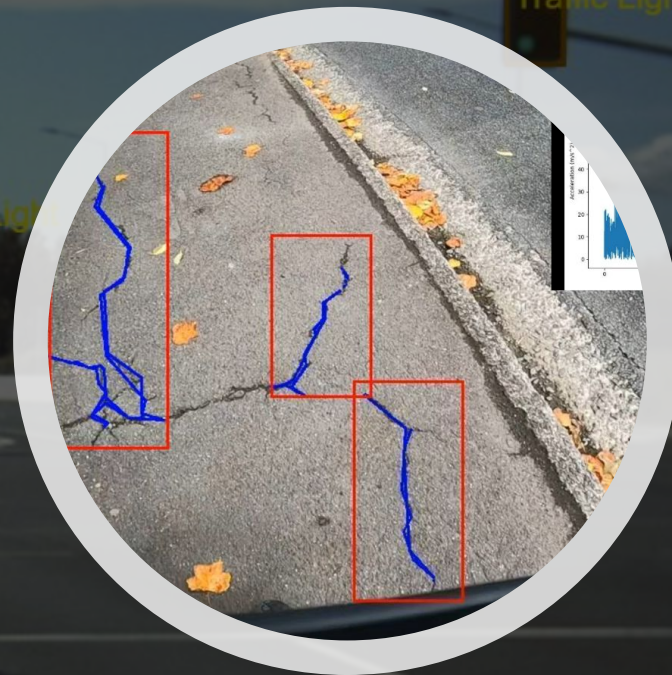
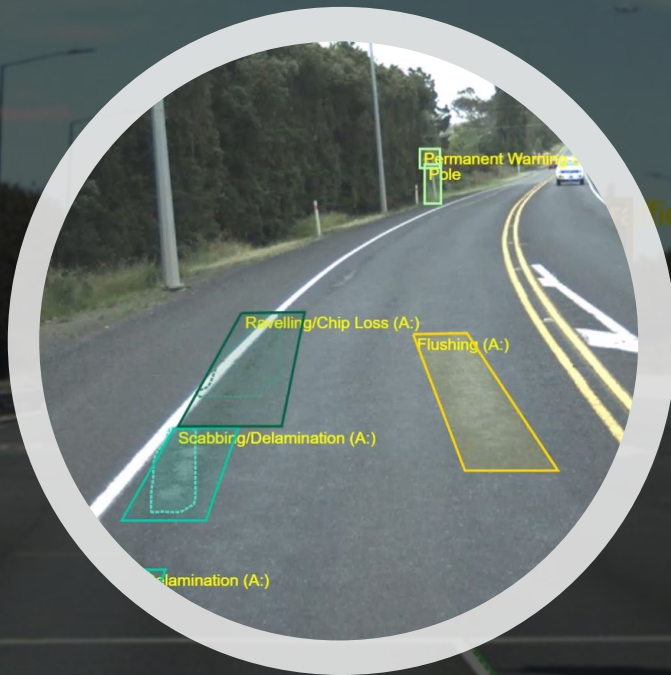
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Faults

- Shoving
- Potholes
- Patching
- Scabbing
- Ravelling
- Failed Patch
- Flushing
- Pumping
- Cracking Types
 - Longitudinal
 - Transverse
 - Crocodile
- ...





What else can you do with video?

Assets | Lane Marking | Footpaths

Benefits of digital road inspections

Ease of Coverage

Accuracy

Speed of Insight

Improved Safety

Cost Reduction

Convenience

Archived snapshot of your roads

Data Analysis for optimised decision making

Technical Challenges of videos and AI

Michael Mayo

Image Quality

- The quality of videos recorded greatly impact on the detection quality
- Ideal conditions for video capture are **soft light (no sharp shadows)** with a **good exposure** and no **obscuring objects**
- Some examples of good quality images on the right



Survey ID: DENNY_HULME_DRIVE_10468111	Description: GRENADA STREET RAB to GLOUCESTER ROAD RAB	Direction: Inc
Date: 13/04/23	Survey Start: 0	Alt: 13.88
Lon: 176.235832438	Lat: -37.679990636	Chn: 26.1
Speed: 28	Dst: 26.1	



Examples of poor image quality



- Poor quality images can increase **false detections**, e.g. shadows detected as flushing

Examples of poor image quality



- Poor quality images can increase **missed detections**, e.g. sunflare

Examples of poor image quality



Examples of poor image quality



Camera Setup

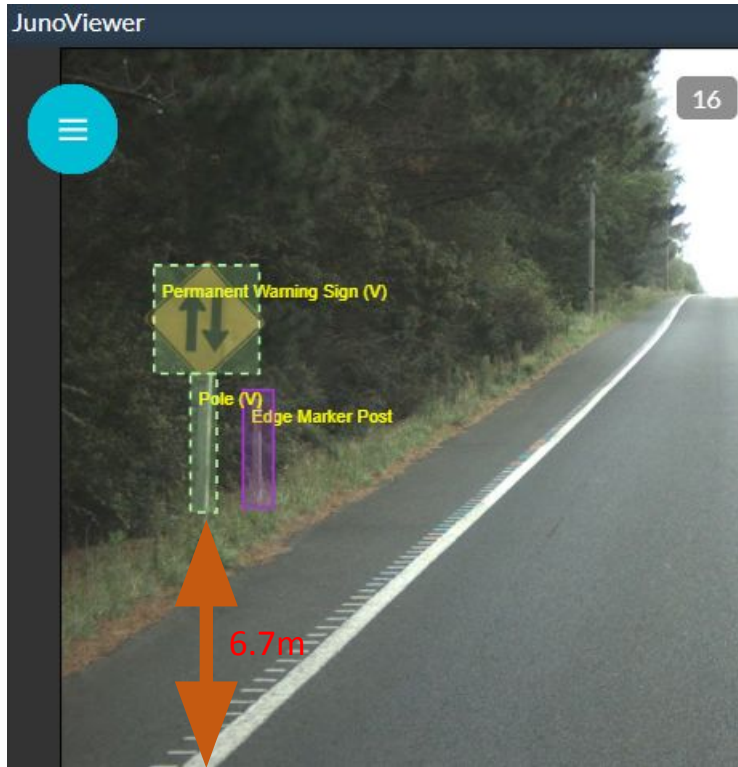
- Consistent camera **angle** and **height** are necessary so that **measurements are as accurate as possible**
- Each video needs **camera calibration factors** calculated
- We usually do this for only a few videos per survey so the camera needs to be in a **fixed position for all videos**
- Example shows two images with different x axis calibration: the lane width is 3.5 or 3m of width in both cases, but pixel width in the image is significantly different



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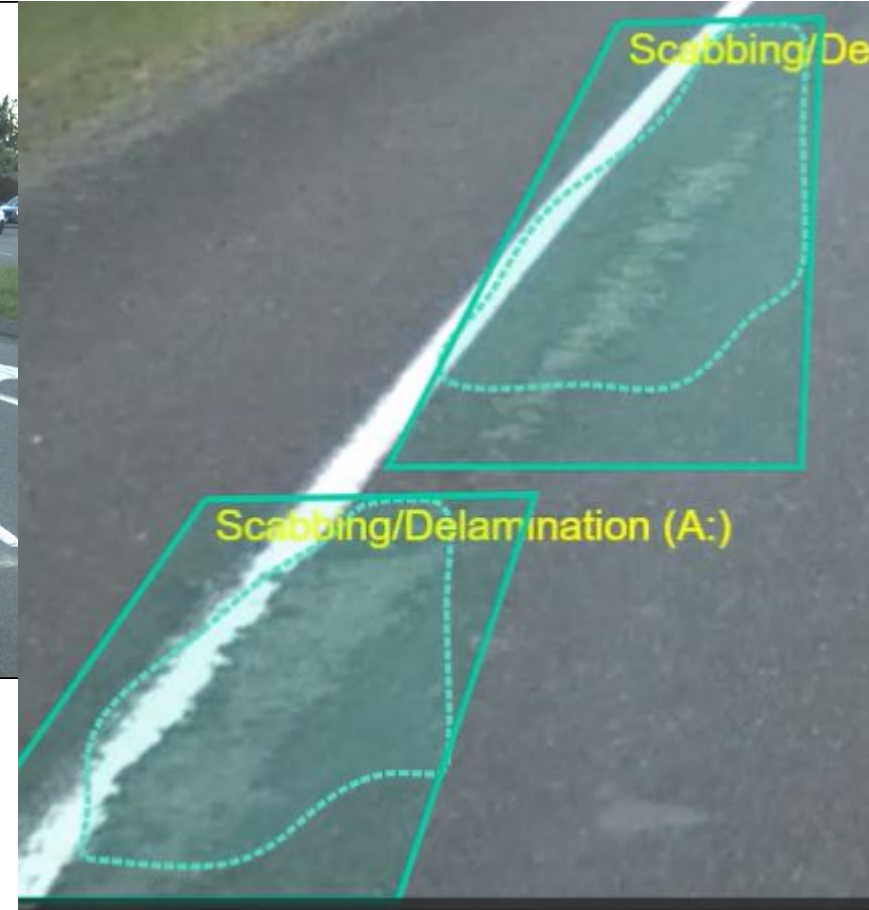
Camera Setup



Location of the sign at 22.7 can be estimated using correct calibration factors.



Linear length of a longitudinal crack can also be estimated using correct calibration factors. This one is about 6m.



Area of certain faults can be well estimated using correct calibration factors in JV.

Camera Setup

- Sample measurement validation using calibration factors from a different video (above) and one from the same video (below)
- Ground truth MOTSAM guidelines from 2011 state the Give Way triangle should be 1.8m wide



How can we make use of JI data?

Sikander Singh

Potential Use of JI Faults Data by TCC:

- **Maintenance Programs and Validating RAMM Dispatches**
- **Three-Year Reseal/Rehab Forward Work Program**
- Desktop Field Validation
- Strategic Planning of Physical and Operational Activities
- Ongoing Fault Comparison and Deterioration Analysis:



Virtual Field Validation

JunoViewer Tauranga CC Analyse - FWP - Modelling - Projects - Manage - Tools -

Section: Tauranga City Council, C - CAMERON ROAD (NORTHBOUND), From 0 to 2929, All 36 Video Lane: L1 Video: CAMERON ROAD (NORTH

fwp_aug2023_upper_v2 (ALL)	RehabAC_UH-23/24	RehabAC_UH-23/24	RehabAC...	RehabAC_UH-23/24	RehabAC...	RehabAC_UH-23/24	ThinAC-23/24, RehabAC_UH-31/32
Naasra 90th	96		155	62	88	54	56
Rut Mean in LVP 90th	5.0		6.0	5.0	5.3	2.0	2.7
FIWD DO 90th	734		1122	1370	1056	1513	1036
fm_potholes (ALL)	2.26	0	2.71	0			
Texture Mean in Lane 90th	0.7		0.6	0.6			
fm_cracks_gen (ALL)	0.2	1.73	0.85	1.74			
fm_cracks_struc (ALL)	3.47	2.79	2.34	3.28			
fm_surf_defects (ALL)	1.03	0.01	1.12	1			
fm_deformation (ALL)	0.05	0	0.33	0.12			
fm_struc_fail (ALL)	3.6	0.07	3.6	0.84			
surf_age (ALL)	15.36	9.25	15.45	7.42			
Removed_Marking							
Traffic_Counter							
Service_Covers							
Flushing							
Detritus							
Construction_Joint							
Edge_Break							
Shoving/Deformation							
Failed_Patch							
Mechanical_Damage							
Patching							
Patched_Pothole							
Ravelling/Chip_Loss							
Pothole							
Scabbing/Delamination							
Sealed_Crack/Joint							
Pumping_Cracking							
Transverse_Cracking							
Longitudinal_Cracking							
Crocodile_Cracking							
Bitumen Spot							

JunoViewer Switch To Window

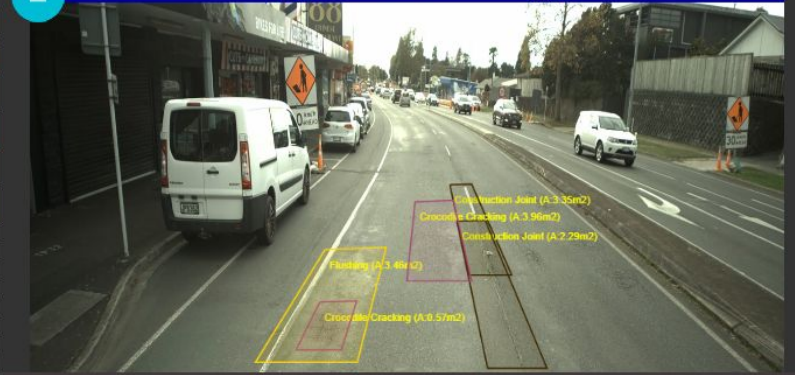
Survey ID: CAMERON_ROAD_(NORTHBOUND)_06978LL2 Description: SEVENTEENTH AVENUE (LHS) to NINTH AVENUE RAB

Survey Start: 0 Direction: Inc

Date: 14/05/23 Ab: 31.91

Lat: -37.706438672 18 On: 15.0

Lon: 174.0



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Centralised Data Analysis

The screenshot displays the JunoViewer software interface for Tauranga City Council. The main map shows a street network with various colored overlays representing different data layers. A central window displays a video stripmap of a road section, with a red box highlighting a specific area labeled "Crocodile Cracking (A-1.3m2)".

Network: Tauranga City Council

Sections:

- #1 - AURIKURA WAY TO RAKIRAKI WAY ACCESSWAY
- #10 - ORANGE LANE TO 109 CASTLEWOLD
- #10 - ORANGE LANE TO RESERVE
- #10 - PRINCESS ROAD TO REAR 108 BALMEDIERIDGE
- #11 - SOLOMON AROUND

Plot Sections:

Show layer feedback pop-up:

Enable FWP:

FWP Version: FWP_Master_Nov2021

FWP Alignment Version:

Show FWP by: Category Type Year

Select FWP data from: 6 selected

Category:

- Project
- Rehab
- Seal
- ThinAC

Stripmap: Stripmap

Special Layers:

- Naasra
- ADT
- LWP Rut
- ONRC
- LaneMeanTexture
- UrbanOrRural
- FWD Curve
- FWD D0
- Aligator Cracks
- L&T Cracks
- Joints
- Potholes
- Surface Expiry
- Surface Material

FWP Years @ FWP_Master_Nov2021:

- 2023
- 2024
- 2025
- 2026
- 2027
- 2028

Maintenance:

- Mechanical_Damage (4)
- Longitudinal_Cracking (16)
- Crocodile_Cracking (29)
- Flushing (1)
- Detritus (2)
- Failed_Patch (1)
- Construction_Joint (300)
- Scabbing/Delamination (6)

Questions

