Road Asset Management (RAM)
Georgia
12-15th September 2022

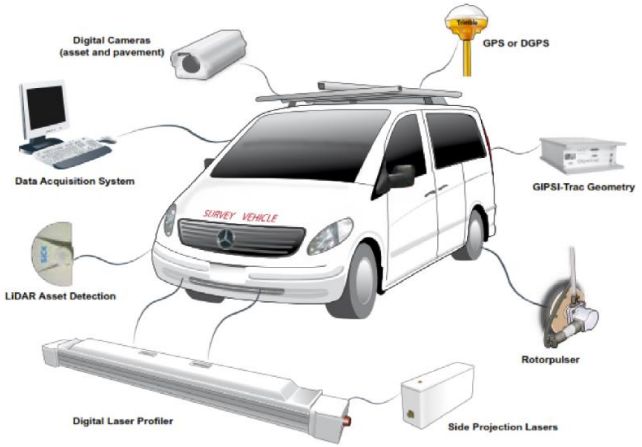
Session: Asset Condition Data Collection for Major Asset Types

Dr Theuns Henning
PhD (Civil Eng), CMEngNZ, IntPE.
t.henning@auckland.ac.nz

Agenda

- Data Collection as part of the Road Asset Management System decision and reporting cycle
- Types of data
- Data collection techniques
- Data collection principles and strategies

Source ALPTEST



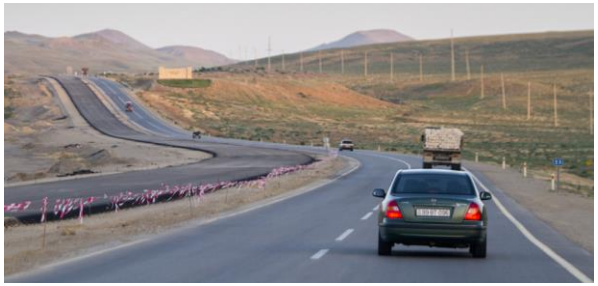
Source PIARC

Why do we need the data?

How many assets do I manage?

What is the value of the assets

How are the assets performing?



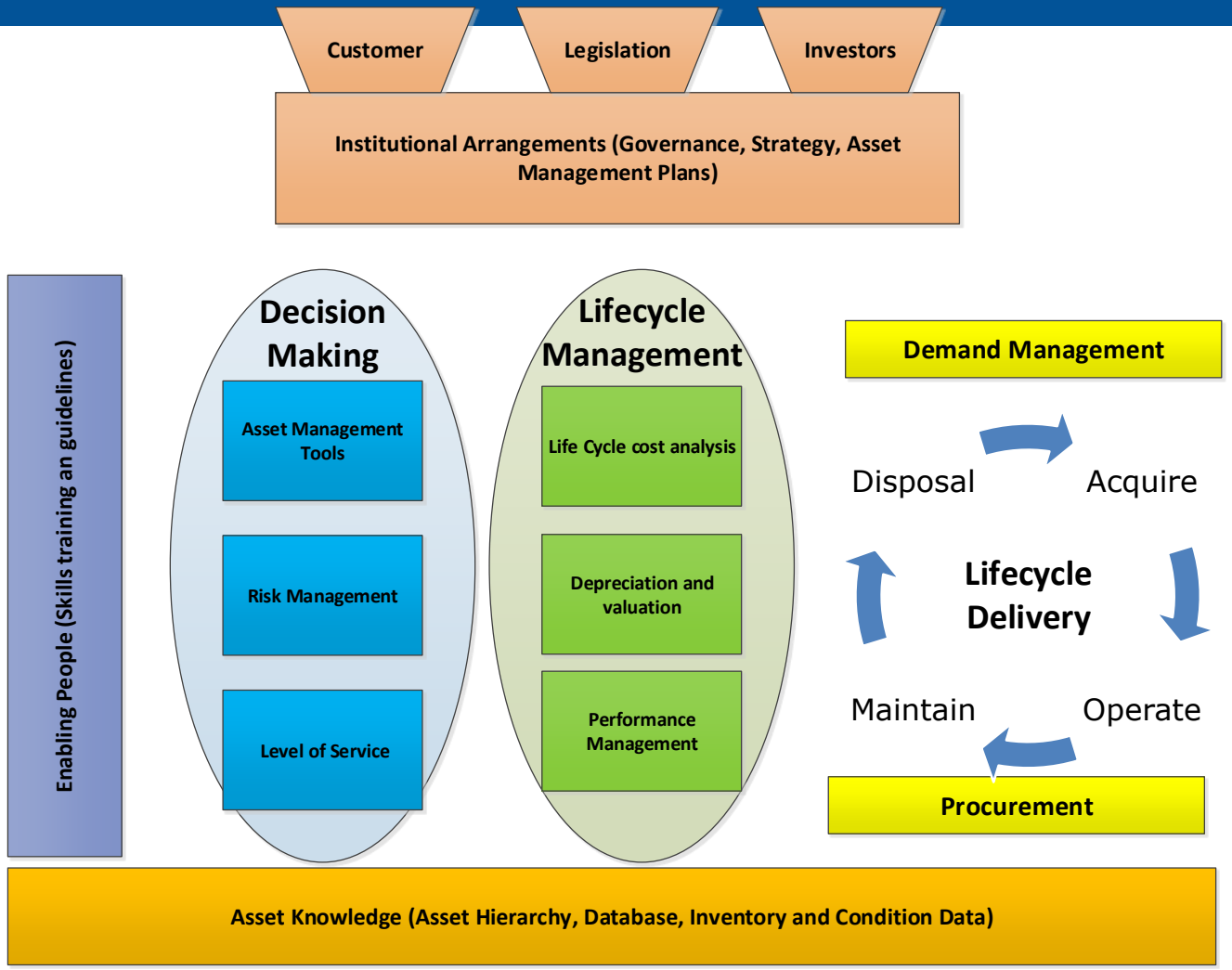
How safe and comfortable are the road user experience?

What maintenance works are required

What are the long-term investment needs?

Photo: Macos.livejournal.com

All RAM Activities Depends on Good Data



Types of Data We Collect

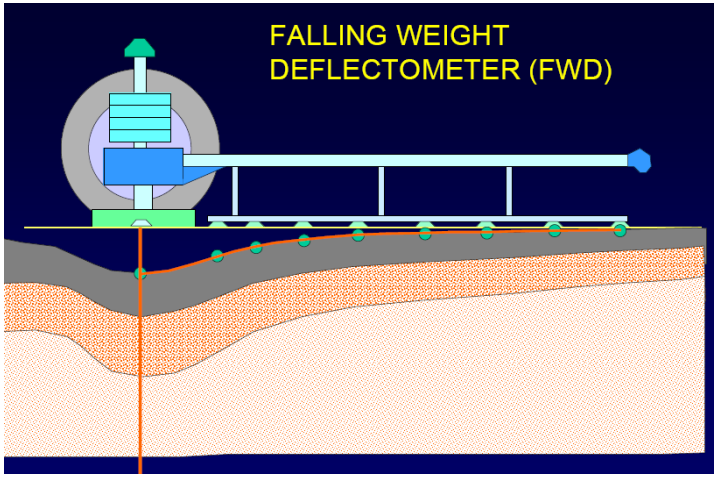
- Inventory
  - Physical elements of system
  - Do not change markedly over time
- Condition
  - Change over time
  - Require regular (or irregular) monitoring
- Maintenance Records and Cost
  - Cost and detailed works recorded for maintenance
- Use
  - Traffic Volumes
  - Truck numbers and loading
- Customer Feedback
  - User satisfaction surveys
  - Records from complaint system

Pavement Data Framework

Evaluation Type	Pavement Function	Pavement Characteristics	Examples of Indicators and Indexes
Functional Evaluation	Serviceability	Roughness	IRI
			PSI
			QI
	Safety	Texture	Macrotexture
			Microtexture
		Skid Resistance	Skid Resistance Coefficient
			IFI
Structural Evaluation	Structural Capacity	Mechanical Properties	Deflections
		Pavement Distress	Cracking
			Surface Defects
			Profile Deformations
Referencing System		(Location of Pavement Characteristic Data)	

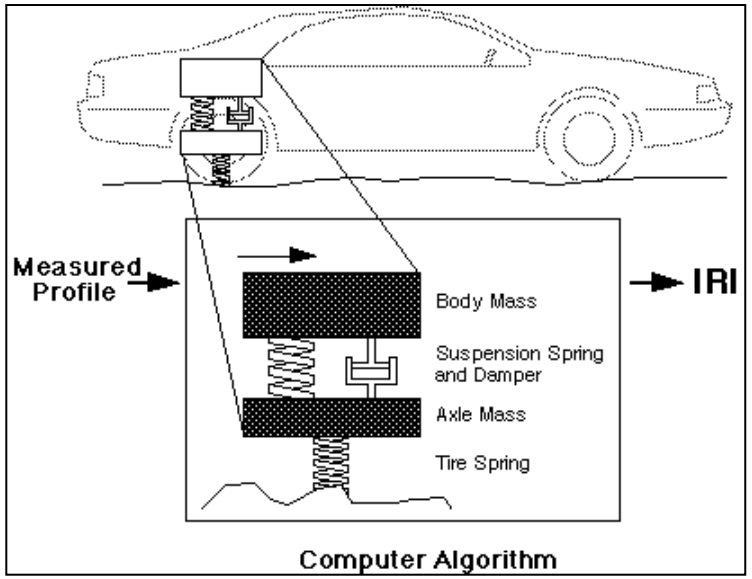
Pavement Strength Testing

- Falling Weight Reflectometers
- Rolling Deflection Measurements

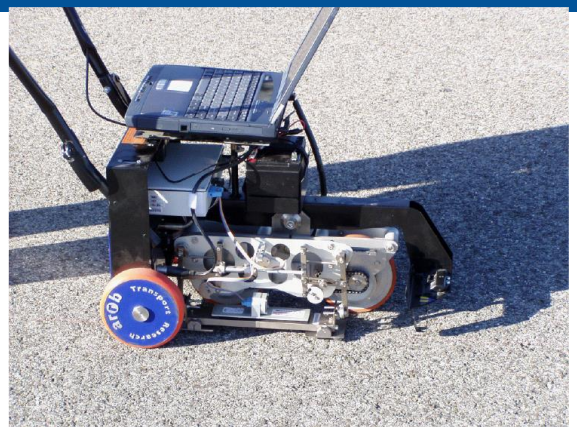


Roughness- International Roughness Index

- ‘Bumpiness’ of road
- Usually related to serviceability but also reflects structural deterioration
- Affects VOC, safety, comfort, speed
- Most commonly expressed as IRI
- IRI simulates response of ‘Quarter-car’ to road profile

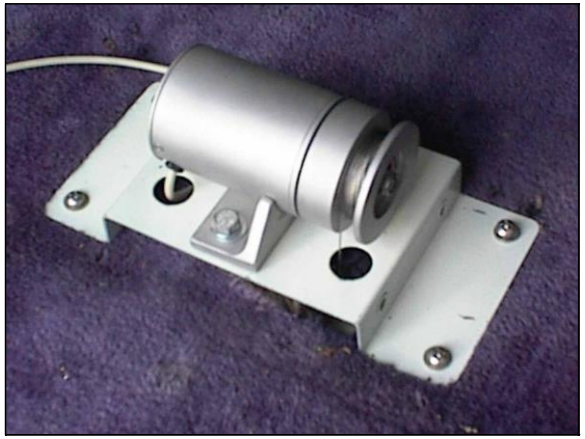


Roughness Measurements



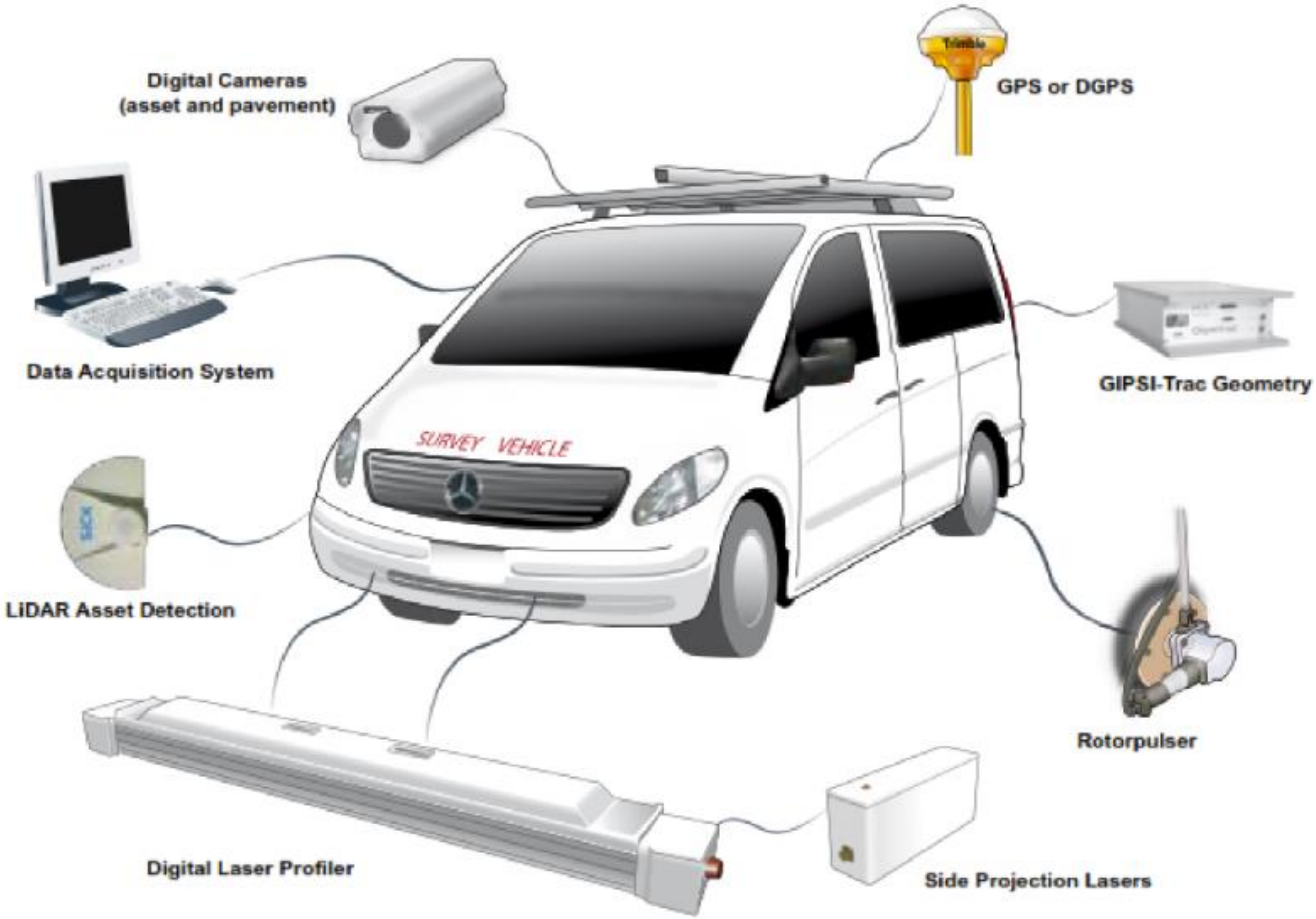
Class I

Class III



Source World Bank

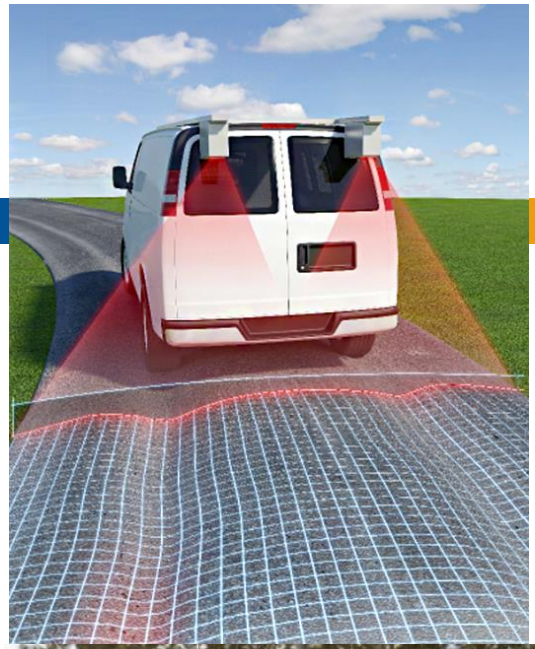
Class 1 - Laser



Source PIARC

Scanning Lasers

- Road crack detection
- Road rut detection Road macro-texture evaluation (MPD)
- Road ravelling evaluation Pothole detection (area, depth, volume)
- Detection of lane markings, shoulders, drop-offs, curbs
- Detection of joints and faulting on concrete roads
- Longitudinal Profile and Roughness (IRI) Road Geometry (gradient, cross-slope and radius of curvature) – optional



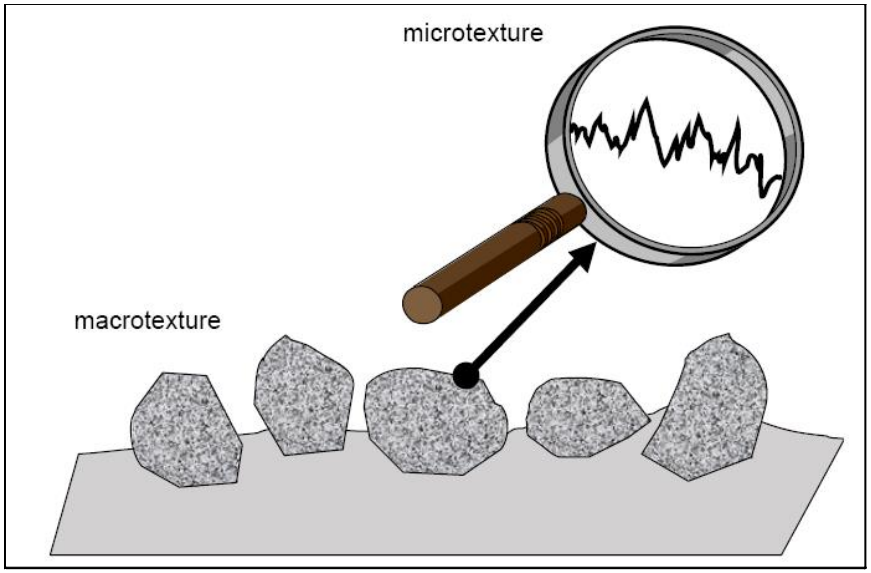
Source: DCL & ROMDAS

Rut Depths

- Measured using discrete sensors (ultrasonic/laser) or line
- Data analyzed to simulate rut depth under a straight edge
- Systematic under-recording with discrete sensors

Texture

- Measurements focus on microtexture and macrotexture
- High speed measurements use lasers
- Expressed as the Mean Profile Depths



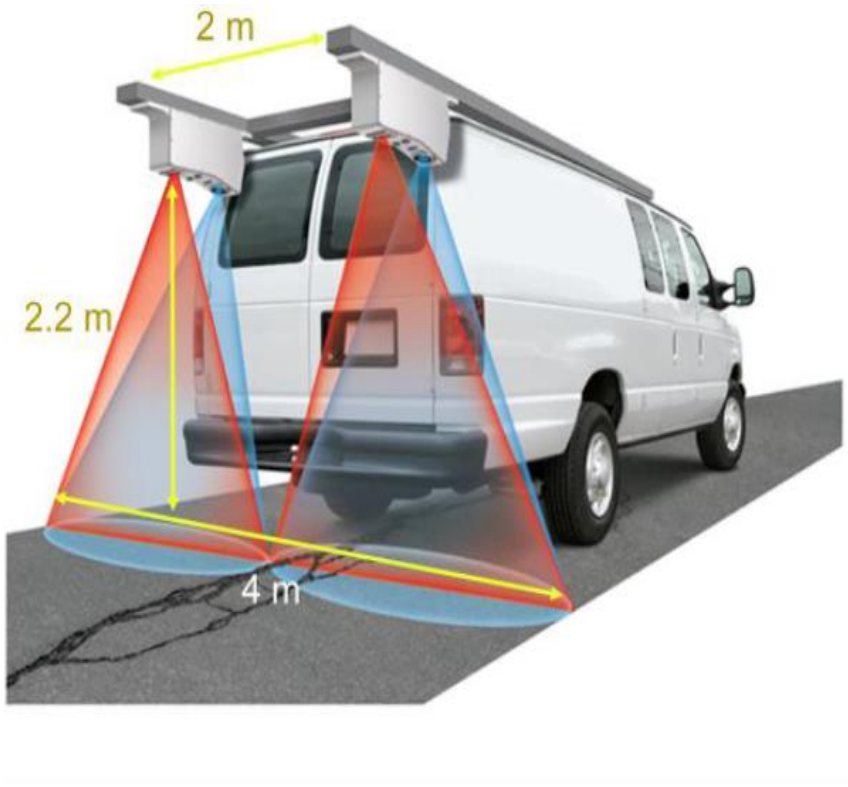
Skid Resistance Measurements

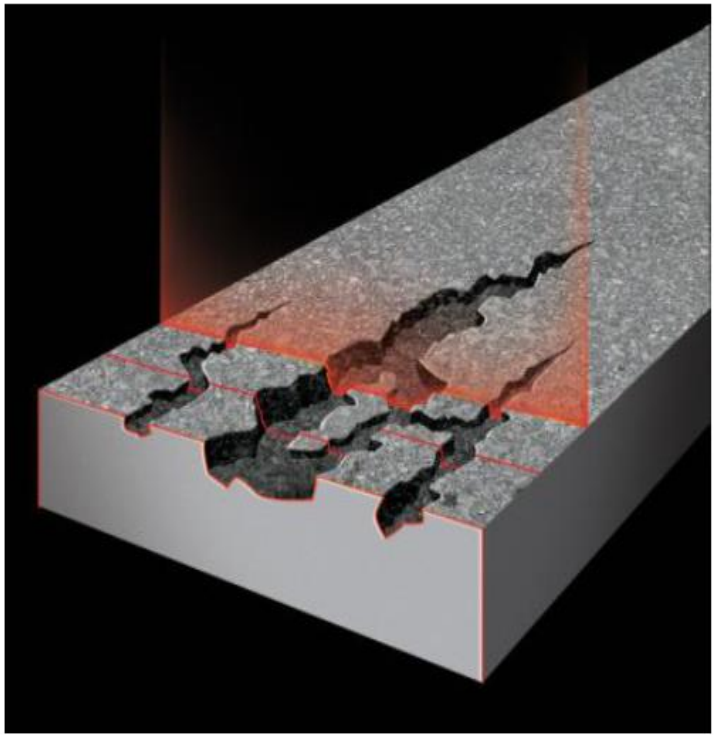
Griptester

British Pendulum

SCRIM

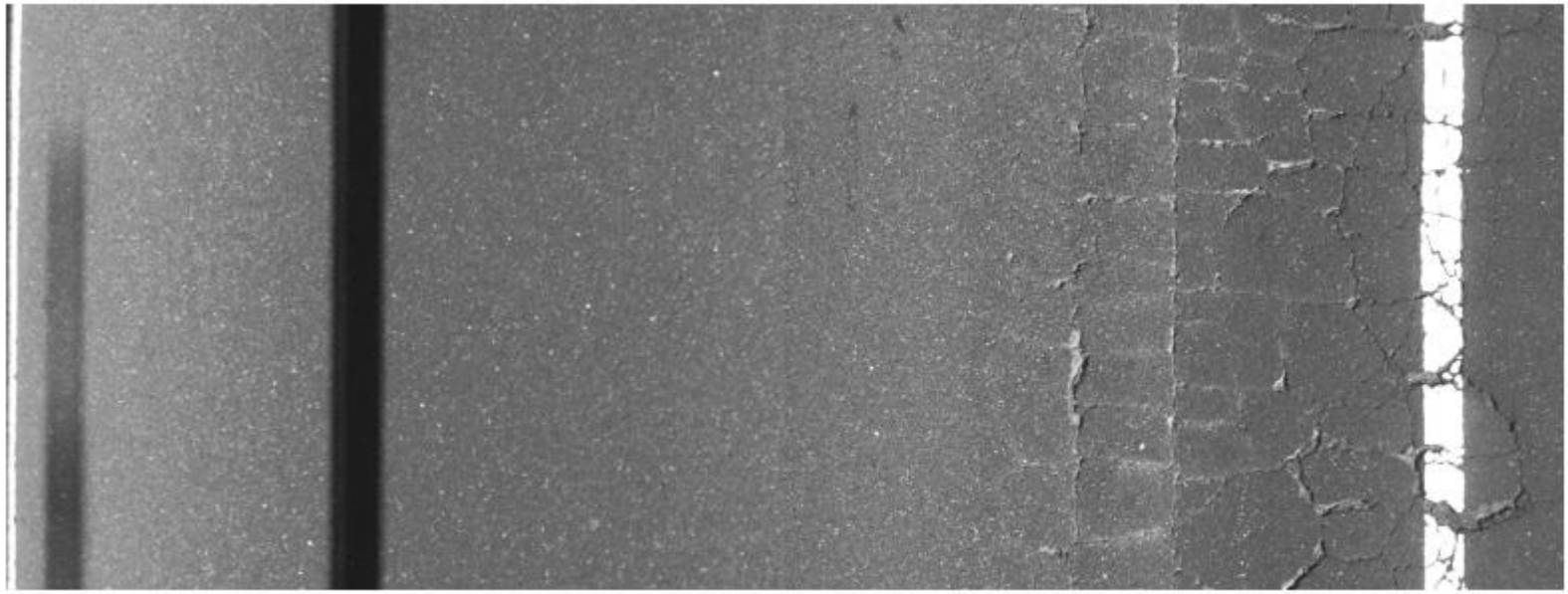
Laser Crack Measurement System (LCMS)





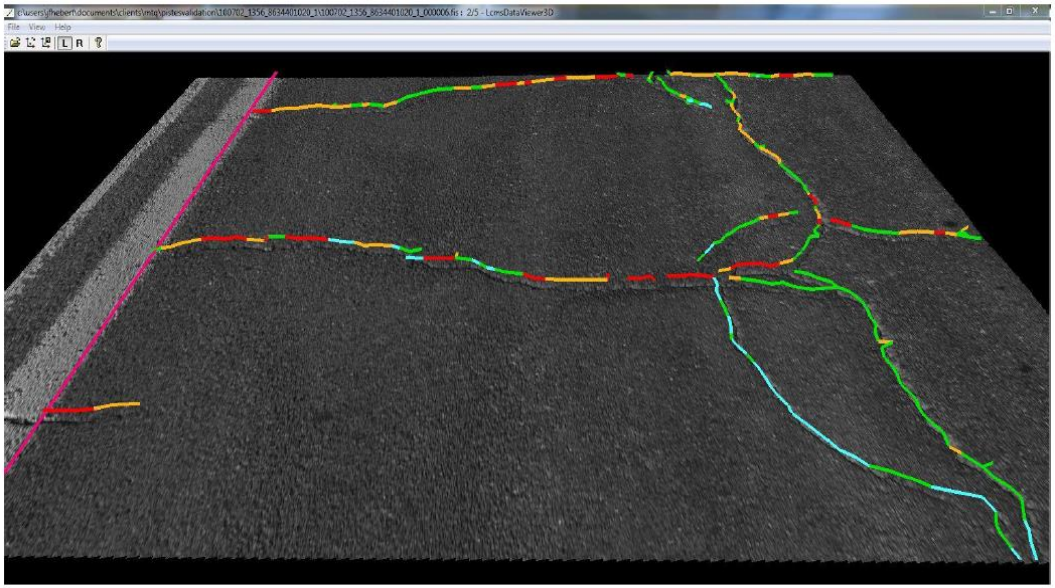
Source Pavemetrics

Images from Line Scan

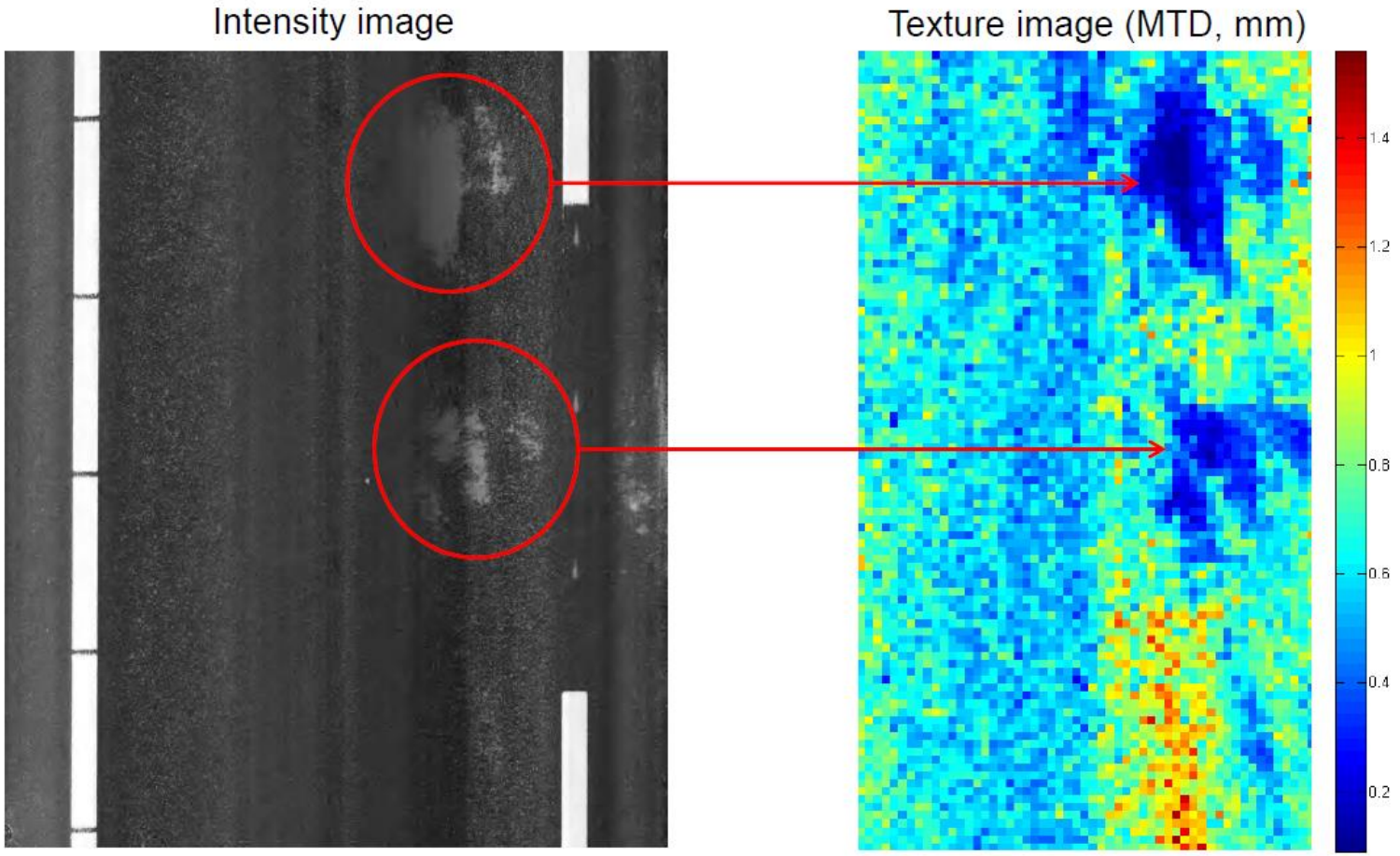


Source ARRB

LCMS Processing of Data

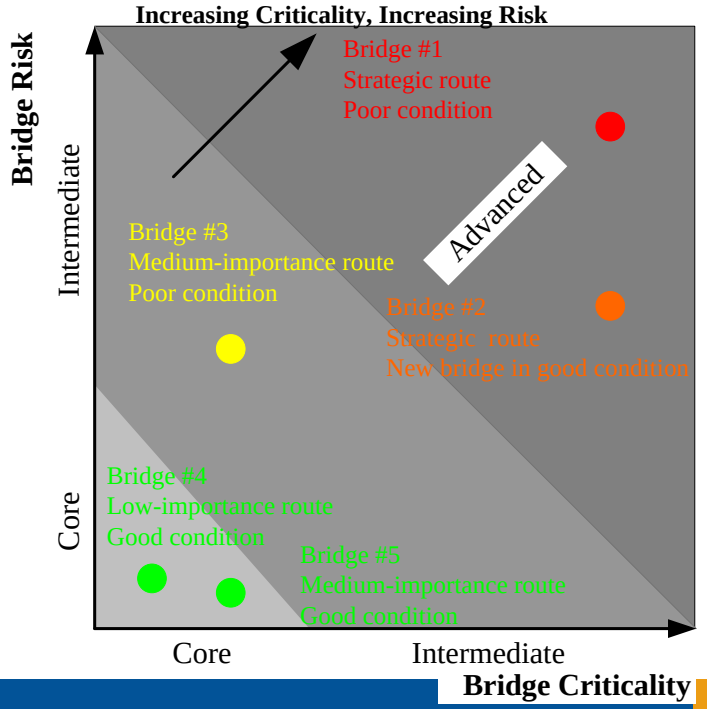


Detecting Bleeding



Risk and Criticality Based Strategy for Bridge Data Collection

Data collection regime	Failure risk-criticality band	Assessment resolution	Data collection tools
Core	Low	Aggregate bridge risk	Visual inspections every 3-6 years Limited, usually reactive SHM
Intermediate	Intermediate	Individual limit state risks	Visual inspections every 2-3 years Some, reactive and proactive SHM
Advanced	High	Individual structural or functional element risks	Visual inspections every 1-2 years Extensive, mostly proactive SHM



Bridge Data Collection Regimes

DEVELOPMENT LEVEL	VI, TESTING AND MONITORING PROGRAMME	INSPECTION FREQUENCY		
		General inspections	Special inspections	Routine surveillance inspections
Core	Routine surveillance inspections, general inspections, programmed special inspections, reactive NDE	3–6 years	As identified during general inspection process or as planned by the bridge asset manager (eg access to critical elements or components)	As required by contractual arrangement (eg annual)
Intermediate	Routine surveillance inspections, general inspections, programmed special inspections, reactive and proactive NDE, network SHM data	2–3 years		
Advanced	Routine surveillance inspections, general inspections, programmed special inspections, reactive and proactive NDE, network SHM and bridge-specific SHM	1–2 years		

Bridge Inspections

NZ TRANSPORT AGENCY	Bridge routine surveillance inspection report		Supplier logo		
Network area:	Bridge name:		Highway:	RP:	BSN:
Marking code 0 = Not inspected 1 = Satisfactory 2 = Monitor next inspection R = Routine maintenance *(provide comment)* S = Structural maintenance *(provide comment & photo)* N = Not applicable	Bridge type:		Map ref. (easting):		
	Deck width:		Map ref. (northing):		
	Total bridge length:		Owner:		
	Spans:		RCA:		
Inspector:		Reviewer:			
Date (mth/yr):		Date (mth/yr):			

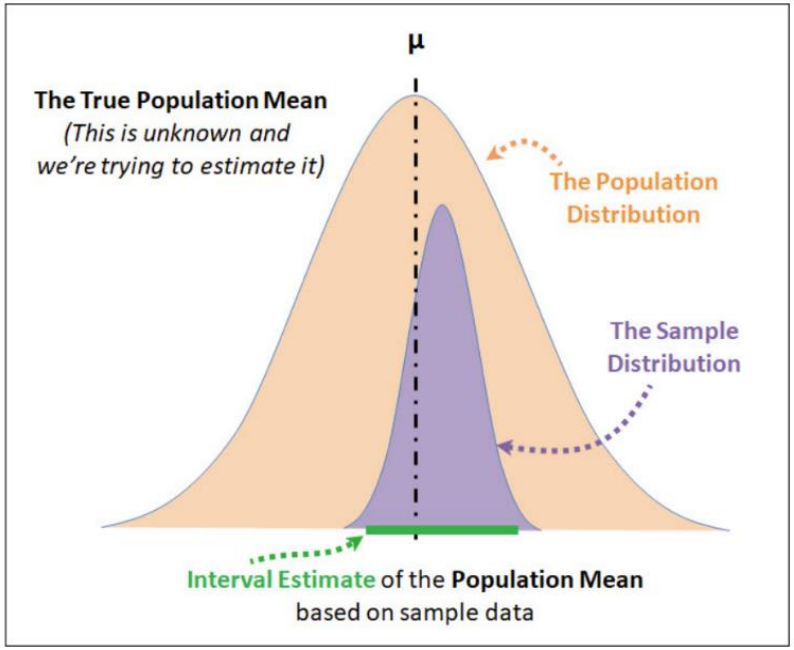
Item	Description	Mark	Defect Description/Remedial Work	Priority (H/M/L)	Estimated Cost
1	Signs				
2	Superstructure/deck drainage				
3	Movement/expansion joints				
4	Carriageway and deck surfacing				
5	Approach adequacy				
6	Guardrail/handrail				
7	Road marking				
8	Flood debris/vegetation				
9	Scour/erosion				
10	Other defects				

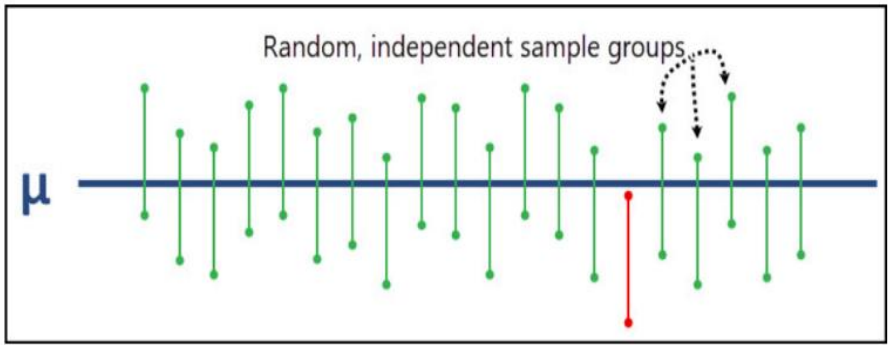
Photo –FlyKit

Photo -Inspecterra

Principles for sampling data collection

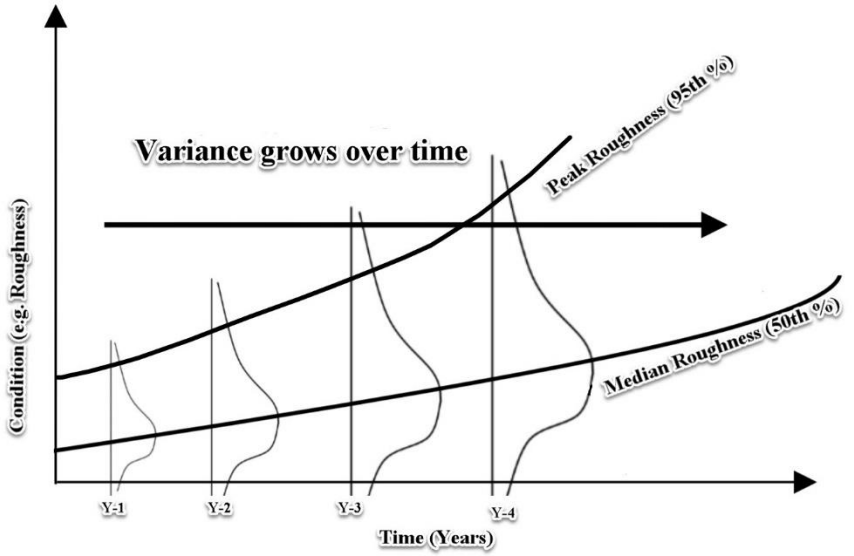
- We cannot always afford to measure a 100% of the network
- For some applications it is ok, depending on what you use the data for

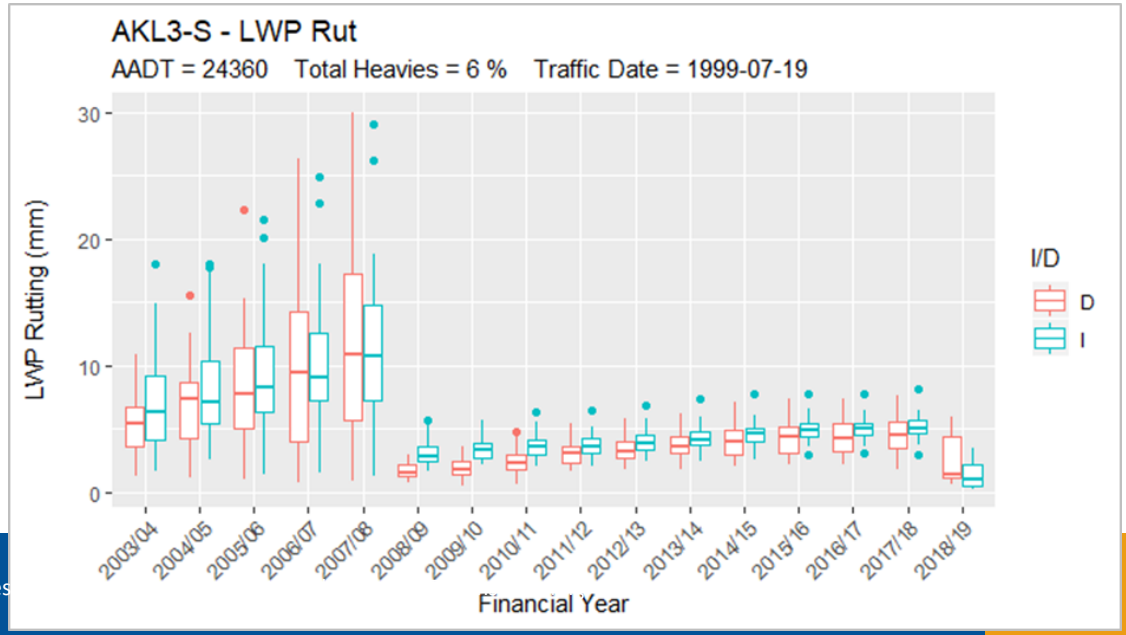




Survey Frequency

- Network Level
  - Frequent enough to detect
- Project level
  - Have to catch a site before it bec
- Frequency is a function of:
  - Section criticality
  - Network planning cycle

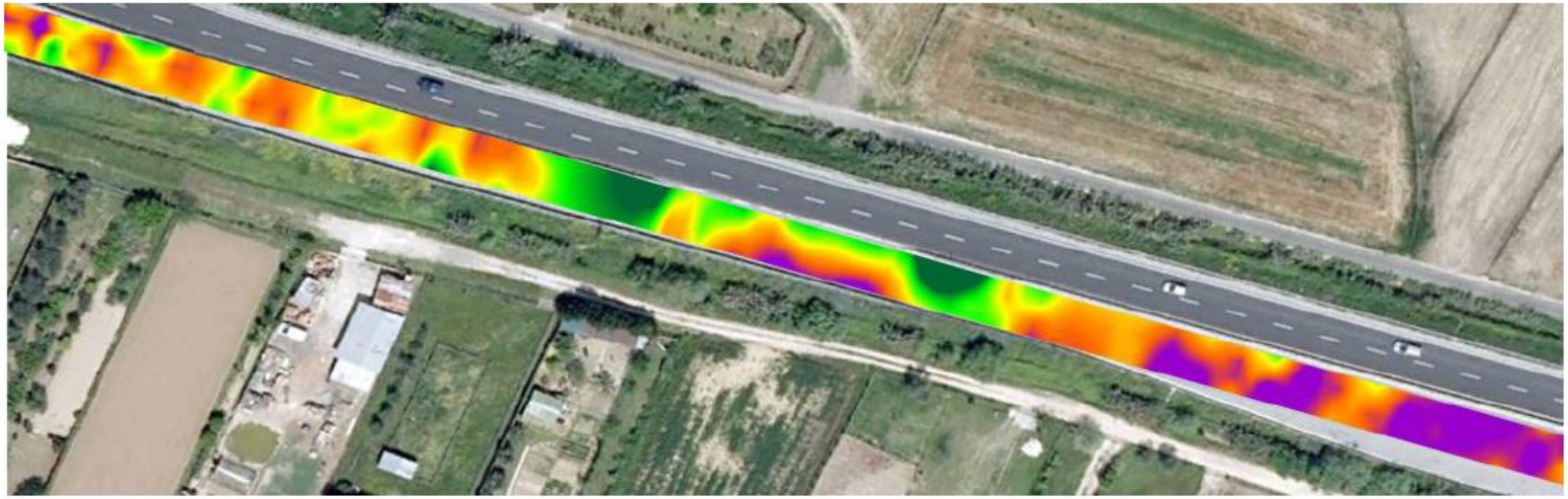




Typical Survey Frequencies

- Inventory Data
  - One off exercise
  - Updated/verified ~5 years
- Pavement Condition Data
  - Main roads 1-2 years
  - Minor roads ~2-3 years
- Bridge Condition Data
  - Regular surveys 1-2 years
  - Intensive surveys ~5 years
- Traffic Data
  - Permanent count stations (24/7/365)
  - Short-term count stations (~ 1 - 7 days)

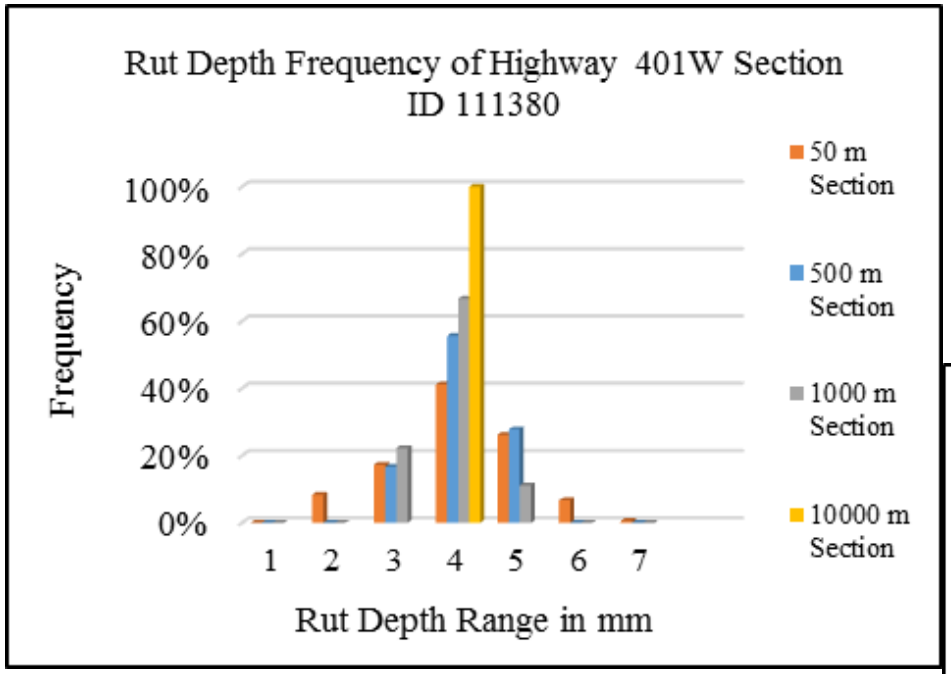
Homogeneous Section Lengths

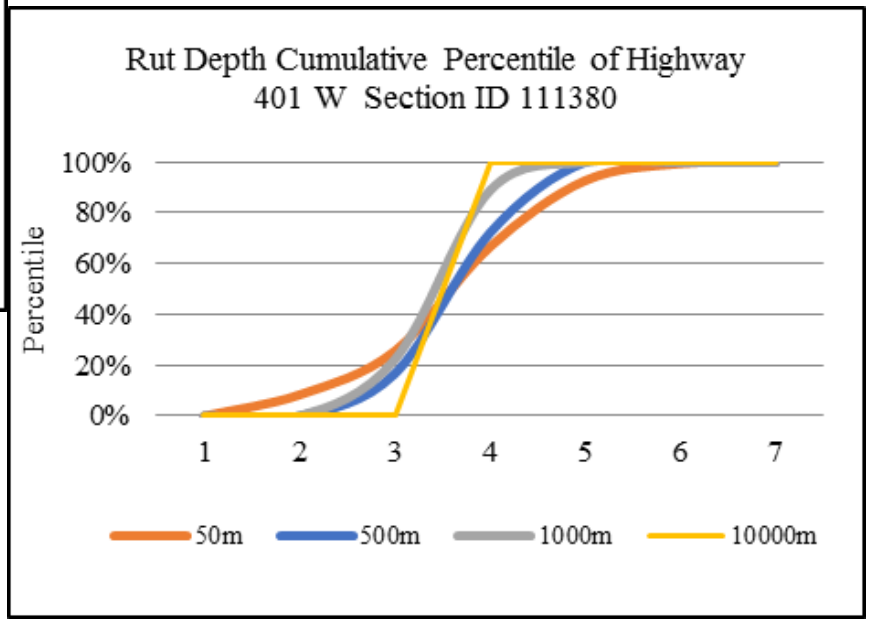


- Rectify any problem before overlaying
- Better the QA
- Lower the risk
- Longer life
- Lower life cycle costs

Source WDM

Importance of Section Length





Questions

Dr Theuns Henning

t.henning@auckland.ac.nz