Road Asset Management (RAM)

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# Session: Asset Condition Data Collection for Major Asset Types

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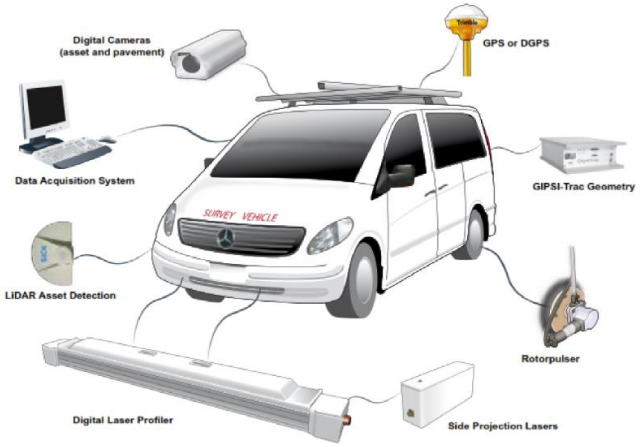
# Agenda

- 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?

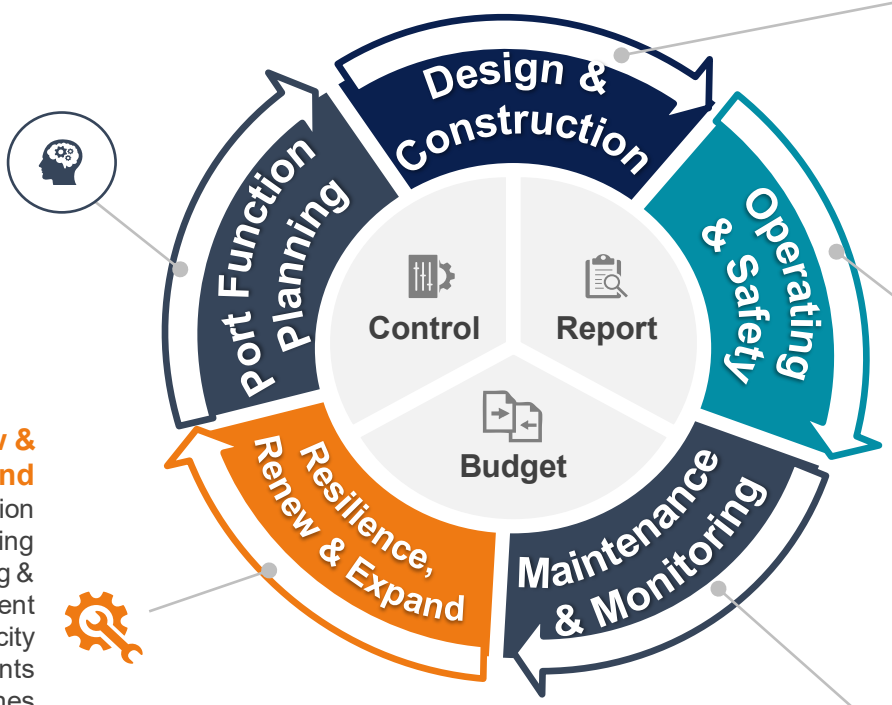
How safe and comfortable are the road user experience?

What are the long-term investment needs?

What maintenance works are required

Photo: Macos.livejournal.com

# The decisions we make during the life of assets




**Design and Construction**
- Functional requirements
- Capital budgeting
- Design requirements
- Environmental impact assessment

**Operations & Safety**
- Network management
- Traffic management systems (ITS)
- Worksite safety and traffic management
- Road safety monitoring
- Road safety management and law enforcement
- Overweight control

**Maintenance & Monitoring**
- Maintenance inspection
- Regular/ preventive maintenance planning
- Maintenance execution
- Contract and workflow management

**Resilience, Renew & Expand**
- Investment decision making
- Reconditioning & refurbishment
- Expanding and capacity improvements
- Route criticality / lifelines
- Exposure/network risk
- Asset resilience improvements
- Coastal protection

**Transport Planning**
- Demand and capacity management
- Network expansion
- Other modes of transport
- Utilities requirements

# Types of Data We Collect

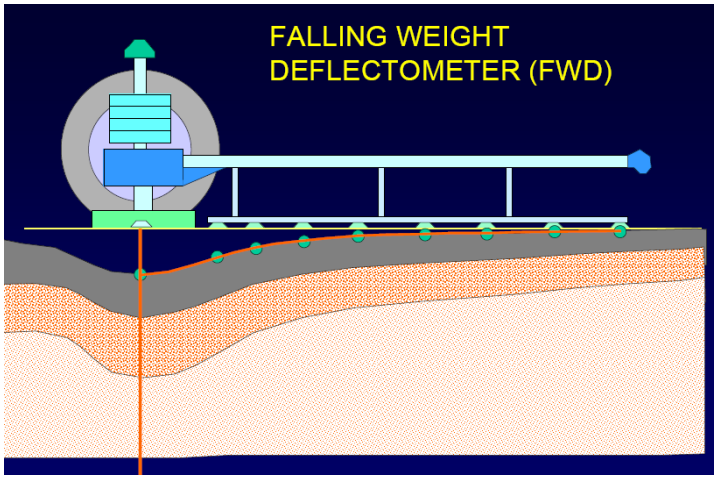
- Inventory
  - Physical elements of system
  - Do not change markedly over time
- Condition
  - Change over time
  - Require regular (or irregular) monitoring
- Maintenance Records and Cost
  - Cost and detailed works recorded for maintenance
- Use
  - Traffic Volumes
  - Truck numbers and loading
-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

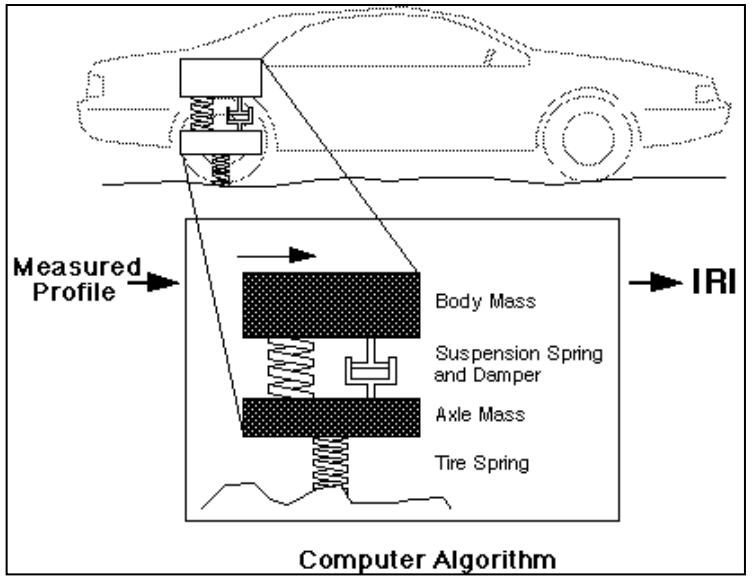
# Pavement Strength Testing

- Falling Weight Reflectometers
- Rolling Deflection Measurements

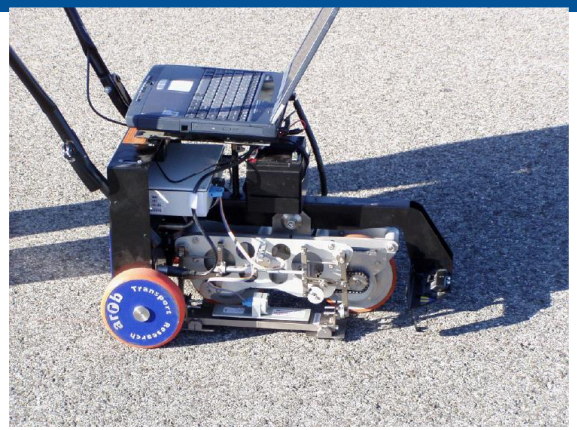



# Roughness- International Roughness Index

- ‘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

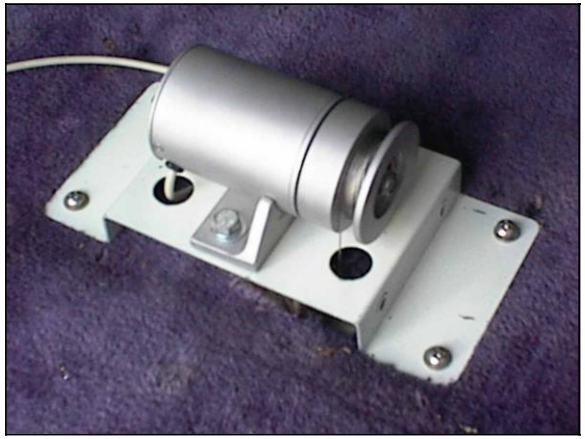


# Roughness Measurements



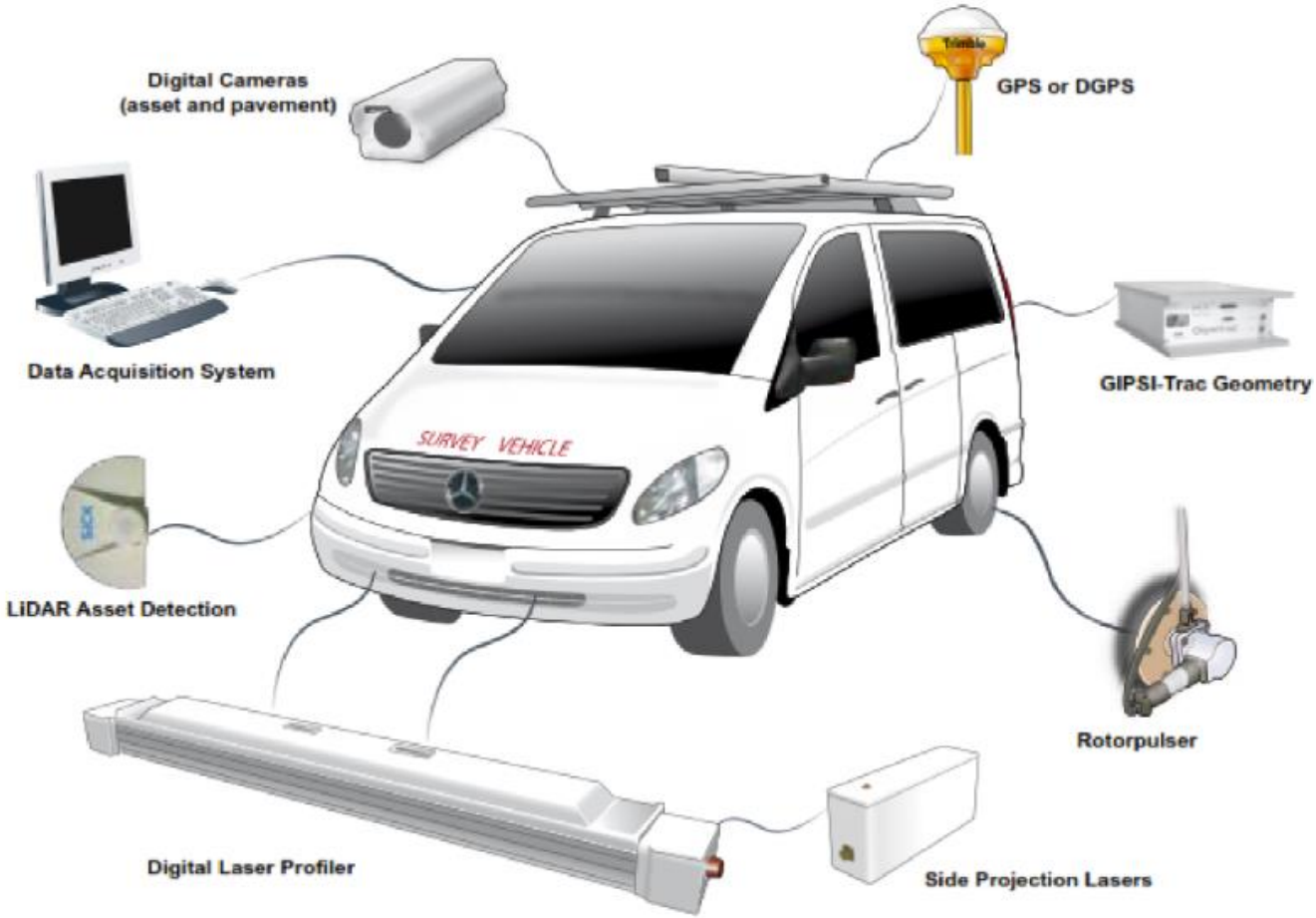
**Class I**

**Class III**



Source World Bank

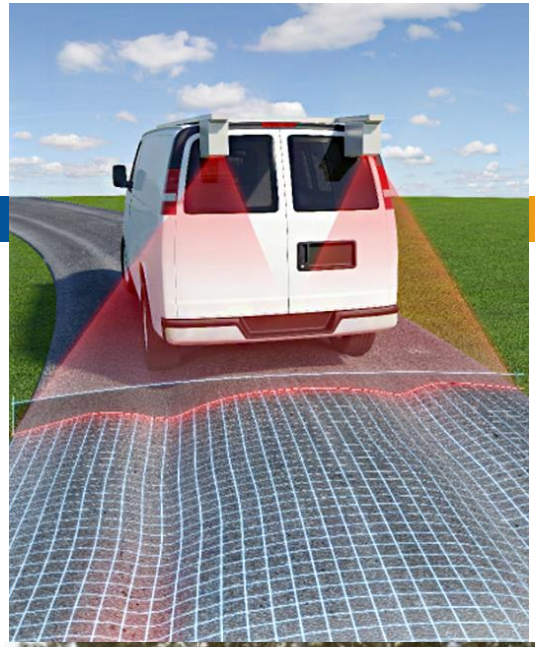
# Class 1 - Laser




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



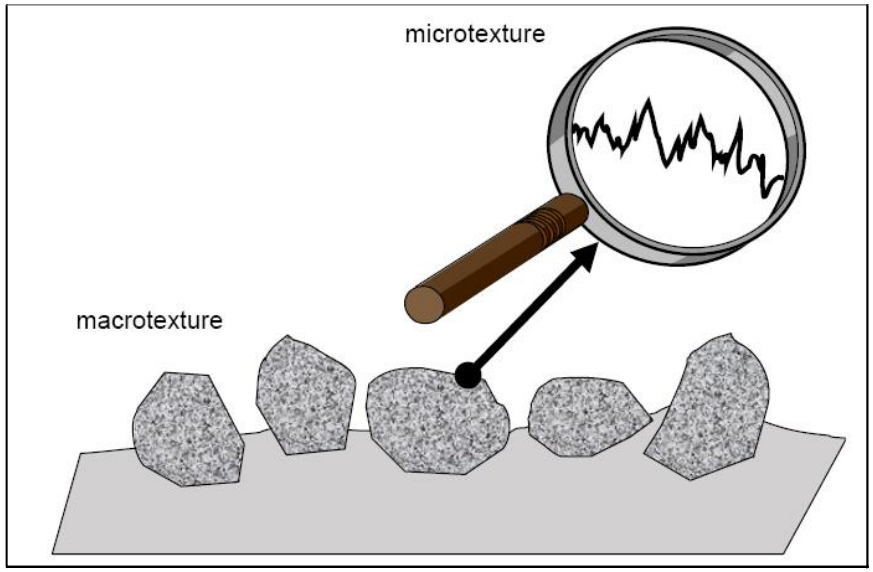

Source: DCL & ROMDAS

# 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



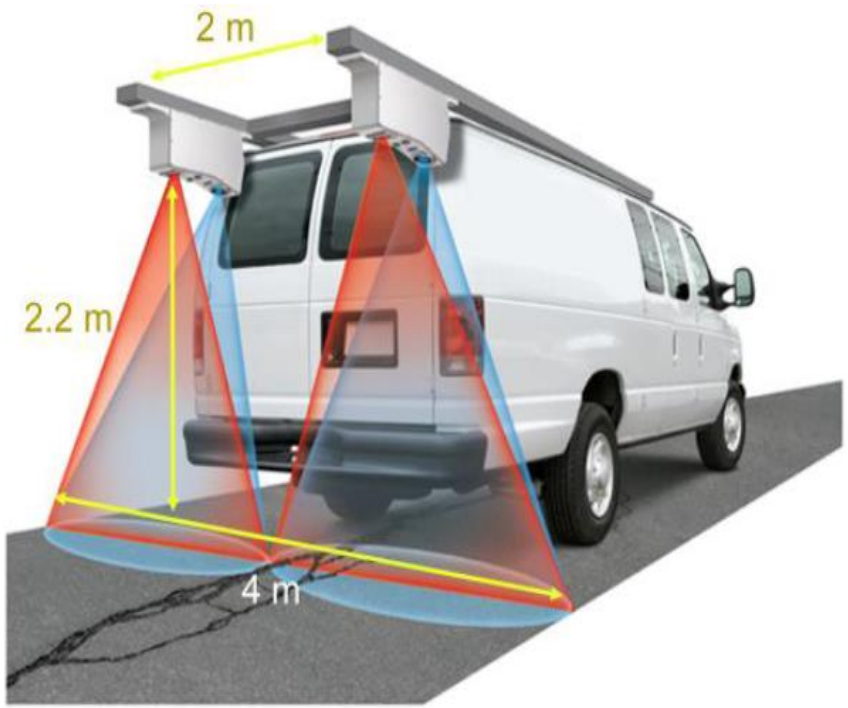
# Skid Resistance Measurements

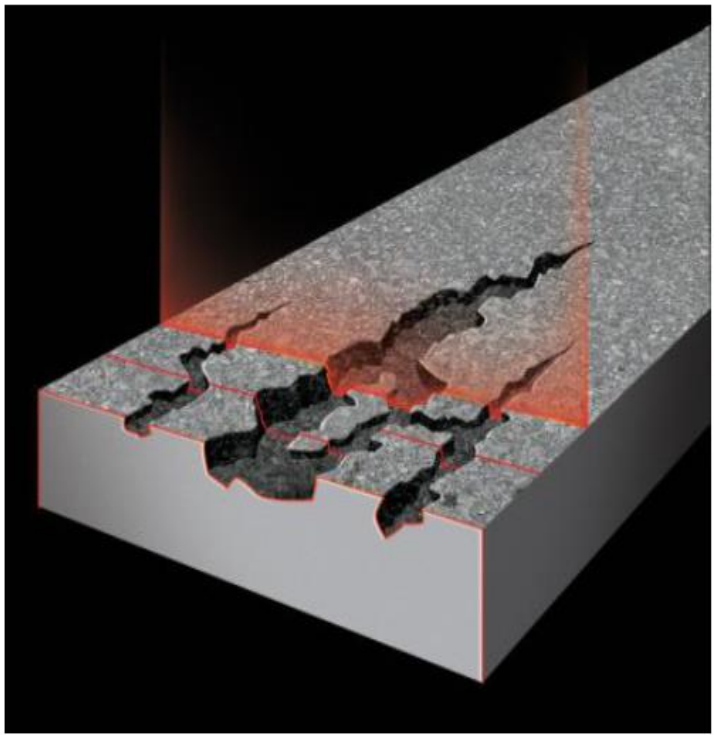
Griptester

SCRIM

British Pendulum

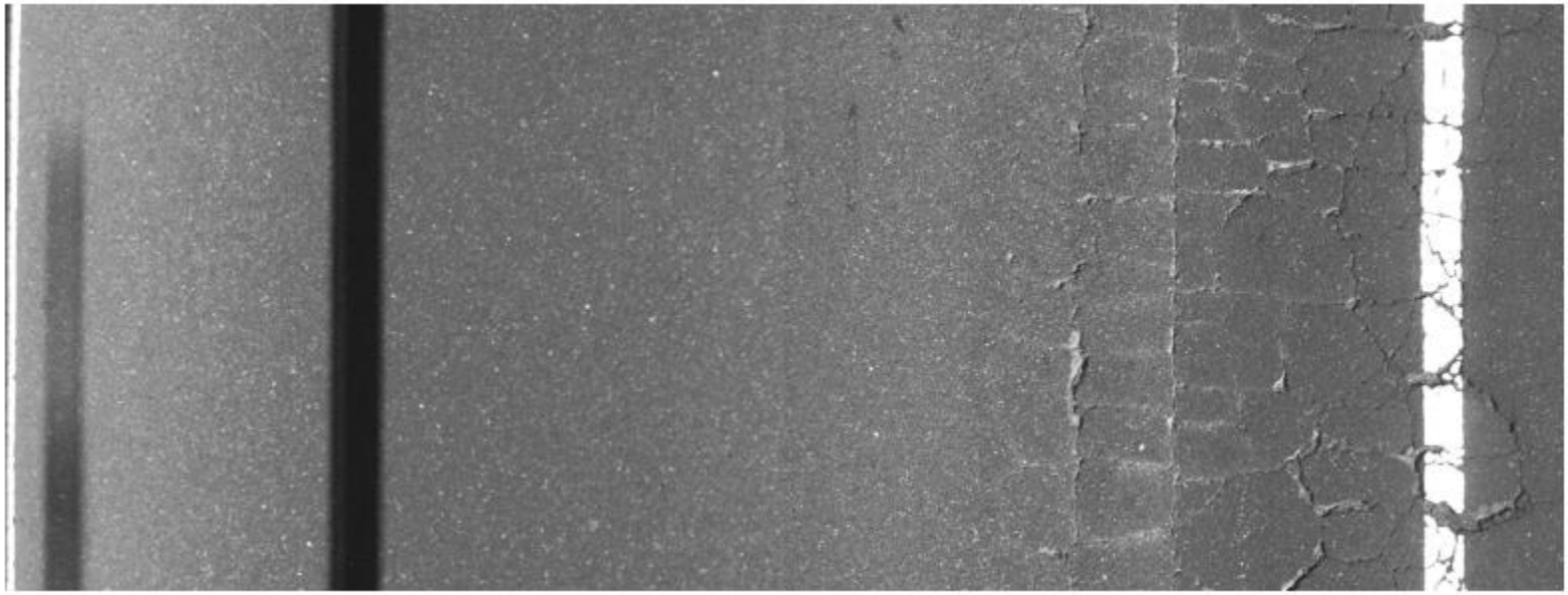
# Laser Crack Measurement System (LCMS)



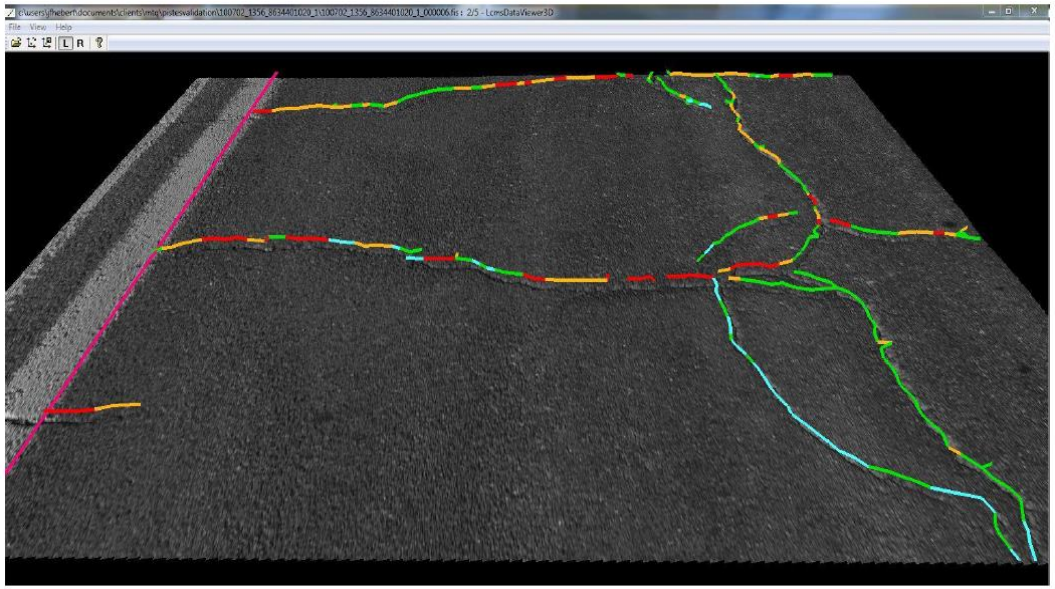
**Source Pavemetrics**

# Images from Line Scan

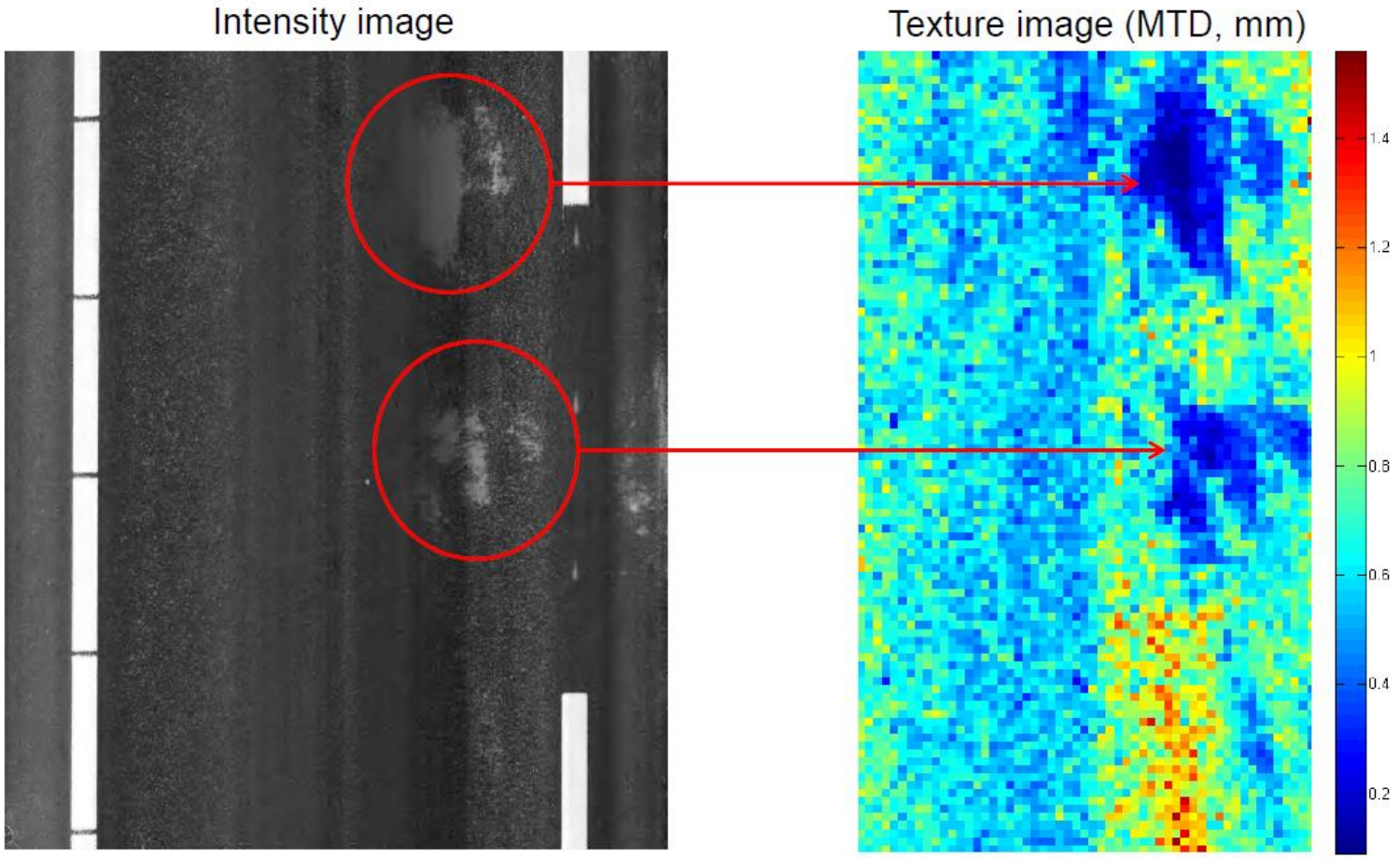


Source ARRB

# LCMS Processing of Data

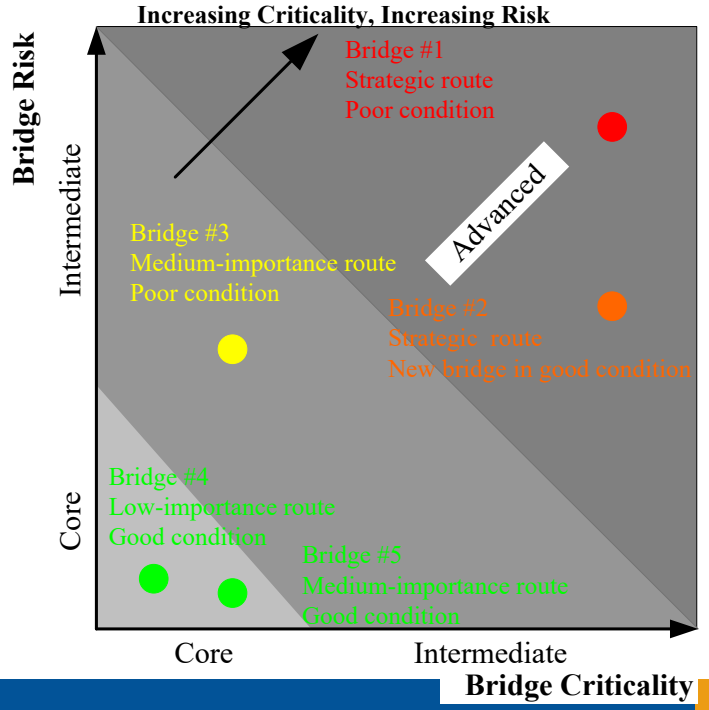


# Detecting Bleeding



# 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<br>Limited, usually reactive SHM |
| Intermediate | Intermediate | Individual limit state risks | Visual inspections every 2-3 years<br>Some, reactive and proactive SHM |
| Advanced | High | Individual structural or functional element risks | Visual inspections every 1-2 years<br>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<br>0 = Not inspected<br>1 = Satisfactory<br>2 = Monitor next inspection<br>R = Routine maintenance *(provide comment)*<br>S = Structural maintenance *(provide comment & photo)*<br>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): | | | |

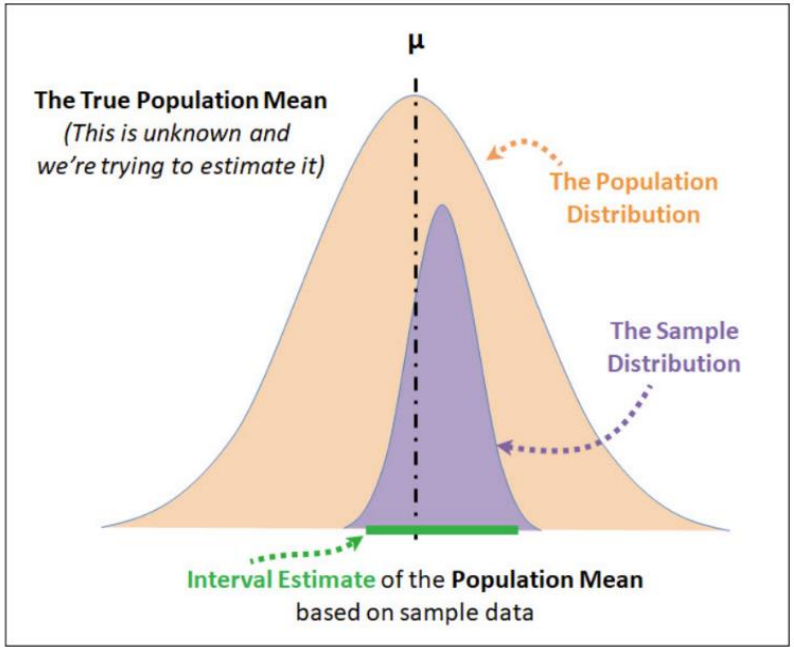
| Item | Description | Mark | Defect Description/Remedial Work | Priority (H/M/L) | Estimated Cost |
|---|---|---|---|---|---|
| 1 | Signs | | | | |
| 2 | Superstructure/deck drainage | | | | |
| 3 | Movement/expansion joints | | | | |
| 4 | Carriageway and deck surfacing | | | | |
| 5 | Approach adequacy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

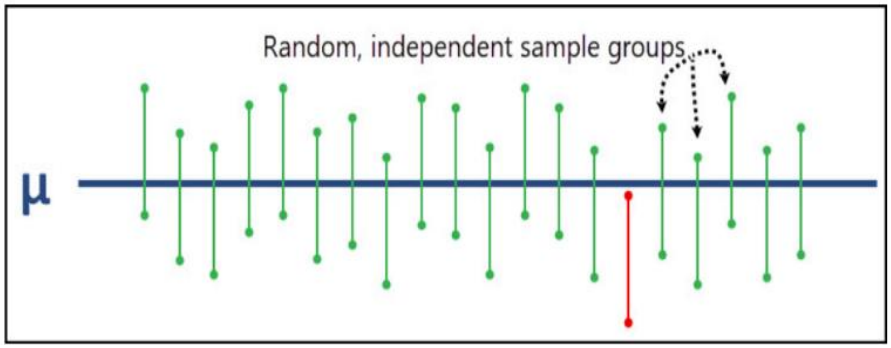
Photo –FlyKit

Photo -Inspecterra

# Principles for sampling data collection

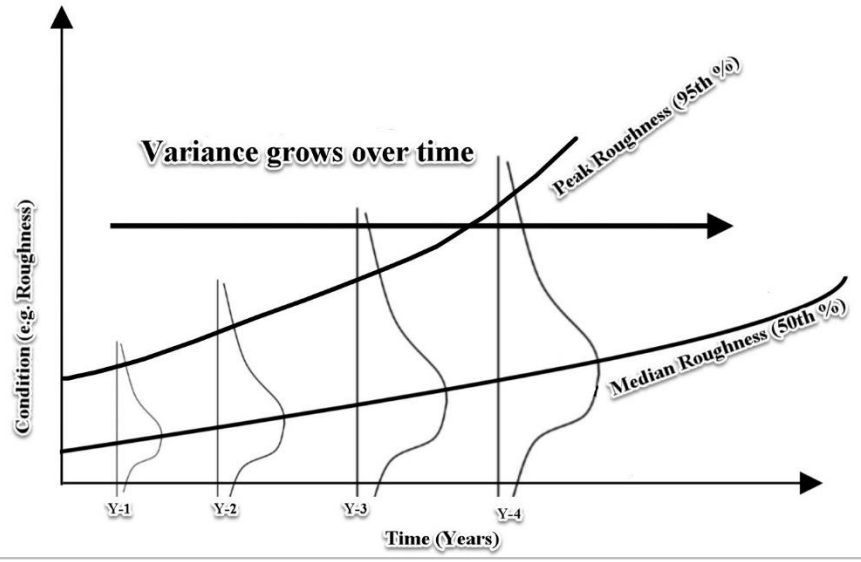
- We cannot always afford to measure a 100% of the network
- For some applications it is ok, depending on what you use the data for

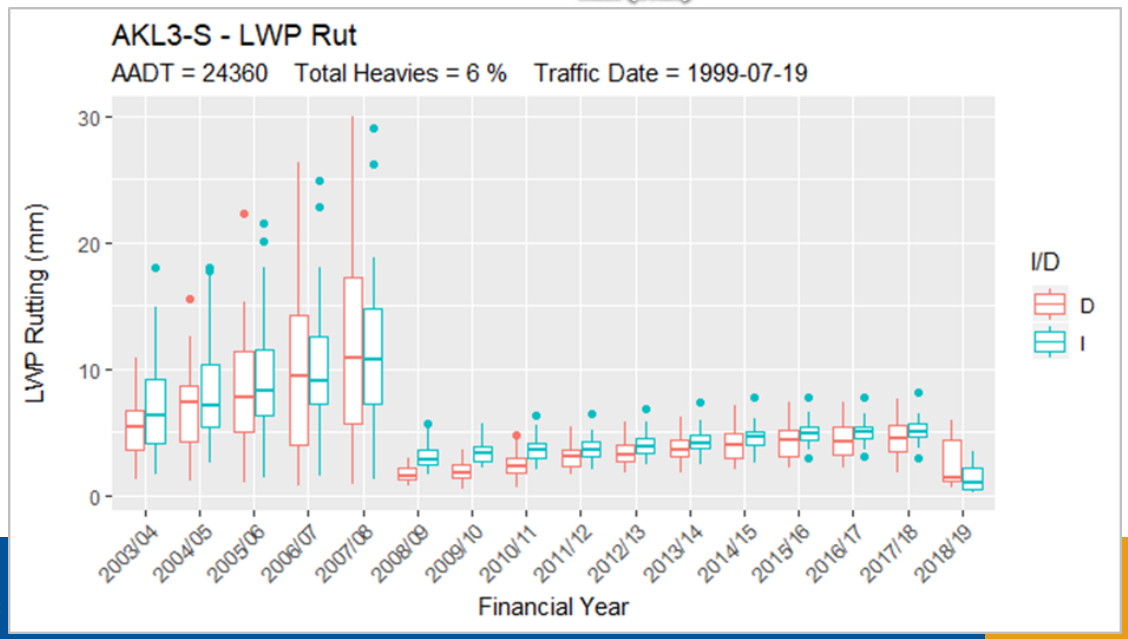


# Survey Frequency

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

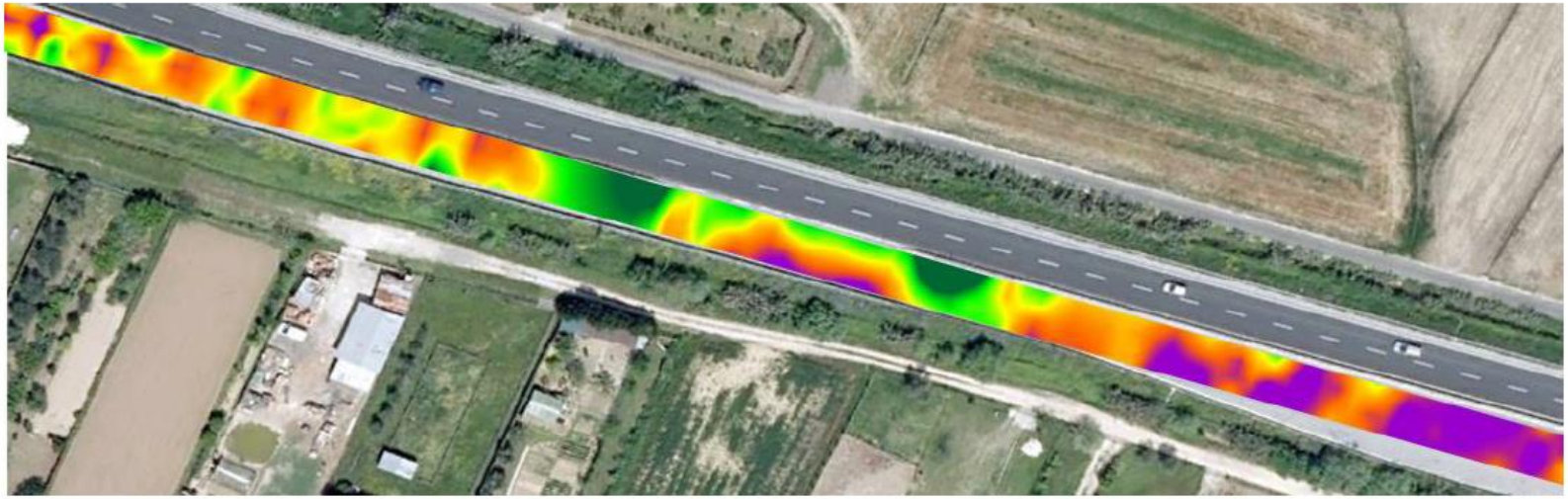


# Typical Survey Frequencies

- 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)

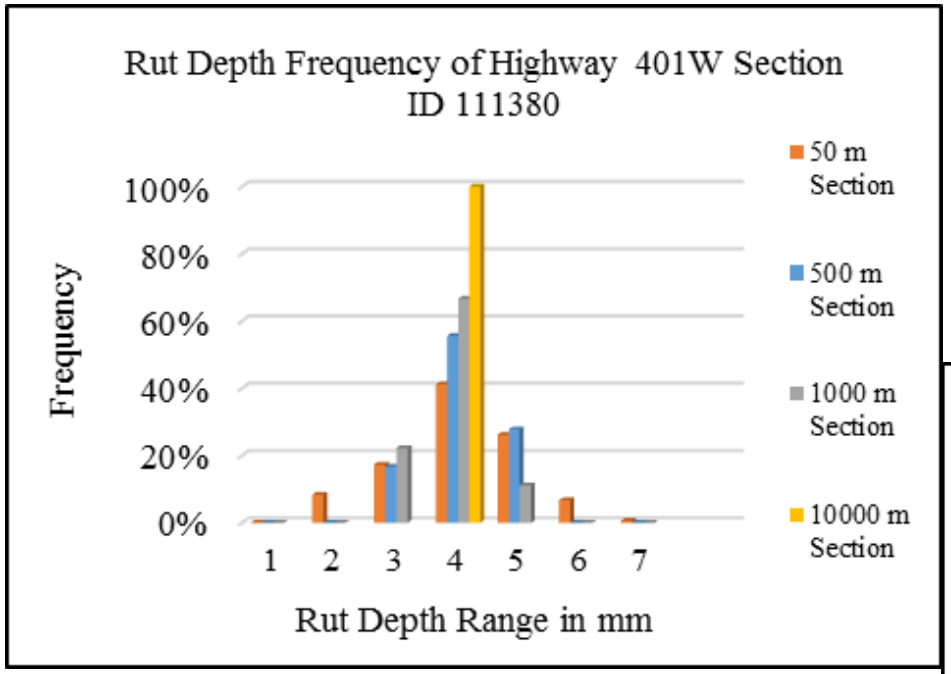
# Homogeneous Section Lengths

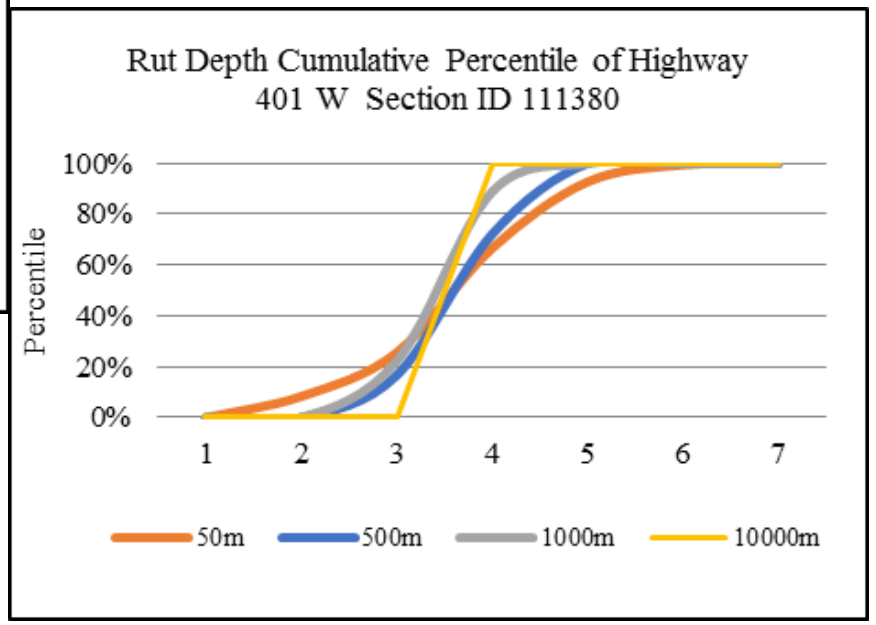


- Rectify any problem before overlaying
- Better the QA
- Lower the risk
- Longer life
- Lower life cycle costs

Source WDM

# Importance of Section Length



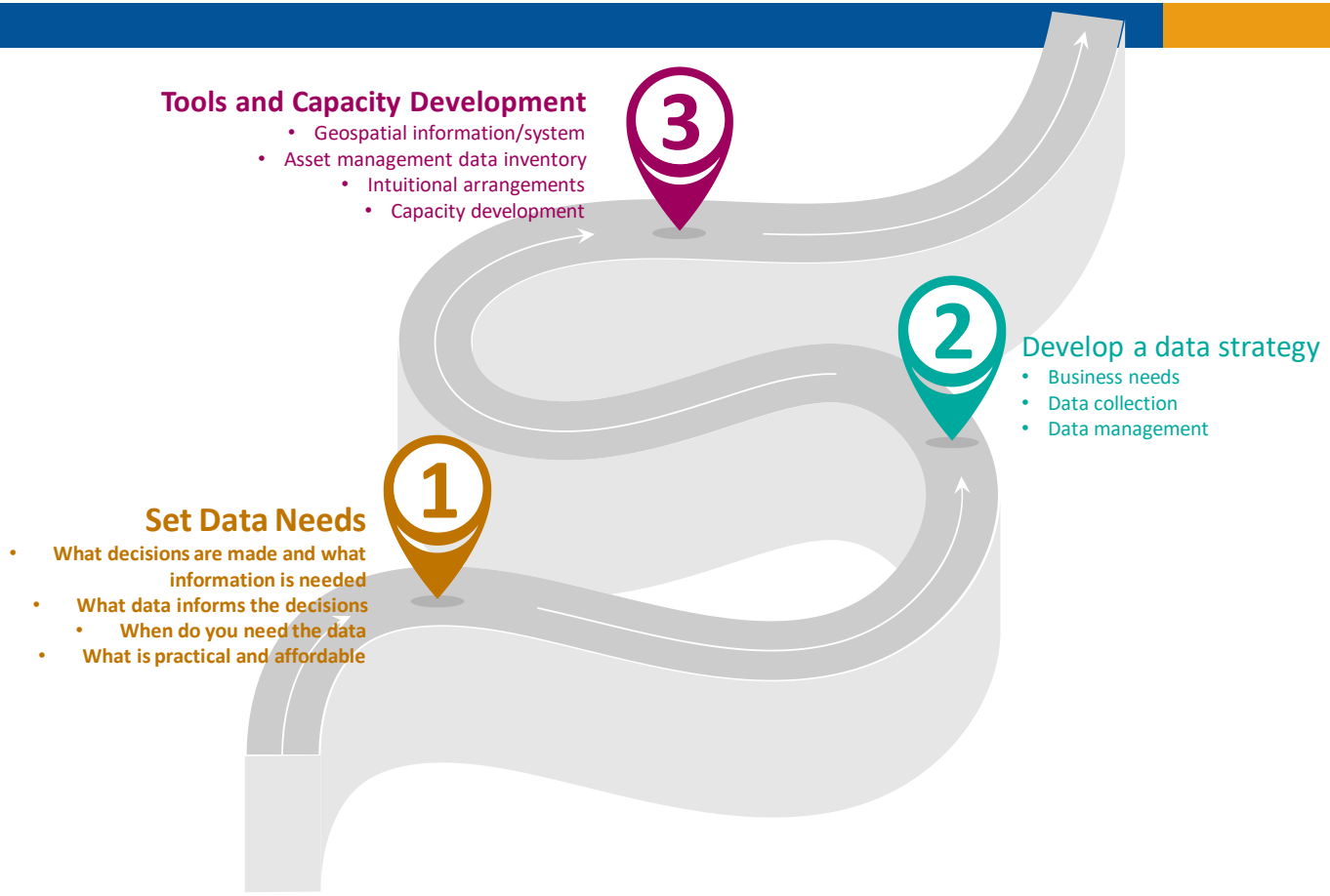
# Data Essentials

**To informed decisions can only be made from accurate data**

# Data Quality and Application Principles

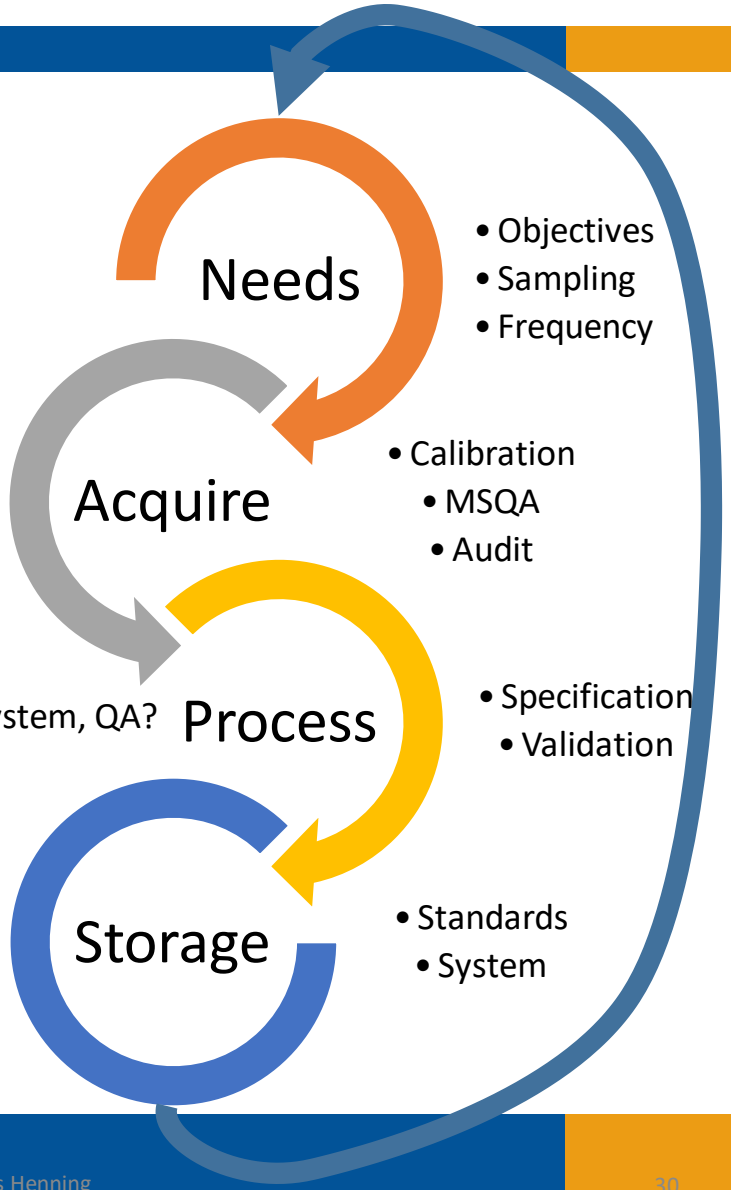
- Start with what you have
  - Using the data for ‘real’ gives it a purpose and drive improvements over time
- Developing an understanding for data items criticality
  - What difference does an item have on the final $$
  - Developing a habit of thinking in confidence ranges
  - Record data items for priority improvements

# ROADMAP DATA COLLECTION AND QUALITY IMPROVEMENTS



# Data Strategy

- What do we need?
- Criticality and deterioration rates?
  - Sample size, frequency, time of year?
- Does it already exist?
  - Where is it stored? Is it new?
- How do we obtain it?
  - Survey? Concurrently with other data?
- Collection specifications?
  - Calibration, accuracy, precision, repeatability, referencing system, QA?
- Data specifications?
  - Process raw to defined specification, Validation
- How and where to store?
  - Data standards. Who needs access? What reporting requirements?
- Location Referencing.
  - Link and node? Coordinates?



# Questions

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