Using Multi Speed Deflectometer for Network Pavement Strength Assessment

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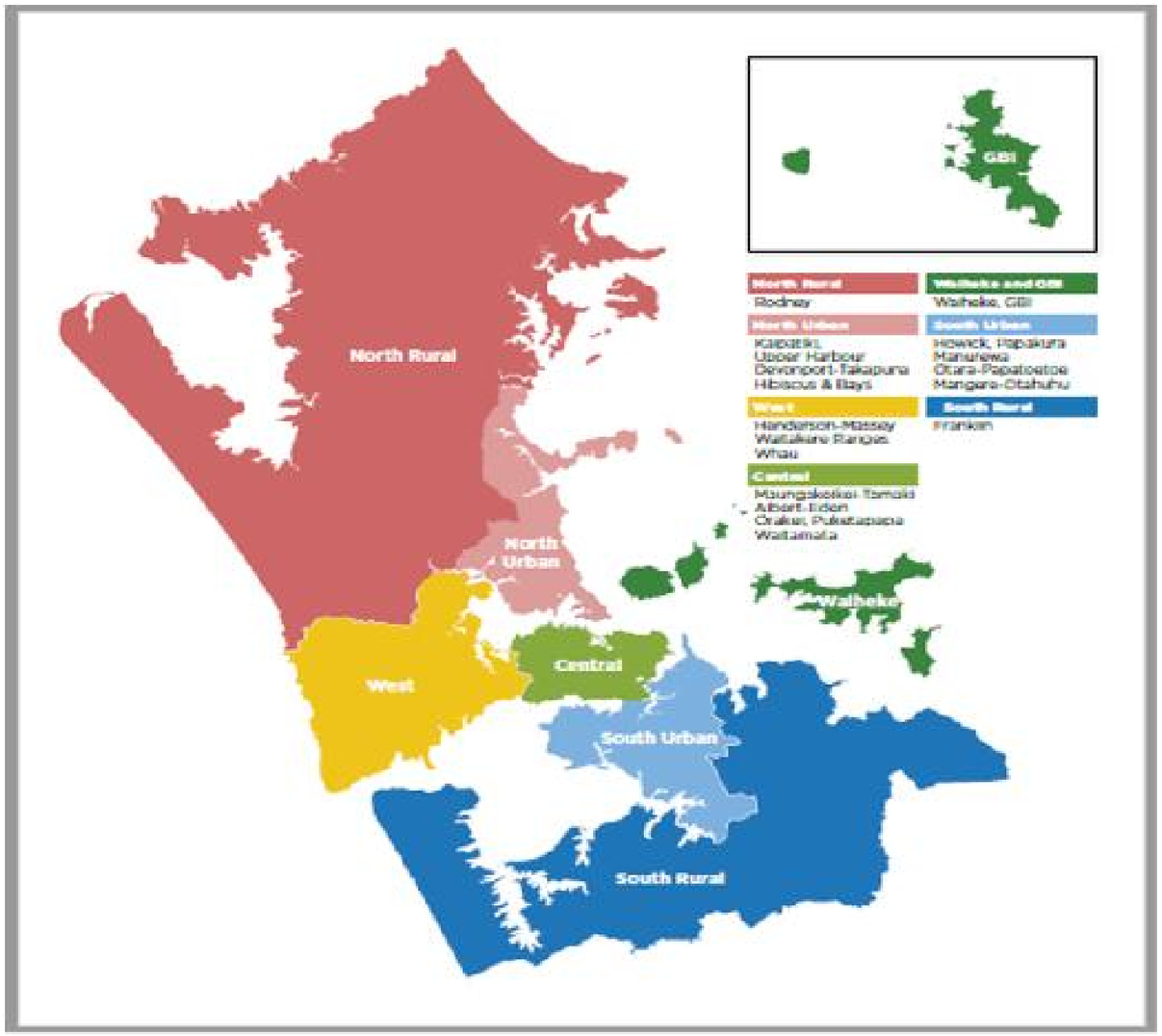
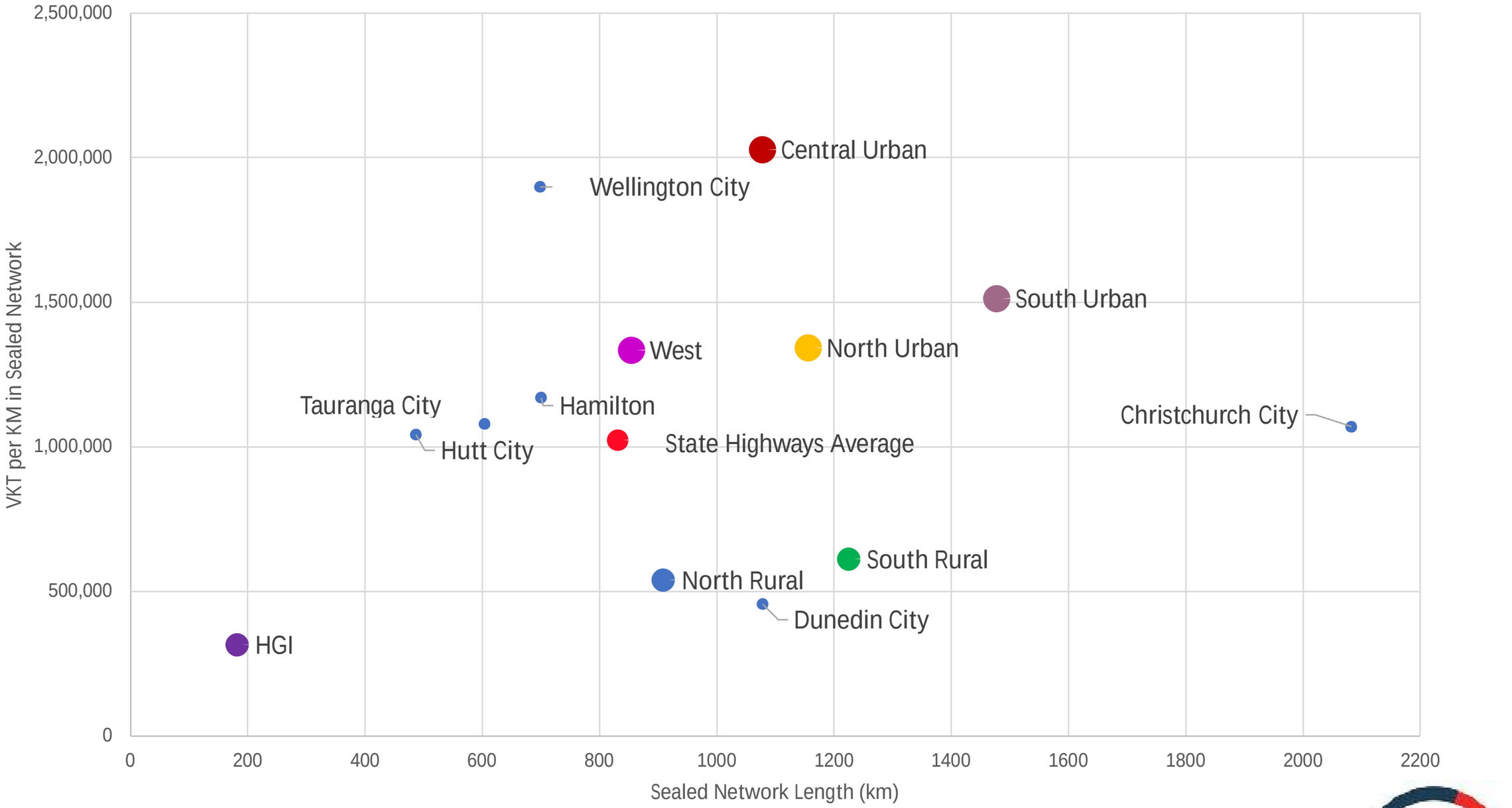
Auckland Transport
An Auckland Council Organisation

The AT Network



- 7,722 km of Road
- Rural roads 2,951 km (38%)
- Urban roads 4,771 km (62%)
- Sealed roads 6,883 km (89%)
- Unsealed roads 839 km (11%)

Traffic Loading on the AT Network



Current Pavement Condition

2021 AMP based on Roughness

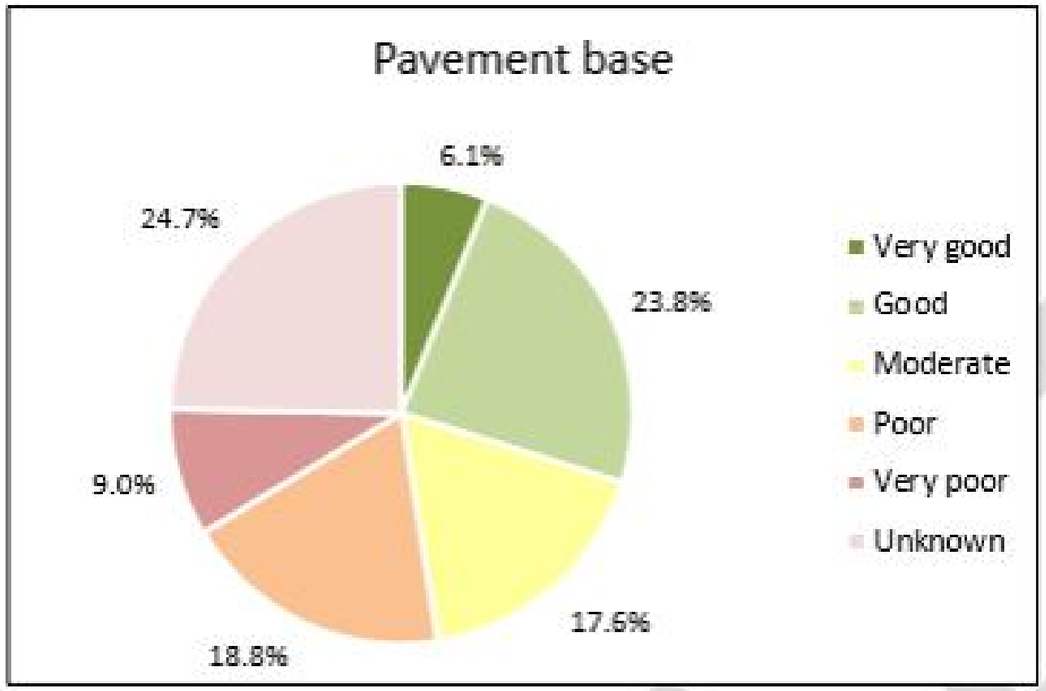
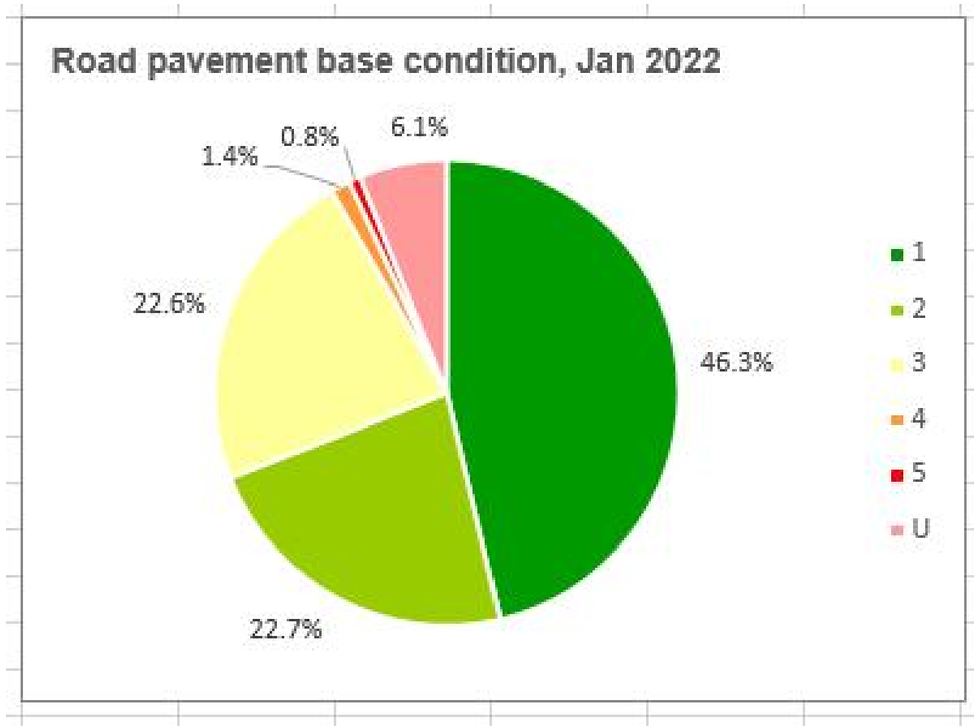


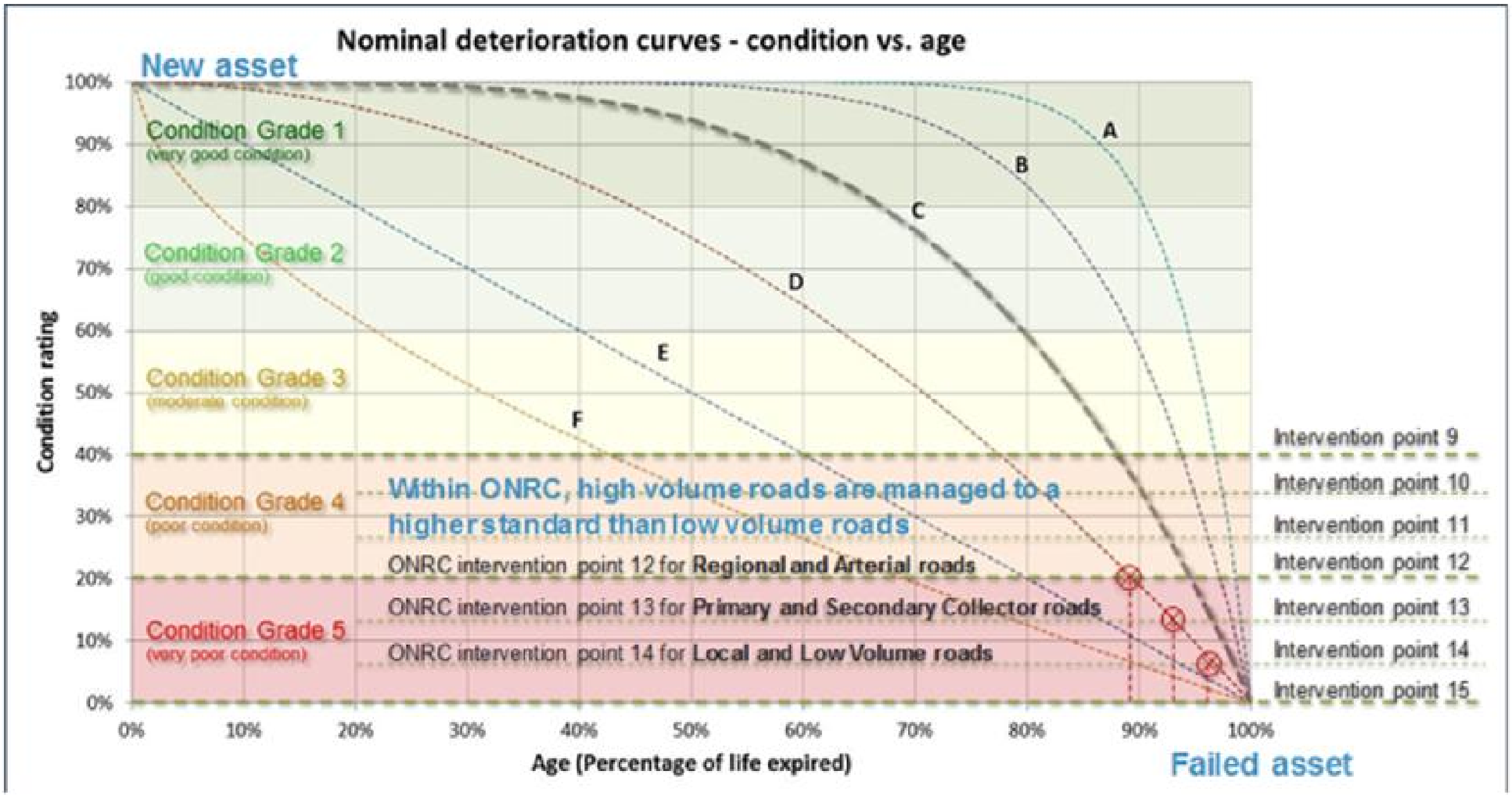
Figure 2-7: Sealed pavement base condition

Source: Auckland Transport RAMM database (December 2019)

2022 based on PII



Pavement Renewal Deterioration Model



2021 AMP future condition / funding profile

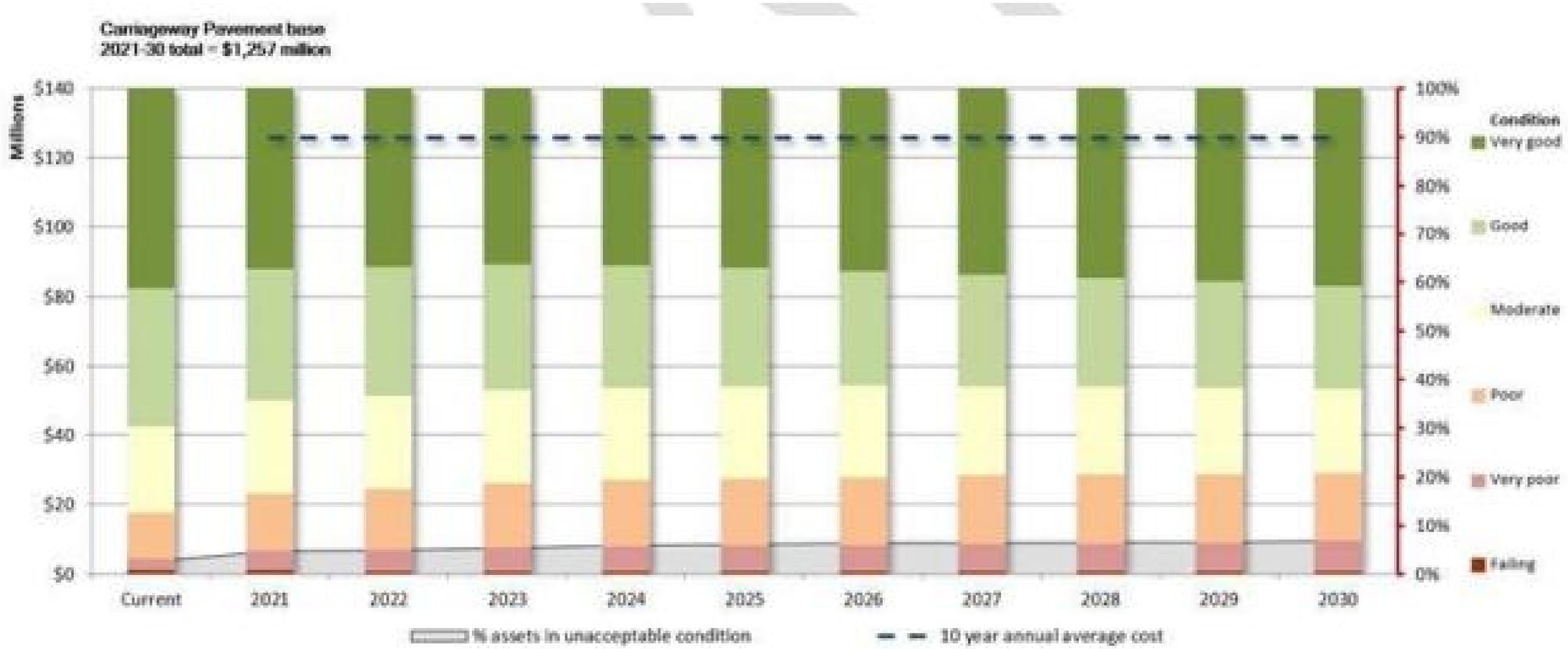


Figure 6-13: Predicted condition profile of pavements based on recommended financial requirements

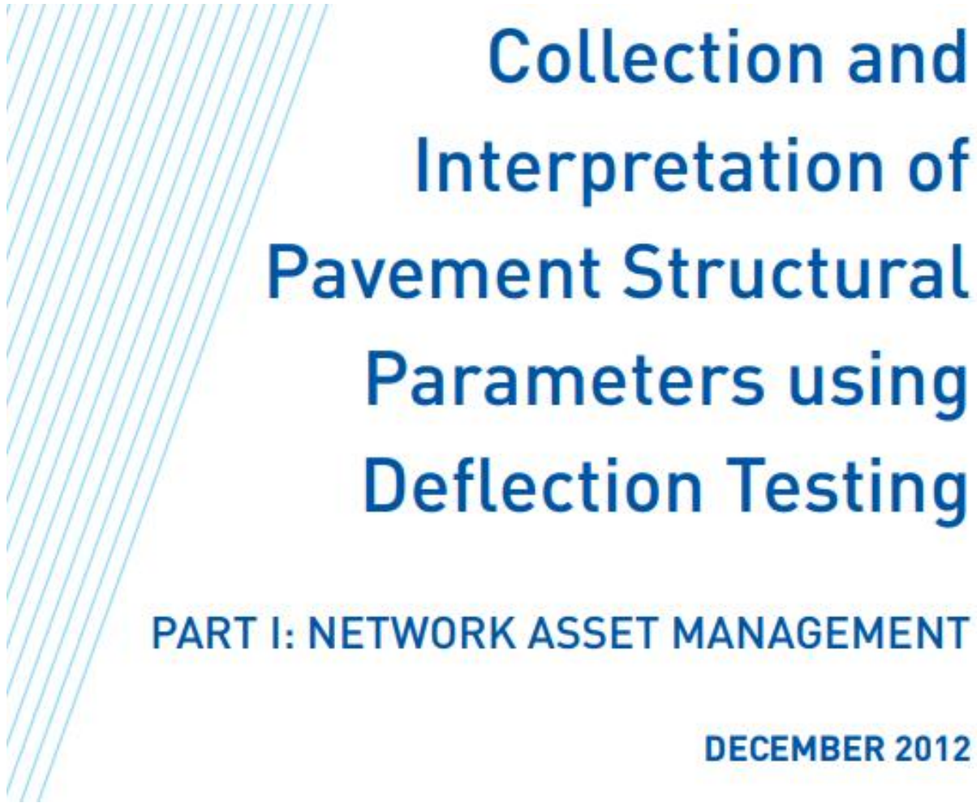
NZTA Research Report 599

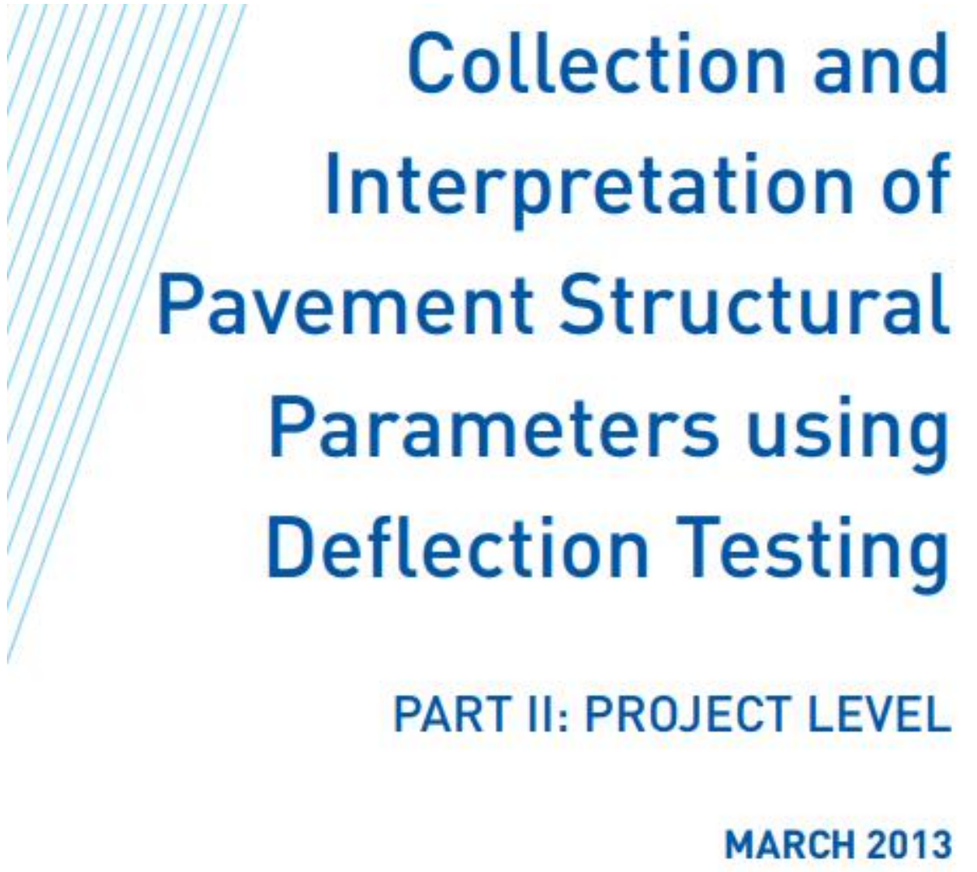
- Current RAMM TSA does not include pavement strength (FWD)
- Report 599 recommends:
  - Use composite indices (SCI and PII) rather than individual faults
  - Use FWD to determine pavement failure mode -Radius of curvature and Central Deflection
  - Identifying failure mode is important – shallow (shear) failure in upper layers or deep seated failure – determines treatment
- Further research required

The need to collect pavement strength data

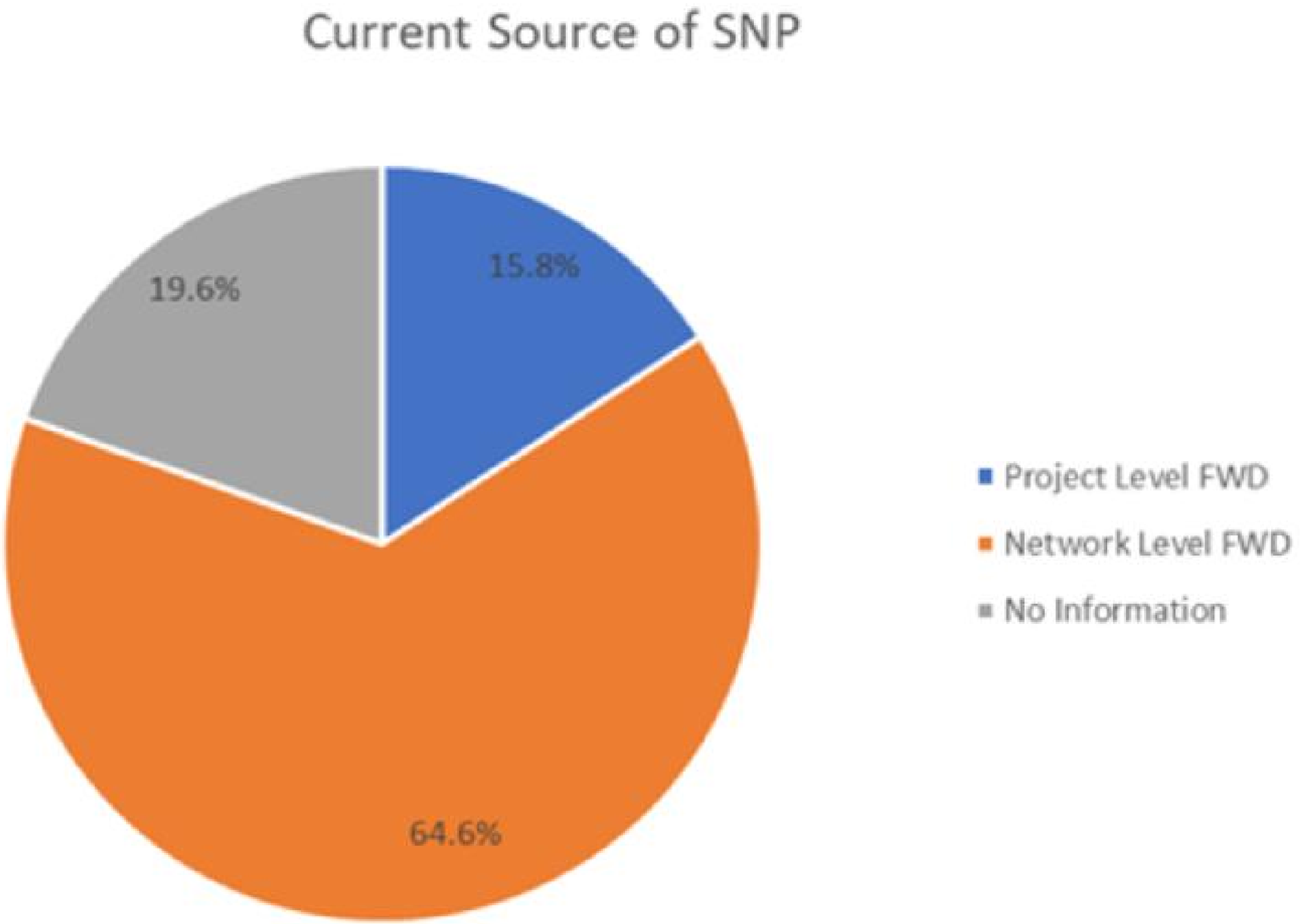
- To monitor pavement structural condition
- Long term pavement deterioration modelling (SNP)
- Developing short and long term pavement renewal programmes and funding requirements
  - 3 year – Delivery – PFRs and Design
  - 10 year – RLTP (regional land transport program)
  - 30 year – AMP

RIMS FWD Guidelines





Current Pavement Strength Data for AT



What is “Multi Speed Deflectometer”

- Continuous pavement
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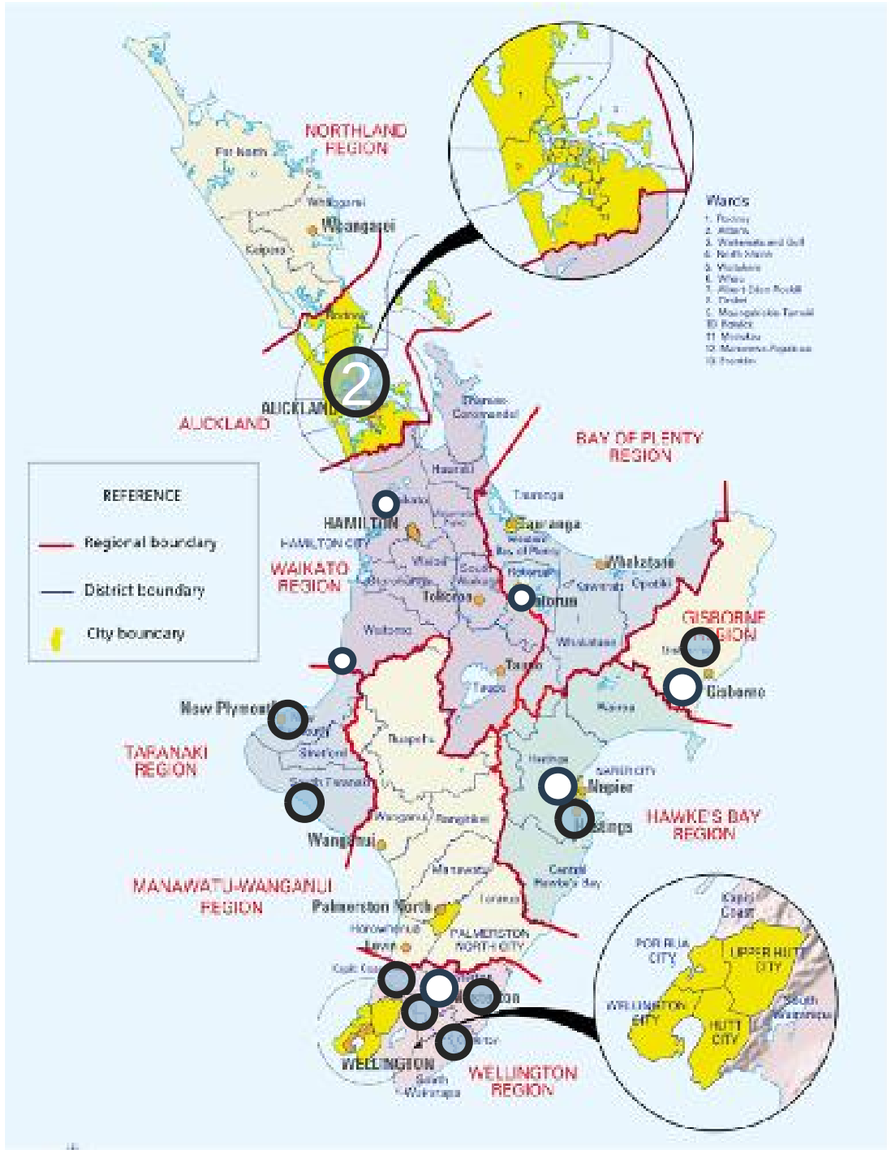
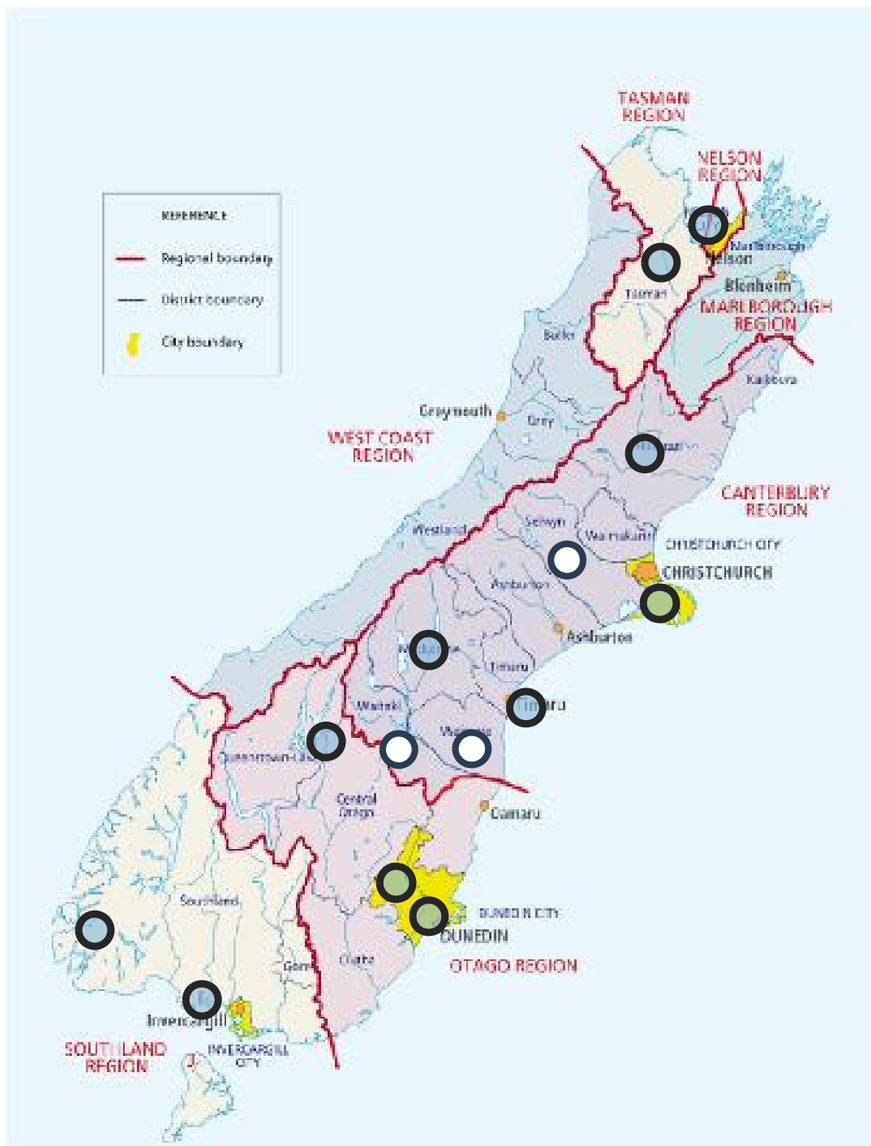
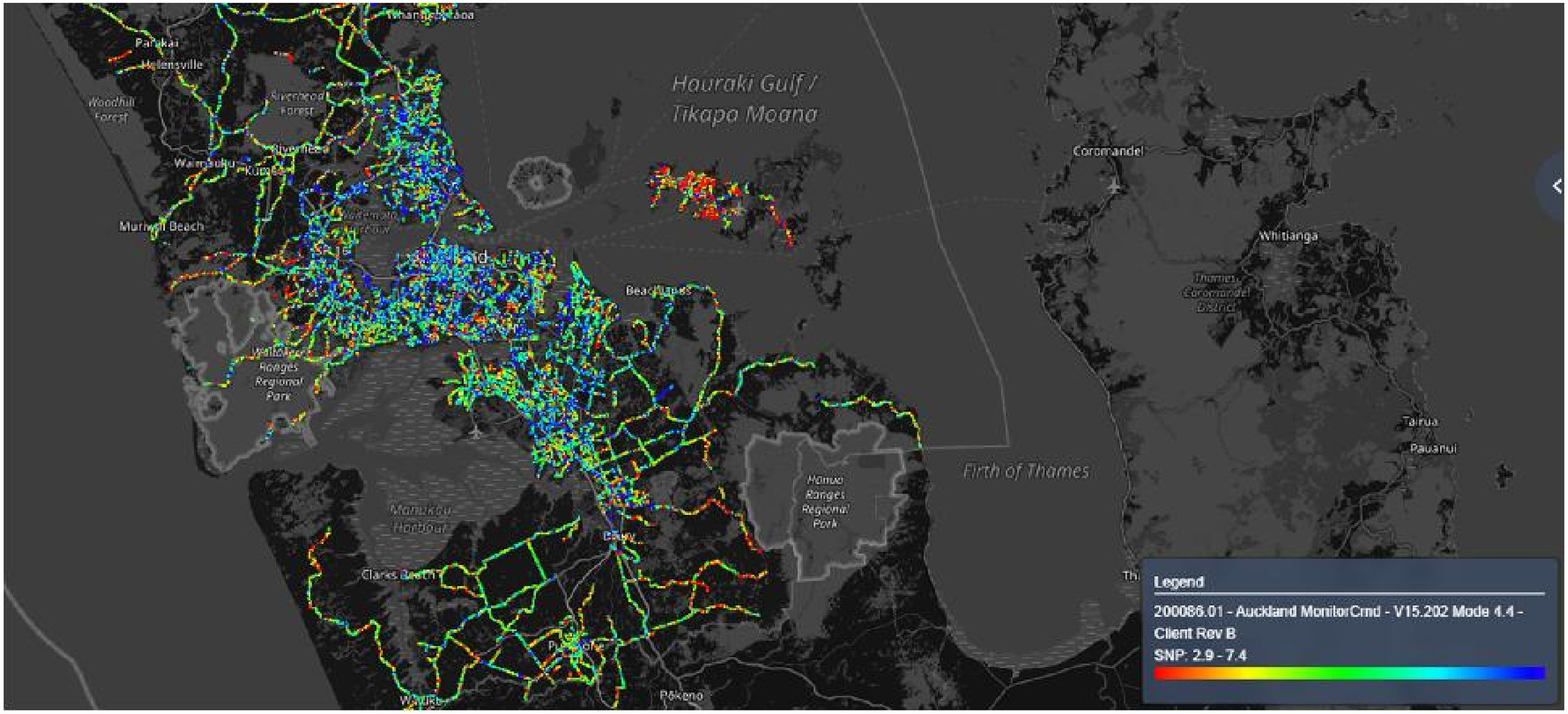
MSD Use in New Zealand





MSD Use in AT



Primaries, Arterials, Kainga Ora, Waiheke, Great Barrier: 4,460 lane kms (dual wheel path)

Validating MSD for AT

$$SNC = (1/25.4) \sum_{i=1}^{nlayer} a_i h_i + SNSG$$

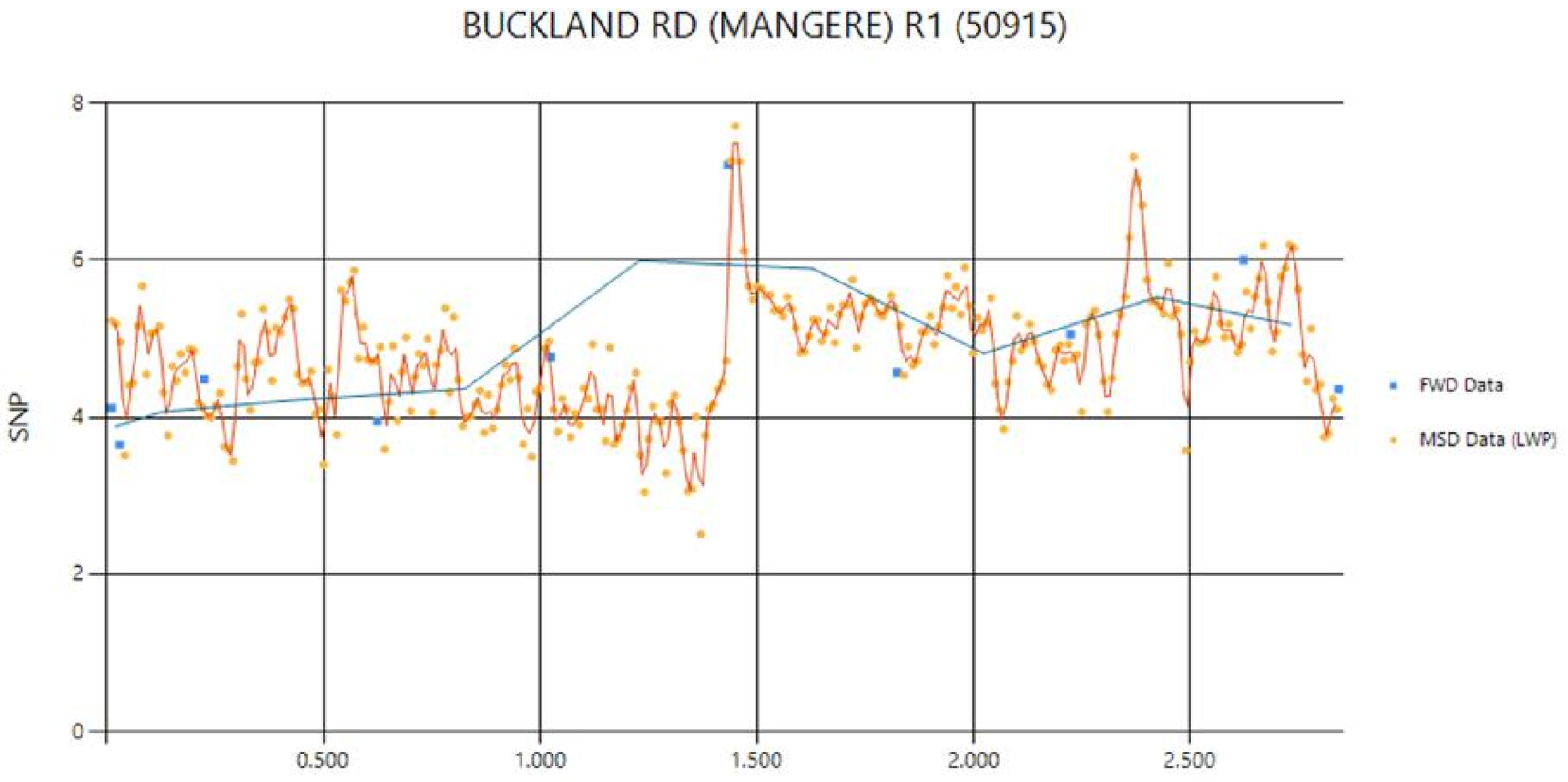
$$SNSG = 3.5 \log_{10} CBR - 0.85(\log_{10} CBR)^2 - 1.43$$

$$a_l = a_g (E_l/E_g)^{0.33}$$

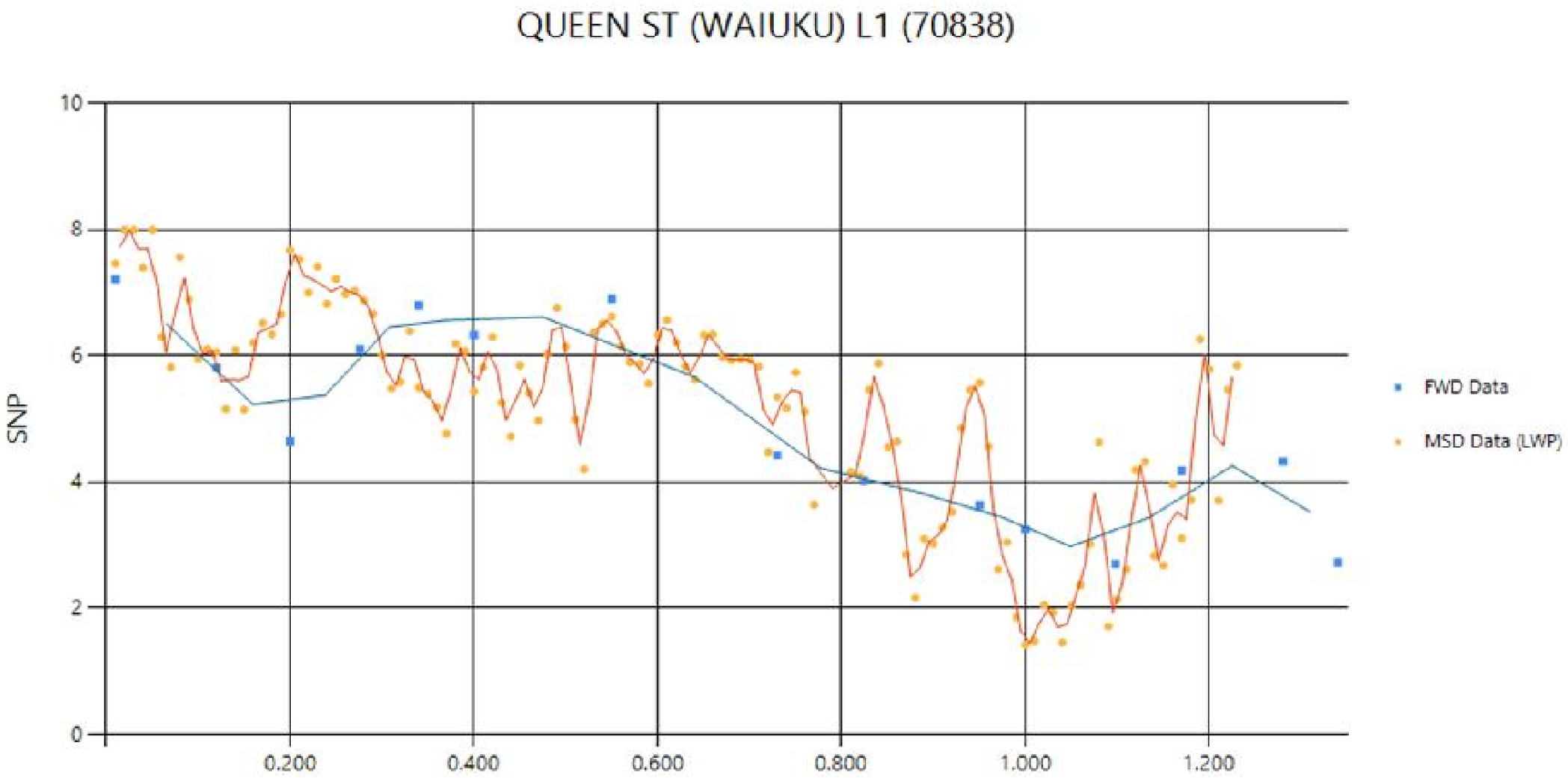
SNP (FWD) is a function of:
Pavement layer thickness
Subgrade CBR
Layer moduli

SNP (MSD) is a function of:
Lower Layer Parameter
Base Layer Parameter
Transfer Function to FWD Calib Data

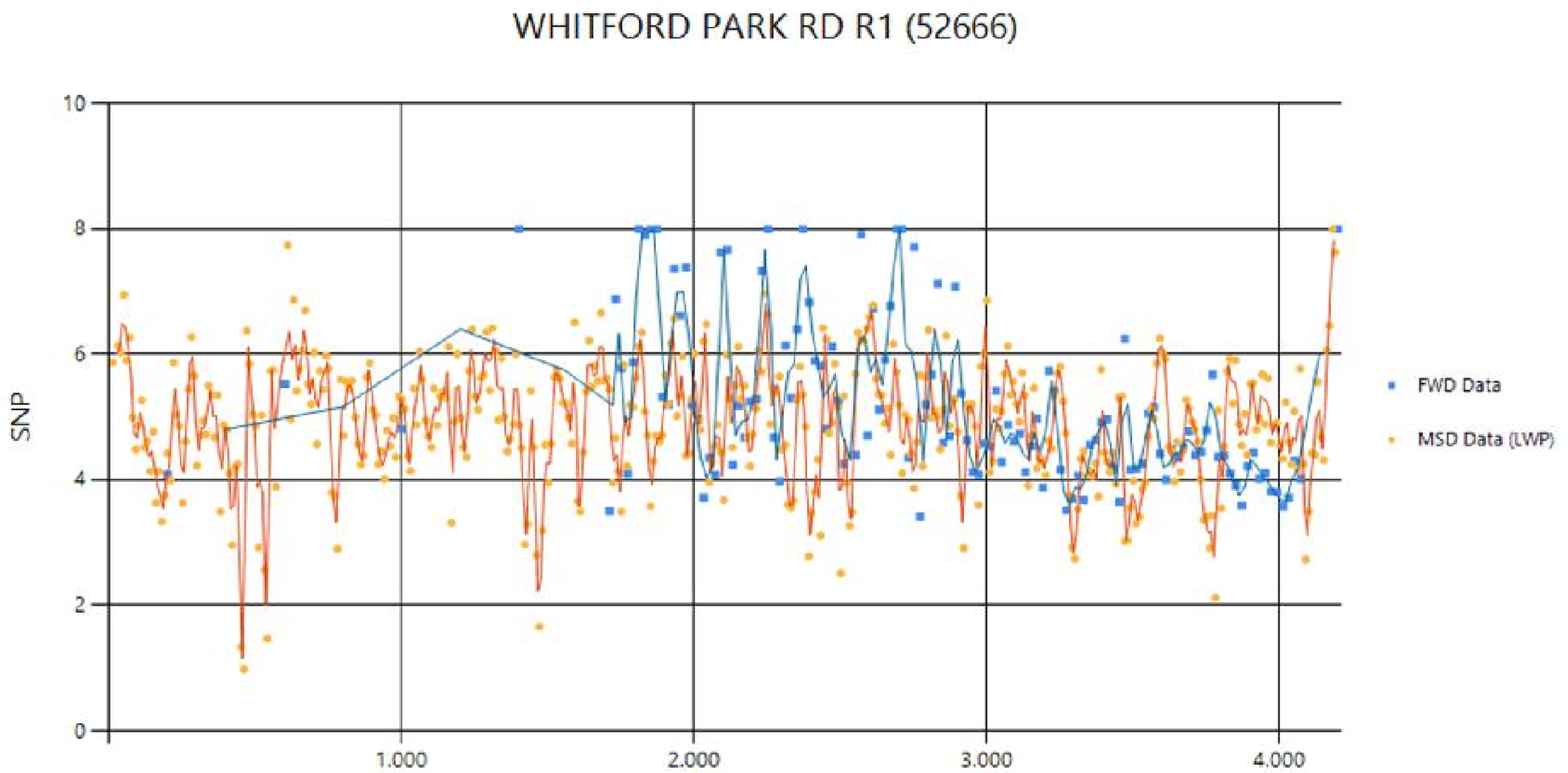
Validating MSD for AT: Per Site



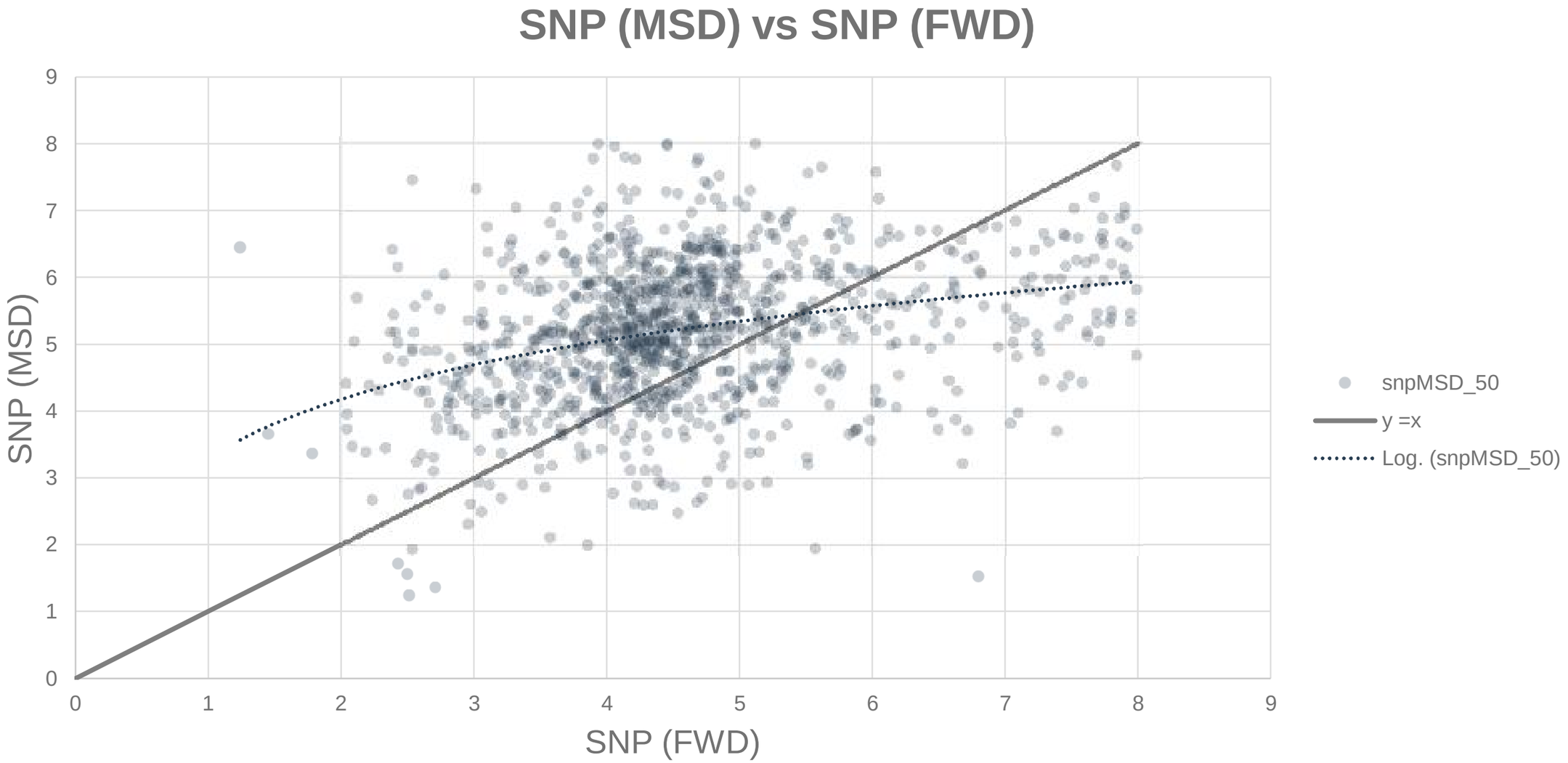
Validating MSD for AT: Per Site



Validating MSD for AT: Per Site

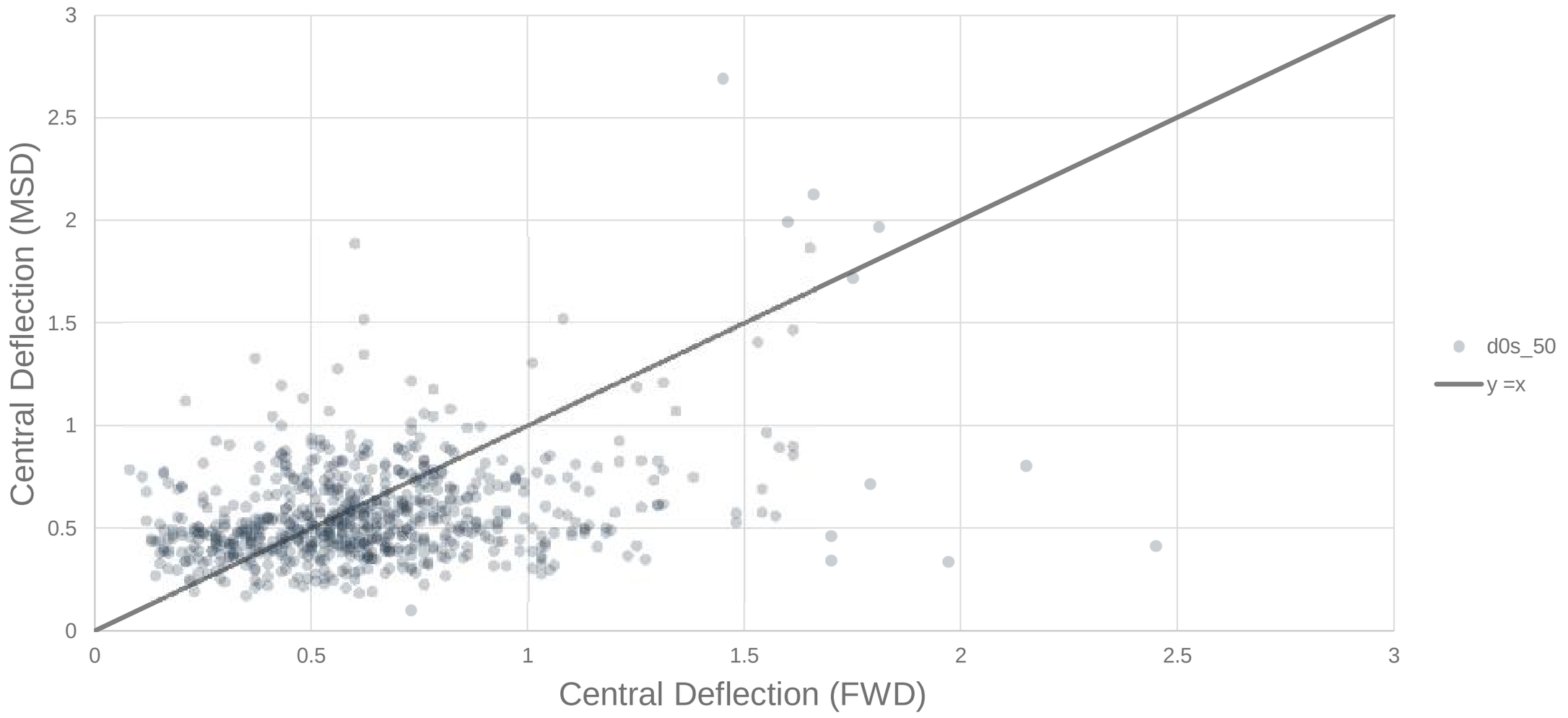


Validating MSD for AT: Across Network



Note only treatment lengths with project level FWD testing data was considered above.

Validating MSD for AT: Across Network



Note only treatment lengths with project level FWD testing data was considered above.

Conclusions

- Per site validation examples show:
  - Good relationship between MSD and FWD 5 pt moving average slope
  - Highlights the benefits of using MSD in lieu of FWD network level testing for STL identification (Buckland Rd)
- Across Network validation examples show:
  - Wide spread between MSD and FWD median readings per RAMM treatment length
  - Numerous variables contribute to this – however we have identified a dependency on surface macrotexture

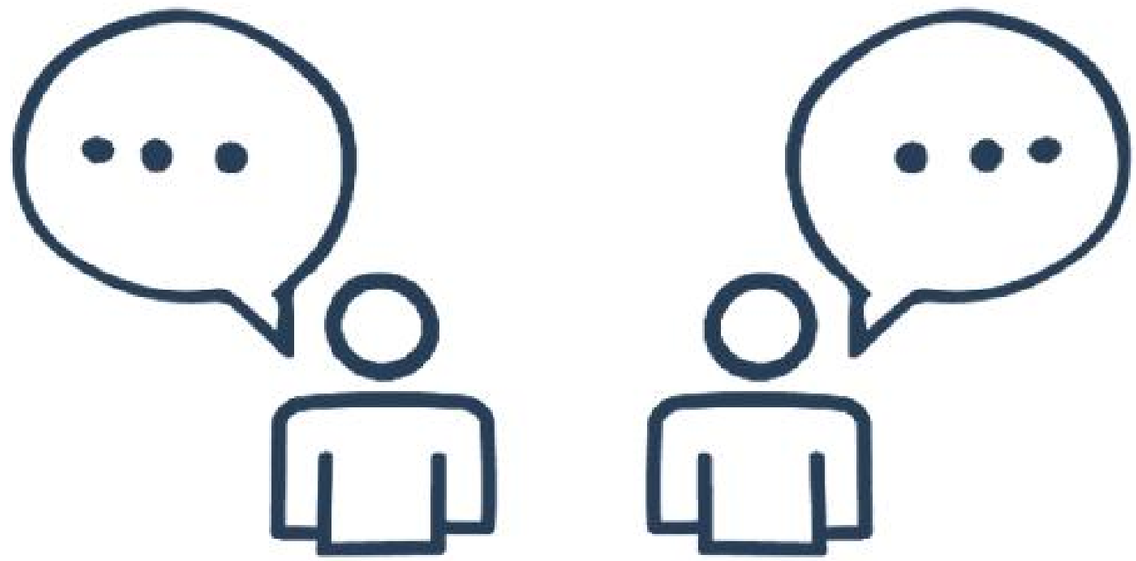
Recommendations

- Current Recommended Use for MSD:
  - Network level structural testing
  - Homogenous Treatment Length Identification
  - Identifying locations for targeted FWD testing

Future Work

- Development of additional MSD derived distress modes
- Condition Index (PII) calculated from structural data rather than surface defects data + roughness (2023 AMP?)
- Automated STL generation from MSD data
- Remaining life refinements according to RPP approach (later presentation)
- 30 year Forward Work Plan based on MSD structural data

Questions



Thank you.

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