



FWD Pavement Life Analysis – Austroads vs RPP

Presentation by Peter Scott (AT) and Lily Grimshaw (Geosolve)

12 May 2022

AT Pavement Renewal Process (PFR)

- PFR based on Waka Kotahi procedures
- [Monetised benefits and costs manual v1.5 August 2021 \(nzta.govt.nz\)](https://www.nzta.govt.nz/monetised-benefits-and-costs-manual-v1.5-august-2021)
- Site assessment
- Review maintenance history – RAMM data
- FWD testing of site
- NPV Analysis
- Existing maintenance strategy – patch and seal
- Rehabilitation or Reconstruction
- Deferred Rehabilitation

AT Pavement Renewal Strategy

- Based on faults not pavement strength (FWD) results

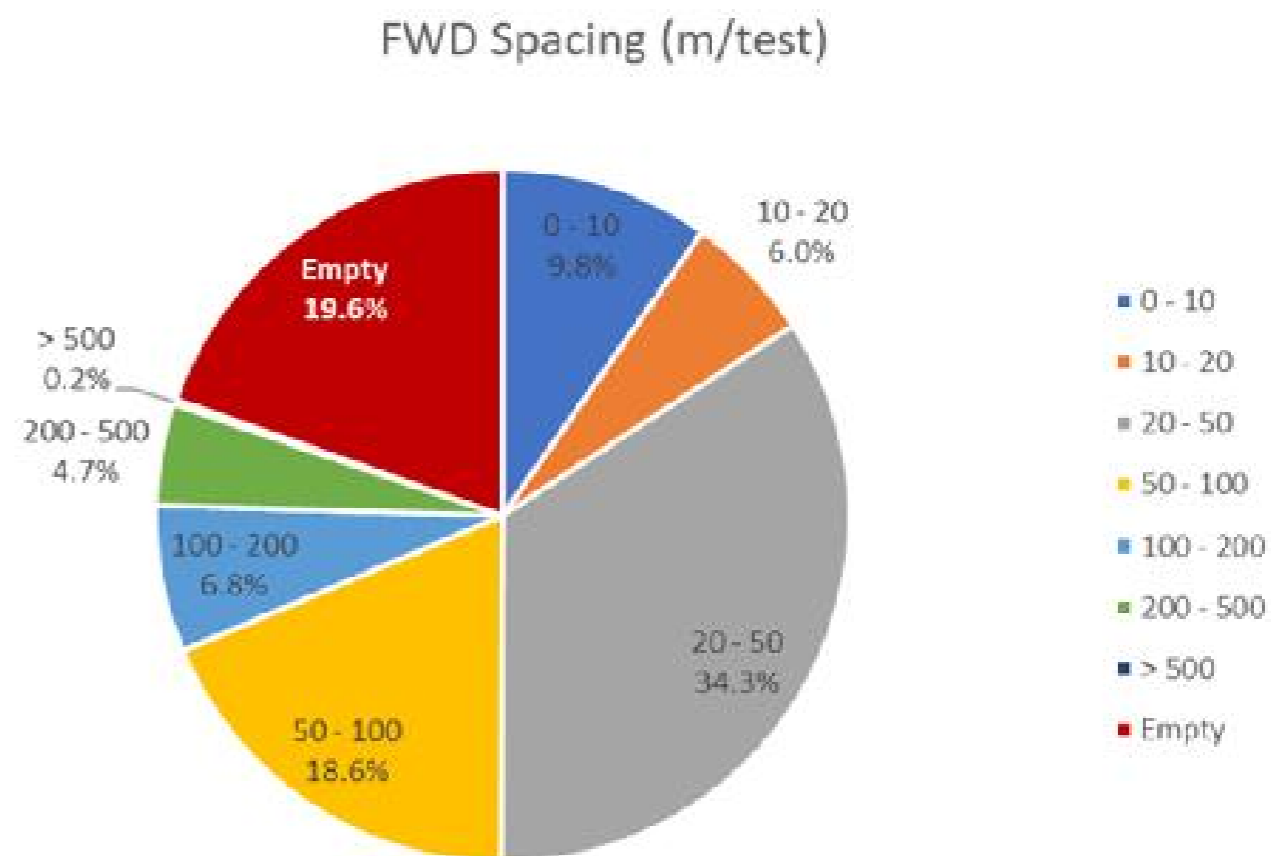
Table 5.3: Pavement Renewal Decision Matrix (Based on Failure Spread over Treatment Area)

Failures		Pavement Renewal Recommendation - Percentage of failure spread area over treatment area				
Failure Type	Failure Definition	Regional	Arterial	Primary Collector	Secondary Collector	Low Volume / Access
Alligator Cracking	Visible Cracking	≥ 25%	≥ 30%	≥ 40%	≥ 50%	≥ 70%
Pumping	Visible Pumping	≥ 25%	≥ 30%	≥ 40%	≥ 50%	≥ 70%
Rutting	Rutting ≥ 10mm	≥ 25%	≥ 30%	≥ 40%	≥ 50%	≥ 70%
Shoving	Shoving ≥ 10mm	≥ 25%	≥ 30%	≥ 40%	≥ 50%	≥ 70%
Block Cracking	Visible Cracking	≥ 25%	≥ 30%	≥ 40%	≥ 50%	≥ 70%
Roughness	≤ 60km/hr: NAASRA ≥ 150 >60km/hr: NAASRA ≥ 120	≥ 25%	≥ 30%	≥ 40%	≥ 50%	≥ 70%
Potholes	≥ 1 x pothole (incl. repairs) / 50m (on average)	100%	100%	100%	100%	200%
Combined spread	Total Coverage (combined)	≥ 25%	≥ 30%	≥ 40%	≥ 50%	≥ 70%

Example: If the failure spread of alligator cracking, pumping and rutting (combined) is greater than 40% of the treatment area on a "Primary Collector" road,

AT Pavement Testing Practice

- Geosolve has been doing FWD testing for AT since 2014 (consistency of data)
- Network level FWD testing (65%)
- Project level FWD testing (16%)
 - All rehab and asphalt sites for design
 - Remaining life calculation/graph
 - Sites need rehab but rehab life charts show good pavement life



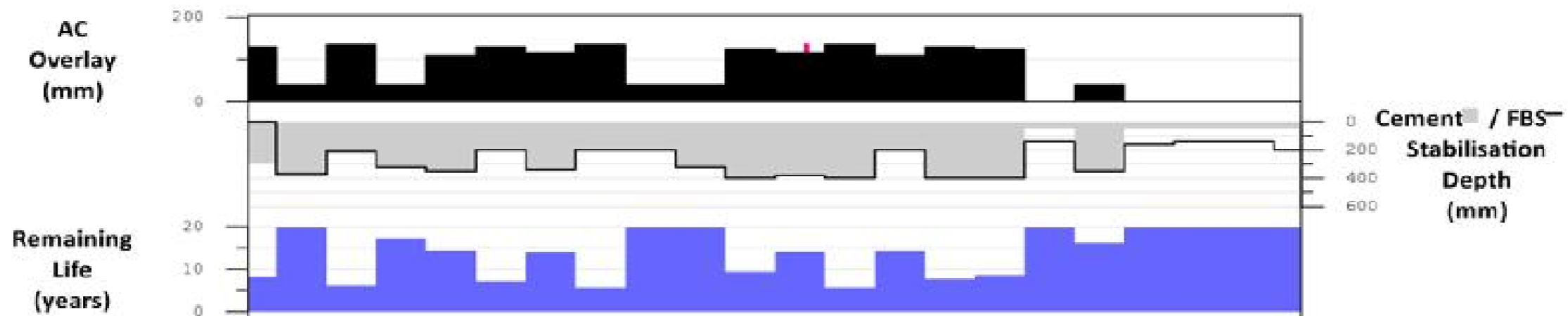
Mahunga Dr Rp 960 – 1171 PFR

Option cost estimates

	Heavy Maintenance	Rehabilitation option
Item		
Construction / Implementation	N/A	\$ 740,610.00
PV Construction / implementation (a)	N/A	\$ 698,688.68
PV Maintenance, renewal and operating (b)(c+d)	\$ 922,388.75	\$ 118,300.03
PV Total costs (whole of life) (A)(B)	\$ 922,388.75	\$ 816,988.71
PV Total costs (first 7 years)	\$ 864,713.50	\$ 699,263.50

Net Present Value (NPV)	\$ 105,400.03
Economic Indicator (EI)	-0.6

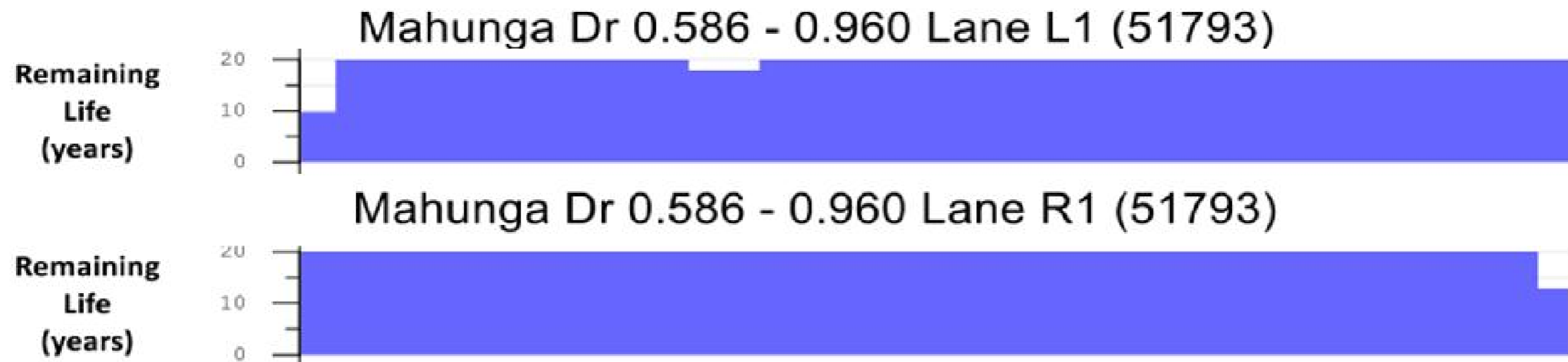
Mahunga Dr 0.960 - 1.171 (51793)
 (51793) Hastie Ave (+23 m) to Miro Rd (-145 m)



Mahunga Dr Rp 586 – 960 PFR

Option cost estimates

	Heavy Maintenance	Rehabilitation option
Item		
Construction / Implementation	N/A	\$ 1,312,740.00
PV Construction / implementation (a)	N/A	\$ 1,238,433.96
PV Maintenance, renewal and operating (b)(c+d)	\$ 1,690,944.49	\$ 209,849.43
PV Total costs (whole of life) (A)(B)	\$ 1,690,944.49	\$ 1,448,283.39
PV Total costs (first 7 years)	\$ 1,588,515.37	\$ 1,239,008.78
Net Present Value (NPV)		\$ 242,661.10
Economic Indicator (EI)		-0.7



Binsted Rd Rp 6 – 187 PFR

Option cost estimates

	Do minimum option	Rehabilitation option
Item		
Construction / Implementation	N/A	\$ 519,506.20
PV Construction / implementation (a)	N/A	\$ 490,100.19
PV Maintenance, renewal and operating (b)(c+d)	\$ 758,667.25	\$ 106,878.89
PV Total costs (whole of life) (A)(B)	\$ 758,667.25	\$ 596,979.08
PV Total costs (first 7 years)	\$ 681,831.79	\$ 490,675.01
Net Present Value (NPV)		\$ 161,688.17
Economic Indicator (EI)		-0.8

Binsted Rd 0.006 - 0.187 Lane L1 (41190)



Binsted Rd 0.006 - 0.187 Lane R1 (41190)



Millhouse Dr Rp 149 – 725 PFR

Option cost estimates

	Heavy Maintenance	Rehabilitation option
Item		
Construction / Implementation	N/A	\$ 1,840,125.00
PV Construction / implementation (a)	N/A	\$ 1,735,966.98
PV Maintenance, renewal and operating (b)(c+d)	\$ 2,870,662.73	\$ 328,359.09
PV Total costs (whole of life) (A)(B)	\$ 2,870,662.73	\$ 2,064,326.07
PV Total costs (first 7 years)	\$ 2,709,847.12	\$ 1,736,541.80

Net Present Value (NPV)	\$ 806,336.66
Economic Indicator (EI)	-0.8

Millhouse Dr 0.024 - 0.725 (51916)



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

Austrroads Models

- Austrroads 2011-2012 Part 5 Pavement Evaluation and Treatment Design
- Austrroads GMP

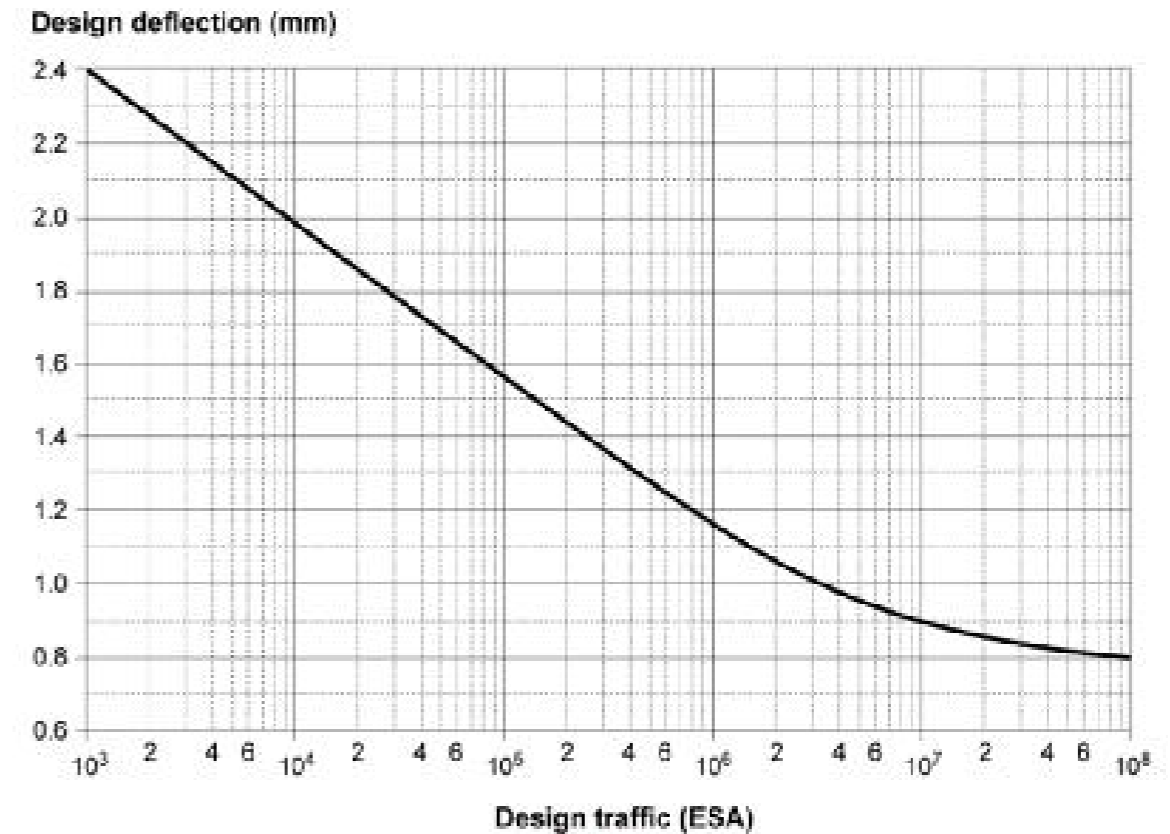


Figure 8.5: Design deflections to limit permanent deformation

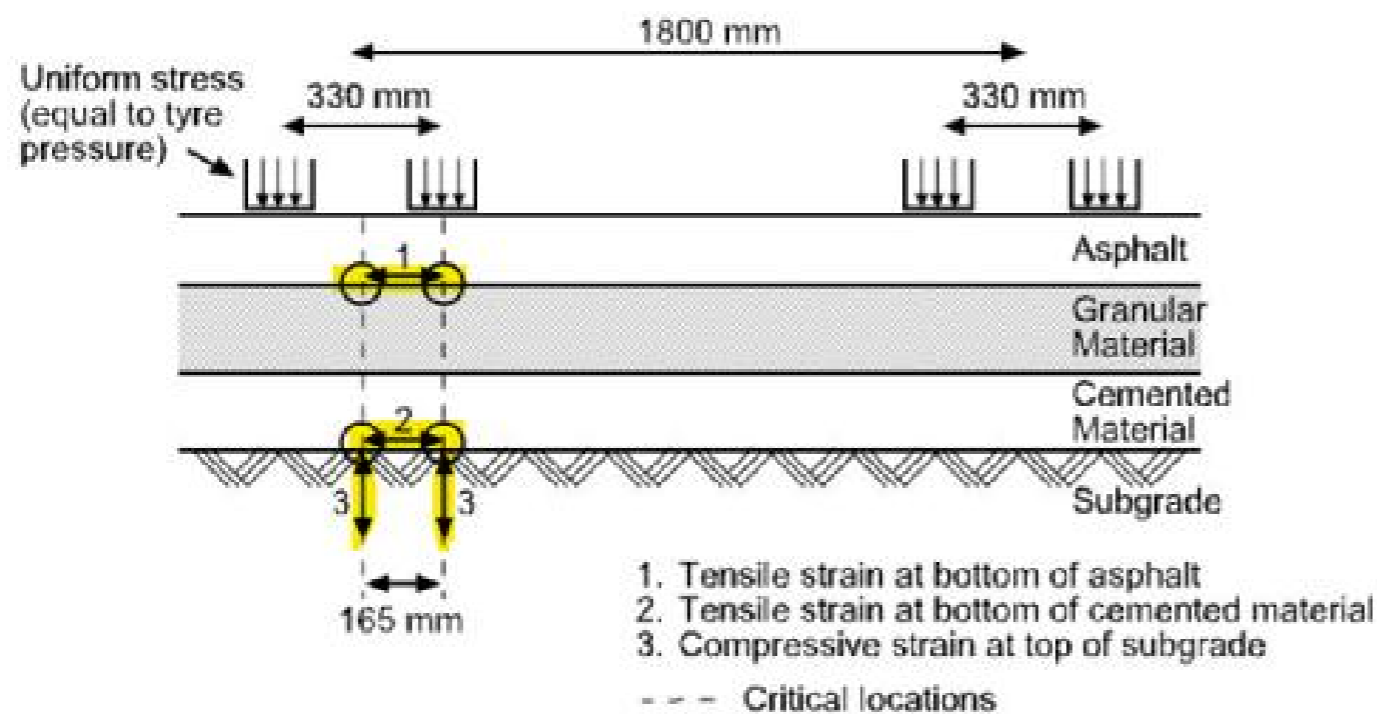
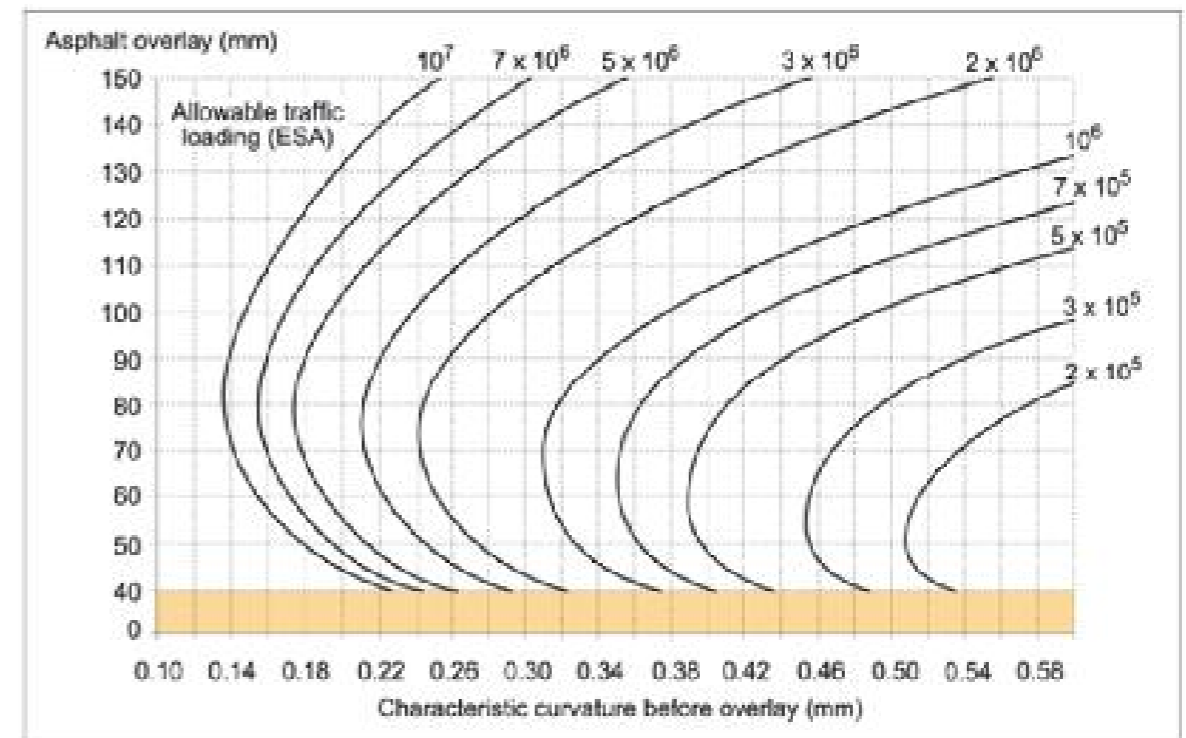
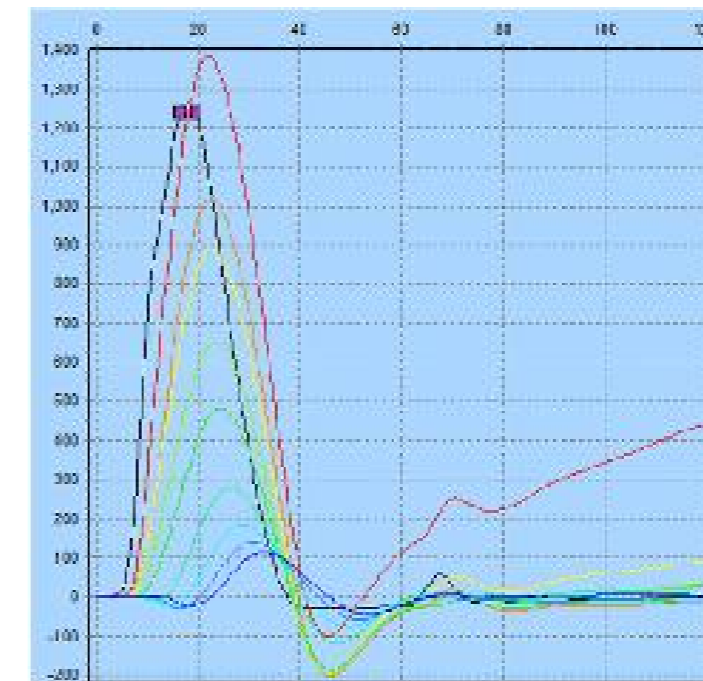
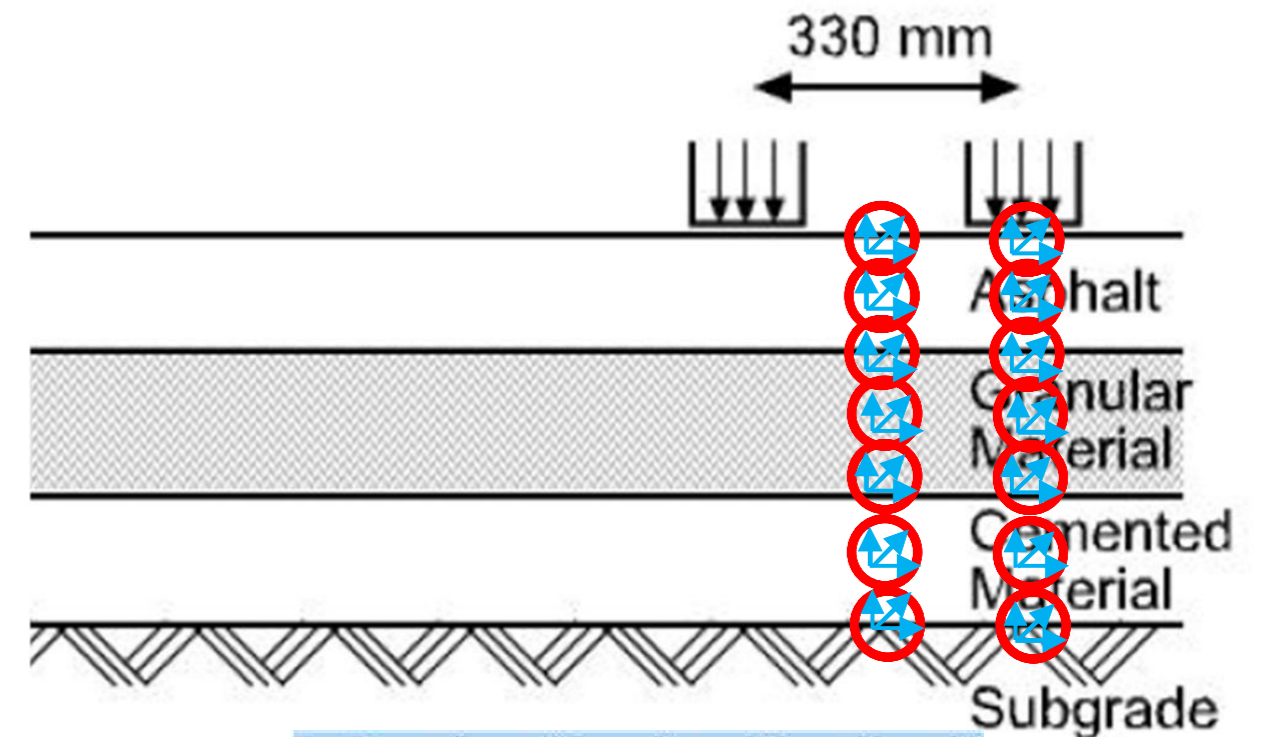
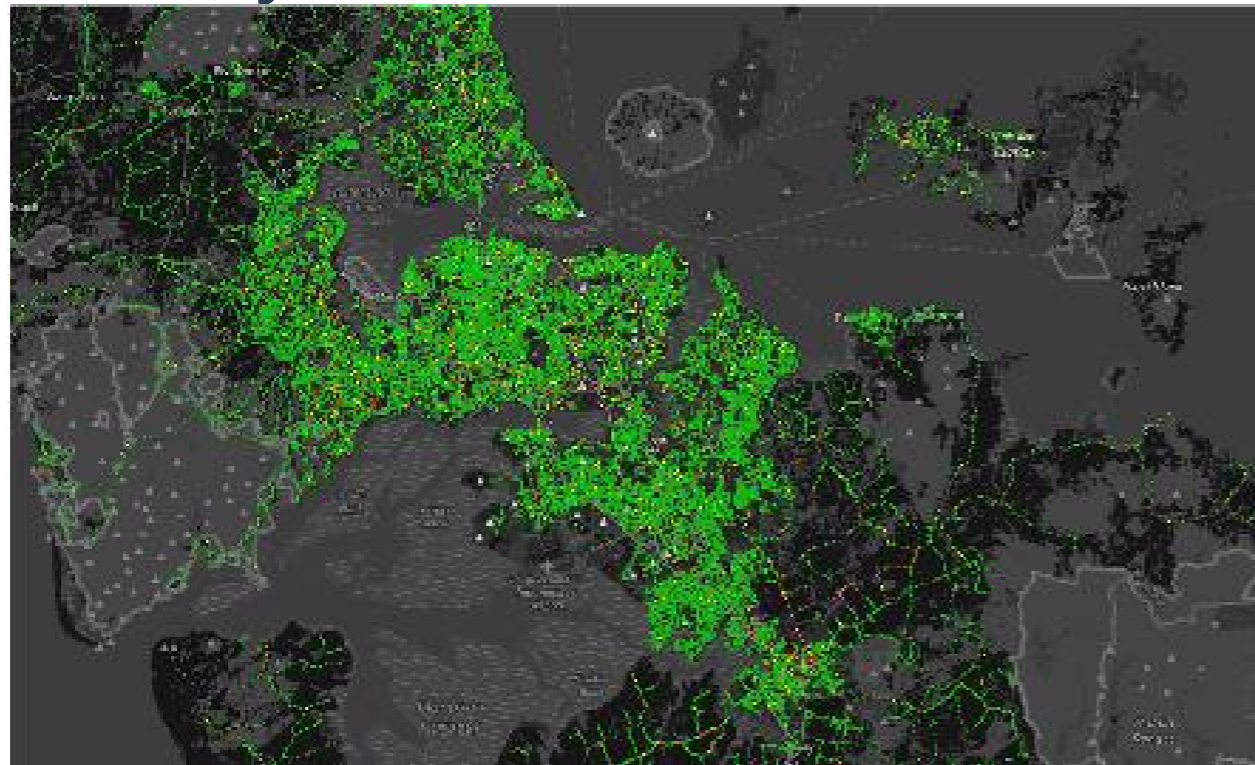


Figure 8.2: Pavement model for mechanistic procedure



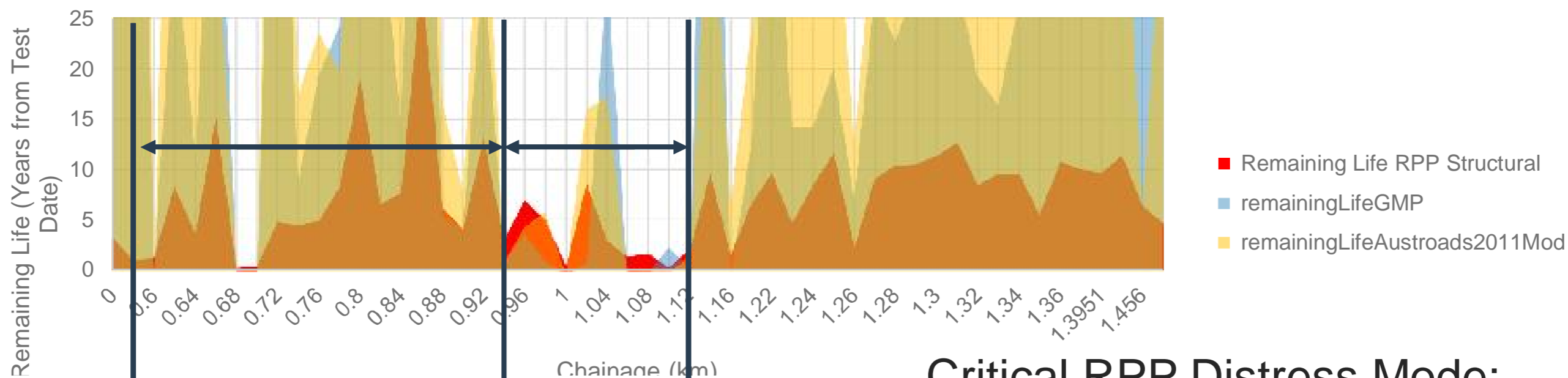
Regional Precedent Performance (RPP)

- Premise: Calculate and compare mechanistic and empirical parameters derived using the full-time history FWD deflection bowl



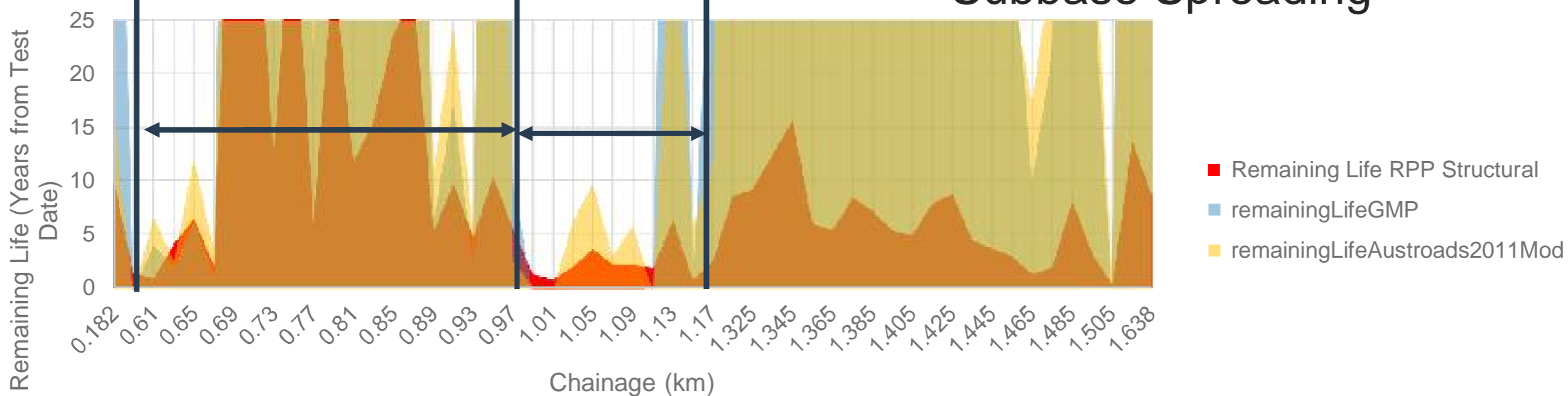
Mahunga Dr Revisited with RPP

Mahunga Dr L1

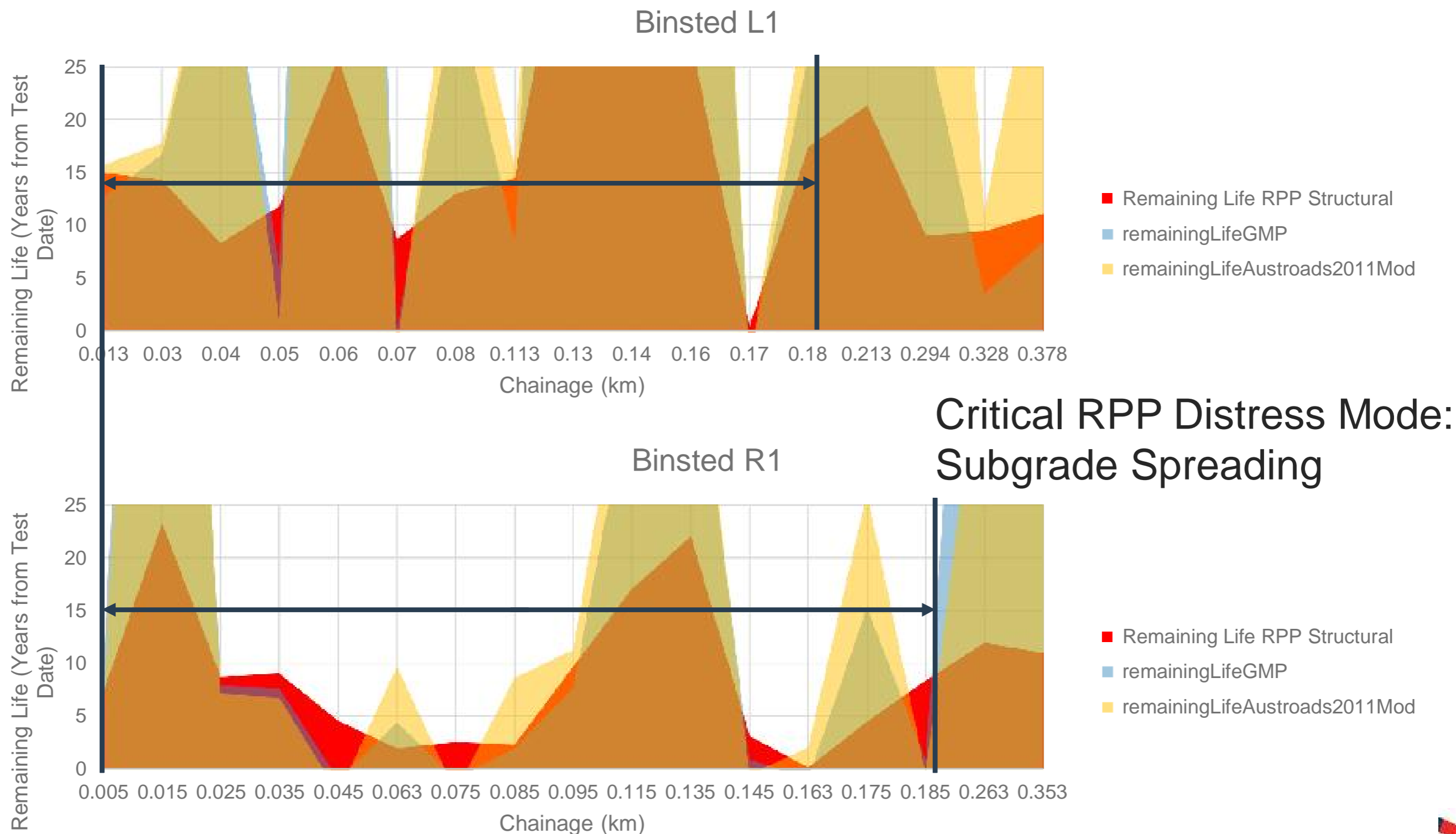


**Critical RPP Distress Mode:
Subbase Spreading**

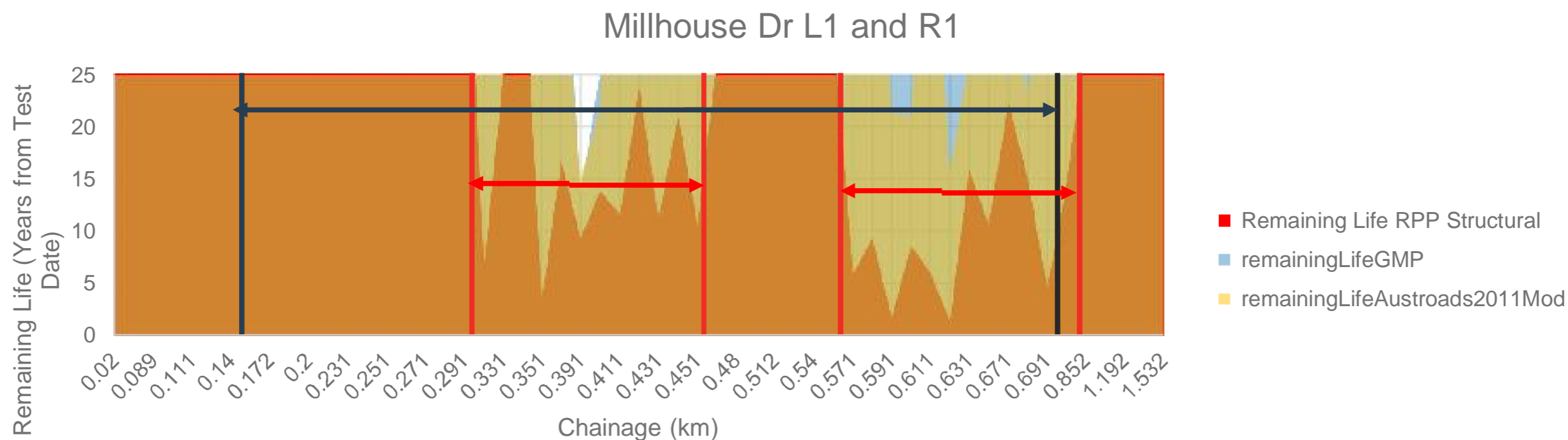
Mahunga Dr R1



Binsted Rd Revisited with RPP



Millhouse Dr Revisited with RPP



Critical RPP Distress Mode:
Saturated Basecourse

Conclusions

- Austroads models (GMP and 2012 AC Overlay) can overestimate pavement life
- RPP vs Austroads
 - RPP shows lower remaining life consistent with observed distress on rehab sites
 - RPP “sees” structural distress otherwise missed by Austroads
- Recommendations:
 - Consider RPP structural remaining life magnitude and extents in PFRs
 - Opportunities to refine rehab extents and depths for Millhouse
 - Refine NPV calculations to consider RPP structural results

Future

- Provide Austroads and RPP analysis results in FWD reports for use in PFRs
- Use Composite Indices **and** FWD data in renewal strategy
- Consider ALL relevant pavements data
 - HSD
 - FWD
 - MSD
 - RAMM Maintenance
 - RAMM Visual Classification
 - Surfacing Date
 - Layer Date
 - Traffic Information

Questions



Thank you.

