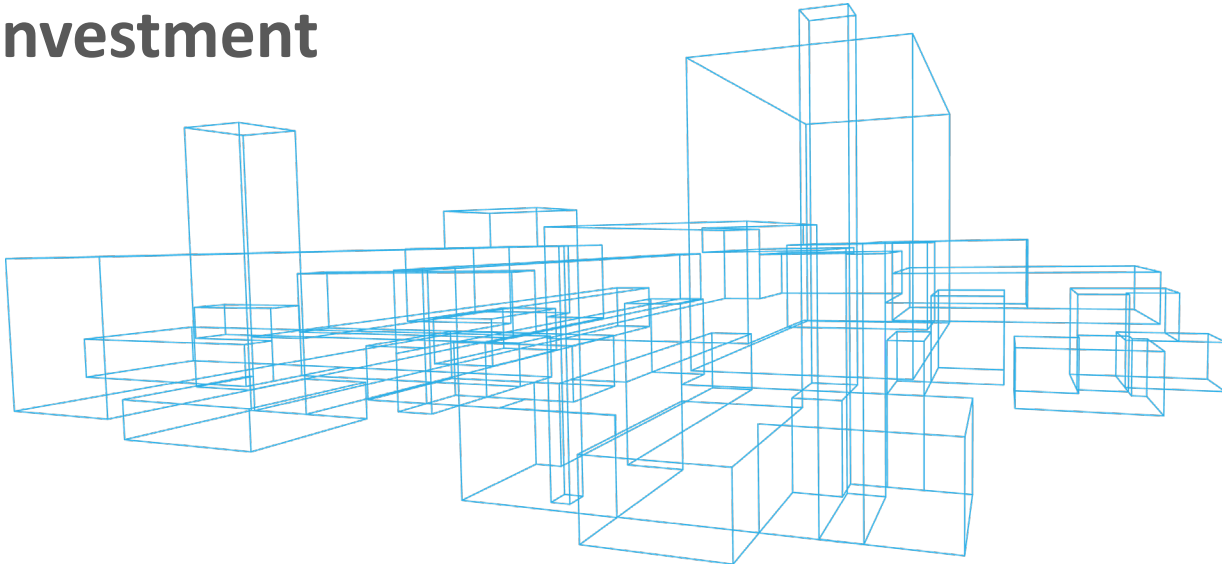
IDS Infrastructure Decision Support

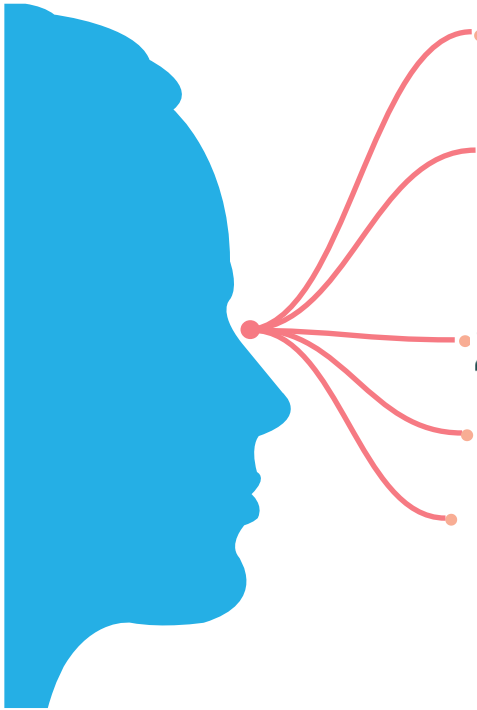
THE UNIVERSITY OF AUCKLAND
Te Whare Wānanga o Tāmaki Makaurau
NEW ZEALAND

2021 State Highway Investment Analysis

Theuns Henning



Key Messages



- Success does not always come over night
- No alternative for technical robustness
- There is power in true collaboration
- Aiming our research towards practical impacts
- Project management 101 –delivers results

Recognition

- IPWEA New Zealand *'2021 Excellence in Asset Management'* Award
- *'IPWEA Australasia 2022 Excellence in Asset Management'* category and *'IPWEA Australasia 2022 Public Works Medal for Project of the Year'*
- Finalist in the 2021 Engineering New Zealand ENVI awards, '*Engineering Partnership Award'* category
- Project Team were winners of the *'Best Presentation Award'* and *'Innovation Award'* at the 2021 Roading Infrastructure Management Support Group (RIMS) Conference

Gemma Mathieson, COO, IDS, receiving the Australasian Awards from Chris Champion, National President & Board Chair 2020, Engineers Australia. Credit photographer: Gianna Grbich.

NLTP Project Partners – A True NZ Inc. Effort

PROJECT CONTRIBUTORS

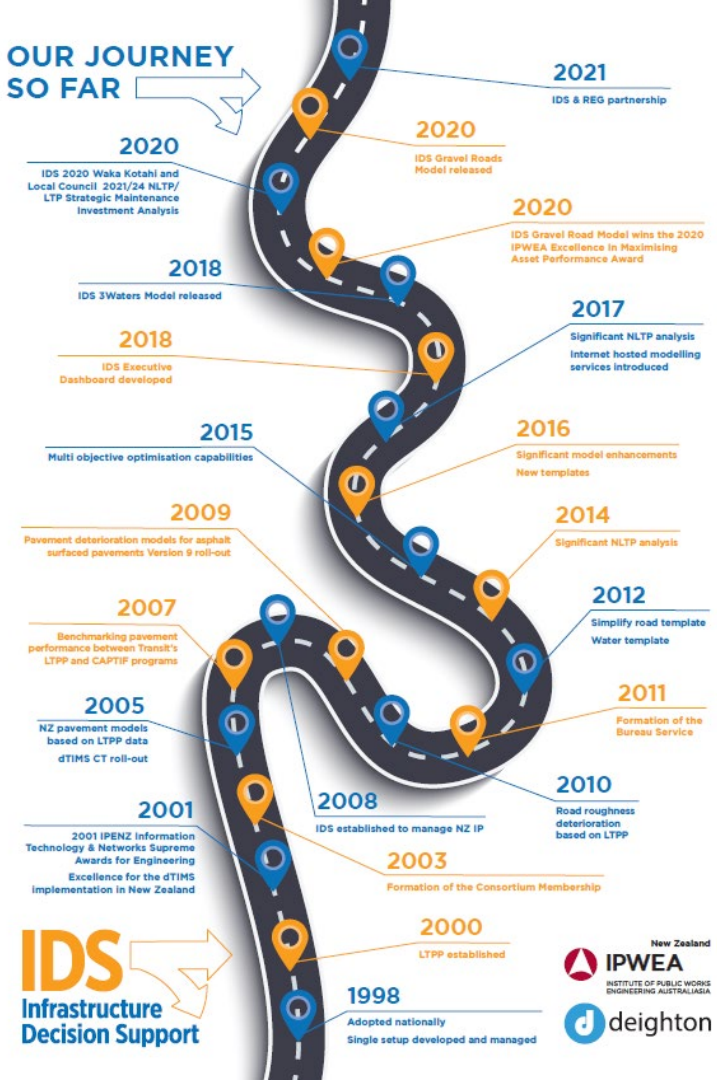
About IDS

- A charitable organisation, IDS is owned by the civil engineering industry to support and serve the industry and their communities of New Zealand.
- Provides industry leadership in the development, advocacy, and implementation of evidence-based decision making for infrastructure.
- Provides kaitiakitanga of the publicly-owned taonga (IP) encompassing methodology, models and interrelationships.
- Drawing on performance-modelling IP, provide clients with solutions to maintain, improve and protect their infrastructure networks.
- IDS are wholly owned by IPWEA New Zealand.

New Zealand IPWEA
INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALASIA

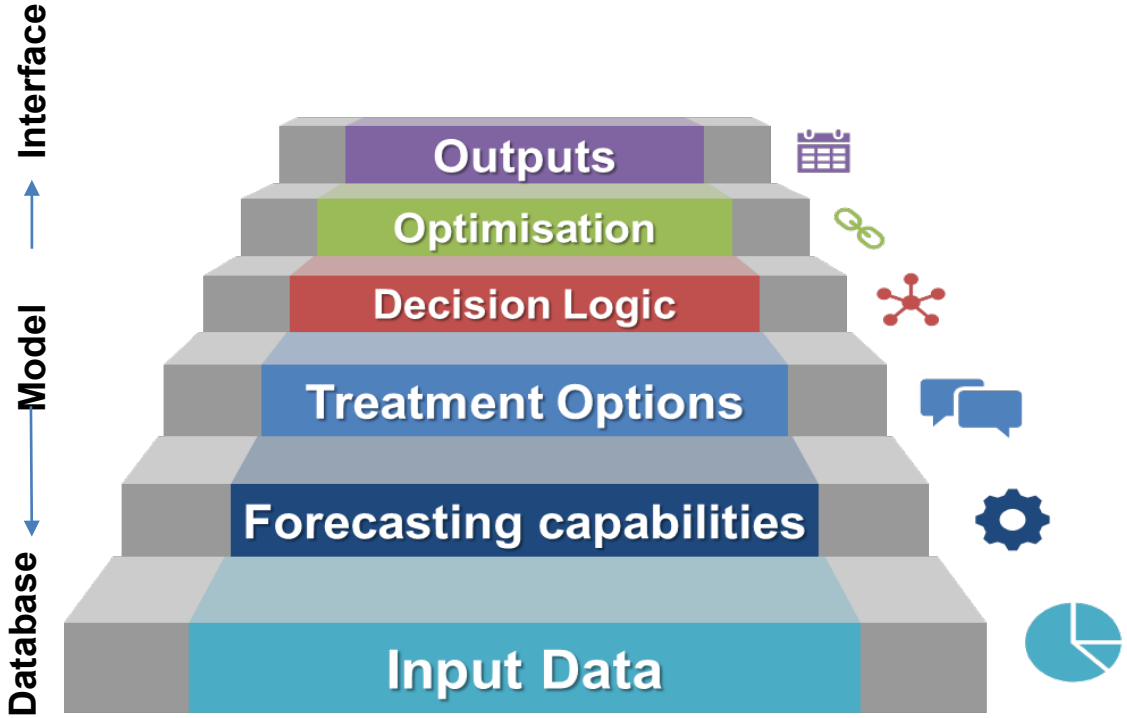
The Development Journey

- **5 x PhDs**
  - Theuns Henning
  - Sachi Kodipilly
  - Megan Schlotjes
  - Mohammad Mia
  - Lin Chen
- **5 x Masters**
  - Carol Ma
  - Zuwei Deng
  - Derek Roux
  - Gemma Mathieson
  - Annisa Hasanah

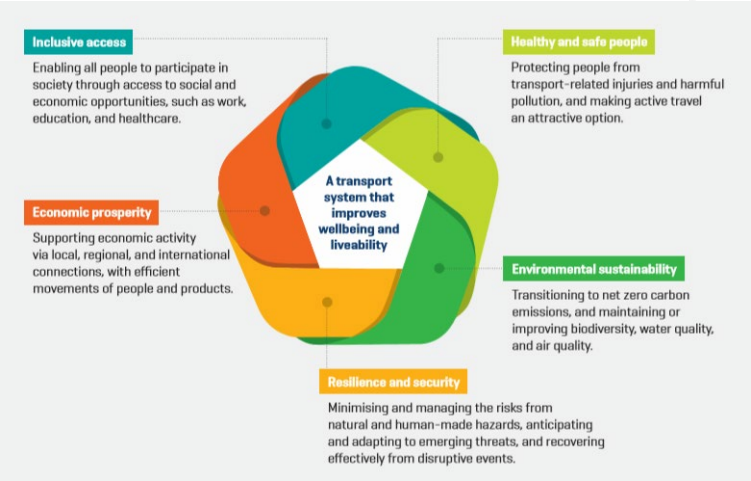


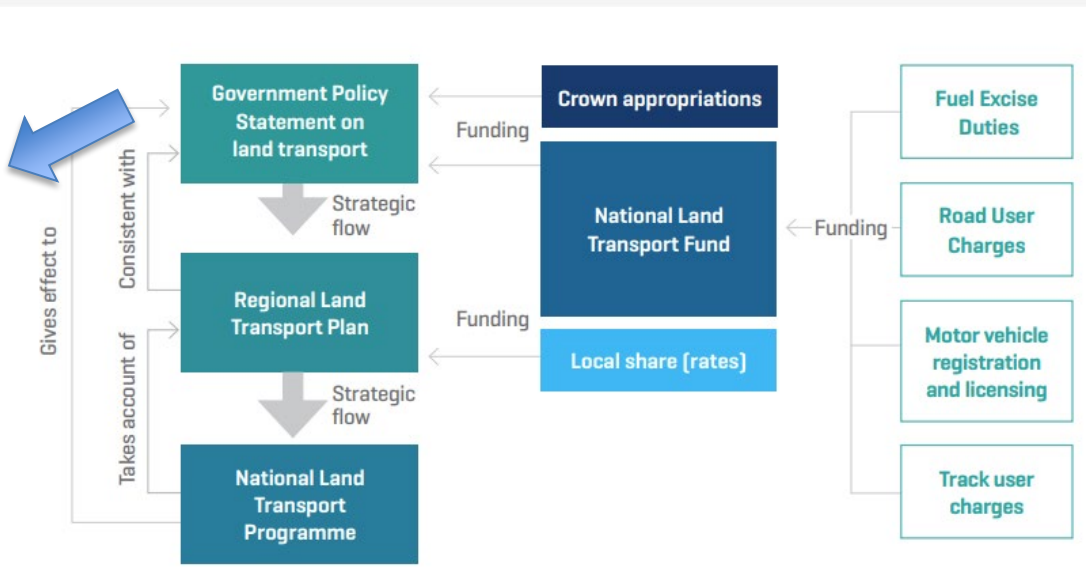
IDS Infrastructure Decision Support

The IDS dTIMS Model



Investment Analysis





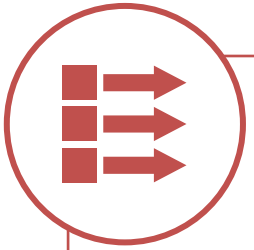
Project Stages

Implementation

- *Funding rollout*
- *Contract areas*
- *Programme*

Investment Analysis

- *NLTP bid*
- *Contract quantities*
- *Long-term consequences*

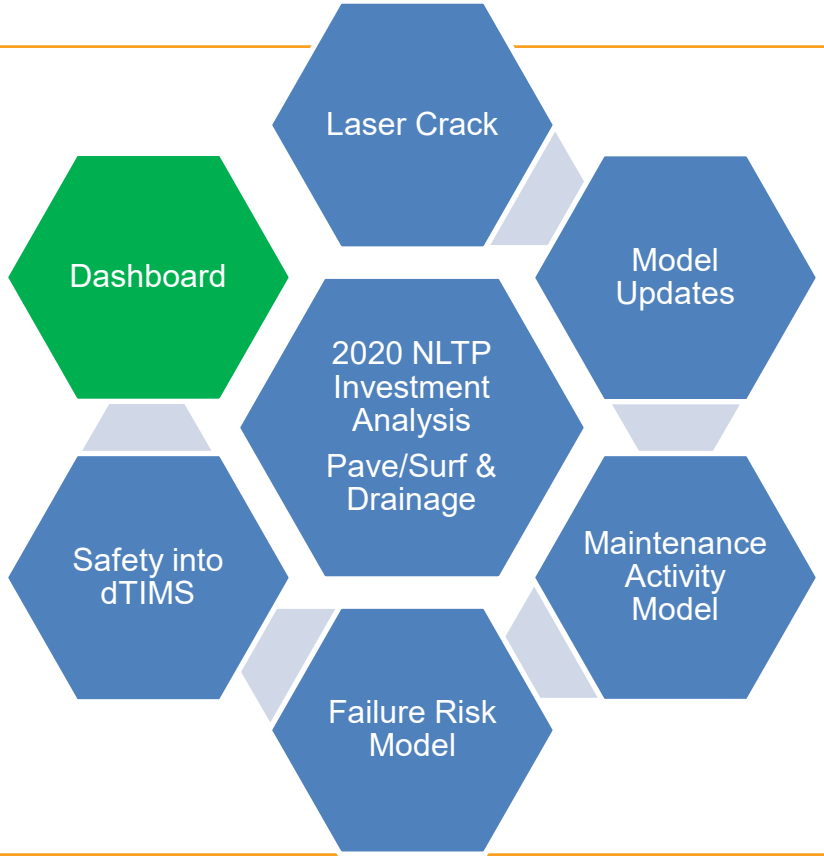


Development Projects

- *Data Input*
- *Forecasting*
- *External inputs*

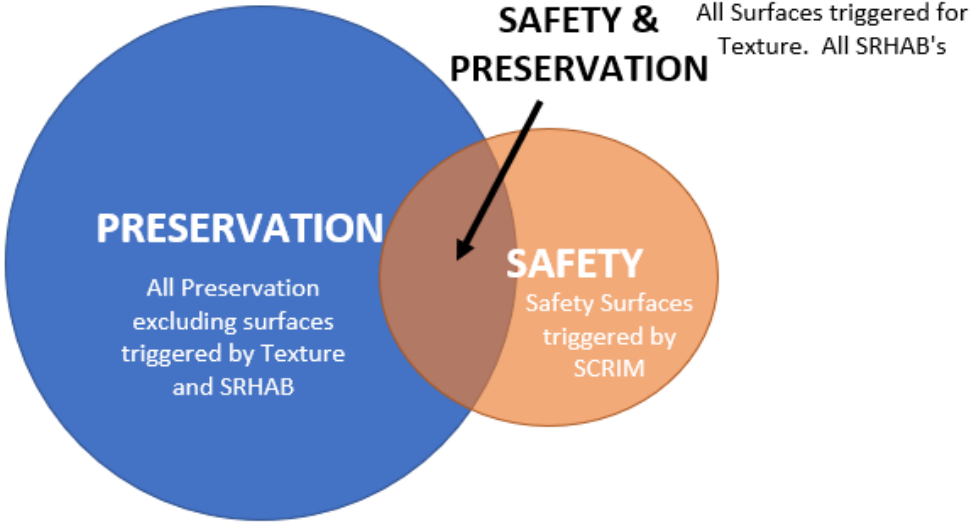
Development Projects

- Data Improvements
  - Crack Scanner Calibration
  - Strength data
- New Models (in dTIMS)
  - Maintenance Activity
  - Safety (texture, skid, aquaplaning)
- New Models (outside dTIMS)
  - Drainage
  - Failure Risk
  - Crash Risk/Social Cost
- Model Improvements
  - Rutting & Cracking

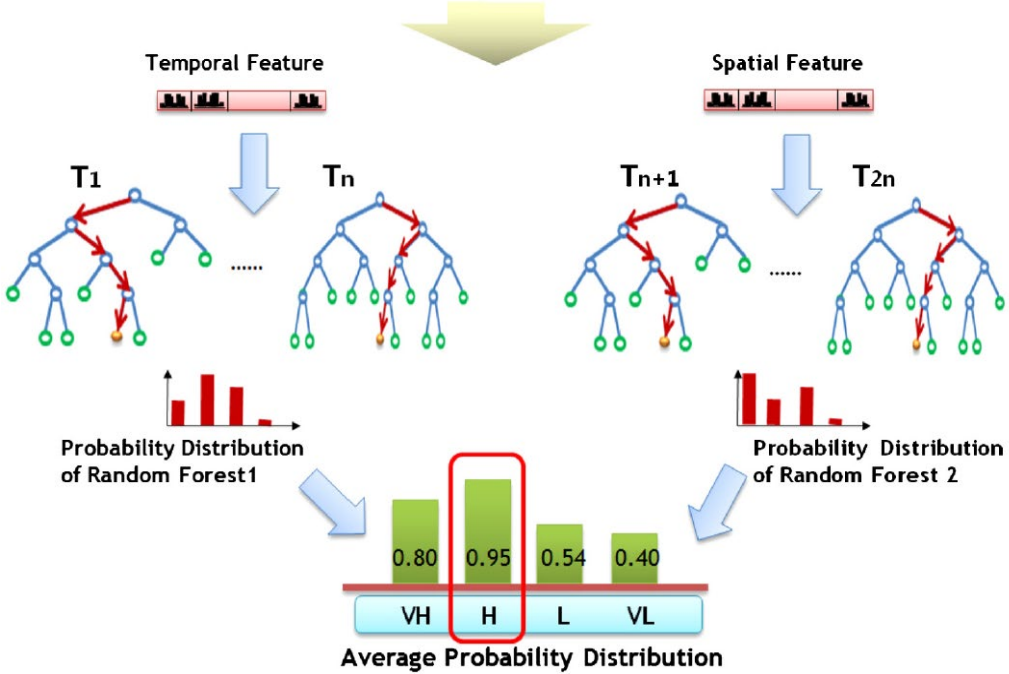


Integrating Safety with Renewals

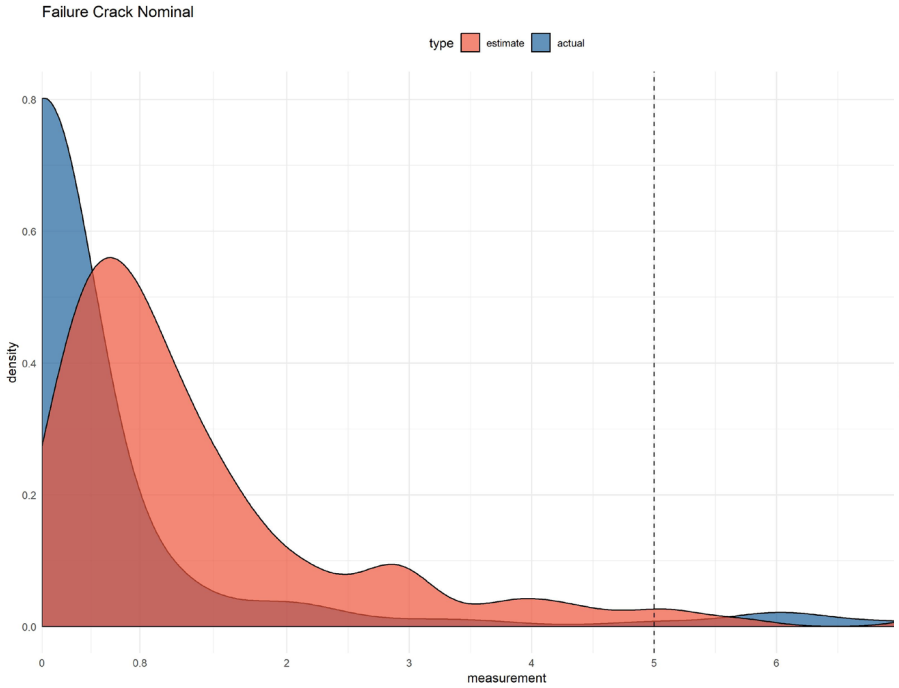
- **Safety Investment** (SCRIM CS only)
- **Safety & Preservation** (All Texture CS and SRHAB)
- **Preservation** (everything else)

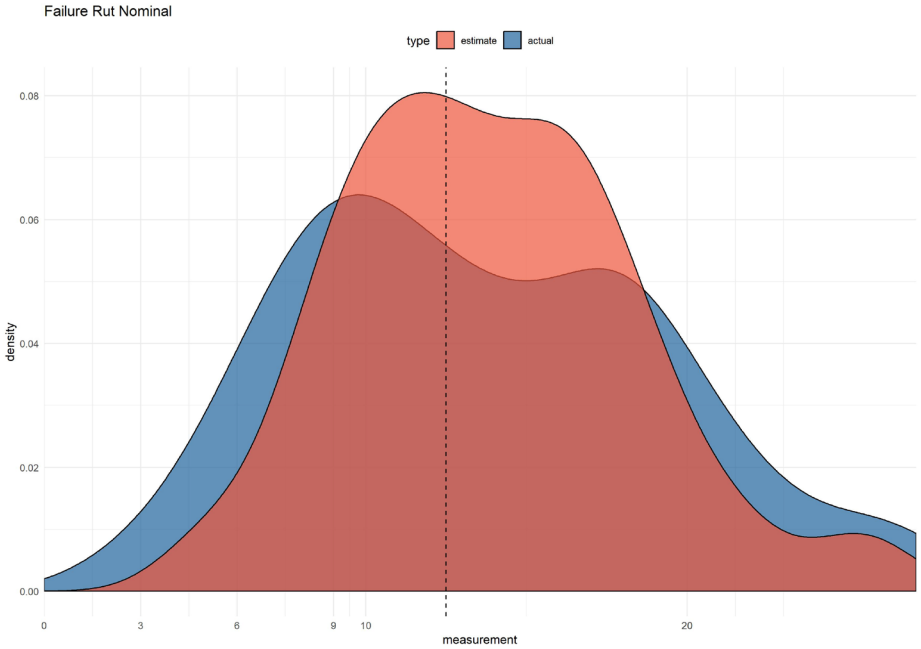


Failure Risk –Random Forest

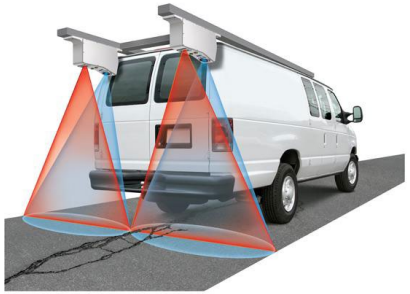


Failure Risk –Predicting Actual Performance





Crack Scanning Potential Origin of Errors

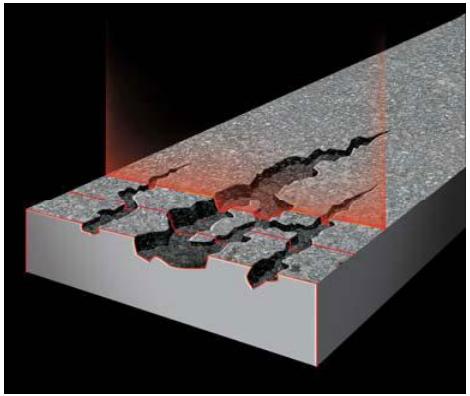


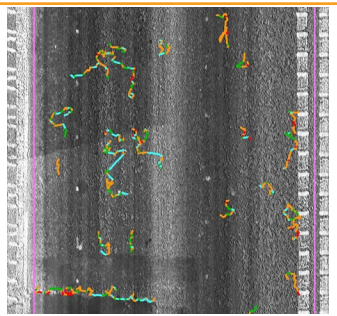
How we measure

- The measurements are very accurate
- Most issues relates to distance recording

How we analyse the images

- Machine learned algorithms
- Can be accurate but needs to be trained well
- Most errors on chips seals comes from this step





How we quantify the crack extent

- Linear length of measured cracks
- Grid block across surface area (blocks should be small)

Key Investment Drivers

2016 Model Recommendation: $100M p.a.

What has changed:

- Accelerated traffic growth over past 5 years, aggravated by HPMV vehicles
- Cost to deliver renewals has increased
- Renewal achievement below strategic program recommendations

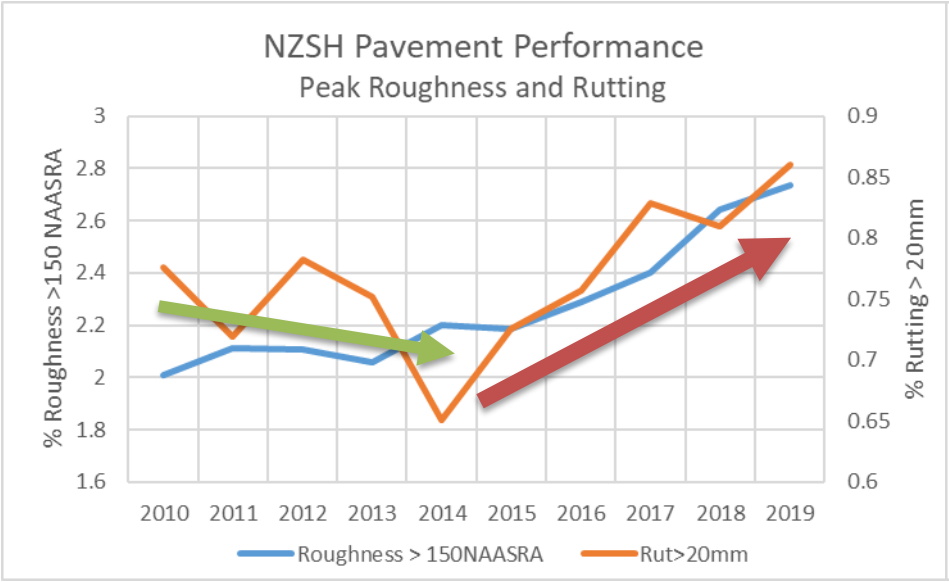
As a result:

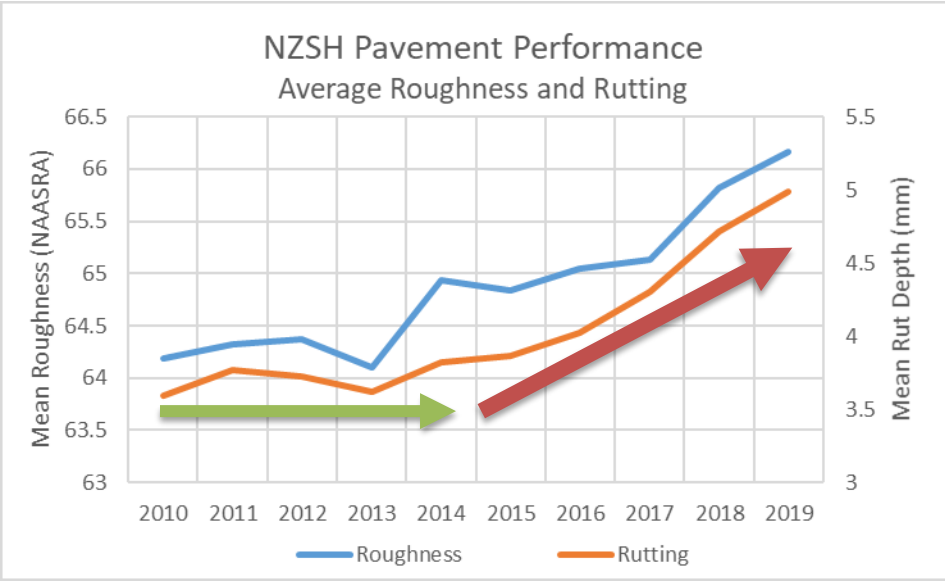
- Network condition has deteriorated
  - Quantity and Effectiveness of Renewals
  - Mtc Strategies applied to remainder of the network

What impact has this had ($estimations):

Traffic Growth :	UNKN
Cost to Deliver:	$165M
Backlog:	$45M
TOTAL:	**$210M**

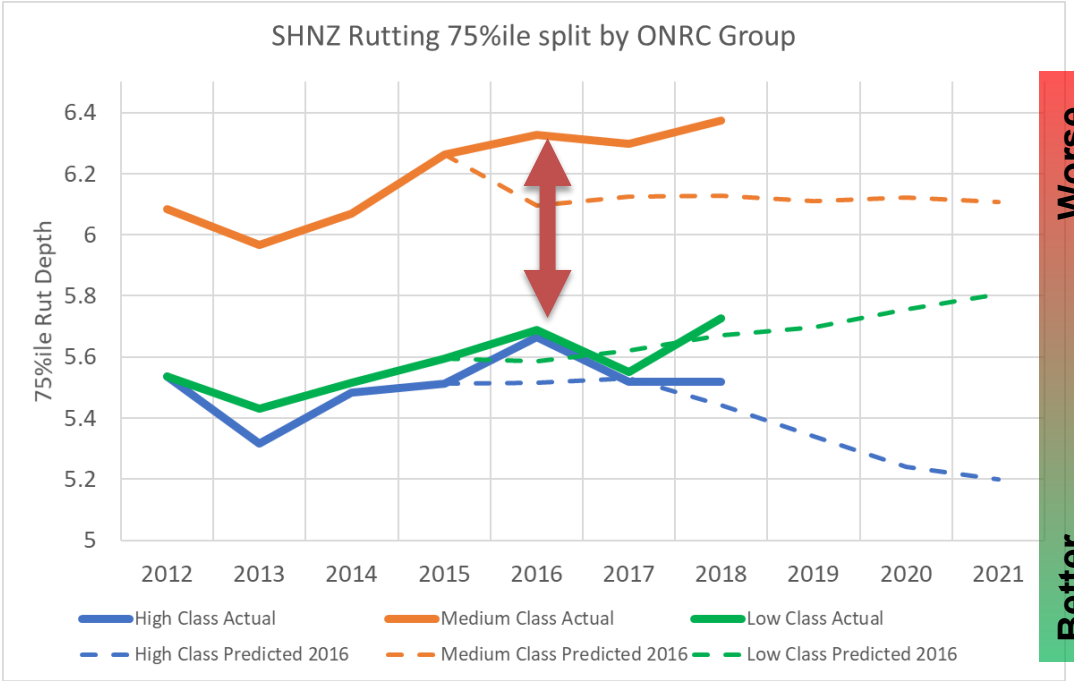
Performance – National Pavement Measures



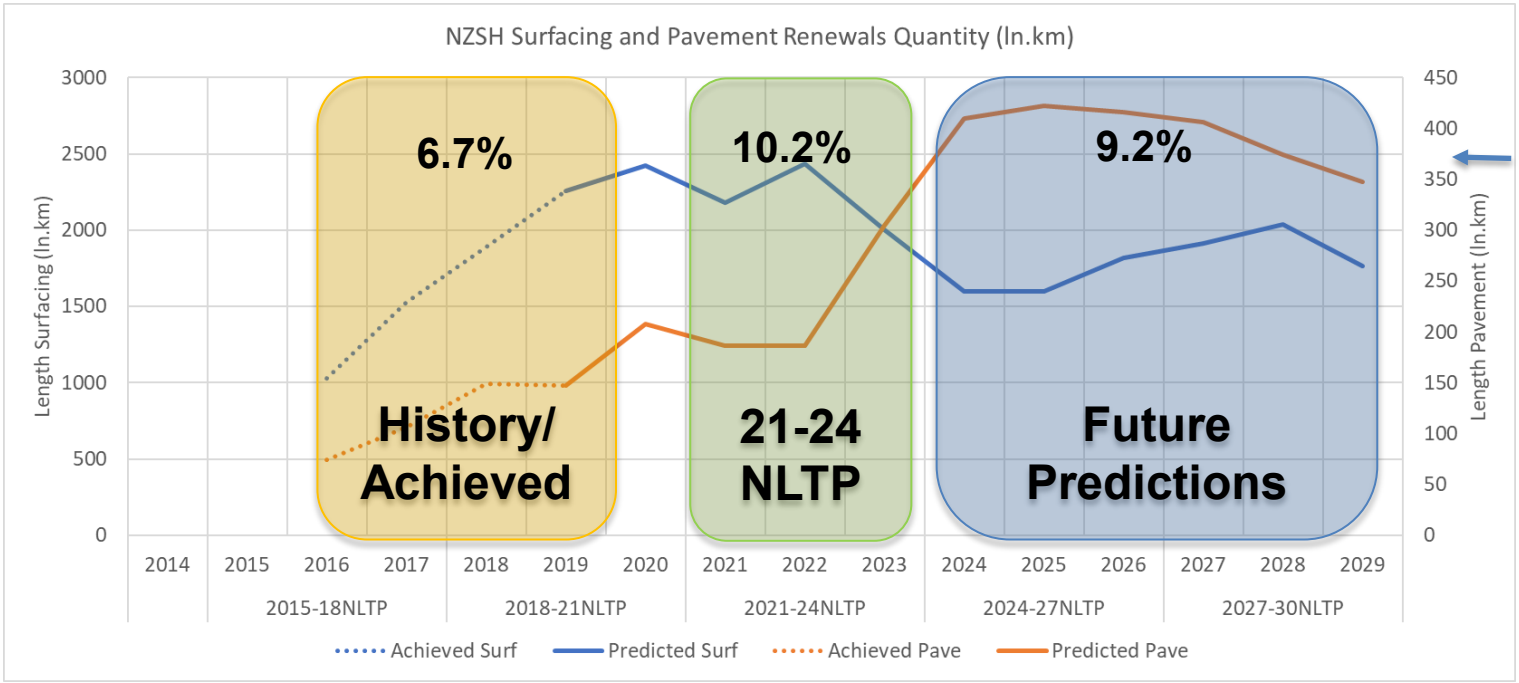


Performance – ONRC

- **High Class** performing well
- **Medium Class** under-performing
- **Low Class** over-performing

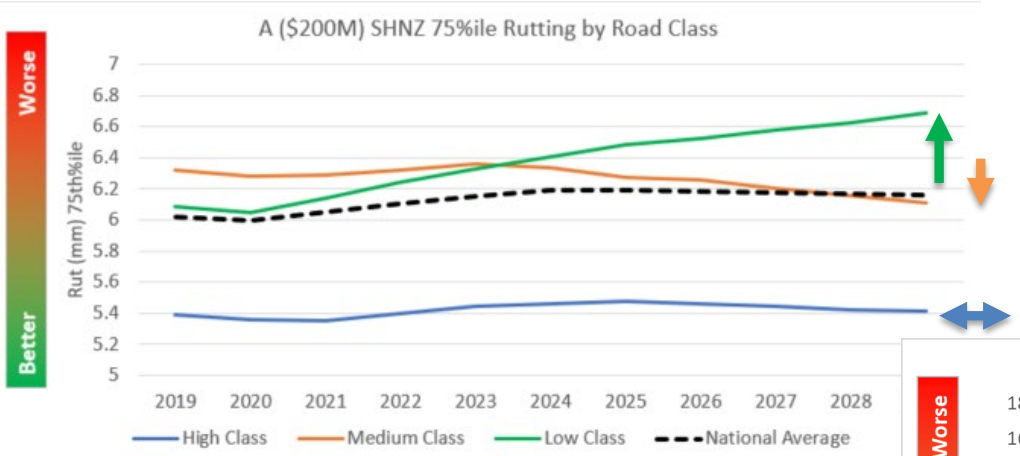


Recommendation - Quanties



% Network Treated

Strategic Objective are met for $200 Million

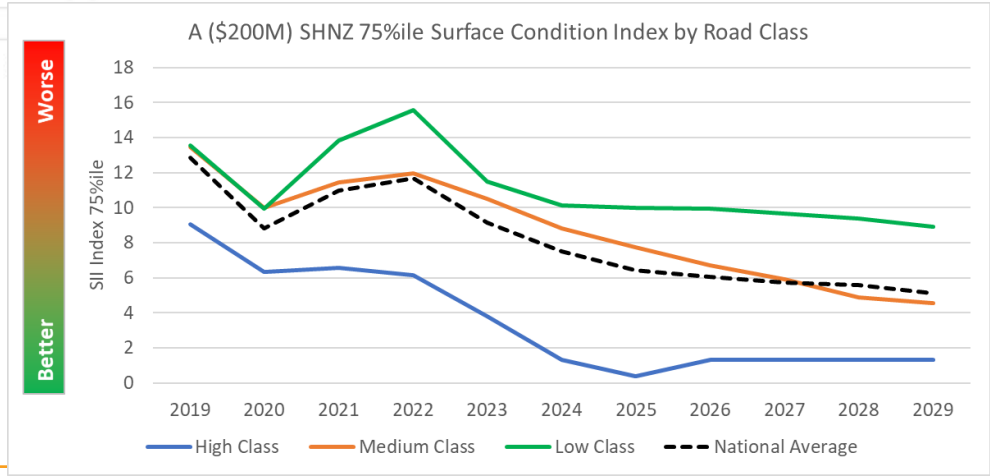


Pavement:

- Medium Class Improves,
- Low Class Slip

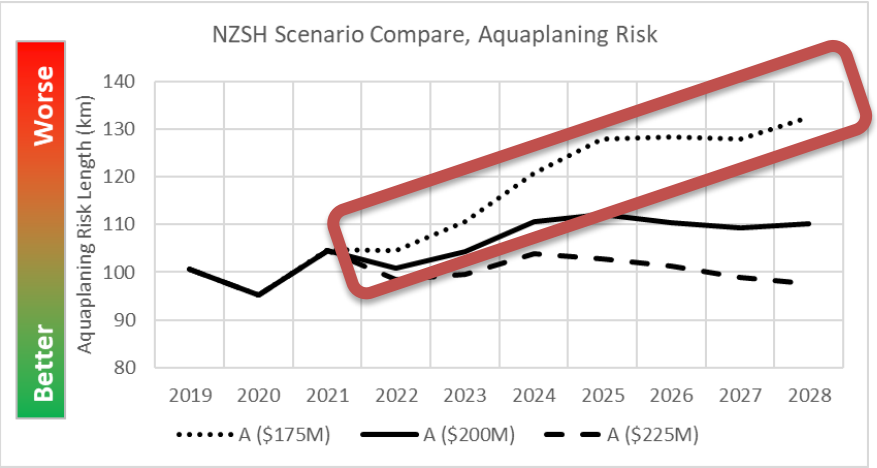
Surface:

- Low Class Maintained for Waterproofing
- Other Classes Improved

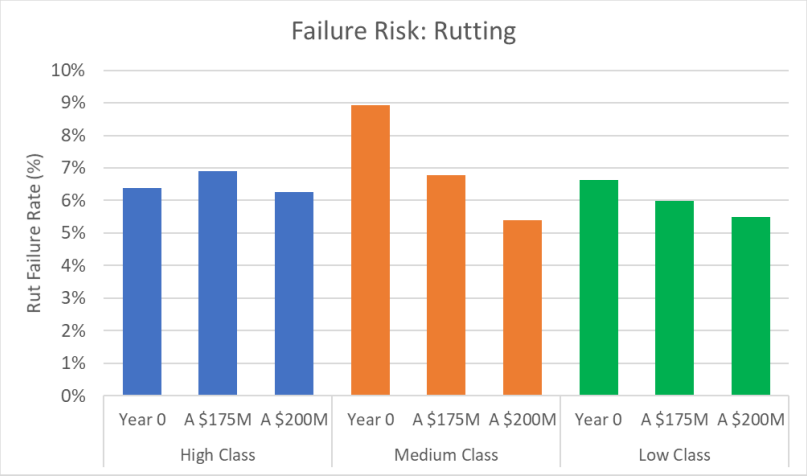


There are Risk for Investing Under Recommended Levels

- Aquaplaning Risk accelerates



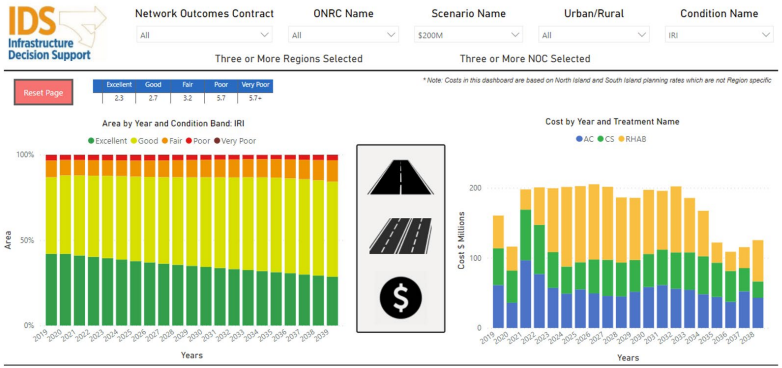
- What the programs leave behind

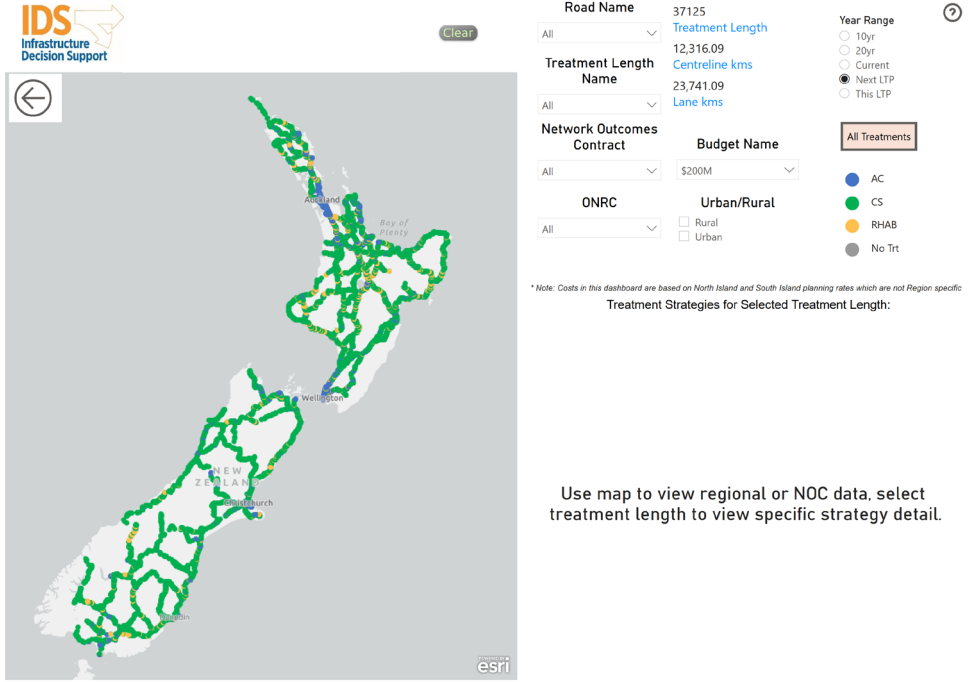


Dashboard

Excerpt from the project's Senior Executive Dashboard showing the Treatment Map.

Users can view the model generated forward works programme for each scenario and have the ability to filter down to individual treatment levels





Use map to view regional or NOC data, select treatment length to view specific strategy detail.


WHEN
WET
Questions