ROAD INFRASTRUCTURE
MANAGEMENT FORUM

**Our Carbon Equation**

New Zealand
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# From Rules to Objectives

*Bringing innovation into TCC renewal forecasting approach*

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Tauranga City

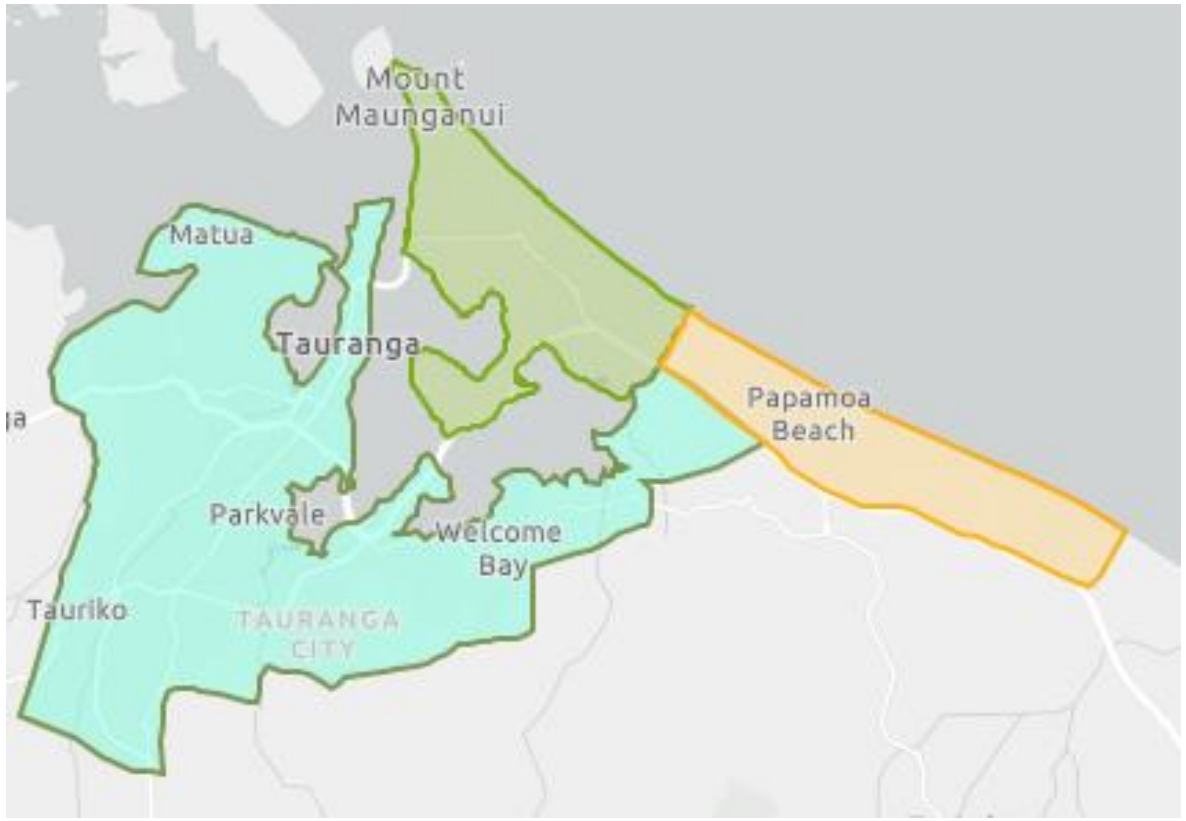
RIMS
Roading Infrastructure Management Support

in association with
IDS
Infrastructure
Decision Support

# Introduction and Overview

- TCC network summary and challenges
- Our Asset Management approach
- Bringing innovation into our modelling framework
- Field Validation of the model outputs
- What is next?

# Network Summary




## Road By ONRC (600km)

National – 5km

Regional 12km

Arterial Road – 85km

Primary Collector – 55Km

Secondary Collector - 120

Access and Low Volume -326km

**320 km A/C (55%), 260 km Chipseal (45%), 14 km Interlocking Blocks ,1.5 km Concrete**

## Subgrade Type by Area

Mt Maunganui - Sandy

Tauranga - Ashes

Papamoa - Sandy and Peat

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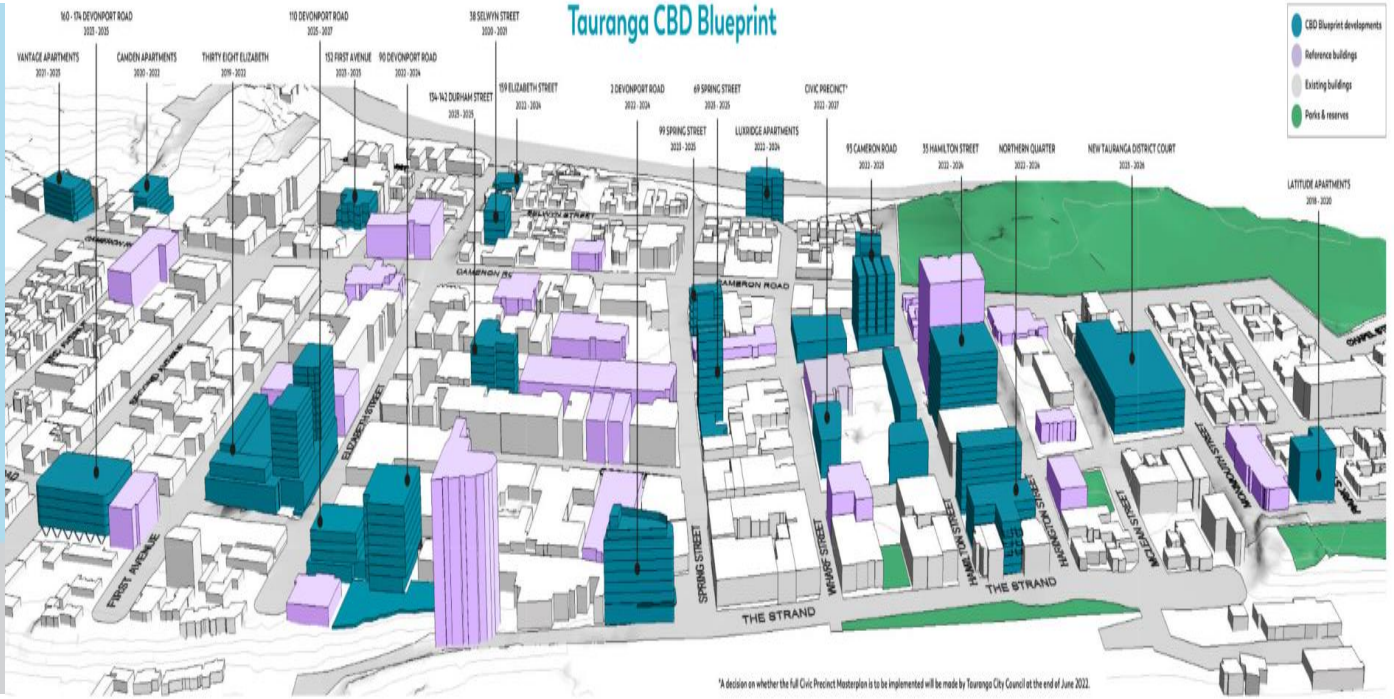
# Challenge 1: Population Growth
# Current and potential Urban Growth Areas

Adds pressure to our network and assets, leading to increased congestion and asset deterioration.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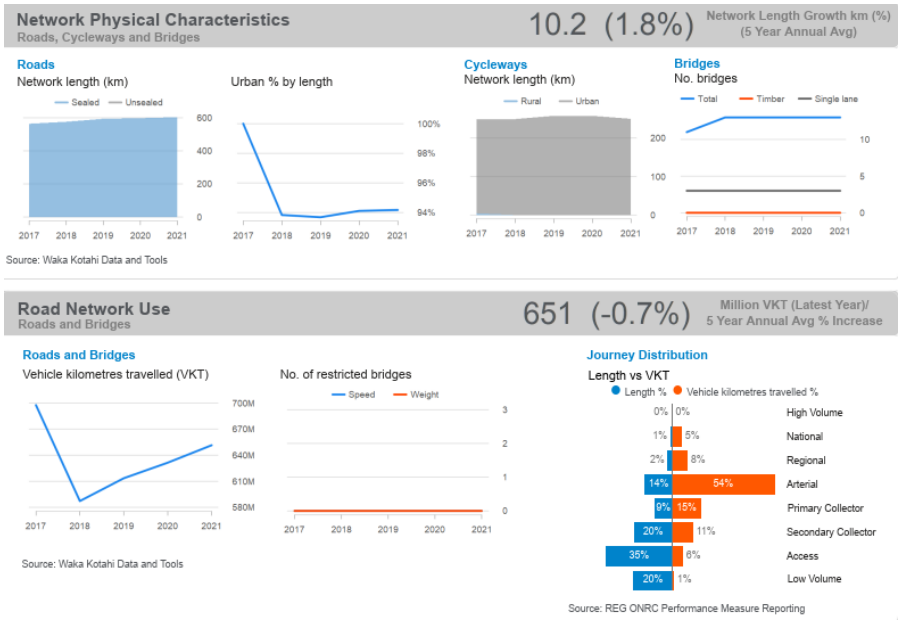
# Challenge 2: Increased Commercial Activity

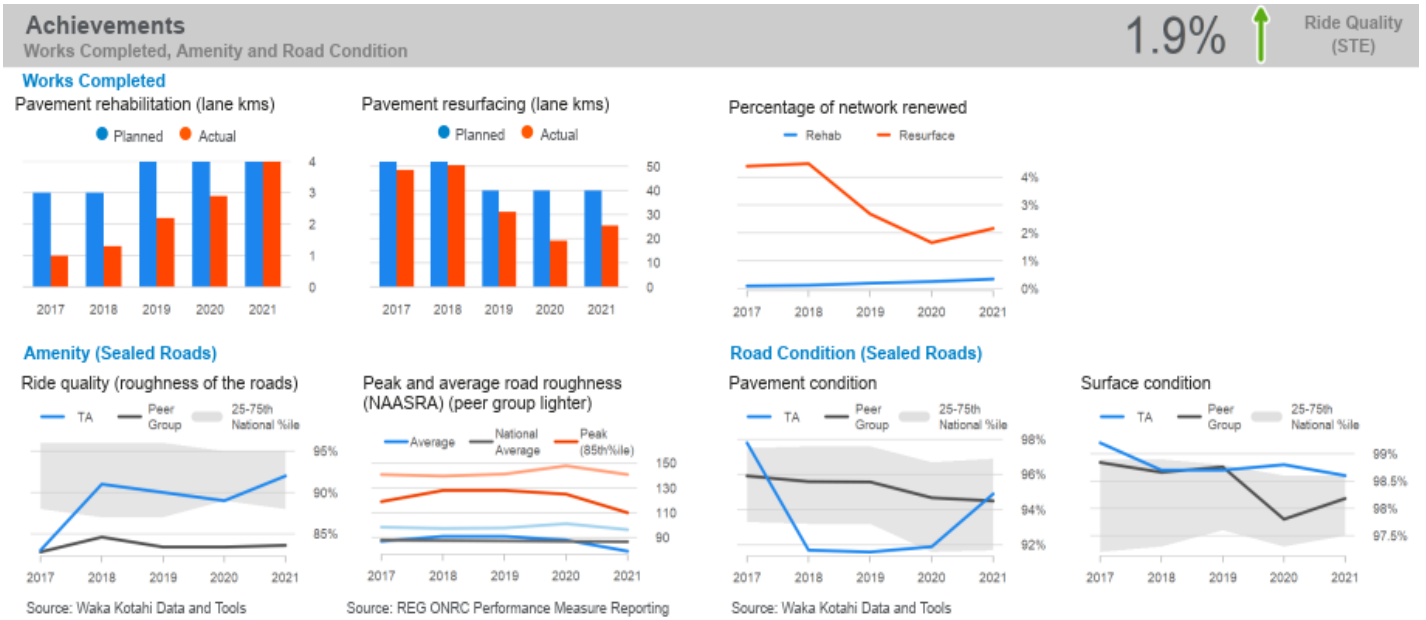
More heavy vehicles utilizing our network due to port expansion, speeding up failures.

# Challenge 3: Under-Investment

**Under-Investment** – Long term under investment, leading to growing backlog and increased risk

**Growing Maintenance Operational and Renewal (MOR) commitment** – Growing asset base, increasing TCC's need for MOR to support these assets

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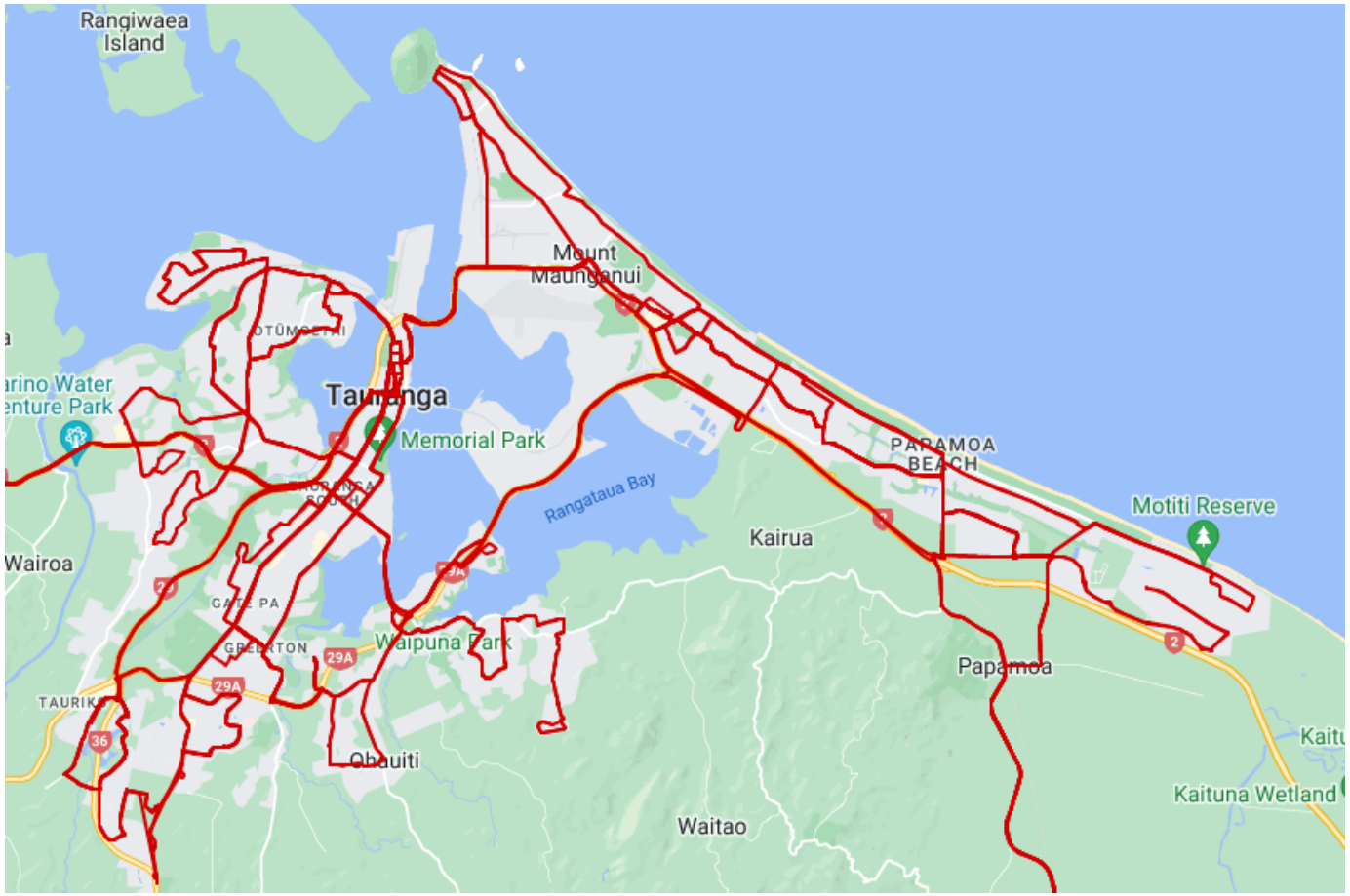
# Challenge 4: Multi Modal - Bus Routes

Straining roads not designed to support buses (especially electric busses)

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# TCC Approach to deal with Challenges Asset Management Planning Approach

- **Improved Asset Data**
- Data driven evidence-based decision making is our goal
- Accurate condition assessments and assets inventory
- **Continuous Improvement of Forecast Modeling**
- Innovation in forecast modeling
- Development of condition-based renewal program of other asset types
- Improved data, improving forecasting, improving asset valuation
- **GIS Capital Planning Tool** – Transportation , 3 Waters, Parks – Better project alignment, efficient and less rework – reducing carbon footprint

# Multi-Objective Modelling

- Collaborated with Lonrix to use a new innovative exploratory model (Juno-Cassandra)
- New modelling framework suitable for any modelling period from two years to 40 years plus
- Two key milestones:
  - Incorporate Machine Learning models into the Deterioration Model
  - Move away from Rules toward Objectives

# Let's start with the Objectives!

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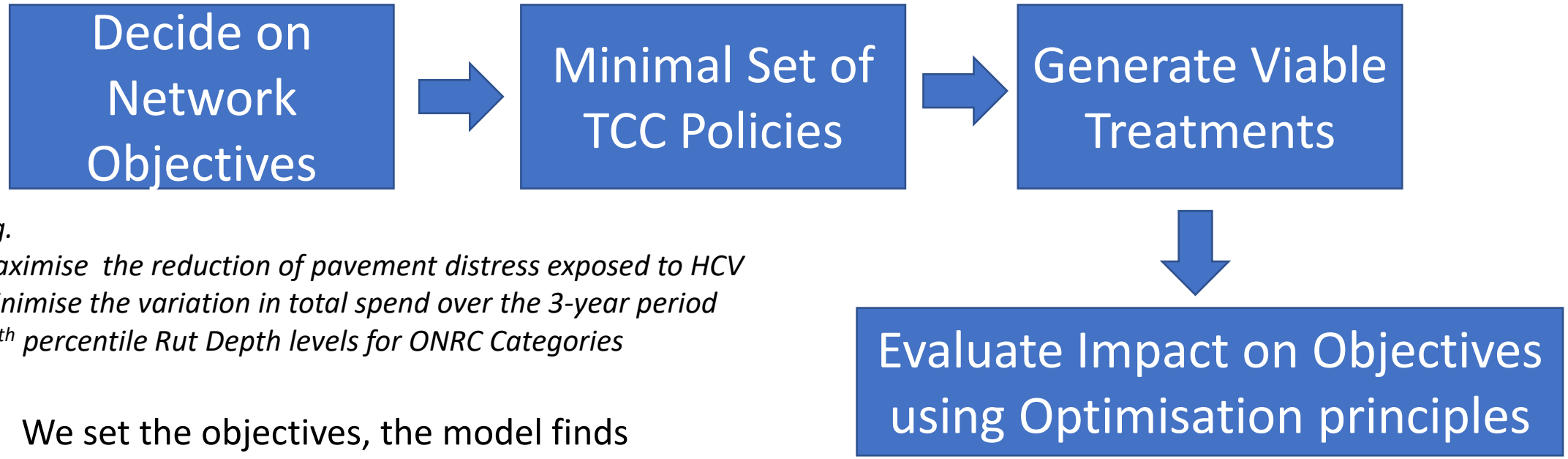
Study to Investigate:

- Can we START with network objectives and minimal rules, and
- Design an algorithm to maximise achievements on those objectives




*E.g.*
*Maximise the reduction of pavement distress exposed to HCV*
*Minimise the variation in total spend over the 3-year period*
*90$^{th}$ percentile Rut Depth levels for ONRC Categories*

We set the objectives, the model finds how to optimally achieve those objectives

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# Initial Results (November 2021)

**Field Validation**:

- Senior members of contract team including contract manager and supplier
- Valuable exercise – helped get buy-in from all parties and build confidence in the model and AMP process

**Initial Findings**:

- Overall, the results are well-aligned with objectives and observed condition
- Especially good results for Surface Seals
- Rehabilitation outcomes less than desirable – more work on this is needed

| Treatments | Juno Model Length (km) | Actual Validated Length (km) | Delta | Percentage Variation |
|---|---|---|---|---|
| AC | 6.3 | 8.4 | 2.1 | 33% |
| Seal | 14.4 | 14.7 | 0.3 | 2% |
| Rehab | 1.3 | 0.3 | -1.0 | -75% |
| Projects | 18.5 | 18.4 | -0.1 | 1% |
| **Grand Total** | **40.5** | **41.8** | **1.3** | 3% |

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# What is Next?

## Next Steps (1):

### 1. Improved usage of data:

- Improve the relevance of the evidence
- Utilise AI-driven defect detection methods to augment visual surveys and all-fault data
- Intelligently combine evidence to maximize information for the model

# What is Next?

## Next Steps (2):

### 2. Include “Soft Objectives” in the Model:

- Design objectives to minimize Carbon Footprint
- E.g. favour treatment candidates situated in the same area within a specific year
- Incorporate a Risk-Benefit-Cost view of treatments in which element Criticality is explicitly considered

# Acknowledgement

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LONRIX

Fulton Hogan

**Thank You!**